

Stephen J. Morewitz · Caroline Sturdy Colls
Editors

Handbook of Missing Persons

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Stephen J. Morewitz and Caroline Sturdy Colls

1.1 Introduction

Many people go missing each year, and their fate often remains unknown. In Europe, approximately 250,000 children are reported missing annually (Missing Person, (no date)). In the USA, 84,136 active missing person records were maintained in the National Crime Information Center (NCIC) on December 31, 2013 (NCIC Missing Person and Unidentified Person Statistics for 2013). About 35,000 individuals are reported missing in Australia on an annual basis (Australian Federal Police, (no date)).

Practitioners, law enforcement personnel, researchers, and families in many countries have expanded our knowledge of the issues surrounding missing persons and the most effective techniques for solving missing persons cases. Increasingly, the police and researchers are using a range of biological, physical, anthropological, social, psychological, economical, political,

geographic, and historical theories and methods to determine missing person risk factors, the most effective scientific and ethical methods for conducting missing person investigations, and the family, community, organizational, cultural, religious, and political conditions that impact upon these inquiries.

As a result of scientific, political, and ethical innovations, investigators now view the study of missing persons as a distinct discipline. The *Handbook of Missing Persons* is the first interdisciplinary handbook that uses the forensic social sciences, ethics, history, and the biological and physical sciences to clarify why missing persons go missing; law enforcement, family, community, and governmental responses to missing persons; and the most scientifically sound and ethical scientific techniques for locating and recovering missing individuals. The themes and methodologies addressed in the book are deliberately diverse, in order to demonstrate the wide range of personnel involved in missing persons inquiries, how they might work together, how their approaches may differ, and how inquiries may benefit from taking an interdisciplinary approach.

This book focuses on both living and deceased missing persons in a broad range of geographical and social contexts. The volume could not possibly have captured every single country's approach to missing persons inquiries or all of the disciplines involved in these investigations. However, the book presents a variety of examples of best

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practice, an array of challenges that may be faced by practitioners, and a range of contemporary issues from around the world in order to inspire further discussion among, and provide guidance to, those involved in missing persons cases. As well as individual, domestic missing persons cases, the *Handbook of Missing Persons* also focuses on people who go missing and are murdered during acts of genocide and armed conflicts. It is the intention of the authors to raise awareness of the range of specialisms from which missing persons inquiries could benefit. Therefore, the book aims to provide a source of advice for police officers and other law enforcement personnel, legal experts, social and physical scientists, forensic investigators, search specialists, and public and private agencies, e.g., family liaison teams.

1.2 The Social Sciences and Missing Persons Investigations

The *Handbook* uses theories and methods from such disciplines as anthropology, sociology, and psychology to analyze the social structure and process in which individuals go missing and the community and organizational responses to missing people. Chapter 2 immediately provides an overview of the risk factors involved in missing persons inquiries. Forensic social scientists analyze the extent to which factors such as the age, race, ethnicity, socioeconomic status (SES), and mental health characteristics of missing people and their family members, friends, and communities are associated with an increased likelihood that the individuals will go missing. Therefore, the *Handbook* analyzes the social, behavioral, and psychological factors that increase young people's risk of running away and engaging in other forms of juvenile delinquency (Chaps. 5–7). Persons with mental health problems such as depression and dementia may be at increased risk of going missing and posing a substantial threat to themselves and the community (Chap. 8). The *Handbook of Missing Persons* helps law enforcement professionals develop effective behavioral profiles based on social sciences theories and methods.

The book also offers research on the degree to which demographic, SES, and mental health conditions influence the direction, scope, and outcome of community involvement in missing person investigations. In certain communities, full-scale investigations of missing persons are initiated, while in other communities, very little is done to actually search for missing individuals. Forensic social scientists analyze which conditions affect whether comprehensive investigations are initiated (Chaps. 3, 4, 9, and 17).

Cases involving missing persons in the community are often characterized by a high degree of uncertainty. The police may not even have a crime scene to investigate. Investigators who study the victims of mass murder and genocide face a variety of social, political, and financial obstacles in carrying out effective investigations of individuals who may have murdered years ago. Moreover, police departments and other law enforcement agencies have limited resources in responding to missing persons. Under these circumstances, demographic factors, SES characteristics, psychological conditions, police resources, political pressure, and other factors may determine which missing person cases receive priority. The *Handbook of Missing Persons* investigates the extent to which these types of factors affect the direction, scope, and outcome of missing person investigations. For example, the police's reliance on eyewitness memory, facial recognition, and other psychological processes may affect the success of their investigation (Chaps. 10 and 11).

In this context, the *Handbook of Missing Persons* presents research on such processes as the nature of police authority and discretion in the conduct of missing person investigations. The latter will be affected by the extent to which the police are faced with uncertainty concerning whether an individual is truly missing and the extent of community and law enforcement resources in terms of personnel, equipment, and time availability. The public may be very concerned and even outraged about racial, ethnic, gender, and SES disparities in the ways in which the police conduct missing person searches. For example, in recent times, the phrase, "Missing

white woman syndrome” (Wikipedia, n.d.) has been coined to describe the fact that missing white women are more likely to receive the full attention of the police compared to missing disadvantaged minority individuals.

The *Handbook of Missing Persons* can help law enforcement personnel develop and modify their responses to missing persons. For example, social science research is presented to help determine the effectiveness of AMBER and Silver Alerts by assessing the barriers to effective implementation and evaluating innovations designed to improve response time in local communities (Chap. 4). Chapter 15 provides a statistical analysis of missing persons characteristics in Croatia in order to highlight how missing persons strategies should be tailored to community demographics. The *Handbook* also studies the psychosocial consequences for the families of missing persons, the social process of reuniting former missing persons with their families, and ways to improve counseling and other resources for former missing persons and the families of missing persons (Chap. 9).

1.3 Ethical Issues and Missing Persons Inquiries

In addition, the *Handbook of Missing Persons* addresses ethical problems associated with individuals who go missing. It examines the ways in which law enforcement professionals can protect privacy and confidentiality during their missing persons investigations (Chap. 12). Such discussions are necessary, but they have rarely been undertaken with regard to missing persons inquiries. The advent of DNA analysis in particular means strategies need to be developed in relation to issues around privacy, paternity, and maternity and the detection of genetic disorders, for example, that may arise in the course of missing persons investigations. Chapter 25 is dedicated to a discussion around the privacy issues surrounding the collection of genetic information. However, several authors consider these issues in relation to their own field of expertise in order to highlight how a consideration of ethical issues should be central to all social and physical sciences’

practices. As this topic has been discussed in relation to international death scenarios only sporadically (see, e.g., Bikker 2012, 2014; Nader, Dubrow, & Stamm, 2013; Varghese, 2010; Sturdy Colls, 2015), several chapters consider the ethical, political, social, and cultural ramifications of missing persons inquiries within the context of mass disasters and the investigation of war crimes and genocide (Chaps. 31–34).

1.4 “Missing Presumed...?”

Different issues will persist within missing persons inquiries depending upon whether the individuals concerned are known or thought to be living or deceased. A seminal work by Newiss (1999) was the first to highlight the negative implications of devising search strategies aimed at locating a living person when in fact that person was deceased and vice versa. The *Handbook* extends this discussion to outline the implications of such a mistake by practitioners from a variety of different disciplines from the social and physical sciences, in order to raise greater awareness among practitioners of the need to work closely with law enforcement personnel and evaluate levels of confidence in the intelligence they possess/provide. Chapter 16 focuses specifically on long-term or “cold-case” missing persons inquiries, a circumstance that may in fact arise from an incorrect assessment of a missing person’s status, and considers how the emergence of new techniques and technology may impact upon solving factors in these cases.

1.5 Physical Sciences and Missing Persons Investigations

A wide range of forensic methods now exist that have the potential to assist law enforcement personnel with missing persons inquiries, in both missing presumed alive and missing presumed deceased scenarios. Forensic practitioners specializing in archeology, geography, geology, cadaver dog handling, entomology, palynology,

and botany can all make a valuable contribution to searches for missing persons, their recovery, and the collection of evidence connected to the events resulting in them becoming missing. Chapters 18–21 demonstrate how, by combining search and recovery strategies, the detection and analysis of environmental samples, and knowledge concerning the behavior of a missing person or perpetrator, it may be possible to more effectively locate a missing person. These faster and more efficient responses have clear benefits in terms of protecting missing persons (in cases involving living victims), providing information and (hopefully) successful case resolutions for family members, and recovering the remains of a missing person (in cases involving deceased individuals). The collection of environmental evidence, along with other forms of trace evidence (Chap. 30), can help build a profile of the missing person's actions, the behavior of a perpetrator, and the potential fate of a missing person. This can, for example, provide evidence that can be used to further develop search strategies, lead to the successful location of a missing person, and provide evidence for use in a court of law. The chapters that focus on these topics intend to increase awareness of these lesser-known specialisms and demonstrate how seeking professional advice in these areas can increase the chances of a successful resolution to missing persons inquiries.

Successful confirmation of identity will be prevalent in all missing persons investigations. The methods used will once again differ based on whether the individual concerned is alive or dead, although a number of forensic methods can be used in both scenarios. The most widely known forensic identification method is of course DNA analysis which, since its development in the 1980s, has completed revolutionized missing persons investigations. Chapters 22–24 provide a detailed discussion of the applications and capabilities of DNA testing in order to present the latest developments relevant for missing persons inquiries. However, the complex nature of these inquiries means that DNA testing is not always appropriate or possible, while international standards for human identification in cases involving

deceased individuals mean that more than one positive identification method is now required to confirm identity (Interpol, 2009). Presumptive methods, such as visual identification, may first be necessary in order to provide an initial indication of identity in the case of both living and deceased inquiries. Chapters 17 and 28 demonstrate how forensic age progression and facial reconstructions as part of public appeals may prove fruitful, particularly in longer-term case inquiries when the missing person has aged (when the missing person remains alive) or the body of a deceased individual is located with limited/no soft tissue remaining. The analysis of fingerprints and fingermarks (Chap. 26), teeth, and skeletal remains (Chaps. 27 and 33) may offer suitable positive identification methods (depending upon the circumstances of the missing persons case), either as stand-alone methods in their own right or as confirmatory methods for other techniques, e.g., DNA or facial reconstruction. In cases involving deceased individuals, entomological (Chap. 20) and stable isotope analysis (Chap. 29) may assist in establishing the post-mortem interval (PMI) and demographic information about a missing person, respectively. All are presented in the *Handbook* in order to outline their potential value. Many of the forensic methods discussed throughout the book can also have value in relation to the detection of perpetrators in cases where a person is missing as a result of the actions of a third party. Therefore, the benefits of these techniques in relation to these scenarios are also discussed in many of the chapters.

1.6 Conclusions

As well as highlighting how the social and physical sciences can positively impact upon missing persons inquiries, the *Handbook of Missing Persons* does also aim to manage the expectations of law enforcement personnel and other practitioners involved in missing persons inquiries. Missing persons cases are often complex, highly pressured, and extremely sensitive. The methods and approaches described throughout

this book will not be appropriate in every scenario nor will they be practically possible. All of the authors of the chapters herein have attempted to highlight the advantages and disadvantages to all of the techniques described and have provided a wide range of case examples in order to demonstrate how and when these may or may not be effective. Practitioners engaged in missing persons inquiries should tailor their own methodologies to the specific case circumstances in which they find themselves working. The *Handbook of Missing Persons* is not intended to be a textbook which can be followed to the letter in all inquiries. Rather it is the intention of the book and its authors to provide a comprehensive and timely assessment of the variety of specialisms from which investigations may benefit and to encourage those responsible for missing persons inquiries to consider how the broader infrastructure for dealing with them can be improved. As the Norwegian Ambassador for Bosnia-Herzegovina stated after the mass killings in the former Yugoslavia, “as we have the people and the technology to do it, nothing should prevent us helping to resolve the fate of those missing persons” (ICMP, 2004). However, in light of all of the challenges involved in doing so, only a pragmatic, interdisciplinary response can bring us closer to achieving this goal.

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A Profile of Missing Persons: Some Key Findings for Police Officers

2

Shaunagh Foy

2.1 Introduction

The most publicised reminders of inaccurate risk classification by police officers dealing with missing person's reports come from cases where the missing person was presumed to have runaway but was later found to have met with foul play. Fortunately, such occurrences are extremely rare. Despite this, there is still enormous pressure on the officer taking the initial missing persons report to ask the right questions, assess possible risk factors, make a judgement about what may have happened to the missing person and then allocate appropriate resources—all within a timely manner. For all police officers, and for every missing person report made, the task is complex (see Fyfe, Stevenson & Woolnough, 2014 for more on this). No research has been conducted in the area of misclassifications of risk when a new missing person report is received, so the true numbers remain unknown. Given the high numbers of missing persons reports that are made on a daily basis, it is important that researchers work towards helping all police officers make an informed and hopefully confident assessment of risk that has a high degree of reliability (Bartkowiak-Theron & Herrington, 2008).

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2.2 Incidence Rates in Australia

It is estimated that in Australia, approximately 35,000 persons were reported as missing for the period 2005–2006. Proportionately, this is a rate of 1.7 persons per 1000 Australians (James, Anderson & Putt, 2008). The New South Wales Police Force in Australia report that in 2010 11,595 people were reported missing in NSW, with 65% of people reported missing being under the age of 18 (NSW Police Force). Despite these large numbers, and despite some public misclassifications, and very harsh criticisms of the police service, no rigorous standards exist by which officers can assess the likely status of a missing person's risk.

Unfortunately, statistics on the incidence of missing persons reported to police across Australia are not routinely compiled into a national database, though efforts are currently underway to rectify this. This means there is no detailed information to enable deeper analysis or to explore national trends (Henderson, Henderson & Kiernan, 2000). Where statistics are recorded, persons who go missing several times within a 12-month period inflate any statistical profile. Additionally, sometimes a person is not discovered to be missing until his/her remains are found in an isolated outdoor location. Identifying who is a missing person is also made more difficult because adults are free to go missing (Swanton & Wilson, 1989). Other persons reported as missing

to the police are simply never located, as is evidenced by the approximately 400 unsolved missing persons cases being monitored by the NSW Missing Persons Unit at any one time (J. Sutcliffe, Personal Communication, January 4, 2001).

2.3 Making a Risk Assessment

It appears that the improper handling of a missing person report usually occurs because the officer in charge of investigating the report has regarded the missing person as a runaway or as someone who has chosen to voluntarily disappear (Simons & Willie, 2000). Only where the person is located deceased or injured due to foul play or suicide does it become clear that the initial report required a more urgent response. The challenge for the police is to accurately assess missing persons reports, assess the person making the report, understand the story that preceded the going missing event, and learn about the person that is missing.

In light of the consequences of incorrectly classifying a victim of homicide or classifying a suicidal person as a runaway, for example, it is argued that detailed research is needed so as to work towards developing more robust methods for classifying possible risk. The receipt of a missing persons report is, at times, the first indicator that a murder has been committed (ACPO, 2013).

More recently efforts have been made to develop guidelines by various law enforcement agencies in the UK (ACPO, 2005) as well as the USA and Australia (Sen. Constable Lisa Hoggard, personal communication, October 20, 2014). However, in some of these instances, the risk assessment process remains time consuming and labour intensive (Bayliss & Quinton, 2013). Most notably, however, is that the risk categorisation process still requires subjective interpretation as to the likely reasons for the person being missing. In Australia, and in other law enforcement agencies around the world, the categories of 'low', 'medium' and 'high' risk are often assigned to a missing person based on information such as age (children and older persons are considered to be high risk), possible harm that the persons might pose to themselves or the public and whether or

not the behaviour was deemed to be out of character. To date no research has assessed the accuracy of these risk assessments and the extent to which they improve the location of the missing person. Importantly, these very broad categories do not give any indication as to the reasons *why* a person is missing.

This chapter reviews some of the more salient findings from a larger study that is the first known attempt to establish a profile of missing persons. The research examined information that was extracted from police files that pertained to missing persons who, on being located, were determined to have run away or to have met with foul play. Examined were variables that were considered important for their capacity to make a prediction about one's missing person status. Many variables were also identified as relevant because of the possibility that such information might reveal previously unexplored patterns or trends that differentiate type of missing person. Only a small number of the more salient findings will be discussed in this chapter.

2.4 Lack of Missing Persons Research

Currently, there is no established way for the police to determine if a missing person is the victim of foul play or if that person is likely to shortly return home, and to date no research has been conducted in that area (Henderson et al., 2000; Maxson, Little & Klein, 1988; Newiss, 1999). Those studies that do exist have instead focused on the effect of police intervention (Plass, Finkelhor & Hotaling, 1995), assessment of the current legal and organisational status of police response to missing persons cases (Maxson et al., 1988) and perceptions of police response by significant others, as well as the costs of missing persons to the community (Henderson & Henderson, 1998). More recently, descriptive characteristics of children who experience an attempted or completed abduction were published by Newiss (2013).

The lack of research into the area of missing persons reports and their investigation is possibly

a function of the low profile awarded to this activity (James et al., 2008; Newiss, 1999). It perhaps also relates simply to the small numbers of missing people facing adverse circumstances. Of all the individuals who go missing each year, only a very small minority will be the victim of serious crime (Swanton & Wilson, 1989). Despite this, it is surprising that no research has explored whether there are any tangible differences between different types of missing person and, if there are differences, whether there is any predictive value in those qualities. More recently, research by Newiss has attempted to delineate age and gender differences in missing persons who have met with foul play (Newiss, 2004), as well as an exploration of subsamples of missing persons, such as research on abducted missing children (Newiss, 2013), and those who are missing for prolonged periods of time (Newiss, 2004). Tarling and Burrows (2004) also examined a random sample of just over 1000 missing persons and explored the outcomes. Despite these more recent research efforts, there still remains the need for advances towards an actuarial approach to risk assessment and missing persons, where the specific outcome, or reason for being missing, is explored.

The lack of research specific to the assessment of possible risk of harm experienced by the missing person is apparent in the lack of structured guidelines offered to police who are investigating a missing person report. Kiernan and Henderson (2002, p. 5) note that an 'objective base is required to better inform policy makers and practitioners so that effective strategies can be established in the missing person arena. All levels of the community need to be informed by empirical research rather than by misguided, ill-informed impressions of missing persons and their issues'. This is not to suggest, however, that assessment of risk should be reduced to a system of numerical scoring. The ACPO Manual of Guidance for the Management of Missing Persons (ACPO, 2005) argues for the importance of not doing this (see also Newiss, 2004). Instead, risk is classified according to a broad set of criteria that still enable the judgement of the officer receiving the missing person report. The importance of allowing for the subjective, human judgement is considered to be

critical in the development of an accurate risk assessment. The importance of being informed and guided by quantitative data is also considered to be extremely important in the risk assessment process (see Tarling & Burrows, 2004). An actuarial approach, in unison with personal experience and clinical judgement, is therefore considered to be optimal in the analysis and assessment of risk. Determining if there are characteristics that pertain to specific types of missing person, and which may help with the assessment of what it is that has likely happened to the missing person, is the focus of this chapter.

2.5 Previous Missing Persons Research

Most research on the topic of missing persons is conducted by large representative bodies with an interest in defining types of missing persons and estimating their incidence. Two large-scale studies have been conducted that offer the greatest contribution to the missing persons literature. The first is a large study conducted in 1998 in Australia by Henderson and Henderson. The main objective of the research was to explore the economic impact of missing persons on the Australian community; however, it also examined characteristics of the missing person population, such as age, gender, socioeconomic status, if there were any health or mental health issues and if there was a history of going missing. This research is one of the few studies internationally to include persons 18 years and over. Also examined were circumstances of the missing person incident, looking specifically at time of day and day of the week, when the person went missing, who made the missing person report, the season that the person was last seen, the reasons for going missing and details surrounding the location of the missing person. However, while the Henderson and Henderson research is an Australia-wide survey of missing persons, it does not specifically examine different categories of missing persons, and so in this sense the contribution of Henderson and Henderson's research to the present study is, unfortunately, limited.

The second study of notable influence was conducted in America in 1990 and then repeated in 2000. Research for the US Department of Justice, Division of Juvenile Delinquency, titled the National Incidence Studies of Missing, Abducted, Runaway, and Thrownaway Children (National Center for Missing and Exploited Children, 1994) (commonly referred to as NISMART 1 and NISMART 2) is the largest project known to be conducted on missing persons worldwide (Flores, 2002). Unfortunately, like most studies on missing persons, this project restricted their missing persons research to include only children and adolescents under 18 years. The lack of missing persons research exploring the adult population is disturbing given that in Australia just less than 50% of those reported as missing persons were adults (Henderson & Henderson, 1998).

2.6 Profiling Applied to Missing Persons Cases

In the present research, profiling is a methodology used to identify not who the missing person is but rather what has happened to the missing person. The challenge is to determine what type of pre-disappearance behaviours and circumstances can be identified without the presence of the missing person. Factors relating to the psychological wellbeing of the individual, for instance, were key parts of the assessment. Given the complexity of social and psychological processes that give rise to running away, attempting or completing suicide as well as the circumstances surrounding foul play, the emphasis was on any available information that fits within a broad psychosocial framework and which has the potential to (a) offer distinguishing features between types of missing person and (b) assist in reliably predicting the reasons the person has for being missing.

This exploratory research was concerned only with runaway, suicide and foul play persons because these three categories occur more frequently than do other types of missing persons, such as those who are lost or who have been in an accident. Pre-disappearance behaviour is also

expected to be more easily differentiated across the three groups. For instance, those who have run away, as well as those who have committed suicide, are expected to have displayed, either explicitly or implicitly, behavioural evidence which supports their decision to run away or suicide. The three types of missing persons being analysed in this research are defined below.

2.6.1 Defining Runaway, Suicide and Foul Play Missing Persons

Runaways are defined as persons who have voluntarily left their place of residence with the intention of finding an alternative living environment for either the short term or the long term, and this has occurred without the authorisation or knowledge of significant others (Collins, Powers, McCalla, Ringwalt & Lucas, 1993). Adult runaways are those who have deserted or abandoned their place of residence. Because of problems with the definition of runaways as separate from throwaways, the latter category is also included in this research. They are defined as persons who are either told to leave or whose parents, friends or partner did not want the missing person to return home or did not care whether or not he or she returned home (Collins et al., 1993). Runaways and throwaways can include children, adolescents or adults who were reported as missing.

Suicide is defined as a person who has left with the intention to attempt or complete suicide and who has been reported missing as a result. For the present research, the suicide group includes completed suicide attempts as well as serious but unsuccessful suicide attempts.

Foul play is defined as a person who is abducted and possibly murdered and who was reported as a missing person. Foul play includes those abducted by a family member, which commonly occurs during a custody or visitation dispute, as well as nonfamily abduction whereby coercion has been used to take a child, adolescent or adult (Collins et al., 1993).

Ultimately in the present study, it is the circumstances surrounding the location of the missing person that determines the classification that

the missing person is allocated. The possibility that some of the missing persons went missing for reasons other than what they intended cannot be ruled out. For instance, it is possible that one who is the victim of homicide initially left with the intention to run away or that one who left with the intention to suicide later decided to more simply run away.

This study relied on the examination of information recorded by police in closed missing person files. Extracting the relevant information from police files, as well as adequately interpreting the findings, was achieved by drawing on a number of different perspectives. At the most fundamental level, information pertaining to the missing person's behaviour was used to guide the collection of information for each type of missing person category. Two guiding theoretical perspectives are relevant here. The first is the view that behaviour is open to functional analysis (Cooper, Shapiro & Powers, 1998) which maintains that behaviour is best understood in terms of the goals or needs it serves; the second is behavioural consistency theory, originally espoused by Canter (1995), who states that past behaviour is predictive of future behaviour. The first highlights behaviour for its purposefulness, and the second for its consistency and predictability. Offering more guidance again, a practical framework for the examination of both the purpose of behaviour and its consistency is victimology theory which is useful for its literature on victims of crime. Finally, psychological autopsy as a methodology is extensively relied on within the suicide literature because it highlights the psychological state of the individual prior to the suicide act.

Key theoretical principles inherent in the FBI model, investigative psychology, psychological autopsy and victimology theory, are relevant to missing persons and the search for contrasting profiles. Awareness of the underlying psychological principles enables the profiles to be created and understood within a larger framework (Canter, 1995). Importantly, no one theory or approach dominates the search for unique features within the three types of missing person as they are all, to varying degrees, implicit in this exploration.

2.6.2 Analysing Runaway, Suicide and Foul Play Missing Persons

All the data for this research was extracted from archived police files of solved missing persons cases. Information was also obtained from long-term missing persons files where cases were finalised by the coroner and the person was deemed deceased due to suicide or foul play. Data was also extracted from solved homicide cases from the Homicide Library attached to the New South Wales Police Force. The objective was to determine if there exists a meaningful and unique profile of factors that allows each type of missing person to be distinguishable from the remaining two. This is a first attempt to quantify the various types of information that police have available to them and to assess the possibility that this information can serve to distinguish the three groups.

2.6.2.1 Criterion Selection and Data Reduction

All aspects of the information contained within the files were considered for their capacity to distinguish between types of missing person. Determining what aspects of the data were suitable and obtainable required combing through the files a number of times. As many variables as possible were created at the beginning of the data collection process (greater than 60), and only with repeated readings of the files, consideration towards the theoretical relevance of the information and checks as to the frequency of occurrence of the variables were a final set of variables determined to be included. Information was obtained from police files concerning (a) the reporting person's details about the missing person (e.g. gender, age, marital status, occupation), (b) details consistent with the psychological autopsy method (e.g. mental status prior to going missing), (c) details consistent with victimology (e.g. risk-taking behaviour) and (d) the event characteristics (e.g. when and where the missing person was last seen). A total of 26 variables were isolated and analysed which resulted in a very rich and dynamic picture of the three

different missing persons types. Only three of the more salient findings are examined here because they both support previous research findings and offer new insights. Details of the data collection process and the variables extracted are detailed elsewhere (Foy, 2006). The characteristics presented here include (a) whether the missing person was last seen in a public place or at home, (b) whether the disappearance is out of character and (c) the suspicions of the reporting person.

2.6.2.2 The Analyses

The analysis of the data for the present study comprised two stages. In the first stage the data were examined using the chi-square test of independence statistic. The objective of this statistical technique was to look closely at the various qualities that differentiate the three types of missing persons who were known to have run away, attempted or completed suicide or who had met with foul play. The chi-square test of independence is used to determine whether there is a significant difference between the expected frequencies and the observed frequencies across the three categories of missing person. The second stage required examination of the residuals which reveal which of the three missing persons types are contributing towards the statistically significant chi-square. Assessment of the residuals is an important part of this data analysis because, without a thorough examination of the residuals, one cannot determine which variables are contributing to a significant chi-square result. Much more detailed information regarding the statistical analyses is located elsewhere (Foy, 2006). For the purposes of this overview, it is sufficient to note that inspection of the residual indicates the degree of statistical significance.

The analyses conducted answer the questions: Do the number of individuals or objects that fall in each category differ significantly from the number you would expect? Is this difference between the expected and observed due to sampling variation, or is it a real difference? Significant results indicate a real difference between the three types of missing person on the characteristic discussed.

2.7 Overview of Entire Missing Persons Sample

A total of 357 missing persons files were selected for inclusion in this research. The sample ranged in age from 9 years to 77 years with a mean age of 28 years ($SD=15$ years). In this research, more adolescents were reported missing than any other age group (mode=15 years), which is consistent with previous reports. Figure 2.1 presents the 357 missing persons in this sample according to their missing person category. There were 250 (70%) runaways, 54 (15.1%) persons who attempted or completed suicide and 53 (14.8%) persons missing due to foul play. Presented below are figures detailing the type of missing person, age according to missing person status and followed by a breakdown according to gender.

Figure 2.2 graphically depicts the five age categories according to the three types of missing person. Noteworthy is that almost half (47.6%, $n=119$) of the '17 and under' age group fall into the runaway category, while those aged between 41 and 65 were overrepresented (44.4%, $n=24$) in the suicide category. For the foul play category, those aged 18–25 comprised 39.6% ($n=21$) of the foul play sample. This is consistent with other missing persons research.

Gender and type of missing person. There were 184 females (51.5%) in the entire sample, compared to 173 (48.5%) males. Figure 2.3 depicts gender according to the three types of missing person. Of the 250 runaway cases, 54.4% ($n=136$) were female and 45.6% ($n=114$) were male. For the suicide sample 18.5% ($n=10$) were female, while 81.5% ($n=44$) were male. For the foul play sample, 71.7% ($n=38$) were female and 28.3% ($n=15$) were male. These findings are consistent with other findings (see Biehal, Mitchell & Wade, 2003).

Private versus public place and missing person category. This variable categorises where the person who is missing was last seen. The categories are (a) whether they were in their own home or (b) in a place other than their home (such as place of employment or a friend's residential home) which is referred to as a public place. Just over half of the runaway sample (55.2%, $n=138$) were

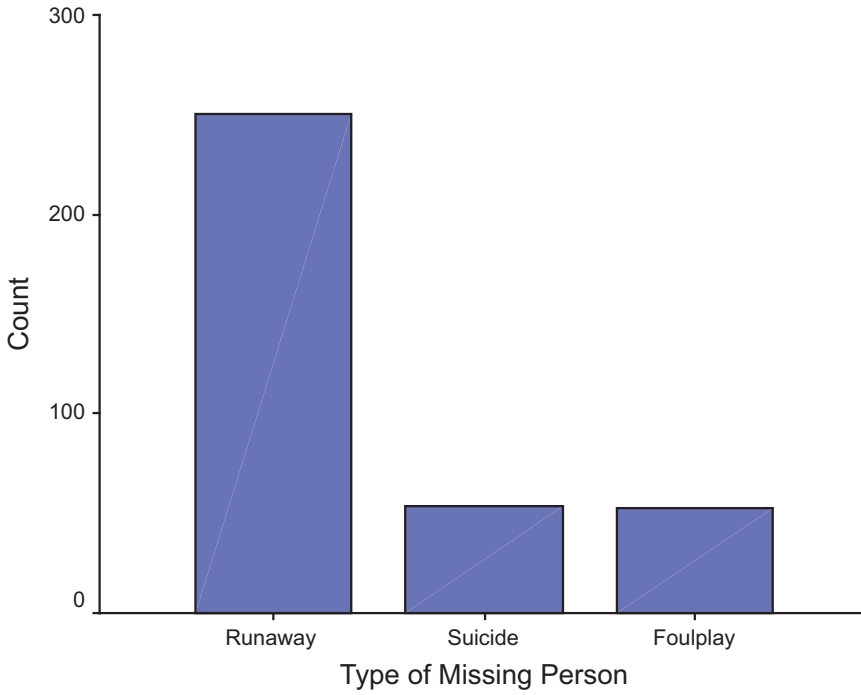


Fig. 2.1 The missing persons sample according to missing person category (Copyright: Shaunagh Foy)

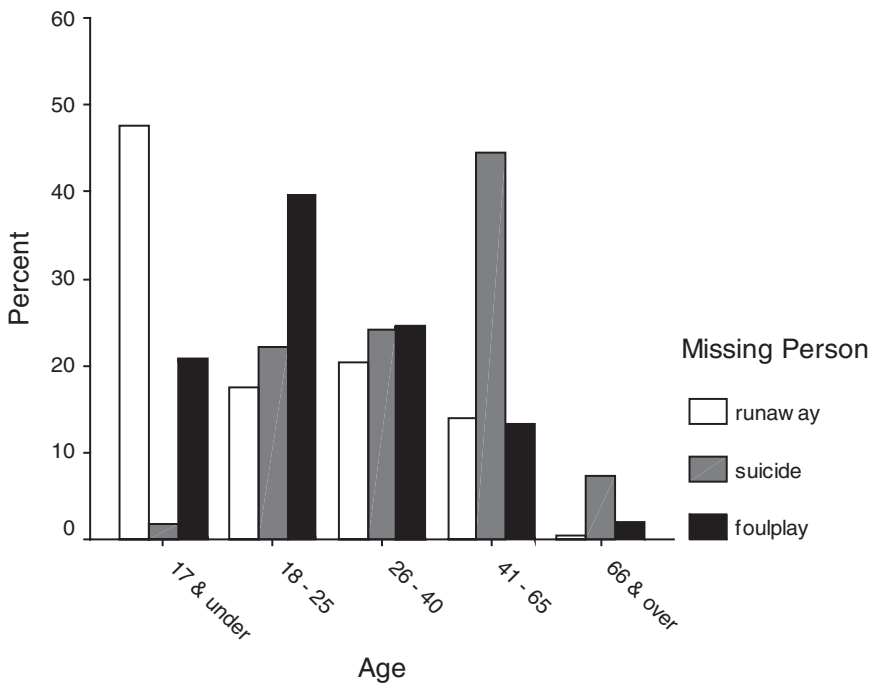


Fig. 2.2 Age according to missing person category (Copyright: Shaunagh Foy)

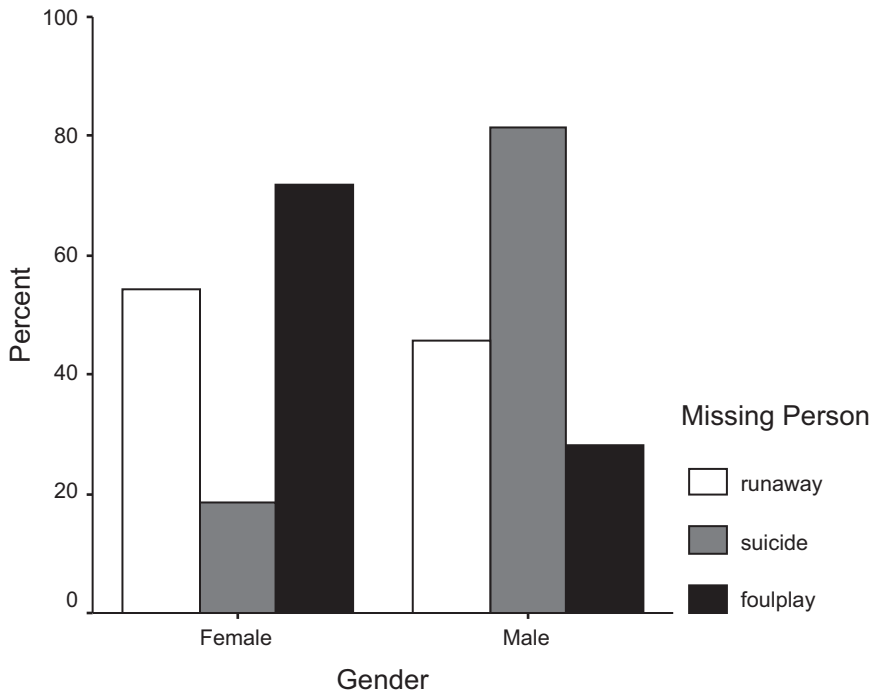


Fig. 2.3 Gender according to missing person category (Copyright: Shaunagh Foy)

last seen at home with 36% ($n=90$) last being seen in a public place. For the suicide group, 48.1% ($n=26$) were last seen at home, and 48.1% ($n=26$) were last seen outside of their home. For the foul play group, 84.9% ($n=45$) were last seen outside of their home, and only 7.5% ($n=4$) were last seen in their home (see Fig. 2.4).

Chi-square analysis revealed that when all three groups were assumed to be equally distributed across the place of last sighting, runaway persons were less likely to be last seen in public, whereas those who fell victim to foul play were nearly always last seen in public. This finding was highly significant. The observation that 84.9% of the foul play cases were last seen in a public place supports the strong standardised residual, as well as the strong chi-square statistic achieved for this analysis. Persons missing due to suicide remained evenly distributed within the contingency table so there were no significant residuals for this category of missing person.

Personality and behavioural factors: The following analyses detail some of the factors that are specific to the missing person's personality or

behavioural history, as recorded in the police files. The variables constituting this theme include (1) whether the disappearance was out of character for him or her or (2) what suspicions the reporting person has about what has happened to the missing person:

1. *Whether the disappearance was out of character and missing person category.* For the runaway sample, it was out of character for the person to be missing for 42% ($n=105$) of the cases. Going missing was considered not to be out of character for 32.4% ($n=81$) of the runaway sample. For the suicide sample, being missing was considered to be out character for 81.5% ($n=44$) of the sample, while only 9.3% ($n=5$) of the reporting persons thought it was not out of character for the person to be missing. For the foul play sample, 83% ($n=44$) of the cases stated that it was out of character for the person to be missing. No cases stated that the going missing behaviour was not out of character for the person missing due to foul play (Fig. 2.5).

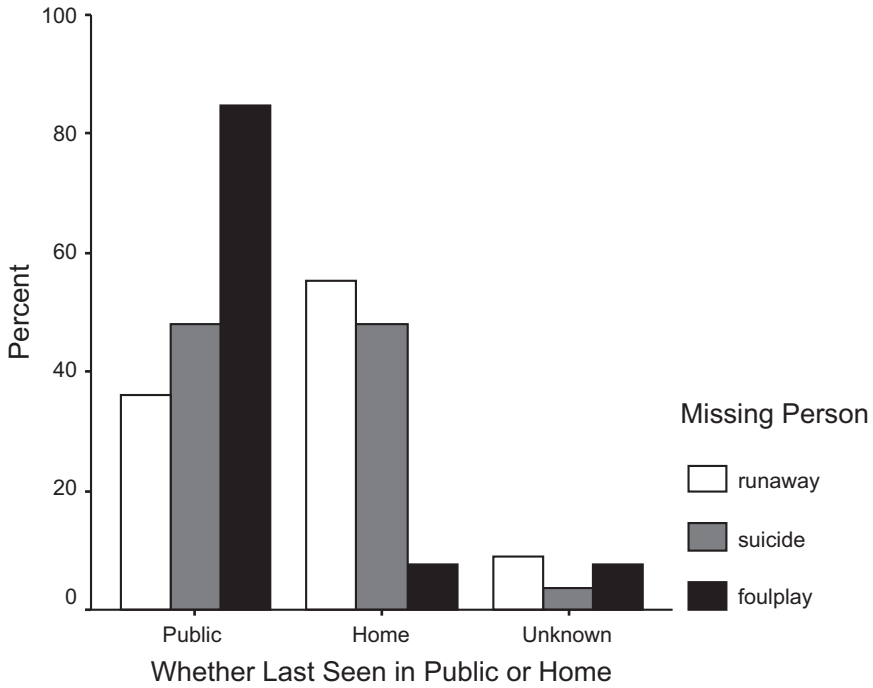


Fig. 2.4 Whether missing person was last seen in public or at home according to missing person category (Copyright: Shaunagh Foy)

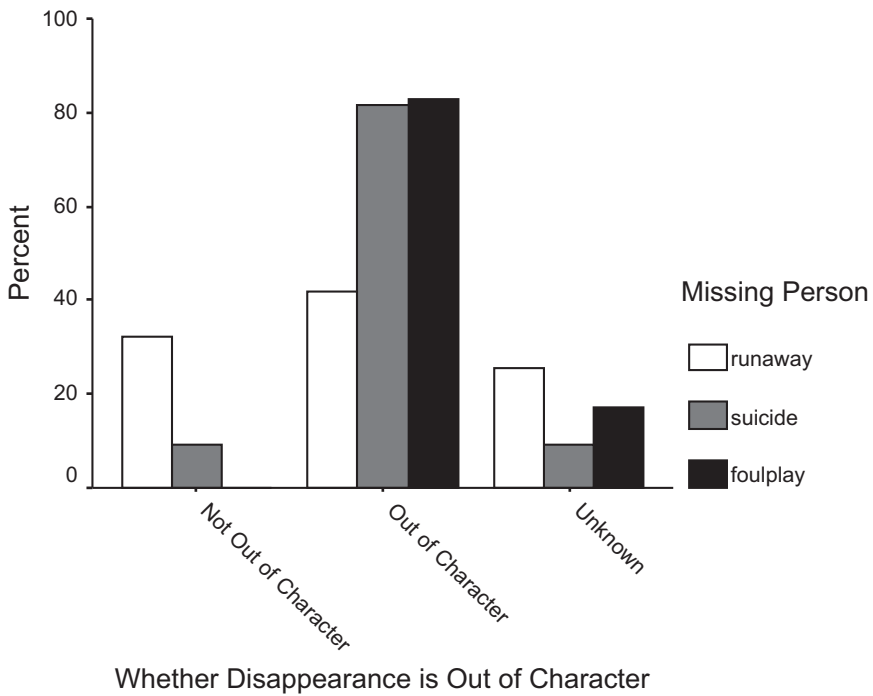


Fig. 2.5 Whether disappearance is considered to be out of character according to type of missing person (Copyright: Shaunagh Foy)

For the chi-square analyses, there were significant differences between the three groups on this variable, which proved to be very rich in information. When compared between types of missing person, persons who had run away from their place of residence were more likely to be regarded by the reporting person as behaving in a way that was not out of character. On the contrary, the suicide samples were less likely to be regarded as behaving in a way that was not out of character for the missing person and more likely to be regarded as behaving in a way that was out of character. Particularly strong, however, were the results of the foul play sample. None of the reporting persons regarded the disappearance as being 'not out of character' for the missing person with this providing strong statistical significance. Correspondingly, 44 (83%) reporting persons for those missing due to foul play indicated to the police that the disappearance 'was out of character'.

2. *Suspensions or fears of the reporting person.* This variable describes what the reporting person thinks has happened to the missing person to explain why he or she is missing. For the runaway sample, 63.6% ($n=159$) were correctly suspected as having run away. For the suicide sample, 74.1% ($n=40$) were correctly suspected as having left to suicide, and for the foul play sample 79.2% ($n=42$) were suspected as having fallen victim to some unknown misadventure.

In terms of statistical analyses, runaways were, on average, correctly identified as having run away by the person reporting with 63.6% of the runaways correctly identified. In contrast, those who were thought to have suicided when in fact they had run away occurred less frequently than expected, accounting for only 12% of the runaway sample. Also occurring less frequently than expected were the number of runaways who were suspected of being missing because of misadventure who comprised 13.6% of the runaway sample. Overall, the reporting person was more often correct when he or she stated his or her suspicions about why the person was missing, and these findings revealed strong statistical significance.

A similar pattern was noted for those who had suicided, with 74.1% being correctly identified as having left with suicidal intent. This finding was significant. Occurring much less frequently than expected was the finding that there was only one person who completed suicide who was thought to have run away, and likewise only one person who had suicided was thought to be missing because of misadventure. Overall, then, this suggests that for many cases, when a reporting person suspects their friend or relative has left to suicide, the reporting person is very often right.

For those who were the victim of foul play, 79.2% ($n=42$) were correctly regarded as having met with misadventure by the reporting person. Only one foul play victim was thought to have run away, and only two foul play victims were thought to have left with suicidal intent. These findings were also statistically significant (Fig. 2.6).

2.8 Conclusion

This research outlines a theoretical and empirical approach that unambiguously links circumstantial evidence, as well as one's knowledge of the missing person with the person's reasons for being missing. The results from the chi-square analyses performed in this research provide the police with explicit themes that are common to the lives of the different types of missing person. The predominant behavioural style that a missing person exhibits adds weight to the notion that the three types of missing person can be profiled by virtue of the consistency of their behaviour. On its own this information has the potential to help police direct their questions towards areas that are relevant, informative and discriminating.

While these findings are hopeful, it is important to note a key limitation in this research. The findings from this research should not be used to guide the decision making of police officers because in this study (a) the sample sizes are very small, and (b) only three types of missing persons were examined in this research. It is impossible to know if the suspicions of the reporting person only occur when the person has run away, suicided or met with foul play. It is quite possible that persons missing due to being in an accident

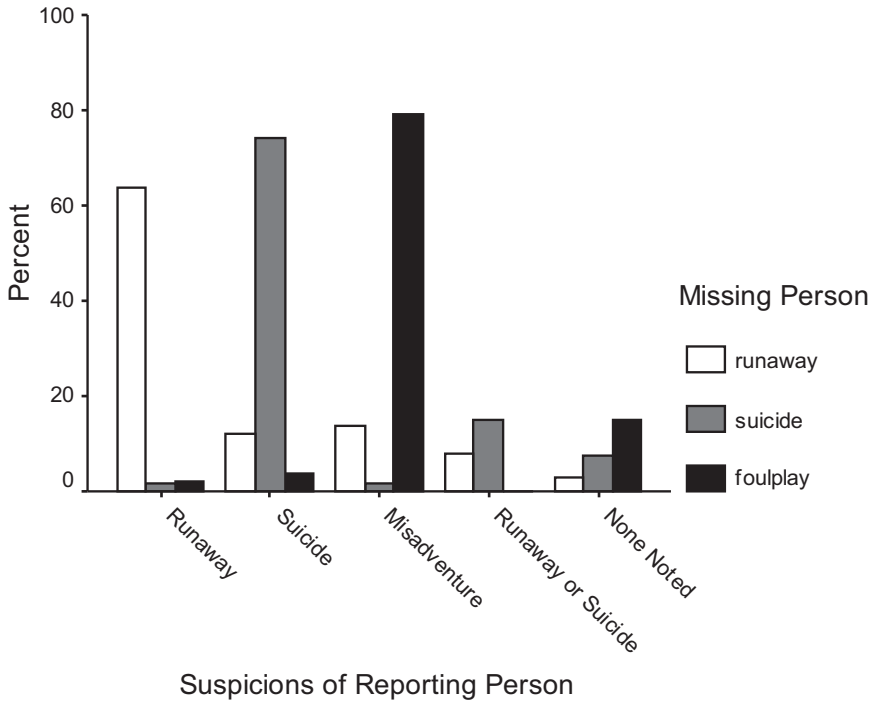


Fig. 2.6 Suspicions of the reporting person according to missing person category (Copyright: Shaunagh Foy)

of some kind are also frequently thought of as missing due to misadventure (see Henderson & Henderson, 1998 for related research). Hence, the results of this research should not be interpreted as indicating that all suspicions of misadventure are automatically indicative of foul play specifically nor that all suspected suicides are indicative of suicide or that all suspected runaways are runaways. The strong effect for suspicions of the reporting person does, however, point towards the accuracy of interpersonal and social perceptions and judgement (see also Ambady & Rosenthal, 1992).

One of the key obstacles for police officers who must fulfil their duty to assess the likely risk factors involved, manage the investigation and communicate to others about the missing person is that no explicit professional standards exist in law enforcement practice and there have been few efforts internationally to develop or evaluate interventions to improve decision making in this area. Based on the available literature, there is only limited evidence of efforts to develop training programmes in risk assessment (Bayliss &

Quinton, 2013). At a minimum the findings from the present study highlight the potential utility that profiling has within law enforcement.

The present research offers policing personnel specific characteristics about the person that previously has not been fully realised, in regard to both the relevance of certain characteristics and unique ways in which the groups differ overall. The strongest message from these findings is twofold. The first is that the circumstances surrounding where a missing person was last seen distinguish those who have met with foul play from the runaway and suicide groups, and the second is just how accurate the judgements of the reporting person are. Those who know the missing person are in the best position to make the judgement about the likely motives or goals of the person, as well as (to some extent) the possible risks that the missing person may be exposed to.

The findings from the present research achieved their goal in that they communicate to the police factors that are associated with the increased risk of being a runaway, suicide

or foul play victim who is reported as a missing person. While limitations exist, the results from this study improve on traditional methods of risk assessment by explicitly acknowledging that patterns within missing person's data can be identified and, that with the implementation of more sensitive and standardised data collection procedures and advanced computing methods, the generation of sensitive classification and prediction criteria is very possible.

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Lucy Holmes

3.1 Introduction

Missing person appeals are a common feature of missing incidents across the world. In the case of large-scale disasters or man-made atrocities, spontaneous congregations of missing posters are frequently observed. This was the case after the attacks on the World Trade Center on September 11, the terrorist bomb detonations in London in July 2007, in the aftermath of the Second World War after 1945, after the Tsunami off the coast of Thailand on Boxing Day 2003 and following the crisis in Kosovo in the late 1990s (Edkins, 2011). The posters carried by the Madres of the Plaza de Mayo, whose children ‘disappeared’ in Argentina in the war of 1976–1983, have become particularly well known (Edkins, 2011).

In the UK missing person appeals are varied, regular, commonplace and innovative. They are conducted by the families and friends of missing people, by police forces and by the national charity, Missing People. This chapter will discuss the nature and scope of publicity appeals in the UK, the main methods used and recent developments and the extent of knowledge about their

effectiveness. The chapter will also outline the main aims and perceived benefits of publicity appeals, as well as the potential risks, risk assessment and attempts to mitigate these. In order to address these issues, this chapter draws on published and unpublished literature as well as analysis of survey and interview data gathered by the charity, Missing People, and the Geographies of Missing People research project.

3.2 Missing Persons in the UK

Across the UK, police forces receive nearly five missing person reports per 1000 population annually (NCA, 2014). In 2012–2013, police in England, Scotland and Wales received 306,118 missing person reports, down slightly from 313,019 in 2011–2012 and 326,764 in 2010–2011 (NCA, 2014). Police data recording practices do not allow for accurate calculation of how many individual people go missing each year, but in 2012–2013 it is estimated that between 103,000 and 252,000 individuals were reported missing (NCA, 2014).

In the UK, the police are the primary investigative agency for missing person incidents. There are, however, occasions where a person is considered missing by family, friends or acquaintances but it is not appropriate for the police to be involved; the police would not normally open a missing person enquiry in situations where a

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missing person has lost contact with their family, where adopted people are searching for biological relatives or where the missing person is wanted by police for arrest or investigation and that wanted status outweighs their vulnerability.

UK police forces are responsible for investigating missing incidents where there is a concern for the wellbeing or safety of the missing individual. The police recognise that using a media strategy within missing person investigations has the following objectives: 'to generate information and public awareness to assist the enquiry and to control speculation' (ACPO, 2010, p. 49). Police guidance also emphasises that forces should be aware of the impact that missing person enquiries, and associated media appeals, have on local communities.

All police decisions about missing person investigations, including the use of media strategies, will be predicated on a dynamic risk assessment, overseen by senior officers throughout the investigation. In addition to using appeals, police will undertake search and location activities, again guided by the risk assessment. Police investigations are guided by the Association of Chief Police Officers (ACPO) Guidance, soon to be updated and reissued as Authorised Professional Practice documents by the College of Policing (expected 2016). These guidelines outline the options for appeals, plus the considerations to be made before issuing an appeal. The police guidance also emphasises the importance of investigating officers establishing a communication link with the charity, Missing People (ACPO, 2010).

As well as appeals being created and circulated by the police or Missing People, many families searching for a missing relative choose to create their own appeal materials. The recent Geographies of Missing People study (2013) found that family search activity included site-specific searching; door knocking; visiting cafes, pubs, supermarkets and homeless shelters and rough sleeping spaces; writing to churches; contacting hospitals; contacting a local member of Parliament; and contacting family, friends and address book contacts (Parr & Stevenson, 2013).

A key component of family search is circulating information about the missing person, making an

appeal. The families and friends of missing people often engage in public appeals, from homemade posters and leaflets to awareness events and social media activity. In June 2013, a Russian student from the University of Edinburgh in Scotland, Yulia Solodyankina, went missing. Friends and fellow students instigated a massive publicity appeal which used Facebook and Twitter, online blogs and posters, held drumming events across the city centre and circulated thousands of coffee cups bearing Yulia's photograph. This activity ran alongside, and complemented, appeals from the police and the charity, Missing People, which featured on digital billboards and in national media outlets. Sadly, Yulia's body was located in January 2014, and her family have since expressed their gratitude for everyone who had helped with the search.¹

3.3 Appeal Methods in the UK Context

A missing person appeal is communication by those searching for the missing person to a wider network of people who may be able to help locate that person and to the missing person directly. Appeals must contain information about the missing individual that would allow the people who may encounter the missing person (or may have encountered them in the past) to recognise and identify them and information about what action they should take in that event. Appeals should also provide information that allows the missing individual to recognise himself or herself and to know what action they can take to end the search.

Missing person appeals can have a profound effect on the course of a missing incident. Since 2008 the charity Missing People has surveyed families² of missing people annually to gather feedback about their experiences and the services

¹<http://www.bbc.co.uk/news/uk-scotland-edinburgh-east-fife-25913991>

²Families were eligible for inclusion if they had received a service from the charity in the previous calendar year and if they were not ruled out by certain inclusion criteria, such as the case having developed into a 'no-body murder' prosecution.

they received. In 2013, 25 % of surveyed family members whose loved one had been found, and where an appeal had been made, stated that they felt the publicity had played a part in the resolution of the incident. In 2014, 18 % felt the publicity had influenced the outcome (Missing People, 2013, 2014):

‘My daughter saw her own poster, I think that made her think she ought to go home. Someone then called her, and it was all over Facebook. It encouraged her to come back’. (Missing People Family Feedback Survey respondent 2014)

In the UK context, a wide range of appeal methods are available to informants and investigators. Some appeal methods are suitable for those appeals which can be shared in the public domain. Once these appeals have been made public, there is limited scope for them to be withdrawn completely, and, therefore, it is important that the people issuing the appeal consider carefully what information to include. More consideration is given later to the selection of information included in appeals.

It is important to note that when the police are involved they have the power to go ahead with a missing person appeal even if the informants (family, carers) are opposed to it. Conversely, should the police decide that an appeal would not be appropriate, they would need to persuade the family to concur; should the family launch an appeal, it would be difficult for that to be recalled effectively. The relationship between a family and the police can have considerable effect on the investigation, so the ability of the police and family to agree on an appeal strategy may become significant (Holmes, 2008).

3.3.1 Missing Person Posters

One of the most commonly understood and used appeal methods is the missing person poster. While police and families may create and distribute posters themselves, the charity, Missing People, can supplement this by accessing its

network of Poster Partners, who have signed up in advance and can be sent an electronic copy of a poster to print and display. This means posters can be distributed across a large area very quickly and with little resource expenditure. The charity’s Poster Partners also agree to withdraw posters when notified that the person is no longer missing. Posters can also be downloaded from the charity’s website, upon provision of an email address. Anyone who downloads a poster receives an email explaining that the charity will recontact them should the appeal close, asking them to withdraw any posters they have displayed.

Other types of poster appeal have been used in the UK. One example is of an appeal for a missing man, Luke Durbin.³ Luke was 19 years old when he went missing after a night out in 2006. Luke’s family arranged for a photograph of Luke’s eyes, along with an easy to remember website address, to be displayed on posters at railway stations across the country. The associated website contains descriptive information about Luke, the circumstances in which he disappeared and a number of photographs and CCTV images.

Another type of poster appeal that has been used in the UK was provided by the advertising company, AdMedia, which circulates posters to pubs, bars and clubs, railway stations and motorway service stations. The company provides space for missing person appeals to be displayed and printed and posters to be circulated. The advantage of this campaign was the wide reach. The lead time required to print and circulate the posters meant, however, that it was suited to longer-term missing episodes rather than brand-new cases.

Another highly localised approach to making an appeal is an Appeal Day organised by Missing People. Charity volunteers organise a stall in a local shopping centre, station or other public spaces and share one or more appeals with the public in that area, using posters and leaflets.

³www.findluke.com

3.3.2 Physical Items

As well as the display of posters, missing person appeals may appear on high circulation items or products such as milk cartons (Brown 1997 in Lampinen, Arnal & Hicks, 2009). One of the first people ever to be displayed on a milk carton in the USA was Etan Patz,⁴ a 6-year-old boy who was last seen in May 1979 on his way to school and has never been found. Etan's disappearance garnered national attention, and his disappearance was one of several that led to the 1984 creation of the National Center for Missing and Exploited Children (NCMEC) in the USA,⁵ and President Ronald Reagan subsequently chose May 25th, the day of Etan's disappearance, as National Missing Children's Day. The date has been adopted around the world as International Missing Children's Day.

The display of missing child appeals on milk cartons is one example of using physical items with wide circulation to display appeals. This has been used extensively in the USA with some degree of success (Walmart 2001 in Lampinen et al., 2009) and has been used in the UK in partnership between Missing People and the supermarket chain Iceland. Others include the use of grocery bags⁶ or on the outside of lorries (a partnership between Missing People and the supermarket Iceland).

3.3.3 Broadcast and Print Media

In the UK, a wide range of media outlets also support the search for missing people by airing or displaying missing person appeals. Newspaper and magazine appeals are the most easily accessed by investigators, particularly through local newspapers. The charity Missing People has developed partnerships with a number of print media publications, which allows for a

⁴<http://www.missingkids.com/poster/NCMC/603392/1>

⁵<http://www.missingkids.com/History>

⁶http://www.nationalchildsafetycouncil.org/index.php?option=com_content&view=section&layout=blog&id=16&Itemid=201

planned and regular approach to appeals. Regular appeal slots are currently provided, pro bono, by a wide range of local and national publications including the street paper, *The Big Issue*, the free newspaper, *The Metro*, the magazine for homeless people, *The Pavement*, the national newspaper, *The Mirror* and many local newspapers including the *Manchester Evening News*, the *Newcastle Chronicle*, the *Liverpool Echo* and the *Scottish Daily Record*.

Television appeals range from single ad hoc appeals incorporated into scheduled programmes to dedicated television programmes such as 'Missing Live', a television programme which aired on BBC1 for eight series between 2005 and 2013. Radio appeals are more likely than television appeals to be local rather than national, and to be reactive rather than scheduled.

3.3.4 Online, Digital and Innovative Methods

As well as using print and audio/visual media outlets, the families of missing people, the police and the charity, Missing People, increasingly rely on websites and social media sites online to provide an opportunity to circulate missing person appeals. The charity, Missing People, displays missing person appeals, searchable by region, age and sex, on its website at www.missingpeople.org.uk. Other organisations have similar pages, such as the UK National Crime Agency's CEOP Command's website at www.missingkids.co.uk and the International Centre for Missing and Exploited Children's (ICMEC) site at www.icmec.org. Websites that allow widespread sharing of appeals between users are ideal for circulating appeals, and already Facebook and Twitter are also significantly used for this purpose. At the time of writing, Missing People has more than 100,000 subscribers to its profiles on Facebook and Twitter. Every year, on International Missing Children's Day on May 25th, the charity holds its annual 'Big Tweet' and circulates a missing child appeal every 30 min for 24 h. The event attracts a number of high-profile supporters, and in 2014 the campaign generated 83,000 'retweets' of appeals.

An innovative new way of circulating missing person appeals has been developed by the charity Missing People in partnership with Royal Mail. Royal Mail provides digital handheld devices to its 120,000 postal workers throughout the UK and, under this new partnership, will be able to circulate missing person appeals to these devices. These can be nationally or regionally targeted. Another new appeal method is that which has been developed by Missing People in partnership with the Outdoor Media Centre. The Centre is an advertising industry body which brokers pro bono advertising space to be provided on digital advertising billboards for urgent missing person appeals.

Another large-scale alert system, Child Rescue Alert (CRA), has recently been adopted in the UK. The UK CRA is closely modelled on the US AMBER Alert system. AMBER Alerts were named after 9-year-old Amber Hagerman who was abducted and murdered in Texas in 1996, and the name is an acronym for America's Missing: Broadcast Emergency Response.⁷ Like AMBER Alerts, the UK CRA allows for a widespread appeal for a missing child to be created and circulated in a high-risk situation. Delivered in partnership between the National Crime Agency's CEOP Command, the charity Missing People and software provider Groupcall, the CRA system will utilise the charity's appeal processes (as described previously) and will also send alerts via text message, email and an app to subscribed members of the public. Police guidance suggests that investigators consider the use of CRA for missing people under 18 years of age, in line with Child Rescue Alert Activation Protocol (ACPO, 2010).

3.4 Challenges and Risks

A key challenge with public missing person appeals is the limited scope the investigators have to withdraw the information when it is deemed appropriate to do so. This challenge

varies with the nature of the appeal; newspapers and television media operate within professional standards and are therefore likely to comply with requests to delete appeals, while posters that have been printed and distributed will be harder—maybe impossible—to withdraw. The implications that obsolete missing person appeal information may have on the formerly missing individual are not fully understood. The charity, Missing People, has experienced situations where families of formerly missing individuals have been caused distress by online appeals that have been copied to websites outwith the charity's control and not withdrawn. There seems to be limited scope for families or investigators to take action beyond requesting its withdrawal and relying on the goodwill of the host website to delete the appeal.

While some appeals may be public, others may be targeted to a specific group in a more discreet way. Although, by the definition used above, we might define as an 'appeal' any information circulated using closed police networks and databases (such as the Police National Computer) or between police and statutory partners, this will not be discussed in depth in this chapter. There are, however, other networks through which appeals may be circulated without the information being released into the public domain. Examples of when this might be appropriate include occasions where making the appeal public might be expected to have a negative impact on the missing person's behaviour or where a public appeal might increase the risk posed to the missing person.

If a vulnerable missing person is unlikely to be able to return home of his or her own accord (such as a very young child or an older person with dementia), publicity appeals may be considered in order to enlist timely help with the search. However, for some vulnerable individuals, alerting the public that they are missing could conceivably increase the risk to them. This is a particular consideration for older children and young adults who may be vulnerable to exploitation and abuse while away from home, where a public appeal could draw unwanted attention to them. Similarly, a missing person who has been

⁷More information on AMBER Alerts can be found at www.amberalert.gov.

kidnapped or a victim of trafficking could potentially be placed at further risk if the person or people holding them are aware of the investigation.

There will also be circumstances in which a public appeal, or certain information about a missing person, might cause distress to them if it were shared. Private information about health conditions may not be suitable for public appeals or may be discretely referenced as a need for medication. Similarly, a history of violence that renders a missing person a potential threat is not likely to be disclosed but, again, may be referenced in veiled terms such as ‘do not approach’ or ‘call 999 if sighted’.

In order to provide an alternative to public appeals, the UK charity, Missing People, has developed and tested a range of discreet appeal processes that allow the circulation of missing person appeals to selected audiences. While the information that is shared is still suitable for the public domain, it is not widely circulated through public channels. This means that it is more straightforward to withdraw, and it is suitable for use when it is thought that widespread publicity might increase the missing person’s vulnerability or when others (such as the missing person’s family) might be negatively affected by publicity.

One such network for circulating discreet appeals is the Westminster Protocol network, developed by Missing People and the Department for Health in 2010. The network comprises statutory sector agencies (the police, local authority and the NHS foundation trust) and voluntary sector agencies (homelessness service providers such as day centres). Westminster is a large London borough with a large number of homelessness services and a highly transient population. The borough includes Soho, the West End, Victoria, Paddington and Marylebone. The borough of Westminster also hosts a high concentration of rough sleepers and receives a large number of missing person reports. The Westminster Protocol provides a process by which the charity, Missing People, can circulate information about a missing person. The receiving organisations then check their records to determine whether that missing person has

accessed the organisation’s services and, if so, a suitable professional can open a conversation with that person about his or her missing status and, if appropriate, support them to reconnect with Missing People, the police or their family. The Protocol was evaluated and found to be a useful and workable tool. The evaluation also recommended further expansion of the scheme throughout the voluntary sector (Holmes & Diamond, 2011).

As a result, Missing People then went on to develop a Support Partner Network nationwide, based on the principles of the Westminster Protocol. The Support Partner Network is a network of organisations that provide support and care to vulnerable people. Support Partners sign up to receive missing person appeals, which they display for their staff only (not publicly). Should they encounter a missing individual, they are then able to open a dialogue about that person’s missing status, allowing them to provide more appropriate support within their own confidentiality and safeguarding policies. Missing People provides information to all Support Partners about how best to support missing people and the options available; this support enables Support Partners to feel more confident in dealing with the issues around missing and to support their users more effectively.

3.5 Content of Appeals

Whether an appeal is widespread or more discreet, careful decisions must be made about what information to include. Appeal content will, of course, be determined by the creator of that appeal. Formal appeals, such as those issued by the police, tend to contain certain pieces of information: identifying information such as name, sex, age and ethnicity; a likeness (usually a photograph or age-progressed photograph); details of the disappearance (usually the location and date); and sometimes details of vulnerability or risk (e.g. ‘needs medication’).

The charity, Missing People, uses a standard template for all missing person appeals, carefully crafted to allow sufficient information to meet

the appeal's aims (which are discussed later) without revealing sensitive information about the missing individual. The appeals include the word 'Missing', an image of the missing person, his or her name, his or her age at disappearance, the date he or she went missing, the area from which he or she went missing, the charity's contact details and opening hours (24/7) and some additional text which varies depending on the aim of the appeal (which is discussed later).

Other appeals sometimes contain different information. Some, such as those from the National Center for Missing and Exploited Children (NCMEC), include additional identifying information about the missing person, such as height, weight and ethnicity. Others, such as those from the International Centre for Missing and Exploited Children (ICMEC), may include information about to which areas the missing person might have travelled or been taken. A variety of missing person appeals can be observed on police force websites and voluntary sector organisation websites such as www.zagini-eni.pl in Poland or www.anar.org in Spain.

Edkins (2011) observed that some appeal posters displayed in New York after the attacks of September 11, 2001 contained additional information, over and above that required to identify someone: 'Expecting first child this week [...] He also has a 2 year old at home who has just said his first sentence: "I want my daddy"' (Edkins, 2011, p. 20).

For anyone thinking of issuing a missing person appeal, there are many considerations to take into account. A missing person appeal should not contain, for example, any information that might increase the risks faced by the missing person or that could prejudice a police investigation. Further, there is an issue of what impact the disclosure of information could have on the missing person. In the context of the search for a missing individual, these considerations will inevitably be weighed against the assessment of the risks they face as a result of being missing and the benefits associated with them potentially being found or making contact, as a result of the appeal:

'I would hate for her then to be, you know, public information and to intrude on her privacy. I mean, my gut feeling is that she's not alive, I don't think

that (she's alive) is the case but part of me then doesn't want to interrupt her life if she's done that as a choice'. (Daughter of a missing woman, interviewed for Living in Limbo)

'One side of me thought 'Oh god, they are closing in' and the other half probably felt relieved about it really because I wasn't getting anywhere doing what I was doing'. (Formerly missing adult, interviewed for the Geographies of Missing People project 2013)

Much of the information contained in a missing person appeal will be passed to the police by the informant (if there is a police investigation) or will be already known to the person creating the appeal. However, there are circumstances in which this information may not be readily available. For example, when a patient goes missing from a hospital ward, a recent photograph may not be on hand. In order to increase the likelihood of appropriate images being available, the National Crime Agency has produced a framework for care providers who look after vulnerable adults who may go missing. The framework contains guidance about what information care providers should collect and make available to police in the event of a disappearance: 'All details [as listed] should form part of the standard admission policy into a care facility' (UKMPB, 2014, p. 9). The framework also recommends that an up-to-date photograph should be made available, with consent if available, but, otherwise, 'decision to take one must be based on risk assessment outcome' (UKMPB, 2014, p. 9). In a similar way, there have been recommendations for the public about keeping available information that would be useful in the event of someone going missing. For example, the Alzheimer's Association provides guidance about 'wandering and getting lost', which includes the recommendation that carers keep a recent photograph available to give to police if needed (Alzheimer's Association, 2015).

3.6 Aims of Missing Person Appeals

Missing person appeals may have a range of objectives, depending on individual circumstances, and these aims will inform the choice of appeal methods. There are also a number of

possible benefits that may not constitute an explicit aim of an appeal. These aims are now discussed alongside the key challenges associated with meeting each aim and consideration of the evidence available regarding effectiveness of appeals for meeting these aims.

There has been relatively little research into the effectiveness of publicity appeals in generating information that leads to a missing person being found although there are certainly many and varied examples in Missing People's history of this being the case. There is evidence from annual surveys conducted by the charity that, in a small proportion (around 6% over 5 years) of closed cases, the charity's appeal had directly led to the incident coming to an end. It is, however, important to note that, while 89% of missing person cases are resolved within 48 h (UKMPB, 2014), very short-term cases are less likely to be referred to Missing People for publicity assistance. This means that the charity works on an overrepresentative group of longer-term cases, which may suggest that the proportion of the charity's cases that are resolved through publicity is smaller than would be the case in the general population of missing cases. In the absence of police data about the effectiveness of publicity, however, this cannot be confirmed.

Clearly missing person appeals can be successful in contributing to missing people being found. However, significant research is still required to establish how often this is the case and how appeals contribute to missing people being found and to find out what could improve this effectiveness. Increasingly, research is focusing on the barriers to success and the ways in which appeals can be made more efficient:

'Recent empirical research (Griffin et al. 2008) shows that AMBER Alerts usually only "work" when relatively little risk is posed (e.g. when the child is abducted by an immediate family member) and are least likely to be successful in the "stereotypical" abduction cases for which they were designed'. (Griffin & Miller, 2008, p. 160; see Chap. 4 this volume)

There are five broad aims associated with missing person appeals: (1) to elicit information to help locate the missing person; (2) to appeal directly to the missing person to make contact;

(3) to satisfy families, informants and the public that a proportionate response has been made; (4) to raise awareness of the issue of missing and of available support services; and (5) to memorialise the missing person. Each of these aims is examined below, alongside the associated benefits, challenges, risks and evidence of effectiveness of appeals at meeting the aims.

3.6.1 Aim 1: To Elicit Information That Will Help Locate the Missing Person

'For a local issue, the publicity was very good. The village people were searching the fields and they found her in the end'. (Missing People Family Feedback Survey respondent 2013)

One aim of a publicity appeal is to notify a particular target audience, or the public at large, that the individual in question is missing. It may be that somebody who knows the missing person, or who has seen them recently, will see the appeal and act as requested. Alternatively, it may be that someone who has seen the appeal will subsequently see and recognise the missing person and then take action. Lampinen, Peters and Gier (2012) identified that appeals must therefore stimulate two types of memory: 'opportunities for recognition occur both among people who have previously encountered the missing person (retrospective person memory) and among people who subsequently encounter the missing person (prospective person memory)' (Lampinen et al., 2012, p. 706; see Chap. 11 this volume).

Families of missing people recognise that this is a key aim for circulating a missing person appeal. A relative of a missing man, interviewed by Holmes (2008), described their hope that a poster appeal would attract the attention of local people who would remember the missing man's face and be vigilant if they saw him:

'Somebody somewhere has got to have seen him. [...] We just wanted to get him out there so everyone could look at him, have a good look, so when they was on their business they might, you know... 'Oh, I remember seeing him somewhere, on that poster''. (Relative of a missing adult, interviewed for Holmes, 2008)

As this aim of making an appeal relies on third-party knowledge and action, it is particularly relevant in situations where the missing person might not be expected to make contact or return of their own volition. Examples might include older people with dementia who may be confused or lost, very small children who might not be able to take action themselves or people who have chosen to become and remain missing. While missing person appeals are appropriate to use in a wide range of circumstances, the main aim of the appeal may be reflected in the wording or content of the appeal. For example, publicity which is circulated in the hope of generating third-party information might prefer language such as ‘have you seen...?’ over, ‘... please let us know you’re OK’.

In order to meet the aim of generating third-party information, appeals must meet a number of criteria: (1) an appeal must be seen or heard by a sufficiently large and appropriate target audience; (2) the appeal content must be sufficient to allow the target audience to recognise or identify the missing person or to give information as to their movements⁸; (3) the appeal must explain the steps the audience should take if they have any information; (4) anyone with information must be willing to share it with the person or agency appealing; and (5) the information garnered must also be useful and useable. Meeting each of these criteria presents challenges and a number of potential risks. These are addressed below.

3.6.1.1 The Appeal Should Reach a Suitably Large and Appropriate Audience

In order to increase the likelihood of someone with information seeing an appeal, widespread appeals should aim to reach the largest possible number of people from the most appropriate groups (i.e. those most likely to have relevant information). Suitable distribution methods for large-scale publicity have been discussed earlier

⁸For example, an appeal might include information about a vehicle the missing person was believed to have travelled in, and it would be appropriate for an appeal to ask for people to report if they see or have seen the vehicle.

and include social media and online websites, posters, print, broadcast and advertising media and high circulation items. Each of these outlets has access barriers. In order for online appeals to reach a large audience, the website or profile needs to receive a high number of viewers. For example, an appeal microblogging site Twitter will only reach a large audience if the individuals who share the appeal have a large number of followers. Using organisational accounts like Missing People’s, or obtaining celebrity support, can help achieve this.

Large-scale circulation of physical appeal materials, such as posters, requires either (or both) supporters who can distribute these in a given area or a network of outlets who can be sent materials for display. A family member of a missing person, interviewed by Holmes (2008), said ‘the whole [town] was plastered in posters and, I think for a lot of parents they can’t do that. They don’t have the network to get people out there’ (Relative of a missing adult, interviewed for Holmes, 2008).

As well as reaching a large number of people, widespread appeals also need a high proportion of the people reached to be in relevant geographical areas. Police forces are able to develop partnerships with outlets in their areas, such as local newspapers or websites, allowing them to target particular locations with appeal materials. When a missing person is thought to have travelled, however, it can be challenging for investigators to access appeal outlets in distant locations. One solution is to use a national appeals provider, such as Missing People, who is able to maintain networks of appeal outlets nationwide. If a person has gone missing, or is thought to have travelled abroad, this is even more challenging. Some families fund their own overseas journeys to search and circulate appeal materials (Holmes, 2008). Organisations also exist, such as the Missing Abroad department of the UK charity, Lucie Blackman Trust,⁹ with the aim of supporting families searching for a family member missing in another country, and can support this appeal activity.

⁹<http://www.missingabroad.org/>

It is also important that appeals are targeted towards the people most likely to have or obtain relevant information. Miller, Griffin, Clinkinbeard and Thomas (2009) suggest that in the case of AMBER Alerts, for example, that effort should be focussed ‘on people most likely to see the perpetrator and child [...] officials would do well to target high-traffic businesses (e.g. gas stations or restaurants) and individuals who work in those businesses’ (Miller et al., 2009, p. 118).

One challenge in attracting a sufficient audience for an appeal is that the media organisations that control access to large-scale print and broadcast media may have processes or inclusion criteria that form obstacles to investigators using the channel. The need for some media broadcasters or publications to confirm content in advance can mean that certain media outlets are not suitable for some missing person appeals, such as those which are likely to be short term.

Editorial decisions about content may also influence which missing cases are chosen for transmission or publication. There is relatively little research internationally on the topic of race-, class- and gender-based bias in media reporting of missing person cases (Gilchrist, 2007; Liebler, 2010; Min & Feaster, 2010; Moscovitz & Duvall, 2011; Shalev-Greene & Reddin, 2015; Stillman, 2007), and what exists is predominantly US-focussed. While the picture painted by this research is mixed, there does seem to be evidence for a media bias towards overrepresenting white missing people and particularly missing white girls and women. One study found that non-African American girls were significantly overrepresented in kidnapping coverage and, overall, that ‘the coverage of missing children cases may be disproportional based on race and gender’ (Min & Feaster, 2010, p. 212). The phrase ‘Missing White Woman Syndrome’ has been coined to reflect the media’s ‘fascination with missing women who are white, young, pretty, and often from middle- or upper-class backgrounds, and media’s simultaneous apparent lack of regard for those who do not fit this description’ (Liebler, 2010, p. 549).

There are and have been, of course, missing boys and men, and of missing people of colour, who receive a high volume of media coverage,

such as in the case of missing Mikael Kular. In January 2014 3-year-old Mikael went missing from his home in Edinburgh, Scotland.¹⁰ Mikael was missing for several days before his body was found; his mother has since been convicted of his murder. Mikael’s disappearance attracted widespread media attention across the UK even before the associated Child Rescue Alert was activated. There is, however, sufficient evidence from research that media bias may play a role in the amount of media coverage a missing person appeal receives to suggest that investigators may need to consider this challenge when making an appeal and that journalists might be encouraged to reflect on current practice and seek to eliminate prejudicial behaviour.

Another challenge in reaching a large number of people is in ensuring that people pay attention to the information provided in appeals. Miller et al. (2009) suggest that research on memory has shown that people may struggle to acquire information in the presence of distractions or if they do not allow sufficient time to absorb the information; for example, ‘an AMBER alert presented during the nightly news is unlikely to be encoded into memory if the viewer is “cognitively busy” helping her child with homework’ (Miller et al., 2009, p. 113). Research has also found that members of the public may not dedicate sufficient time or attention to missing person appeals, even when they consider the issue of missing people to be an important one (Lampinen et al., 2009).

Further, even when appeals are presented in a time or place that should allow for full absorption and when people actively turn their attention to appeals, there are other factors that affect their ability to retain the information. Lampinen et al. (2009) found that adults often struggled with memorising the faces of missing children, even when they tried:

‘The customers at this store displayed no evidence of memory for the children’s pictures. This was true regardless of the importance the customers attached to the issue, the self-reported time spent looking at the pictures, and the customer’s intention to look for the children in the community’. (Lampinen et al., 2009, p. 414)

¹⁰<http://www.theguardian.com/uk-news/2014/jan/17/volunteers-search-mikael-kular-edinburgh>

3.6.1.2 There Must Be Sufficient Content to Allow Identification, and the Target Audience Must Be Capable of Recognising the Missing Person

Lampinen et al. (2012) have conducted a series of experiments concerning person memory and found that recognition rates can be low and therefore that missing person appeals should take this into account in their design and conduct. Any missing person appeal designed to allow both acquaintances and strangers to identify a missing person must contain sufficient identifying information to allow this. This must be carefully tailored to the appeal medium; a radio appeal might benefit from more detailed description of physical characteristics than a television appeal. Similarly, a televised appeal may be more effective if it includes moving images and voice recordings, as well as just photographs.

The image that is chosen is an important factor not only in the public representation of the missing person but also in making recognition more or less likely. Many things will affect a viewer's ability to recognise a missing person from a photograph, including 'the acquisition, retention, and retrieval of the missing child's appearance' (Gier & Kreiner, 2011, p. 3). There may, for example, be barriers for viewers to recognising missing people who belong to a different age group or ethnicity than they were; Gier and Kreiner (2011) explain that the other-race effect and the other-age effect may come into play, whereby a relative lack of exposure to people of other races and ages may make recognition more difficult (Gier & Kreiner, 2011). Several researchers have also explored the effect of image choice on prospective and retrospective memory. It has been shown that the mood of the person in the photograph may have some effect, although studies have shown conflicting results: for some, that angry faces are more distinctive than others and, for others, that it is easier to recognise faces with a positive mood display (Leppanen and Hietanen 2003 and 2004 cited in Gier & Kreiner, 2011, p. 2).

Increasingly technology has allowed the creation of sophisticated 'age-progressed' images, showing an image of how a missing person might appear after the passage of time (see Chap. 16 this volume). Research has found little in the way of evidence of effectiveness, in terms of age-progressed images improving person memory. Lampinen, Arnal, Adams, Courtney and Hicks (2011) did not find evidence for the effectiveness of age progression in terms of improving prospective person memory; they attribute this to adults' extant understanding of the ways in which children physically age and thus the lack of added value from age-progressed photographs. However, the research team rightly acknowledge that age-progressed images can be used to encourage renewed interest in an investigation, thereby increasing the reach of the appeal: 'forensic age progression was created as a method to develop new leads in such cases and give new hope to families of the missing' (Lampinen, Arnal, et al., 2011, p. 8).

At least one study (Charman & Carol, 2012) has demonstrated that age progression may not aid recognition but may, in fact, result in two types of error: 'an observer may mistakenly "recognize a non-target (a false alarm) or may fail to recognize an actual target (a miss)"' (Charman & Carol, 2012, p. 176). This study suggested that age-progressed images may result not only in increased 'false alarms' which, after all, are an acceptable risk for investigators but also in 'misses', because 'the addition of an [...] age-progressed image to an outdated image increases the number of faces that are considered as plausible targets, presumably making the target face less likely to stand out, decreasing target-recognition and increasing non-target "recognition"' (Charman & Carol, 2012, p. 176). Ultimately, the study authors suggest that the observers of age-progressed images, in effect, use that information incorrectly. While this work tested only one type of age progression technique, they posit that their findings might be applicable to other techniques as well.

3.6.1.3 There Should Be Clear Instructions for the Target Audience

It is vital that the viewers of a missing person appeal are clearly directed in how to behave should they remember or see the missing person. This direction might include whether or not to approach the missing person, how to contact the investigators and whether they might be able to pass information confidentially.

When investigators or families decide what contact information to include, they should consider the times of day that contact might be made (can a 24-hour response be guaranteed?) and who is best placed to cope with the incoming information. The UK charity Missing People is able to provide a 24-hour sightings helpline and can then divert information in a timely manner to the relevant investigators. Providing a family member's contact details on a publicity appeal creates a risky situation in which they are open to abusive, misleading or malicious contact and potentially liable to receive contacts around the clock at a time when they are already under considerable stress.

3.6.1.4 Target Audience Must Be Willing and Able to Share Information

In order for a publicity appeal to elicit information about a missing person's whereabouts, any viewers who hold that information must be willing to share it with those searching. Previous research (Griffin & Miller, 2008; Miller et al., 2009) has recognised that willingness to report information is vital. Griffin and Miller (2008) note that the success of appeals rests on people's willingness to share information rather than 'hesitating out of doubt or diffusing the responsibility to others' (Griffin & Miller, 2008, p. 165). This observation suggests that the nature, wording and frequency of missing person appeals may have an impact on viewers' behaviour, and further research might seek to find solutions to this problem.

Miller et al. (2009) also noted that negative attitudes towards police can discourage people from reporting sightings of missing people (Miller et al., 2009). In order to circumvent this

obstacle, independent organisations may be able to accept information from the public in a confidential way, before passing this to police investigators. In the UK the charity Missing People fulfils this function.

Concern about sharing information is an issue not only for members of the public but also for professionals who may recognise a client from a missing person appeal. During the evaluation of the Westminster Protocol Pilot, professionals from London's homelessness services described occasions of recognising a client in an appeal but being unsure how the request for information squared with their own obligation of confidentiality to their client (Holmes & Diamond, 2011). The charity, Missing People, provides advice to such service providers to help them to support their missing clients in such a way that protects their confidential relationship while also supporting the missing person to explore their options.

3.6.1.5 The Information Generated Must Be Useable

Finally, for a missing person appeal to succeed in gathering information that helps to locate a missing person, the information that is provided by the viewers must be useable and useful. This will, ordinarily, be for the police to ascertain during the course of an investigation. For investigators, the sheer volume of information produced by a large-scale appeal can present a challenge in terms of resources; just answering the phones and recording information can be overwhelming for an investigative team. Police guidance recognises that public appeals can generate a large number of 'sightings' and that investigative teams will need a strategy for assessing and managing this information (ACPO, 2010).

The possibility of receiving information that leads to a missing person being found is balanced against the possibility of receiving information which is, at best, misguided or mistaken and, at worst, malicious or misleading. This downside to publicity appeals can be challenging for investigators and for the families of missing people. Families report feeling that publicity appeals, and the subsequent receipt of sightings, raise

their hopes that the missing person will be found or will make contact and that their hopes can be dashed when this does not come to pass:

‘We found by making the appeals you get a lot of sightings and you get your hopes up. That part of it is upsetting. There was plenty of people who contacted the police saying they had seen my brother—it all turned out to be a wild goose chase. I would say it’s an absolute must but you’ve got to be prepared to be disappointed’. (Missing People Family Feedback Survey 2014)

Some information that is received, such as sightings, may be verified but fail to result in the missing person being found. Other information may, in fact, be incorrect, such as sightings that turn out to be the wrong person. Families are a key source of information about the missing person that may help investigators to prioritise information:

‘As a result of the police appeals and things there were lots of calls but a lot of them could be discounted, you know, ‘I saw him sitting in a pub smoking just yesterday, absolutely certain it was him’. Are you entirely certain? You know, [he] has never smoked, and it’s very unlikely’. (Relative of a missing adult, interviewed for Holmes, 2008)

Overall, it may be that, as Lampinen et al. (2012) suggests, the possibility of obtaining useful information makes the risk of receiving inaccurate information an acceptable one.

3.6.2 Aim 2: To Appeal Directly to the Missing Person to Make Contact

As well as seeking information about a missing person, appeals may alternatively or also seek to communicate directly to the missing individual. This is of particular relevance when a missing person may not know that they have been reported missing, when they may not think that anyone cares enough to look for them or when they might be frightened of making contact. Appeals which are most concerned to reach out directly may contain contact information for organisations like Missing People, which provides a 24-hour service via phone, text and email

and can provide advice and support to missing children and adults:

‘And I, to be honest, saw them more as an opportunity for him to see, to know that he was being looked for and being missed, more than I expected someone like me to walk down the street and recognise someone in a doorway from a poster and either approach them or ring somebody who might come’. (Relative of a missing adult, interviewed for Holmes, 2008)

‘His picture was on Missing People’s website and he found his picture on the Internet and realised he was considered missing, that someone was worrying about him and then he came back’. (Missing People Family Feedback Survey respondent 2014)

‘Posters made her feel that she would be discovered soon so made her mind up to return home. I also think that it showed we cared about her’. (Missing People Family Feedback Survey respondent 2013)

As well as hoping that the missing person might see his or her own appeal, information that is shared may also reach service providers who the missing person may access. One example would be sharing information with services for homeless people, in case the missing person accessed the service:

‘What we do have a lot, is a lot of people that’s been reported in local newspapers who then independently access our service, you know. To the point that we have one now, today, who has been seen as a missing person by three of four members of staff, via their local paper’. (Interview for Holmes & Diamond, 2011)

This aim applies not just to those instances where missing adults might be encouraged to make contact by seeing an appeal for themselves but also those rarer occasions where someone might see a photo of a missing child and wonder if it could be them. Ben Needham went missing on the Greek Island of Kos in 1991 at the age of 21 months; he would now be in his mid-twenties. There has been extensive publicity surrounding Ben’s disappearance, including posters, television appeals, social media and website appeals, generating many potential sightings. Many age-progressed images have been created, and a number of appeal posters are worded to reach out to men of a similar age who could be Ben.¹¹ Ben’s

¹¹<http://www.helpfindben.co.uk/posters.html>

family have since reported that men have approached them after seeing the appeals, although none has been found to be Ben.¹²

Some research has taken place that has considered missing people's response to their own appeal, but this has not yet been the focus of any published research. Further exploration of this issue could help investigators to understand the ways in which publicity appeals influence or affect missing people:

'This person came up to me in the street and said 'I've seen your face on TV, you've been reported missing'. [...] I felt a sense of relief because I could talk to someone, and they took me to the police station'. (Formerly missing adult, interviewed for the Geographies of Missing People project 2013)

3.6.3 Aim 3: To Satisfy Families, Informants and the Public that a Proportionate Response Has Been Made

Alongside other search or investigative activities, appeals can provide reassurance to families of missing people that everything possible is being done to find the missing person. Appeals respond to families' need to do everything possible to find the missing person (Holmes, 2008) and can allow families to be 'active partners in managing their missing situations' (Parr & Stevenson, 2013, p. 11). Interviewees who took part in the research for Holmes (2008) identified this as an important aspect of their relatives' publicity: 'we don't want it to be completely forgotten, you know, we want people still to be out looking and keeping their eyes open and stuff' (Relative of a missing adult, interviewed for Holmes, 2008). Other families, who have provided feedback to the charity Missing People, have echoed this sentiment: 'I would say that as a parent as soon as publicity goes up you are reassured that there are other people looking, because there is only so much one individual can do' (Missing People Family Feedback Survey respondent 2014).

While publicity appeals may help many families, there is, however, the possibility that missing person appeals can have a less positive effect on others. For some family members, the potential for negative attention on them or on the missing person can be emotionally challenging, illustrated by an interviewee who stated 'you just don't know at the outset, you don't know whether somebody might exploit a story' (Relative of a missing adult, interviewed for Holmes, 2008). For others, there is a risk that children or other relatives will be distressed by the publicity or find out about the disappearance in an undesirable way: 'the kids will pick up, every time there's a bigger appeal the local papers will run it, and they will start asking questions' (Relative of a missing adult, interviewed for Holmes, 2008).

Families of missing people can also find that being involved with a publicity appeal—particularly when directly involved in media activity—can be daunting and stressful: 'it ain't the easiest thing to do anyway, you know, you end up bawling your eyes out, but someone's got to do it' (Relative of a missing adult, interviewed for Holmes, 2008). Some families feel that it is their duty to maintain the search for a missing person and continue to search despite the effects on them and their family (Holmes, 2008). The effort of maintaining the momentum of a publicity appeal can also become exhausting over time (Parr & Stevenson, 2013).

As well as reassuring families (or other informants) that every effort is being made to find a missing individual, appeals may also serve to provide reassurance to the public that a police force is proactive in its attempts to find and make safe vulnerable people. There are, however, limits to this. The introduction of AMBER Alerts in the USA has been held up by some academics as an example of 'crime control theater' which, at best, misleads the public and, at worst, delays the development and introduction of more effective policies (Griffin, 2010; Griffin & Miller, 2008).

Griffin and Miller (2008) posited that child abductions can lead to 'moral panic', which can result in policymakers creating responses to the threat of abductions. They go on to identify the AMBER Alert system as one example of 'crime

¹²<http://www.theguardian.com/uk/2013/apr/28/ben-needham-kerry-needham-interview>

control theater’, situating the alerts as ‘symbols of official steadfastness for law enforcement agencies and other justice institutions that must function and interact with a public that is prone to moral panic about child safety. [...] It shows, in essence, that authorities are “doing something”’ (Griffin & Miller, 2008, pp. 166–167). The risk associated with this policy response, however, is that the ‘overoptimistic portrayal’ of such a system may have a negative effect on law enforcement agencies as well as the public perception of the phenomenon of child abduction (Griffin & Miller, 2008, p. 160). A potential pitfall is of misrepresenting the nature and prevalence of child abduction, thus exacerbating public fear and reaction. In the absence of empirical research about the effectiveness of alerts (at meeting their aim to elicit information leading to the location of abducted children), it is difficult to address whether the benefits of using AMBER Alerts outweigh the risks. Griffin (2010) later went on to conclude that, while the popular desire to believe in AMBER Alerts and the suggestion that the policy is justified if just one life is saved, in fact ‘exaggerating its effectiveness can be detrimental to law enforcement officials who must deal with the backlash when the overrated system “fails”’ (Griffin, 2010, p. 1061). Further, Griffin suggests that the use of the alert system distorts public discourse about how crimes against children (typically not committed during a missing episode or kidnap) might be addressed (Griffin, 2010).

3.6.4 Aim 4: To Raise Awareness of the Issue of Missing and of Available Support Services

A possible benefit of a missing person appeal is to make the public aware of where they might turn for help and support if a family member were to go missing. For the UK charity Missing People, missing person appeals present a key opportunity for members of the public to become aware of the charity’s services, in case they ever need them. Another possible benefit of missing person appeal is of raising awareness among

missing people, or those who are considering going missing, of available support. The UK charity Missing People promotes the use of its telephone number, 116 000, on all missing person appeals—the number is also available round the clock to missing, or potentially missing, children and adults.

Further to this, the regular public appeals for missing people serve to show the public that people from all walks of life, of all ages, both male and female, and of all ethnic backgrounds go missing. The frequency of appeals is a stark reminder of how many people go missing and of the risks they face. Publicity appeals may, in this way, inform the nature of public discourse about missing and, correspondingly, the policy and policing response.

3.6.5 Aim 5: To ‘Make Real’ and/or Memorialise the Missing Person

A final reason why people create missing person appeals—perhaps one that is subconscious or secondary—is to bear witness to the life of the missing person, to memorialise their life and to acknowledge their existence and their loss. Edkins (2011) explores this motivation for creating missing person posters: ‘the photographs of the missing are a precious remnant, a trace, a proof that the person exists. This is a person, a missing person they proclaim’ (Edkins, 2011, p. 16). There is also a sense in which missing person posters ‘can reinstate the value of personhood and the specificity of the person’ (Edkins, 2011, p. 28). Commentators have framed the activities of the Mothers of the Plaza del Mayo in this way, arguing that the mothers used the images they displayed to ‘make real’ their children who had disappeared (Foss & Domenici, 2001; Jones, Zagacki & Lewis, 2007).

Arguably, this purpose of missing person appeals has particular poignancy in cases where family members have a strong sense or belief that the missing person has died. After large-scale terrorist attacks, natural disasters or political or crime-related disappearances, the role of publicity

to search and reunite remains crucial (and, at times, effective), but the need for families to memorialise takes on extra meaning. Appeals can perform the function of protecting a liminal space wherein the missing person remains missing rather than ‘presumed dead’ (Jones et al., 2007) or in communicating the family’s sense of loss to wider society: ‘I am missing this person, I miss him or her and their posters constitutes the relational *act* of missing that person’ [...] This was a performance of love and companionship without the other being present’ (Jones et al., 2007, pp. 115–116).

Further to this, missing person appeals, in whatever form, provide a public reminder of society’s moral responsibility to search for and care for all of its members: ‘a responsibility that can be fulfilled only to each as a person, a responsibility to resist the invocation of the missing en masse in support of cause or nationalism’ (Edkins, 2011, p. 36). This has been particularly noted by observers of large-scale disappearances, such as the attacks on the World Trade Center in New York. Jones et al. (2007), analysing missing person posters after 9/11, observed that posters played a role in reminding society that ‘in tragic circumstances, every living survivor has a duty to the missing to remain hopeful and exhaust the search’ (Jones et al., 2007, p. 119).

3.7 Conclusion

Further research is urgently needed to understand how appeals function; how they affect missing people, their family, their community and the police; and how appeal tactics might become more effective. This would aid the police and others searching to be more sophisticated in their risk assessment of appeal strategies. Missing person appeal methods and routes must also be continually enhanced and extended in line with improved understanding of the appeal process.

Finally, missing person appeals, in all their forms, have a range of aims and effects. These are known, acknowledged and understood to varying extents. The decision to launch an appeal, whether by the police, family or another agency,

should take into account the implications of these aims and effects on everyone concerned. Most importantly, anyone considering a missing person appeal must balance the risk the missing person faces while away, and the potential for an appeal to lead to them being safeguarded, against the possible detrimental effects an appeal could have on the missing person, their family and the wider community. This is likely to be an enduring challenge for everyone concerned with finding and making safe the many thousands of people who go missing every year.

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The Rhetoric and Reality of the AMBER Alert: Empirical and Public Discourse Considerations Regarding the Child Abduction Phenomenon

Timothy Griffin

4.1 Introduction

Threats to children elicit strong emotional reactions, as children represent the future and by their innocence and vulnerability engender our strongest sympathies (Best, 1987). Child abduction is an especially pointed example. Numerous public policies have been enacted in the USA in the wake of child abduction-murders, such as the Jacob Wetterling Act, Megan's Law, three-strikes-and-you're-out mandatory sentencing legislation, and mandatory severe prison terms for sex offenses against very young children, such as Jessica's Law (Griffin & Wooldredge, 2013). All of these laws were associated with the abduction and violent murder of very young children. The legislation they often inspire is a powerful indication of how the abduction of children is an especially fearsome phenomenon for American parents and policymakers.

4.2 AMBER Alert

Among the legislative responses to a particularly horrid child abduction-murder is the AMBER (America's Missing: Broadcast Emergency Response) Alert system, which was inspired by the murder of Amber Hagerman in Arlington, Texas in 1996. The young girl's abduction had been witnessed, but at the time there was no way for law enforcement officials to rapidly disseminate information about the kidnapping to the public in order to elicit their assistance in locating the abductor and child. In the wake of the murder, local officials in Texas created the "Amber Plan," which enabled public safety officials to request publication of an AMBER Alert by electronic news outlets in order to solicit potentially helpful tips from attentive citizens. The AMBER Alert system was unified into a national network in the USA by the 2003 federal PROTECT Act, and other nations, such as the UK, have adopted their own versions of the system, often in conjunction with other emergency alert systems such as weather warnings.

4.3 Official Portrayals of an AMBER Alert

Public safety officials and child protection advocates have routinely praised the AMBER Alert system for its effectiveness. As of this chapter

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writing, the US Department of Justice asserts that “AMBER Alert has been very effective. AMBER Alert programs have helped save the lives of 711 children nationwide” (US Department of Justice: Office of Justice Programs, 2014). While the author is aware of no public opinion polls directly measuring levels of popular support for and belief in the AMBER Alert system, the indirect evidence strongly suggests the system’s utility is accepted largely without question. Included in this indirect evidence is the prevalence of rhetoric such as that cited above, as well as ongoing legislative expansions and AMBER Alert spin-offs, such as Blue Alerts when police are attacked in the line of duty, Silver Alerts for missing elderly, special categories of Alerts for the mentally ill, and even missing pet alerts (Griffin and Wiecko, 2015). Additional evidences that the AMBER Alert system is popularly regarded as effective are several high-profile lawsuits brought by the aggrieved family members of children abducted and murdered in cases where the AMBER Alert system is deemed to have been misused (Griffin et al., in press).

4.4 Prior Research on an AMBER Alert

Despite official claims of the AMBER Alert’s lifesaving capacities, the few empirical studies available have suggested an AMBER Alert might not be as effective as is popularly assumed—at least in terms of saving abducted children’s lives. For example, the first empirical analysis of the system suggested it was prone to overuse, as many of the alleged abductions were actually hoaxes or misunderstandings, and that even when successful, most AMBER Alert cases involved custody disputes and other familial abduction scenarios (Hargrove, 2005).

While the Department of Justice indicates AMBER Alerts have “helped save the lives” of hundreds of children since the system’s inception, the annual reports from the National Center for Missing and Exploited Children (NCMEC), which oversees the implementation of the AMBER Alert system and gathers data on all

Alerts issued, ironically suggest the inherent limitations of an AMBER Alert and the qualified nature of its successes. According to NCMEC’s own data, most AMBER alerts do *not* contribute to the safe recovery of the abducted children. For example, in NCMEC’s most recent report, which examined the AMBER Alerts issued in 2012, 52 (just over 31 %) of the 167 AMBER Alerts issued were deemed to have directly contributed to the recovery of the abducted child (or children, in multiple-victim abduction cases), but even this might be somewhat misleading. NCMEC’s report for the 2012 AMBER Alerts indicates that “the most common reason for an AMBER Alert success story is an individual *or law enforcement* [emphasis added] recognizing the vehicle from the Alert at 38 % ($n=20$),” (NCMEC, 2013, p. 28), but conflating effective police work that occurs “because” of an AMBER Alert is problematic, because police had mechanisms in place to communicate information about abducted children *prior* to the creation of an AMBER Alert. If the purpose of the AMBER Alert system is to elicit *citizen* assistance, then it is hard to see how the program has achieved this goal in cases where police simply do their job.

Furthermore, most AMBER Alert “successes” in NCMEC’s most recent report involved familial abductors or others known to the abducted children (34 of the 52 successes or 65 %, involved familial abductors), and most recoveries of abducted children—even those involving an effective Alert—occurred long after 3 h (NCMEC, 2013). This is a crucial point, because prior literature has established that most child abduction-*murder* victims are attacked by strangers or acquaintances and are killed within 3 h of their kidnapping (Hanfland, Keppel, & Weis, 1997). Thus, these data strongly suggest claims of AMBER Alert lifesaving effects should be tempered. Furthermore, the very few successes (18 or about 11 % of all Alerts issued) involving what NCMEC categorizes as “Non-family Abductors” (NFA) almost certainly did not involve clearly “predatory” abductors with perverse or murderous intentions toward the child. Although NCMEC does not provide specific narrative data on these cases, other, more detailed research strongly sug-

gests they would have involved (apparently) relatively unthreatening acquaintances of the child's family, thieves of running motor vehicles whose abduction of the child was incidental to the theft, babysitters, or unstable baby snatchers apparently yearning to possess a child (Griffin et al., article forthcoming). While abductions by such individuals are still problematic, it seems to be special pleading to say that "successful" AMBER Alerts in such cases clearly "saved lives."

Largely absent from the extant literature are scholarly, peer-reviewed examinations of the AMBER Alert system's effectiveness. In the first such study, researchers found (as have the annual NCMC reports) that in most abduction cases involving an AMBER Alert, the alert had no effect, most recoveries occurred much later than 3 h after the abduction, and the identity of the perpetrator was strongly associated with case outcomes (Griffin, Miller, Hoppe, Rebideaux, & Hammack, 2007). Furthermore, regardless of whether the Alert had any effect, the abducted children were significantly less likely to be harmed when the abductor was a parent or other family members and significantly more so when the abductor was a stranger or acquaintance. This study was limited, however, in that it relied on a nonprobability sample of 275 AMBER Alerts issued from January 2003 to March 2006 and media accounts of the basic events surrounding those AMBER Alert cases. Furthermore, the study provided no analyses of the correlates of AMBER Alert "success," only relationship correlates of outcomes in all AMBER Alert cases studied (Griffin et al., 2007).

Later, in a theoretical analysis, Griffin and Miller (2008) argued there are (possibly insuperable) obstacles to AMBER Alerts rescuing children from life-threatening abductions. First, for an AMBER Alert to rescue a truly endangered child, a "spectacular confluence of felicitous events" is required, including immediate knowledge of the crime by law enforcement, rapid issuance of the alert based on accurate information, and an attentive citizen to spot the perpetrator or abducted child in the narrow time frames usually necessary to save a child's life in just such abduction situations (Hanfland et al., 1997). A second

possibly unavoidable obstacle to AMBER Alerts registering lifesaving rescues is the inherent tension issuing authorities face when attempting to carefully gauge the level of threat posed in a particular child abduction case while still adhering to the relatively strict issuance criteria to avoid the superfluous use of Alerts. In short, it is difficult to see how authorities can make such decisions both fast and accurate. A final major practical obstacle to AMBER Alerts registering clear "lifesaving" rescues is the extreme rarity of the type of crime which inspired the system's creation—stereotypical child abduction-murder scenarios (Finkelhor, Hotaling, & Sedlack, 1992). In short, even if the AMBER Alert system was capable of registering lifesaving rescues, it has very few chances to do so.

Most recently, multivariate analysis of 448 AMBER Alert cases and their outcomes once again showed the primacy of perpetrator identity in conditioning the fate of the abducted child (Griffin et al., article forthcoming). Specifically, familial abductors were far less likely to harm children in AMBER Alert cases overall (regardless of whether the Alert had any effect), and there were no significant predictors of AMBER Alert success (where the Alert had some effect) other than issuance delay—the length of time between the abduction and the issuance of the AMBER Alert. Remarkably, that relationship was found to be negative; in other words, the more rapidly an AMBER Alert was issued, the less likely it would have any effect. This is counterintuitive, because the entire purpose of the AMBER Alert system is to rescue children through the rapid dissemination of information to the public. The authors speculated that rapid issuance of AMBER Alerts is associated with a case type more readily amenable to effective *police* response, such as impulsive child snatchings or unplanned and reckless abductions committed by one family member after a conflict with another (Griffin et al., article forthcoming).

While acknowledging it is impossible to know what would have happened in any particular AMBER Alert case had no alert been issued, the authors compared AMBER Alert success cases (again where the alert had some effect)

with AMBER Alert non-success cases (where the alert was issued but had no apparent effect on the case outcomes but in which the abducted child[ren] were returned unharmed) and found the two categories of cases to be almost identical on every measurable case attribute (relationship of the abductor to the child, recovery time, the nature of any measurable initial threat, the age and gender of the victims, and so forth). While this does not prove AMBER Alerts have not saved some children's lives, this strongly suggests that AMBER Alert success is usually incidental to, and not a crucial factor in determining, an abducted child's fate in AMBER Alert cases. On almost every measurable factor, AMBER Alert successes look virtually identical to AMBER Alert cases where the child was recovered safely but the alert had no effect, and since those very similar looking non-success cases ended well, it strains credulity to assume most AMBER Alert successes saved children from imminent harm (Griffin et al., in press). This article too, however, suffered from methodological shortcomings, as the authors conceded a substantial problem with missing data and the inability to measure the subjective "threat" posed by particular child abductors.

Nonetheless, in an analysis of 333 AMBER Alert success cases publicized by various state AMBER Alert-issuing agencies and the National Center for Missing and Exploited Children, the author found that the vast majority of these successes involved apparently nonthreatening abductors such as family members or car thieves who incidentally abducted the child(ren) during the course of stealing a running vehicle (Griffin, 2010). Furthermore, consistent with prior studies, the vast majority of the recoveries were shown to occur long after the 3-h window deemed crucial in the most menacing child abduction situations (Griffin, 2010). Again, while "actual threat" is unmeasurable, it seems most reasonable that it must be regarded in such familial abduction cases involving an AMBER Alert as comparable to the threat posed in familial abductions where there was *no* AMBER Alert—where the overwhelming majority of the abducted children are not harmed by their abductors (Finkelhor et al., 1992).

In summary, the limited available research, despite its scarcity and shortcomings, appears to confirm that AMBER Alerts are usually not effective at all in directly contributing to the recovery of abducted children, and even when they are effective, there is little evidence to suggest the system is achieving lifesaving rescues. There is thus very likely a disjunction between popular rhetoric and apparent sentiment about the AMBER Alert and its achievements, and what the limited available empirical evidence suggests about its effectiveness. The balance of this chapter will examine some of the concerns public safety officials, the public, academics, child welfare officials, and parents should consider in light of this tension and the apparent limitations of the AMBER Alert system and how these considerations can guide public discourse regarding the nature of threats to children and their respective solutions.

4.5 Potential Benefits of AMBER Alert

Although the author is largely skeptical of the overall utility of the AMBER Alert system, a number of its demonstrated and potential benefits should be acknowledged. First, the evidence is overwhelming that AMBER Alerts have been and continue to be successful at facilitating the recovery of some abducted children. Even if the lifesaving effects of AMBER Alerts are questionable, the ability of the system to generate productive citizen tips that lead directly to the rescue of abducted children or to intimidate abductors into surrendering the child(ren) and/or themselves is beyond dispute. Child abduction is a pervasive and undeniable social ill, and the designers and implementers of the AMBER Alert system are to be commended for their intentions and for the system's achievements—even if their estimation of those achievements is arguably inflated. While there is compelling evidence to believe the vast majority of successful AMBER Alerts involved cases where the children almost certainly would have been recovered even if the alerts issued in those cases had had no effect or had never even been issued at all, it is reasonable to believe the

alerts in those cases at least hastened recovery. Even if the vast majority of child abduction cases end with the safe recovery of the child and even if the alerts have no effect, it stands to reason that where an AMBER Alert does have an effect, it almost certainly accelerates the recovery of the victims. This only makes sense, because it means in those AMBER Alert success cases this citizen tip or intimidation of the abductors essentially outpaced the normal law enforcement procedures in place to recover abducted children—even if those procedures probably would have achieved recovery eventually. If rapidity of recovery in child abduction cases is regarded as a social good (and the author so regards it), then this is to the credit of the AMBER Alert system and its designers. More rigorous research is necessary to establish whether AMBER Alerts accelerate the recovery of abducted children when successful, but the presumption itself is both plausible and merited.

Second, a potential unintended benefit of the AMBER Alert system is its ironic but possible ability to focus greater levels of attention to the more common and pervasive familial abductions which usually do not garner the media attention lavished on lurid and horrifying child abduction-murder cases. While it was designed to facilitate the rescue of children in life-threatening situations, it is overwhelmingly deployed in relatively mundane cases involving familial abductors reacting against custody disputes or domestic conflicts. However, because of the AMBER Alert system, this sort of case is perforce thrust into the public view. An ironic possible benefit is greater public attention to the social pathologies (dysfunctional families, domestic violence and child abuse, substance abuse, lack of education and employment opportunities, and poor official custody arrangements) underlying so many familial abductions. It is possible the AMBER Alert system, inspired by one of the horrific but fortunately rare instances of child abduction-murder in the USA, could ironically draw attention to the category of child abduction which usually fails to garner so much media and social attention.

A final possible benefit of the AMBER Alert system is the opportunity its very existence pro-

vides for researching and possibly improving public participation in crime control. Thus, even if the AMBER Alert system is inherently constrained in achieving the lofty hopes inspiring its creation, the infrastructure deployed and the concept itself could be shown to be useful for other applications—a consideration not to be taken lightly in an era of renewed concerns about effective counterterrorism. Future research on the system specifically, and its various expansions and offshoots, could shed light on these very important matters.

4.6 Worth It if It Saves Just One Life?

Despite the hypothetical benefits acknowledged above, the simple truth is the best evidence strongly suggests belief in the lifesaving effects of an AMBER Alert is facile. In response to such critiques, defenders of the AMBER Alert system have often argued, as one advocate put it, “If it saves one child’s life, that tells me that it does work” (Crawford & Hundley, 2011). This is certainly a plausible argument to be borne in mind when evaluating the system. However, the argument that an AMBER Alert is worth it if it saves just one life is problematic because it overlooks a number of very important issues. First, it is impossible to prove either way whether AMBER Alerts have or have not successfully saved even *one* child’s life. This again is because it is impossible to know what would have happened in any particular AMBER Alert case had no AMBER Alert been issued. To say the system is worth it if it saves just one life carries with it the stealth presumption that AMBER Alerts have in fact saved one or more abducted children’s lives—a proposition which cannot be proven and which is very open to question if not full-blown doubt (see literature review above).

Another problem with the argument that an AMBER Alert is worth it if it saves just one life is that the statement is made in a vacuum of reasonable considerations about the potential costs and even dysfunctional effects of the AMBER Alert system. In part owing to a dearth of adequate

evidence regarding the system's effectiveness, there are a number of open questions about an AMBER Alert's overall utility in the legitimate overall social effort to combat the clear problem of child abduction. At the heart of these concerns is the fundamental problem outlined above: Far-fetched claims of an AMBER Alert's effectiveness are made in the absence of compelling empirical evidence, and thus the concerns outlined below could be rendered moot or greatly mitigated by empirical investigation. However, to date, such investigation has been lacking.

4.7 Potential Drawbacks to AMBER Alert

While the system to date appears to largely have been judged on the basis of its intentions rather than its demonstrated achievements, there are plausible reasons to suspect the AMBER Alert system might actually be counterproductive in certain child abduction cases. To say this might strike some as public policy blasphemy, but in the absence of adequate empirical investigation falsifying these concerns, they should be regarded as both plausible and worthy of reasoned and honest examination.

First, there are a number of ways an AMBER Alert can backfire, and there is in fact indirect evidence that in some cases it has. One clear potential problem is that AMBER Alerts by definition make public what law enforcement officials know about the abduction of a child, including the appearance of both perpetrator and victim, the license plate and description of any identified vehicle involved in the kidnapping, and the very fact that authorities now are aware of the child's disappearance and are actively working to resolve it. The problem of course is that this also makes all this information potentially available to the abductor(s), who can also watch television, listen to the radio, and read highway message boards. Because of AMBER Alerts, perpetrators potentially know exactly what car not to drive, what direction not to go, and how not to appear. It is difficult to see how this can ever be a productive investigative strategy.

A related concern is that the dissemination of offender and victim information to the public and the request for assistance in locating the abducted child opens the door not just to the possibility of helpful citizen tips in locating a child, but also any number of well-intended but inaccurate and ultimately superfluous and time-consuming tips, all of which have to be falsified by law enforcement officials—unless they are to be completely ignored, which begs the question of why an AMBER Alert is issued in the first place.

Another potential way an AMBER Alert can backfire in the case of a missing child search is its possible impact on perpetrator behavior. AMBER Alert advocates and system operators have promoted the AMBER Alert system not just as a mechanism for soliciting citizen tips, but for intimidating abductors into releasing the children they abduct. The idea is that the perpetrators become aware of the AMBER Alert and decide they would rather not be on the wrong side of the law or perhaps as a result of the alert only at that moment came to the realization they are even in violation of the law. This is especially true in familial abduction cases; it has been noted in prior literature that some family abductors do not even consider the kidnapping to be in violation of the law or even wrong at any level (Johnston & Girdner, 1998). However, no one has investigated whether this dynamic could work in reverse. If relatively less menacing child abductors, such as noncustodial parents, are amenable to the intimidating effects of the official scrutiny so powerfully symbolized by an AMBER Alert after a child abduction, is it not plausible this dynamic could work in the opposite direction? Could a potentially murderous abductor regard an AMBER Alert as a flag that official attention to the crime has begun and thus the window of opportunity to commit whatever murderous acts he or she is contemplating is shrinking? An AMBER Alert could thus potentially carry with it not just the possibly good outcomes of citizen tips or offender intimidation, but also a potential "precipitation effect" in which the public scrutiny of the alert induces the offender to behave violently with even greater rapidity (Griffin, 2010). (There are in fact specific cases where AMBER

Alerts are issued for abducted children and the perpetrator kills the child shortly thereafter.) It can fairly be objected to this speculation that you could never prove an AMBER Alert was the reason a particular abductor killed a particular abducted child—unless the perpetrator of a child abduction-murder were to report that—and the author is aware of no such specific confessions. However, this exact same logic has its converse in that you could never prove a particular abducted child is alive because of an AMBER Alert “success.” Uncertainty is a double-edged sword, and in the absence of compelling evidence either way, the only way to come closer to resolving such issues is through rigorous and pointed research (see below).

This issue merits elaboration. In concert with the concerns mentioned above that superfluous tips resulting from AMBER Alerts could potentially bog down investigators, the possibility of precipitation effects cannot be lightly dismissed. Even organizations committed to the AMBER Alert system agree it is useful in the successful recovery of abducted children in only a minority of cases. Again, the vast majority of abducted children were recovered—even the vast majority of abductions involving an AMBER Alert—as the result of *successful law enforcement investigation*. Anything which could potentially inhibit the functioning of investigators trying to locate a missing child should be subjected to the strictest scrutiny. However, to date, the AMBER Alert system has generally eluded such scrutiny, and thus these legitimate questions and concerns remain open.

Finally, there are a number of remarkably simple strategies by which a motivated and adroit child abductor could actually *exploit* the AMBER Alert system to foil investigators. They will not be mentioned in these pages for the obvious reason that that if they are ever proven to have been deployed the author cannot be responsible for having hatched the idea for future perpetrators of child abductions. Again, the only way to know if such tactics have ever been used or if they have ever been effective is to more carefully research the AMBER Alert system as per some of the suggestions below.

Defenders of the AMBER Alert system can reasonably argue that many of the concerns expressed above are speculative. They certainly are speculative and will of course remain so as long as the system’s efficacy is accepted without question in the absence of rigorous investigation. Such investigation could in fact largely or even completely falsify these potential problems, but to date it does not exist. This leads to a larger question regarding the AMBER Alert system specifically and reactionary crime control policies in general: Where does the burden of proof lie in assessing the worthiness of a particular public crime control policy? Should the fact that an AMBER Alert is *intended* to save lives bequeath it a presumption that it is at some level effectively doing so? Or should the burden of proof lie against such a presumption? The author’s concern is that the AMBER Alert system is part of a larger dysfunction in which such reactionary crime control policies are publicly rendered the benefit of the doubt for no other reason than the emotional language attached to their creation.

4.8 Directions for Future Research

The arguments above make it clear the author is skeptical of the overall utility of the AMBER Alert system—especially its alleged ability to save the lives of truly imperiled abducted children. However, it is entirely possible the author is wrong, and that future research could cast new and more encouraging light on the capabilities of an AMBER Alert. Previous research has consistently suggested the AMBER Alert system is less successful than everyone (including the author) would like to believe. However, all peer-reviewed research on the AMBER Alert system effectiveness has relied on media accounts of abduction cases involving AMBER Alerts and their case outcomes. Other research on the system has been limited to experimental settings on the perceptions of test subjects and their perceptions of the AMBER Alert system, which have questionable external validity, since they cannot replicate the real-world settings in which real AMBER Alerts

are issued and either attended to or not by real citizens (Greer, Pan, Flores, & Collins, 2012). While such analyses have been useful in underscoring both the benefits of and potential limits to the AMBER Alert system, they cannot be regarded as the final word on the subject. The child abduction phenomenon is so pervasive and problematic that any prospective solution to it merits rigorous scrutiny beyond what has been provided to date.

A number of very compelling research questions regarding the AMBER Alert system remain entirely or largely unstudied. Among them are:

1. Does the tension between the competing imperatives of rapid issuance and rational use of the AMBER Alert system create an inverse relationship between issuance time and issuance validity? In other words, are AMBER Alerts more likely to be issued unnecessarily, such as in runaway situations or simple misunderstandings, when they are issued quickly?
2. How can the potential “lifesaving” effects of the AMBER Alert system best be estimated? This is very problematic because, again, it is impossible to know what would have happened in a particular AMBER Alert case if no alert had been issued. Nonetheless, future researchers could devise estimation procedures in which a hazard rate for particular AMBER Alert abduction situations could be calculated based on known case facts (such as the identity of the abductor, the age and gender of the victim, recovery time, and so forth) which could be compared to the known attributes of known child abduction-murder cases. To the extent, AMBER Alert successes involve abductions that apparently conform to known child abduction-murders, and the lifesaving effects of the system could be estimated.
3. Conversely, what are the possible drawbacks of the AMBER Alert system? Can public scrutiny actually agitate some offenders into becoming more dangerous? Does publicizing information about the abductors and their victims enable the perpetrators to better elude law enforcement officials? The only way the author can conceive of resolving this question is to directly ask perpetrators (after they are caught and interrogated by investigators) if they were aware of any AMBER Alert issued in their particular case and if it at all affected their behaviors.
4. To what extent do members of the general public attend to AMBER Alerts once they are issued? One concern system operators have consistently mentioned in the discussion of how AMBER Alerts are deployed is avoiding the problem of “AMBER fatigue”—where overuse of the system leads to a diminished inclination on the part of the public to pay attention to AMBER Alerts once they are issued. Undoubtedly mitigating this concern is that only one person in the right place at the right time needs to be attentive for the system to succeed, and in fact AMBER Alerts continue to succeed for this very reason. Nonetheless, this crucial question—at the very heart of what AMBER alert is supposed to be about—remains completely unstudied and thus remain open.
5. Similarly, what is the general public’s perception of the AMBER Alert system and its accomplishments in general? As noted above, no public opinion polls have been conducted to answer this question, but it is crucial to understand how the general public perceives the AMBER Alert system and the nature of threats to children in general.
6. The point above logically leads to another crucial question: Does AMBER Alert distort the public discourse about the nature of threats to children and their prospective solutions? Above it was argued that an AMBER Alert could potentially “democratize” the child abduction phenomenon because so many Alerts are issued in, and lavish attention on, cases involving unstable and dysfunctional familial abductors as opposed to abductions involving “predators.” However, the opposite could also be true. If in fact the average American citizen believes the AMBER Alert system is effective at rescuing children in life-threatening situations and if the attention focused on child abductions publicized by the very nature of the AMBER Alert system

distracts public attention away from the predominant threats against children, then the AMBER Alert system is not just of limited utility, but very likely (and ironically) deleterious to child safety. Even if it can be assumed that all of the over 700 children directly recovered in the USA as a result of the AMBER Alert system since 1996 would have died were it not for the AMBER Alerts issued for them (which is a very dubious assumption), that number (an average of about 40 per year) is still a very small fraction of the estimated 2200 children who die from neglect or abuse annually in the USA alone (Palusci & Covington, 2014). If child safety is the goal, then what deserves greater social attention—a sensational but possibly ineffective policy that might not have saved a single child’s life or the persistent social and structural dysfunctions that pose the greatest risk to children’s lives but have to date eluded effective public policy response?

7. How does the international experience with the AMBER Alert system compare and contrast with what is known about AMBER Alerts in the USA? To the author’s knowledge, the only known empirical analyses of the AMBER Alert system are based on data from the USA. Empirical analyses of other nations’ (e.g., the UK, Canada, and Australia) versions of the system could cast light on how different cultural and technical approaches to enlisting citizen support in recovering abducted children could inform scholarly discussion on this crucial subject.

4.9 The Role of NCMEC

The National Center for Missing and Exploited Children (NCMEC) in the USA has the best available data on the American version of the AMBER Alert system, which are based on investigators’ reports of all cases involving AMBER Alerts. In the author’s view, NCMEC should make these data publicly available, perhaps to the Inter-university Consortium for Political and Social Research, one of the main American clearinghouses for publicly available data for criminal

justice and criminology researchers. The leadership at NCMEC is understandably cautious about sharing information regarding crimes against children and to date have been unwilling to share these data in order to protect victims’ privacy. However, AMBER Alerts by definition are public, and the nature of the crimes committed against the children who were the subjects of Alerts is already publicized, and thus there is no privacy to protect. Alternately, the data experts at NCMEC could conduct their own analyses in order to replicate or falsify the findings of earlier research. The author suspects that a faithful replication of prior research using NCMEC’s data would simply confirm previous findings. In fact, as mentioned above, NCMEC’s annual reports, while not divulging data on specific cases, have to date yielded *general* findings very similar to those available in previous peer-reviewed research: The majority of Alerts have no effect, rapid issuance and/or recovery is rare even in “success” cases, and a large proportion of AMBER Alerts are unfounded or involve familial abductors instead of apparently menacing strangers (NCMEC, 2006–2012).

That NCMEC has offered even that much information is to the organization’s credit. However, in the authors view, more sophisticated analyses are necessary to truly estimate the “life-saving” effects of an AMBER Alert, as suggested above. There is also, in the author’s view, a problem with NCMEC’s exclusive possession of these data, because its personnel have an interest not just in promoting the welfare of missing and abducted children (which is certainly admirable), but also promoting the organization as effectively addressing the social problem of missing children. Because NCMEC is so tightly interwoven with the AMBER Alert issuance and maintenance process, and because its personnel have been so outspoken in promoting the AMBER Alert system as an effective resource for endangered children, the author believes this constitutes a conflict of interest. This is certainly not to question the sincerity and dedication of the hardworking individuals and advocates at NCMEC, but merely to suggest that the same people tasked with promoting the system should not be the only ones with access to the data by which it can be best evaluated.

4.10 Conclusion: Successfully Addressing the Problem of Missing and Endangered Children

The irony of this chapter in an edited volume regarding how best to understand and address the problem of missing persons is its focus on a policy (AMBER Alert) which, in the author's view, has been overwhelmingly ineffective in achieving its intended goal of saving the lives of abducted children. The possibly disappointed reader cannot be blamed for questioning the utility of such a skeptical exercise: What is the point of focusing on something that does *not* work to address an undeniable social ill such as child abduction?

In the author's view, law enforcement officials, child safety advocates, scholars, and the general public should think of the AMBER Alert system as an important symbol of how *not* to go about the pursuit of public safety. In the wake of a truly terrible crime such as the murder of Amber Hagerman, it is easy to enact symbolic legislation that sounds superb in theory but which may be incapable of achieving its admirable but unrealistic goals. It is for this reason an AMBER Alert has previously been described as a "crime control theater"—a public policy designed to create the appearance of crime control where real crime control might not be feasible (Griffin & Miller, 2008). It is quite possible that the type of crime inspiring the AMBER Alert system—the rapid and brutal abduction and murder of a defenseless child—while fortunately rare, is virtually impossible to stop once set in motion. The AMBER Alert system is premised on the enlistment of citizen assistance in saving children from the worst imaginable fates, and there is certainly nothing wrong with that goal. However, the offenders perpetrating such appalling crimes likely know how most people view such acts and almost always target isolated and vulnerable victims and commit their crimes quickly, mercilessly, and *away* from public view (Hanfland et al., 1997).

The sad truth might well be that the best defense against deadly child abduction-murder

is to avoid abduction in the first place, and the best defense against the more common "garden variety" familial abductions is stronger social arrangements, better legal custody conditions, and simple but effective police work when such abductions occur. If the AMBER Alert system is invested with a presumption of efficacy owing to its modest achievements in resolving the latter category of child abductions, then it can possibly defeat its own purpose by frivolously taxing law enforcement resources and distracting social attention from more prevalent threats to children.

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Peggy S. Plass

5.1 Introduction

Children go missing for many reasons. Some of these events are clearly crimes in and of themselves (e.g., non-stranger abductions), while others clearly are not (e.g., a child who is late returning home from school for some benign reason, causing temporary alarm to parents), and still others are somewhat in-between (e.g., a teenager who runs away, becoming a status offender). Because of the broad range of ages encompassing the legal concept of “child,” there are also marked differences in the potential for harm or alarm for the same experience for children of different ages. A case in which a 16-year-old becomes separated from her mother in the mall, requiring that her parent search for her, may be considerably less alarming than a 5-year-old who is lost in a similar context. Characteristics of these missing incidents, ranging from the impact on children and families to the involvement of criminal justice system resources, may also vary widely across these continuums of age and type of missing event.

However, regardless of the characteristics of the child who is missing or of the type of event that precipitated his disappearance, children who

are missing are at risk for other forms of victimization, outside the mere experience of being missing. If missing children were just “misplaced” much of the alarm surrounding these events would be nonexistent—the problem would be solved by simply locating the child. It is because of this risk for something else happening—some other form of criminal victimization—that these events are so horrifying. If the mother of my hypothetical 5-year-old above knew that she need only worry that her lost daughter was playing with toys in an unknown store in the mall, tracking her down might be worrisome, but would be less likely to be frightening. It is because of the “something else” which might happen to this child—sexual assault, physical assault, accidental injury—that a missing child inspires such great fear.

This is not to say, of course, that child disappearances are not alarming on their own. But even the most terrifying type of these events—a non-family abduction of a child—we know to usually be motivated by the desire to perpetrate another crime (usually a sexual assault) (Finkelhor, Hammer, & Sedlak, 2002). Thus a consideration of these secondary victimizations—criminal offenses which occur in the context of a missing event for children, but which are not the event itself—is crucial to understanding the experience of being missing for a child and her family. This chapter will provide a theoretical framework for thinking about these secondary

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victimizations along with an examination of what we know about the incidence of these types of victimization. Two key questions will be examined—to what extent does the experience of being missing increase a child’s risk for other victimization? To what extent does experiencing a secondary victimization affect the overall impact of being a missing child?

5.2 Types of Missing Child Events

Before beginning to discuss secondary victimization, it may be useful to briefly review the reasons that children become missing, along with some of the methodological problems with studying these populations. There are several general categories of “missing” status that have been identified in the research in this field (see, for example, Sedlak, Finkelhor, Hammer, & Schultz, 2002), including the following: (1) non-family abductions; (2) family abductions; (3) runaways; (4) throwaways; (5) “lost” children; and (6) benign missing children. Most of these terms are likely quite familiar, while others might require a bit more explanation.

Non-family abductions (also sometimes referred to as stranger abductions), while probably the most feared type of missing child event, are also the most rare (Finkelhor, Hotaling, & Sedlak, 1992; Sedlak et al., 2002). The stereotypical non-family abduction—in which a young child is “stolen” from his parents and murdered or never seen again—is, thankfully, extremely uncommon. Abductions need not involve moving a child a great distance (moving a child even a few feet against her will generally meet the legal criteria for an abduction) and need not last for a long time (an event might be over before a child has even been identified as “missing”). The second National Incidence Study of Missing, Abducted, Runaway and Throwaway Children (NISMA-2), a national study intended to garner information about the number and characteristics of missing children events, estimated that there were only 115 events which met the criteria for the very

serious “stereotypical abduction”¹ category of event in 1999 (the last year in which data were gathered). The same study estimated about 58,000 short-term non-family abductions²—a conceptualization of these events using a broader definition. Most of these events involved teenage girls as victims and most were apparently perpetrated for the purpose of a sexual assault (Finkelhor et al., 2002; Sedlak et al., 2002).

Family abductions involve situations in which a family member, usually a parent, takes a child in violation of some custody agreement and/or against the wishes of a custodial parent. These events usually take place in the context of divorce, separation, or other family discord. Unlike non-family abductions, children who are abducted by family members are young (with nearly half under age 6). Estimates for the number of family abduction events each year generally far outnumber those for non-family abductions (Hammer, Finkelhor, & Sedlak, 2002a, 2002b; Sedlak et al., 2002).

While it is possible to consider the categories of runaway and throwaway children as two separate types of events, they are in reality quite similar to one another. A runaway child is one who leaves home on her own, without any external coercion, usually because of (often very significant) family conflict. A throwaway child is one who leaves home because parents or other caretakers insist—he is “kicked out” of the home.

¹A stereotypical abduction in the study was defined as one in which the offender was a stranger to the child and which involved any one of the following characteristics: the child was gone overnight, the child was killed, the child was taken more than 50 miles from the original site, there was an attempt to ransom the child, or there was evidence that the offender meant to keep the child permanently (Sedlak et al., 2002).

²A Nonfamily abduction in the study was defined as one in which “a nonfamily perpetrator takes a child by the use of physical force or threat of bodily harm or detains a child for at least 1 h in an isolated place by the use of physical force or threat of bodily harm without lawful authority or parental permission; or when a child who is younger than 15...or is mentally incompetent, without lawful authority or parental permission is taken or detained by or voluntarily accompanies a nonfamily perpetrator who conceals the child’s whereabouts, demands ransom, or expresses the intention to keep the child permanently” (Sedlak et al., 2002).

There is often overlap between these categories—for example, a child might leave home after a fight with a parent and when she returns home the next day the parents might refuse her entry to the home, making her both a runaway and a throwaway child. Research on the incidence of missing child events generally find that runaways are the single most common category, comprising a large proportion of all missing children annually (Sedlak et al., 2002). Most of these runaway and throwaway episodes involve older children (teenagers) and in many of these cases caretakers may know the location of the children involved—i.e., they are not literally “missing” (Hammer et al., 2002b).

The last two categories of event, sometimes referred to together as “general missing,” are the ones which have received least attention in the research in the field. “Lost” children are those who are involuntarily missing because they are lost (e.g., in the woods or in a strange neighborhood) and unable to find their way home—because they are injured and physically unable to return home, or because they are perhaps stranded without transportation and unable to get to their homes. These events have been found to be a little more common than are family abductions and considerably less common than runaways, and are likely to involve older boys (Sedlak et al., 2002; Sedlak, Finkelhor, & Hammer, 2005). The benign missing category includes situations in which children were late enough in returning home to cause alarm to their caretakers, but the reasons for their “disappearance” were not nefarious, and usually involved something like a miscommunication with parents or a child who lost track of the time. These events typically involve teenagers and are considerably more common than the “lost” child category of events.

One of the complications with any discussion of secondary victimizations for missing children is the paucity of data sources. Counting any victimization involving children is complicated—official police statistics, reported in the FBI’s Uniform Crime Reporting system, include detailed information about victims (including

their age) only for the single crime of homicide. The National Crime Victimization Survey contains data regarding the age of victims, but only includes people age 12 and older in their methodology. NIBRS (the National Incident Based Reporting System), which is slowly replacing/supplementing the UCR system, has information about victim age for many crimes reported to the police, and will eventually be an invaluable tool in estimating the level of victimization experienced by children in the USA. Currently, however, only about 1/3 of the UCR reporting agencies are able to file NIBRS reports.

These large national data sources are also limited in the crimes which they track. The UCR provides victimization data for 8 “index” offenses (homicide, rape, assault, robbery, burglar, larceny, motor vehicle theft, and arson) while the NCVS covers six crimes (rape, assault, robbery, burglary, larceny, and motor vehicle theft). NIBRS data cover a much broader range of offenses, but are also limited to crimes reported to the police. Even more significantly, while all of these data sources provide some information about crimes that may be likely as secondary victimizations for missing children, it is impossible to ascertain which, if any, took place in a context which actually involved a missing child.

The Uniform Crime Reporting system does include reports of arrests of children for running away, and NIBRS includes kidnapping as one of the offenses for which data are gathered.³ None of these national data sources, however, includes information on the “general missing” category of event, and matching other victimizations which might occur in the context of a missing event, even those events for which some national arrest data are available, remains complicated.

³The NIBRS kidnapping cases include those in which the offender relationship is identified as “family,” as well as those in which offenders are acquaintances and strangers. It is unclear the degree to which these “family” kidnappings resemble a more traditional conception of “family abductions.”

Arguably the best single source of information about missing child events are the NISMART studies (National Incidence Study of Missing, Abducted, Runaway and Thrownaway Children). NISMART data have been collected two times to date—the original study which provided data about the incidence of missing child events in 1990 (Finkelhor, Hotaling, & Sedlak, 1990), and the most recent which provided similar information for the 1999 study year (Sedlak et al., 2002).⁴ NISMART was developed as part of the 1984 Missing Children's Assistance Act, one of the provisions of which was a requirement for collection of data regarding the incidence of missing child events in the USA. NISMART and NISMART-2 involved interviews with thousands of parents and (in the case of NISMART-2) children, with a sampling strategy designed to be representative of the population of the United States, making them excellent sources for an estimate of the number of such cases that occur. Both studies were designed to measure the incidence of both very serious types of missing events, as well as less serious and alarming ones. Thus they can be considered a source of information about a broad range of missing child events. Notably, the NISMART-2 interview also included items regarding the occurrence of secondary victimizations in the context of all categories of missing child events.

A variety of other smaller scale studies also provide information about missing child events. For example, the research on runaways is fairly extensive and includes reports from numerous smaller scale surveys or interviews with this population of children (e.g., Tyler et al., 2013; Whitbeck, Hoyt, Johnson, & Chen, 2007). These studies are generally done with youth who are very "serious" runaways, with involvement in events which last a long time, involve travel for a great distance and often in which the runaway participants are homeless. Likewise, there are small-scale survey/interview studies with parents of children involved in family abductions (e.g., Greif & Hegar, 1993), providing more detailed

data on the experiences of these young people. Both of these types of research are likely to include information about other victimizations which children experienced while they were missing or away from home.

5.3 Theoretical Frameworks

The most useful theoretical frameworks for understanding the incidence of secondary victimizations in missing children events are Routine Activities and Lifestyle theories (Cohen & Felson, 1979; Hindelang, Gottfredson, & Garofalo, 1978). While both of these approaches have broad applications in the field for understanding patterns of victimization generally, there are many ways in which they are especially well suited to an explanation of criminal victimizations which occur when children are missing. A brief description of the elements of these two theoretical frameworks will likely make their usefulness in understanding secondary victimizations among missing children apparent.

While Routine Activities and Lifestyle theories are technically two different approaches to explaining criminal victimization, they are perhaps best seen as being complimentary to one another. Both focus on the ways (and places) in which people spend their time as significant elements in explaining their risk for victimization. Routine activities theory focuses on three essential elements for a criminal event, all of which must be present for a "successful" victimization. There must be (1) a motivated offender who encounters (2) an appropriate victim in a situation in which there is (3) an absence of guardians. The sorts of things that would make someone an appropriate victim might vary from crime to crime—an adult woman would not be an "appropriate" victim for a pedophile who was interested in a sexual encounter with a child. A large young man might be seen by a potential robber as a less appropriate victim than a frail elderly woman.

Lifestyles theory might be seen as identifying the variables which make it more (or less) likely that an appropriate victim will encounter a motivated offender in a situation in which there is an

⁴A third wave of data collection, NISMART-3, is expected soon.

absence of guardians. A person's lifestyle—the type of activities in which one engages, and where and with whom one pursues these activities—can be seen as being more (or less) likely to bring these three elements together. So, for example, the theory predicts that spending time in public places—especially at night and especially alone—is an “activity” which would increase risk of victimization. The theory also posits that the more one shares characteristics with offenders, the higher the risk of victimization. Thus, as most offenders are young and male, one would expect that young men would also be at higher risk for victimization (which turns out to be true, of course). Consider someone who sells drugs on a street corner at night. This person's lifestyle means that he associates with offenders (other drug sellers and drug buyers), thus increasing his likelihood of encountering a motivated offender. He has things which offenders might be expected to want (drugs and cash), which make him an appropriate victim. He is engaged in a secretive illegal activity which might make guardians less likely (no reporting to the police, for example). Thus, his lifestyle, the way in which he spends his time, makes it more likely that he would find himself in a situation in which the three elements specified in Routine Activities theory would coalesce.

Clearly, being missing is in and of itself a risky activity for a child. First, the one thing that all categories of missing child events have in common is an absence of guardians. In a sense, this is the definition of being missing for a child—she is out of the protection or control of her guardians—those who are tasked with caring for her. Such a condition does not necessarily guarantee a victimization, but it obviously greatly increases its likelihood by guaranteeing that one required element for victimization is present. This also means, however, that one might expect to see variation across categories of missing child event with regard to this variable. Thus a child who is in the presence of any guardian (e.g., in a family abduction) might have less risk than a child who is completely separated from a caregiver (e.g., a stranger abduction) for a secondary victimization.

All children might, in some sense, be considered appropriate victims, at least for some forms of crime. Children are smaller and less physically powerful than adults, which mean that they would offer little threat to an assailant. They are more trusting and less cognitively developed than adults, making them more amenable to deceit, fraud, or trickery. For a person with a sexual interest in children, they are the only appropriate victims—there is no legal way to indulge this particular form of sexuality, and no way in which it might be expressed without a child victim. Being missing, however, might be seen as something which would increase the already existing level of “appropriateness” of a child for victimization. Children who are missing, even in cases in which the missing status is voluntary (e.g., runaways), are likely to be frightened and/or emotionally vulnerable. With no appropriate caretakers to meet their material or emotional needs, missing children might be seen as ripe for victimization—easily manipulated, easily overpowered, easily deceived, or highly needy. A runaway who has been on the street for a few days may be desperate for a place to stay making him an attractive target for anyone amenable to taking advantage of that desperation. A crying child holding an iPod who has missed the last bus home might be seen as more vulnerable for a robbery than a happy child riding her bicycle in her neighborhood and listening to music on a similar device.

Being missing might also be seen as increasing a child's likelihood of encountering a motivated offender. Again, this likelihood might vary across categories of missing event. A runaway may be likely to be exposed to other teenagers living on the street who are accustomed to engaging in delinquent activities, or to pimps or others who are accustomed to preying on young people in a similar situation. A child abducted by a stranger is almost certainly in the presence of someone who wants to engage in some sort of illegal activity with the child, and may be likely to expose the child to others with similar interests and intents (think about child pornographers). A child abducted by a family member with violent tendencies has increased his risk of child abuse.

Research in the field has identified a variety of risk factors for involvement in a missing event among children (e.g., Finkelhor et al., 2002; Plass, Finkelhor, & Hotaling, 1997). The variables that might be expected to place a missing child at risk for a secondary victimization, however, might be somewhat different and have received relatively little attention in the literature in the field. These risk factors might span a wide range of variables including things like the type of event, characteristics of the event (e.g., when and where it takes place, how long it lasts), the age and gender of the child, and other characteristics of the young people involved (e.g., emotional maturity and stability, size, resourcefulness, and the like).

It is possible to make some predictions about the patterns which one might expect in terms of risk factors for the experience of secondary victimization among missing children. First, we should logically expect that missing children should have higher rates of victimization than do children who are not missing, as the state of being missing, regardless of its cause or context, is an inherently risky activity. We might also be able to predict some variations in the risk for secondary victimization across categories of missing child event and across different characteristics of a missing child. In terms of event characteristics, the degree of separation from a capable guardian should be related to the risk of secondary victimization. Thus, a child who is missing in the company of strangers should have a higher level of risk for secondary victimization than would a child who is in the company of known companions. More “serious” missing events—those in which children are gone for a longer period of time or in which they travel for a greater distance from home, for example—might also be expected to be associated with a higher risk of secondary victimization, as they might increase the risk of encountering a motivated offender.

A final very significant issue with regard to the incidence of secondary victimizations among missing children is related to the outcome of these events. Almost with a doubt, the occurrence of a secondary victimization will greatly increase the risk of physical or emotional harm in a missing child event. Even in the most alarming of

missing events—a non-family abduction—what happens during the event will have a huge impact on the likelihood of harm for a child. A youngster who is abducted by a mentally ill woman who wants a child to raise, who is recovered after a week of being missing, albeit well treated at the home of the abductor, might well experience less trauma than a teenager who is abducted by a stranger, beaten and raped, and released within an hour. Because of the broad range of characteristics of missing child events, an examination of what happens during these events is crucial to understanding how they might affect children and their families and the likelihood that they would involve resources of the criminal justice system (e.g., law enforcement or the courts).

While an examination of all of these questions is complicated by the availability of data, at least some of them can be addressed. In the remainder of this chapter we will examine evidence regarding the incidence and impact of secondary victimizations among missing children, focusing on the following two areas:

- Is being missing an “activity” which increases a child’s risk for victimization? i.e., do missing children have higher rates of victimization than do children generally? Are there predictable characteristics of missing events that might increase (or decrease) a missing child’s risk for secondary victimization?
- What is the impact of secondary victimization in missing events for children? To what extent do these victimizations shape the experience of being missing itself?

5.4 Incidence, Patterns, and Impact of Secondary Victimization in Missing Child Events

Is being missing a “Risky” Activity?

An attempt to compare the risk of criminal victimization among missing children with that of the population of children generally is definitely complicated by problems of measurement. However, in spite of this dearth of data allowing

for a thorough examination of the question, there is a fairly strong body of evidence that would suggest that being missing is a state which does indeed greatly increase a child's risk of criminal victimization. While data from the NISMART studies are probably best suited for addressing this question (and will be examined below) it is also worth noting that there is other research which has documented the ways in which missing children increase their risk of becoming crime victims. Finding comparison data (for victimization among non-missing children) is complicated by multiple factors—primarily a lack of comparability in the definitions of victimizations across the many sources of data about missing children and those which document victimization more generally, and the overall lack of adequate victimization data for children under the age of 12 in the United States. Thus only the roughest of comparisons can be made between data regarding criminal victimizations for missing and for non-missing children. As we will see, however, even these rough comparisons leave little doubt that being missing is an “activity” which greatly increases a child's risk for victimization.

Data from the National Crime Victimization Survey are perhaps the best option for estimating the extent of victimization among children in the USA generally. While far from ideal, the NCVS data are probably the best rough national estimates of child victimization possible. In interpreting differences between these numbers and those found for the levels of victimization among various populations of missing children three significant factors should be kept in mind. First, the NCVS data offer information only on children age 12 and older—and many missing children events involve younger children as well. Second, the definitions of criminal victimizations used for the NCVS are not always necessarily exactly the same as those used in studies involving populations of missing children (although there is certainly rough comparability). Third, it is impossible to establish which (if any) of the child victimizations reported in the NCVS data occurred in the context of a missing event (thus, they are far from a perfect “comparison” population as they likely include events which involved missing children).

Examination of research on the various types of missing children definitely suggests that being “missing” is a risky activity for children. To begin, there is widespread documentation of the dangers of running away from home across multiple methodologies. For example, ample evidence exists in the research on runaways with regard to the high risk of sexual assault and sexual exploitation for children involved in this type of missing event. Whitbeck et al. (2007), for example, in a study involving interviews with 400 runaways between the ages of 16 and 19, found that about 30% of these children reported having been sexually assaulted while they were on the streets. For a relatively stable period of time, research on the topic has had similar findings—i.e., that the rate of sexual assault for runaways is in the neighborhood of 30% (Tyler et al., 2013; Tyler, Hoyt, Whitbeck, & Cauce, 2001b). Some populations of runaway/homeless youth have been found to have even higher risk—for example, Whitbeck, Chen, Hoyt, Tyler, and Johnson (2004) found that more than half of the LGBT teens in their study of homeless youth reported a sexual victimization since leaving home. NCVS data consistently indicate rape and sexual assault rates among children (12–17-year-olds) as less than 1% (Bureau of Justice Statistics, 2014).

Most research finds rates of sexual assault for runaways higher for female than for male children, although the differences are not as large as those between non-runaway boys and girls. For example, Terrell (1997) found that 36.8% of girls and 9.5% of boys in their sample of 240 runaway and homeless adolescents reported a sexual victimization on the streets, a ratio of 3.8:1. Tyler, Hoyt, Whitbeck, and Cauce (2001a, 2001b) note a similar female to male ratio (3.75:1) in their study of 372 homeless and runaway children. Data from the NCVS in this same time period, although problematic due to the small number of cases on which male victimization rates are based, show a considerably higher female to male sexual assault victimization ratio in the same time period (33.4:1 in 1999 and 9.5:1 in 2002) (Bureau of Justice Statistics, 2014).

A second form of sexual victimization which has received a great amount of attention in

runaway populations is that of prostitution. Many studies have found that being forced or coerced into prostitution is an all too common result of running away from home (e.g., Simons & Whitbeck, 1991; Tyler et al., 2012). For example, Tyler et al. (2012) found that 20 % of runaways in their sample of 249 homeless and runaway youngsters reported having been involved in sex for sale experiences while they were on the streets. Whitbeck et al. (2004) found 16 % of LGBT and 10 % of heterosexual runaway youth in their study had engaged in survival sex. While some might argue that prostitution is a criminal offense rather than a victimization, this is clearly not the case when prostitutes are children.

Although sexual assault is likely the most discussed secondary victimization in research on runaways, there is also evidence that this population of children are at risk for other forms of victimization as well. Whitbeck et al. (2007), for example, find that about a third of the teen runaways in their study had experienced a physical assault involving a weapon. Generally, it appears as though the risk for physical assault is somewhat greater than that for sexual assault among runaways (just as it is for the population of Americans generally). Rates of aggravated assault for children in the NCVS in that time period were considerably lower—about 0.4 % for 12–14-year-olds and about 1.6 % for 15–17-year-olds (Bureau of Justice Statistics, 2014).

Other research has found that runaways have a risk for robbery as well. For example, Heerde et al. (2014), in their review of research pertaining to victimizations among runaway and homeless youth, note that the majority of studies that examine the issue find robbery victimization rates of between 20 and 30 % among runaway youth. Robbery rates reported in the NCVS for youth in the United States are consistently less than 1 % (Bureau of Justice Statistics, 2014).

Thus it is well established that children who are involved in serious runaway events—especially those who are homeless—are very likely to experience secondary victimizations while they are away from home. In addition, it appears clear that the rates of victimization experienced are considerably higher among this population than

those found for American children generally. However, the majority of children who run away from home each year do not fall into the category of very high risk which is present in the lives of the youth who were the subject of most of the research discussed above. Many runaway events involve children who leave home for a very short period of time and who do not engage in very risky behaviors such as heading for a large city and living on the streets there. These children are still arguably at a greater risk for victimization than are children generally (albeit at a considerably lesser risk than their more serious runaway counterparts). The NISMART studies, drawing cases from a random sample of the population of the United States, provide a valuable source of information on these sorts of events. In the definition used in NISMART, a child could be considered a runaway if she left home without permission and stayed away for a single night. While the study includes cases which would be considered much more alarming (involving children who left home and travelled great distances and/or who were away for extended periods of time), the fact that the definition is broad enough to include much less serious incidents makes it a unique source of information about the risks of children involved in more “everyday” types of runaway events. Indeed, on average about 20 % of the NISMART-2 runaways were gone from home less than 24 h, and 77 % were away for less than 1 week. About 40 % travelled no more than 10 miles from home, while about 70 % travelled less than 50 miles. Parents actually knew where their runaway child was in about 60 % of these events as well (Hammer et al., 2002b). Not surprisingly, the levels of secondary victimization found among runaways in analyses of the NISMART-2 data are considerably lower than those reported in studies involving only more serious/severe runaway cases and children who were, for example, living on the street. Plass (2007) reported a secondary victimization rate of about 8 % among the NISMART-2 runaways. Consistent with other research, physical assaults were the most common type of secondary victimization for the NISMART-2 runaways, followed by sexual assault and robbery (which were

nearly equal). The 8% overall rate is comparable to that found for children in the NCVS in 1999—about 9% of 12–14-year-olds and 12% of 15–17-year-olds reported any violent victimizations, while 2 and 3% of children in those age groups reported serious violent victimizations in those years (Bureau of Justice Statistics, 2014). Thus, the NISMART runaways have considerably higher victimization rates than do the NCVS children for serious violent victimizations, and are about comparable to the NCVS children with regard to violent victimization generally. As one would predict, the rates of victimization among populations of runaways who have left home on a more or less permanent basis and who might be homeless, as discussed above, are considerably greater than are the measures of victimization among American teens generally.

The likelihood of sexual victimization among non-family abducted children has also been quite well documented. Indeed, data from the NISMART studies suggest that sexual assault is far and away the most common motivation for this type of abduction (Finkelhor et al., 2002). Even among the non-stereotypical kidnapping abductions, the NISMART-2 data found that almost half of these events involved a sexual assault or an attempt at a sexual assault (Finkelhor et al., 2002; Plass, 2007). That rate was slightly (although not markedly) higher among children who experienced what the NISMART-2 study labeled a “stereotypical kidnapping” (see footnote above for the criteria used in this definition). Less than 1% of the NCVS children (5% of the 12–14-year-olds and 8% of the 15–17-year-olds) reported a rape or other sexual assault in 1999 (Bureau of Justice Statistics, 2014). The difference in the rate of sexual assault for the two groups is so great, it is difficult to contemplate that one could conclude that involvement in a non-family abduction is not something which enormously increases the risk of sexual assault for children, even with the methodological problems that are at issue here.

Non-family abducted children also appear to have high rates of completed and attempted physical assaults (about a third of the non-family abducted children were physically assaulted, with

another third reporting an attempted physical assault) (Finkelhor, Hammer, & Sedlak, 2002; Plass, 2007). Again, the rates of victimization in this time period for children found in the NCVS is considerably lower—1.5% of 12–14-year-olds and 2.23% of 15–17-year-olds reported an aggravated assault in 1999 (Bureau of Justice Statistics, 2014).

Undoubtedly most serious among the secondary victimizations associated with non-family abductions is homicide. It is difficult to establish with certainty how many child victims of abduction are murdered each year, but best evidence suggests two things. First, that these types of murders are rare—children are much more likely to be killed in other circumstances. It is also true, however, that if we examine the risk of homicide victimization among non-family abducted children it is almost certainly considerably higher than the risk of homicide victimization among children generally. For example, in the late 1980s, Hotaling and Finkelhor estimated that there were likely 48–316 child stranger abduction homicides that occurred annually in this time period (Hotaling & Finkelhor, 1990). During generally the same time period (1989), the first NISMART study estimated 3200–4600 legal definition non-family abductions which were known to law enforcement (Finkelhor et al., 1992). Combined, these two estimates would suggest a rate of homicide victimization among non-family abducted children ranging from a low of 1043/100,000 to a high of 9875/100,000. Either of these numbers is clearly astronomically higher than the rate of 3/100,000 homicides of all children in the United States reported during that period (Federal Bureau of Investigation, 1990).

Some victimizations have also been documented among family abducted children, although the evidence here is less well established. The best-documented negative effects on children involved in family abductions are primarily emotional (Chiancone, 2001; Plass et al., 1996). There is some evidence, however, that youngsters who are involved in family abductions are also victimized in more physical contexts as well. For example, Greif and Heger (1993), in a study of 371 cases of family abduction (with cases gleaned from the files of various

missing children's organizations), found fairly high levels of actual or suspected abuse of children during abductions. About one-third of parents in their study involved in cases in which children were recovered reported that the child involved was abused by the abducting partner during the event. Physical abuse was most common (23%) although a significant minority reported sexual abuse (7%) or both physical and sexual abuse (5%).

The NISMART-2 data also provide some evidence of secondary victimizations among family abduction events. Plass (2007) found that family abducted children had the second highest levels of secondary victimization among the five types of missing children events (with non-family abducted children having the highest levels of secondary victimization). Physical assaults were most common here (8%), followed by sexual assaults (4%). Given that family abduction victims are likely to be younger children, it is difficult to make comparisons between these rates and those reported in the NCVS (for children 12–17). It is notable, however, that the family abducted children's rates of victimization are at least comparable to those reported for simple assault in the NCVS and are higher than those for sexual assaults or aggravated assaults for those youngsters.

Finally, there is some information available about the levels of secondary victimization among children who fall into the "lost" or "benign missing" categories. The NISMART-2 data stand virtually alone as a source of data on this population of missing children. Plass (2007) reported a surprisingly high level of victimization among these categories of missing children. Twelve percent of the "benign missing" and 7% of the "lost" NISMART-2 children experienced some sort of secondary victimization during their events. Physical assaults were the most common type of victimization for each group (8% of the benign missing and 5% of the lost children).

Thus, even taking into the account the considerable methodological difficulties with making any comparison between rates of secondary victimization for missing children and those whose

victimizations occur in a non-missing context, the existing data support a claim that being missing is an extremely risky activity for children, and one that almost certainly greatly increases the risk for other types of victimization.

Having provided evidence of the riskiness of the "activity" of being missing for children, we will now proceed to examine whether certain characteristics of missing child events prove to be more or less strong predictors of secondary victimizations. As discussed above, existing theories of victimization would suggest some logical characteristics to examine. For example, events which involve a complete lack of known guardians (i.e., in which the child is in the company of a stranger) should have higher incidence of victimization. Those events which are more serious—in which children are missing for longer periods of time, in which they travel or are taken long distances, or in which their parents are completely unaware of their whereabouts—should have higher risks of victimization. The NISMART-2 data allow for the examination of some of these questions, but again there is also some suggestive evidence from other studies.

To begin, it is clear that some categories of missing child events are more "dangerous" and more prone to the occurrence of secondary victimizations. The NISMART-2 data indicate that well over half of the children who were involved in non-family abductions experienced some sort of secondary victimization (Plass, 2007). The second highest level of secondary victimization—that found among family abducted children—was about 18%. While it is not always clear in who's company a child was during a NISMART-2 missing event, there is no doubt about the non-family abduction cases. These children were, by definition, not with family (although they also may not have been with strangers). Thus, it might seem accurate to say that when children are in the company of non-family, their risk for secondary victimization is inflated.

However, the NISMART-2 data also indicated that levels of secondary victimization were higher among family abducted children than they were

for any category except non-family abductions. This is both expected and surprising. Expected because we know that generally children—especially young children, who are the most likely “victims” of family abductions—are so much more likely to be victimized by family generally, that perhaps it is expected that the levels of victimization in this category of event should be relatively high. It is unexpected, however, in the sense that we might assume that children who are in the company of a family member when they are “missing” should have at least some level of care and protection (“guardianship”). Research in the area of family abductions has often implicated the role of domestic violence in these events (Greif & Hegar, 1993; Janvier et al., 1990; Plass et al., 1997), which could be a likely the explanation for the high levels of secondary victimization among this category of missing children.

The impressive body of research about the fate of runaways provides a clear indication that more serious types of these events—those in which children leave home for a long time, travel a long way, and/or become homeless—offer greater dangers for the young people involved. The levels of sexual assault experienced by the NISMART-2 runaways (1.3%) (Plass, 2007) are considerably lower than the levels of sexual assault reported by research populations of more “serious” runaways, as noted above (Heerde et al., 2014). The fact that studies involving these more serious types of events also involve greater amounts of secondary victimization would seem to support the claim that such characteristics increase a child’s risk.

Thus, there is some indication that, much as victimization theories would suggest, missing child events which involve greater isolation from guardians are likely to have increased risk of secondary victimization, although the pattern with regard to family abductions merits greater scrutiny. In addition, research on missing child events which include a sample population which has more “serious” characteristics (e.g., children gone for a longer time, further away) also show higher rates of secondary victimization than do the more “everyday” (less serious) events of this type.

5.5 Secondary Victimization and the Impact of Missing Events

It seems clear that missing children have an increased risk of victimization compared with children who are not missing, and that among missing events, characteristics which might define them as “more serious” are associated with an even greater increase in risk of secondary victimization. How significant are these secondary victimizations in affecting the outcome and impact of missing events? It is to that question which we now turn our attention.

Some types of missing events would seem to be more likely associated with physical or mental harm—regardless of the presence or absence of secondary victimization—than would others. It is, however, important to keep in mind that the two are not necessarily the same. A child might experience a missing event without being either physical or mentally harmed. While this might be especially easy to see in categories like the benign missing cases, it is also quite possible for other types. Consider a family abduction in which a parent takes children for a week, bringing them to Disneyworld during that time. The children might experience no harm in a situation such as this, might instead have a very good time and not even ever know that they had been “missing.” Likewise, consider a teenager who argues with his parents and leaves home against permission and without telling them where he will be, but then proceeds to spend the night at the house of his best friend. He can be defined as a runaway, but it would appear unlikely that he would come to any harm in such a situation. Thus, harm (either emotional or physical) is not necessarily synonymous with being missing.

Secondary victimization during a missing event might be expected to be more tantamount to harm, but that is not necessarily the case either. A missing child might be pushed down by a bully when she is lost in a strange neighborhood, but sustain no actual physical injury. A runaway who is out on the town with a group of his friends might be accosted and threatened by a vagrant

Table 5.1 The impact of secondary victimization on physical and mental harm: type of secondary victimization

Percent of harm among cases with	Physical harm	Mental harm
Any secondary victimization	27%	33%
No secondary victimization	1.6%	8.5%
Gamma	0.92	0.68
Any physical assault	39.2%	23.9%
No physical assault	2.3%	10.8%
Gamma	0.93	0.44
Any sexual assault	25.9%	71.4%
No sexual assault	4.3%	9.7%
Gamma	0.77	0.92
Any robbery	26.3%	66.9%
No robbery	4.4%	10.1%
Gamma	0.77	0.89

seeking to take their money. If the runaway and his friends manage to elude the vagrant, successfully escaping with their possessions and their safety, they might later laugh about the incident and not experience any emotional harm from the episode. Thus an examination of how these factors vary—the experience of being missing, the type of missing event, the occurrence of secondary victimization, and the resultant emotional or physical harm—is significant in understanding the dynamics of secondary victimizations in missing child events.

Research using the NISMART-2 data has addressed the question of the relationship between secondary victimization and both types of harm. The NISMART-2 interviews included items related to whether or not children experienced physical or emotional harm as a result of their missing event. Table 5.1 is adapted from information provided by Plass (2007), in an analysis of the NISMART-2 data examining the relationships between secondary victimization and the experience of harm for missing children.⁵ Several things emerge here. First, it is correct that being missing and experiencing a secondary victimization and experiencing some type of harm

are not all the same thing. A child can be missing but not have a secondary victimization, can be missing without being harmed, or can even be criminally victimized in a missing event without being harmed. In addition, however, the data do make it clear that experiencing a secondary victimization in a missing event is strongly predictive of harm for the child involved. While the relationship is, not unexpectedly, greater for physical harm ($\text{gamma} = .92$), there is also a substantial relationship between secondary victimization and mental harm ($\text{gamma} = .68$).

There is also evidence that the missing children were not necessarily more likely to report one type of harm over the other, although there is variation there across the categories of secondary victimization. Overall, a little more than a quarter of the missing children who experienced any secondary victimization reported physical harm, with about a third reporting mental/emotional harm. The comparable numbers among those without secondary victimizations are 2% (for physical) and 9% (for mental harm). Sexual victimizations (arguably the most serious secondary crimes measured here) had a higher level of mental than physical harm reported. Physical assaults are, in fact, the only category of secondary victimization in which missing children reported higher rates of physical than mental harm. While the strength of the relationship between secondary victimization and harm varies across the categories of victimization, it is strong for virtually every category. This would seem to provide clear evidence that what happens during a missing event—especially in the context of the presence or absence of a secondary victimization—is crucial in predicting the effect the event will have on the child involved.

Table 5.2 provides data allowing a consideration of the way in which the relationship between secondary victimization and harm varies across categories of missing event. The impact of criminal victimization during an event would appear to be somewhat different for different types of missing experiences, although again there is little variation in the ultimate finding—regardless of what type of missing event a child was involved in, having a secondary victimization was a strong

⁵ See Plass (2007) for complete methodological information on these data.

Table 5.2 The impact of secondary victimization on physical and mental harm: event type

Percent of children who experienced harm	Physical harm	Mental harm
<i>Non-family abduction</i>		
Any secondary victimization	30.4 %	70 %
No secondary victimization	0.0 %	27
Gamma	1.00	.73
<i>Family abduction event</i>		
Any secondary victimization	34 %	56 %
No secondary victimization	2 %	46.2 %
Gamma	.94	.20
<i>Runaway event</i>		
Any secondary victimization	24 %	11 %
No Secondary Victimization	0.3 %	1.6 %
Gamma	.98	.77
<i>Benign missing event</i>		
Any secondary victimization	10 %	0 %
No secondary victimization	1	4.5 %
Gamma	.84	-1.00
<i>Missing/lost event</i>		
Any secondary victimization	88.7	64.9 %
No secondary victimization	15 %	6 %
Gamma	.96	.94

predictor of whether or not there was harm reported for that child. This was especially strong in the runaway and family abduction categories, where almost all of the children who reported any physical harm had also reported a secondary victimization (thus it would see that a secondary victimization was almost the only way in which runaways or family abducted children might have been physically harmed). Secondary victimization had the smallest effect in predicting mental harm for the family abducted children (reports of mental harm were very similar across those family abducted children who had a secondary victimization and those who did not). In fact, the only category in which secondary victimization was not related to a greatly increased likelihood of the experience of harm was that of mental harm among the “benign missing” group. Across types of secondary victimization, and across categories of missing child event, secondary victimization is strongly related to the experience of physical or mental harm for children.

5.6 Conclusion

As noted at the beginning of this chapter, children can be missing for a variety of reasons. The best research in the field has noted the fact that the concept of “missing child” is not one thing, but rather should be continued as a series of events which, while having some commonalities, may also be very different from one another (e.g., Asdigian et al., 1995). While being missing is almost certainly something which increases a child’s risk for other forms of victimization (secondary victimization) it is also clearly possible to be a missing child without experiencing secondary victimization. Especially given the significance of secondary victimization in affecting outcomes of missing child events, it would seem reasonable that this element of the experience of being missing should have a significant place in any attempts to understand the full continuum of these events, and in the formation of theory and policy related to being missing.

It is obvious that data and measurement issues are significant in this area. As more data related to the ways in which children experience criminal victimizations become available (e.g., the third NISMART study, more complete coverage of the USA with NIBRS data), these things can be further examined. First among these needs is a refinement of estimates of risk of victimization for all categories of missing children, compared to the risk of victimization for children not involved in missing events. The rough approximations provided here are compelling, but better data are needed to completely resolve this issue. It may be that being “missing” should appear in the field of child victimization in a way similar to that of being “in school” or “in the family.” There is a large body of work examining the ways in which children experience victimization in both of those contexts, and some consideration of the specific “dangers” which are present either at school or in a violent or abusive family. Perhaps being “missing”—across the entire continuum of meanings for that term—should likewise be a “place” or context in which the study of risk for victimization is focused. Ultimately, a consideration of the overall impact of secondary victimization on missing events—both as a motivation

for those events and as an occurrence for which risk is increased by being missing—can shed light on both how and when children are missing and on how and when children become victims of crime more generally.

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Conduct Problems Among Runaway and Homeless Teens

6

Stephen J. Morewitz

6.1 Introduction

This chapter uses published self-report narratives and data from the Missing Persons Project (MPP) to evaluate patterns of conduct problems, including conduct disorder (CD) and oppositional defiant disorder (ODD) among runaway and homeless young people (Morewitz, 2016; Goldstein & Morewitz, 2011). The MPP is based on a random sample of 998 missing-persons reports that were filed between 1991 and 2012 and published on websites including the North American Missing Persons Network and the National Center for Missing and Exploited Children. Additional media accounts of missing persons were also used as case studies. Each missing-person report was coded using a protocol that contains 291 variables. The coded data were entered into a data file and statistical analysis was then performed using Systat 9 for Windows program (1999).

Youth with conduct problems have an increased probability of engaging in antisocial activities during adulthood (Chen, Thrane, Whitbeck, Johnson, & Hoyt, 2007). They are also

likely to develop mental disorders in adulthood. Runaway and homeless youth with and without conduct problems are also likely to suffer adverse health, financial, and criminal justice outcomes (Benoit-Bryan, 2011, September; Yates, MacKenzie, Pennbridge et al., 1988).

Published self-report narratives and results from the MPP illustrate possible patterns of possible conduct problems among runaway and homeless youth even though information about whether they were ever diagnosed as having conduct problems is not available. The term, runaway, refers to children who leave home without asking their parent's permission and stay away for a night (Hammer, Finkelhor, & Sedlak, 2002). Other youth may be forced out their home by their parents and are referred to as throwaways. Homeless youth are young people who have become homeless because of lack of housing and may be without their family members.

6.2 Conduct Disorder (CD)

CD, which is common in children and adolescents, consists of repeated and persistent antisocial behaviors such as violation of age-appropriate social norms and individuals' rights (Turgay, 2005; Burke, Loeber, & Birmaher, 2002). CD can involve running away from home or care institutions, bullying, fighting, harming animals, setting fires, destroying property, committing theft,

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engaging in deceitful behaviors, skipping school, and committing other serious violations of rules. Because the markers of oppositional defiant disorder (ODD) are often present in CD, mental health professionals should not make the diagnosis of ODD if the person has CD).

Children and adolescents with CD frequently are hyperactive, have impulsive and explosive behaviors, are deficient in social skills, and have comorbid conditions such as deficits in learning and cognitive functioning, including attention deficit and hyperactivity disorder (ADHD), lower intelligence quotients, and reduced capacity for verbal reasoning, planning, and organizing (Turgay, 2005). CD by itself is rare. Youth with CD frequently have high rates of other comorbid conditions such as autism spectrum disorder, substance use, and anxiety and depressive disorders (Turgay, 2005; Guttmann-Steinmetz, Gadow, & Devincent, 2009; Booth & Zhang, 1997; Cauce et al., 1997).

Some runaway and homeless youth may have low self-control, which increases their likelihood of participating in criminal conduct including substance use (Baron, 2003). Moreover, homeless and runaway young people who have low self-control may have a higher probability of interacting with deviant peers and following deviant social beliefs and values. Runaway and homeless youth with low self-control may be more likely to be unemployed and homeless for longer durations.

When runaway and homeless youth with and without CD leave home, they are at increased risk of using hard drugs when they leave home. According to Hammer et al. (2002), an estimated 292,000 children and adolescents were taking hard drugs at the time of their runaway/throwaway episode. Hammer et al. (2002) analyzed that an estimated 317,800 children and adolescents were substance dependent at the time of their runaway/throwaway incident.

Homeless and runaway young people with CD may have an increased probability of using high-risk drugs that are related to sexual activity and human immune virus (HIV)/acquired immunodeficiency syndrome (AIDS) (Booth & Zhang, 1997). Booth and Zhang (1997) discovered that

CD was the greatest determinant of heroin and/or cocaine use on a life-time basis. The authors also found that CD was the best predictor of whether the homeless and runaway youth engaged in survival sex or exchanging sex for drugs, food, shelter, or money. In their investigation, CD also was positively linked to the number of sex partners and the number of drugs taken by the homeless and runaway youth.

6.2.1 Prevalence of Mental Disorders Including CD in Runaway and Homeless Youth

The rate of mental disorders and developmental disabilities among runaways and throwaways is substantial. Hammer et al. (2002) discovered that an estimated 24,300 runaway/throwaway children and adolescents had a major mental disorder or developmental disability at the time of their runaway/throwaway incident.

One type of mental disorder, CD, is prevalent among homeless and runaway young people (Robertson & Toro, n.d.; Cauce et al., 1997; Feitel, Margetson, Chamas, & Lipman, 1992; Robertson, 1989). In fact, running away is a marker of CD. The disorder can be diagnosed using the Diagnostic Interview Schedule for Children (Booth & Zhang, 1997).

Research has shown that the rates of CD among homeless youth ranged from 48 to 93% (Cauce et al., 1997; Feitel et al., 1992; Robertson, 1989). Another investigation by McCaskill, Toro, and Wolfe (1998) revealed that 39% of young people, ages 12–17, from shelters, had disruptive behavior disorders (mostly CD). This CD rate was higher than in a sample of matched-house youth.

Booth and Zhang (1997), in a study of the CD rate among runaway and homeless youth from a drop-in center that provided services to high-risk young people, revealed that 50% of the male and 60% of the female youth had a diagnosed CD.

The prevalence of CD in the general population is much lower. In the general population, reported rates of CD range from less than 1 to 10%. The rates differ widely based on the type of

population sampled and the methods for determining CD. The rates may have increased and urban areas may have higher rates than rural areas.

6.2.2 CD Etiology and Risk Factors

CD probably develops as a result of a complex interaction among social and biological conditions. The impact of these conditions may vary depending on whether CD emerges during childhood (early-onset) or later during adolescence. Early-onset CD may be a serious problem since a large number of runaways or throwaways are young children. In Hammer et al.'s (2002) investigation, an estimated 302,100 children 13 years or younger ran away or were thrown away by their parents at the time of their runaway episode.

Researchers and clinicians often have difficulty determining the extent to which a young person's conduct problems result from a mental disorder, the problems and stress associated with street life, child abuse, family violence, substance abuse by parents, or the child's own substance use problems (Robertson, 1996; Robertson & Toro, n.d.; Sharma & Marimuthu, 2014). In many cases, the young person's problems result from a variety of these conditions.

Cognitive deficits among youth at risk for CD typically will appear in children with early-onset CD. Youth with early-onset and adolescent-onset CD may tend to have reduced brain functioning, e.g., amygdale and ventromedial prefrontal cortex, that has been linked to antisocial conduct. Children with early-onset CD may be more likely than youth with adolescent-onset CD to have genetic factors that may be linked to the development of CD.

Social and family conditions play a major role in the etiology of CD, especially those with childhood-onset CD and related illegal behaviors. Such factors as sexual abuse in the family, low socioeconomic status (SES), poverty, single-parent status, large families, and parental divorce may increase the probability of CD and illegal activities because of weaker bonds with family and schools, less material support, and impaired social skills and school performance (Chen et al., 2007; Moffitt, 1993; Patterson & Yoerger, 1997).

Children from dysfunctional families such as those characterized by ineffective parental discipline and involvement are at increased risk of developing conduct problems, especially childhood-onset CD.

Different types of abuse can increase the likelihood of conduct problems. Early sexual abuse in the family may increase the risk of CD and related problems among runaway female youth (Tyler, Hoyt, & Whitbeck, 2000). Girls and boys from families characterized by physical and sexual abuse are more likely to run away and engage in delinquent activities such as engaging in deviant survival strategies (Chen et al., 2007; Baron, Kennedy, & Forde, 2001; Hagan & McCarthy, 1997; Lee & Schreck, 2005).

A risk amplification model helps to clarify the adverse effects of dysfunctional and disorganized families on CD (Whitbeck, Hoyt, & Yoder, 1999; Tyler, Hoyt, Whitbeck et al., 2001). Dysfunctional families and disorganized families promote coercive interactions among family members such as child sexual and physical abuse and neglect. As a result, children in these families face trajectories for premature independence and their exposure to deviant peers on the streets and associated risky and deviant behaviors such as survival sex and other deviant subsistence strategies. Runaway and homeless youth who engage in these deviant behaviors are a greater risk for sexual victimization, sexually transmitted infections (STIs) and HIV/AIDS, physical assault, and other adverse outcomes. In Hammer et al. (2002), an estimated 14,900 runaway/throwaway children and adolescents was the victim of sexual assault or attempted sexual assault during their runaway/throwaway episode. Hammer et al. (2002) also showed that an estimated 27,300 young persons were in the company of a sexually exploitative person at the time of their incident. In terms of physical assault victimization, Hammer et al. (2002) discovered that an estimated 69,100 young persons were physically assaulted or victims of attempted physical assault during their runaway/throwaway episode. According to Patterson, Dishion, and Bank (1984), coercive families are "basic training" grounds for conduct problems and other antisocial behaviors.

Homeless and runaway youth with childhood-onset CD, like homeless and runaway young people in general, are also likely to have weak attachment to school (Chen et al., 2007; Yiu & Khong, 2009; Peled & Cohavi, 2009), which can lead to their disengagement from school and negative attitudes toward school and career development, school classes absences, truancy, school dropout, and exposure to deviant peers during school (Hammer et al., 2002; Quilgars, Johnsen, & Pleace, 2008). Hammer et al. (2002) estimated that among runaway/throwaway youth enrolled in school at the time of their runaway/throwaway incident, an estimated 70,500 had missed at least 5 days in school. Tarasuk, Dachnar, and Li (2005) found that a majority of homeless youth in their study had not graduated from high school and only 3% indicated that they were currently in school.

Runaway and homeless youth with conduct problems can exhibit different behavioral problems in school. For example, they may exhibit aggressive behaviors and suffer from ADHD, which can be associated with childhood abuse, family violence, substance use, and other problems (Sharma & Marimuthu, 2014).

Certain subgroups of youth such as those from sexual minority backgrounds may be more at risk from the chronic stress associated with verbal and physical abuse at school, which increase their risk for running away from home and various other negative behaviors (Savin-Williams, 1994; Cochran, Stewart, Ginzler et al., 2002).

Homeless and runaway youth with CD and ODD have a greater probability of challenging the authority of teachers and not wanting to follow school rules and regulations. Children and adolescents with conduct problems will not follow the rules of their teachers, parents, and other individuals in authority. Youth who defy their teachers and violate school rules and regulations are more likely to have poor school performance and drop out of school.

Not surprisingly, homeless and runaway youth with and without CD also are more likely to be suspended or expelled from school (Thompson & Pillai, 2006; Quilgars et al., 2008). In one investigation comparing youth using emergency shelter services in New York and Texas, Thompson and

Pillai (2006) discovered 56.8% of the youth in New York and 33.5% in Texas indicated that they had been truant or expelled from school.

Homeless and runaway young people with childhood-onset conduct problems and related ADHD and other learning disorders, like homeless and runaway youth in general, have a higher probability of exhibiting disruptive behaviors in school, failing school, or having low school performance, low scores on standardized tests, and low self-esteem that create barriers to obtaining legitimate jobs (Patterson & Yoerger, 1997; Chen et al., 2007; Rogers, Segal, & Graham, 1994; Peled & Cohavi, 2009; Thompson & Pillai, 2006; Robertson & Toro, n.d.). Several reports have shown that 25–35% of homeless young people were kept from completing a year of school (Clark & Robertson, 1996; Robertson, 1989; Upshur, 1986). Some investigations have demonstrated that approximately 25% of homeless youth take remedial or special education courses (Clark & Robertson, 1996; Robertson, 1989).

In some instances, youth who drop out or are expelled may miss being with their school friends. In a qualitative study of runaway girls in Israel, Peled and Cohavi (2009) describe the case of one runaway girl reported that after she was expelled from school, she missed the fun that she used to have with her school friends.

Adverse peer interactions, including interaction with deviant peers and rejection by peers may increase the probability of CD (Chen et al., 2007). When young people, run away from home or a care institution, those with and without CD have an increased risk of getting into fights and exhibiting other forms of aggressive behaviors. In one self-report narrative, a female runaway stated that she had a fight with her best friend (Mishriki, 2001–2013). In another self-report narrative, one female runaway noted that she had to leave where she had been staying after getting into a fight with her friend who was living there (Mishriki, 2001–2013).

In regard to interaction with deviant peers, youth with aggressive tendencies may select deviant peers (Hinshaw & Lee, 2003). Moreover, deviant peer networks can promote antisocial conduct and delinquent and serious criminal

behaviors. Hammer et al. (2002) discovered that an estimated 70,500 children and adolescents were with a violent person at the time of their runaway/throwaway episode. Rejection by peers can also facilitate the persistence of CD.

Among runaway and homeless young people with and without CD, peer conditions such as peer group affiliation can foster a variety of delinquent and serious criminal behaviors (Kipke, Montgomery, Simon et al., 1997). For example, in the MPP Case 553, a 16-year-old boy from Rockville, MD, reportedly was traveling in a stolen vehicle with two of his classmates at the time that they were running away from a youth academy.

Runaway and homeless young people, especially those with CD, may be at risk for engaging in violent behavior. Kim, Tajima, Herrenkohl, and Huang (2009) found that running away increases the likelihood of subsequent violent delinquency. Similarly, according to Baron and Hartnagel (1998), chronic homelessness and related conditions is linked to robbery and other violent crimes.

Other factors, such as childhood depression, family violence, and bullying are linked to a higher probability that children in general will engage in violent behavior (Morewitz, 2010; Morewitz, 2004; Goldstein & Morewitz, 2011; Morewitz, 2016). One investigation showed that parental/guardian use of psychosocial abuse in intimate relations is related to an increased risk of violent behavior among young people in general (Ferguson, San Miguel, & Hartley, 2009). In another study, McFarlane, Groff, O'Brien, and Watson (2003) found that children who are exposed to intimate partner violence (abuse of their mothers) have a greater probability of exhibiting externalizing behaviors such as physical aggression and internalizing problems such as anxiety, social withdrawal, and depression. In other research, Baldry (2003) showed that girls who are exposed to both father's violence against the mother and mother's violence against the father increase the likelihood that the girls will bully others in school than girls who are not exposed to intra-parental physical abuse. Victims of bullying are also at increased risk of engaging in subsequent violent behavior (Morewitz, 2010).

Whitbeck, Hoyt, and Bao (2000), based on a study of 602 runaway and homeless young people, discovered that although family conditions can cause depressive symptoms and comorbid problems such as conduct problems in runaway and homeless young people, life on the streets can worsen depressive symptoms and comorbid problems such as conduct problems among runaway and homeless youth. A life-course approach can clarify the ways in which street life can worsen already severe conduct problems and high levels of distress in this vulnerable population.

Youth who exhibit aggressive behaviors, including homeless and runaway youth, may be at increased risk for suicidal behaviors (Hammer et al., 2002; Tremblay, Nagin, Séguin et al., 2004). In Hammer et al.'s (2002) research, an estimated 70,500 runaway/throwaway children and adolescents had previously tried to commit suicide. Runaway and homeless youth also may engage in self-mutilation such as burning or cutting themselves on their extremities, hitting themselves and scraping skin to draw blood (Tyler, Whitbeck, Hoyt et al., 2003).

Runaway and homeless youth with and without CD may become friends with older peers on the streets. Younger runaway and homeless young people may favor interacting with older peers because it is fun and exciting. Interacting with older peers may be a way for these younger runaways to feel like they are more grown up. For example, a female 11-year-old runaway in one self-report narrative felt that hanging out with peers much older than her was a wonderful experience (Mishriki, 2001–2013).

Older peers can contribute to the delinquency of younger peers. Runaway children and adolescents on the streets gain access to alcohol and drugs (Hammer et al., 2002) and stolen merchandise and engage in sex when they interact with older peers (Mishriki, 2001–2013). According to Hammer et al. (2002), an estimated 302,100 children and adolescents were with someone known to be abusing drugs during their runaway/throwaway incident.

Runaway and homeless youth with and without CD may stay in the local vicinity at the time that they run away. According to Hammer et al.

(2002), an estimated 503,100 children and adolescents had traveled more than 1 but no more than 10 miles during their runaway/throwaway incident. According to findings from the MPP, 27% of the runaway youth may be staying in their local area, according to law enforcement personnel.

In other instances, they may run away within in their state or to other states and countries. Hammer et al. (2002) discovered that an estimated 147,600 children and adolescents had left the state during their runaway/throwaway episode.

Runaway youth also may disguise their appearance to avoid detection by law enforcement. For example, In MPP Case #528, a 16-year-old runaway girl reportedly dyed her hair and wore a wig. At her last known location, the blond-hair runaway girl was seen with dyed black hair. Runaway and homeless youth also may use nicknames or aliases that also might help them avoid detection by the police. For example, a 17-year-old girl in RYP Case #532 used two nicknames.

Youth who are exposed to community factors such as high levels of neighborhood violence and the presence of violent and criminal peers and gangs may have a greater likelihood of developing CD. Hammer et al. (2002), in their investigation, found that an estimated 256,900 children and adolescents spent time in a location where criminal behaviors were known to take place during their runaway/throwaway incident.

Runaway young people, especially those with conduct problems, may engage in various delinquent acts such as vandalism and robbery. They participate in delinquent activities frequently because of their deviant subsistence strategies (Whitbeck et al., 2000; Hammer et al., 2002; Thompson & Pillai, 2006; Chen, Thrane, Whitbeck, & Johnson, 2006; Edinburgh & Saewyc, 2009; McCarthy & Hagan, 1992). According to Hammer et al. (2002), an estimated 197,400 children and adolescents who ran away had participated in criminal activities during their runaway/throwaway episode. In an investigation of shelter youth, Thompson and Pillai (2006) discovered that 16% had committed misdemeanors. A study by the Federal Youth Services Bureau revealed that two-thirds of shelter youth and four-fifths of street youth had tried

to commit or completed a theft (Greene, Ringwalt, Kelley, Iachan, & Cohen, 1995).

Runaway and homeless young people often suffer from hunger and food insecurity. They frequently steal food as part of their deviant subsistence strategy in response to hunger and food insecurity. According to McCarthy and Hagan (1992), 47% of the youth in the study indicated that they had stolen food.

Runaway and homeless children and adolescents participate in prostitution as a deviant subsistence strategy (McCarthy & Hagan, 1992; Hammer et al., 2002). In their sample of homeless young people, McCarthy and Hagan (1992) discovered that 29.7% had engaged in prostitution.

Runaway and homeless youth who have CD and use drugs may be at increased risk of committing other delinquent acts and getting arrested (Chen et al., 2006). The police may use discretion in deciding whether to arrest runaway young people. Extra-legal aspects of their behavior affect whether they are arrested and other criminal justice outcomes. For example, the police may be more likely to arrest runaway young people who appear defiant. In addition, runaway young people who display defiant verbal and nonverbal cues may be more likely sent to juvenile court (Mann, 1980).

6.3 Oppositional Defiant Disorder (ODD)

According to the DSM 5, individuals with oppositional defiant disorder (ODD) are defiant and argue with adults and exhibit anger, irritability, or vindictiveness for at least 6 months (American Psychiatric Association, 2013). In contrast to those with CD, children and adolescents who are diagnosed with ODD do not harm people or animals, do not commit vandalism, steal or engage in deceitful behavior.

Individuals with ODD exhibit defiant behaviors, anger, irritability, and vindictiveness while interacting with a person who is not a sibling. Individuals with ODD must exhibit four symptoms from one of three behavioral categories: anger and irritability, argumentative/defiant behaviors, or vindictive behaviors. For example,

in one self-report narrative, a 14-year-old runaway boy described how he constantly argued with his mother (Mishriki, 2001–2013).

Youth with ODD frequently are defiant; they do not want to follow rules set by their parents and others in authority such as teachers, coaches, and school principals. In MPP Case #390, a 16-year-old girl from Stockton, California, was known to have a “rebellious streak.”

In a number of self-report narratives, runaway youth describe the different times that they skip school classes or skip school entirely (Mishriki, 2001–2013). One 15-year-old runaway reportedly skipped classes all of the time with friends. They would hide in the bathroom and discuss their problems. In one self-report narrative, a 12-year-old female runaway indicated that she opposed her parents’ rules that they had established for her (Mishriki, 2001–2013). Instead, the teen wanted to be independent. One girl who reportedly later ran away from home noted that her parents would not let her just go out and do anything that she wanted to do, and these restrictions really bothered her (Mishriki, 2001–2013). The girl noted that she was getting very “rebellious.” Another teen runaway also discussed his opposition to following rules (Mishriki, 2001–2013). In this self-report story, a male teen runaway noted that he enjoyed not having rules. He was quite happy not to have people telling him “what to do.”

Youth with ODD may blame others for their mistakes. They also are often resentful, vindictive, or spiteful. For example, in one self-report narrative, a runaway teenage girl, whose mother was bedridden and recovering from cancer, blamed her stepfather for trying to completely control her life. The daughter may have been responding to her stepfather’s controlling behaviors when she told her mother that her stepfather was lying (Mishriki, 2001–2013).

Young people with ODD frequently annoy individuals. They may wear clothes and behave in certain ways to annoy people. In one self-report narrative, a runaway girl noted that she dressed and acted in ways that annoyed her mother (Mishriki, 2001–2013).

Youth with ODD may be more likely to have comorbid psychosocial disorders, such as ADHD,

CD, internalizing mood disorders (anxiety and depression), and reduced family and social functioning than those without ODD (Boylan, Vaillancourt, Boyle et al., 2007; Greene, Biederman, Zerwas et al., 2002). According to Greene et al. (2002) investigation, a clinically referred sample of young people with ODD with or without CD had higher rates of comorbid psychiatric problems and more social and family impairment than a psychiatric comparison group.

Persons with possible ODD symptoms may exhibit both anger and symptoms of mood disorders. For example, in one self-report narrative, a 13-year-old runaway girl described herself as a very angry and sad person (Mishriki, 2001–2013). Younger children with ODD may be a subgroup that is vulnerable to anxiety and affective disorders (Boylan et al., 2007).

Mental health professionals should be cautious in diagnosing ODD since temporary oppositional behaviors are prevalent among preschool children. Transient oppositional behaviors are also quite common during adolescence. Symptoms of ODD may become more prevalent as a child ages, and ODD may be a precursor to CD. In addition, youth with ODD may have similar behavioral profiles as those with CD (Wiesner, Elliott, McLaughlin et al., 2015). However, children with ODD often do not develop CD.

ODD often develops before the age of 8 and not later than the period of early adolescence. These symptoms develop at home but also may appear at school and in other settings over time. Before puberty, males have a higher rate of ODD than females. However, after puberty, both girls and boys seem to have similar rates. During the preschool years, males with ODD may have a more difficult temperament such as being more difficult to soothe and high levels of motor functioning.

During school years, children and adolescents with ODD may use alcohol, tobacco, or illegal drugs. They may get suspended or expelled from school as a consequence. For example, in one self-report narrative, a runaway girl noted that she had been expelled from two schools for taking drugs. She described how she frequently annoyed her mother and did not talk any more.

6.3.1 Prevalence of ODD

As in the case of CD, the rates of ODD differ depending on the population studied and the methods of ascertaining cases. Reported rates of ODD have ranged from 2 to 6% and like CD the rates of ODD are probably much higher among runaway youth.

6.3.2 Family Factors Associated with ODD

ODD is more prevalent in families characterized by marital conflict. In one self-report narrative, a 13-year-old runaway girl noted that her mother frequently had fights that her different boyfriends and that she was frequently angry and had trouble expressing her feelings toward her mother (Mishriki, 2001–2013).

Children and adolescents who come from families that have members with a history of mood disorder, CD, ODD, and ADHD may be at risk for ODD. In addition, youth who have families that have a history of an antisocial personality disorder or a disorder related to substance use may have a higher risk for ODD. For example, in one self-report narrative, 16-year-old runaway girl noted that her mother has a severe case of bipolar disorder. She described her mood as always changing and she found her mood swings very difficult to understand (Mishriki, 2001–2013). In another self-report narrative, a 15-year-old runaway girl noted that her mother started drinking alcohol again and that her mother kept leaving her and her brothers and sister (Mishriki, 2001–2013).

6.4 Treatment of Conduct Problems

In the USA, federal legislation has been passed to combat the problems of homeless and runaway youth. In 1974, the Runaway and Homeless Youth Act was enacted to combat the difficulties facing homeless, unaccompanied young people. State legislators have passed laws to help homeless and runaway youth. For example, funding in

the state of Maine was provided to create a comprehensive intervention for homeless and runaway young people. This intervention is designed to offer outreach, emergency shelters, transitional living, and drop-in services (National Conference of State Legislatures, 2013, October 1).

Treating CD among runaway and homeless youth may be more difficult since disorder represents more persistent behavioral problems and consequently presents more of a challenge to providers than runaway and homeless youth without CD (Pollio, Thompson, Tobias et al., 2006). In an investigation of longitudinal outcomes for youth receiving runaway/homeless shelter services, Pollio et al. (2006) discovered that youth who received mental health services between 6-week and 3-month follow-ups and health services between 3- and 6-month follow-ups were more likely to have more increases in days on the run than for those not receiving these services. Mental health services may have included treatment for CD and other mental disorders as well as treatment for criminal justice-related behavioral problems, suggesting that treatment programs for runaway and homeless youth with conduct problems may be less beneficial than for those without conduct problems.

In the general population, the treatment of youth with CD and other conduct problems can be complex and difficult. Burke et al. (2002) note that CD is treatable if mental health professionals focus their efforts on dealing with the youth's comorbid disorders, multiple risk factors, and impairments in social, family, school, and job functioning. Treatment should address the runaway and homeless youth's substance use, STIs/HIV risks, ADHD, other learning disorders, poor school performance, deficits in social skills, employment difficulties, depression, suicidal behaviors, anxiety, and other psychiatric disorders, and interaction with deviant peers.

Similarly, Slesnick, Prestopnik, Meyers, and Glassman (2007) discovered that a comprehensive treatment program that targeted drug use, social stability, and psychosocial problems demonstrated that street-living, homeless young people can participate in interventions and improve their externalizing problems, emotional status, and coping with tasks.

Interventions that attempt to reduce substance use among runaway and homeless youth can lead to favorable outcomes since substance use is a major comorbid condition of CD and other conduct problems. Interventions should emphasize changing the runaway and homeless youth's low motivation to change their drug use. An investigation by Slesnick, Bartle-Haring, Erdem et al. (2009) showed that negative perceptions of family environment were linked to increased depressive symptoms among both shelter-based runaway youth and their parents, which resulted in the youth's greater motivation to change their substance use. The authors suggest that programs focus on the family environment and parental difficulties can improve the youth's motivation to change drug use.

Since youth with CD are at increased risk of acquiring STIs and HIV/AIDS, programs that assess knowledge of HIV, sexual behavior, and correlates of risky sex among runaway and homeless youth can assist providers in better understanding these risk factors and related service utilization. For example, an investigation of street children in Kinshasa, Democratic Republic of Congo, showed that a history of substance use and street youth aged 20–24 had an increased probability of engaging in risky sexual behavior (Kayembe, Mapatano, Fatuma et al., 2008).

For female runaway and homeless youth, interventions also should focus on pregnancy and sexual victimization. Edinburgh and Saewyc (2009) demonstrated that using a strengths-based model with advanced practice nurses reduced the risk behaviors of runaway, sexually exploited girls. Girls showed reductions in drug use, STIs, truancy, and runaway incidents.

Treatment programs for runaway and homeless youth face challenges because runaway and homeless youth, especially those with CD, ODD, and other conduct problems, are distrustful and hostile toward adults in authority. Runaway and homeless young people are at risk of becoming entrenched in street life and vulnerable to engaging in deviant subsistence survival strategies such as survival sex, prostitution, other delinquent behaviors, and serious crimes.

Runaway and homeless youth also face barriers to access services such as lack of transportation. Based on a qualitative study with 60 homeless young people from a drop-in center for homeless youth and young adults, Thompson, McManus, Lantry et al. (2006) assessed the participants' perceptions of homeless services and providers. The investigators discovered that homeless youth and young adults preferred service providers who respected them, demonstrated empathy, and were friendly toward pets. Moreover, participants in the study favored service providers who showed support for them while at the same time respected their need to be autonomous. Homeless young people considered providers who disrespected them, were rigid, or who had unrealistic views about them to be barriers to using homeless services. In addition, participants were less likely to use homeless services that were offered in dangerous facilities and neighborhoods. Homeless young people also regarded facilities that were dirty, had poor food, and other unsuitable conditions were barriers to using these facilities.

If runaway and homeless youth can be reunited with their families or placed in stable care institutions, they may benefit from treatment for CD, ODD, and other conduct problems. Different psychosocial and psychopharmacological interventions are necessary to treat runaway and homeless youth with CD and ODD since these disorders overlap, and youth with these disorders often have comorbid problems such as ADHD (Kutcher, Aman, Brooks et al., 2004; Maughan, Rowe, Messer et al., 2004; Goldstein & Morewitz, 2011). According to Turgay (2005), treatment for youth with CD with ADHD and other comorbid disorders should involve training parents to improve their parenting skills, helping the youth enhance their peer interactions, assisting youth with accepting the authority of adults, and using medications.

Studies have evaluated various psychosocial and pharmacological interventions to treat youth with conduct problems (Goldstein & Morewitz, 2011). Parent training is designed to modify ineffective parenting since it is a risk factor for conduct problems such as CD and ODD. The Triple P Positive Parenting program is a parent-training

program that is delivered on different levels to help children. The program draws on social learning theory, behavior therapy, development studies and information-processing principles. De Graaf, Speetjens, Smit et al. (2008), using a meta-analysis, found that the Triple P Positive Level 4 programs reduced children's conduct problems.

Parent-child interaction therapy (PCIT) treats CD, ODD, ADHD, and other conduct problems using a family-centered approach (Goldstein & Morewitz, 2011). In this intervention, the therapist assists parents in implementing approaches that reinforce the positive behaviors of their children. The therapist will coach parents as they interact with their children. Using a meta-analysis, Thomas and Zimmer-Gembeck (2007) found that PCIT reduced the number of child conduct difficulties and parent problems.

Cognitive behavior therapy (CBT) uses different approaches such as cognitive therapy and rational emotive behavior therapy to limit conduct difficulties. However, some studies have not demonstrated that CBT has limited children's conduct and relationship problems (Munoz-Solomando, Kendall, & Whittington, 2008; Koegl, Farrington, Augimeri et al., 2008).

Multi-system therapy (MST) is designed to modify systems such as family, school, and peers that promote conduct problems in children and adolescents. Henggeler, Rowland, Randall et al. (1999) found that MST appears to improve school attendance and family relations and limits child conduct problems. The authors also report that MST is less expensive than psychiatric hospitalization.

Other psychosocial interventions for conduct problems include group therapy, community-based residential programs, school-based programs, and wilderness school interventions (Goldstein & Morewitz, 2011).

Conduct problems may not be effectively treated with drugs by themselves (Conner, 1998–2000; Goldstein & Morewitz, 2011). However, drug therapy can be effective in treating youth with conduct problems who have comorbid conditions such as ADHD. Medications to treat comorbidity in young people with CD with ADHD can include psychostimulants, atomox-

etine (a norepinephrine reuptake inhibitor), antidepressants, selective serotonin reuptake inhibitors, atypical antipsychotics, or mood regulators such as lithium (Turgay, 2005). In a study of the effectiveness of atomoxetine in treating children with ADHD and ODD, Newcom, Spencer, Biederman et al. (2005) showed that the medication can reduce symptoms of ADHD and ODD. However, the investigation showed that patients with ADHD and comorbid ODD may require higher doses to achieve suitable results.

6.5 Conclusion

In conclusion, given the prevalence and serious behavioral consequences of conduct problems among runaway and homeless youth, interventions such as school-based and community-based treatment programs should be initiated. These interventions should address the fact that runaway and homeless young people are frequently distrustful and hostile toward social service providers and other adults in authority. In addition, drug treatment may be helpful for runaway and homeless young people with conduct problems and comorbid problems such as ADHD.

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Pregnancy and Parenting Among Runaway and Homeless Young Women

7

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7.1 Homelessness Definition and Prevalence

Homelessness is one of the leading social problems in the United States. Various definitions of homelessness describe homeless persons as those who are currently, or have been, living on the street or in a shelter for the past 24 h, who have been staying with friends or family since leaving a permanent residence, or who have no fixed residence (Piliavin, Sosin, Westerfelt, & Matsueda, 1993). However, according to the Stewart B. McKinney Act, 42 U.S.C. § 11301, et seq. (1994), a person is considered homeless who “lacks a fixed, regular, and adequate night-time residence; and...has a primary nighttime residency that is: (a) a supervised publicly or privately operated shelter designed to provide temporary living accommodations...(b) an institution that provides a temporary residence for individuals intended to be institutionalized, or (c)

a public or private place not designed for, or ordinarily used as, a regular sleeping accommodation for human beings.” National estimates suggest between 2.3 and 3.5 million people experience homelessness annually (National Alliance to End Homelessness, 2009a).

Adolescents and young adults comprise approximately one-quarter of all people who are homeless (Cauce et al., 2000). Numbering approximately 1.7 million (Molino, McBride, & Kekwaletswe, 2007; Whitbeck, 2009), homeless youth have been defined by federal law (McKinney-Vento Act P.L. 100–628) as “an individual who is less than 21 years of age, for whom it is not possible to live in a safe environment with a relative and who has no other safe alternative living arrangement” (McKinney-Vento Act sec. 725(2); 42 U.S.C. § 11435(c)). Examples of such substandard living situations include staying in shelters, tents, cars, abandoned buildings, motels, bus or train stations, in another person’s house (relative or stranger), or other locations that are not ordinarily used for humans to sleep (McKinney-Vento Act 2001). Other national research suggests that homelessness is not rare among adolescents in the general population, with approximately 8% of adolescents between 12 and 17 years of age reporting having spent at least 1 night in an emergency shelter, public place, abandoned building, or with a stranger during the previous year (Ringwalt, Greene, Robertson, & McPheeters, 1998).

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Homeless youth face many challenging life experiences, and this chapter focuses specifically on this population's high rates of pregnancy and early parenthood. These are complex topics, as homeless youths' complicated circumstances, both prior to leaving home and after becoming homeless, make pregnancy and early parenthood particularly difficult to understand and prevent. This chapter discusses the prevalence and etiology of pregnancy and early parenthood among homeless youth, adverse outcomes associated with homeless youth pregnancy, and opportunities for prevention and intervention services to more effectively promote healthy sexual, reproductive, maternal-child health, and parenting outcomes among homeless youth.

7.2 Becoming Homeless and Surviving on the Streets

Youths' premature departure from the family home involves varying degrees of independence. Many youth perceive themselves as active agents in the process, choosing to leave undesirable situations for a better life. Others may choose to run away from intolerable situations at home or are motivated to run away to seek more desirable or adventuresome social situations (Lindsey, Kurtz, Jarvis, Williams, & Nackerud, 2000). However, research confirms that running away is often a choice of last resort for adolescents dealing with unbearable situations, such as conflict and maltreatment (Schaffner, 1998).

In contrast to those who leave independently, some youth are pushed out of their homes by parents who force them to leave (Powers, Eckenrode, & Jaklitsch, 1990), or are simply abandoned by parents or other caregivers (Dadds, Braddock, Cuers, Elliott, & Kelly, 1993). "Doubly homeless" youth, who make up an estimated 17.7% of homeless youth, are those who have been removed from their homes by child protective service authorities and subsequently run away from their foster care placements. Doubly homeless youth report the most problematic family backgrounds (MacLean, Embry, & Cauce, 1999), highest rates of mental health disorders resulting from trauma

experienced before and after entering homelessness, and are most vulnerable to abuse and sexual health risks (MacLean et al., 1999).

Once youth become homeless and immersed in "street culture," they often develop problematic behaviors as a means of survival. Many homeless street youth become involved in high-risk survival behaviors to earn income to meet their basic food or shelter needs or to finance substance use. Survival behaviors may include prostitution or survival sex (i.e., participating in sexual acts in exchange for money, food, lodging, clothing, or drugs), pimping, pornography, panhandling, theft, selling stolen goods, mugging, dealing drugs, or conning others for goods (Halcón & Lifson, 2004). Survival behaviors are often viewed as necessary due to few formal employment opportunities; formal employment is difficult given the irregular school attendance and high rates of school dropout common among homeless youth (Thompson, Safyer, & Pollio, 2001).

Negative social influences among street youth may encourage youths' use of survival behaviors, such as panhandling or drug distribution, rather than seeking and engaging in formal employment (Ferguson, Bender, Thompson, Xie, & Pollio, 2012). Homeless youth frequently form street families, who provide each other with protection, emotional support, and material aid (Bao, Whitbeck, & Hoyt, 2000). Youth who feel loyal to their street family may engage in illegal behaviors that secure resources for their peer family and develop street skills that enable them to secure resources and survive.

7.3 Runaway/Homeless Youth Pregnancy

Homeless youths face a myriad of factors that make life extraordinarily challenging; one such challenge that is of particular concern is pregnancy and early parenthood. Rates of pregnancy among runaway/homeless females have steadily increased during the past three decades, making runaway/homeless females five times more likely to become pregnant than their housed peers (Reeg, Grisham, & Shepard, 2002). National and

regional studies report that 30–60% of female homeless youth indicate past or current pregnancies (Cauce, Stewart, Whitbeck, Paradise, & Hoyt, 2005; Ensign, 2001; Greene & Ringwalt, 1998; Halcón & Lifson, 2004; Haley, Roy, Leclerc, Boudreau, & Boivin, 2004; Milburn, Ayala, Rice, Batterham, & Rotheram-Borus, 2006; Wagner, Carlin, Cauce, & Tenner, 2001; Winetrobe et al., 2013). Many homeless females have been pregnant multiple times (Kilbourne, Herndon, Andersen, Wenzel, & Gelberg, 2002). One study reported 30% of their sample of homeless young women had been pregnant twice or more (Halcón & Lifson, 2004); another study found that half of homeless women had experienced pregnancy four or more times (Bassuk, Weinreb, Dawson, Perloff, & Buckner, 1997). Clearly, homeless youth represent a high-risk population in regard to pregnancy risk and associated psychosocial consequences; several factors help to explain this risk level.

7.4 The Etiology of Pregnancy Among Runaway/Homeless Youth

The reasons for higher rates of pregnancy, including multiple pregnancies, among homeless/runaway youth are multifaceted (Zweig, Phillips, & Duberstein Lindberg, 2002). Broadly, residential instability interrupts normal adolescent development and is exacerbated by disruption in education, lack of adult caretakers, and exposure to similarly situated homeless peers. At the same time that youth are introduced to these risks, they are often disconnected from traditional supports such as school, family, and society. As a result, pregnant homeless adolescents often have complex profiles consisting of a constellation of high-risk individual characteristics, health-compromising behaviors, and poor family functioning (Greene & Ringwalt, 1998; Haley et al., 2004; Sheaff & Talashek, 1995). In understanding why homeless youth become pregnant, a number of specific risk factors have been identified.

Risky Sexual Behaviors. Compared to non-homeless youth, homeless/runaway adolescents report elevated rates of engagement in risky sexual behaviors. In addition to engaging in higher rates of sexual activity (Carlozzi & Long, 2008), with 95% of homeless females reporting they are sexually active (Nyamathi, Bennett, Leake, Lewis, & Flaskerud, 1993), homeless youth are also more likely to begin sexual relationships at an earlier age and engage with multiple sexual partners (Greenblatt & Robertson, 1993; Solorio et al., 2008).

Furthermore, homeless youth are likely to engage in unprotected sex. Among homeless youth, contraception and condom use is met with ambivalence, inconsistency, and infrequency (Anderson, Freese, & Pennbridge, 1994; Haley et al., 2004; Solorio et al., 2008; Wagner et al., 2001). One study (Gelberg, Browner, Lejano, & Arangua, 2004) noted that 42% of sexually active homeless women reported not using any form of birth control during intercourse during the previous year. Of those who did use contraception, condom use was most common; however, only one-third used condoms consistently (Gelberg et al., 2004). Contraceptive use may depend, in part, on the type of sexual partner; homeless women with multiple partners are twice more likely to use contraceptives than women in stable relationships (Gelberg et al., 2008). Similarly, among street youth, only 30% of females reported using condoms during their most recent sexual encounter. In addition, 40% noted that using condoms was less likely to occur with regular sexual partners than with casual partners (Anderson et al., 1994).

Homeless youth may face barriers to contraception use. Being homeless may impair one's access or capacity to practice effective birth control (Gelberg et al., 2008; Hathazi, Lankenau, Sanders, & Jackson Bloom, 2009). The expense and consistency required for effective use of contraceptives is often prohibitive for young women who are homeless. As it is difficult for many young females to use birth control correctly and consistently, youth who live on the streets experience even greater challenges. For those

who have lived on the streets for longer periods of time, the risk for adolescent pregnancy is significantly higher than for newly homeless youth (Haley et al., 2004), likely due to these various risky sexual behaviors.

Sexual risk behavior also occurs in the context of survival sex—exchanging sex for food, clothing, and shelter. Homeless youth often have few legal means to earn sufficient money to meet their basic needs and many homeless youth view engagement in survival sex as one of their only viable options for survival on the streets (Anderson et al., 1994; Halcón & Lifson, 2004; Warf et al., 2013). With 10–50% of homeless youth engaging in survival sex (Greene, Ennett, & Ringwalt, 1999; Halcón & Lifson, 2004; Haley et al., 2004; National Alliance to End Homelessness, 2009b; Warf et al., 2013), it is particularly concerning that as many as 64% of respondents reported inconsistent or no contraceptive use during survival sex (Warf et al., 2013). Not all homeless youth engage in survival sex; those who are depressed, have friends who trade sex for money/other resources, and are propositioned to trade sex are more likely to engage in this behavior (Tyler & Johnson, 2006). Engaging in sex work as a means of income and survival on the streets introduces homeless youth to a host of negative consequences in addition to pregnancy, including suicide attempts (Greene et al., 1999; Walls & Bell, 2011; Warf et al., 2013; Whitbeck, 2009), robbery, assault, and arrest for prostitution (Warf et al., 2013), and sexually transmitted infections (Lankenau, Clatts, Welle, Goldsamt, & Gwadz, 2005).

It should be noted that the sexual risk taking described here not only places youth at risk for pregnancy but also for contracting HIV and other STIs (Clatts, Goldsamt, Yi, & Gwadz, 2005; Gangamma, Slesnick, Toviss, & Serovich, 2008; Kral, Molnar, Booth, & Watters, 1997; Solorio et al., 2008; Zimet & Sobo, 1995), with 23–46% of homeless youth having at least one STI (Rew, 2001). Indeed, the two problems are interrelated; youth who report having a sexually transmitted disease (STD) are more than twice as likely to report a pregnancy compared to those without STDs (Halcón & Lifson, 2004). Thus,

risky sexual behaviors of homeless youth may lead to a wide array of dire health consequences.

Substance Use. Homeless youth report twice as much drug use as housed adolescents (Slesnick, Bartle-Haring, Glebova, & Glade, 2006), with national data from the Runaway/Homeless Youth Management Information System (RHYS MIS) indicating that most youth reported that, in their lifetime, they had smoked cigarettes (78%), drank alcohol (76.2%), or smoked marijuana (98.8%) (Thompson, 2004). While youth may initiate use prior to running away, many increase their use as they are exposed to various social situations and traumatizing experiences on the street (McMorris, Tyler, Whitbeck, & Hoyt, 2002).

Drug and/or alcohol abuse are often viewed as a “normal” practice on the streets, where homeless youth use substances as a coping mechanism. Not only do homeless youth often have more favorable attitudes toward drug use (Fors & Rojek, 1991) leading to use when socializing, but they also report using substances to cope with trauma experiences and to numb their emotions (Bender, Thompson, Ferguson, Yoder, & Kern, 2013). Thus, although drugs provide a means of escape from the physical and emotional difficulties associated with surviving on the street (Zlotnick, Tam, & Robertson, 2003), the results thwart discerning and forward thinking attitudes, with problematic results.

This high level of substance use and abuse has been shown to be a risk factor for pregnancy among runaway/homeless youth. Many homeless youth report engaging in substance use prior to sexual relations (Hathazi et al., 2009; Solorio et al., 2008). The combination of using drugs/alcohol and engaging in risky sexual behaviors significantly increases the likelihood of pregnancy (Ruttan, Laboucane-Benson, & Munro, 2012), as these youth report having sex while intoxicated, inconsistently use contraception, and are more likely to report multiple sex partners (Rotheram-Borus, Para, Cantwell, Gwadz, & Murphy, 1996; Solorio et al., 2008; Thompson, 2004; Thompson & Pillai, 2006).

Street Victimization. Sexual victimization is unfortunately quite common among homeless

youth. Females are more likely to become victims of sexual assault and exploitation while males are more likely to become victims of physical violence (Janus, Archambault, Brown, & Welsh, 1995; McCormack, Janus, & Burgess, 1986; Rew, Taylor-Seehafer, & Fitzgerald, 2001; Whitbeck & Simons, 1993). Specifically, males are more often victims of physical threats and assault, while females experience sexual exploitation, assault, and rape (Stewart et al., 2004). One study found that 37% of homeless youth participants had been sexually victimized since being on their own (Tyler, Hoyt, Whitbeck, & Cauce, 2001). Another study reported 36.6% youths were propositioned for sexual favors and 20.7% were sexually assaulted while on the streets (Terrell, 1997).

Familial maltreatment (physical abuse, sexual abuse, and neglect) by families of origin has been shown to increase the risk of youths' victimizations once on the streets (Whitbeck, Hoyt, & Ackley, 1997a). Physically abused adolescents are significantly more likely to be assaulted on the streets than adolescents who were not abused by their families (Hoyt, Ryan, & Cauce, 1999; Ryan, Kilmer, Cauce, Watanabe, & Hoyt, 2000). Other known factors contributing to increased victimization include economic deprivation, involvement with delinquent peers, longer periods of time spent on the streets, and engaging in survival sex (Baron & Hartnagel, 1998; Tyler et al., 2001; Whitbeck & Simons, 1990; Yoder, Whitbeck, & Hoyt, 2003). These same risk factors are also strong predictors of early and unplanned pregnancies among runaway/homeless youth.

Frequent experiences of childhood maltreatment and related sexual victimization on the streets increase homeless youth's pregnancy risk (Stewart et al., 2004). In one study, past sexual abuse was a significant predictor of pregnancy among a sample of homeless young women (Haley et al., 2004). A greater proportion of those who experienced familial incest or stranger sexual abuse also had more than one perpetrator and were likely to have been pregnant during their lifetime. Haley et al. (2004) found 40% of pregnant homeless young women had experienced

familial abuse and the first episode occurred at an early age with greater severity. Teen females that reported a history of past sexual abuse were more likely to report wanting to become pregnant, having a partner that wanted them to become pregnant, and being fearful of infertility because of past abuse than those with no sexual abuse history (Haley et al., 2004). As several studies have reported, there appears to be a pathway from childhood maltreatment to subsequent sexual victimization and risky sexual practices that increases chances of pregnancy among homeless youth.

Mental Health. The focus of a great deal of research on homeless youth has been on the multitude and magnitude of their mental health challenges, including depression (Kennedy, 1991; Unger et al., 1998), anxiety (Kidd, 2004), suicide (Mallett, Rosenthal, Myers, Milburn, & Rotheram-Borus, 2004; Yoder, 1999), and trauma-related disorders (Thompson, 2005; Whitbeck & Simons, 1990). Homeless youth experience higher rates of mental health conditions than young adults in the general population. Estimates of serious psychiatric disorders among homeless youth range from rates of 19–50% (Robertson & Toro, 1998) and an estimated 20–40% of homeless youth report having attempted suicide (Kidd, 2004). As they are continually exposed to traumatizing events, their ability to recover and overcome symptoms is impeded (Foy, Eriksson, & Trice, 2001). Youth who fail to seek treatment or remove themselves from dangerous street life are at risk for developing Post-Traumatic Stress Disorder (PTSD) (McCarthy & Thompson, 2010), with rates of PTSD as high as 30% (Bender et al., 2013).

Mental health challenges (and comorbid mental health substance use) have been associated with pregnancy among homeless youth (Tyler, Hagemen, & Melander, 2011). As youth become embedded in the culture of homelessness, they are marginalized from society due to lack of housing, difficulty attending to personal hygiene, food insecurity, and societal stigma (Dachner & Tarasuk, 2002; Gaetz & O'Grady, 2002). Their ability to cope with the stress of living on the streets may be inhibited by their experiences of victimization.

Thus, the physical and psychological stress associated with pregnancy and the subsequent challenges of caring for a child while homeless only complicates the process by which young women address their mental health challenges and remove themselves from homelessness (Webb, Culhane, Metraux, Robbins, & Culhane, 2003).

Pro-social Disengagement. Homeless youth who disengage from traditional pro-social sources of support through dropping out of school, engaging in delinquent behavior, or becoming entrenched in significant poverty, are at increased risk of pregnancy. Delinquent and criminal behavior has been associated with pregnancy among runaway/homeless females; one study (Thompson, Bender, Lewis, & Watkins, 2008) demonstrated that a significantly greater percentage of runaway females who were or had been pregnant reported being on probation, or charged with a misdemeanor or felony than did their non-pregnant counterparts. Youth who spend longer periods of time without adult supervision and in the company of deviant peers are significantly more likely to engage in delinquent behavior (Heinze, Toro, & Urberg, 2004; Warr, 2002); it is likely that these behaviors co-occur with the runaway/homeless female's pregnancy.

Disengaging from school, an institution associated with pro-social values and financial independence, places homeless youth at risk for pregnancy. In one national study of runaway youth (Thompson et al., 2008), youth who dropped out of school were more than twice as likely to report being pregnant. Thus, youth who have limited housing stability experience greater educational problems and decreased engagement in their education. Their limited exposure to positive experiences in educational settings—combined with housing instability—may be one factor in becoming pregnant (Thompson, Zittel-Palamara, & Maccio, 2004). Absence from school may decrease development of positive peer relationships and increase peer pressure from similarly situated peers who engage in deviant, high-risk activities such as risky sexual behaviors that lead to sexually transmitted diseases and pregnancy (Tyler, Whitbeck, Hoyt, & Yoder, 2000). Teen pregnancy

may exacerbate school problems by creating even greater obstacles to engaging in traditional forms of education (Maynard, 1996), including successfully graduating.

Resource scarcity and impoverished living conditions have also been noted as risk factors for homeless youth pregnancy and early parenthood. Severe financial poverty is nearly synonymous with homelessness and homeless youth are at even greater vulnerability due to the lack of education and employment opportunities. As homeless youth forego educational opportunities due to poor academic performance and school attendance, the result is low educational levels. Coupled with limited work experience and even criminal histories, their success in obtaining and maintaining competitive employment is highly constrained (Whitbeck, 2009). In a recent study (Ferguson, Bender, Thompson, Maccio, & Pollio, 2012), 31 % reported earning their income exclusively from survival behaviors (i.e., prostitution, selling blood/plasma, dealing drugs, stealing, and panhandling) without participating in formal employment. Drug abuse often leads to illegal means of support, including theft, property crimes, drug distribution (Farabee, Shen, Hser, Grella, & Anglin, 2001) and prostitution or survival sex, pimping, pornography, panhandling or conning others (Gaetz & O'Grady, 2002; Greene et al., 1999). All of these activities further combine to suggest higher risk of sexual activity and possible pregnancy.

Pregnancy Motivation. While the vast majority (73 %) of homeless youth pregnancies are unintended (Gelberg et al., 2001), studies suggest that some homeless youth intentionally become pregnant. In a large representative survey of homeless youth, 21 % of the respondents agreed that they would like to become pregnant within the next year and an additional 25 % of youth reported indifference regarding the possibility of pregnancy within the next year (Winetrobe et al., 2013). For some young homeless women, pregnancy was viewed as a positive event and became a reason for them to discontinue their risky lifestyle and assert control over the various decisions associated with exiting homelessness (Saewyc, 2003).

Pregnancy is associated with being homeless for extended periods of time (Halcón & Lifson, 2004; Milburn, Rotheram-Borus, Rice, Mallet, & Rosenthal, 2006; Slesnick et al., 2006; Thompson et al., 2008; Tucker et al., 2012). Milburn, Rotheram-Borus, et al. (2006) found that 40% of female youth who had been homeless for 6 months or more had been pregnant one or more times, whereas 14% of newly homeless female youth reported a lifetime history of pregnancy. In addition, youth who have been homeless longer are significantly more likely to show pro-pregnancy attitudes (Tucker et al., 2012).

Personal, social, and financial benefits may influence reproductive choices. Some may believe that pregnancy and parenthood are solutions to obstacles they face. For example, youth may perceive pregnancy as a conduit toward accessing health care and other social services that they cannot access as a single individual; others may feel pressured by partners to demonstrate the strength of their relationship through parenting (Haley et al., 2004; Smid, Bourgois, & Auerswald, 2010; Tucker et al., 2012).

Several qualitative studies suggest that homeless female youth reported the desire to find love in their lives and becoming pregnant was a way of ensuring unconditional love (Hanna, 2001). Pregnancy and parenting have been described as motivating factors for life changes that create bonds in lieu of relationship voids and feelings of abandonment that homeless youth have often experienced in their families of origin (Thompson et al., 2008; Tucker et al., 2012; Winetrobe et al., 2013). Pro-pregnancy sentiments are also reflected as a way by which a new family unit may be created, existing romantic relationships improved, and an opportunity to display positive parenting skills (Dworsky & Courtney, 2010; Constantine, Jerman, & Constantine, 2009).

Family Risk Factors. Family factors such as lack of intra-familial support, conflict, sexual and physical abuse, and single-parent families have been suggested as risk factors for teen pregnancy (Franklin, Corcoran, & Harris, 2004; Sheaff & Talashek, 1995; Talashek, Alba, & Patel, 2006). Family discord is noted by the majority of run-

away/homeless youth as the primary reason for running away (Hyde, 2005; Tyler et al., 2001; Whitbeck, 1999), citing several sources of conflict with their parents or guardians including parental substance use, conflicting religious beliefs, sexual orientation (Cochran, Stewart, Ginzler, & Cauce, 2002), school performance, and personal style such as dress, hair color, or piercing (Hyde, 2005), and disagreements between parents and youth regarding peer groups and choice in romantic partners (Bao et al., 2000). Saewyc (2003) and others have also documented that becoming pregnant is one of the primary reasons girls leave or are kicked out of their homes.

Runaway/homeless youth often leave stressful and conflict-ridden home environments (Whitbeck & Simons, 1990; Williams, Lindsey, Kurtz, & Jarvis, 2001; Yoder, Whitbeck, & Hoyt, 2001). Research has shown that at least one-third of homeless youth report a history of trauma exposure from a variety of sources, such as being kicked out of their home, forced into institutional facilities, parents introducing drug use, parental drug use, child welfare placement, parental abandonment/death, imprisonment, family homelessness, parental mental illness, suicide attempts, and rape (Baron & Hartnagel, 1998; Tyler et al., 2001; Whitbeck & Simons, 1990; Yoder et al., 2003). Serious maltreatment is often quite common. One study reported that 80% of their sample of homeless youth had a parent throw something at them and 43% had been beaten by a parent (Whitbeck et al., 1997a). These researchers also found high incidence of sexual victimization, as 31% of females and 11% of males reported being sexually abused by a parent (Whitbeck et al., 1997a, 1997b).

Serious psychological and behavioral consequences exist for maltreated homeless adolescents. Physically and sexually abused youth run away more often and stay away longer than non-abused homeless youth (Kurtz & Kurtz, 1991). Those who experienced physical and sexual abuse at home are also significantly more likely to meet diagnostic criteria for depression and attempt suicide than youth who have not been abused (Ryan et al., 2000). Homeless youth also experience high rates of intra-familial incest prior

to leaving home, which sometimes results in pregnancy (Haley et al., 2004). Conversely, other youth enter homelessness after becoming pregnant and are forced out of their homes by parents or guardians as a result (Meadows-Oliver, 2006).

Pregnancy is associated with generally unstable home environments. In one study of runaway youth across the USA (Thompson et al., 2008), a greater percentage of pregnant teens reported not living with their parent(s) at the time of shelter admission, living in more than two residences during the previous month, and being away from home for longer in comparison to their nonpregnant counterparts. In addition, those from single parent families, who felt abandoned by their parents and who reported emotional abuse by their mothers, were more likely to report being pregnant. This combination of factors suggests these young women had experienced long-term family difficulties and discord, which played a greater role in the disrupted family relationships than occurred among runaway youth who were not pregnant.

These numerous areas of family dysfunction underscore the significance of negative family relationships as predictors of teen pregnancy among runaway youth. Perhaps family relationship problems only escalate when a teen becomes pregnant, making the family environment an unhealthy, unsafe place for the adolescent.

7.5 Consequences of Teen Pregnancy Among Runaway/ Homeless Youth

Pregnancy while homeless often results in poorer health and mental health consequences for adolescent mothers, with increased risk for developing acute or chronic health problems (Crawford, Trotter, Hartshorn, & Whitbeck, 2011; Wagner & Menke, 1992). Unfortunately, homeless women are less likely to receive prenatal care and other reproductive health screenings compared to housed women (Seiffge-Krenke et al., 2010). These young women have more medical problems, which increases the likelihood of increased birth complications. Their poor nutritional intake often results in further difficulties during pregnancy as well as

providing proper nourishment to their infant. In addition, runaway/homeless youth report high rates of drug and alcohol use while on the streets (Thompson, 2004) and such behaviors tend to continue during pregnancy. One study suggested that 38% of homeless young women drank alcohol while pregnant (Wagner & Menke, 1992), suggesting high risk of prenatal exposure to substances.

The struggles of homeless mothers have a powerful influence on their children as they often lack health care benefits, access to prenatal care, adequate nutrition, and stable living conditions needed for healthy infants (Meadows-Oliver, 2006; Tischler, Rademeyer, & Vostanis, 2007). Children born to homeless adolescents are more likely to be born preterm, at low birth weight, and experience neurological and physical problems resulting from prenatal nutritional deficits (Chapman, Tarter, Kirisci, & Cornelius, 2007; Little et al., 2005; Oliveira & Goldberg, 2002; Stein, Lu, & Gelberg, 2000). Low birth weight and preterm births are more common among babies born to adolescents in general, but are more likely among homeless youth (Stein et al., 2000).

The mental and physical stresses of both pregnancy and raising a child(ren) have been found to make young women's departures from homelessness more difficult (Webb et al., 2003). For a population that demonstrates higher than average rates of mental health concerns (Cauce et al., 2000), pregnancy and early parenting only heighten the negative consequences to their lives (Pennbridge, Mackenzie, & Swofford, 1991). Adolescent mothers report greater levels of depression and stress following the birth of their child (Hanna, 2001), and they often experience increased stress from the multiple roles required of being a caregiver to an infant, coupled with difficulties in finding housing and food.

For runaway/homeless teen mothers who carry their pregnancies to term, their lack of resources and stable housing make competent parenting nearly impossible. Youth are typically unprepared to economically, physically, and emotionally care for an infant. Most lack the skills and education necessary to obtain and maintain gainful employment and are forced to engage in survival behaviors such as prostitution,

dealing drugs, or other criminal behaviors to gain resources needed to care for their child (Greene, Ringwalt, & Iachan, 1997; Warf et al., 2013). In one study of homeless adolescent mothers, they reported a desire for a stable home for their baby, but the success of this goal was transitory (Ruttan et al., 2012). Many homeless young parents are required to relinquish the child to family members or the child welfare system. With family members often no longer involved in the lives of their runaway/homeless daughters, the infant is most often placed in foster care system rather than with relatives. Although some homeless young women are successful in raising children, pregnancy and child-rearing while homeless clearly creates heightened risk for a host of physical and emotional consequences for the adolescent mother as well as her child.

7.6 Prevention and Intervention Services

This collection of interrelated risk factors for pregnancy suggests that youth who disclose one factor should be closely screened for other risky sexual behaviors or contextual factors. Identifying youth at risk for pregnancy is essential to target prevention efforts efficiently among under-resourced service agencies serving homeless youth. Those young women determined at risk should be provided with comprehensive sexual health education to prevent further health problems and to address the motivations associated with becoming a parent. Because young adults have the lowest help-seeking behavior of any age group, it is important that pregnancy services be accessible, medically accurate, and culturally responsive to this unique and vulnerable population. As a parallel example, close to 60% of homeless youth in a recent California study reported receiving some form of mental health services, but less than half found them helpful (Bernstein & Foster, 2008). The consequences of not offering appropriate and accessible services for these youth are enormous. Many state policymakers recognize these consequences and express genuine interest in addressing issues for

vulnerable populations, but the complex nature of the problem often seems insurmountable. Thus, more research and coordination are needed to inform policymakers concerning how they specifically can assist homeless youth transition out of homelessness into productive, healthy adulthood. As part of these efforts, more effective and appealing methods are needed to encourage homeless youth to become more actively engaged in reclaiming and improving their sexual health and well-being through pregnancy reduction, acquiring accurate sexual and reproductive health knowledge, and through fostering healthy relationships and behaviors.

Recent policy efforts have begun to focus on implementing and evaluating innovative, evidence-based strategies for reducing pregnancies among vulnerable populations, including homeless youth. For example, as part of the Patient Protection and Affordable Care Act (2010), the Personal Responsibility Education Program (PREP) was designed to fund comprehensive, age-appropriate, medically accurate sex education programs to reduce pregnancies and sexually transmitted infections [STIs]. A portion of PREP funding is allocated annually to better understand burgeoning efforts that seek to reduce pregnancies specifically among high-risk, vulnerable, and culturally under-represented youth populations (ages 10–20 years), including homeless youth, youth in foster care, youth with HIV/AIDS, pregnant women under the age of 21, and youth residing in areas with high birth rates for young parents. While promising results are beginning to emerge from such policy and intervention efforts, a challenge remains regarding funding. As many subgroups of vulnerable populations are targeted by these interventions, insufficient funding is currently allocated for exhaustively exploring and adapting intervention approaches to meet the unique life challenges faced by specific subpopulations. As such, future research efforts should also explore the utility of existing evidence-based intervention approaches, while advocating for increased funding to further adapt interventions such that they best meet the needs of vulnerable youth populations such as runaway/homeless youth.

7.7 Lailah's Story

Lailah was 15 years old when the fighting in her home got so violent that she felt like her only option was to leave. Violence was common in her home, and while her mother faced the brunt of her father's aggression, Lailah was also a frequent target. It became too much to bear, and Lailah went to stay with her Aunt Kay. Kay was nice to Lailah but had several kids of her own. The cousins were already sharing rooms and Lailah seemed to be in the way. After several weeks, Kay told Lailah that she needed to find another place to stay. After asking several friends if she could stay at their houses, Lailah ran out of options and found herself without a place to stay.

Lailah was afraid to stay on the streets. It was cold, dirty, and dangerous. She would try to find a bed at the shelter whenever possible, but sometimes there weren't beds available. During these times, Lailah would find a corner of the park where she was out of sight to catch a couple hours of sleep. Eventually she met other youth hanging out at the park. She met a guy, Ronnie, who was friendly and seemed to think she was special. He was homeless too, but when he found food, he'd share it with Lailah, and eventually they were in a relationship. Ronnie was friends with several other youth who eventually became a surrogate family for Lailah. This street family looked out for one another. For Lailah, it felt good to belong, and her boyfriend and friends provided her with support and resources. Meanwhile, Lailah became disconnected from most people from home. She stopped attending school. She missed some of her friends from home who seemed to have their lives more "together," yet she felt like they couldn't understand her current situation.

Lailah had few resources or ways to make money. She was too young to work and had left behind her ID card that was required to receive any sort of employment or services. When flying signs on the corner one evening, a man pulled up and offered Lailah a place to stay. She soon realized he wanted sexual favors in exchange for a spot on his couch. Lailah began to sometimes engage in survival sex in exchange for food, shelter, or cash when she was really desperate for

basic necessities. Drinking alcohol and smoking pot made engaging in survival sex less uncomfortable, and Lailah began to use substances more often. Her use of alcohol and drugs numbed her from some of the feelings of depression and trauma symptoms that had increased since leaving home for the streets.

If someone were to ask, Lailah would have said she didn't feel one way or another about getting pregnant. She knew being a mom might be hard, but it could also motivate her to find more stability in her life. Things were going well with Ronnie, and she imagined that a baby might bring them together for the long-term. Besides, people might be more willing to help her out if she had a baby. Lailah tried to use condoms when she could, but she didn't always have them with her, and she couldn't always afford them or find free ones. She felt like protection was less critical when she was with Ronnie because they were in a relationship, so getting pregnant with him seemed less problematic. It was also hard to remember and negotiate condom use when she was drunk or high and engaging in survival sex.

After several months of feeling exhausted and not well, Lailah went to the drop-in clinic to see a doctor, where she discovered she was 4 months pregnant. Without a regular doctor, Lailah wasn't able to get consistent prenatal care. She found it difficult to eat well or get enough rest while on the streets. Even though she knew it wasn't good for herself or her baby, she continued to drink and smoke with her friends. Her baby was born prematurely and was very small.

Even though her street family and Ronnie gave Lailah attention and cared for her while pregnant, Lailah felt surprisingly alone after the baby came. The baby was very fussy and hard to soothe. The stress of raising an infant in these conditions only made Lailah's depression struggles more difficult. It also made it harder to attend job training and other educational services that might help her exit the streets.

Lailah was lucky to find a spot in a housing program for young moms and their babies. However, she continued to use drugs to deal with her depressive problems, and she could not adhere

to the clean campus rules of the housing organization. She was asked to leave. With nowhere else to go, she approached the youth shelter where she was welcomed, but was told that the baby could not stay. Child protective services were called because it was clear that Lailah could not adequately care for her baby. Lailah hopes to find more stable housing and a job so that she can get her baby back from the foster care system. She has several steps she needs to take to be successful. She is motivated to make things better for herself, but she feels overwhelmed by the large challenges that seem to be in front of her.

7.8 Conclusion

Homeless youth, a highly vulnerable population to myriad challenging life circumstances and outcomes, experience pregnancy and early parenthood with notably high prevalence. As noted throughout the chapter, the causes and outcomes associated with homeless youth pregnancy are teeming with complexity, and as such, prevention and intervention strategies are not only urgently needed, but also must be crafted to be culturally responsive to the unique needs, risk factors, and difficult life experiences often faced by this population.

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Stephen J. Morewitz

8.1 Introduction

This chapter uses data from published self-report narratives and the results from the Missing Persons Project (MPP) to examine the ways in which a variety of individual, family/friendship, community, media, law enforcement, organizational, legal, and technological factors may influence the social construction and prevalence of missing persons. These factors may affect the structure, process, and outcomes of missing person investigations. The effects of missing persons on their families and friends and the larger society are also examined.

Missing persons are individuals who have gone missing and their location and fate are unknown. Newiss (1999), in his analysis of police responses to missing persons in the UK, notes that the majority of persons who disappear return to their home without having suffered major harm. However, some missing persons are the victims of foul play, an accident, or some other tragic event. This chapter uses data from the Missing Persons Project (MPP) (Morewitz, 2004, 2015, 2016) to describe some of the forensic

sociological patterns of missing persons and the responses of the media, law enforcement, families, friends, community residents, policy makers, and others to individuals who vanish. The MPP is based on a random sample of 998 missing-persons reports that were filed between 1991 and 2012 and published on websites including the North American Missing Persons Network and the National Center for Missing and Exploited Children. Additional media accounts of missing persons were also used as case studies. Each missing-person report was coded using a protocol that contains 291 variables. The coded data were entered into a data file and statistical analysis was then performed using Systat 9 for Windows program (1999).

8.2 Missing Persons Go Missing for Different Reasons

Individuals disappear for different reasons. People may go missing voluntarily. In MPP Case 121, a 43-year-old man went missing voluntarily from Los Angeles, California, on March 9, 1998. This case may have been misclassified since the missing person report noted that the individual was mentally impaired and could only comprehend at the level of a 2-year-old child.

Runaway youth are considered voluntary missing juveniles even though family, friends, police, and others may know where the runaway

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youth can be located (Morewitz, 2016; Las Vegas Metropolitan Police, n.d.). The “voluntary” classification of missing juveniles may reduce the intensity in which law enforcement search for these juvenile runaways and the ways in which they deal with the juveniles if they locate them. The police may put more time into searching for involuntary missing children whose lives may be in immediate danger because they were kidnapped or a victim of other crimes.

Juveniles may run away from their home or a care institution (Hammer, Finkelhor, & Sedlak, 2002; Morewitz, 2016). Young people may run away in order to avoid family physical, sexual, and emotional abuse, conflicts with their parents, school problems, gang violence, neighborhood violence, or for a variety of other reasons. Those with conduct problems are at risk of running away (Goldstein & Morewitz, 2011; Morewitz, 2016). In one self-report narrative, a girl wrote that she ran away from to flee sexual abuse at the age of 15 (Homeless People-Melissa Story, n.d.). In another self-report narrative, a boy reported that he was beaten severely by his aunt before he ran away (Runaway Lives—Read Stories, n.d.). Juveniles may run away by themselves or with their peers, adults, relatives, and others (Morewitz, 2016). In MPP Case 519, a 14-year-old girl ran away with a boy from Midvale, Utah, on October 22, 2010. A 15-year-old runaway girl in MPP 549 may be with an adult male. The girl ran away from Nashville, Tennessee, on January 8, 2006. Runaway young people may stay in the local area and go to another city, state, or country. In MPP Case 509, a 15-year-old girl, who ran away from New Port Richey, Florida, on July 14, 2010, may still be in the local vicinity.

Missing persons may be the victims of human trafficking (Morewitz, 2016; U.S. Government Accountability Office, 2006). The police in MPP Case 408 suspected that a male had forced a 14-year-old girl into prostitution. In one self-report narrative, a teenage runaway girl wrote that while on the streets she was almost forced into prostitution to pay a debt in 3 days (Homeless People-Elle’s Story, n.d. <http://homeless.org.au/people/elle.htm>). Runaway juveniles on the streets often

engage in survival sex and prostitution (Yates, MacKenzie, Pennbridge, & Swofford, 1991).

Individuals may be abducted by family members or third parties (Morewitz, 2004, 2015). Parents may keep them in their country of origin or take them to another country. MPP Case YYY2 is an example of a possible international family abduction. In this case, a 3-year-old girl was kidnapped by her noncustodial father on February 9, 1997, from San Jose, California, and they may be in Mexico. MPP Case 203 illustrates an abduction of a child by strangers. In this case, a 1-year-old baby boy was kidnapped during an early morning robbery by three unknown male robbery suspects. In MPP Case 314, a 9-year-old girl reportedly was abducted from her home in New Mexico by a male stranger.

Individuals may go missing to avoid being stalked (Morewitz, 2003). People who are the target of death threats may go missing because they fear being killed (Morewitz, 2008). Persons who vanish may be the victims of kidnapping, homicide, domestic violence, and other types of foul play (Hanfland, Keppel, & Weis, 1997; Morewitz, 2004, 2015). The police in MPP 338 suspected that a missing 33-year-old woman had been murdered by her husband, who refused police requests for interviews with him or his children and also refused to allow the police to search his house.

People disappear as a result of other terrorist activities, armed conflicts, war, homicide, genocide, and other crimes (Tabeau & Bijak, 2005; Morewitz, 2008; missingpresumeddead.com, n.d.). Persons may vanish and die as they illegally immigrate to a country (U.S. Government Accountability Office, 2006; Hinkes, 2008; Morewitz, 2016a).

Many people go missing as a result of disasters and accidents. A 19-year-old young man in MPP Case 110 was classified as missing due to a catastrophe after he was reportedly swept out to sea while walking along the beach at La Jolla Shores. People also disappear voluntarily to escape financial difficulties, create a new life or social identity, or to avoid police apprehension after committing crimes (Morewitz, 2004).

Persons with Alzheimer's disease and other dementias may wander away because of their cognitive impairments. A 72-year-old woman with Alzheimer's disease in MPP Case 1159 went missing with her 74-year-old husband in Atchison, Kansas.

Individuals with a history of depression, bipolar disorder, and suicidal behaviors may go missing because of their symptoms. Before disappearing, depressed and suicidal persons may quit their job and sell or give away their belongings, especially their prized possessions. In some cases, these persons may leave a suicide note. A 23-year-old man in MPP Case 911 reportedly quit his job, left his prized possessions with a friend, and wrote a suicide note before he disappeared on May 3, 2001, from Morristown, New Jersey. In MPP Case 1043, a 15-year-old girl with bipolar disorder who was living with her grandmother disappeared after she was last seen boarding a bus in Chicago, Illinois, on March 22, 2011. Individuals who suffer from symptoms of depression and substance abuse may disappear. A 28-year-old man in MPP Case 971 who reportedly suffered from depression and substance abuse went missing from his house boat at a marina on December 8, 2006. Persons may disappear because of symptoms of schizophrenia, brain tumors, seizures, amnesia, and other mental disorders may disappear. For example, in Chicago, Illinois, on August 19, 2011, a 65-year-old man who suffers from schizophrenia went missing (MPP Case XYXY1). In MPP Case 967, a 46-year-old man with a history of a brain tumor and associated limited memory capacity, grand mal seizures, and depression went missing in Newport, Kentucky, on May 18, 2010.

People with health problems may go missing without their medications, and their lives are further endangered. In MPP Case 1055, a 14-year-old girl with depression and compulsive disorder went missing in Chicago, Illinois, on June 25, 2011. She reportedly had been without her medication for several days. In many cases, a person vanishes under unknown circumstances. In MPP Case 354, a 22-year-old man went missing from the Island of Kauai, Hawaii, on January 22, 1999. The young man had been living a nomadic lifestyle.

8.3 Prevalence of Missing Persons

Measuring the prevalence of missing persons is difficult for a variety of reasons. Law enforcement personnel may differ in their classification of missing persons based on different definitions of missing persons. In terms of measuring the prevalence of runaway youth, experts do not agree on the definition of running away among children and adolescents (Dedel, 2006). Categories of missing children include runaway youth, kidnapping by third persons, domestic parental abduction, international parental abduction, missing unaccompanied migrant minors, and children who are lost, injured, or otherwise missing (Missing Person, *n.d.*).

Another factor that complicates the measurement of runaway young people is that runaway youth will hide their runaway status to avoid detection by law enforcement personnel (Morewitz, 2016). Many runaway young people do not use social services and as a result, they will not appear in service utilization reports. In addition, measuring the number of people who go missing because of human trafficking and other criminal activities is difficult to measure.

In Europe, about 250,000 children are reported missing annually (Missing Person, *n.d.*). A majority (50–60%) are runaway youth. Between 25 and 30% of missing children are kidnapped by their parents. Migrant minors who are unaccompanied constitute 2–10%. Between 2 and 5% of the missing children are abducted by criminal offenders (nonparents).

About 20% of children in Europe are victimized by sexual violence, according to the Council of Europe (Missing Person, *n.d.*). The child knows and trusts the sexual violence offender in 70–85% of the incidents. Child sexual violence can include sexual abuse by the child's family, sexual abuse in care institutions, prostitution, pornography, Internet solicitation for sexual crimes, and sexual violence that is perpetrated by peers. To escape the violence, children may go missing.

Child trafficking for sexual, employment, and criminal activities are major problems in Europe (Missing Person, *n.d.*). About 2 million children are trafficked in Europe annually, according to

the UNICEF report on Child Trafficking in Europe, in 2007. Children are trafficked for domestic labor and other forms of labor such as factory work, begging, and criminal activities such as prostitution and pornography. Criminal networks are involved in the trafficking of children for sexual and other criminal activities. According to the United Nations High Commissioner for Refugees, in 2009, more than 15,000 children, who were unaccompanied and separated, claimed asylum in the European Union and two other countries, Switzerland and Norway (Missing Persons, n.d.).

On December 31, 2013, the USA had 84,136 active missing person records in the National Crime Information Center (NCIC) (NCIC missing person and unidentified person statistics for, 2013). About 40 % of the cases (33,849) involved minors under the age of 18. Juveniles aged 18 and 20 accounted for 11.5 % of the cases (9706).

During 2013, 627,911 missing person records were entered into NCIC. This number represents a 5.1 % decrease from 2012 when 661,593 records were entered into NCIC. During 2013, 630,990 missing person records were cleared or canceled. Those records cleared or canceled include missing person records that were filed in prior years. These removals occur for different reasons such as the missing person has been found or the individual has come home. In other instances, the record is removed because the agency that entered the missing person report had ascertained that the record is not valid.

According to a report by the Israel National Council for the Child, more than 1000 Israeli children went missing in Israel. A majority of the missing children (980) were over 12 years of age (Missing Person, n.d.). In Canada, the Royal Canadian Mounted Police reported in 2007 that 60,582 children went missing during a 10-year period (Missing Person, n.d.). At the USA-Mexico border and other dangerous locations, undocumented migrants may go missing and die due to homicide, heat stroke, hyperthermia, dehydration, drowning, motor vehicle accidents, and other life-threatening conditions (Hinkes, 2008; U.S. Government Accountability Office, 2006).

A variety of individual, family/friendship, community, organizational, governmental, and

technological factors may influence the social construction and prevalence of missing persons as a social phenomenon. These conditions may affect the structure, process, and outcomes of missing person investigations.

8.4 Individual Factors

In terms of individual factors, the degree to which a person is viewed as vulnerable may influence whether they are classified as a missing person. Missing children, women, elderly persons, and individuals with mental and physical impairments may be perceived as vulnerable, and the police may deploy more resources to investigate these missing persons.

Demographic trends also can influence the prevalence of missing persons. The increasing percentage of older adults in the populations who have Alzheimer's disease and other dementias (Morewitz & Goldstein, 2007) may lead to an increased prevalence of older adults going missing due to these chronic mental disorders.

An increased prevalence of children and adolescents in the population, along with an increase in the prevalence of family abuse and related impairments in family functioning can lead to an increased prevalence of runaway children and adolescents (Morewitz, 2016b). A high birth rate may lead to an increased prevalence of abductions of babies (Morewitz, 2016b).

Demographic factors such as gender and age may influence the reporting of missing individuals. For example, girls who run away from home may be more likely than boys to be reported as runaways since girls are considered more vulnerable than boys. For example, in the MPP, a larger percentage of teen runaways were female (41.9 %) than male (23.9 %) (Morewitz, forthcoming 2016a).

8.5 Family/Friendship Factors

Family and friendship factors can influence the prevalence and nature of missing persons. The increased rate of family abuse and dysfunction can result in a higher rate of family members who

go missing because of family abuse (Morewitz, 2003, 2004, 2016a).

In other instance, left-behind family members may feel that the police are not doing enough to try to find their loved ones (Butterfield, 2001). Left-behind family members may criticize the responses of the police to the plight of their missing loved ones. Family members and others may become outraged over the lack of police response. Left-behind families may rely on the media to publicize the plight of their missing family member. For example, in MPP 1118, the family sought the help of the public in finding their missing family member, a mother of three who has been missing for a week (helpfindthemissing.org, 2010).

Family members, friends, and others may believe that the disparities in missing person investigations are due to political, socioeconomic status (SES), race, gender, age, and other characteristics. For example, the police in Washington, DC, devoted substantial time and resources to investigate Chandra Ann Levy, a Federal Bureau of Prisons intern who reportedly had been romantically involved at the time with U.S. Representative Gary Condit of California (New York & Opinion, 2001). When she disappeared, cadaver dogs were used to aid in the search (see Chap. 19 this volume). In contrast, many members of the public believe that other missing persons without political connections and other high-status characteristics are investigated with the same amount of resources and intensity. Community and public outrage over perceived disparities in missing person investigations has led to the development of a new term in Wikipedia known as the missing white woman syndrome (Missing White Woman Syndrome, [n.d.](#)).

8.6 Media Attention

Increased media attention to the plight of missing individuals has led to the emergence of social movements that attempt to further the cause of POWs, missing children, parent-child kidnapping victims, missing adults, missing seniors, runaways and female victims of bridal kidnapping and death threats. Leaders of these social movements use search parties, hotlines, the Social Media, websites, registries, television announcements,

and other tools to help find their missing loved ones and also highlight underlying problems such as abusive parents, severe cognitive impairment, limited community, organizational, and national resources. These social movements may publicize the nature of cultural traditions such as bridal abductions and death threats that increase the risk of individuals going missing (Morewitz, 2016a).

Leaders of social movements formulate and coordinate strategies to mobilize more effective responses to missing persons. Social movement leaders develop ways to mobilize search parties in local communities and advocate for maximum use of police and technology to locate missing persons. As a result of social movements, the public is continually reminded of the plight of missing persons with a missing person monument and other cultural artifacts (Missing Person, [n.d.](#)). As a result of social movements and increased public awareness of the problems of missing persons, researchers have studied ways to improve the search and rescue of missing individuals and the identification of the human remains of missing persons (see Chaps. 3, 4 and 18 this volume).

8.7 Community Conditions

Do certain communities, regions, and countries have higher rates of missing persons than other areas? People's lifestyle and routine activities in different communities can affect their risk of going missing. For example, women who routinely walk alone in high-crime areas may increase their risk of disappearing as a result of criminal activity.

The influx of tourists in communities may affect the workload of police who are involved in missing person investigations. Newiss (1999) found that areas with an influx of tourists were associated with an increased workload for the police responsible for missing person investigations.

Moreover, higher rates of partner violence and child abuse can lead to an increase in the prevalence of individuals who go missing to escape this type of abuse (Morewitz, 2004). In addition, access to domestic violence shelters, runaway shelters, and foster settings in communities

increases the likelihood that the victims of domestic violence and child abuse will access these shelters to go missing in order to escape their abuser. For example, Newiss (1999) discovered a high incidence of children who went missing from children's homes in the UK was associated with an increased workload among police personnel involved in missing person investigations.

The prevalence of arranged marriages in certain countries may increase the workload of police who are responsible for conducting missing persons. In the UK, Newiss (1999) discovered that arranged marriage increased the workload of the police involved in missing person investigations.

The increased prevalence of stalking in the community can lead stalking victims to go missing to escape the trauma associated with stalking victimization (Morewitz, 2003). For example, a 19-year-old young woman in MPP Case 336 disappeared on March 2, 1998, after she had been reportedly stalked by an unidentified man.

Higher rates of death threats in the community may increase the likelihood that individuals will go missing voluntarily because they fear being killed by their offender. Higher rates of death threats also may be associated with an increased rate of persons who disappear because of homicide or other physical violence (Morewitz, 2008).

The presence of locations where people commit suicide may increase the workload of the police involved in missing person investigations. In the UK, Newiss (1999) found that suicide locations increased the work of law enforcement personnel who investigate missing persons. An increased prevalence in prostitution may lead to an increased rate in the percentage of missing persons in the community. According to Newiss (1999), prostitution is a factor that can increase the workload of the police who conduct missing person investigations.

8.8 Organizational Factors

Organizational factors may affect the rate of missing persons. For example, the policies and procedures of local organizations such as long-term

care facilities can affect the prevalence of missing persons with Alzheimer's disease and other dementias. Organizations may use research to identify different types of wandering behaviors, which residents are at risk for going missing, and develop new or enhance existing program activities or procedures to reduce the risk of wandering behaviors.

In one investigation of eight nursing homes in the Netherlands, Volicer, van der Steen, and Frijters (2013) classified the wandering behaviors of nursing home residents as modifiable wandering (MW) behaviors (e.g., easily altered by the staff) and non-modifiable wandering (NMW) behaviors (e.g., not easily changed by the staff). The researchers found that use of anti-psychotic medications reduced the risk of NMW behaviors. Nursing home residents who engaged in NMW were less involved in meaningful activities in the nursing home.

Other researchers have evaluated the best approaches to reducing wandering behavior among patients with dementia. According to Knopman and Sawyer-DeMaris (1990), changing the patient's environment can be helpful for certain patients, but medications are still frequently required to manage behavioral problems such as wandering behaviors, agitation, and aggressiveness in patients with dementia.

Other organizations such as retail businesses develop new security procedures or enhance existing ones to help prevent abductions of infants, children, and other vulnerable individuals. Hospitals are implementing new strategies such as kidnapping alarm systems. These alarm systems can employ a bar-coding system or umbilical clamp, which triggers an alarm and locks doors and elevators if an infant is within 4 ft. of an elevator or exit (Miller, 2007; Morewitz, 2015).

Organizations will develop establish missing person registries, hotlines, conduct research, publish articles and books, and develop other resources to assist missing persons and their families and friends. Organizations will provide resources to help left-behind families in dealing with the psychosocial, legal, and financial consequences of having a missing loved one. The International Committee of the Red Cross published a practical

handbook to assist the left-behind families of missing persons (International Committee of the Red Cross, 2013, March). Another organization, missingpersons.org, published a handbook to provide emotional support for families and friends of missing persons (missingpersons.org, n.d.).

8.9 Government and Legal Factors

Governmental and legal factors also influence who is considered missing and the quality of personnel and level of resources available to respond to individuals who go missing (Newiss, 1999; see Chap. 14 this volume). Government agencies use AMBER Alerts and Silver AMBER Alerts, research, and other mechanisms to get the public involved in locating missing persons and increase their awareness of the problem of missing persons (James, Anderson, & Putt, 2008; see Chap. 4 this volume).

Governments can require improvements in organizational policies and procedures to protect individuals from going missing (Newiss, 1999). For example, a female adult patient who went missing from San Francisco General Hospital in San Francisco, California, led to new federally mandated hospital procedures such as daily inspections of all stairwells, improved alarm systems, and other security procedures (cbslocal.com, 2014). The patient had been admitted for treatment of an infection on September 19, 2013, and went missing 2 days later. She was found dead lying in a locked stairwell on October 8, 2013, although the hospital had received a report that a woman was lying in a hospital stairwell on October 4, 2013. Officials had been instructed to search the entire hospital campus, but only half of the hospital's stairwells reportedly had been searched.

Legal definitions of death will affect insurance policies of missing individuals. The laws that affect missing person can be complicated since relatives and others may not be able to decide on the assets of missing person until a death certificate has been issued.

Legislation can affect the classification and investigation of missing person cases and therefore influence the prevalence of different types of missing persons. New laws dealing with missing persons can alter public responses to missing persons and alter the ways in which law enforcement deals with individuals who have disappeared.

Governments may devote extensive resources to improving responses to missing individuals. For example, the National Institute of Justice funds missing person databases and projects in the USA. Other governmental agencies conduct research on missing persons and provide other assistance in locating missing individuals (Swanton, Wyles, Lincoln, Wilson, & Hill, 1988).

8.10 Other Technological and Scientific Innovations

A variety of other technological and scientific innovations have been developed to assist in finding and identifying missing persons. In the past, milk cartons, posters, and flyers were some of the methods used to alert the public to missing persons. Now, the use of social networking tools such as Facebook and Twitter can significantly aid in locating missing children and other missing persons (O'Connor, 2011; International Association of Chiefs of Police, 2010–2014).

A system known as SecuraChild relies on social media networks such as Facebook and Twitter to send email and text messages when a child is reported missing (O'Connor, 2011). A parent can enter the SecuraChild website for free and report a child missing. Those with a subscription or access to Facebook or Twitter will be alerted immediately that a child is missing. Other methods are also available. For example, the NCMEC allows individuals to add an AMBER Alert "ticker" to their website or app to a person's cell phone.

The National Center for Missing and Exploited Children (NCMEC) notes that since 2005, social media has helped to complete and recover 98.5% of missing children who had an AMBER Alert (O'Connor, 2011). Between 2005 and 2009, 1430 have been located based on 1451 AMBER alerts.

NCMEC has the highest ever rate of finding and returning missing children. The NCMEC rate was 96.5 % in 2011, compared to 60 % in the 1980s.

The recovery of Jaylin Boudria, a 1-year-old, 5 h after an AMBER Alert was sent to Twitter and Facebook, illustrate the speed at which a missing child can be located through social media tools (O'Connor, 2011). In a parental-child abduction case, a mother in California was able to use Facebook to locate her two children who had been abducted by their father and had been missing for 15 years (huffingtonpost.com, 2010, June 5).

Technological innovations such as the development and use of Global Positioning Systems (GPS) can assist in locating missing persons and better understand the conditions that may affect their missing person episode. One company, Securatrak, makes tools that use GPS to find missing persons (O'Connor, 2011). Vulnerable individuals such as those with Alzheimer's disease and other dementias can wear a watch or pendant that is a location device that relies on GPS (McKinstry & Sheikh, 2013). In addition, vulnerable individuals can carry a mobile phone that serves as a location device based on GPS.

Ethical concerns can arise over the use of GPS to track vulnerable individuals such as those who suffer from dementia. Using a focus group of family and professional caregivers, Landau, Auslander, Werner, Shoval, and Heinik (2010) found that family members and professional caregivers emphasized the need to balance patient safety with patient autonomy and privacy when using GPS to track dementia patients.

Technological advances also can improve the effectiveness of search and rescue teams. For example, innovations in robot-assisted search and rescue operations, such as the use of a wireless sensor network, may enhance the search and recovery of missing persons (Ko & Lau, 2009).

Various advances in forensic science-related fields such as anthropology (Chap. 27 this volume), archaeology (Chap. 19 this volume), biology, chemistry, computer science, criminology, pathology, and sociology assist in locating and identifying missing persons.

Researchers are developing the use of ante-mortem dental records in identifying missing

persons (Blau, Hill, & Briggs, 2006; Chap. 27 this volume). Researchers are enhancing the use of forensic trace DNA (van Oorschot, Ballantyne, & Mitchell, 2010; Chaps. 22 and 23 this volume). They are establishing online disaster responses to help locate missing persons after disasters (Laituri & Kodrich, 2008; Chap. 32 this volume). Investigators are evaluating human-centered intelligent Web-based missing clothing systems (Khosla, Francionne, & Chu, 2006). They are conducting police education research to improve police's responses to missing persons (Stevenson, Parr, & Woolnough, 2014), and using remote sensing and geophysical technology to conduct noninvasive analysis of burial sites (Hunter, Simpson, & Colls, 2013; Chap. 19 this volume).

8.11 Missing Person Investigations

Locating missing individuals is complex, and law enforcement personnel can face significant barriers in responding to missing person reports (James et al., 2008, March). Unlike reports of homicide, burglary, or other crimes, the police may not be able to ascertain if a crime was even committed in many missing person cases (Newiss, 1999). Personnel who are highly trained, skilled, and experienced may be more likely to successfully resolve a missing person case, especially in cases involving limited information about the missing person case and a high degree of uncertainty about the individual's situation.

What factors affect missing person investigations? The police standards for missing person investigations and the definition, prevalence, and nature of missing persons are socially constructed. Social beliefs, values, and traditions help to determine who is considered a missing and the types of procedures undertaken to locate a missing person.

In the past, law enforcement and the public at large may have been under the assumption that a missing child or adult must be away from home for 24 h to be considered missing. The police in some jurisdictions no longer wait for 24 h before launching a missing person investigation.

For example, according to Kwok (2013), the police in the Philippines are no longer allowed to wait 24 h before starting an investigation of a missing child who is 12 years of age and younger. Law enforcement personnel must launch an investigation immediately after a child is reported missing. The previous policy apparently was designed to screen out juvenile runaways who voluntarily went missing.

In Seattle, Washington, the police do not have a waiting period for missing adults (McNerthney, 2010). The police in Seattle reportedly review each missing person case to determine if it is an appropriate case and they try to be cautious in their determination. Missing person investigations may be hindered by other practices. For example, Ritter (2007) notes that many cities and counties in the USA will bury unidentified remains without trying to collect DNA evidence.

The success of a missing person investigation may be affected by different conditions during each stage of an investigation. For example, Newiss (1999) discovered that police personnel who take a call about a missing person may lack standard guidance in helping them to prioritize the missing person call.

In missing person cases that have no useful clues, police personnel may have a certain amount of discretion in conducting the investigations. The police may have discretion in deciding which evidence to consider, the type of resources to use, and which missing person cases should have higher priority. Law enforcement personnel may use their discretion in classifying a missing person case as involving foul play or being suspicious. In MPP Case 1198, the police considered the disappearance of a husband and wife suspicious. The husband, age 34, and his wife, age 46, disappeared from their home in Willard, Missouri, around April 17, 2011. However, in MPP 52, the police suspected foul play in the case of a missing 27-year-old woman who failed to go to her birthday party the day after she vanished. The woman also had left behind her clothing and makeup at her home.

The police determined in MPP 342 that the case of a missing 64-year-old woman who was driving to Sonora, California, did not involve foul

play. She vanished but her purse, wallet, keys, and cell phone were found in her vehicle at a vista near Sonora.

In other cases, the police may use discretion to a certain degree in determining if a vulnerable individual has gone missing and is danger. For example, in MPP 287, law enforcement personnel classified a 25-year-old missing man as endangered missing after he was last 4 am on July 4, 2005. He was supposed to attend a family picnic but did not show up. In addition, neither his financial accounts nor his health insurance card had been used. Certain types of missing persons such as an infant or a person with severe dementia are clear examples of vulnerable individuals. However, in many cases, the police may use discretion in making a determination that an individual is vulnerable and potentially in danger.

The SES and demographic characteristics of the missing individuals and left-behind families may affect the police classification of missing persons. Results from the MPP show that missing Hispanics (29.0%) and missing whites (28.7%) were more likely than missing African-Americans (15.2%) to be classified as involving possible foul play (Chi-Square=23.51, $df=7$, $p<0.001$). These results remained statistically significant after controlling for possible intervening factors, such as the missing person's gender.

Left-behind families may directly try to influence the police's decision-making process by asserting that their missing loved one is the victim of foul play or has gone missing under suspicious circumstances. Left-behind families also may report to the police that their missing family members' behaviors were unusual at the time that they disappeared. For example, in MPP 221, family members reported to the police that they believed that their missing loved one, a 44-year-old woman, was a responsible individual and would never leave her daughter without any notification.

Similarly, families who have lost a loved one to suicide may try to influence and challenge the authority of medical examiners involved in the death investigation by assert that their loved one died in a less stigmatizing way (Timmermans, 2005).

Newiss (1999) noted that in missing person cases the police will vary in the resources that they will employ. The police may conduct an initial search of a house or expand the search to a wide area. In MPP Case 287, the police searched a river in the vicinity and nearby wooded areas after a 25-year-old man was classified as endangered missing. The police may deploy specialist personnel, search and rescue dogs and robots, and aircraft in certain cases. The police may make use of social media in some investigations.

Police departments may differ in the amount of resources that they have in dealing with missing persons. For example, police departments in low-SES areas may not have the same amount and quality of resources as those in upper-SES communities.

Police may use a certain amount of discretion in deciding to devote more time and other resources to resolving a missing person case. Law enforcement personnel also have in place a structure for working with other agencies. For example, the Fresno County Sheriff's Missing Persons/Runaway Unit works with the California Department of Justice and the National Center for Missing and Exploited Children (NCMEC) (Fresno County Sheriff's Office, n.d.).

The social and political characteristics of the families and friends of the missing persons may affect police discretion and other aspects of the investigation. Some left-behind families and friends may lack the capacity to trigger a comprehensive investigation. In contrast, other left-behind families and friends will receive extensive media coverage of their missing loved ones, which can produce community-wide and even national and international attention and support, including extensive searches for their missing loved ones.

Publicity over a missing person and subsequent community concern over the plight of missing individuals in the community can reduce the discretion of law enforcement personnel, forcing them to use more extensive resources such as the use of additional law enforcement organizations, aerial and underwater searches, and search and rescue dogs and robots. Community pressure on the police can lead to regular police conferences with the media to keep the public informed about the progress of police investigations.

8.12 Impact of Missing Persons

Missing persons create a huge burden on family, friends, coworkers, employers, and society as a whole (International Committee of the Red Cross, 2013; Henderson & Henderson, 1998; missingpersons.org, n.d.). Left-behind family members often develop psychosocial reactions; they suffer from the distress of not knowing what has happened to their loved one. The family members who are left behind may feel guilty, accuse themselves, and become angry over their missing family member. The family members may become socially withdrawn and lose interests in participating in their normal activities.

For long-term missing individuals, the left-behind families have conflicts over whether to forget their missing family member. Left-behind family members may have to accept their loved one's death without actual proof of their death. Surviving families face the trauma of the grieving process, which may be especially difficult for family losses that are ambiguous (Boss, 2006).

Some missing persons are found or return home. Previously left-behind families may have to make social adjustments when they reunite with their formerly missing family members. Likewise, the missing formerly missing person faces potential barriers in reintegrating with family, friends, and work associates. The duration of time that the family members have been missing and the severity of their traumatic experiences are some of the conditions that will affect this psychosocial process.

Mental health professionals can help the left-behind families and friends cope with the trauma and social and financial losses. In addition, left-behind families and friends can benefit from other strategies such as gentle exercise, relaxation methods, and proper nutrition in coping with the disappearance of a family member or friend (missingpersons.org, n.d.).

The financial costs are also substantial. In a study of missing persons in Australia, Henderson and Henderson (1998) found that the financial burden of finding missing individuals is over \$72 million.

This chapter has shown that many social, technological, media, community, and political

conditions may influence the structure, process, and outcome of missing person investigations. Additional research is needed to clarify the extent to which gender, age, race, ethnicity, socioeconomic status, media, community factors, legal, and other conditions affect the ways in which the police determine foul play, priority of missing person cases, and use of police resources in missing person cases. More research should focus on the impact of missing persons on their families, friends, and larger society.

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Missing Someone: Exploring the Experiences of Family Members

9

Lucy Holmes

'Each missing person is missed as this or that unique and irreplaceable person, and is missed by those close and by those further away as well. They are not missed as abstract individuals.'

(Edkins, 2011, p. 9)

9.1 The UK Context

9.1.1 Defining 'Missing'

Any definition of 'missing', or a 'missing person', is inherently linked to those who miss that person. The act of missing a person is entirely relational; it has to do with the ways in which people are related, connected, bound together. It follows, therefore, that the impact of missing episodes on those who are left behind is highly relevant to the incident. For a missing person report to be made, for a search to be undertaken, someone has to define the missing person as missing. This chapter concerns those people who miss someone, the impacts on their lives and the structures in place that help them cope with their loss.

This chapter is primarily concerned with the situation in the UK, although other international examples are considered. Police forces in the UK

receive more than 300,000 missing person reports each year, which are estimated to relate to between 100,000 and 250,000 individual missing people (UKMPB, 2014). The disparity arises because many missing people are reported missing more than once; children living in local authority care and adults absconding from mental health institutions are two groups that are particularly known to attract repeat missing person reports. It is not known what proportion of missing person reports involve a family member as the 'informant' (the person making the report) and what proportion involve a professional informant, such as a care home manager or hospital ward manager.

There is also a 'dark figure' of people who go missing in the sense that they are not where they are supposed to be, and might even have run away from their home, but are not reported to the police. Rees (2011) found that a substantial number of young people who self-reported running away believed that no one had reported them missing to the police. Further to this, Edkins (2011) points to the more than 16,000 people in the UK who were buried by their local authorities between 2000 and 2004, with no next of kin involved in their funeral. This chapter is, rather, focussed on the experiences

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of the people who miss, who experience the loss and who search for their missing person.

Throughout this chapter it will also be useful to bear in mind that there are many circumstances which may lead to a missing episode (Biehal, Mitchell, & Wade, 2003; Holmes, 2016), and that these circumstances may have a bearing on the experience of those who miss the person (Holmes, 2008). For example, a stranger abduction of a child may have a starkly different impact on the child's parents than the disappearance of an adult with symptoms of mental illness many have on his or her siblings. However, the circumstances behind a disappearance are not always known, and there are nonetheless commonalities, which will be explored herein. Furthermore, it is also important to note that some people go missing because of the actions of their family members; forced marriage, honour-based violence, domestic violence, familial abuse and rejection are all potential reasons for someone to go missing deliberately. This chapter does not seek to explore the experience of family members who are also perpetrators of violence or abuse.

9.1.2 Defining 'Family Members'

This chapter is concerned with the experience of family members, and will use this term in preference to the word 'families', in recognition that family members are individuals who will have individualised relationships with the missing person and responses to a disappearance. Families are not homogenous groups, and the use of the phrase 'family member' seeks to emphasise this. Moreover, when discussing the use of support services it is relevant that not all members of a family may choose to access services. Finally, the focus on family members is not intended to exclude other important relationships. Indeed, modern notions of family allow us to include close personal relationships under this banner for the sake of this discussion.

What it means to be affected by a missing incident is moot. Previous research and current practice has sought to estimate how many people are affected by the missing phenomenon (Henderson & Henderson, 1998). This is imperfect science,

not least because it cannot account for the differing responses of non-family members who miss a missing person. A missing person's colleagues, acquaintances, friends, neighbours, distant relatives and even contacts on social media may feel affected by a disappearance to differing degrees. An acquaintance may feel sufficiently moved that he or she joins the search by putting up posters and sharing appeals on social media. The neighbour of an abducted child may feel so concerned as to change the way he or she supervises his or her own children. An employee may undertake a fundraising challenge in memory of a missed colleague. All of these suggest a level of affectedness that indicates an emotional response.

In order to create a best estimate of the number of people affected by missing, UK charity Missing People has considered Department of Health (2011) estimates of the numbers of people affected by suicide, and Department for Transport (2011) calculations about the numbers of people affected by road accidents, Dunbar's Number (estimates of social network size) (Dunbar, 2010), public survey data (Understanding Society, the UK household Longitudinal Study), research that estimates of the proportion of missing people who are not reported to the police (Rees, 2011), and demand for the charity's own services. Informed by these sources, Missing People calculates a low estimate by assuming one close family member or friend affected by each incident, a medium estimate assuming five intimates per incident, and a higher estimate based on 15 best friends for each missing person. This produces the estimate that as many as 8,750,000 close friends and family members are affected by someone going missing each year in the UK.

9.1.3 Recognising the Needs of Family Members

Recognition of the needs of family members of missing people has not always been assured. Much changed in the aftermath of the Second World War, when the sheer numbers of displaced people across the globe prompted unprecedented search efforts, with families at the forefront (Edkins, 2011). Edkins (2011) describes people living in

Displaced Persons camps valuing reconnection with their relatives over all else. Since then the development of support services for family members of missing people has varied hugely between countries. The reasons for this have not been explored in the literature, but may lie in the development of discourses around missing which may, themselves, be rooted in the dominating reason for missing incidents in that country or region.

Edkins makes the point that states (national governments) may not recognise the needs of family members, but are more concerned with locating, identifying and restoring missing people. Edkins (2011) explores this in the context of the 2005 London bombings (in which 56 people, including the four bombers, died and scores were missing or unidentified for a period). Edkins notes that the authorities prioritised identification over communication with family members and suggests that ‘the procedures in place for responding to disasters do not focus on people but on procedures’ (Edkins, 2011, p. 196).

9.1.4 UK Support Services and Structures

In the UK, local police forces are the primary investigative agency. Not all missing episodes are suitable for police investigation, and to be investigated a disappearance must meet the police criteria (ACPO, 2010). Examples of ineligible cases would be instances where family members have drifted out of contact over time; this sort of situation would require tracing services rather than a police search. UK police forces nonetheless receive many thousands of missing person reports each year, all of which require some level of response. Police investigations have been guided in the past by ACPO guidance (ACPO, 2005, 2010) which will shortly be replaced by Authorised Professional Practice created by the College of Policing. Individual forces, of which the UK has 48 (45 regional forces and 3 national special forces), interpret and implement this guidance in their local areas, leading to some inconsistency of approach.

Police investigations are, naturally, bound by legal constraints, and the scope and extent of an

investigation is informed by the risk assessment. Police forces have many resources that can be deployed on missing person searches (such as, but not limited to, air support, search dogs and water search teams), under the guidance of Senior Investigating Officers (SIOs) and Police Search Advisers (PolSAs). In many areas there are also voluntary sector search agencies, such as Mountain Rescue and Lowland Search, from whom police forces can request assistance.

Investigative teams may also use Family Liaison Officers (FLOs) although, in practice, these only tend to be used for the most serious or high profile disappearances. Police forces are also able to make referrals for family support to the charity Missing People and, indeed, more than one-third of the charity’s family member service users first heard about the charity from the police (Missing People, 2013). The impact of a police investigation on family members is significant (Holmes, 2008; Parr & Stevenson, 2013) and is explored in more detail later in this chapter.

The main UK organisation available to support family members of missing people is the national charity Missing People. Formerly the National Missing Persons Helpline (NMPH), the charity was founded by Mary Asprey OBE and Janet Newman OBE in response to the disappearance of Suzy Lamplugh, an estate agent who went missing whilst showing a property in London in 1986. The charity later underwent significant expansion following the discovery of a number of murder victims buried at 25 Cromwell Street in 1994. Fred and Rosemary West were later convicted of a range of offences, including murder against at least 11 known victims, some of whom had been reported missing (Edkins, 2011). The case resonated with many family members of missing young women, and the NMPH was instrumental in supporting those family members and helping to identify some of the victims.

As well as providing practical search support, such as missing person appeals (see Chap. 3) and family tracing, the charity provides a range of practical and emotional support services to family members. These include a round-the-clock free confidential helpline, telephone counselling,

a private online forum, written guidance leaflets, allocated family support workers and support events (Steyne, Alves, Robinson, Towell, & Holmes, 2013). The charity aims to be a lifeline for family members during a disappearance, walking alongside family members on their journey, and providing a safe space for people experiencing the acutely distressing pain of missing loss.

Other sources of support available to UK-based family members of missing people include the charity Missing Abroad (who support family members when their relative is missing overseas), trauma services such as the Centre for Crisis Psychology (CCP), and statutory health and mental health services. These are, naturally, complementary to informal support networks, such as friends, neighbours, colleagues, faith groups and school communities. Some family members also turn to others in an effort to help their search or to help them cope, such as private investigators, psychics and other advisers.

Not all family members seek support from external agencies, and family members may seek individualised support separately. For example, one relative of a missing adult may engage with Missing People, liaise with police and deal with practical affairs, whilst another relative of the same missing person may seek support from his or her GP and a counsellor. There is some evidence from interview data collected during the project published as Holmes (2008) that family members take on particular roles when it comes to dealing with outside agencies, meaning that the person who feels most capable deals with the police and search activities, whilst others are more likely to require emotional support. Children, in particular, are likely only to have access to non-missing-specific support, such as support within their school, than to have access to a specialist counsellor or to be involved with search agencies.

The assumption of roles does not only extend to liaison with external people and organisations; it also refers to the roles family members assume when it comes to remembering the missing person—memorialising, marking events, talking about them and protecting their reputation.

This chapter will explore the nature of trauma as experienced by family members of missing people, the use of the concept of ambiguous loss to understand the loss caused by a disappearance, and the immediate and longer term effects of an ongoing missing incident. It will go on to discuss the methods of emotional support that are currently available, and those which may be needed, and the ways in which legal and financial frameworks, and agencies involved with the search, can influence emotional well-being.

9.2 Trauma

Loss of a missing person appears in literature about bereavement, but only in passing (Wayland, Maple, McKay, & Glasscock, 2016), and the type of loss family members experience does not align with the support offered by bereavement or grief therapies (Wayland, 2015). Research comparing the experiences of women in Bosnia and Herzegovina who had had confirmation of the death of their husbands, to women whose husbands remained missing, similarly found that the impact on the two groups was different (Powell, Butollo, & Hagl, 2010). Given that death and bereavement literature are not, then, satisfactorily addressing the issue of missing persons, we must look to different conceptual frameworks.

Two related but distinct concepts are particularly useful for framing the experience of family members left behind when someone goes missing: trauma and ambiguous loss. Trauma is a particular concept that describes a profoundly affecting experience. Brewin, Dalgleish, and Joseph (1996) suggested that a traumatic experience undermines the basic assumptions people make about their place in the world, and their safety, security and vulnerability (Brewin et al., 1996). More than one definition of trauma emphasises the social context in which trauma takes place, and the effect trauma can have on the way in which an individual relates to other people (Green, 2000). The symptoms of trauma can be wide-ranging and can, in their most severe form, develop into post-traumatic stress disorder (PTSD).

Horowitz (1986) organised trauma symptoms into two categories—those concerning intrusions into thoughts and those relating to attempts to avoid or deny the experience (Green, 2000, p. 4). Intrusion symptoms include ‘hypervigilance, startle reaction, flashbacks, intrusive thoughts and searching for the lost person’ (although this last is described in the context of traumatic loss through violent bereavement) (Green, 2000). Denial symptoms include ‘amnesia, inability to visualise memories, disavowal of meaning, numbness and withdrawal’ (Green, 2000). Many of these are seen, to differing extents, in family members of people who have disappeared, as evidenced by the books written by family members of missing children. Two such accounts are quoted below: one by Kate McCann (2011) whose 3-year-old daughter Madeleine disappeared whilst on a family holiday in Portugal and has never been found, and one by Jones and Jones (2015) whose 5-year-old daughter April was abducted and murdered in 2012, and whose murderer has been sentenced to life in prison.

‘I was beginning to feel numb, almost detached, from everything that was happening [...] this seemed worryingly unnatural [...] My numbness was evidently visible to my closest friends: one later commented that she wondered if I’d been given something to sedate me. I hadn’t.’ Kate McCann (McCann, 2011, pp. 111–113).

‘It had been a chaotic and confusing ten days, shot through with unremitting cold dread and dark thoughts that were hard to push away when we had nothing else with which to replace them. That is the anguish of the “not knowing”. [...] Admitting the existence of these images somehow confirmed them as a real possibility, and with that confirmation came renewed waves of fear.’ Kate McCann (McCann, 2011, p. 129).

‘At times like this it’s easy to slip into denial. While I’d accepted what the police had told us the previous evening, when the tears finally took hold of me in the early hours I began to allow myself to doubt what they’d said. Perhaps April was still being hidden somewhere [...] there was no sign of her, dead or alive. How could the police know anything for sure?’ Paul Jones (Jones and Jones, 2015, p. 64).

Symptoms that are seen in family members of missing people which are also symptoms of trauma and PTSD include (but are not limited to) intrusive thoughts about the missing person;

disturbed sleep; depression; anxiety; hypervigilance; extreme distress; functional impairment; conflict and somatisation (Robins, 2010; Boss, Beaulieu, Wieling, Turner, & LaCruz, 2003; De Keijser & Boelen, 2015).

Trauma alone cannot fully account for the impacts felt by family members of missing people. Boss et al. (2003) emphasise that the therapeutic approaches used for those experiencing grief or PTSD are not sufficient for treating family members of a missing person. Robins (2010) similarly found, in a study of family members of disappeared people from Nepal, that the psychological impact of disappearance did not qualify for a diagnosis of PTSD but included, instead, a set of overlapping but distinct symptoms (Robins, 2010, p. 260).

The loss of a family member who has disappeared does, as Boss et al. (2003, p. 457) describe, meet the PTSD criterion of being ‘an experience beyond the normal range of human suffering’ but, unlike PTSD, missing loss is relational rather than an individual mental illness. Boss et al. (2003) emphasize that it is the situation (of not knowing where a family member is) that leads to the individual and/or relational symptoms. The concept which, then, provides the most comprehensive understanding of the specific loss associated with a missing incident is that of ambiguous loss.

9.3 Ambiguous Loss

Since 1973, Dr. Pauline Boss, Professor Emeritus, has developed a framework that helps to understand the complicated grief/loss associated with missing incidents; ambiguous loss (Boss, 1999, 2002, 2006). Ambiguous loss describes the nature of a loss, or a grieving process, whereby the object of loss (the missing person) is either lost physically or psychologically, and where the loss is unclear or unresolved. In a 2014 publication Boss and Yeats describe two types of ambiguous loss: (1) ‘Good-Bye without Leaving’ (dementia, coma, depression, addiction, autism, homesickness) and (2) ‘Leaving without Good-Bye’ (missing people, incarceration,

suicide, adoption, divorce, miscarriage, infertility) (Boss & Yeats, 2014, p. 64).

Ambiguous loss, of the sort experienced by family members of missing people, is unclear, traumatic loss; it is externally caused, it is not pathological and it is uncanny; it differs from other traumatic loss because it is continually in the present (Boss, 2010). Ambiguous loss is not the same as trauma, although it has many overlapping characteristics (Robins, 2010) and it can become lifelong trauma if no resolution is found (Boss, 2002). However, the enduring nature of missing loss, and the ambiguity over what has happened to the missing person, means that ‘a different lens is required than with PTSD, in which the traumatising event may be over but flashing back. Ambiguous loss is chronic trauma’ (Boss et al., 2003, p. 458).

Gregor (2003) and Boss (2010) both highlight that the ambiguity of missing loss makes it the most stressful type of loss. Gregor (2003), in an exploration of loss in Nuremburg in the aftermath of the Second World War, quotes a parish newsletter, which stated ‘all those who are waiting for a missing person are in the worst position. [...] as long as there is not complete clarity, hope clings to every possibility.’ (Gregor, 2003, p. 196). The benefits of understanding missing loss through the concept of ambiguous loss—that labelling it benefits family members, and that it provides guidelines for a therapeutic approach—are explored in more detail later in this chapter. Literature around liminality can bring some further understanding of the ways in which the ‘complex intermingling of hopelessness, hopefulness, and learning to tolerate ambiguous loss’ can affect family members and inform their emotional experience (Wayland, 2015, p. 65).

9.3.1 Need for Evidence of Death

Related to the ambiguity associated with the loss of a missing person is the importance that all societies (through time and geographically) place on death and funeral rituals. As Boss et al. (2003) observed in family members of people lost in the 9/11 attacks on the World Trade Center, ‘all

yearned for evidence of life, and later, for evidence of death’ (Boss et al., 2003, p. 456). This need to have proof of death, and the ability to conduct the appropriate rites, was extremely significant to those affected. Boss (2002) called to mind several examples throughout literature and history of people seeking to retrieve bodies of loved ones:

‘I thought of Sophocles’ Antigone who defied the King and faced death in order to retrieve and bury her brother’s body; and more recent reports of mothers roaming deserted Kosovo battlefields, picking at bones, trying to find their sons; adult children searching southeast Asia for fathers whose planes had been shot down decades ago; Russian and Japanese families waiting to collect their dead from sunken vessels’ (Boss, 2002, p. 15).

Boss (2002) hypothesises that people need to retrieve their dead because their cultural background has conditioned it, because it provides cognitive certainty and understanding that death has occurred, and because being able to bury a body (or body parts) of their own volition allows family members to let the lost person go. Beder (2002) also explores the need for funeral rites and rituals, citing Kollar’s (1989) goals of the funeral; physical, social, psychological and religious. In a study of family member of people missing following the conflict in Kosovo, social workers providing support found that family members reported that it was ‘agonising to be unable to give their family member a proper burial’, and were reluctant to rebury any bodies without identification (Keough & Samuels, 2004, p. 592).

The need to be able to follow appropriate death ritual is, as indicated above, common throughout the world, but there are also important culturally specific factors at play. Robins (2010) gives an example of this in a study of family members of disappeared people in Nepal. In this study, wives of disappeared men experienced stigmatisation by their communities because of their perceived failure to observe correct death and funeral ritual; particularly when other people in the community considered the disappeared men to be dead, but their wives were not prepared to accept this (Robins, 2010). These issues are discussed further in Chap. 31.

9.3.2 The Early Days of a Missing Incident

Having explored the conceptual frameworks of trauma and ambiguous loss it is helpful, next, to consider the different impacts on family members at different times following a disappearance. There is a dearth of research about the experiences of family members during the earliest hours and days of a disappearance. Undoubtedly this is a challenging topic for research as the very nature of the experience makes it unlikely that a researcher could gain any real time access during an event. There are some first-hand accounts such as those mentioned above (McCann, 2011; Jones and Jones, 2015), and the reflective work of practitioners brings further insight. Examples of practice-based learning include Keough and Samuels (2004) study of support provided after the conflict in Kosovo, Robins (2010) study of family members of people who disappeared during the conflict in Nepal, and Boss et al.'s (2003) reflections on a community-based intervention after the 9/11 attacks on New York.

Maslow (1943) posited that human behaviour is driven by five motivational needs, arranged in a hierarchy of importance, suggesting that 'a person who is lacking food, safety, love, and esteem would most probably hunger for food more strongly than for anything else.' (Maslow, 1943, p. 373). In this theory, biological and physiological needs take precedence (in terms of their motivational power) over safety, love and belonging, esteem and self-actualization (Maslow, 1943). In the case of Displaced Persons (DP) following the Second World War, however, a seemingly contradictory observation was made:

'When an official visitor to the DP camp at Warendorf, where families were housed in animal stalls, spoke to the inmates in April 1945, what they requested was not more space or better rations but notepaper and envelopes: "There seemed to be a universal desire to communicate with friends". As Mark Wyman points out, for DPs (displaced persons) "questions of food, clothing and even health were secondary to locating their loved ones".' (Edkins, 2011, pp. 48–49).

The drive to locate and reconnect with family members is, in this case, a motivational need of vital importance.

Research with family members experiencing a longer term missing incident sheds some light on the impacts on family members in the first hours and days after a disappearance. A participant in the research published as Holmes (2008), interviewed several years after their adult child had gone missing, remembered 'I just screamed in the garden for about, I don't know, 3 h. And that's all I did, I just sat there screaming' (Parent of a missing adult, interviewed for Holmes, 2008). Another interviewee commented that 'you feel hopeful but you feel devastated' (sibling of a missing adult, interviewed for Holmes, 2008). Still another said 'we probably were in a state of shock for the first few days [...] you are in a world of your own. [We were] very frightened for her and scared [...] that horrible nervous stomach feeling, tearful' (Adult child of a missing adult, interviewed for Holmes, 2008).

The early days following a disappearance can be a busy time, when other family members, friends and professionals are present and involved. This can be an overwhelming experience, as described by both Kate McCann (McCann, 2011) and Paul and April Jones (Jones & Jones, 2015). For family members affected by a high profile disappearance, or where there are many supporters who wish to help, it may be that some means of gatekeeping visitors and helpers must be found.

The first-hand accounts of Kate McCann, and Paul and Coral Jones also highlight some of the response behaviours those family members found themselves displaying. Paul Jones described frantic pacing and constant movement on the first night after his daughter April disappeared, followed, later, by the urge to exercise 'to the point where it became obsessive. [...] Punishing myself physically felt like a release' (Jones & Jones, 2015, p. 74). Kate McCann (2011) similarly described using long runs to push herself physically.

The early days of a traumatic, ambiguous loss closely mirrors symptoms of other trauma. As time goes on, however, the experiences diverge. More is known and understood about the longer term impacts of a missing incident; research has tended to involve or study family members during longer term missing episodes, rather than in

the early days or post-resolution (although there are emerging exceptions such as Parr & Stevenson, 2013; Holmes, 2014, 2016). This chapter does not explore the experience of family members following resolution, but this is an area of increasing interest to practitioners and researchers alike.

9.3.3 Longer Term Effects

By far the majority of missing person cases are resolved, and resolved quickly. International research shows that in countries where data are available (the UK, the USA, Australia and New Zealand), more than 90% of missing person cases are resolved and, in many areas, this figure is more than 99% (Henderson & Henderson, 1998; Newiss, 1999; Biehal et al., 2003; Tarling & Burrows, 2004; James, Anderson, & Putt, 2008; National Crime Information Center, 2011; New Zealand Police, 2013). Very many of the cases that are resolved are closed within hours or days of the disappearance; in the UK police data consistently show that around 98% of incidents are resolved within a week of the report (UKMPB, 2014, p. 21).

When considering the longer term impacts on family members, it becomes increasingly important to consider the interplay of emotional, social, financial, legal and practical impacts. Although this chapter is primarily focussed on the emotional and social impacts (as these are more prevalent in family members; not all missing incidents have in financial or legal implications), there is a brief discussion of the practical impacts towards the end of the chapter. Where there are financial or legal problems, or practical affairs to be managed or liaison with services to be managed, these issues can have a significant impact on the emotional resilience of family members. This means that emotional effects should not be considered in isolation from the search and from other matters arising from a disappearance.

It is important to remember, as discussed at the beginning of the chapter, that not all family members respond in the same way. Research has begun to explore the ways in which familial

relationship to the missing person can affect family members' experience. Greif and Bowers (2007) and Clark, Warburton, and Tilse (2009) have particularly explored the experience of siblings, noting that the sibling relationship is usually the most enduring family relationship and that the loss of a sibling can result in feelings of isolation and neglect if the loss is not socially sanctioned. The changes to family structure resulting from a sibling going missing may be acutely experienced by remaining siblings, particularly if the sibling left behind is the only remaining child in the family. The experience of being the only remaining child of parents of a missing person is likely to be quite distinct from the experience of the parents or other relatives of a missing person. There is scope for further research to explore this in more depth to extend understanding and enhance support.

In terms of longer term emotional and social psychopathological responses, De Keijser and Boelen (2015) identified: (1) emotional reactions (yearning, longing, guilt, anger, fear); (2) cognitive reactions (recurrent unbidden memories or images, puzzling thoughts about whereabouts); (3) behavioural reactions (searching behaviour, decreased orientation or exploration, reduced motivation) and (4) physical reactions (fatigue, reduced appetite, nausea). The section that follows explores these and some additional areas: the prevalence of psychopathology amongst family members; the enduring nature of these impacts; personal emotional problems; relational problems; physical (somatic) problems; the influence of rationalisation on emotions and the impacts on children.

9.3.3.1 The Prevalence of Psychopathology

De Keijser and Boelen (2015) have observed, in a study of family members of missing people, that 'emotional problems are the rule not the exception and, thus, not indicative of "abnormality"' (De Keijser & Boelen, 2015, slide 21). In a systematic review of the literature about the experiences of family members, the same research team found evidence of depression in between 48 and 68% of relatives, PTSD in

39–67%, serious anxiety complaints in 40% and severe somatic complaints in 51% (Lenferink, 2015). The team's Netherlands-based study similarly found depression in more than 50% of their sample, Persistent Complex Bereavement Disorder in more than 30% and PTSD in more than 10% (De Keijser & Boelen, 2015).

9.3.3.2 Problems Endure Until Resolution

As noted earlier in this chapter, the nature of ambiguous loss is that it endures; without evidence of death, family members may experience feelings and symptoms of this loss indefinitely. The pain that accompanies ambiguous loss can affect family members long after a disappearance. One family member who was interviewed for Holmes (2008) had been missing a sibling for more than 30 years, and said: 'there are moments where the pain is just as bad as it was at the beginning. [...] over time, and it's taken a very long time, the episodes have become further and further apart. [...] But when it does come, it's bad.' (Sibling of a missing adult, interviewed for Holmes, 2008). Another stated that 'it's a long time ago but it's yesterday in your mind' (Sibling of a missing adult, interviewed for Holmes, 2008). A large-scale study of the Geographies of Missing People in the UK similarly found that the emotions felt by family members did not necessarily diminish over time (Parr & Stevenson, 2013).

The fact that the loss experience endures through time affects people not just retrospectively (they can look back and see how long they have been grieving) but also prospectively (they can look forward and see many more potential years of the experience): 'it could be that you never find out, and that's the worst, knowing that 20 years down the line I still might not know whatever happened to her' (Daughter of a missing woman) (Holmes, 2008, p. 26). This is echoed in a best practice guide for counsellors produced in Australia, 'It's the Hope that Hurts': 'families and friends of missing persons speak of the pain of not knowing and the mental torture of perhaps never knowing' (Hunter Institute of Mental Health, 2001, p. 18).

Hogben (2006) explored the nature of time, 'private calendars' and missing incidents, concluding that a missing incident throws family members into suspended animation or stasis. Hogben (2006) goes on to suggest that family members who are left behind exist, on some level, in a permanent present; unable to move on, and struggling to create new private calendar events which are marked without the presence of the missing person. An interviewee for Holmes (2008) acknowledged this sense of time having stopped: 'of course she'd look nothing like that now anyway so, it's strange. We're frozen in time at that time' (Sibling of a missing adult, interviewed for Holmes, 2008). An example Hogben uses is a newspaper interview with the family of missing teenager Amanda 'Milly' Dowler in the south east of England, in which Milly's father describes the difficult decision the family face when signing Christmas or birthday cards; how to sign it truthfully without erasing their daughter from the family (Hogben, 2006).

As well as causing dilemmas such as the one described here, key public and private calendar events can trigger repeat waves of sadness and grief; each Christmas, birthday or anniversary that passes without the missing person is a heightened reminder of his or her absence. Paul Jones reflected on this in his account of the abduction of his young daughter, April: 'I suddenly remembered what day it was—22 October, my 44th birthday. Without April, the day was meaningless. Even now, I'm not convinced I'll ever feel like celebrating my birthday again' (Jones & Jones, 2015, p. 73). Key dates connected to the missing person, such as his or her birthday of the anniversary of the disappearance, may also trigger renewed activity; an anniversary appeal or memorial event, which can in turn lead to renewed search activity and effort (Holmes, 2008).

9.3.4 Personal Emotional Problems

Family members who have contributed to research have been able to identify many personal, emotional impacts which may be more or

less intense at any time. The loss of the person is the overriding emotion; devastating sadness and anxiety. This is closely related to the fact that a person going missing is experienced as a trauma, as discussed earlier. The lack of resolution, as time passes, marks this loss and grief as different to bereavement or other uncomplicated losses.

Other emotions are often experienced alongside the despair and sadness, which may be more complex and, perhaps, less socially desirable and therefore less easy to admit (Holmes, 2008). Shame and embarrassment, at the reflection the incident throws onto the family and the missing person's relationships, can be personally damaging as well as socially isolating (Holmes, 2008). Anger is a similarly challenging, albeit natural, response. This anger might be directed at oneself (and is closely related to feelings of guilt), or towards the missing person (whether or not they are believed to have left deliberately), at search agencies such as the police, at suspected perpetrators of crime against the missing person, at people who may have hidden them or withheld information, or more generally at the situation. One interviewee for Holmes (2008) said: 'one day you might be really upset, the next day you're really angry at him because you don't know' (Sibling of a missing adult, interviewed for Holmes, 2008).

For those with a religious faith, anger may be turned towards his or her god and may have an impact on their belief or commitment to their faith. For others, however, faith can be an important source of comfort during a missing incident. A parent of a missing adult, interviewed for Holmes (2008) identified both occurring in the family: 'I pray more now than I ever did in my life. [...] I do find strength in my prayer. [...] But I think it can go in the opposite way. [My husband is] no great believer anyway but, anything that happens and this especially he says "but surely if there's a god he wouldn't let this happen. I mean if there's a god, what's he doing?"' (Parent of a missing adult interviewed for Holmes, 2008).

Guilt, along with its partners blame and shame, is another challenging emotion for some family members. Holmes (2008) identified four

main drivers for guilt over a missing incident: guilt at failing to prevent the disappearance; guilt at having potentially caused the person to leave; guilt at not having discovered the disappearance fast enough and; guilt for not doing enough to search. In terms of coping with a missing incident, two further guilt triggers emerge from the literature. First is guilt for not coping 'properly', for not responding in the way that people might expect, or for having socially undesirable emotions like anger towards the missing person. Second is guilt at taking pleasure in any personal pursuit. Kate McCann talks about this in her first-hand account of her daughter Madeleine's disappearance: 'It was a long time before I was able to allow myself to take any real pleasure in anything. [...] It was over 2 years before I could bring myself to play music again. [...] I was gradually, very gradually, able to allow myself some pleasure and relaxation in general. Whether this was just a matter of time I don't know: it certainly took well over a year' (McCann, 2011, pp. 351–353). Paul Jones (Jones and Jones, 2015) echoed this sense of guilt at relaxing: 'One day I went to visit some friends in Aberystwyth for coffee, and I actually found myself laughing [...] I knew I needed these days in order to feel sane, but it didn't make me feel any better about enjoying them' (Jones & Jones, 2015, p. 127).

Worry and hope are two related emotions that family members recount. Hope can relate to the hope that the outcome will be a positive one for the missing person, hope for a resolution to be found (no matter what the outcome is), hope for the family members left behind to survive or cope and hope, more generally, for the future. Heeke, Stammel, and Knaevelsrud (2015) found, however, that the extent of hope felt by family members of missing people predicted prolonged grief disorder. Wayland (2015) has conducted a study of the nature of hope in the context of missing, or ambiguous, loss. The study found that family members of missing people described hope in the context of recovery from trauma, and that there are two approaches to hope: hope for the missing person and hope for the self, and that hope can be a source of pain (Wayland, 2015). What is hoped for may change over time (Clark et al., 2009), but hope can

help family members to avoid or delay shock and, even temporarily, stop dwelling on potential outcomes (Jones, Zagacki, & Lewis, 2007).

Worry is linked to hope because it is similarly focused on the future and on imagined possibilities. When it concerns a missing person, a family member's worry may be focused on what is happening to the missing person, on what is happening or may happen to family members left behind (including him or herself) and on the possibility of never achieving any resolution—of never finding out the truth of what happened. Holmes (2008) identified that many family members spoke of living on an emotional rollercoaster, where worry and hopefulness came and went, sometimes influenced by external factors.

Guilt may be a driver for another feeling which is mentioned by family members in research; having a sense of duty to search, a duty to keep encouraging others to search, and a duty to do right by the missing person by protecting his or her reputation and the life to which they may return. A family member who was interviewed for Holmes (2008) described feeling an ongoing sense of guilt for not undertaking more personal, physical searching—for not being out on the streets, visiting soup kitchens and homeless shelters or churches. Others spoke of the comfort that ongoing activity brings, the sense of satisfaction associated with ensuring that everything possible has been tried. This dutiful drive can cause people who might find contact with journalists stressful and challenging to agree to be interviewed, for the sake of publicising the appeal (Holmes, 2008). Some family members also have a keen sense of wanting to uphold the missing person's character, to avoid them being stereotyped (for fear of this negatively influencing the search, or of them being stigmatised on their return) and to 'bear witness' to their character and relationship (Holmes, 2008; Parr & Stevenson, 2013).

9.3.5 Relational Problems

The experience of one family member going missing can have a significant impact on the relationships between remaining family members

(Clark et al., 2009). For some, the shared grief and pain can bring family members closer together, while for others the loss can lead family members to become more distant (Holmes, 2008). Where family members disagree about what they believe caused the disappearance, or hold opposing beliefs about the outcome, this can lead people to stop speaking to one another and become increasingly isolated (Holmes, 2008). Relationships may also be affected by family member's guilt at partaking in pleasurable activities together. Couple relationships may particularly suffer if partners feel guilt at enjoying sexual relations, or feel unable to maintain an intimate relationship whilst their family member is missing. Friendships, too, may suffer if the person with a missing family member feels unable to take part in social activities, leading to increased isolation. Family members may also find themselves withdrawing from social networks, perhaps because they are reluctant to talk about their experience or to keep retelling the story.

The issue of changed family relationships can also be affected by culturally specific factors, such as women's dependence on male family members for support, status and respectability. Robins (2010) found, in Nepal, that wives of disappeared men were at risk of stigmatisation, constraints on their movement, resentment from their husband's family and economic hardship.

9.3.6 Physical (Somatic) Problems

As well as experiencing emotional and social impacts, family members may find that physical problems or illnesses are caused or exacerbated by a missing incident. Missing People's Family Feedback Survey of service users has consistently found that more than a third of respondents reported experiencing a physical health problem as a result of having a missing family member (Missing People, 2013). Examples of physical effects reported in the literature include sleeplessness or sleep disruption, putting on or losing weight, hair thinning, tiredness, new illnesses, decreased ability to manage existing conditions, and problems with pregnancy (Holmes, 2008; De Keijser & Boelen, 2015; Missing People, 2013;

Parr & Stevenson, 2013). Physical complaints may be linked closely with emotional experiences, as explained by a family member interviewed for Holmes (2008): ‘I wasn’t sleeping because of the pain, I’d be up, and then because I’m up, I’m thinking, and because I’m thinking I’m getting depressed, so it was like a vicious circle all the way’ (Adult child of a missing adult, interviewed for Holmes, 2008).

Family members who have shared their accounts of their experiences also describe the ways in which they have coped, physically, with the disappearance. For example, some describe only being able to sleep through the use of medication (Jones & Jones, 2015) while others describe their fear of using medication in case it fogs their mind (McCann, 2011). Physical coping strategies, such as intense exercise, the use of substances such as alcohol or tobacco, and disrupted eating are also found in the literature (Holmes, 2008; McCann, 2011; Parr & Stevenson, 2013; Jones & Jones, 2015).

9.3.7 Influence of Perceptions on Emotions

The way in which family members rationalise and understand a disappearance can also influence the way they feel and behave. This may relate to what they believe caused the disappearance and, in particular, whether they feel the missing person left of their own volition. Intentionality, with regard to missing persons, is a problematic concept (as intentionality cannot be ascribed with any certainty in absentia), but family members can hold strong feelings about it (Holmes, 2008). Certainty of belief about intent can relate to family members’ beliefs about the strength or nature of the missing person’s relationships—would they have chosen to leave without saying goodbye? Would they allow family birthdays to pass without sending a message? Could they possibly have chosen to cut off contact?

Certainty of belief about intentionality means, however, that family members must apply this belief to their assumption about the potential out-

comes for the missing person. By believing that a missing person would not have chosen to leave and, thus, attesting to the strength of family relationships, a family member must, logically, believe that something or someone has prevented the missing person from being in contact. This logical conclusion, and its converse, is illustrated in Fig. 9.1. Belief about outcome (and specifically whether the person is still alive) can change over time, as described by a family member research participant: ‘she says “I think well, if there had been a body maybe it would’ve turned up by now. But if it hasn’t turned up, then maybe, you know, he’s still there”’ (Parent of a missing adult, interviewed for Holmes, 2008).

The conflict inherent in the combination of hope that the missing person will return safe and well, and belief that they would not have chosen to leave (or the converse, the expectation that they will return along with the belief that they chose to leave), may be a source of pain for family members left behind. This may, in turn, trigger or suppress certain behaviours, such as notifying others or undertaking search activities. The way family members rationalise it may change over time, and may be affected by external factors, such as police investigations or media reports. Different family members may also disagree about the most likely explanations and outcomes, which can be a cause of tension in relationships, as outlined earlier.

9.3.8 Experiences of Children

To date, most of the research literature about the experience of family members when someone is missing has focused on the experiences of adults. Increasingly, however, research (including Mannarino & Cohen, 2011; Guidry, Simpson, Test, & Bloomfield, 2013; Davies, 2015) has begun to explore the ways in which ambiguous or traumatic loss affects children who have a missing family member, and first-hand accounts (McCann, 2011; Jones & Jones, 2015) consider the impacts on young siblings of abducted children. Advice for siblings of abducted children, jointly produced by people whose own siblings

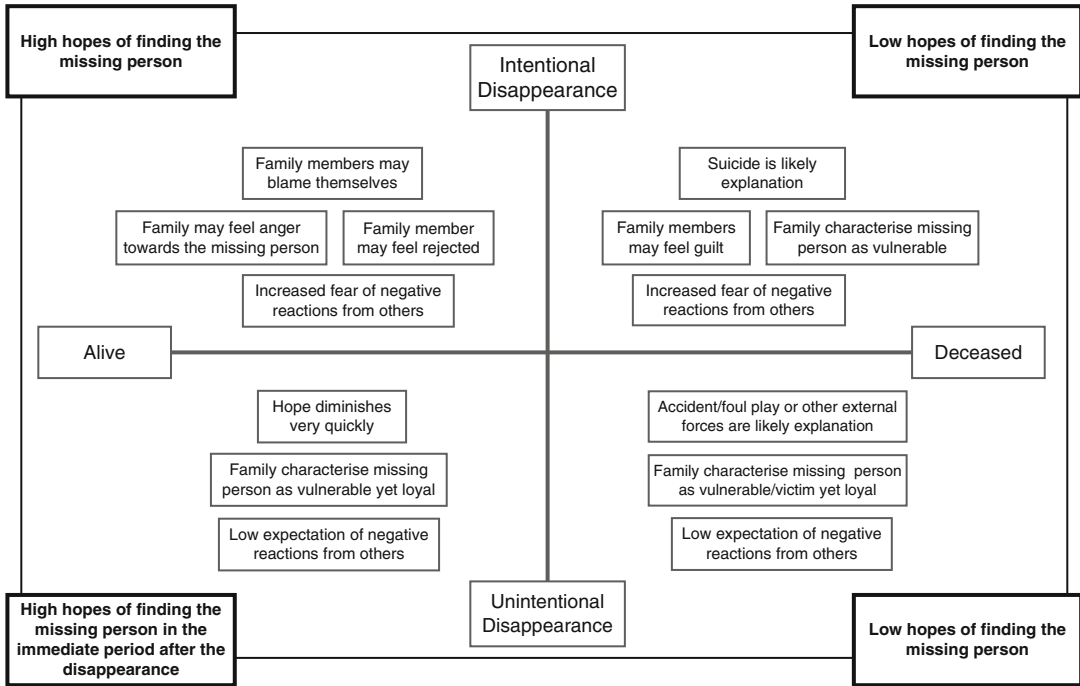


Fig. 9.1 The effect of family members’ perceptions of the disappearance on their emotional reaction to the experience (Copyright: Holmes, 2008, p. 30)

were abducted, addresses some of the potential feelings siblings might experience, such as feeling scared, confused, worried, angry, guilty, numb, helpless or out of control (US Department of Justice, 2007). Work with children experiencing ambiguous loss has also found that when children are not informed about a situation, ‘magical thinking’ can take over, leading to children believing they are in some way to blame (Guidry et al., 2013).

The severity of the impacts on young family members of missing people should not be underestimated. Mannarino and Cohen (2011) observe that children who have experienced trauma during childhood are at significantly increased risk of many of the identified causes of early death in adulthood. Missing People has found that many of the family members supported by the charity have children under 18 years of age living in their household (Missing People, 2014a), and research has found that knowing what to tell children in the family can be a source of stress for adult family members (Holmes, 2008). One interviewee

for Holmes (2008) described the choice not to tell their children too much about their relative’s disappearance: ‘I just felt that to use words like lost or missing or disappeared, they would be very upset, and would continue to be upset on a pretty regular basis, for a very long time because there’s nothing I could say to reassure them, and there’s no conclusion to it. [If] they say to me “where is he?” I say “I don’t know where he is at the moment” but try and always use a tone of voice as if he’s just gone travelling for a while and then play it down.’ (Sibling of a missing adult, interviewed for Holmes, 2008).

The combination of traumatic stress and loss characterise Childhood Traumatic Grief (CTG), described as ‘a condition in which children whose loved ones die under traumatic circumstances develop trauma symptoms that impinge on the children’s ability to progress through typical grief processes’ (Mannarino & Cohen, 2011, p. 24). Children are more likely than adults to show symptoms intermittently, which is typical of childhood affective states generally

(Mannarino & Cohen, 2011). CTG symptoms include those PTSD symptoms also seen in uncomplicated grief, such as trouble sleeping, loss of interest in social activities and trouble concentrating, and those not normally seen in uncomplicated grief, such as intrusive thoughts/re-experiencing, avoidance of reminders, hyperarousal or hypervigilance (Mannarino & Cohen, 2011). Reminders come in three categories: trauma reminders which remind the child of the traumatic experience; loss reminders are things that remind the child of the lost person and change reminders are things that remind the child of the changes that have resulted in his or her life (Mannarino & Cohen, 2011).

9.4 Emotional Support

When service providers plan support programmes for family members of missing people, two complicating factors arise. First, family members do not all react in the same way to a missing incident. Second, family member's emotional response and support needs can vary over time, and be influenced by issues separate from the missing incident or the search for the missing person. This means that family members may need access to support at unpredictable intervals, for long and short periods, and for an indefinite time after the disappearance of their family member.

Research into emotional resilience provides a useful backdrop for understanding how family members of missing people may be supported. Kimhi and Eshel (2015) observe that research into resilience has moved from focusing on pathogenic responses to adversity (those responses which cause psychological disorder) to focusing on capacity for successful adaptation. Resilience has been defined in many ways, including developing successful adaptation to circumstances, personal qualities that allow this adaptation, and protective factors that affect a person's response to their situation (Kimhi & Eshel, 2015). Kimhi and Eshel argue that resilience is 'neither a trait nor an outcome, and not even a process [but] a state of mind that enables

people to readjust and continue their lives despite traumas and adversities' (Kimhi & Eshel, 2015, p. 181).

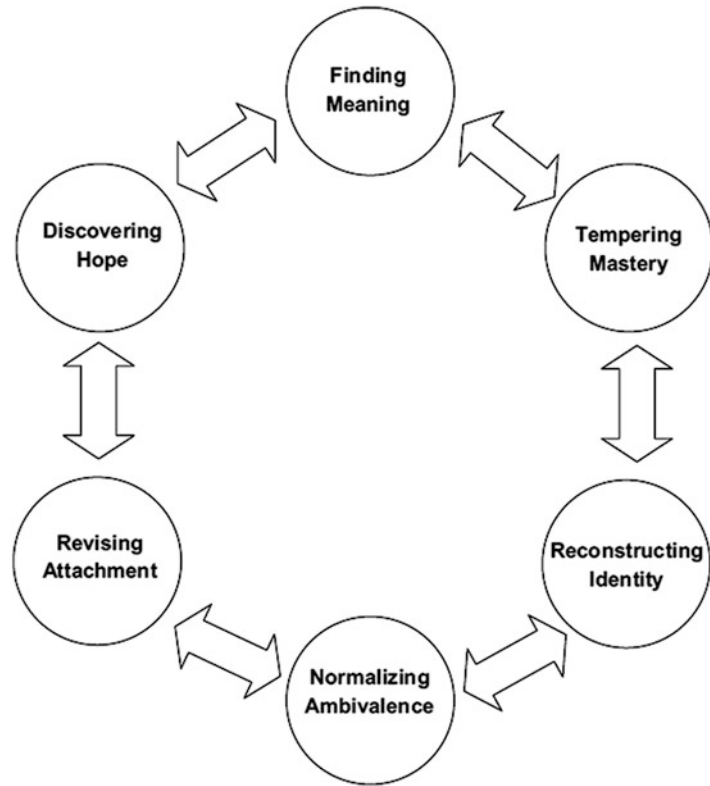
As described earlier, ambiguous loss gives us the most comprehensive framework for understanding the nature of missing loss and for understanding what can best help. Over many years Pauline Boss (2006, 2010) has developed this framework, including the six guidelines shown in Fig. 9.2, for developing and supporting resilience in family members left behind when someone is missing.

It is not the aim of this chapter to provide guidance to counsellors for using these guidelines—the purpose for which they have been developed. However, in summary, the framework suggests helping family members: to understand what the situation means for them and to reinforce positive meanings; to balance feelings of helplessness with 'internal self-mastery'; to reconstruct new identities and redefine relationships; to understand that ambiguity causes ambivalence; to both let go and still remember; and to discover hope and redefine justice (Boss & Yeats, 2014, pp. 67–68).

Counsellors and therapists have tested and approved the use of the ambiguous loss framework for therapeutic practice in a variety of contexts. Robins (2010) concluded that the concept was applicable to family members of people who were disappeared during the conflict in Nepal in the late 1990s and early 2000s. Boss et al. (2003) similarly found the approach to be highly suited to supporting people who had lost family members in the 9/11 attacks on the World Trade Center. Importantly, Boss (2002) found that one of the things that was helpful to family members was having the 'ambiguous loss' label attached to what they were feeling.

This is not the only available framework for supporting therapeutic work with family members of missing people. The Australian Federal Police National Missing Persons Coordination Centre has published a counselling framework (Wayland, 2007) which suggests five themes for working with affected family members: reanimation (helping family members to move forward); a celebration so far (perhaps incorporating

Fig. 9.2 Six guidelines for resilience with ambiguous loss (Copyright: Boss (2006), later reproduced in Boss and Yeats (2014, p. 67))



memorialising and ritual); the trauma timeline (creating a timeline of emotions); a protected place (allowing family members to explore challenging emotions) and opportunities for growth (allowing for change and movement alongside the ambiguity). There are few places, worldwide, where specialist counsellors are available to families of missing people (as at Missing People in the UK, and the FFMPU in Australia), but practice guidelines should allow generalist counsellors to provide appropriate support.

Creating space for memorial and ritual following a disappearance has been explored by a number of researchers, and regularly arises amongst family members and service providers. UK charity Missing People has, for example, planted a tree of remembrance in a park in south west London; written messages of love from family members of missing people were planted along with the tree's roots. At the time of writing, plans are in place for a candlelit vigil for a missing person, Damien Nettles, on the Isle of Wight, timed

to coincide with the 19th anniversary of his disappearance. Beder (2002), Edkins (2011), Gregor (2003) and Jones et al. (2007) all point to examples where spontaneous memorials have been created for missing people. Some, such as those that sprang up in New York after the 9/11 attacks on the World Trade Center, and the protest posters of the Mothers of the Plaza de Mayo in Argentina, arose with different intentions but provided a space for remembering as well as publicising or protesting disappearances (Edkins, 2011; Foss & Domenici, 2001). The full impact—the usefulness or otherwise—of such memorials to missing people have not been fully explored, but appear to provide a sense of community involvement and cohesion, particularly following large scale disasters.

There is also a role for peer support; for family members to come together to help one another to cope and to feel less isolated in the experience. The UK charity Missing People has found that bringing family members together has proven to

be popular, and feedback suggests that family members feel reassured that they are not alone, and benefit from spending time with people who have shared the experience. Spending time with other family members can, however, be somewhat challenging. A parent of a missing adult, interviewed by the Geographies of Missing People research team, said that: ‘it can be quite harrowing listening to other people missing people. You think “god, I don’t know if I can do that, cope with it all”’ (Parent of a missing adult, interviewed for Parr & Stevenson, 2013).

As described earlier, the particular experiences of children with a missing family member have not been fully explored and, similarly, their specific support needs are not fully met and, in many places, there are no tailored support services for children in this situation. Not knowing how to support children in a family with a missing person is a source of concern for the adults in the family. In Australia, the FFMPU has begun to provide support groups and individual counselling for young people affected by the disappearance of a family member (Davies, 2015). The FFMPU seeks to dispel the myths that young people are unable to understand, or are naturally resilient enough without support, or that they will not notice that anything is amiss; instead the unit emphasises that excluding young people from the experience risks damaging their trust and cause more harm (Davies, 2015). (FFMPU, 2013). Guidry et al. (2013) suggest that potential interventions for supporting young people with ambiguous loss might include play therapy, support groups, expressive arts, grief camps, narrative therapy, psycho-education and mentoring. Mannarino and Cohen (2011) suggest that interventions for helping with Childhood Traumatic Grief might be adapted: Traumatic grief Cognitive Behavioral Therapy; UCLA Trauma/Grief Program for Adolescents; Group and trauma intervention for elementary-aged children; and child-parent psychotherapy (CPP).

Work with siblings of abducted children has found, in particular, that those children were profoundly affected by their sibling’s disappearance and experienced losing trust in the adults around them (particularly their parents and the police)

and dysfunctional coping (such as substance use, problems at school, unemployment and anxiety) (Greif & Bowers, 2007). This study recommended that work to support children affected by missing should focus on rebuilding trust, helping with parents’ reactions, work on communication, support with future parenting, help to find meaning, giving permission to move on with life, and healthy coping (Greif & Bowers, 2007).

9.4.1 Support Services Worldwide

It is outwith the scope of this chapter to provide a comprehensive list of support services for family members of missing people around the world, but some key examples are offered. The International Committee of the Red Cross, as well as local Red Cross and Red Crescent societies, can help to reunite family members who have been separated by conflict, political disturbance, migration or disaster. In this relatively small field of professionalism in Europe, there is also a thriving network of national service providers connected by membership organisation Missing Children Europe. Although many members are focussed on instances of missing children, many provide support to family members during a missing incident. Examples of providers across Europe who can support families are Fundacion ANAR in Spain, Nadja Centre Foundation in Bulgaria, APEV and La Mouette in France, Smile of the Child in Greece, Focus—the Romanian Centre for Missing and Sexually Exploited Children, Poland ITAKA Centrum Poszukiwan Ludzi Zaginionych (which supports 1500 families of missing children and adults annually), and Missing in Ireland Support Services in Ireland.

In the UK, national charity Missing People has developed a significant programme of support services for family members of missing children and adults including telephone counselling, an online peer support forum, family events and a 24-h emotional support helpline. Trauma psychologist Alan Pike of CCP, who supported Kate and Gerry McCann following the abduction of their 3-year-old daughter Madeleine, said of the charity: ‘the opportunities now available to

families of missing people to acquire first class psychological support is a testament to the dedication of the organisation, and an example of exactly how a charity sets out to meet the complex needs of those it seeks to help' (Steyne et al., 2013, p. 9). Alongside Missing People, the Salvation Army (which operates worldwide including in the UK) is able to provide Family Tracing support for family members who have lost contact with one another.

Another notable support organisation is Australian Friends and Families of Missing Persons Unit (FFMPU). The unit, based in New South Wales, has developed a range of services over many years, including support groups and bespoke counselling (Morrell, 2011; Wayland, 2007; Jacques, 2002). The FFMPU has recently started providing support specifically designed to help children affected by missing (Davies, 2015). Elsewhere, America's Team HOPE is able to support some family members of missing children, and Canada's Canadian Centre for Information on Missing Adults is able to provide bilingual support throughout Canada to family members of missing adults or children.

9.4.2 Measuring Impact

A number of studies have explored the impact and usefulness of support services for family members of missing people (Davies, 2015; Parr & Stevenson, 2013; Mannarino & Cohen, 2011; Keough & Samuels, 2004; Boss et al., 2003, *inter alia*). In the UK the charity Missing People has, for many years, conducted evaluations of interventions, including a regular Family Feedback Survey (Missing People, 2010, 2011, 2012b, 2013, 2014a) and use of a clinical (CORE-10) measure of well-being for recipients of one-to-one counselling (Steyne et al., 2013).

Ongoing work in the Netherlands is exploring the impact of psychological interventions with family members of missing people (De Keijser & Boelen, 2015), using a randomised control trial (waiting list controlled) design to measure the effectiveness of an approach that uses Cognitive Behavioural Therapy (CBT) and Mindfulness.

The project is currently being piloted in the Netherlands and will shortly roll out into Flemish-speaking areas of Belgium. The 8-week treatment course includes psycho-education (storytelling and social support), rationale of cognitive restructuring, Cognitive Therapy and Mindfulness, and lessons learned. It is being delivered by a network of trained therapists (De Keijser & Boelen, 2015).

UK charity Missing People has recently developed an indicator to help assess the impact of the charity's support services on the well-being of service users. The charity's Wellbeing Indicator is informed by the Office for National Statistics (Tinker & Hicks, 2013) and New Economics Foundation National Account of Wellbeing (NEF, 2009) approaches to categorising and identifying well-being. The resulting indicator aims to provide a framework for understanding how the various ways in which different services (such as producing and circulating publicity appeals) impact on different aspects of a service user's well-being. The indicator uses two categories of well-being (personal and social) and two dimensions of positive functioning (feelings and functioning). By mapping service users' experience of support against the indicator the charity is able to better understand, and to communicate, the effect of services on well-being. The Missing People well-being indicator and data collection activities alongside it show that practical support can have an important impact on well-being, just as emotional support services can (Fig. 9.3).

9.4.3 Practical Challenges

As well as the huge range of emotional and social impacts experienced by family members of missing people, some family members also find themselves facing significant practical, legal, financial or political issues, on top of any search activities they are undertaking. These challenges can have a profound impact on family members' emotional well-being and resilience, as explored previously. Family members' contact with agencies such as the police or the media can affect and be affected by families' emotional responses. These are briefly explored in the following section.

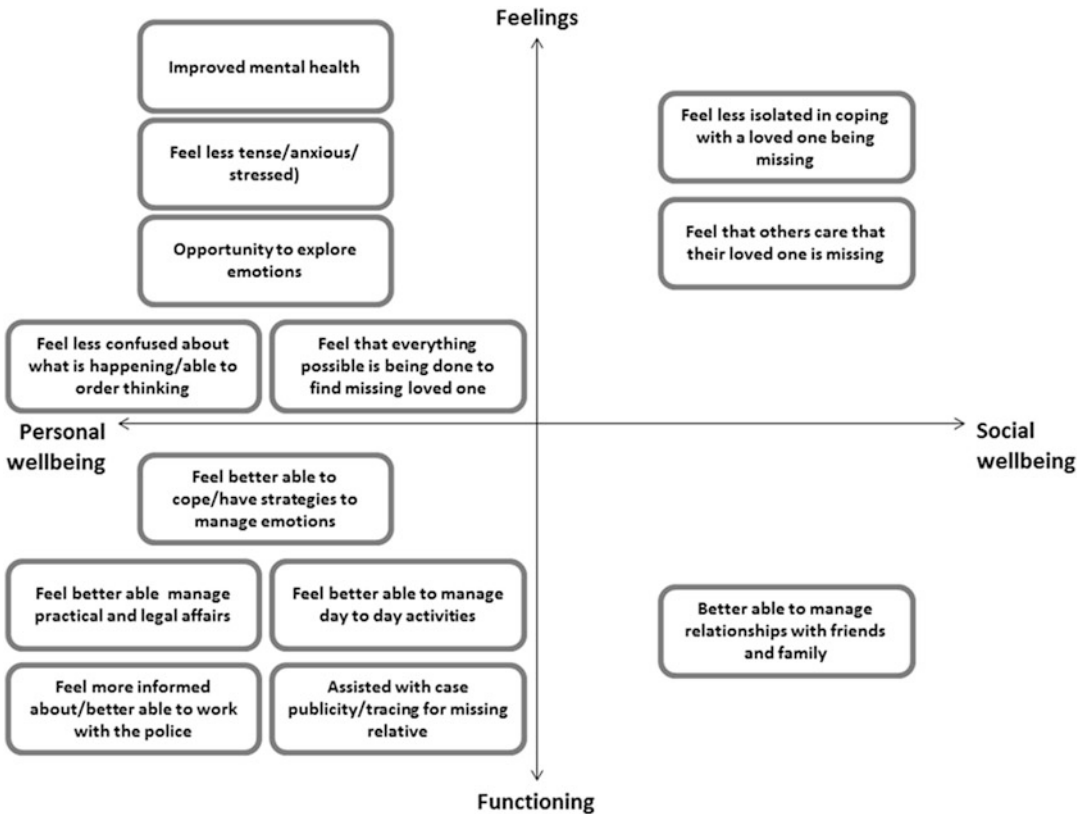


Fig. 9.3 Missing People well-being indicator (Developed by Dickson for Missing People, 2015)

Family members of missing people feel a strong need to do everything practicable to find their loved one (Holmes, 2008). This frequently means reporting the person missing to the police in order to trigger an investigation. However, the decision to make a missing person report is a difficult one; family members may worry about wasting police time, getting the missing person in trouble, making the missing person angry, or fear that the police will not take them seriously (Holmes, 2008; Parr & Stevenson, 2013). Making a missing person report is also an admission that the situation is serious, and that the missing person may not simply return of their own accord (Holmes, 2008). Family members making a missing person report have to weigh up their own need to know that the person is safe against the possibility that the missing person has chosen to leave (Parr & Stevenson, 2013).

Once a police report is made, family members' experience of the police response can have a significant and long-lasting impact on their well-being (Holmes, 2008; Clark, 2012; Parr & Stevenson, 2013). Literature on the subject shows that family members' experiences with police vary a great deal, and that family members' faith in the police is affected by the perceived quality of the response, and the way in which police officers behave (Holmes, 2008; Clark, 2012; Parr & Stevenson, 2013). Parr and Stevenson (2013) explored the issue with a number of family members and found that, in particular, family members find it distressing to be treating as a potential suspect, and that it is extremely worrying if the police appear not to take the disappearance seriously. Holmes (2008) found that family members' satisfaction with the police response was driven by four key areas: (1) being taken seriously,

(2) not feeling that the missing person was being negatively stereotyped, (3) individuals' officers' manner and (4) being kept up to date with enquiries. Parr and Stevenson (2013) similarly suggested that a good police response means showing empathy and communicating effectively, echoing Clark (2012) who found that family members felt comforted by knowing (or perceiving) that the police investigation had been systematic and thorough. Clark (2012) also identified that family members who do not have confidence in the police investigation can also feel worried about expressing their concerns, for fear of alienating the police team.

Family members' satisfaction and confidence in the police investigation is important for three main reasons. First, confidence in the police investigation removes the need for family members to undertake so much search activity themselves, reducing the risk they face and the costs they incur (Holmes, 2008; Parr & Stevenson, 2013). Second, good relationships with police foster honesty and cooperation with the investigation (Holmes, 2008). Third, knowing that the police are doing everything possible has a positive impact on family members' well-being (Holmes, 2008; Parr & Stevenson, 2013).

The police are often not the only outside professionals in contact with family members; many missing person cases have attracted at least a small amount of media coverage, with some garnering significant attention. In their first-hand accounts of having a child abducted, both Kate McCann (2011) and Paul and Coral Jones (2015) write about how challenging it is to live with intrusive media attention. Even when a missing person investigation has a lower media profile, family members may feel duty-bound to publicise the appeal, and to work with journalists to attract attention to the case. This can be challenging, as described by an interviewee for Holmes (2008), who found that journalists try to create a story angle that can feel at odds to the truth of the missing person's life or character: 'when you then get TV programmes and, to an extent, interviews, and they're delving and they're trying to create a human interest story which means that he's got to be portrayed in a light that makes peo-

ple feel sorry, interested, and want to help find' (Sibling of a missing adult, interviewed for Holmes, 2008). Another spoke of how personally difficult it can be to take part in media interviews: 'I'm a very private person, so that for me I have to then sort of have the courage and strength to do it because I know at the end of the day I've only got me to rely on and go home to. So I'm mindful of my own well-being in that process. I've had a few bad experiences already with the very limited media work that I've done' (Adult child of a missing adult, interviewed for Holmes, 2008). There is some, limited advice for family members about undertaking media work from support agencies such as Missing People in the UK and FFMPU in Australia.

The impact of missing person appeals, in the broadest sense, is addressed in Chap. 3. As well as these impacts, family members may also face other consequences of their own search activity. Holmes (2008) found that some family members were spending considerable amounts of their own money funding search activities (including national and international travel), as well as finding their own incomes diminished as a result of disrupted work (or loss of jobs), and the loss of the missing person's income.

Not all missing people leave behind jobs, bank accounts, insurance policies, pensions, social security benefits, property, offspring or spouses. When they do, however, the practical and legal ramifications can be significant. Holmes (2008) discovered examples of family members being left in dire financial straits when the missing person was a main or joint income generator or property owner. The legal situation in the UK at the time of that study was inconsistent, as people living in Scotland and Northern Ireland had access to tailored Presumption of Death legislation not available to people living in England and Wales. The situation nationwide is now improved since the passing of the Presumption of Death Act 2012–2013 in England and Wales, following a campaign by the charity Missing People. A campaign is ongoing, at the time of writing, calling for the introduction of Guardianship legislation in the UK to that in place in some Australian and some Canadian states (Missing People, 2014b).

9.4.4 Areas for Further Research and Understanding

Over the last 20 years there has been a welcome increase in the amount of research into the experiences of family members of missing people. There are, however, a number of gaps in this research. There is still relatively little knowledge about the specific impacts on children when a family member is missing, and into the most appropriate ways for both professionals and family carers to support them through the experience. Further research might also usefully explore how family members' perceptions of a disappearance influence their ability to cope and live life positively. The role, effect and usefulness of memorials to missing people might be explored. Services that provide support to family members should be encouraged to produce high quality evidence of the impact of their services on the people they seek to serve. Finally, research must also explore what happens when a missing person returns; the impact on the returning individual, their family members and the best ways of responding and supporting them.

9.5 Discussion and Conclusions

When someone goes missing, whether they are a much loved child, a vulnerable adult with dementia, an adult living with mental illness, or a teenager who has run away from home, the people left behind can be severely and permanently affected. Missing loss is uniquely painful; those who experience loss without resolution are left unable to complete their grieving, and may be left facing chronic and unending trauma. The experience may be compounded by the need to deal with the police and possibly journalists, and by the practical, legal and financial ramifications of the missing person's absence. By understanding the nature of ambiguous loss, and the ways it affects the family members of missing people, we can work to embed appropriate support structures and services. In the 23 years since the UK charity Missing People was founded, there has been sustained and significant improvement to

the knowledge in this field, and to the support available for all family members of missing people. While there is work still to do, both in the UK and across the world, the situation is undoubtedly brighter now than ever before, and there is a large community of people who walk alongside those people who miss, and those who are missed.

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Geographies of Missing People: Improving Police Knowledge and Response to Missing Persons

10

Olivia Stevenson and Penny Woolnough

10.1 Introduction

In 1998, Lawrence Sherman advocated an ‘evidence-based’ approach to policing, arguing that ‘police practices should be based on scientific evidence about what works best’ (Sherman, 1998, p. 2). Over the past decade, there has been an Anglo-American move towards evidence-based policing, and 2013 saw the launch of the United Kingdom’s ‘What Works Centre for Crime Reduction’, led by the College of Policing (<http://www.college.police.uk>). This is the first professional body entrusted by a national government with evaluating police practices on the basis of continuous review of research evidence. Directly related and growing in importance, are policing interventions (e.g. hot spot policing), and principles and strategies (e.g. neighbourhood policing) that have at their core, strategic and tactical decisions underpinned by robust evidence (see Lum, Telep, Koper, & Grieco, 2012 for a

review). Whilst substantial advances in policing have been made, a greater focus on crime has meant there remain significant gaps in our understanding of missing persons and, therefore, to what extent greater knowledge can or should inform policing practices. One key gap is research on missing adults (for exception, see Hirschel & Lab, 1988; Henderson & Henderson, 1998; Biehal, Mitchel, & Wade, 2003; Tarling & Burrows, 2004; Stevenson, Parr, Woolnough, & Fyfe, 2013). To date, knowledge centres on one of the original and largest studies to explore missing persons’ experience. Using case records held by the UK charity Missing People (then the National Missing Persons Helpline), a survey of 114 former missing people was carried out and results were used to construct a typology of missing experience. Drawing a clear distinction between intentional and unintentional absences, missing experience is understood on a continuum (Biehal et al., 2003). Importantly, this research suggested an adult’s intentions or motivations will affect how he/she travels, where he/she goes and what he/she does. For example, a person who intentionally removes themselves from a situation (e.g. a woman leaving home to avoid a situation of domestic abuse) is likely to engage in a very different journey and behaviour than someone who is unintentionally missing (e.g. an elderly male who becomes lost due to cognitive impairments associated with dementia). While this study and subsequent others have attempted to

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explore some of the issues that may be relevant to an understanding of the geographies of missing people, they only ‘skim the surface’, providing little in the way of in-depth understanding of this important area or direct guidance to support agency responses to missing persons. Against this background, this chapter aims to contribute to both the evidence-base around adult missing persons (a field where research is still in its infancy (but see Payne, 1995; Biehal et al., 2003; Parr & Fyfe, 2012; Parr & Stevenson, 2013a; Stevenson et al., 2013)) and the field of police knowledge.

10.2 Setting the Policing Context

The UK Association of Chief Police Officers (ACPO) provides a definition of ‘missing’ equating to ‘anyone whose whereabouts cannot be established’, and a definition of ‘absent’ as ‘a person not at a place where they are expected or required to be’ (ACPO, 2013, p. 5). In both the United States and the United Kingdom, the police are the principal agency charged with responding to reports of missing persons. Estimates suggest that each day 2,300 missing person police reports are filed in the USA (Krajicek, 2005) and 858 in the UK (SOCA, 2013). An approximate ratio of 1:140,000 US and 1:75,000 UK per head of population highlight that dealing with missing persons is a fundamental part of everyday policing. Yet, the complex web of behaviours that surround the phenomenon of missing persons can make it difficult to establish whether someone’s disappearance is ‘intentional’ or ‘unintentional’ or whether he/she might be at risk of harm from themselves or others. This presents unique and complex investigative challenges and with each case estimated to cost UK police a minimum of £1325–£2415 (Shalev Greene & Pakes, 2014) significant resourcing and financial implications of the police response to missing persons are clear. In recognition of the challenges in missing person investigations, a number of influential reports have assisted in shaping and standardising operational procedures across the UK (ACPO, 2010; Biehal et al., 2003; Hedges, 2002; Tarling

& Burrows, 2004). For example, in an effort to advance the scientific basis, Gibb and Woolnough (2007) developed the first normative spatial profiles to specifically aid police response in missing person investigations. They analysed closed UK police-recorded missing person cases by variables, such as age; sex; suicide attempts; previous missing episodes; and mental health conditions, to identify how these factors could be used to ‘predict’ the ‘outcome characteristics’ of the missing persons’ experience. For example, distance travelled, where the missing person will be located, and timescales in which he/she will be traced/found. Gibb and Woolnough (2007) developed geographical and temporal profiles associated with these predictions (Fig. 10.1). This work is used by police, and search and rescue agencies throughout the UK and overseas to help expedite the safe, efficient, and cost-effective location of missing persons (see also ACPO, 2006).

Like wilderness search and rescue data (e.g. Syrotuck, 1975), this work is based on the premise that missing people behave in similar ways depending on particular elements that make up their specific circumstances. Shalev Greene, Schaefer, and Morgan (2009) argue for the use of spatial analysis techniques to explore the behaviour of missing persons as an approach to help expedite safe return and thus reduce resource and financial implications of missing persons cases. However, while spatial approaches based on categorical knowledges have been applied and are well received by police, understanding the more ‘specific’ and ‘particular’ detail of lived missing experience that qualitative data produces (see Edkins, 2011; Stevenson et al., 2013, 2014; Stevenson and Woolnough 2014) has been missing from the evidence-base. There remains a significant lack of academic and practitioner knowledge based on missing experiences as articulated by missing adults and family members themselves (for exception see Parr & Fyfe, 2012; Parr & Stevenson, 2013a, b; Stevenson et al., 2013). In this chapter, we address this gap and elaborate the quantitative complexities of missing experience, through the use of recent research evidence to shed light on the geographies of missing adults and the search experiences

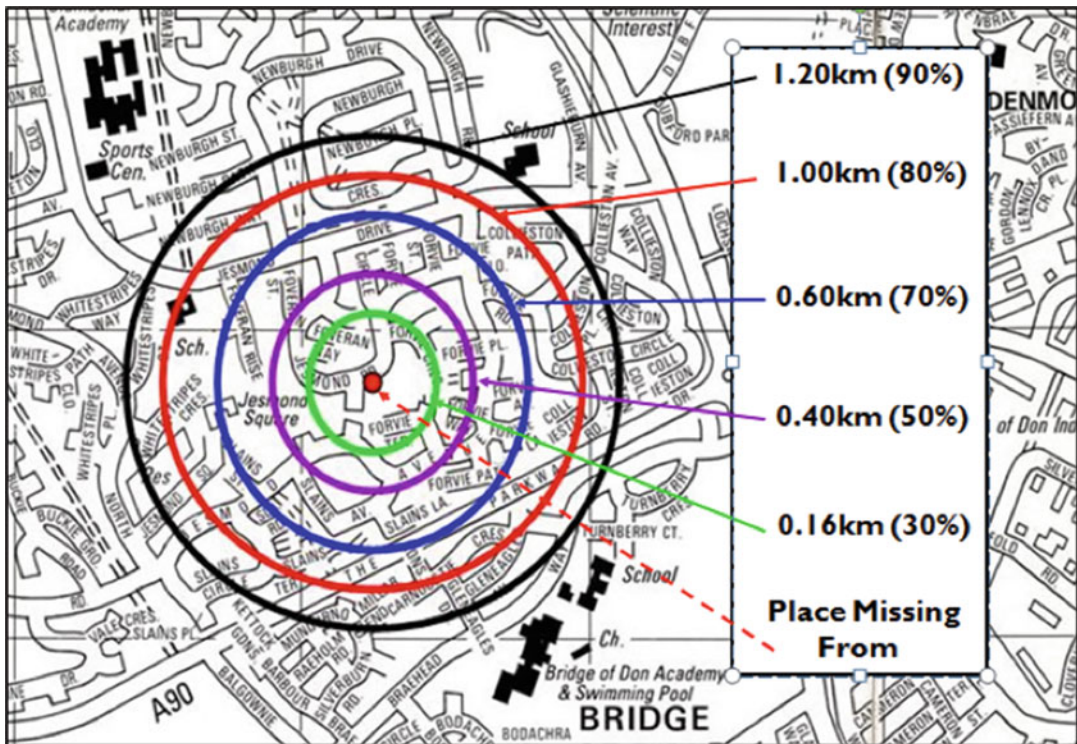


Fig. 10.1 Spatial profile (Reproduced from Gibb & Woolnough, 2007)

of families. In doing so, we provide new ways of understanding missing journeys from the inside, and across different adults' narrated experiences, offering useful insights for prevention and intervention and ultimately considerations for appropriate police training in this field.

10.3 Background to the Geographies of Missing People Project

Attempts to collect systematic police data on missing people within the UK are on the increase (see SOCA, 2013) and the development of spatial behaviour profiling (as described above) has helped UK police to improve their understanding and response to missing person investigations (Gibb & Woolnough, 2007). Yet, ambiguities remain within the existing evidence-base, and it would appear we are some way off from an established knowledge of 'what works' within this

particular area of policing. As Lum et al. (2012, p. 62) assert, in order to create translational tools for conveying evidence to police practitioners that can be used to alter 'police tactics, strategies, accountability systems and training', a first important step forward is to build an evidence-base and research infrastructure. If we are to take Lum et al.'s call as the foundation of good policing, in order for the police to respond with respect to missing situations, police knowledge needs to be underpinned by embodied evidence. Paying close attention to missing experiences, then, is a vital part of the evidence-base. For example, as we argue in this chapter, it aids our understanding of why people go missing, what missing people think about, and how they plan and decide what to do and where to go. In the same vein, being attentive to family knowledge and family search practices enhances the informational setting, which is important to police officers when formulating search parameters in missing investigations, for example.

As an attempt to address the paucity of evidence described above, the study *Geographies of Missing People: Processes, Experiences, Responses (2011–2014)*¹ was funded by the UK Economic and Social Research Council (ESRC-REF ES/H030166/1). With support of two UK police forces, this research is a deliberate attempt to explore the complex processes involved in being reported as missing via a focus on the voices of missing people themselves. There is a more established evidence-base on families of missing people (see Holmes, 2008; Steyne, Alves, Robinson, Towell, & Holmes, 2013; Wayland, 2007; Wayland, Myfanwy, McKay, & Glasscock, 2016), but there is a limited appreciation of family search practices and family–police interactions (but see Parr & Stevenson, 2013b; Parr, Stevenson, & Woolnough, 2016). Against this backdrop of limited empirical evidence, the rest of the chapter draws on findings from interviews with adults (18 years and over) reported as missing during 2009–2011 and families of missing people with different missing durations and where their missing person in 11 cases is still absent (at the time of the research). The next section briefly outlines the methods before moving on to present empirical findings from the study.

10.4 Methods

In total, 104 persons participated in the project as outlined in Table 10.1. Working via a case study approach, a range of data collection methods were undertaken during 2011–2012, including in-depth, semi-structured interviews, focus groups, mapping exercises, and officer case-file reconstructions. Our data collection focused on

¹The academic team for this project also included principle investigator, Professor Hester Parr, and co-investigator and director of the Scottish Institute for Policing Research, Professor Nicolas Fyfe. We thank Parr and Fyfe for their input into research design and delivery and specifically, Parr for work-up's of missing and family material delivered throughout the project and Fyfe, for work-up's from interview data with police officers on missing issues, which was used for education and training events during 2013.

Table 10.1 Case study approach (Reproduced from Stevenson et al., 2014)

(<i>n</i> = 11) interviews with key partners and national agents	Interviews with: key partners and national missing agents to understand the broad policy and procedural landscape of missing; and map the services and provision in place for search and support
(<i>n</i> = 45) interviews with returned missing people, age 18–79 reported as missing in 2009–2011	Interviewing returned missing people to understand among missing adults their: decision-making; planning; mobility choices; environmental resourcefulness; and pathways for return
(<i>n</i> = 21) interviews and (<i>n</i> = 4) 1 focus group with family members of returned missing persons (including 11 with family members of longer-term or outstanding missing persons)	Interviewing families of people reported missing about: their experiences of living with absence; and to understand how families mobilise and deploy their own resources to search for missing loved ones
(<i>n</i> = 12) case reconstructions, (<i>n</i> = 20) interviews and (<i>n</i> = 3) 1 focus group with police officers in a varied rank and role	Interviewing local police officers and carrying out case reconstructions to examine police organizational responses to specific missing person cases

gathering information about the scope and capacities of organisations to track missing adults (age 18 or more) over space and through time, the experiential geographies of missing persons, and policy and operational understandings of what it means to be missing, which we refer to elsewhere as “missingness” (and see Stevenson et al., 2013). For the remainder of this chapter, we focus on interviews with returned missing people and families of missing people, but our analysis of wider project materials helps inform the writing and arguments expressed within this chapter (see www.geographiesofmissingpeople.org.uk for further information and materials).

Working with the databases of two UK police forces, the UK Missing Person Bureau and the UK charity Missing People, and in line with the

1998 Data Protection Act, the study worked to generate a 360° insider view of missing experience. In particular, returned missing people and families of missing people were sampled from our partner organisation databases. The sample frame was developed in consultation with these organisations and excluded certain cases, for example, where the reporting person was under 18 years of age, where possible abduction was suspected, was a lost-contact case, person had dementia, and where we were advised that receiving an invitation could potentially be too distressing to the individual. In each organisation we worked with a designated point of contact to send out a standardised letter, project information sheet and consent form to a relevant sample of missing people and families of missing people. Potential participants were invited to respond directly to the research fellow via reply slip, email, phone or social media. Overall, response rates for each sample population were low and so recruitment strategies were diversified to include placing adverts in newspapers; working via charity family support days and websites; and an online missing person story tool.

Face-to-face in-depth and semi-structured interviews took place with adults reported as missing in a location of their choosing. The same was the case for the family interviews, except in seven cases, where interviews took place via telephone as requested by the participants. All interviews were digitally recorded and transcribed verbatim and analysed using QSR Nvivo8 software via a range of emic and etic codes. Full details of the research methodology are available: for people reported as missing, see Stevenson et al. (2013); and for families of missing people, see Parr and Stevenson (2013b). The translation of the research findings into practice has been a core component of the project and the data form the basis of a police education package delivered to officers involved in training via the Police National Search Centre (PNSC), Scottish Police College (SPC) and National College of Policing (NCoP).

While we make no attempt to claim our findings are representative of all missing experiences, the interviews provide new and important

evidence, offering value to police and partner agency understanding, policy, and practice in this field. In the remainder of this chapter, we draw on our qualitative evidence to provide insights into social and spatial dimensions of lived missing experience. First, we present data from those reported as missing before moving on to those left behind.

10.5 Results and Discussion

10.5.1 Missing People: Planning to Leave

Whilst vital to understanding the ‘exceedingly complex web of behaviours and responses that surround the phenomenon of missing persons’ (James, Anderson, & Putt, 2008, p. 2), it is equally important to understand what happens at the exact time of leaving and how people plan to leave. Indeed, as previous studies have shown (James et al., 2008) and our latest research evidence reflects (Stevenson et al., 2013), decisions to go absence are around: mental health crisis, drug and alcohol issues, relationship breakdowns and debt. When someone is reported as missing to the police it is because their geographical location at that moment in time is unknown or uncertain and to complicate matters, the missing individual may not be static in his/her new location or exhibit prior known behaviours (Stevenson et al., 2013²).

The level of consideration given to going missing varied amongst the adults interviewed, but in just over half of all missing episodes (53%), the decision to leave was instantaneous:

‘There was no overall plan or anything, it was only just an instant, I’m getting out of here now, while I’ve still got the car keys’ (Andrew, repeat missing).

²Empirical materials contained in this chapter have been presented at conferences and in practitioner forums, and are first published within two study reports: for adults reported as missing, see Stevenson et al. (2013); and for families of missing people, see Parr and Stevenson (2013b).

For others, there was a longer planning window; 23 % of journeys were planned the night before, and 13 % of journeys had been planned several days in advance. Planning strategies varied from: withdrawing money from bank accounts over a period of time to avoid detection, to reserving hotel rooms in advance, to using a different name when interacting with people on missing journeys. Not always easy to recognise, indications that a person might have intentions to go missing consisted of verbal and behavioural clues, such as not attending work and not calling in sick, or seeing General Practitioners and showing signs of significant physical and emotional stresses before going missing.

Identifying the nature and extent of a missing person's preparation or planning a disappearance is a critical aspect in understanding subsequent missing behaviour. Asking questions such as 'did the missing person appear to prepare for an absence?' and 'how and in what ways?' are particularly important. However, planning to leave days in advance was not associated with being missing for longer periods.

10.5.2 Mobility and Decision-Making

It is important to obtain accurate information on distance travelled by adults reported as missing (Shalev Greene et al., 2009). Distance travelled is perceived as a valuable factor for building response scenarios and search planning for specialist police search advisors (e.g. PolSA) and volunteer search and rescue teams. However, an over emphasis on linear relationships of distance and time runs the risk of police search being focused on departure and destination locations, rather than journey experience, mobility and encounters. Our empirical data suggest a wider appreciation of missing experience relating to all stages of the journey is important to providing better understanding of this highly mobile and varied 'group'.

Nearly all adults in our study reported that their missing journey was not predetermined in terms of how long it would last or the exact location they would end up. Rather, the critical first

few hours of a journey were spent focused on decisions on where to go and how to travel, as indicated by Amanda and Matthew:

'I was very deliberate in where I was going to go and then when that no longer became an option I was thinking what do I do now?' (Amanda, repeat missing).

'Obviously I knew I was going somewhere, but I didn't know where' (Matthew, reported once).

States of confusion characterised the first few hours of a journey and the need to keep moving as both a bodily and therapeutic response helped missing persons deal with their thoughts and emotions. Only 18 % of respondents used cars or public transport, as for the first few hours walking was the preferred option reported by the majority (49 %). Using public transport meant the scheduling of journeys was outside an individual's control and waiting at bus stops added to the anxiety of being located. Awareness of formal surveillance technologies, such as Automatic Number Plate Recognition (ANPR), travel card technology, or CCTV to track movements, influenced decisions around mode of travel and distance travelled:

'I kept thinking if I go get on a bus somewhere half the buses now have CCTV, so they'll know where I'm going. So that's why I started walking. No one will know where I'm going, they can't follow me' (Trish, reported once).

Since confusion is a commonly reported state-of-mind on missing journeys, rather than moving from point A to point B in linear ways, journeys were often characterised by wandering in circles, loops or squares. This is not to suggest that adults travel aimlessly. On the contrary, considered decisions about their routes and where to go were taken and related specifically to 'personal' geographies, which involved for the many (46 %) staying local and going to familiar or significant places:

'Directions I chose weren't premeditated it was just a need to keep moving. But I gravitated towards paths that I had been along before' (Leon, repeat missing).

'The route that I walked is one I used to cycle when I was a kid. That was the reasons for picking those routes 'cause I knew where they take me' (Lewis, repeat missing).

Adults specifically chose routes through back streets to enable them to avoid crowds and the possibility of detection. They also steered clear of their local and neighbouring streets for fear they would be noticed, as Malcolm (repeat missing) describes: ‘In case the police were at my house, I stayed around Bush Road and didn’t go on to my street. It was a proximity thing. I was far enough away but still in a familiar area’.

On this basis, going to familiar places and staying local was recognised as a risky strategy as it could lead to being seen. But, importantly, the risk was balanced by the recognition that: ‘If I had gone somewhere I didn’t know it would have been a lot harder to get through the next few days because I wouldn’t know where anything was’ (Alex, missing once). As Alex’s quote shows, and others confirmed, to be ‘lost’ was perceived as a significantly different experience from being missing. Being lost was a risk to personal safety, as the missing person might not be able to blend in easily. Choosing where to go, then, is often a conscious deliberative process, as well as an act of memory and crisis.

10.5.3 Hiding while Missing

Interviewees described the myriad of ways they used the built and natural environment on their missing journeys to meet their needs. They were attentive to resources that could facilitate their perceived need to hide from a range of people, such as the police, families and mental health workers. Concealment practices ranged from taking shelter to avoid detection, changing physical appearance, using a false name, avoiding CCTV, taking new clothes off washing lines or from charity collection bins, staying with friends who would not disclose their whereabouts, or choosing hiding places in the natural and built environment:

‘I did think about maybe the police would be looking for me. Yeah, I sort of took side roads’ (Andrew, repeat missing).

‘I realised that there are cameras along the road so depending upon what I am wearing I

might be distinguishable. There was a backpack with me at the time, which I basically left, because it was distinguishable’ (Alex, reported once).

‘I bought myself a pair of scissors so when I got to the bus stop I stood there and I took my hair and I cut it off’ (Wilma, repeat missing).

Men and women both used the built and natural environment to hide, demonstrating a high degree of resourcefulness. Wooded areas, shady parks and derelict buildings featured heavily in narrative accounts.

Male journeys (18%) involved higher uses of the natural environment, as Matt (repeat missing) exemplifies: ‘I can go in the woods and nobody can find me because nobody would think of looking in there’. In contrast, female journeys (16%) involved higher levels of concealment through the built environment. Using a combination of busy urban areas and back alleys, Rhona (repeat missing) describes the tactics she employs to avoid detection from the police or her family: ‘There’s a lot of people in the West End that you could easily disappear in a crowd. I got very good at geographically finding my way around. I had to navigate my way so I didn’t get caught by police or from seeing someone that looks like my mum and ducking in another direction’. Although missing journeys can be taken at a time of great emotional and cognitive difficulty, journeys are not always or entirely chaotic. Rather, they include a high amount of cognition in relation to hiding and disguise even in first-time missing person journeys.

10.5.4 Using the Environment as a Resource

Adults used both the physical and built environment on their journeys in a range of ways. Small and large parks in (semi) residential areas were popular resting places and featured in 46% of missing journeys:

‘There’s like a park there. I remember sitting on a bench in there for ages. Watching ... and the trees sort of shaded and nobody noticed you. I just sat there for ages and ages’ (Trish, reported once).

Cliffs, beaches and seashores were also identified as calm environments to contemplate their situation and take time out from physically moving:

‘Just sitting along the beachfront and looking out to sea. I sat for a while just looking at the waves and the beach’ (Sarah, reported once).

What may be surprising is that missing people are predominantly members of ‘homed communities’ (i.e. not homeless), but 34 % of them when missing slept rough. Some slept during the day when it was warmer, and at night sought out sheltered environments to protect themselves from the elements and avoid detection:

‘I walked along the canal and then found somewhere in a field, a little wood off the road and found a very secret place to bed down there for the night ... the main priority is not be noticed by the police and causing trouble’ (Daniel, repeat missing).

Sleeping rough was the most traumatic part of a journey and where resource was available, then, hotels and bed and breakfasts (B&Bs) were used (24 %). Often they were chosen in familiar areas and, in some cases, the missing person had stayed there previously. Hotels and B&Bs provided relief from constant mobility and motion, as well as a place to hide. Some missing adults were cognisant that police check local hotels and, as a precaution, often checked in under a false name and paid in cash to avoid detection:

‘I gave a false name and address because I paid cash and just in case the police came round and checked. It’s one of the things that you think they do. That they might check the local hotels’ (Malcolm, repeat missing).

Missing adults also draw on the built environment and commercial places in their missing journeys. The urban commercial environment, such as shops, cafes and retail parks, provided possibilities for washing, eating and resting:

‘I went into that café and got changed and had a wash and stuff. And I might be behaving differently and acting strangely but I’m still perfectly aware that I need to wash, keep myself clean and ... safe’ (Wilma, repeat missing).

Transport hubs, such as bus stations, train stations and airports, with their high footfall,

also offered these same opportunities for adults to rest, eat, wash and sleep masked by the rhythms of these spaces. Such places offer access to essential facilities, but do not provide cover indefinitely as they are heavily policed and surveyed environments. Yet, adults were drawn to these places because they provide a series of possibilities for travel (that were not always taken) and a sense of hopefulness for future plans:

‘Lot of people arrive early for flights they’ve got to catch early in the morning and they stay over at the airport so you don’t really stick out’ (Daniel, repeat missing).

This suggests that being immersed in sites for ‘legitimate’ mobility is helpful for some people as they go absent. On this basis, transport hubs are potential sites of education and intervention around the issue of missing persons.

10.5.5 Issues of Return

Previous research has found that the majority of missing persons incidents are resolved quickly (NPIA, 2011; Tarling & Burrows, 2004) and our latest work shows the majority of adults returned or were located within 48 h (54 %), with almost a quarter (24 %) missing between 48 h and 7 days (Stevenson et al., 2013). Multiple influences for return or reconnection were identified. These ranged from being located by the police, friends or family, or the missing person choosing to return to his/her ‘everyday’ life. Importantly, return was often coupled with practical questions and mixed emotions of guilt, relief, apprehension and fear—often caused by uncertainty about how to return and how family, friends and the police would respond.

‘I wasn’t sure if I was in trouble with the police or not. I didn’t know, and I thought if they found me, I would get arrested. You don’t know what procedures are’ (Walter, reported once).

‘When you get to that situation and you are about to go back, your mind is thinking about “what am I going to go back to face.” It’s just like the whole situation and you get a cramp in your stomach. It makes you feel anxious’ (Max, repeat missing).

Nearly all interviewees (93%) reported police involvement in their journeys and return. Interviewees offered a range of experiences. Wilma (repeat missing) commented: ‘The police are the soundest. They’re the ones that are least judging’, while Angela (reported once) described police interaction as embarrassing and induced feelings of being a ‘criminal’. Missing adults who felt ‘criminalised’ also reported that they were not given the opportunity (or only a limited one) to talk about their missing experience. Whilst recognising resource and time constraints, this is a lost opportunity for data capture and ‘informed’ policing (see Parr & Fyfe, 2012; Shalev Greene et al., 2009).

The research evidence suggests that at the point of return what officers say and explain about being a missing person is very important in helping people cope not just at the time of return, but for years after the event. Key messages, such as ‘it’s our job. It’s what we are here for, we’re just glad that you’re safe now’ were critical to generating a positive police-adult missing returner experience. This suggests there are further opportunities for police and partner-agency policy development and training that focuses on where, when and how to conduct ‘return’ interviews. Understanding the experiences of missing people helps recognise their geographical journeys, and assists families of missing people with their relationships with police processes and officers officially tasked with locating the missing person. The next section of the chapter looks at this task in more detail.

10.5.6 Families of Missing People

Every year in the UK, 110,000 adults are reported missing to the police (SOCA, 2013). The UK charity, ‘Missing People’ receives around 114,000 annual calls on their 24-h help-lines from missing persons, their families and friends. The scale of need is clearly significant. For those left behind, searching for a missing person is a confusing process marked by (often competing) geographical knowledges and complex relationships with police officers who are officially

charged with the task of locating the missing (this process may be significantly different in non Anglo-American countries, and see Edkins, 2011; Parr & Fyfe, 2012, for example). There are many dimensions to the search and in discussing UK family experiences it is acknowledged that we are privileging a partial representation of the complexities, including policing procedures and practices, and family experiences and emotions. Indeed, we recognise that police officers may hold different, but equally valid views to those of families of missing people, but regardless we argue that there is a lot of beneficial learning to be gained in understanding why families feel the way they do and why their search action occurs. Indeed, it is from this knowledge that important understandings and practical insights can be provided to those having a professional responsibility for and to missing families (Parr & Stevenson, 2013b). Within the next section of the chapter, we offer data driven insights to suggest that police education should have at its core families of missing persons working as partners and the need for police practices to shift from just managing expectations of families to increased positive partnership work.

10.5.7 Reporting

From a police perspective, ‘search and investigation’ are separate but mutually supporting elements of a missing person enquiry (College of Policing, 2012). For police, the ‘golden hour’ for a ‘successful’ search is in the first 24-h after a person has last been seen. The principle is that effective early action can result in securing significant material to aid investigation. Yet, reporting an adult missing triggers official risk assessment and investigative procedures, which can leave some families worried about whether their missing family member will appreciate such intervention. This is especially true in cases where the missing person is experiencing mental health problems, and where police interventions may result in a medical and legal process, such as a Mental Health Section and detainment in hospital. It is quite common, therefore, for families to

mount significant searches of their own before calling the police for assistance, especially in cases of repeated disappearance. Families often undertake investigation and key searches, which occur prior to, during and post police involvement in the missing case. Although this occurs both with and without police knowledge, it rarely feeds into police investigations.

Yet, search activity is significant and extensive and differentiated by different types of activity—physical, documentary and virtual, social networking, liaison with other agencies/professionals and other practices (see Parr et al., 2016 for further examples)—as families go to enormous lengths to locate their missing person or information about them. Indeed intensive searches take place:

‘I got into organisational mode. So I contacted Missing People, got some posters printed out, got some of my old friends from home to hand them out around the town and then we started looking at places that we felt he might have gone to. We went to London ...and basically went round all the big stations[W]e went to [East town] briefly and then we drove down to [the South Coast]’. (Sally, daughter to Ned, missing for 7 days, returned).

Many families pound the streets, draw up maps and follow lines of lateral thinking about where their missing members might be, both with or without police knowledge. Sometimes this occurs before an official report. Undoubtedly, then, there will be barriers to the golden hour principle indicated above, but the significant amount of search work that has already been done by families quite often goes unrecorded in official investigations. This has implications for effective action and search by police officers. Further, the complexities of making a report are an important point for police officers to be cognisant of when communicating with family members for information. Points we shall return to later in this chapter.

10.5.8 Drivers for Search

Once a person is reported as missing to the police, an official search may take place. Based on contingent information and risk assessment, police

searches for missing people vary in type and extent (Fyfe, Parr, Stevenson, & Woolnough, 2015; Fyfe, Stevenson, & Woolnough, 2015; Gibb & Woolnough, 2007; Parr & Fyfe, 2012): ‘Search is a routine element of investigating reports of missing persons. It involves making an assessment of what the initial enquiries suggest are the most likely circumstances of the person’s disappearance, and then concentrating the search in accordance with those circumstances’ (ACPO, 2006, p. 94). Search involves a range of activities from physical search of the home address, search of the place the person has gone missing from and search of the immediate area to virtual checks such as ANPR vehicle checks. Guidance further recognises that initial search judgments ‘will have a significant effect on the effectiveness of the investigation’ (ACPO, 2010, p. 35). In other words, early searches are critical to providing information and intelligence that feed into latter parts of an investigation.

Some families reported feeling from the outset confident in the police as search experts, recognising that the police were the most effective means to locate their loved one, given their knowledge of missing persons and resources (assumed to be) at their disposal to carry out effective searches, as summarised here, by Alice:

‘They were very, very quick at getting searches up and running so there was no need for us to do anything like that. The police are the specialists, they know what they’re looking for’. (Alice, step-daughter to Martha, still missing after 5 years).

From the start if families perceived the police as specialists in physical searches this impacted on their decision not to search, however, unlike Alice, above, many families continued to engage in some form of search (as outlined earlier in the chapter) alongside or in response to police actions. This joint police/family search activity is reported as rarely being done as partnership. Family search mostly occurred either as a negative response to a lack of knowledge of police search or a dissatisfaction with it. It is also a form of active emotional management stemming from the understandable need to be ‘doing something’. In understanding the drivers for search, then, we might fruitfully recognise not only an emotional

need by families to be, ‘doing something’, but give wider and more formally active consideration of family relationships with police processes and officers officially tasked with locating the missing person.

10.5.9 Police Processes: Cultures of Communication

Knowing that ‘no stone has been left unturned’ in the search for their missing person was represented as critical to positive family–police relationships. One of the key factors contributing to this was associated with professional and empathetic officers who seem genuinely invested in the case and who communicated, to gather and share information, regularly with the family regardless of rank. Families report what was particularly helpful in terms of police involvement in cases was a sense of investment by officers, receiving clear statements that showed they cared, as Alice explains:

‘[T]hey were absolutely determined. And certainly the CID sergeant, his thoughts were “that could have been my mum” and I think that’s what they were holding onto, that could be them and what would they want done?’ (Alice, stepdaughter to Martha, still missing after 5 years).

Where communication was not so effective—or there were non-systematic communication pathways or poor standards of communication—then the relationship between the police and families was compromised. Whether this was the case, families were sometimes left with the impression that there was little coordination between police officers, with the following quote being typical:

‘There was no handover from one policeman to the next. One seemed to finish his shift and then it was somebody else. There was no continuity at all. And that was really bad. [T]here was no liaison between any of them through the whole episode’. (Eithne, mother of a missing son, Edward, missing for 24 hours).

Often families reported not being fully informed of what was happening and having to chase varied police officers for news:

‘Communication is massive, that’s the biggest. [W]e shouldn’t have been the ones that were chasing

what was going on and who do we speak to next, and what do we do now, and what have you done, and are you doing any more and where do we go from here, why should that be us?’ (Raquelle, sister to Libby, 3 years and still missing).

The key benefit of police communication lay in families understanding police search decision-making and search parameters and often this was not well understood or misunderstood. This can be interpreted as a lack of engagement by families, indicating that their particular person who is missing is not central to policing processes (Edkins, 2013; Parr & Stevenson, 2013b).

10.5.9.1 Communications Breakdown: The Case of Sasha

To explore the above discussion in focus, we draw on the detail of an interview with Sasha, who discusses her still missing husband. Bill had been missing for 2 years (at the point of interview) and he was living with Sasha on the day he was last seen. On the day Bill disappeared, Sasha came downstairs to find a note that said he was leaving to kill himself. Bill had been diagnosed with a terminal illness and this was not his first attempt to take his own life. Sasha along with a friend called the police. As a result of his absence and the police report, the police undertook a variety of search tasks tabled below (on the left hand column on Table 10.2) as a response, and this recovered Sasha’s husband’s car, but there was no trace of Bill.

Family–police cooperation is key to good outcomes within missing persons enquiries and yet Sasha, as many of the other interviewees expressed, had no clear understanding about police decision-making, about the parameters of searches and those who asked precise questions about the geography of police search remained dissatisfied. This can have dire consequences, as was the case for Sasha. Indeed, the disjuncture between the police and Sasha (based on family narrative of the case) resulted in a complete communications breakdown, which led to both her and the police making search enquiries unappraised of the other. As Table 10.2 demonstrates a huge amount of police resource and time was in fact allocated to locating Sasha’s husband.

Table 10.2 Search activities (Reproduced from PNSC training materials delivered by Stevenson and Woolnough in 2014)

Police search activity	Family search activity
<ul style="list-style-type: none"> Search Team, Dog Team, Helicopter, Underwater Search Team, British Transport Police, Search and Rescue volunteers 	<ul style="list-style-type: none"> Searched area round the vehicle and woods
<ul style="list-style-type: none"> Text message to be vigilant to wardens, county council wardens, farmers, game keepers, equine establishments, rural business 	<ul style="list-style-type: none"> Internet search: (behavioural profiles; search protocols; bone scavenging)
<ul style="list-style-type: none"> Media appeals 	<ul style="list-style-type: none"> Poster campaign: artefacts; missing person profile
<ul style="list-style-type: none"> Posters circulated to all local beauty spots 	<ul style="list-style-type: none"> Interviewing: local people; walking associations; park rangers; quarry and brick works owners; and search and rescue operatives
<ul style="list-style-type: none"> Door-to-door leaflet drops in the areas surrounding the vehicle 	<ul style="list-style-type: none"> Media appeals
<ul style="list-style-type: none"> Finger tip searches in the areas surrounding the vehicle 	<ul style="list-style-type: none"> Computer search
<ul style="list-style-type: none"> House search and local environs 	<p><i>Searches requested of police</i></p>
<ul style="list-style-type: none"> Search of local garages, wasteland, parks 	<ul style="list-style-type: none"> Interviews: ramblers and walking associations; quarry and brick works owners
<ul style="list-style-type: none"> Interviews with: family members; friends; associates; local ramblers associations; and quarry and brick work owners 	<ul style="list-style-type: none"> Poster campaigns
<ul style="list-style-type: none"> Documentary evidence: diaries and letters 	<ul style="list-style-type: none"> Media appeals for artefacts <u>not</u> missing person profile
<ul style="list-style-type: none"> Computer search 	

Yet, because of a failure to communicate, for example, Sasha felt her requests for information regarding the search were met with a great level of police resistance, and this led Sasha to question the professional standards of the search work as her quote shows:

‘After a fortnight, I had a conversation with them about the forensics; about the distance people would have travelled, but they wouldn’t discuss that with me. I requested a copy of the [search] map [and was told], “well nobody has asked for it before”. They did a copy, but there was no legend, so all their little crosses and colours didn’t mean anything to me and the police officer who was explaining it couldn’t interpret it either. I just feel their analysis was poor. I was expecting a more detailed analysis. The last discussion I had with the police officer before we agreed we wouldn’t speak, other than through email, was I came across an American website and of course after two weeks you are not searching for a body because it will either have been eaten, disintegrated, separated by animals, dispersed by the wind, so I was asking what actually they were looking for and said I read this report, that in fact there wouldn’t be a body there, we might be looking for a bone or clothing and that’s when I had a row. He said “you don’t know and you’ve read this report and you think everybody will have disintegrated well it’s not like that, it depends where he was” (Sasha, wife to Bill, still missing after 2 years).

Although there is more nuance to the case than we can relay within this chapter, the key point here is families are not passive in the face of missing investigation issues. When they are dissatisfied with what they know of the police searches being conducted they respond to it, sometimes launching their own search strategies (as shown in the right hand column of Table 10.2) that can last for years, and which can have significant financial, temporal and emotional cost to them (Holmes, 2008). When they lose complete trust in police abilities to search, communications and cooperation breakdown completely, which is hugely damaging and has force reputational costs.

The provision of empathetic and clear communication and liaison pathways is hugely beneficial as it lets families know that the disappearance of their missing person is being taken seriously and investigated in a robust manner. It is not enough for families to know that a search is taking place, it is important they know what searches, where, and the results and at times they want to join the search. Of course, there are multiple complexities to the management of community searches and if a family member is a police

suspect it might not always be possible. However, there is still a need to manage information flow and if managed in the right way and with the correct level of assurance then working with families for search can make a huge difference to the investigation and their emotional recovery. To quote Sasha again:

‘I thought you haven’t been truthful with me in explaining how difficult a search is so my understanding is that you are not doing a very good job, but the reality is you are doing the best job in the circumstances’ (Sasha, wife to Bill, still missing after 2 years).

Although many families understand that they cannot obstruct or disrupt police investigation, many are sure that they could have more productive working partnerships, and improved communication, information flow, content, and task allocation could reflect and produce better police–family liaison.

10.5.10 Character Witness by Family Members

Rock (2001 quoted in Parr & Stevenson, 2015, p. 300) suggests: ‘the witness interview is more than ... a speech event, it consists of multiple tasks—telling, listening, writing, formulating, analysing—and has multiple goals—the extraction, communication, and use of emotional and factual information’. Indeed, a critical point of police search enquires is around conversations, in which the missing person’s character and their spatial preferences are reassembled via in/formal witness statements of family and significant others. As might be the case for all of us, there are often inconsistencies that emerge in such evidential gathering; unsurprisingly, friends, workplace and acquaintance testimony may complicate family character witness. Consequently, there might be the need for repeated police interviews often referenced by the phrase ‘to bottom out’ inconsistencies. However, it is a balancing act as one of the most reported stress points in family–police relationships was around the need for family to repeat this character witness multiple times to multiple officers who often asked the

same questions. This increased the perception that their witness statements were not being properly handled or taken note of. Of course, there may well be good investigative reasons to check and recheck statements with different officers initially, but when this continues over a period of months and years, families perceive this negatively.

In many family accounts of such interviews, and other related conversations, there was positive commentary about how police interview tactics usefully jogged memories and generated ideas, as Aileen states:

‘It was very much a case of “where do you think she could have gone?” It’s amazing the things that come back when you [the police] start prompting. Things like “where would she normally go shopping, would it be unusual for her to go anywhere else?” It was about routines and things like that’ (Aileen, sister to Rhys, 2–3 weeks missing).

There was also, however, a barrage of talk about how difficult it had been to impress upon some officers the particularity of the person who was missing. Families who report difficult relationships with police officers in this regard describe communicating with them as deeply unsettling, as Sasha relates: ‘I didn’t feel that what I said was valued’. Further, for some families, they not only felt their information was undervalued, but found they had difficulty impressing upon officers something about the unusual nature of the spatial behaviour and the disappearance, and the particularity of the character of the missing person. Here Laura and her husband Charles talk of their missing son, Simon, gone for 2 years, and the difficulty they had in conveying their character witness to local police, to quote:

‘They [the police] wouldn’t accept he was a missing person. I said “this is not right, there’s something not right here, he’s gone.” And they wouldn’t accept it, they said call back in a few weeks ...What I couldn’t get across to them was he didn’t phone on the Wednesday ... he phoned me every Wednesday. I think generally the police at that time thought “he’ll turn up, don’t worry about it. We’ve seen this thing happen before, he must have overreacted to the situation.” And there was this thing about a missing person for a certain time. Yeah, they kept saying twelve weeks. And I kept saying “I can’t believe that’s right.”’

In this case, Laura and Charles spoke about a varied relationship: they also were not always made aware of the police searches being carried out or who was on/off the investigation team. When new staff came on board without warning, they had to repeat the facts and answer what they thought were odd questions, often via email, which in their opinion were inappropriate, unclear, and repetitive. So in summary, they felt their character witness was not being well noted or respected, and this led the family to question how well the searches were being run.

Indeed, it was late one Sunday night the family received a phone call to say the case had closed as the police believed Jim to be a ‘perfectly competent adult and he’s gone missing of his own accord’ after a year. The family report not being involved in that decision and feeling in limbo as a result of this, but are trying to live their lives actively, alongside their own continued search/ing (see Parr et al., 2016).

10.5.11 Good Practice

Officers have a role in reducing experiences of trauma in missing situations by promoting police–family partnership work. Good partnership work is also likely to reduce officer resource allocation to dealing with constant family enquiries and their search efforts. Good practice in partnership work that families reported specifically related to:

- Police officers agreeing to make regular call times for news sharing (i.e. proactively rather than reactively)
- Notifying families when officers change on the case and introducing new officers with good hand-over
- Police officers calling every few months in long-term cases
- Promoting local force ‘investment’ in locating the missing person
- Referring families to appropriate support, such as the UK Missing People charity
- Police officers sharing search tasks—where possible—with families in partnership (e.g.

police giving families ‘letter writing’ tasks to a range of other agencies or online social media searches)

The best experiences of partnership working are when there are clear and sole named officers for communication and updates. This was particularly illustrated in the cases that involved the deployment of Family Liaison Officers (FLOs). The potential for PolSAs to help deliver much needed technical information to families should also be considered.

Finally, families can and should be seen as ‘reasonable’ active partners and can be well regarded as such in investigations, as illustrated by this final quote from the mother of a still missing son:

‘To put all of this into some ... positive advice to the police, would be to say to them don’t assume that the partners or parents or spouses of people that go missing are incapable of guiding your inquiries. Don’t reach conclusions that you don’t discuss with those people. The disappearance of a loved one is emotionally shocking, but it also focuses the mind very greatly, and that weight should be given to suggestions and recommendations that members of the family make’.

10.6 Improving Police Education and Response to Missing Persons

For some time now the police have been at the centre of continuous and intensive attempts at reform. Linked to this has been the rise in evidence-based policing agendas, which challenge the police to base actions on scientific evidence about ‘what works’. This has led to the recognition that policing is a complex enterprise, and so is drawing conclusions from evidence. Consequently, the value of police craft in relation to police science is ever more on the agenda. Indeed we ourselves have entered into these debates and argued elsewhere (Fyfe, Stevenson, et al., 2015, p. 409) that to understand missing person policing, greater recognition needs to be given to the complex interplay between police actions that are ‘ordered and conditioned by a

procedural discourse around how investigations should be conducted, and the narratives that officers construct about their approach to investigations, which are often shaped by a mix of police craft, science and reputational issues’.

Despite substantial advances in policing and ever-increasing discussion on police craft, a greater focus on crime has meant there remain significant gaps in our understanding of missing persons and, therefore, to what extent greater knowledge can or should inform policing practices. In an attempt to expand the limited evidence-base in this field, this chapter (and as the research team has done throughout the wider project) has introduced empirical evidence to demonstrate the importance of including people’s narrated experience of being missing and searching for a missing loved one in the hope such experience will inform future policing practice (see Fyfe, Parr, et al., 2015; Fyfe, Stevenson, et al., 2015; Parr & Stevenson, 2014; Stevenson et al., 2014; Woolnough, Stevenson, & Parr, 2014, 2015). We assert that qualitative evidence helps to ‘people’ missing person enquiries and exists as a complement to the more categorical knowledges that are produced as a result of working with large data sets related to spatial behaviour profiles.

Trying to understand the complexities of missing persons for policing practice has only just begun, but to this end, the translation of the research findings into practice has been a core component of our project. As we have written about elsewhere (see Stevenson et al., 2014), we have been engaged in extensive knowledge exchange activities in partnership with policy and practice stakeholders from Police Scotland, the U.K. Missing Persons Bureau (National Crime Agency) and the charity, Missing People. This has comprised the development of training materials for police officers involved with missing persons. In particular, this has included the design and delivery of training on taught courses to PolSAs via the U.K. PNSC and the Sergeants Leadership Development Programme at the Scottish Police College. The structure of the training was designed to provide officers with an enhanced knowledge to complement existing quantitative

understanding of missing persons and give insight into going missing from missing persons’ perspectives, as well as address the needs and roles of families in investigations and search. The evaluation responses from various ranked officers who were asked how they would use the training materials in their policing practice revealed that our materials were useful for influencing search areas, supporting search strategies, and acting as a reminder that ‘it was good to hear the mispers’ point of view. In particular, mispers have not committed a crime by being missing and I will ensure my offers treat mispers respectfully and with sympathy’ (Police Sergeant, 2013).

Free resources available for local training and continuous professional development include 10 ‘stories of missing experience’ called Missing People, Missing Voices (Parr & Stevenson, 2013a <http://www.geographiesofmissingpeople.org.uk/missingvoices/>). These story resources are intended to enable deep learning, and better facilitate empathetic responses among police officers that have to deal with numerous missing person cases day in and day out. The UK ACPO Lead for Missing Persons on hearing the story resources at the International Conference on Missing Children and Adults (UK, 2013) observed: ‘listening to a presentation on the findings so far made a huge impact on me and gave me a greater insight into the psyche of those who go missing than anything I had experienced in the past 30 years. This work will provide a sound foundation for the future development of police tactics’ (annual missing persons conference, Portsmouth 2013). The research is being applied in ways that are intended to foster attitudinal change in policing cultures toward missing persons and their families. The wider teams recommendations for placing missing persons’ voices at the heart of policing practice are also being used in national policing strategy, as is currently the case in Police Scotland. The findings of the family research reported here have led to direct changes in relation to family liaison and partnership working as set out in the UK Authorised Professional Practice (published by the College of Policing) and the Police Scotland Missing Person Standard Operating Procedure.

This study shows that partnerships involving researchers, police, and related agencies, non-governmental organisations, and missing persons and their families can yield a holistic understanding of missing person cases and important insights into responding to them effectively. If an evidence-based agenda for policing is here to stay, then linking research findings with training, statistical analysis with qualitative knowledge, and police actions and perceptions of missing persons and their families are all important in translating research into action. For full information on this and other aspects of the project, visit the project website: www.geographiesofmissingpeople.org.uk

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James Michael Lampinen and Kara N. Moore

11.1 Prospective Person Memory in the Search for Missing Children

In September of 2008, an 8-year-old boy with autism went missing in Las Vegas, Nevada (Eiland, 2013). The boy was with his babysitter and told the babysitter he wanted to go to the mall. The babysitter told him he could not go, but he was stubborn. He snuck out of the house and decided to go shopping on his own. When the fact that he was missing was discovered, the authorities were contacted, and fliers were put up in the area showing pictures of the child. About 3 h later, Trinka Witherspoon got on a mass transit bus. She noticed a child riding the bus by himself. It took her a few minutes, but she soon realized that she had seen his picture previously, when she briefly glanced at a missing child poster at the bus stop. She went to the front of the bus and told the bus driver that she thought a missing child was on the bus. The bus driver stopped the bus so that Ms. Witherspoon could run back to the bus stop and retrieve the poster and confirm his identity. Thanks to Ms. Witherspoon's quick thinking, the boy was reunited with his family.

A common strategy when children or adults go missing is to release photographs of the missing person to the general public in hopes that someone will notice the missing person and alert authorities (Pashley, Enhus, & Leys, 2010). Examples of these strategies include news alerts (Withnall, 2014), AMBER alerts (Office of Juvenile Justice and Delinquency Prevention, 2004; Zgoba, 2004; Chap. 4 this volume), Silver alerts (Edwards, 2013), missing child posters (Walmart Foundation, 2001), photographs of missing persons on product packaging (Brown, 1997), cell phone alerts (Office of Juvenile Justice and Delinquency Prevention, 2013), direct mail campaigns (Office of Juvenile Justice and Delinquency Prevention, 2004), social media campaigns (KATU, 2014; Starke, 2013), and so on.¹ Such alert systems rely on the premise that members of the general public can act as the “eyes and ears” of law enforcement by informing law enforcement if they see or have seen the missing person.

Lampinen, Arnal, and Hicks (2009a) argued that such alert systems rely on two distinct types of memory: prospective person memory and

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¹AMBER Alert refers to a US program that involves the rapid release of a missing child alert in cases in which a child is abducted and is considered to be in imminent danger. The AMBER alert program is named for Amber Hagerman, a child who went missing in Texas. AMBER also stands for “America’s Missing Broadcast Emergency Response.” Silver alerts are programs in which an adult with diminished capacity is missing and considered to be in imminent danger.

retrospective person memory. Prospective person memory refers to situations in which a member of the general public sees an alert and then later encounters the sought after individual. In retrospective person memory, a member of the general public first encounters the missing person, and then later comes into contact with the alert. Imagine, for instance, that Bob comes into contact with a missing child poster at a grocery store. He attends to the poster, so that if he encounters the child he will recognize her. As Bob is collecting his groceries, he sees a small child who looks similar to the child in the poster. Bob decides to call the missing child hotline. In this case, the decision to alert authorities relies on prospective person memory. By contrast, imagine that Susie is at an outdoor mall doing her holiday shopping, when she sees an older woman sitting on a small bench shivering, because she does not have a thick enough coat on. After Susie completes her holiday shopping for the day, she looks over at the bench, and the woman is still there. Later that evening, she turns on the local news and sees an alert about a woman with dementia who went missing earlier in the day. She can't be sure, but the woman looks similar to the woman she saw on the bench at the outdoor mall. She decides to call the police. In this case, Susie has relied on retrospective person memory.

Successful recoveries in actual cases have occurred through both prospective person memory and retrospective person memory, and both types of memory processes are important. Given that it is logically possible to encounter an alert either before or after encountering a missing person, it is important to maximize both types of memory processes in order to maximize the effectiveness of these alert systems. In other works, we have discussed retrospective person memory (Lampinen, Miller, & Dehon, 2012), but in the present chapter we focus on factors that influence successful prospective person memory.

11.2 Event-Based Prospective Memory

Prospective person memory can be thought of as a special case of event-based prospective memory. Event-based prospective memory involves remembering to perform an intended behavior whenever a certain event occurs (Einstein & McDaniel, 1990). Refilling your dog's water bowl when it is empty and delivering a message to your friend when you see her are both examples of event-based prospective memory. In the typical event-based prospective memory experiment, participants are instructed on how to perform an ongoing task such as rating the pleasantness of a set of words. After participants have practiced performing this task, they are given instructions for a prospective memory task. For instance, they might be told, "If at any point in the experiment you see an animal related word, press the '!' key." Participants then continue working on the ongoing task (e.g., rating the pleasantness of words). Occasionally, an item will occur which will require the prospective memory response (e.g., CAT). Prospective memory is assessed by determining how people respond to the cue during the ongoing task (e.g., do they press the "!" key when they see "CAT"?).

There is an ongoing debate about the role of attention in prospective memory performance. Some researchers believe that prospective memory tasks always require attentional resources in order to be effective (Smith, 2003). Others theories claim that prospective memory tasks sometimes require attention and at other times occur automatically or reflexively (Einstein et al., 2005; McDaniel, Guynn, Einstein, & Breneiser, 2004). The degree to which prospective memory is automatic is an important consideration for research on prospective person memory, in that members of the public are unlikely to be able to maintain sustained attention in looking for missing persons over the time period that would be required for a successful recovery under most circumstances.

11.2.1 PAM Preparatory Attentional Memory Model

One important theory of prospective memory argues that prospective memory tasks always require the allocation of attentional resources in order for successful prospective memory. This theory is known as the Preparatory Attention Model (PAM) theory (Smith, 2003). Evidence for this theory is provided by the finding that participants are slower at ongoing tasks when told to look for a prospective memory cue. The logic behind this is that if prospective memory tasks did not require preparatory attention and memory then performance on the ongoing task would not be affected by performance of the prospective memory task. An example of preparatory attention and memory would be checking to see if a given item is a cue. You may ask yourself as the items are presented “Is this the item I’m looking for?” However, the attention and memory you devote to a prospective memory task does not have to be this explicit and may just involve forming an intention to recognize the item or maintaining a retrieval mode. The PAM theory makes the assumption that preparatory attention and memory processes take cognitive resources that makes performing other tasks more difficult.

11.2.2 Multi-Process Theory

The multi-process theory holds that prospective memory sometimes occurs reflexively and relatively automatically, while at other times requires focused attention (Einstein et al., 2005). In order for automatic retrieval of an intention to occur, the following conditions should be present: the cue is salient, the association between the cue and the intended action is very strong, and the ongoing task engages the same kinds of mental processes that are necessary to identify the cue (i.e., focal ongoing task). Einstein et al. (2005) conducted a study where the prospective memory cues were either focal (i.e., a word) or non-focal (i.e., a syllable). They found that participants performed more quickly and accurately when cues were focal than when they were non-focal.

The researchers proposed that participants may have relied on spontaneous retrieval processes for the focal cues which improved performance, whereas focused attention and memory seemed to be necessary for non-focal cue monitoring.

If the PAM theory is correct, it indicates that focal attention must be present at the time that a missing person is encountered. However, given that the person viewing a missing person alert is unlikely to know when and where (or even if) they are likely to encounter the missing person, it is unlikely that he or she would be able to maintain focused attention on the task of finding the missing person long enough for a successful recovery. The multi-process model, on the other hand, suggests that people will sometimes spontaneously notice a missing person, but this should only occur if very strong memory representations are formed of the missing person, and the person’s attention is sufficiently drawn to the missing person’s face to spark a reminding. In what follows, we describe a set of factors that can influence the success of missing person alert systems. We organize these factors in terms of prospective person memory, although many of the same factors should apply to retrospective person memory.

11.3 Methodological Approaches to the Study of Prospective Person Memory

Prospective person memory has only been systematically examined in the last 5 years. Two primary approaches have been used to examine prospective person memory. One approach is to simulate a search for missing or wanted persons in computer-based laboratory analog experiments. For instance, Lampinen, Arnal and Hicks (2009a) describe a study in which participants were shown photographs of four individuals and were asked to imagine that the individuals were wanted by the police. Participants were told to press a response key if they saw the wanted people at any point in the experiment. Participants then engaged in a task meant to simulate a common day-to-day activity, accomplishing

items on a to-do list. Participants were given a to-do list (e.g., mail a letter) and were asked to make a response every time there was an opportunity to accomplish one of the items on their to-do list. They viewed slides simulating a walk through a college campus. Occasionally, a slide appeared which provided an opportunity to accomplish one of the items on their to-do list (e.g., a mailbox). The slides also include a large number of people. Occasionally, one of the target individuals appeared in the slides. People noticed the wanted individuals only about one-third of the time.

In other studies, researchers have simulated searches for wanted or missing persons in a field setting. In the first such study, Lampinen, Arnal and Hicks (2009a) tested students in five classrooms. Each student was given a picture showing two target individuals, one of whom would later show up in the classroom. In one version of the photograph, the man was shown clean shaven, while in the other he was shown with facial hair. Participants were asked to study the photograph for 4 min. They were told that they could win up to \$100 if they saw the person and contacted their instructor. Two days later the critical target, clean shaven, came to the classrooms, ostensibly to deliver photocopies to the instructor. He turned to the class and in a loud voice said, “Good morning.” He then paused a few seconds, looking directly at the class and then left. Less than 5% of students identified the target, and most of them had seen the picture of the target when he was clean shaven.

11.4 A Theoretical Account of Prospective Person Memory

The low rate of identification in the field study reported above has been replicated many times, and in this section we describe a theoretical account of why prospective person memory is often poor. The model leads us to identify factors that could be manipulated in order to improve prospective person memory. We conceptualize prospective person memory as a probabilistic event, in which a series of preconditions must be met and each precondition occurs in an individual case with some probability. The set of preconditions can be seen as being necessary and sufficient for successful prospective person memory. Thus if even one precondition fails to occur, the individual will fail to have a successful prospective person memory. These preconditions are shown in Fig. 11.1. First, a member of the general public must come into contact with a missing person alert on television, on a poster, through social media or through another source. Second, the member of the general public must attend to the alert sufficiently to encode details of the alert into memory. Sometime later, the member of the general public must come into contact with the missing person. When coming into contact with the missing person, they must attend to the missing person’s face. For a recovery to occur, viewing the missing person’s face needs to trigger a reminding of the previously seen alert. Finally, the individual must take action and

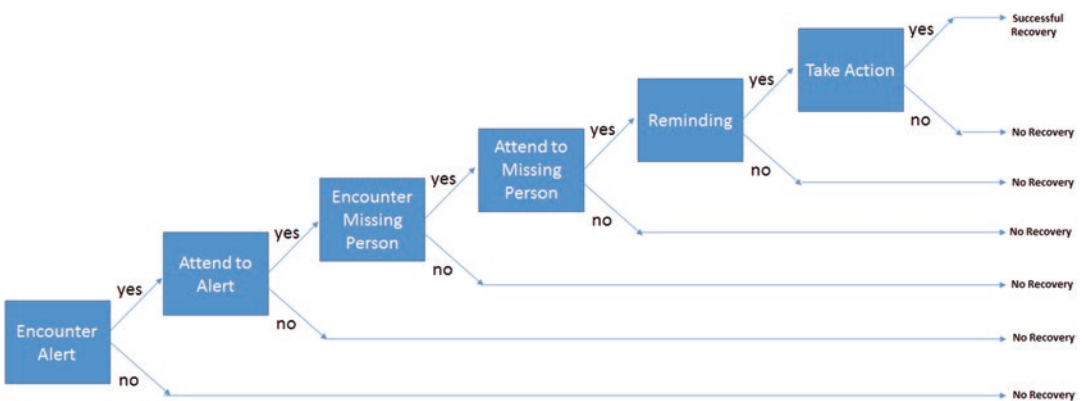


Fig. 11.1 Preconditions for successful recovery via prospective person memory (Copyright: Authors’ own image)

alert authorities. The set of preconditions is large and explains why successful prospective person memory can be difficult. However, this conceptualization also provides a way of focusing public policy on actions that could improve missing person alert systems. It should also be noted that while the probability of all these preconditions being met for an individual person may be small, given wide dissemination, the probability of the preconditions being met for at least one person, may be non-trivial and may lead to recoveries. We organize the remainder of this chapter in terms of this set of preconditions.

11.4.1 Wide Dissemination

In order for a recovery to occur due to prospective person memory, missing person alerts need to be in locations where people are likely to encounter them. Later in the chapter, we present evidence that the probability of an individual noticing a missing person is often very low. Given the low base rate of identifications, it follows that missing person alerts need to be widely disseminated. For instance, in many of the studies reported in this chapter, the probability that a person shown an alert will notice a missing person, is often 5% or lower. Although that percentage is discouraging, it implies that widespread dissemination should be the rule. If there is a 5% identification rate, but 1000 people see the alert and 100 of those people later encounter the target, then the expected frequency of identifications is 5, a number that is certainly sufficient to lead to a recovery.

11.4.2 Attending to Missing Person Alerts

Merely disseminating missing person alerts is not sufficient to result in successful recoveries. This is because alerts only work to the degree that people attend to those alerts. There is a large body of literature in marketing psychology that demonstrates that people are selective in the messages they attend to, and the media marketplace

is saturated with messages (Ratneshwar, Warlop, Mick, & Seeger, 1997; Warshaw, 1978). Thus a major impediment to the effectiveness of missing persons alerts is the degree to which the members of the general public attend to these alerts in the first place.

For instance, consider a study by Lampinen, Arnal, and Hicks (2009b). Researchers placed missing child posters on bulletin boards at the exit of a local supermarket, much like in the widely known supermarket poster campaigns at Wal-Marts in the United States. The posters showed four boys and four girls all missing from the local area. As customers left the store, researchers stopped the customers and asked them to respond to a survey. The vast majority of the customers indicated that they believed the problem of missing children was important. However, 70% of the customers indicated that they had not looked at the posters and approximately 20% indicated that they only looked at the posters briefly. When customers were shown photographs of children, they were unable to identify the children from the missing child posters at greater than chance levels.

Lampinen et al. (raw unpublished data) replicated this experiment, but also asked customers why they failed to look more closely at the posters. These data were coded and are presented in Table 11.1 and Fig. 11.2. The most common reason people gave for not looking at posters of missing children is that the customer simply failed to notice the posters. Customers also frequently cited being too busy. Other explanations given by customers included fatigue, competition from other advertisements, and belief that it would not make a difference (i.e., self-efficacy). To make the posters more prominent, Peters, Lampinen, and Sweeney (2009) placed large foam boards with pictures of missing children at the cash registers of a local supermarket. Prior research in marketing psychology had found that this sort of point of purchase advertising improves memory for products (Pieters & Warlop, 1999; Russo & Leclerc, 1994). Point of purchase advertising also improved attention to and memory for the pictures of missing children. Approximately 75% of customers reported looking at the posters,

Table 11.1 Coding categories for question asking participants why they did not spend more time looking at the pictures of missing children

Category	Explanation	Examples
Busy	Participant indicated that they did not have time to look	“No time to look,” “I was in a rush,” “I was pre-occupied with other things,” “I was focused on shopping”
Didn’t notice	Participants indicated that they walked by the posters without noticing them.	“They didn’t grab my attention,” “Didn’t know they were there,” “Habit, I don’t usually look at bulletin boards”
Didn’t think to	Participant indicated that it did not cross their mind to look	“Didn’t cross my mind,” “Didn’t think about it,” “I was obviously oblivious”
Self-efficacy	Participant indicated that they did not believe that looking would increase their chance of finding a missing child	“Don’t think I could identify a child from a poster,” “Not from around here,” “Do not think pictures are accurate”
Not familiar	Participant indicated that they looked briefly but none of the children looked familiar so they did not look any further	“None of the children looked familiar,” “Looked long enough to see if I recognized anyone, I look longer if someone looks familiar”
Fatigue	Participant indicated that they were too tired to look	“Tired,” “Fatigued”
Competition	Participant indicated that there are so many product ads on the walls of stores that they tune out any advertising on the walls	“Too many other ads”
Look elsewhere	Participant indicated that they did not look longer at the posters in the store because they look at pictures of missing children elsewhere	“I look at work so no need to look at store”
Lack of novelty	Participant indicated that pictures of missing children are so common that they no longer grab the participant’s attention	“Too used to seeing posters,” “Too common to see bulletin boards”
No response	Participant did not respond to survey question	

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compared to 30% in the original study, and memory for the children’s pictures exceeded chance—approximately 60% hits to 40% false alarms.

In addition to location, another factor which may influence attention to missing child alerts is the total number of alerts that people have seen. It is possible that large number of alerts may overwhelm people, and lead them not to attend to the alerts. One example of this general principle is target set size, or the total number of alerts presented at any given time. Lampinen, Peters, and Gier (2012) tested the impact of target set size in a series of three experiments. Participants studied four mock missing child posters or 12 mock missing child posters. They were told to press the “h” key on their computer, if they saw any of the

children at any point in the experiment (they were told “h” stands for “help”). They then engaged in a task meant to simulate being a camp counselor. They saw 46 pictures of children and were asked to sort them into a “P” team and a “Q” team keeping the number of boys and girls equal on the two teams. Four of the forty-six pictures were pictures of children who had been shown in the posters. In Experiment 1, each poster was shown for 15 s. Recognition memory accuracy was not significantly influenced by the number of posters studied. In Experiment 2, total study time was equated for the two conditions. Participants in both conditions had a total of 60 s to study the entire set of posters. In Experiment 2, therefore, there was less study time per poster in the 12 poster condition than the 4 poster condition.

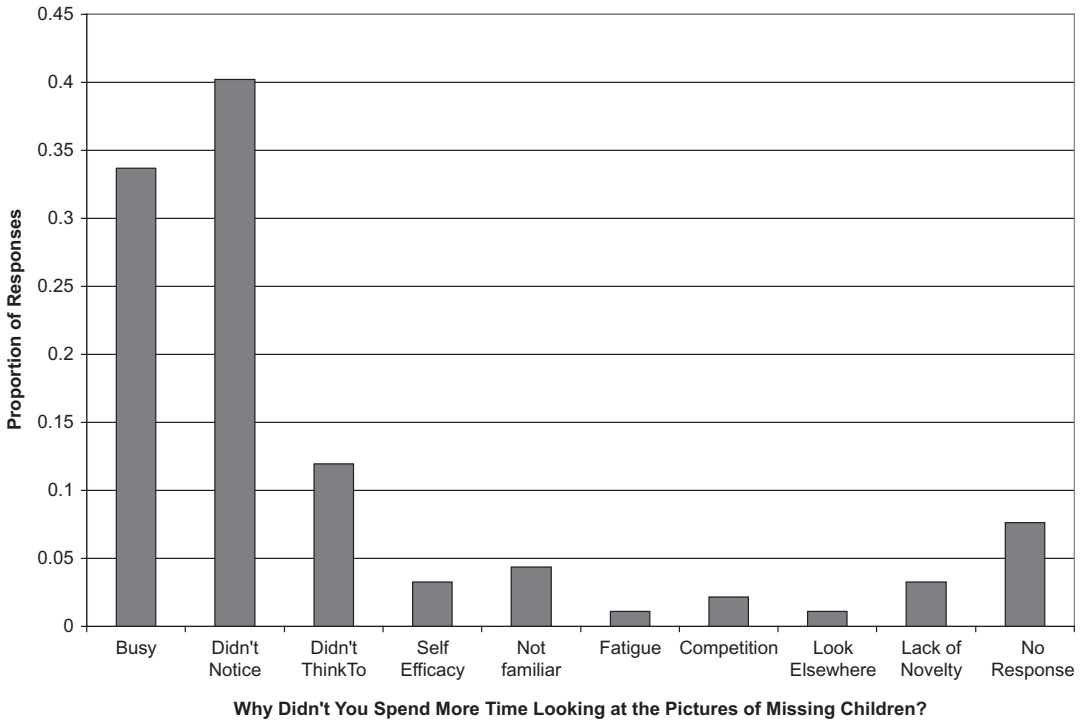


Fig. 11.2 Reasons for failure to attend to missing child posters (Copyright: Authors' own image)

Under these conditions, recognition memory was superior in the 4 poster condition, demonstrating the importance of attention to missing person posters.

In Experiment 3, participants were presented with bulletin boards containing either 4 missing child posters or 12 missing child posters. Participants were told to look at the posters the way they would if they were in a supermarket looking at missing child posters and to take as much time as they liked to look at the posters. While participants looked at the posters, the researcher surreptitiously timed them with a stopwatch. Mean total looking time was almost identical in the two conditions—51.72 s in the 4 poster condition versus 53.68 s in the 12 poster condition. Thus time per poster was much lower when 12 posters were displayed than when 4 posters were displayed. Consistent with this finding, recognition memory scores were significantly lower in the 12 poster condition.

In other research, Lampinen, Erickson, Peters, Sweeney, and Culbertson-Faegre (2012) examined the effect of repeatedly seeing missing person alerts. The impetus for this research was the claim that when AMBER alerts are overused, people tend to tune them out (Griffin, 2010; Chap. 4 this volume). This has sometimes been called the “car alarm effect.” Participants were shown mock missing person alerts in classroom settings. The students were told that if they saw the people depicted in the alert and contacted the researchers that they could win a prize of up to \$200. Some participants (i.e., the car alarm group) saw one mock missing person alert per week for 6 weeks. The first five alerts showed pairs of individuals (a different pair each week) who were supposedly missing in the local area. The people shown were actually residents of another state and were never in the area, making it impossible for participants to identify them. In the sixth week, the alert showed two people, and

following the alert those two people were standing by the exits leading out of the building, ensuring that students would pass one of them as they left the building. Other students saw only a single alert in the sixth week of the study showing the two people who were at the exits. Correct identification was significantly higher in the one video condition than the six video condition (car alarm condition) suggesting that overuse of missing person alerts may make people numb to the alerts.

This finding suggests that when creating missing person alert systems that it is important to use our knowledge of factors that influence attention to create a missing person alert system that draws public's attention to missing person alerts. It is noteworthy that there is a tradeoff between too much information and not enough information. Law enforcement and missing person advocates want to publicize as many active cases as possible among people who are likely to encounter the person. But too many alerts can become overwhelming to people, and attention to individual alerts can then be diminished.

11.4.3 Encountering the Missing Person

Another factor that influences the success of a prospective person memory task is whether the individual actually encounters the missing or wanted person. In laboratory or field experiments, of course, researchers set up situations in which participants necessarily encounter the target individual. But in real life, the probability of encountering the missing person may be relatively small. This implies that (1) maximizing the other factors that influence prospective person memory success is extremely important and (2) that missing person alerts be targeted at people who are most likely to encounter the missing person. One factor to consider in this regard is simply the likelihood of the person being in the geographic area.

11.4.4 Attending to the Missing Person

In order for a recovery to occur through prospective person memory, a member of the general public must not only encounter and attend to a missing person alert, but must also encounter and attend to the face of the missing person. A large body of research, however, demonstrates that people are often relatively oblivious to events and changes in the environment that seem as if they should be readily noticed. For instance, Simons and Chabris (1999) had participants watch a video in which people in black t-shirts and white t-shirts passed basketballs back and forth. Participants were asked to count the number of passes completed by one of the teams (e.g., black t-shirt group). During the film, a person wearing a gorilla costume walked into the midst of the basketball players and beat his/her chest and then walked off screen. About 40% of participants failed to notice the gorilla.² In another study, Simons and Levin (1998) had a researcher stop participants on campus and ask for directions. While directions were being given, men carrying a large door walked in between the two people, and one of the men carrying the door switched places with the person who was receiving the directions. Less than half of the participants noticed the change.

In a more recent study, Hyman, Sarb, and Wise-Swanson (2014) put money in clearly visible locations on the branches of tree that overhung a narrow path on campus. Because of the location of branch, and because the branch was at head height, people walking on the path had to move their heads in order to avoid the branch. Less than 20% of people walking by noticed the money and this dropped to under 10% for people who were using cell phones. How do people fail

²This is averaged across the conditions in which the gorilla and players were opaque. In another set of conditions, the players and gorilla were transparent, and errors were greater in those conditions.

to notice what intuitively seems like obvious environmental cues? The answer is that our attentional resources are much more limited than we are ordinarily aware of and we notice much less of the environment than we think we do (Enns, 2004). These attentional limitations provide constraints on the ability to notice people that we have been asked to be on the lookout for.

Other factors also place constraints on our ability to notice other people in our environment. People encounter dozens of other people during the course of a day, but probably do not spend a tremendous amount of time examining their faces. The reason is partly that staring or closely examining another person's face violates social norms and can be seen as inappropriate or even creepy (Buchanan, Goldman, & Juhnke, 1977; Ellsworth, Carlsmith, & Henson, 1972; Smith, Sanford, & Goldman, 1977). Although, normally this social convention is not impactful, it can limit the effectiveness of missing person alert systems.

Looking behavior is also influenced by the degree to which people believe it is likely that they will encounter the missing person. This follows from Fishbein and Ajzen's (1975) reasoned action model. According to the model, people's actions are a function of their attitudes, cultural norms, and their evaluation of the likelihood of success (i.e., self-efficacy). Most people believe the problem of finding a missing person is an important one and would like to help if they could (Lampinen, Arnal & Hicks, 2009b). But if one also believes that the likelihood of encountering a missing person is low, then one is unlikely to engage in any actions to do so. This account is consistent with both theories of self-efficacy (Bandura, 2001) and rational choice models of decision-making (Neumann & Morgenstern, 2004).

The role of expectancy of encounter was made clear in some research on prospective person memory (Lampinen, Erickson, Sweeney, & Starr, 2015). Participants were told that they were taking part in a study of media psychology, and as part of this study they would watch recent news videos and rate the quality of the videos. Two of the videos were real local news stories, but the third one was a mock wanted person alert.

After participants rated this last video, they were told that the person was not really wanted by police, but if they encountered the person anywhere and contacted the researchers, they could win up to \$200. The students had been selected for this study based on a prescreening questionnaire, which identified the dining hall that they typically attended. The target person was later located in the dining hall at a location that the students had to pass in order to enter the dining hall. To create an opportunity for personal interaction with some of the students, the target passed out fliers to a local play. Out of 112 students who had viewed the video and who the researchers confirmed were at the dining hall on the day in question, nobody reported a sighting. This was despite the fact that, in a follow-up survey, participants were able to pick the target's face out of a lineup well above chance levels.

One factor that could have led to the low rate of identifications was that participants thought the likelihood of encountering the target was low. In the initial survey, participants were asked how likely they thought it was that they would encounter the target. Only 10% of participants thought it was at all likely that they would encounter him. Moreover, participants were asked if they intended to actively look for the target individual. Intention to look for the target individual was significantly correlated with expectation of encounter. In a second experiment, participants were specifically told that based on past research it was known that they had a 90% chance of encountering the target individual. With these instructions, close to 80% of participants thought it was likely that they would encounter the person. In addition, self-reported looking behavior was also higher and there were 4 successful identifications.

The above study concerned participants who were responding to questions about a mock missing person alert. Do people share the same low expectations concerning likelihood of encounter in actual missing persons cases? To examine this issue, Moore and Lampinen (raw unpublished data) surveyed 209 participants and asked them about their experiences with actual missing person alerts. One question asked, "What do you think your chances of encountering an actual

missing person are?” Close to $\frac{3}{4}$ of participants indicated that they believed it was “not at all likely” and almost all of the rest of the participants (23.67%) thought it was only somewhat likely. In addition, approximately two-thirds of the participants thought that it was unlikely they would be able to recognize a missing person if they saw his or her picture and later encountered that person. Given these results it would not be surprising if members of the general public exert relatively little effort in looking for missing persons.

These results suggest, at least tentatively, that one of the hurdles we need to overcome in missing person alert systems is that people who see missing child alerts, missing adult alerts, silver alerts, fugitive alerts, and so on do not think they are likely to encounter the missing or wanted person. Researchers, law enforcement, and missing person advocates need to think about how to target messages to overcome that preconception. Lampinen et al. (2015) did it in a very artificial way in the laboratory; they provided participants with false base rate information indicating a 90% chance of encounter. Ultimately public relations campaigns need to be created that overcome low expectations of encounter. Indeed, situation can be described in terms of a tragedy of the commons (Hardin, 1968). People are likely correct that there is a low probability that any particular individual is going to encounter a missing person. Missing alert systems are not built on the assumption that any particular individual is likely to encounter the target individual. Rather they are built on the assumption that *some* individual is likely to encounter the target individual.

11.4.5 Prospective Person Memory Retrieval

Even after one has seen and attended to a missing person alert and seen and attended to the missing person, there is no guarantee that seeing the missing person will trigger a reminding of the alert. Research on event-based prospective memory generally indicates that people are often far from perfect in remembering to engage in delayed

activities (Breneiser & McDaniel, 2006). For instance, in a study in which participants are asked to make a keyboard response if they encounter the words “door, jacket, hair, or book,” participants will often fail to make the appropriate responses to these words, even if their retrospective memory for those words is intact. This is because prospective memory requires that the prospective memory target spurs a reminding that is not initiated by a direct request from an experimenter.

In prospective person memory, the situation is more complex because facial recognition, even under the best of circumstances, is far from perfect (Bruce et al., 1999). This is especially true when recognizing faces of individuals that we do not have a great deal of familiarity with. A large body of research on the fallibility of facial recognition in the context of eyewitness identification exists (Lampinen et al., 2012). It is well established that mistaken eyewitness identification (that is mistaken face recognition) is the largest cause of wrongful convictions (The Innocence Project, 2006). Laboratory studies have found that when the guilty suspect is in a lineup, witnesses identify the suspect somewhat less than half the time (Clark, Howell, & Davey, 2008). When the guilty suspect is not in the lineup, an innocent person is identified a bit over half the time.

Even when the task does not require memory for the face, but merely matching faces that are perceptually present, facial recognition is far from perfect. For instance, when the ability of grocery store clerks to verify identity based on photo ID cards has been tested, it has been found that they make errors more than 30% of the time (Kemp, Towell, & Pike, 1997). In other research, Megreya and Burton (2008) presented participants with either a person or a picture of a person. While that target individual, or picture of the target individual, was still present, participants were presented with a photographic lineup that either included the target person’s picture (target present) or did not include the target person (target absent). One would think that this procedure would result in very high accuracy rates, but in fact, overall accuracy hovered around 70%.

These findings highlight how difficult it is for people to recognize the faces of strangers that they have seen a single time.

Consequently, prospective person memory involves a complication that is not present in word-based prospective memory tasks. If one is told make press the “/” key if one encounters the word “hair” at any point in the experiment, the task is clear and unambiguous. A word either clearly is, or clearly is not, “hair.” However, if one is told to make a response (i.e., call the authorities) if one sees a particular person, it may be unclear to the viewer whether the face they are looking at is or is not the person in the missing person alert.

One factor that influences prospective person memory for faces of missing persons is the degree to which the photograph matches the missing person’s current appearance. For instance, Gier, Kreiner, and Hudnell (2012) showed participants a mock AMBER alert (see footnote 1), showing photographs of four children. The appearance of each of the children was either clean and well kempt or dirty. On a later memory test, participants were shown new photographs of children from the AMBER alert as well as pictures of other, never before seen, children. Half of the photographs showed the children with a clean appearance and half with a dirty appearance. Participants were more accurate in recognizing the child’s photograph when the appearance in the test photograph matched the appearance in the study photograph. Similarly, when the age of the child in a missing child poster matches the age of the child when seen in the test phase of a prospective person memory task, recognition is significantly higher than when the age of the child on the missing child poster is younger than the child’s age when seen in the test phase of a prospective person memory task (Lampinen, Arnal, Adams, Courtney, & Hicks, 2012).

Although it makes sense to try to match a person’s likely current appearance when producing missing persons alerts, a difficulty arises in that one might not know with any certainty what a person’s current appearance is. Sweeney and Lampinen (2012) addressed this problem by presenting participants with multiple photographs.

In their study, participants studied mock missing child posters that either contained a single image of each child or three images of each missing child. Examples of the posters are shown in Fig. 11.3. Participants were told that if they saw one of the missing children to press the “H” key on their keyboard to “alert the authorities.” After studying the missing child posters, participants engaged in a computer task in which they were asked to imagine that they were camp counselors and that their job was to sort a group of children into two teams. Correct recognition was significantly higher for the multiple photograph condition than the single photograph condition.

Preliminary research from a recent field experiment also suggests prospective person memory may be superior when multiple pictures are shown. Lampinen, Curry, and Erickson (2014) had participants take part in what they thought was a study of media psychology. Participants watched two news stories and provided ratings after each news story. The first news story was a real local story. The second was a mock missing person alert. In the alert, the “missing person” was shown either with her hair down and no glasses (Appearance A) or with her hair up and wearing glasses (Appearance B). The alert either showed a single photograph of the target or two photographs of the target. In the two photograph conditions, the two photographs were either both in Appearance A, both in Appearance B, or one in Appearance A and one in Appearance B. Screen captures from the videos are shown in Fig. 11.4. Subsequent to the news alerts participants were told that the woman was not really missing, but that if they saw her and contacted the experimenters they could win a prize of up to \$200. As participants left the experiment room, the target was standing with her face in plain view in the hallway. For approximately half of the trials, she was wearing her hair up and wearing glasses and for approximately half of the trials her hair was down and she was not wearing glasses. This study is ongoing, but the initial results are shown in Fig. 11.5. As can be seen, despite the fact that the target was in the hallway outside the room where the video was seen and shortly after the video was seen, the vast majority of participants

Example Posters: Single Image



Example Posters: Multiple Images



Example of sequence of slides in the team sorting task

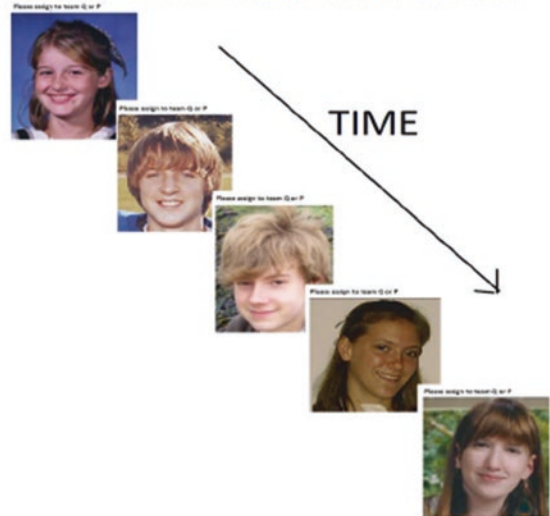


Fig. 11.3 Example posters from the multiple image and single image conditions. Note: Figure is reproduced from Sweeney LN, Lampinen JM (2012) The effect of presenting multiple images on prospective and retrospective per-

son memory for missing children. Journal of Applied Research in Memory and Cognition, 1, 235–241. Copyright 2012, Elsevier, Reprinted with permission

failed to notice the target. Recognition was significantly higher when the photographs in the alert matched the target’s current appearance. Additionally, recognition was higher when multiple pictures were shown in the alert. Importantly, two photographs showing different appearances did just as well as two photographs that both match the current appearance.

Missing person alerts sometimes include photographs not just of the missing person, but also of people who the missing person might be with. This is common in cases where the abductor may be a parent or other family member (Lampinen, Arnal, Adams, Courtney, & Hicks, 2009). The logic behind this approach is that a recovery of the missing person might occur either by virtue of the missing person being identified or the associated individual being identified. However, there

are also reasons to be cautious with this approach. It is possible that including an associated person in a missing person alert may cause attentional resources to be split between the two photographs, resulting in poor memory for the missing person. Moreover, it is possible that when the missing person is actually encountered, he or she might be with a different person. For instance, in a family abduction scenario, a missing child might be with an accomplice of the abductor. In such a case, the fact that the missing person is with an unexpected person (based on the alert) might actually reduce identifications.

Lampinen and Sweeney (2014) addressed this issue by presenting participants with mock missing child alerts that either included an associated adult or did not include an associated adult. Participants were then shown a group of natural-



Fig. 11.4 Screen captures showing the multiple and single image video conditions (Copyright: Authors' own image)

istic photographs showing children and adults. Most of these pictures showed children and adults who were not previously seen. However, a subset of the photographs showed a child who had been previously seen in the missing child posters. Participants were asked to sort the child adult pairings into two teams, but to press the “H” key if either person had been in the mock missing child posters. There were three conditions. Some participants had seen posters that only had a picture of the child. Some participants saw posters that had a picture of the child and the adult that later appeared with the child. Finally, some participants saw posters that had a picture of the child, and an adult who did not later appear in the slides at all. As can be seen in Fig. 11.6,

recognition was best when the poster showed the child with an adult that he or she later appeared with. Importantly, having the child appear with an adult who was different from the adult he or she would later appear with did not impair recognition relative to the child only poster condition.

11.4.6 Taking Action: Reporting the Sighting

The final precondition for a successful recovery due to prospective person memory is for the individual who spots the missing person to take action and report the sighting to the authorities or missing person hotline. It is well known that one

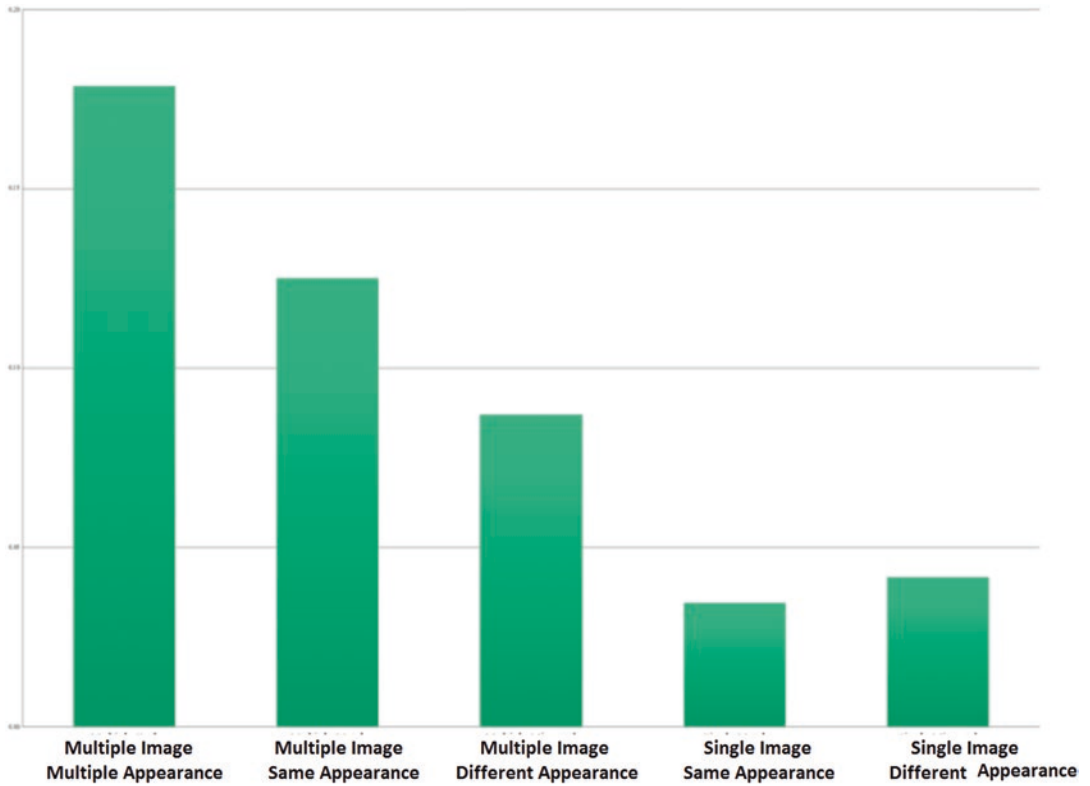


Fig. 11.5 Impact of multiple images on prospective person memory in a field study (preliminary data—data collection is ongoing) (Copyright: Authors’ own image)

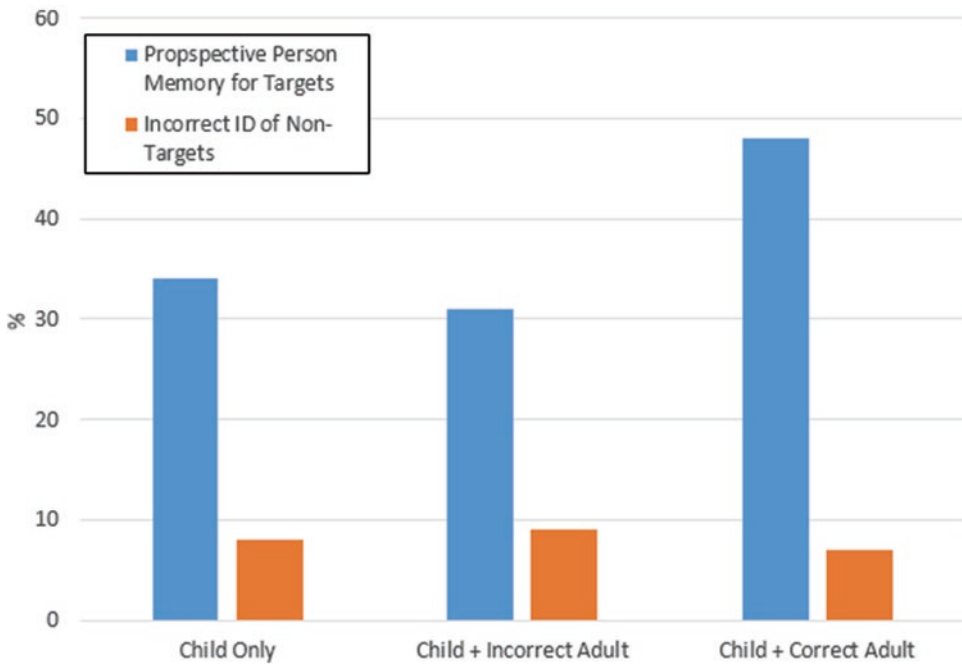


Fig. 11.6 Effects of including an associated adult on prospective person memory (Copyright: Authors’ own image)

difficulty in getting cooperation from the public is that members of the general public often do not want to get involved in law enforcement investigations (Wenik, 1985). Studies of bystander intervention have found that people will often fail to assist others who are in need of help (Darley & Latane, 1968). Bystander intervention is less likely when other people are present (i.e., diffusion of responsibility) and when the situation is ambiguous. Both factors may play a role in the public's willingness to get involved in missing persons cases.

As noted above, because recognizing the faces of strangers is difficult, the appropriate response in a prospective person memory scenario is considerably more ambiguous than in standard word-based prospective memory experiments. Consider a study by Lampinen, Curry, and Erickson (2016) that was designed to simulate a Silver Alert. Participants viewed a mock missing person alert showing a photograph of an elderly woman who was said to be missing. Participants were told that the woman was not really missing, but if they saw her and contacted the experimenters they could win a cash prize of up to \$200. Subsequently, the woman was at the dining halls where the students reported eating lunch in a location that the students had to walk by in order to enter the dining hall. In a follow up survey, the researchers determined which students actually had been at the dining halls on the days in question.

Overall, slightly less than 2% of participants who had seen the video and who had been at the dining hall in the day in question, contacted the experimenters to report a sighting. Another 1% of participants reported a sighting, but the sighting report was mistaken. The researchers contacted the participants and asked them to complete a follow-up survey. One question on the follow-up survey was, "You were asked to be on the lookout for a person as part of a contest. Was there ever a point where you thought you saw someone who might be that person, but you

decided not to report it?" Approximately 13% of the participants who had seen the mock Silver Alert and who were subsequently in the dining hall on the relevant date reported that they did see someone who they thought might be the target individual, but they decided not to report it. Approximately 4% of the participants saw someone who they decided not to report, when in fact the person they saw was the target individual. Note that had these people reported the sighting, it would have more than tripled the number of correct sightings of the target individual. When asked why they did not report the sighting, participants typically indicated that they were not certain in their identification and did not want to look foolish. These results suggest that a major impediment to successful prospective person memory may be that some people who notice the missing person may fail to report the sighting because of uncertainty or because they do not want to get involved.

11.5 Summary and Recommendations

In the present chapter the role that prospective person memory plays in missing persons cases was described. As noted previously, both prospective person memory and retrospective person memory can be important. Given that a missing person alert may be encountered either before or after the missing person is encountered, it is important to maximize both types of memory. An important implication of the present chapter is that it is possible to take what is known about perception, attention, and memory and to use that knowledge to build alert systems that are more effective.

This chapter was organized in terms of a model of the preconditions that are necessary for a recovery to occur due to prospective person memory. In order for alerts to be effective, a member of the general public has to come

into contact with an alert, has to attend to the alert, has to come into contact with the missing person, attend to the missing person, retrieve information from memory, and take action. Failure of any of these preconditions will lead to a lost opportunity to recover the missing per-

son. This fact helps to explain why identification rates are often near floor in field studies of prospective person memory. Assuming that the preconditions are independent then the probability of any given individual reporting a sighting is:

$$p(\text{sighting}) = p(\text{encounter alert}) * p(\text{attend to alert}) * p(\text{encounter person}) * p(\text{attend to person}) * p(\text{retrieve memory}) * p(\text{take action})$$

Given that each of the probabilities of these preconditions is less than 1.00, then the joint probability is likely to be low for any particular individual. However, this does not mean that the situation is hopeless, because a successful recovery does not require that *everyone* who encounters the missing person report a sighting, but that *someone* who encounters the missing person reports a sighting. This implies that successful recovery efforts rely on the joint activities of a large number of people.

Each of these preconditions also provides us with an opportunity to improve the system and increase identifications. The message is to take actions necessary to increase the probabilities associated with each precondition. For instance, widely disseminating missing person alerts in areas likely to be encountered by members of the general public will increase the odds that a member of the general public will encounter the alert. Taking advantage of insights from marketing psychology can increase the probability that alerts will be attended to. In this regard, an important consideration is balancing the need for wide dissemination with the problem of oversaturation. Public relations efforts which emphasize the need to be proactive may overcome low expectations of encounter and increase the odds of attending to the face of a missing person. Taking advantage of more than a century of research on human memory can improve the odds of memory retrieval. And letting the public know that they should report all tips, even if they are not sure, may improve reporting.

None of this is meant to imply that missing person alert systems are a magic bullet. Indeed, the research reviewed in this chapter implies that

missing person alerts will never be perfect in aiding recoveries, but no investigative tool is. Instead, missing person recovery efforts should utilize all investigative tools and should try to maximize the effectiveness of those tools.

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12.1 Introduction

Regardless of the reason for a disappearance, investigations of missing persons' cases necessarily involve people, whether dead or alive. In dealing with people, investigators and scientists must consider the ethics of handling personal or sensitive information and remain respectful of persons (alive or dead) and cultures. Outside of respect for an individual's personhood rights is the need for respect of a family unit and a community, and the possible consequences to them of the disclosure of information. Lastly, ethics of missing persons' investigations must consider the ethical challenges to society of resource sharing, truth-telling, and responsible governance.

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In a classic individual case of a person missing from wrongful action and a loved one seeking her whereabouts or fate, many of the personal ethics (like privacy or resource allocation) are generally perceived as secondary to the critical need to find their family member. Out of desperation, a loved one may forego protections, such as informed consent, in the urgency of the situation. In such cases, where family members become less able than usual to protect themselves, it is essential that the institutions investigating cases ensure protections are in place to prevent abuse of power or misuse of sensitive data, whether during the investigation or after a case is completed. In addition, the institutions may choose to have an ongoing, transparent dialogue with the family out of respect for their wishes.

In contrast, if a person is or is believed to be willingly missing (like a runaway from an abusive home) the ethics of the case may take on a different angle, where transparency may fall secondary to the needs of the victim. Investigating institutions are likely to scrutinize the victim's motivation to go missing in order to determine how to best help the victim.

Further, in a case of a person disappeared due to conflict, state violence or illegal activity, that person and their family may be in current danger (if the conflict is ongoing) or be subject to stigmatization if information is revealed about their identity. For instance, a drug trafficker's child who goes missing near an international border may be subject to investigation by both authori-

ties investigating trafficking and the traffickers who employ the trafficker. In this case, the family of the missing child has few options to investigate the whereabouts of their loved one.

Finally, in cases of mass fatalities, the sheer number of missing and/or dead, and the time and resources needed to recover and identify them, may mean that ethical standards are at risk of being compromised. Increasingly too, mass fatality events involve people from across the globe with all the complexities of differences in culture, law, and ethical norms this entails.

These examples and those presented in Table 12.1, while very different, each highlight the ethical challenges of investigating cases while maintaining the human rights respects afforded to all humans. The issues outlined below may apply broadly to the standard operation of investigations or may be considered case-by-case as issues. Here we discuss the particular challenges in missing persons investigations of (1) stratifying and prioritizing cases, (2) respecting the needs and interests of families, especially with respect to protecting private and/or personal information from misuse or disclosure, and (3) dealing with potentially vulnerable populations. This review therefore just touches upon the sensitive ethical nature of missing persons investigations and paints a broad picture of considerations to be granted to an individual, a community, and our global society.

12.2 Ethical Implications of Stratifying and Prioritizing Investigations

Missing persons cases are numerous and must be ranked, especially when social services and law enforcement have limited budgets and can be short-staffed. Inevitably, different cases of disappearance or identification are given different priorities, for more or less legitimate reasons. Among the first questions asked during a missing persons investigation are how and why did the individual go missing? Answering this question can help to make decisions about prioritization. In some

cases, a person may have been taken against his or her will. In other cases, the missing person may have intentionally left his or her home and community. Disappearances may be caused by external factors, such as illness, social conditions, and mass disasters. For example, many elderly or mentally ill people wander off and the homeless who move may lose touch with their regular shelters or social circles (Biehal, Mitchell, & Wade, 2003; Kiepal, Carrington, & Dawson, 2012). People go missing in large numbers during natural disasters, violent conflict, social or political upheaval, and other incidences of mass disorder, when people tend to be displaced and separated from their family and friends.

The second question asked is how likely is it that the person is alive? The ethical dimensions of search and identification efforts may shift based on the presumed answer to this question for two reasons: (1) the motivations of other individuals to cooperate with any request may be stronger if a missing person is thought to be alive and (2) some ethical issues could be less relevant if a person is known to be no longer alive. The methods used to search for the missing also will shift if a person is presumed dead, which may bring additional ethical concerns, particularly in relation to the handling of human remains and the challenges of respecting cultural preferences while maintaining a potential crime scene (see Chap. 34 for further discussions).

Traditional and social media play a valuable role in missing persons investigations, but can create additional ethical challenges in prioritization and maintaining a truthful investigation. In the first hours and days of a missing persons investigation or mass disaster, information can flow quickly via social media, traditional media, and word-of-mouth. At times, this information can be misleading, incorrect, or imprecise, leading to confusion and anger. Continued attention to a crisis by the media or via social media can elevate a particular event to a higher priority than other events, funneling resources away from other efforts. Likewise, lack of attention to an event may result in inadequate resources to conduct an effective investigation and effort for identification.

Table 12.1 Examples of missing persons' cases and ethical challenges they may pose during an investigation

Case	Potential Ethical Challenges
<p><i>Mass Disaster: Sneha Anne Philip</i> was last seen on september 10, 2001. Because she lived very close to the world trade center and was a physician, her family believed she died while trying to help victims of the 9/11 terrorist attack. A subsequent New York city police investigation revealed she was dealing with problems at work and in her marriage, had possibly had affairs with other women, was waiting on the outcome of pending criminal charges and struggling with drug and alcohol abuse at the time of her disappearance. Her family refuted this information. Nevertheless, based on this information and the lack of physical evidence linking her to the world trade center attack, police investigators concluded possibly she had disappeared for reasons other than the 9/11 attacks. Her family petitioned to have her included in the list of victims of the terror attacks. The surrogate court denied the family's first petition, but the new york state appeals court eventually overturned the ruling. Philip was declared the 2751st victim of the twin towers' collapse on January 31, 2008. Philips' case demonstrates how a missing person's family, law enforcement, and courts can influence the missing person's memory^a</p>	<ul style="list-style-type: none"> • Determining truth without physical evidence • Harm to reputation of a victim
<p><i>Voluntary Missing: Margie Profet</i> was believed to have gone missing after she was last seen in 2005. She had ceased communication with her family in 2002. According to some rumors, Profet may have suffered from mental illness and some suspected she had committed suicide. Seven years after her disappearance, in May 2012, Profet contacted her family after a friend told her that she was thought to have gone missing. She had been living in isolation dealing with an illness that caused her chronic pain. She had not known of the missing persons investigation looking into her disappearance and returned to her family^b</p>	<ul style="list-style-type: none"> • Privacy protections around a mental illness
<p><i>Disappearance: Madeleine McCann</i> disappeared from bed while on vacation with her family and a group of family friends in Portugal on May 3, 2007. She was four years old at the time of her disappearance. Because McCann and her family were UK citizens, the subsequent investigation was a collaboration between Portuguese and British investigators. After the Portuguese police misinterpreted a British DNA analysis report, McCann's parents were named suspects in September 2007. They were cleared as suspects in July 2008. The case received very high media coverage, placing great scrutiny on the McCanns over suspicions that they had been involved in their daughter's disappearance. The McCanns eventually received damages and front-page apologies later in 2008. In 2011, the McCanns testified before the Leveson Inquiry into British press misconduct. The case called attention to press standards and the need for tighter regulations in order to protect families of missing persons^c</p>	<ul style="list-style-type: none"> • Sharing of family information across international borders • Errors in forensic analysis • Prioritizing investigation of a high-profile case • Privacy of families

(continued)

Table 12.1 (continued)

Case	Potential Ethical Challenges
<p><i>Disappearance: Kyron Horman</i> was reported missing on June 4, 2010, when he did not return home from school. He was seven years old at the time. In late June 2010, Horman's father told investigators his wife, Horman's stepmother, had offered to pay their landscaper to kill Horman. Investigators unsuccessfully attempted to obtain evidence of Horman's stepmother's involvement. On June 1, 2012, Horman's mother filed a civil lawsuit against Horman's stepmother seeking \$10,000,000 in damages from Horman's stepmother for her responsibility in Horman's disappearance. On July 30, 2013, Horman's mother announced she was dropping the civil lawsuit because it could interfere with the ongoing law enforcement investigation^d</p>	<ul style="list-style-type: none"> • Conflicting objectives and actions of family and law enforcement
<p><i>Accidental Disappearance: Socorro "Lee" Pelias Rakoski</i> went missing from her home in Florida. Because the 81-year-old woman suffered from dementia, a Silver Alert was issued. The alert was canceled days later when she was found in Texas. Police in Texas spoke to her and determined she was competent and able to make decisions, but she was admitted to a hospital for dehydration and malnutrition^e</p>	<ul style="list-style-type: none"> • Assessing need for special alert in cases of mental incompetence or risk to health
<p><i>Kidnapping: Arjan Erkel</i> is a Dutch medical aid worker for Médecins Sans Frontières. He was leading efforts to provide medical care to refugees from Chechnya when he was kidnapped by three unknown gunmen. He was released 20 months later after the Dutch government paid a one million Euro ransom. The Dutch government, claiming it had paid the ransom as a loan to MSF, sued the organization for refusing to pay back the ransom amount. It was the first time a government sued a relief agency. The case raises questions about who is responsible for ensuring the safe return of missing persons—while the Dutch government claimed MSF was financially responsible for the ransom, MSF responded that they had not agreed to pay any ransom out of concerns that it would set a precedent, allowing their workers to be seen as "walking bank safes"^f</p>	<ul style="list-style-type: none"> • Identifying who is responsible for the safe return in abductions
<p><i>Disappearance: Daniel Morcombe</i> was a 13-year-old Australian boy who was abducted on December 7, 2003. Early in the investigation into Morcombe's disappearance, law enforcement identified Brett Peter Cowan as a possible suspect because he had a criminal history related to child molestation and because he lived near the area where Morcombe was last seen. No forensic evidence connected Cowan to Morcombe's disappearance, so law enforcement opened an undercover investigation that eventually allowed law enforcement to charge Cowan with Morcombe's murder in August 2011. Later that month, bones were found and DNA testing confirmed they were Morcombe's. On March 13, 2014, Cowan was found guilty in the murder of Daniel Morcombe and sentenced to life imprisonment^g</p>	<ul style="list-style-type: none"> • Law enforcement duty to carry out justice • Pursuing investigations without physical or forensic evidence, instead based on criminal history

(continued)

Table 12.1 (continued)

Case	Potential Ethical Challenges
<p><i>Disappearance: Shannon Louise Matthews</i> is a British girl who disappeared when she was ten years old on February 19, 2008, in Dewsbury, West Yorkshire, England. Matthews was found on March 14, 2008, in the home of her mother's partner's uncle. The investigation revealed that Matthew's mother had planned the kidnapping in order to gain the reward money generated through publicity on the case. Both Matthew's mother and the uncle were found guilty of kidnapping, false imprisonment, and perverting the course of justice. After Matthews was found, local police placed her under police protection where she received care from social services. After police lifted the mandatory protection order, Matthews elected to remain in the care of family services^h</p>	<ul style="list-style-type: none"> Assessing when family reunification is in the best interest of a victim
<p><i>Disappearance: Santos Interiano</i> disappeared while illegally entering the United States in June 2013. He had been led by smugglers from El Salvador, through Guatemala and Mexico, and into the U.S. He had maintained cell phone communication with his sister over the course of his journey. Especially after crossing the border into the United States, Interiano expressed growing desperation and fear for his safety. The smugglers subjected him and other migrants to harsh living conditions and threats to their safety. About a month later, Interiano's father received a phone call from an unknown caller. The caller stated that Interiano was found dead with his identification card, but was unable to provide proof of Interiano's death. Interiano's sister, who was living in Boston, unsuccessfully attempted to report her brother as missing to U.S. authorities. It is likely that authorities could not file a report on Interiano because he disappeared while breaking a law. Interiano's family was eventually able to file a missing persons report with the Salvadoran government and his sister continues to check U.S. NamUs in hopes of finding more information on her brother's disappearanceⁱ</p>	<ul style="list-style-type: none"> Effect of legal status on whether a disappearance can be investigated

^a<http://nymag.com/news/features/17336/>; http://www.nytimes.com/2008/02/02/nyregion/02dead.html?_r=0

^b<http://blogs.nature.com/news/2012/05/missing-biologist-surfaces-reunites-with-family.html>; <http://www.psychologytoday.com/articles/201204/the-mysterious-case-the-vanishing-genius>

^c<http://www.theguardian.com/uk/2008/jul/21/madeleinemccann.internationalcrime>; <http://www.theguardian.com/uk/2012/apr/27/madeleine-mccann-hope>; <http://www.newstatesman.com/law-and-reform/2008/10/madeleine-mccann-daily-british>

^d<http://www.kgw.com/story/local/2014/11/02/11732984/>; http://www.oregonlive.com/portland/index.ssf/2012/06/desiree_young_seeks_10_million.html

^e<https://silveralertbill.com/category/silver-alert-success-stories/page/12/>

^f<http://www.andrewbalcombe.com/writing/ahostagesjourneyarjenerkel.pdf>; <http://www.swissinfo.ch/eng/ngo-claims-victory-in-ransom-lawsuit/5785506>

^g<http://www.brisbanetimes.com.au/queensland/police-confirm-remains-were-daniel-morcombes-20110828-1jg65.html>; <http://www.brisbanetimes.com.au/queensland/daniel-morcombe-murder-trial-verdict-brett-peter-cowan-sentenced-live-coverage-20140314-34qtl.html>

^h<http://www.theguardian.com/uk/2008/dec/04/shannon-matthews-kidnap-mother>; <http://www.yorkshireeveningpost.co.uk/news/latest-news/top-stories/shannon-found-shannon-made-subject-of-care-order-1-2174640>

ⁱ<http://www.bostonglobe.com/metro/2014/07/26/students-make-efforts-identify-immigrants-buried-unmarked-graves-near-southwest-border/4iDqnsqHzu9m8N6pPZXf1/story.html>

When a person is reported missing, investigators consider all aspects of his or her disappearance in order to define the goals of the investigation and develop optimal strategies to accomplish these goals. An investigator may start by characterizing a missing persons case to determine factors such as how the individual went missing, whether another person was involved in the individual's disappearance, whether any circumstances (such as mental illness or mass disasters) could have caused or affected the disappearance, and what conditions he or she may be under while missing (e.g., access to food and water, shelter, or psychological stress).

Agencies prioritize cases to maximize the number of people who can receive aid and ensure individual cases are handled as efficiently and effectively as possible. Which agency is named to be the lead on an investigation affects the resources available, access to records, and ability to interact intimately with the community and with wider infrastructure. The agencies' policies will dictate how long to investigate a new case and when to cease active efforts.

The circumstances of a person's disappearance can indicate whether the missing person is in imminent danger. For example, an abductor might threaten to harm the missing person. Additionally, the missing person may not be able to care for him or herself or may not have access to food, water, or medication. Some individuals may often be inherently more vulnerable (e.g., children, elderly or disabled people, or those with mental health difficulties). Investigators are likely to place high priority on locating individuals whose safety or health are at risk. This prioritization in many cases would be subjective in nature thereby risking errors in judgment that may endanger the missing person or lead to additional psychological harm.

Assessing the urgency of a missing persons case may also help law enforcement and other investigators determine the most appropriate strategy for locating the missing individual. For example, in the United States, the National Silver Alert Act allows law enforcement to release information regarding the disappearance of an individual with a known cognitive impairment.

Silver Alerts are particularly useful when an individual might not be aware that he or she is missing or could unintentionally harm him/herself or others. A Silver Alert allows law enforcement to tap public support in order to quickly locate a missing person when there is imminent risk of harm to the missing person or others.

During an emergency response to disaster, law enforcement, and other relief agencies' limited resources are spread especially thin, and identification of the dead may seem less important. However, accounting for the dead and displaced allows relief agencies to budget limited resources, dispatch aid workers to places with the greatest need, and establish long-term plans to provide displaced individuals with travel and identification documents, and access to shelter, education, and financial support. Identifying the missing soon after a crisis allows them to be returned to their homes and families and minimizes the psychological and social trauma of disaster on families and communities (Williams & Wienroth, 2014), arguably helping with the process of recovery. However, in these contexts too, the ethics of prioritization may be questioned. Identification teams may, for example, be under implicit or even explicit pressure to prioritize the identification of particular nationalities or ethnic groups over others (see Chap. 14 this volume).

12.3 Respecting the Needs and Interests of Families

The disappearance of a loved one can place significant emotional, psychological, and financial stress on the family of the missing person. Families of missing persons often feel they cannot have closure until their loved one is found, even if he or she is found deceased (Scully, 2014). Many families may also view their effort to aid identification as an act of care for their loved one and consider identification critical to beginning the grieving process (Woods, 2014). In many cases, families want to receive the remains of their missing loved one in order to give their loved one proper respects in death. This in itself raises ethical challenges as cultural

differences in handling remains of loved ones vary vastly around the world. Whereas in one culture remains should be buried, another may find cremation or burial at sea more suitable. Still others may prefer the final resting spot to be that in which their loved ones died and wish that the remains be returned to the place where he or she is found. As investigators locate human remains, these cultural differences must be balanced with the need to investigate a potential crime or human rights abuse.

More practically, identification is also necessary for families to receive social benefits associated with confirming a relative's death, such as reparations, compensation, life insurance, or state support (Parker, London, & Aronson, 2013; Scully, 2014; Woods, 2014). The right to know the facts discovered over the course of a missing persons investigation might apply to entire communities, in addition to families of the missing. Some have argued that societies have a right to know and understand events that impact their history, for example, during transitions from war to peace (ICMP, 2014).

Usually, families work closely with law enforcement and other investigators to find their loved one. Understanding the psychological and social benefits of biological identification (including genetic identification, fingerprinting, forensic pathology, and forensic odontology) for families can motivate law enforcement to avoid viewing cooperating family members simply as a "means to an end" for an investigation and can ensure certain protections, rights, and access to support for the family of the missing (Biehal et al., 2003; Haimes & Toom, 2014). The interests of the family, however, can sometimes conflict with the aims of law enforcement or other aid agencies or even with the interests and rights of the missing person. Such conflicts raise important questions regarding the rights of the family during a missing persons investigation. For example, in the identification of human remains found after the 2009 bushfires in Victoria, Australia, the authorities were criticized for what has been described as sole reliance on biological, physical, and genetic factors for identification that unnecessarily delayed the reconciliation pro-

cess and exacerbated the personal and social distress to families (Turney, 2010). In some investigations, the family may be involved and informed from the outset in the process (e.g., mass disaster), in which case the investigators should maintain an open dialogue to the extent the family wishes. But in many cases investigators cannot assume the family to be uninvolved in the disappearance, in which case the investigators may keep aspects of the missing persons investigation from the family. With missing persons investigations often taking many years to pursue, what has and has not been shared with family members may be vague over time, leaving the family feeling left out and uninformed. At the same time, the integrity of the forensic process must be maintained until the reason for disappearance is determined.

Fingerprinting, forensic pathology, and forensic odontology are frequently included in standard identification operating protocols for missing persons investigations (De Valck, 2006). Biological identification generally requires cooperation with biological family members of missing persons, often requiring samples of the biological family members closely related to the missing person. Forensic pathology requires consent of family members; odontology requires cooperation of family to provide records. DNA-based identification increasingly is becoming a primary method of missing persons identification because of its reliability and efficiency. In fact, genetic identification sometimes is expected in legal proceedings (Williams & Wienroth, 2014). In mass disasters, genetic identification is often (though not always) the most expedient method of handling numerous cases at once (see Chap. 25 for discussion of ethics in using DNA in missing persons).

Family members and loved ones also can provide important information on the circumstances of the missing person's disappearance. Family dynamics are complex, as are the relationships between law enforcement and families, particularly when a disappearance may implicate somebody close to the victim. It is important over the duration of an investigation that proper consideration is given to the effects

of an investigation on the individuals, the family unit, and the community.

However, when considering reunification of families, law enforcement and social services also consider circumstances that could endanger the missing person after he or she is found. Over the course of some investigations, law enforcement might question whether the missing should be returned to their families or instead be given referrals to appropriate social service agencies who can help rehabilitate individuals who chose to leave their communities. For instance, when a person enacts his or her own disappearance, he or she might be motivated by factors, such as domestic problems and violence (Kiepal et al., 2012). Law enforcement might discover a history of domestic abuse, poor living conditions, or inadequate access to education, and ultimately determine that the missing, once found, should not be returned home.

12.4 Geneticization of Family Relationships

The application of contemporary identification tools, such as DNA identification, implicitly creates a power imbalance when communities directly affected by disaster or crime become reliant on the states and agencies with access to and control over these technologies (Bennett, 2014; Parker et al., 2013; Scully & Williams, 2014; Williams & Wienroth, 2014). In particular, concerns have been raised regarding how modern states and agencies, in using these tools, might influence sociocultural definitions of family. As the use of genetic identification becomes more common in missing persons' cases, families defined outside of genetic relationships as understood by contemporary science are excluded from identification efforts. This can result in misunderstandings between investigators for whom the term "brother" denotes a narrow, clearly defined genetic relationship, and members of cultures where "brother" can mean something much looser and indeed not imply a genetic relationship at all.

Some have argued that the growing use of DNA-based identification implicitly gives primacy to biological family relationships, resulting in the "geneticization" of families and the marginalization of families defined by nonbiological, social relationships (such as adoption) (Bennett, 2014; Scully & Williams, 2014). Furthermore, families defined by nonbiological relationships may face greater obstacles in legal cases and gaining access social benefits or aid because they are unable to provide scientific "proof" of identity or relatedness (Stevens, 2012). Such sociocultural differences present a challenge for investigators to protect the rights of nonbiological family members while continuing their efforts to identify missing persons as efficiently as possible. Indeed, using genetic information rather than social information about families may reveal relationships that were previously unknown to some parties (see Chap. 25 for additional discussion) (Cox & Jones, 2014; Parker et al., 2013).

Some families also may refuse to accept a declaration of death. For example, following the Srebrenica massacre in Bosnia and Herzegovina, it was common for families to refuse death certificates issued when many bodies had not been clearly identified (Wagner, 2008; Williams & Crews, 2003). They expressed concerns that their loved ones were being "written off" as deceased simply in order for the case to be closed and for the country as a whole to "move on" into a new political settlement. Especially in cases of mass disaster, when there is a critical need to restore overall social or political order, it is in the interest of governments and law enforcement to treat mass disaster victims as whole populations, rather than individuals. Often, individual victims in these scenarios cannot be afforded the attention ascribed to individuals in single missing persons scenarios because of the scale of the event (Hunter & Simpson, 2007). Indeed, the interests of the families may clash with how law enforcement and relief workers conduct their work. As such, concerns have been raised that families are at risk of being "instrumentalized" and "objectified" by investigators (Edkins, 2011; Williams & Crews, 2003).

12.5 Privacy Concerns of the Missing and Their Families

In addition to the material benefits associated with identification alone, family members often want information about their loved one's case that law enforcement or medical professionals might discover over the course of the missing persons investigation (Woods, 2014). In some cases, however, a missing person might not want his or her family to know the circumstances of how he or she went missing. There is a wide legal and philosophical literature on the question of whether it is possible to commit wrongs against individuals who are unaware of the events, for example, through slander while they are alive or by failing to respect their wishes after death (Taylor, 2014; Woods, 2014). It is often left to the discretion of investigators to balance the rights of the family to know what happened to their loved one, and the missing or dead person's right to privacy.

Any investigation into the whereabouts of an individual, his/her associates, and lifestyle is bound to reveal sensitive information about a person's private life. As with any criminal case, privacy intrusions seeking information that may help solve the case are secondary to the need to protect the public, and hence allowable in most jurisdictions. The challenge is how to release and use this acquired information to aid the investigation while also preserving privacy as far as possible. How this information is handled by the authorities working a case, shared with other authorities, and shared with the public, all open ethical debate about the boundaries of state intrusion and personal privacy.

Missing persons investigations can involve multiple agencies, including law enforcement, healthcare professionals, emergency response, social workers, and members of the legal system. Personal information might include less sensitive information on appearance, age, and time and place last seen as well as more sensitive information, such as implicit connection to illegal activity or a history of domestic violence. Such information, particularly surrounding the circum-

stances of a disappearance, can be exchanged at a high rate between multiple agencies, and even across state or national borders (Scully & Williams, 2014). Missing Children Europe, for example, is an umbrella organization working with groups in 27 EU states along with a growing number of non-EU countries. It runs a hotline allowing parents to report their children missing. Missing Children Europe connects parents to law enforcement, social services, and/or emergency services in the area where their child went missing and provides direct emotional, psychological, social, legal, and administrative support to parents. Concerns have been raised regarding the security of these exchanges, the confidentiality protections afforded to the people connected to the data, and how to handle disclosure of sensitive information (Knoppers, Saginur, & Cash, 2006; London, Parker, & Aronson, 2013; Parker et al., 2013; Scully, 2014).

Taking into consideration the limited resources for missing persons' investigations and the need for efficient identification, law enforcement may also solicit help from the public. The U.S. Silver Alert program allows law enforcement to disseminate information on an individual's disappearance as well as private medical information, including conditions that affect the person's competence. In doing so, law enforcement may reveal personal information about the missing person without his or her explicit consent. Silver Alerts allow public dissemination of private health information, making it particularly important that involved authorities carefully consider whether the individual's right to privacy outweighs the risks for the missing individual or to others (Wasser & Fox, 2013).

In some countries, like the U.S. and Australia, missing persons databases are run directly by state agencies, like the U.S. National Institute of Justice coordinated National Missing and Unidentified Persons System (NamUs). NamUs includes a variety of information on missing persons and found remains, such as name, age, physical characteristics, and circumstances of a disappearance. More sensitive information is restricted only to authorized individuals in law enforcement, medical examiners, case managers,

social workers, and others involved in conducting the investigation, while the least sensitive information can be accessed or submitted by the public. The Australian Federal Police also run a searchable database of profiles of people who went missing within Australia and abroad. The profiles include names, ages, physical descriptions, photographs, and circumstances of disappearances. The system also allows the public to report disappearances and provide information on a missing person. Similarly, the National Crime Agency UK Missing Persons Bureau maintains the national database on missing and unidentified persons, and coordinates information on missing persons cases; it has a searchable website that the public can use to try to identify missing family members. Such systems must be kept secure in order to prevent the unintentional release of sensitive information. The risk of abuse of power may be greater in countries with different ideas about privacy, confidentiality, and human rights, and where privacy protections may not be in place.

In some cases the missing individual may have wanted to keep secret the circumstances of his or her disappearance, while the family might want access to all the facts uncovered during the investigation. The question of what information to disclose is left to the discretion of the agencies involved and could require discussion and agreement among multiple agencies. Whether or not to disclose particular data associated with a disappearance depends entirely on the circumstances of a case, the discretion of the investigators, and how the individuals reporting the missing person are perceived. This case-by-case evaluation means that, at times, personal information may be released to the public on an individual who may be alive and well but seeking refuge from the individuals reporting the disappearance.

Providing DNA samples for identification can maximize the chances of family reunion if their loved one is found alive. Family members may even feel morally compelled to consent to providing biological samples for kinship comparison. Considering the substantial personal benefits of identification to family members, it is important to ensure families are well informed of risks

associated with participation in DNA testing (see Chap. 25 on privacy challenges of genetic information), including the discovery of incidental findings (such as misattributed paternity) and the predictive value of genetic information (Parker et al., 2013).

One organization that has made substantial of DNA matching technology for identification is the International Commission on Missing Persons (ICMP), an intergovernmental organization that works with governments, law enforcement, civil society groups, NGOs, and families of the missing. ICMP typically becomes involved in efforts to identify missing persons after armed conflict, human rights abuses, natural disasters, and organized crime. It has developed several programmatic strategies that fall under two primary objectives: to provide technical support for governments, law enforcement, and justice institutions and to foster public participation and social and political advocacy. ICMP recognizes the sensitive nature of genetic information and other types of information families might provide, and emphasizes that genetic information should be accessed and used only for purposes to which the family member has explicitly consented. As a result, ICMP processes and stores genetic information on missing persons, but does not share it routinely with law enforcement (International Commission on Missing Persons, 2014). However, since ICMP's processes maintain integrity as an accredited forensic laboratory, the International Criminal Tribunal uses ICMP's identification of victims of the Srebrenica massacre to support prosecutions for the former Yugoslavia (ICTY) in The Hague.

12.5.1 Databases

Concerns about security and privacy raise questions as to who should have access to and who should administer interoperable databases containing information on missing persons. Government-held DNA databases can be readily monitored for quality and security. Databases held by private entities, such as NGOs or entities with diplomatic immunities, are less secure, but

could minimize abuse of power. Some citizens may also have concerns about the use that might be made of their information by government bodies. A network of databases amongst cooperating institutions could suffice, but authorities without conflicts of interest must oversee parameters for searching and accessing such an infrastructure. Who collects and has access to sensitive family information might impact the future utility of such information. For example, information collected solely for identification purposes may be used against a family's will for surveillance or public safety applications. As such, it is important that families cooperating with investigators provide explicit consent regarding how information should and should not be used (ICMP, 2014).

12.5.2 High-Risk and Vulnerable Populations

Earlier it was noted that families of missing persons might be considered generally vulnerable, because in these particularly fraught circumstances they may be less likely to take proper account of issues such as confidentiality. Missing persons investigations notably involve populations that are high risk and vulnerable in the more traditional sense, such as the homeless, unemployed persons, immigrants, refugees and asylum seekers, sex workers, and disadvantaged youth. When working with these populations, it is particularly important for authorities to consider the rights of the missing and their families to privacy, personal security, and to receive the same protection from law enforcement as anyone else.

Research has demonstrated that "social exclusion" is a critical risk factor that predisposes individuals to go missing (Kiepal et al., 2012). The concept of social exclusion encompasses a number of challenges, such as exclusion from the labor market, weak or limited relationships with family and friends, and lack of access to state support. Family relationships, employment, and social and state institutions often establish structures that allow individuals to maintain routine participation in social activities and tie them to certain locations. Social

relationships and professional obligations create greater motivation for individuals to remain in their communities. Socially excluded individuals may disproportionately experience poverty, low skill levels, unemployment, domestic problems, crime, substance abuse, mental illness, and poor health (Kiepal et al., 2012). Moreover, social exclusion limits access to resources to cope with such adversity. These challenges can force socially excluded individuals to resort to running away or make them vulnerable to crime or other circumstances that cause them to go missing (Kiepal et al., 2012).

Additionally, individuals with few or no family members, friends, or colleagues might not be reported missing to law enforcement if he or she disappears from his or her community. Even when a socially excluded individual is reported missing, law enforcement and social services may consider many disappearances of socially excluded individuals voluntary and, therefore, place low priority on subsequent missing persons investigations. As such, not only are socially excluded individuals more likely to go missing, they are at a greater risk of being harmed after disappearing. Investigators and law enforcement must take these risk factors into consideration in order to avoid neglecting missing persons cases of socially excluded individuals.

Isolation from familial, social, or professional ties can lead disappearances to go unreported or unnoticed. Even when a disappearance is reported, few family, friends, or community members may be available to aid investigators attempting to locate the missing person. Socially excluded communities or individuals also may mistrust law enforcement and government authorities and be reluctant to cooperate with personnel appointed to work with the family. As such, social exclusion can also affect how the subsequent missing persons investigation is carried out (Kiepal et al., 2012). Although law enforcement often rely on cooperation from families and communities in missing persons investigations, they should be prepared to use alternative methods to complete their investigation and provide equal protection for socially excluded populations.

Social exclusion also can contribute to extra vulnerability when people are exposed to certain kinds of natural disaster leading to mass death. For example, poorer people often are more likely to live in areas prone to flooding, or in housing that gives less protection in earthquakes; to lack the resources to leave a dangerous area, to have alternative accommodation to go to, or even to have access to warnings about impending danger. Older or disabled people may physically be unable to escape from a dangerous area rapidly enough, and be dependent on assistance from others. Finally, specific populations may be more vulnerable to disappearing as a result of state violence, particularly if they are targeted for political or other reasons.

One approach to addressing the higher risk of disappearance of certain populations is use of surveillance technologies to trace their locations or identities. Global Positioning Software (GPS) may be applicable to tracing locations of people with potential wandering tendencies such as those with dementia or schizophrenia. GPS also can be applied to locating children and teenagers. In fact, tracing cellular signals is an important component of missing persons that are suspected to have a cellular phone at the time of disappearance. Expanding this technology to persons at high risk of disappearing opens a range of privacy concerns for both living and deceased individuals. Genetic information too may be valuable in identifying persons at risk of disappearing or dying unidentified. For examples, migrants, the homeless and street sex workers may be easier to identify post-mortem through pre-emptive DNA collection of these high-risk persons (Katsanis, Kim, Minear, Chandrasekharan, & Wagner, 2015).

12.6 Summary

Missing persons investigations call for law enforcement, families, and communities to consider the circumstances surrounding a person's disappearance as well as the conditions he or she might be living under while missing. Missing persons' investigations can raise concerns about

the missing person and his or her family's rights to privacy, personal security, equal protection under the law, and to know the truth about a disappearance, versus the interests of other actors (e.g., the state). It is, therefore, necessary to consider the unique circumstances of each case to maximize benefit and minimize harm for the missing person(s), respect the rights and interests of the family, and ensure justice is achieved.

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Forensic Genetics Against Children Trafficking: Missing Children Genetic Identification

13

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13.1 Human Trafficking

According to UNODC, Article 3, paragraph (a) of the Protocol to Prevent, Suppress and Punish Trafficking in Persons:

Trafficking in Persons is the recruitment, transportation, transfer, harbouring or receipt of persons, by means of the threat or use of force or other forms of coercion, of abduction, of fraud, of deception, of the abuse of power or of a position of vulnerability or of the giving or receiving of payments or benefits to achieve the consent of a person having control over another person, for the purpose of exploitation. Exploitation shall include, at a minimum, the exploitation of the prostitution of others or other forms of sexual exploitation, forced labour or services, slavery or practices similar to slavery, servitude or the removal of organs.

Human trafficking involves the forced transfer of a person and the use of their services in order to recruit them for commercial trafficking. Frequently, the consent is obtained but through deceitful acts and false promises. Many times, due to the social conditions of the victim, they are not aware of being exploited (Crimes, 2009). To make it easier, a person is trafficked if he or she is forced or tricked into a situation in which he or she is exploited. Child trafficking differs from human trafficking in that no force or deception needs to take place in order to prove that a child has been trafficked. This difference is based on the fact that a child is considered incapable of taking an informed decision.

13.1.1 Elements of Human Trafficking

Human trafficking usually consists of three stages. In the first stage, the victims are recruited; in the second, they are transported; and in the third, they are exploited. At the *recruitment stage*, criminals use many methods to force or trick people into being trafficked. In some cases, the people are abducted and assaulted. In other cases, however, the people are offered good jobs and attractive opportunities that do not actually exist or that force them into exploitative labour and living conditions. At the *transportation stage*, victims may be moved by land, sea, and/or air,

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openly or covertly, in groups or alone, using public or private means of transportation. People can be trafficked across legal or illegal border crossings, or, in cases when persons are trafficked inside the borders of a country, no border crossing at all.

At the *exploitation stage*, victims may be obliged to do any of the following:

- Have sex or be sexually assaulted
- Work in places such as factories, restaurants, farms, plantations, mines, or homes (as domestic helpers), without the right to rest or the option to leave
- Have an organ removed
- Beg, sell illegal drugs, or fight as child soldiers
- Get married

The initial consent of an adult to perform a certain kind of work or perform a certain kind of service is rendered meaningless if the person has been forced or tricked into an exploitative situation. One form of exploitation does not necessarily exclude another: a victim can be trafficked for labour exploitation and, at the same time, be sexually exploited. Anyone knowingly involved in any stage of the trafficking process is a trafficker and is guilty of a crime.

13.1.2 Trafficking in Children

Children, the most fragile and innocent members of society, can be subjected to many abuses. Indeed, one of these abuses is human trafficking, an apparently lucrative criminal activity. According to UNICEF, ‘an estimated 300 million children worldwide are subjected to violence, exploitation, and abuse including the worst forms of child labour in communities, schools, and institutions; during armed conflict; and to harmful practices such as female genital mutilation/cutting and child marriage’. In the United States figures demonstrate the magnitude of the missing children problem within a country. Approximately 800,000 children are reported missing each year. Of these, approximately 360,000 are runaways and 340,000 are classified

as ‘missing with benign explanation’, and about 100,000 are abducted either by family members or other known individuals or are lost and/or injured (Crimes, 2009; UNICEF, 2004). While these figures are disturbing, they relate to mostly domestic situations and do not represent the greater international problem where children are illegally sold for malevolent purposes. These numbers also mainly show domestic situations and do not represent the huge international problem of the harmful illegal trade of children. Recent reports give information about the nature of trafficking of children but its real scale is still not clear. In 2002, the International Labour Organization (ILO) estimated that 1.2 million children are kidnapped and trafficked in a year (Hagemann, 2002).

13.1.2.1 Examples of Child Trafficking and Slavery

Worldwide, child trafficking for illegal adoptions, prostitution and sexual exploitation, forced labour and slavery, the use of child soldiers, delinquency, and similar circumstances is an international problem which has become pandemic. That is why there is a need to guarantee that families are genuine in cases of adoption and to bind together missing children with relatives of missing children. About 27 million children all over the world are slaves (International Labour Office, 2012).

Newborn Trafficking Gang in Fumian (China)

A hospital in the Fumian district, in Yulin (China) was the centre of a newborn trafficking gang involving workers of the maternity ward of a hospital. The case had huge media impact because many reliable doctors and employees were involved. Out of the 52 members accused, 11 were doctors and nurses. Doctors or nurses could get paid 5 Euro for each non-wanted baby, and then they resold them for 300 Euro, depending upon the baby’s appearance and the baby’s health. The mother also had to sign a contract giving her child up for adoption and promising not look for them in the future (Magazine A Fondo N° 858).

Slave Children in Volta, Ghana

While most children between 4 and 14 are either at school or playing with their friends, more than 3000 trafficked children who work in the fishing industry in Ghana are forced to work under the searing heat of the sun. Bonded into labour due to poverty, these children (some as young as 4 years old) spend their days on Lake Volta—paddling boats, collecting fish, diving under water to disentangle nets, or working as domestic helpers in fishermen's homes. They are not given the opportunity to go to school and are often ill-treated and malnourished. They work under terrible labour conditions working more than 15 h a day, without salary and only a meal per day. Slave children of Volta are part of a lucrative and long-running business where traffickers pay around 50 Euro and take the children from their families or legal tutors. A fisherman can own even 30 children, valuable for their tiny hands which are ideal for working with the nets. They are also cheap; they obey their commands and their innocence increases their courage and audacity.

Since 2002, IOM Ghana and its partner NGOs and Government agencies have been working to rescue trafficked children from the fishing communities of Yeji, in the Brong-Ahafo Region and Kete-Krachi and Kpando in the Volta Region of Ghana. Through the programme, IOM Ghana has rescued over 700 children who were subjected to exploitative labour. After their rescue, children participate in rehabilitation exercises and are reintegrated into their communities of origin (el semanal n° 863 de ABC).

13.2 Worldwide Initiatives Against Children Trafficking and Exploitation

13.2.1 UNODC-UN.GIFT

We must ensure that children are treated humanely and in keeping with national and international standards. In an effort to combat human trafficking and especially to protect children (and women), the United Nations launched the *UN-Global Initiative to Fight Human Trafficking*

(UN.GIFT) in March 2007 (UN, 2007). Such initiatives demonstrate that governments recognize the significance of the problem of human trafficking and the need to take to eradicate the victimization of children. International agreements and policies must be in place to track, identify, communicate, and share data for effective prosecution of perpetrators and for the rehabilitation of child-victims. Global coordination play a crucial role, but legal and societal difficulties that include data access and disclosure among countries exist that substantially slow down the progress of implementing a comprehensive and effective counter-trafficking system.

The UN.GIFT was created to promote the global fighting against human trafficking based on international agreements achieved by the United Nations. To date, 140 groups have signed the protocol for the prevention, suppression, and punishment against human trafficking which complete the Palermo Convention against the transnational organized crime (Crimes, 2009). UN.GIFT was launched in March 2007 by International Labour Organization (ILO), the Office of the High Commissioner for Human Rights in Human Nations (OHCHR), the United Nations Children's Fund (UNICEF), the United Nations Office on Drugs and Crime (UNODC), the International Organization for Migrations (IOM), and the Organization for Safety and Co-operation in Europe (OSCE).

The Global Initiative is based on a simple principle: human trafficking is a crime of such magnitude and atrocity that it cannot be dealt with successfully by any government alone. This global problem requires a global, multi-stakeholder strategy that builds on national efforts throughout the world. By encouraging and facilitating cooperation and coordination, UN.GIFT aims to create synergies among the anti-trafficking activities of UN agencies, international organizations, and other stakeholders to develop the most efficient and cost-effective tools and good practices (UNODD, 2009). UN.GIFT aims to mobilize state and non-state actors to eradicate human trafficking through the reduction of both the vulnerability of potential victims and the demand for exploitation in all its forms,

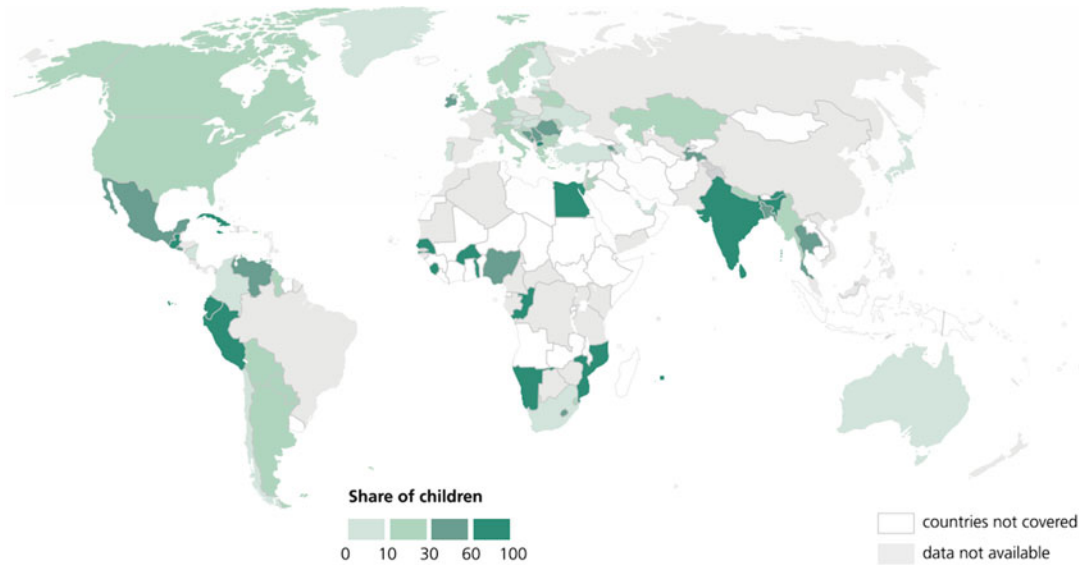


Fig. 13.1 Share of children among the total number of detected victims of human trafficking. Figure taken from the Global Report on Trafficking in Persons 2014 (UNODC, 2014)

ensuring adequate protection and support to those who fall victim; and supporting the efficient prosecution of the criminals involved, while respecting the fundamental human rights of all persons.

In carrying out its mission, UN.GIFT increases the knowledge and social conscience on human trafficking; promotes effective rights-based responses; and encourages partnerships for joint action against human trafficking (Fig. 13.1).

13.2.2 International Organization for Migrations (IOM)

IOM, first known as Provisional Intergovernmental Committee for the Movements of Migrants from Europe (PICMME), was created in 1951 after the chaos and migrations to occidental Europe after Second World War. IOM's history is written parallel to disasters caused by humans and natural disasters in this middle century, Hungary in 1956, Czechoslovakia in 1968, Chile in 1973, refugees from Vietnam (known as "Boat people") in 1975, Kuwait in 1990, Kosovo and Timor in 1999, the Asiatic tsunami, and the earthquake of Pakistan

in 2004 and 2005. IOM is committed to the principle that humane and orderly migration benefits migrants and society.

Since its creation as a logistic organization, IOM has expanded its labour to the limits of being the main international organization that works with governments and civil society to promote the understanding of migrations, increase the socioeconomic development through migrations, and safeguard the honour and comfort of migrants. The increasing scale of its activities walks hand in hand with the expansion of the IOM that has changed from a little organism to be an Organization with a budget of nearly 1000 millions of Dollars (USA) and a staff of 5400 people in more than a hundred of countries all over the world.

IOM is the reference point in the world debate of social, economical, and politics repercussions of migrations in the twenty-first century. IOM has been working to counter the trafficking in persons since 1994. In this time, it has implemented more than 800 projects in over 100 countries, and has provided assistance to approximately 20,000 trafficked persons. Its primary aims are to

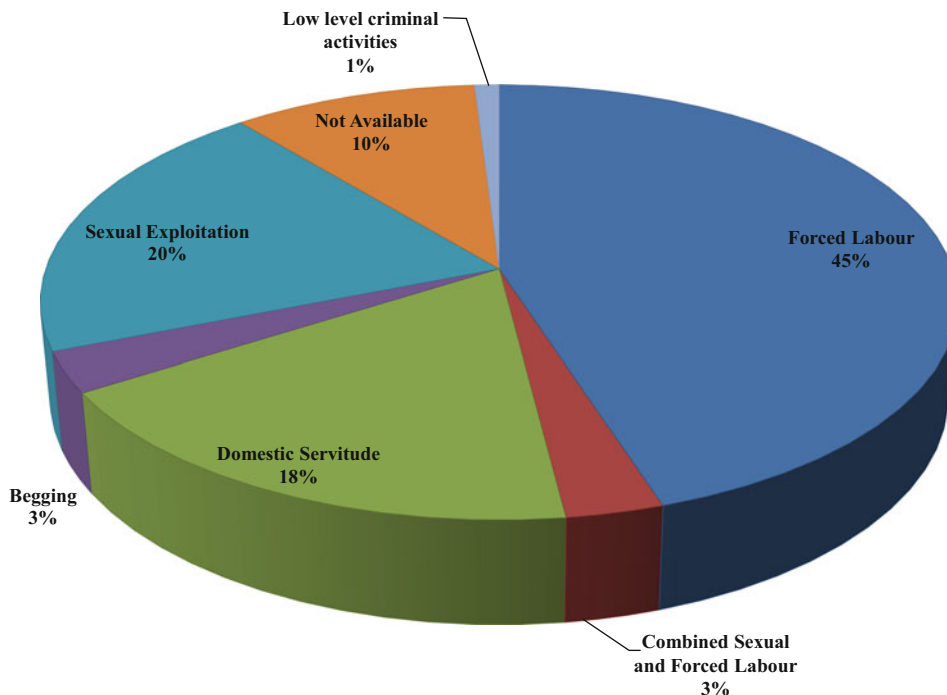


Fig. 13.2 Main causes of human trafficking reported by IOM in 2012 (International Organization for Migration, 2012)

prevent trafficking in persons, and to protect victims from the trade while offering them options of safe and sustainable reintegration and/or return to their home countries.

IOM has assisted about 5498 cases of human trafficking victims in 2012. More than a half of these persons were adults (72%), 28% were under 18 years old. Of all these cases, 58% were women and 42% were men. The main purposes of human trafficking were reflected in Fig. 13.2 as well as the world distribution of cases of human trafficking (Fig. 13.3) (International Organization for Migration, 2011, 2012).

This kind of initiative show that governments are aware of the real problem of human trafficking, and that some steps should be taken to fight against child trafficking. However, there are many obstacles to overcome in human trafficking. International agreements to identify, look for, communicate and share data, as well as intercept the criminals and help the victims have to be established. Worldwide legal and political coordination plays a crucial role, but legal and social difficulties slow the process for the implementation of a system against human trafficking.

13.2.3 International Labour Organization (ILO): International Programme on the Elimination of Child Labour

The ILO's International Programme on the Elimination of Child Labour (IPEC) was created in 1992 with the overall goal of the progressive elimination of child labour, which was to be achieved through strengthening the capacity of countries to deal with the problem and promoting a worldwide movement to combat child labour. IPEC currently has operations in 88 countries, with an annual expenditure on technical cooperation projects that reached over US\$61 million in 2008. It is the largest programme of its kind globally and the biggest single operational programme of the ILO.

The number and range of IPEC's partners have expanded over the years and now include employers' and workers' organizations, other international and government agencies, private businesses, community-based organizations, NGOs, the media, parliamentarians, the judiciary, universities, religious groups, and, of course,

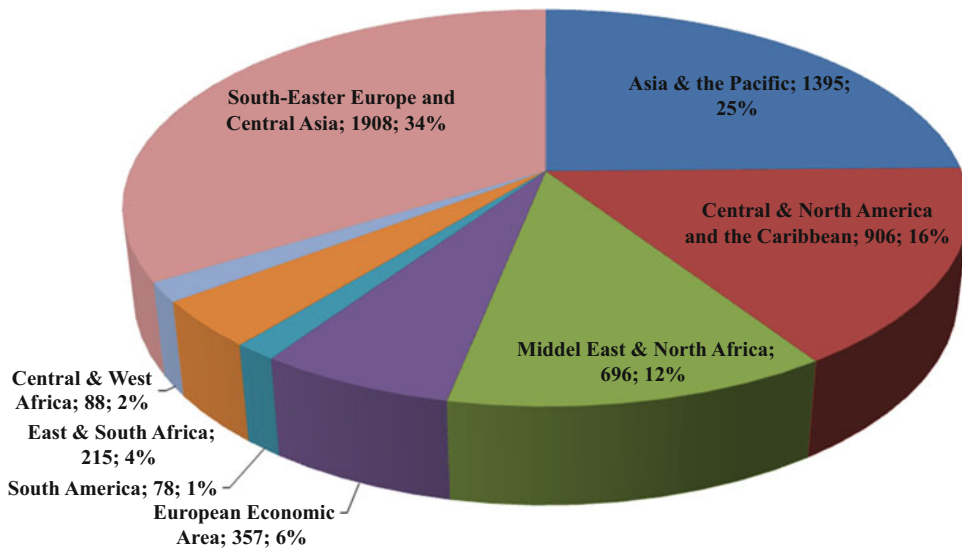


Fig. 13.3 Global distribution of human trafficking cases attended by IOM in 2011 (International Organization for Migration, 2011)

children and their families (International Labour Office, 2002).

IPEC's aim is the progressive elimination of child labour worldwide, with the eradication of the worst forms an urgent priority. Since it began operations in 1992, IPEC has worked to achieve this in several ways: through country-based programmes which promote policy reform, build institutional capacity, and put in place concrete measures to end child labour; and through awareness raising and mobilization intended to change social attitudes and promote ratification and effective implementation of ILO Child Labour Conventions. These efforts have resulted in hundreds of thousands of children being withdrawn from work and rehabilitated or prevented from entering the workforce. Complementary to this direct action throughout has been substantial in-depth statistical and qualitative research, policy and legal analysis, programme evaluation, and child labour monitoring, which have permitted the accumulation of vast knowledge base of statistical data and methodologies, thematic studies, good practices, guidelines, and training materials (International Labour Office, 2012).

The term 'child labour' is often defined as work that deprives children of their childhood, their potential and their dignity, and that is

harmful to physical and mental development. In its most extreme forms, child labour involves children being enslaved, separated from their families, exposed to serious hazards and illnesses, and/or left to fend for themselves on the streets of large cities—often at a very early age. Whilst child labour takes many different forms, a priority is to eliminate without delay the worst forms of child labour as defined by Article 3 of ILO Convention No. 182:

- 1.1. All forms of slavery or practices similar to slavery, such as the sale and trafficking of children, debt bondage and serfdom, and forced or compulsory labour, including forced or compulsory recruitment of children for use in armed conflict.
- 1.2. The use, procuring, or offering of a child for prostitution, for the production of pornography or for pornographic performances.
- 1.3. The use, procuring, or offering of a child for illicit activities, in particular for the production and trafficking of drugs as defined in the relevant international treaties.
- 1.4. Work which, by its nature or the circumstances in which it is carried out, is likely to harm the health, safety, or morals of children (Table 13.1).

Table 13.1 Sectoral distribution of child labour (5–17 years)

Agriculture	Industry	Services
<ul style="list-style-type: none"> • Agriculture 	<ul style="list-style-type: none"> • Mining and stone extraction • Construction and public services 	<ul style="list-style-type: none"> • Wholesales
<ul style="list-style-type: none"> • Hunting 		<ul style="list-style-type: none"> • Hotels and restaurants
<ul style="list-style-type: none"> • Forestry 		<ul style="list-style-type: none"> • Transports
<ul style="list-style-type: none"> • Fishing 		<ul style="list-style-type: none"> • Storing and communications • Finances • Insurances • Commercial properties. • Other social and personal services

Compiled data from ILO (International Labour Office, 2012)

13.2.4 National Center for Missing and Exploited Children

Established in 1984, the *National Center for Missing and Exploited Children*® (NCMEC) is the leading nonprofit organization in the USA working with law enforcement, families, and the professionals who serve them on issues related to missing and sexually exploited children. This organization gives information and resources to authorities, families, and minor victims of abuses as well as to other kind of professionals.

Thirty years ago, police could enter information about stolen cars, stolen guns, even stolen horses into the FBI's crime database—but not stolen children. Several tragic cases began to awaken the nation to the problem that there was no coordinated national system for addressing missing children cases. In 1979, 6-year-old Etan Patz vanished from a New York street on his way to school. Over the next several years, 29 children and young adults were found murdered in Atlanta. Then in 1981, 6-year-old Adam Walsh was abducted from a Florida shopping mall and later found brutally murdered. That is why NCMEC was created (National Center for Missing & Exploited Children, 2010a; Sedlak et al., 2002).

In the same year, the Congress of the United States approved the Law of Assistance of missing children, and the *National Resource Center and Clearinghouse on Missing and Exploited Children* was established. Nowadays, there is a national toll-free hotline for missing children available 24 h. Only in 2013, the operation centre

of NCMEC received more than 183,000 calls. To date, more than four millions of calls have been received. Around 800,000 of complaints of missing children each year are received. Most of them are rapidly found. The NCMEC is involved in the most serious cases in those the minor is in a high risk. In 2013, NCME received 10,094 case reports of missing children and helped to find 10,531 missing children. The percentage of rescued minors increased from 62 % in 1900 to 97 % in 2013 (National Center for Missing and Exploited Children, 2010a). The organization works with the dissemination of photos and posters of children to catch public attention through its website, www.missingkids.com, and a programme of distribution of the photos that gather organizations and companies managing the distribution of pictures of the missing children and millions of people all around the world (National Center for Missing and Exploited Children, 2010b; Sedlak et al., 2002).

13.3 The DNA-PROKIDS Program: DNA to Fight Crime on Children

Because of the importance of the children trafficking problem and based on our experiences with the Phoenix Program (Lorente et al., 2000) and those at the University of North Texas Health Sciences Center and Center for Human Identification (UNTHSCCHI), we have launched DNA-PROKIDS (Program for Kids Identification with DNA Systems) located at the University of

Granada and in collaboration with UNTHSCCHI. The Program is an international effort to help identify missing children, provide support to their relatives and to contribute to efforts against human trafficking. This nonprofit program is supported by the Spanish Government, the Andalusian Government, and donations from private companies and foundations (BBVA, Banco SANTANDER, CajaGranada—BMN and Life Technologies).

13.3.1 History

The initiative DNA-PROKIDS was created in 2004 by Dr. José Antonio Lorente, director of the Genetic Identification Laboratory of University of Granada. After a pilot study from 2006 to 2008 in countries from Central America and Asia, it became a worldwide action. In 2009, with the collaboration of Prof. Bruce Budowle and Prof. Arthur Eisenberg, from the Human Identification Center of University of North of Texas, (UNT-HC); and with private financial support, it started the international expansion of the project. Nowadays, the collaboration has expanded to China, India, Indonesia, Philippines, Nepal, Sri Lanka, Thailand, Brazil, Guatemala, and Mexico. The first forerunner of DNA-PROKIDS was celebrated in October 2009 in Granada, gathering all the most expertise of this field all over the world.

In January 2010, Dr. José Antonio Lorente and Prof. Arthur Eisenberg met experts of 'DNA Analysis Laboratory of the Natural Sciences Research Institute' and Philippine Council for Advanced Science and Technology Research and Development' with the main aim of informing and advising these organizations about the initiative.

In 2010, the 'First International Congress of DNA-PROKIDS: Genetic identification against children trafficking', called together scientists, international organizations, NGOs, and law enforcement agencies. The main aim was to establish a global alliance against the human trafficking through the use of new technologies in genetic identification.

The main conclusions of the congress led to the development of actuation protocols in five special fields:

1. International conscience about the human trafficking problem, especially of minors, and the possibilities of using DNA typing as a tool for fighting against it.
2. The promotion and establishment, inside the legal framework of each country, of the genetic identification of children who do not live with their families and those given into adoption, to avoid illegal adoption cases.
3. The consensus in technical and analytical protocols compatible with sample collection, data analysis, data scrambling, and national and international data comparison. The systematization of sharing data protocols, alarm, and searching through DNA to avoid human trafficking.
4. The organization of scientific experts' meetings to coordinate methods and protocols in genetic identification; as well as legal experts that, through the analysis of national legislations, study the possibility of adopting common measurements to combat human trafficking.
5. The consensus about the real need of the formation of professionals to fight human trafficking (sanitary, judicial, and police services).

13.3.2 Objectives

The main mission of DNA-PROKIDS is to identify the victims and return them to their families (reunification), to hamper traffic in human beings thanks to identification of victims, and to gather information on the origins, the routes and the means of this crime (police intelligence) and key elements for the work of police forces and judicial systems.

The objectives in which DNA-PROKIDS is based are:

1. Promoting international and systematic collaboration, creating a worldwide database with genetic information in order to achieve: reintegration of missing children into their families using DNA comparison with families

of human trafficking victims prevention of illegal adoptions of kidnapped, stolen, or trafficked children, by checking the biological link between children and their relatives (mother, father, grandparents) who put them up for adoption.

2. Studying and applying improvements to enable police and judicial systems to fight more effectively against traffic in human beings, especially in children and women.
3. Analysing and suggesting common legislative frameworks to solve the problem.
4. Assessing and solving social and communication problems that hamper an effective fight against traffic in human beings.
5. Providing collaboration for the coordination and training of specialists in genetic identification from different countries.

DNA-PROKIDS is composed of three tiers. The first tier is at the national level with two genetic databases or indices per country. One index is for DNA profiles and nongenetic data obtained from children who, after proper investigation, are found in an illegal situation (e.g., not living with the natural family because these children were kidnapped or 'adopted' illegally). The other index consists of DNA profiles and nongenetic data voluntarily provided by relatives (parents, siblings, and other family members and whenever possible, 'adoptive' mothers) or from personal items of reported missing children. The DNA profiles in these two indices will be compared routinely to assist in identifying missing children. DNA-PROKIDS first tier pilot programmes are in effect in Guatemala and Mexico followed by Brazil and China. Coordination amongst these countries and other countries are highly recommended. Without coordination, systems, such as those that include nonoverlapping genetic markers operated using incompatible software may be developed which do not allow effective data exchange at the detriment of an effective strategy to fight child trafficking globally.

The power of identity testing and database searching will be most effective if DNA analysis is performed in every single case of a child being given to adoption. Furthermore, when possible, the mother (or other available biological rela-

tives) should also be tested to confirm her relationship to the child and their right to relinquish the child. Implementation of this act alone would reduce crimes related to children, where children who had been kidnapped, are sold for adoption.

The second tier is at international level. This will allow development of the infrastructure required to share data among countries through various existing approved links and networks as well as through establishment of new, specific links. International cooperation requires agreements from participating laboratories to identify a common set of DNA markers for routine genotyping of all samples in relation to the programme; the type of nongenetic data that should be collected; the extent of information that can be shared observing confidentiality requirements that may differ per state; and tapping sufficient and sustainable financial support to establish such programmes in various countries.

The third tier is focused on data generation. There will be a universal automatic, mandatory inclusion (with signatory countries) in the database of (1) any reported child found out of his/her family (without legitimate reasons); (2) children who are going to be adopted (and before any adoption can be made it will be necessary to confirm that the child has not been reported as missing anywhere in the world); and (3) the immediate inclusion of voluntary relatives of missing children (Fig. 13.4).

Many efforts are performed to increase the database and facilitate communications between countries, like collaborations with INTERPOL in criminal investigations that will make criminals reluctant to commit these actions against children (illegal adoptions, exploitation, and trafficking).

13.3.3 Genetic Identification

Standard kits for the collection of samples have been developed for all the countries participating on DNA-PROKIDS initiative. These kits have cotton swabs, finger blood puncture devices and an informed consent questionnaire, chain of custody documents and personal data fulfilled by donors; as well as details about sample collection and contact details (Fig. 13.5).

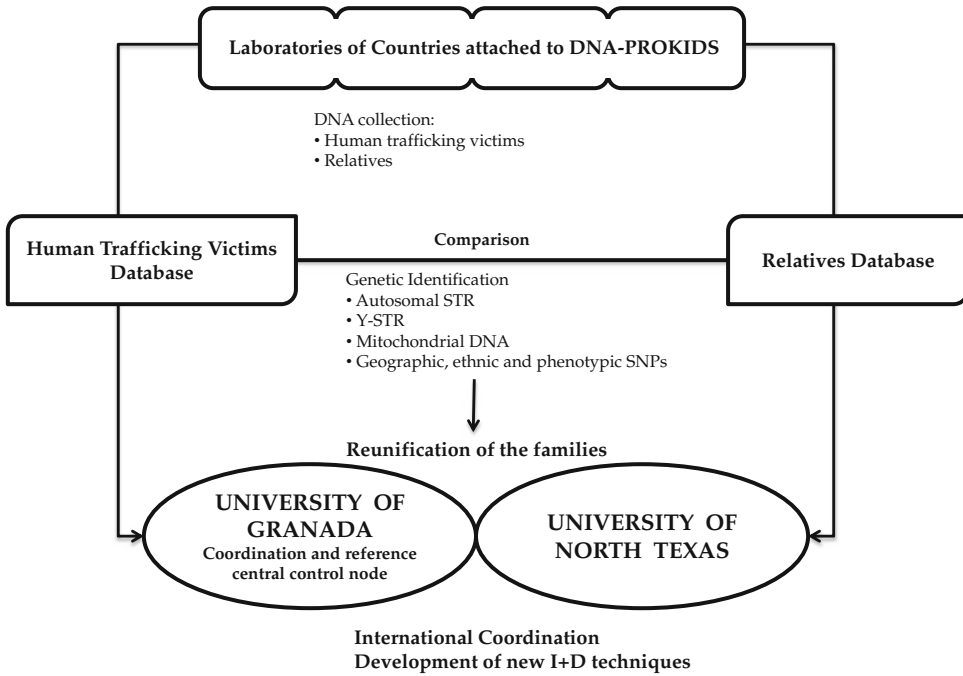


Fig. 13.4 Scheme to follow in the initiative DNA-PROKIDS (Copyright: Author’s own image)

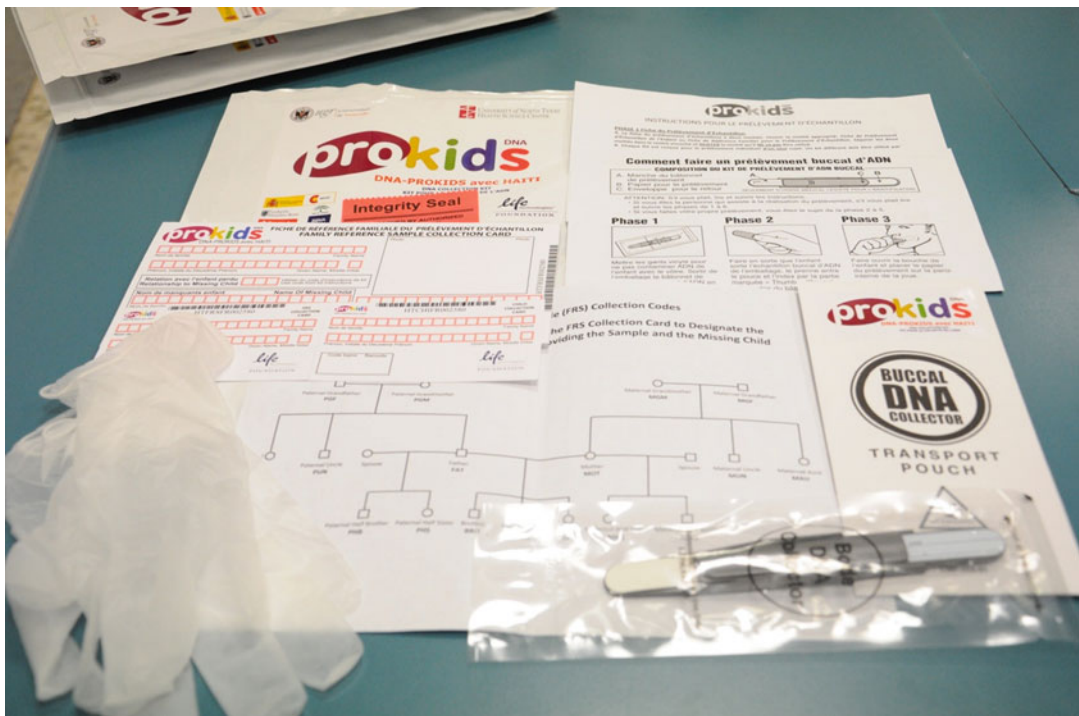


Fig. 13.5 DNA-PROKIDS samples collection kit (Copyright: Author’s own image)

Fig. 13.6 Collection data form and informed consent of DNA-PROKIDS programme (Copyright: Author’s own image)

DNA-PROKIDS makes use of the same robust DNA typing methods used for forensic casework and those described above for missing persons identification. These markers are extensively validated and substantial data exist that support their utility. In addition to STRs and mtDNA, single nucleotide polymorphisms (SNPs) are particularly suited for a programme like DNA-PROKIDS (Bulbul et al., 2009; Daniel, Sanchez, Nassif, Hernandez, & Walsh, 2009; Gross, Zaumsegel, Rothschild, & Schneider, 2013; Walsh et al., 2013). SNPs are genetic variants that are the result of substitutions or insertions/deletions at one or a few bases in the genome. They occur at about 1 SNP/1000 bp in the human genome and account for approximately 85% of human genomic variation. Millions of SNPs have been identified and a subset of these is suitable for

identity testing. They would help to increase the probability or likelihood ratio in cases of positive association, and also to overcome problems related to mutation that could occur more so with STRs and mtDNA.

The form contains data about the donor like gender, familiar relationship with missing minor, and a photo of the individual (Fig. 13.6).

13.4 Conclusions

13.4.1 Efficiency of DNA-PROKIDS Program

The application and usefulness of DNA identity testing already are well documented. To date, DNA-PROKIDS-participating countries have

analysed over 2500 cases (from Mexico, Guatemala, El Salvador, Paraguay, Peru, Bolivia in Latin America, and the Philippines, Thailand, Indonesia, and India in Asia), and there are more than 4200 registered samples and compiled in databases. DNA analyses, first and subsequent application of accompanying meta-data, have already helped to identify more than 560 missing children, who have been returned to their families; and more than 250 illegal adoptions that have been avoided. If not for this intervention, it is likely these children would have been given or sold into illegal adoptions, would still be under exploitation, or would have died without identification. Additionally, their respective families would still be suffering the loss of their children. Beyond the identification of these children and returning them to their families, the database could play a deterrent role. Efforts, that increase the size of the database and facilitate communication among countries, such as is encountered with various criminal investigations through INTERPOL, may make criminals more reluctant to commit these heinous crimes on children (trafficking and exploitation, illegal adoptions) because at least authorities will more likely be able to identify and apprehend perpetrators.

If these programmes were enacted, the ability to immediately identify reported missing children would not only permit returning them to their families, but also would begin to compromise criminal network operations. More operational data and updated information can be found at www.dna-prokids.org

13.4.1.1 Law of Alba-Keneth Alert System

After the establishment of DNA-PROKIDS in Guatemala, the *Law of Alba-Keneth Alert System* was approved and exposed. This law was named like this in honour of two children, Alba Michelle España and Kenneth López Agustín. Alba Michelle España Díaz was 8 years old and lived in the suburb of La Barrera, Camotán, Chiquimula. She disappeared the 14th June 2007, just one day before she was 9. Her corpse was found in a lamentable way. Kenneth Alexis López Agustín was 4 years old and he was from Jalapa.

He was missed 16th December 2009. His corpse was found with his throat cut and buried under a house's patio on the 23rd December. In both cases, the accused confessed that they were paid a large amount of money for the children.

The *Law of Alba-Keneth Alert System* is a combination of coordinated actions between public institutions that allow acceleration, localization, and protection of the children or adolescents who have been murdered or are missing, as well as the recuperation and protection of them. All public institutions must participate in the frame of the *Law of Alert System Alba-Keneth*. This law contemplates the creation of a national database of missing or abducted minors with the aim of supporting families and create a DNA bank of missing children and their relatives to confirm in an immediate way their biological relationship between individuals (Tanto, 2010).

13.4.2 Solved Cases Thanks to DNA-PROKIDS

13.4.2.1 Haiti Earthquake

The 12th January 2010 at 16:53:09 local hour, an earthquake of 7.3 scale and lasting more than a minute devastated the area of Prince Port (Haiti). The effects caused in this country, which was the poorest of all Latin America, were catastrophic with 316,000 deceased people, more than 350,000 wounded, and more than 1.5 million people lost their homes. It is considered as one of the most severe humanitarian catastrophes in history.

At the end of January, a total of 25 Haitians minors were moved to Santa Cruz (Bolivia) after the earthquake, accompany by two Haitians and a Bolivian who could not certify their familiar relationship. Police suspicions prevented them from being trafficked to Brazil or Argentina. Of this group of minors, 13 have been returned with their true families after genetic identification, thanks to the DNA-PROKIDS initiative developed by the Bolivian General Fiscally. The remaining 12 children that could not be genetically identified stayed in Bolivia where the police and judicial research is kept on until the moment that they are identified or delivered to the Haitian Government.

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Missing Persons Investigations and Identification: Issues of Scale, Infrastructure, and Political Will

14

Soren Blau

History counts its skeletons in round numbers. A thousand and one remains a thousand, as though the one had never existed

(Szymborska, 2001: 38–39)

14.1 Introduction

“One of the tragedies of missing persons is that it does not discriminate; it is universal. It crosses race, age, gender and class” (Warrington, 2012).

There are a variety of different contexts in which men and women of all ages may go missing: an individual may involuntarily go missing as a result of an accident or misadventure; alternatively an individual may choose to leave family and friends and begin a new life without providing any details (Edkins, 2011; James, Anderson, & Putt, 2008; Newiss, 1999); large numbers of people may be reported missing following a natural or human-made disaster; defense personnel may go missing in action during wartime or periods of conflict; or individuals or groups of people may be “disappeared” as a result of periods of ethnic, religious and/or political violence. In each case, it is the lack of information about the fate of the missing person that creates numerous emotional,

legal, financial and health costs for surviving family members and the broader community.

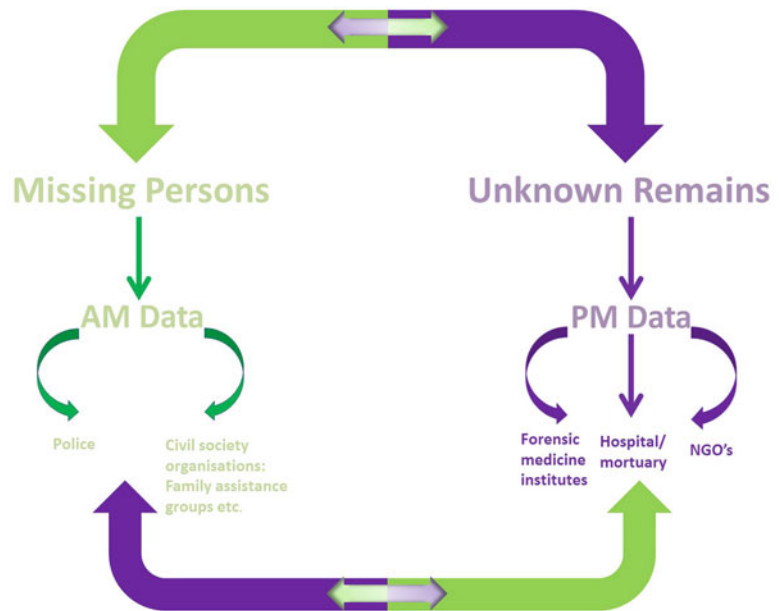
In contrast to dealing with the death of a friend or relative where the details of death are known, having a loved one go missing creates a vacuum of information as the fate of the individual is unknown: it is an ambiguous loss because there is often no information about whether the person is dead or alive (Edkins, 2011): “Not knowing what has happened to someone you love, where they are and whether they are safe is like living in darkness” (Anon, 2009); “Having someone go missing is worse than someone dying” (Sturcke & Addley, 2007); “We can’t move back, we can’t move forward. I’m stuck in a hole and I’ll never get out of a hole until I have our daughter” (Bice, 2008). The scale of the impact of missing persons on the wider community is large. For example, the Australian Institute of Criminology estimates that approximately 330,000 people across Australia (population over 23.5 million) are affected each year as a direct result of people going missing (Henderson & Henderson, 1998).

The effective investigation of missing persons cases requires the gathering and scrutinizing of all relevant information. This includes the circumstances of the disappearance, such as the location,

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Fig. 14.1 The ideal relationship between organizations involved in the collection and management of ante- and postmortem data (Copyright: Author's own image)



time, date, what the person was wearing or carrying (Davis, Jensen, Burgette, & Burnett, 2014), and the biological data about the missing person: ancestry, sex, age, stature, and health and dental status, that is, antemortem (AM) information.

Depending on the circumstances of the disappearance, the majority of people reported missing voluntarily reappear or are found alive. However, there are numerous examples of missing persons who end up deceased either being the victim of foul play or dying as a result of an accident or suicide. Therefore, there is also a need to correlate the AM data with that extrapolated from the analysis of unidentified human remains (postmortem—PM data). Human remains may be located accidentally (e.g., during construction works, while walking, washed up on beaches, rivers, and so on), or intentionally following information obtained through police investigations which facilitates locating a burial/dump site and then the recovery using archaeological techniques (Hunter, Simpson, & Study Colls, 2013).

An attempt to identify unknown human remains and thus provide answers to families of missing persons requires a coordinated, rigorous, and timely querying and comparison of AM and PM data (Fig. 14.1). This can only occur when the appropriate systems within the

relevant organizations (police, forensic medical institutions, family assistance groups, etc.) are in place and personnel within these institutions are appropriately trained within their own discipline about the role and contributions of other organizations involved in the missing persons investigations.

While in principle finding a missing person involves identifying unknown human remains¹ through an apparently simple comparison of AM and PM data, there are a number of variables that in practice mean the process is very complex. The geographic and sociopolitical context of where and how a person goes missing often determines the response time to activating the search as well as the logistical and financial infrastructure in place to facilitate and sustain the search and identification process. The circumstances of the disappearance and the response time also impacts on the preservation and condition of the remains which in turn affects the identification process (Table 14.1). This chapter considers each of these variables in light of the different scenarios in which people go missing.

¹The missing person may either be presumed deceased or thought to be alive but may ultimately be located as a result of the identification of deceased remains.

Table 14.1 The different types of missing person cases and variables that effect identification

Type of case/Variables	Individual ("Cold Case")	Missing in Action (MIA)	Disaster (Human/Natural)	Political/Ethnic/Religious Violence (Human Rights Violations)
Scale: numbers of individuals	Single	10,000s–millions	100s–1000s	10,000s
Geography	Variable: typically single location	Battlefields, crash sites	Usually single location	Often multiple, widespread, clandestine locations
Political will/state, community support	Varying	Widespread	Widespread	Limited
Financial support (resources)	Varying	Widespread	Widespread	Limited
Response time	Often delayed	Years	Immediate	Years
PM data (preservation/condition of remains, cause of death, method of disposal, time, environment)	Skeletonized	Skeletonized, sometimes fragmentary	Varying	Skeletonized
AM data (quality and quantity)	Limited	Varying	Recent	Limited (usually no records, few living relatives, less memories, difficult to substantiate information)

14.2 Individual Cases

“Thousands are missing....And thousands are missing them” (ICRC, 2012).

When a person goes missing in a domestic context typically a report is made to the local police. Statistics vary between countries but each year it is common for thousands of people reported missing to be located relatively soon. For example, in Australia, approximately 35,000 people are reported missing each year and 95 % surface or are found within the first week (Anon, 2013; see also Henderson & Henderson, 1998; see Kullman, Solheim, Grundin, & Teivens, 1993 for similar figures for Sweden). An additional 3 % of people reported missing surface within 6 months (Warrington, 2012: 17) while long-term missing are those individuals who have been absent for 6 months or longer.

The number of missing persons reports varies depending on the context but each case has to be individually assessed and prioritized. In the context of Australia, it has been shown, for example, that initial reports of missing white, healthy, and financially stable males are given a low priority (Warrington, 2012).

The investigation also requires the systematic acquisition, recording, and storage of all possible identifying information, e.g., distinguishing tattoos or scars, and dental, medical, fingerprint and

DNA records. As investigations of missing persons may take many years, it is necessary to have a database where all relevant information can be securely stored and regularly accessed. In many domestic contexts the infrastructure and political will exists to facilitate the collection, storage, and scrutinizing of such data (e.g., Kullman et al., 1993; Ritter, 2007: 3; Monson, Miller, Wilson, DiZinno, & Budowle, 2002).

Police then liaise with medicolegal institutes who are responsible for receiving and analyzing unknown human remains. Depending on the cause of death, method of disposal, environment in which the body is buried/or dumped, and the time between death and discovery, the remains may be in varying stages of preservation: a complete (intact) body; complete but altered body (e.g., decomposed, burnt, traumatized, and scavenged); partial body; or full or partial skeleton. The completeness and preservation of the remains determines the types of analyses that can be undertaken to facilitate identification and therefore which forensic experts are required (Table 14.2).

The goal of the missing persons investigation is to compare and hopefully find a match between AM and PM data (see Fig. 14.1). However, there are a number of variables which impact on what, theoretically, appears to be a fairly straightforward task. These variables include:

Table 14.2 Condition and preservation of human remains and the types of methods that can potentially be used for identification

Preservation	Biological profile	Fingerprints	DNA	Odontology	Medical	Tattoos/scars
Complete and intact body	✓	✓	✓	✓	✓	✓
Complete but altered body (decomposed, burnt, traumatized, etc.)	✓	?	✓	✓	✓	?
Body part (fragmented, disrupted, burnt, etc.)	?	?	?	?	?	?
Complete and well preserved skeleton	✓	X	✓	✓	✓	X
Poorly preserved and partial skeleton	?	X	?	?	?	X

Key

✓ = Yes

? = Possibly: the ability to employ a specific technique is dependent on which part of the body is present and the condition of the remains (e.g., if the hands are absent, fingerprinting will not be possible; severely burned/decomposed hands may also mean fingerprinting is impossible, and so on)

X = No

Context of disappearance: National and international borders may create obstacles to comparing and scrutinizing data, especially given that different states within the one country often have different legislation relating to data sharing (Blau, Hill, Briggs, & Cordner, 2006). Other complications result from the fact that people increasingly live and work away from the place of origin; in many contexts people travel frequently, and numbers of people migrating (legally and illegally) have surged. It has been noted that people who are immigrants have less chance of being positively identified (Kringsholm, Jakobsen, Sejrsen, & Gregersen, 2001).

AM data collection: Unless personnel involved in missing persons investigations are trained in rigorous and accurate AM data collection, information pertinent to identification may not be collected (Winskog, 2012). For example, failure to include dental data in the missing persons investigations has been shown in a number of contexts to significantly delay identification (Blau et al., 2006; Kamb, 2003).

PM data collection: Depending on the time between a person going missing, dying, and the recovery of human remains, the condition and preservation of the remains will vary. Consequently, a variety of forensic specialists including forensic pathologists, forensic anthropologist, forensic odontologists, fingerprint experts and molecular biologists may assist in the identification process (see Table 14.2). In cases of long-term missing where typically the remains are located fully skeletonized and there may be no hypothesis about the identify of the deceased, the forensic anthropologist plays an important role in providing lead generating information in the form of a biological profile (i.e., ancestry, sex, age, and stature) (Blau, 2009; Cattaneo et al., 2000; Sauer, 1992). Such information can facilitate a search of missing persons records for leads and thus for AM records of particular individuals. Errors in the biological profile can significantly delay the identification. For example, in a case study provided by Donlon (2008), the mistaken sex estimation resulted in a delay of 17

years to identify an individual. Terminology used to record PM remains needs to be clearly defined. For example, if the recording form only allows the practitioner to record “Black” or “White” when estimating ancestry then data provided by the forensic anthropologist cannot be utilized to its full potential. This may result in misleading or limiting identification information.

While new techniques are being developed to assist in aspects of identification such as age (e.g., Wedel, Found, & Nusse, 2012), forensic anthropology information is not typically included in database information (see below). This is problematic in cases of long-term missing.

Databases: Computer registration of missing persons has assisted in positive identification (Kullman et al., 1993). However, in many contexts there may not be a centralized missing persons database that stores all pertinent information to facilitate searching and/or matching (e.g., Cattaneo et al., 2000). While funding has been invested in the development of databases for disaster victim identification (DVI) (e.g., FASTID and Plass Data—Crabbe et al., 2013), there are few databases that contain all relevant information.

Where databases do exist (e.g., DNA—Monson et al., 2002; dental—Kullman et al., 1993), training is required to input collected AM and PM information so that terminology is consistent. Inconsistent terminology may result in ineffective searching (Higgins & James, 2006). In terms of data querying, it has been argued that in cases of dental data, for example, only a trained dental practitioner should be responsible for undertaking the AM and PM comparisons (Bassed & Leditschke, 2011; Kieser, Laing, & Herbison, 2005; Kullman et al., 1993). Further, specific training is required for personnel tasked to maintain and update databases.

14.3 Disaster Victim Identification (DVI)

Following natural and human-induced disasters there is an immediate response to care for the living and injured. The second imperative and one

of the most difficult disaster response tasks is to recover and identify the deceased so they can be returned to their families for the appropriate death rituals to be undertaken. The principle of comparing AM and PM data to attempt to achieve identification is the same in cases of individual missing persons and disaster situations. However, unlike long-term missing persons cases that involve searching for an individual, typically over a long period of time, a disaster can occur in a moment, with significant chaotic impact on life and infrastructure.

Nature and scale of the incident: Depending on the nature of the disaster (whether aviation, train, boat accident, bombings and explosions, earthquakes, fires, floods, infectious disease outbreaks, landslides, mudslides, avalanches, tornadoes, or hurricanes), the number of deceased is typically in the hundreds, thousands, or tens of thousands. Consequently, the process of identifying the deceased is massive and therefore, may not occur at all. Where identifications are attempted, the process typically takes months if not years to complete (O'Callaghan, 2014).

AM data: Another confounding factor that may complicate an identification process is the nature of the affected population. A closed-population disaster implies that the exact number and often the names of missing individuals are known (e.g., aviation disaster). In contrast, an open-population disaster refers to an event where not even the number of individuals missing is unknown let alone possible identities (e.g., terrorist bombing) (Blau & Hill, 2009).

PM data: The nature of a disaster will dictate the forces that affect the recovered remains. For example, exposure to fire, impact, crushing, explosion, free-fall, and/or chemicals in conjunction with the incident's setting (land, water, temperatures, humidity, war zone, presence of carnivore/rodents, etc.) influence the condition and preservation of human remains.

A DVI protocol has been developed by the International Police Organization (INTERPOL) and internationally accepted by 188 countries

(Blau & Hill, 2009; Sweet, 2010). Forensic odontology, DNA, and fingerprints are the three types of evidence that are designated by INTERPOL as primary identifiers. While personal property and associated evidence must be considered in the identification process, there are inherent dangers when secondary identification techniques are solely relied upon (Anon, 2001). However, the nature of the disaster and level of preservation and condition of the remains will determine the methods suitable for identification (see Table 14.2). The role of dentists in the positive identification of deceased people following disasters is well established. Dental structures (teeth, restorations, and the surrounding bone) are highly individual and in some countries are well recorded. Further, teeth are able to withstand a range of forces and are therefore typically well preserved despite the nature of the disaster (Blau & Hill, 2009; Hill, Lain, & Hewson, 2011). Consequently, positive identification through the comparison of AM and PM dental records has been widely used in DVI situations regardless of the scale. Some examples include: the 1990 Scandinavian ferry disaster where 158 people lost their lives and the majority (68%) were identified using dental records (Solheim, Lorentsen, Sundnes, Bang, & Bremnes, 1992); in the 2004 Boxing Day tsunami, nearly 85% of the victim identifications at the Thailand Tsunami Victim Identification (TTVI) operation in Phuket were established using dental records (Berketa, James, & Lake, 2012; De Valck, 2006; Schuller-Götzburg & Suchanek, 2007; see also Schou & Knudsen, 2012), and in the 2009 Victorian (Australian) bushfires, the majority of deceased individuals were also identified dentally (Lain, Taylor, Crocker, Craig, & Graham, 2011).

While dental evidence may survive, it is only a powerful identification tool when there are robust AM dental records (Nuzzolese & Di Vella, 2007). There are, however, instances where dental records do not exist or cannot be located. For example, young children may not yet have attended a dentist, and many rural or lower socio-economic populations may have limited-to-no access to dentist care. In these situations, other identification methods are required.

DNA evidence is now widely used in DVI with technologies improving rapidly (e.g., Hartman, Dummer, Eckhoff, Scheffer, & Stringer, 2011). Prior to the 11th September 2001 attack on the New York World Trade Center the use of DNA profiling for victim identification in disasters was typically limited to situations with fewer than 500 persons (Biesecker et al., 2005). However, the number of deceased resulting from the attack on the World Trade Centre (2479 individuals), and extreme fragmentation (more than 20,000 fragments of human remains), meant traditional victim identification methods was limited (Mundorff, Shaler, Bieschkie, & Mar-Cash, 2008). Consequently, DNA became the prime method for identification (Mundorff, Bartelink, & Mar-Cash, 2009) with over 90% of fragments having been identified using DNA alone (Mundorff et al., 2008). Similar to dental identifications, DNA identifications require good AM comparative data. Not only does the appropriate relative have to be selected for comparative purposes (Ge, Budowle, & Chakraborty, 2011), but the process of extracting and analyzing DNA is destructive and relatively expensive.

While anthropologists have contributed to aspects of DVI for over a century, their role in providing simply a biological profile has begun to expand (Mundorff, 2012; see also Sledzik & Rodriguez, 2002). With expertise dealing with differentially preserved human remains, forensic anthropologists are increasingly being integrated into DVI because of the contributions they can make to the various phases of the investigation. At the scene (Phase 1), the forensic anthropologist is able to assess the number and condition of remains, and assist in the recovery effort; in the mortuary (Phase 2) the forensic anthropologist may assist by triaging cases, separating human from nonhuman remains, and detecting inconsistencies between biological profile and hypothesized identifications which may indicate sample mix up, contamination, etc. The forensic anthropologist may also be able to provide information to assist in differentiation siblings when no relevant family reference samples exist, as well as sorting commingled remains and sampling for DNA analysis. In the detail of this process the

forensic anthropologist also contributes to the reconciliation (Phase 4) phase (Blau & Briggs, 2011; Mundorff, 2008, 2012; Mundorff et al., 2008; Mundorff, Black, Blau, Drawdy, & Kosalka Shore, 2015; Saul & Saul, 2003). While radiography has been important in DVI situations (Kahana & Hiss, 1997), there is an increased use of imaging technology, specifically computed tomography (CT) scanning in the DVI process (Bassed & Hill, 2011; Berran, Mazuchowski, Marzouk, & Harcke, 2014; Blau, Robertson, & Johnston, 2008; Hoyer, Nielsen, Nagel, Uhrenholt, & Boel, 2012; Manhart, Bittord, & Büttner, 2012; O'Donnell, Iino, Mansharan, Leditschke, & Woodford, 2011; Ruddy et al., 2009; Silder, Jackrowski, Dirnhoder, Vock, & Thali, 2007). While clear images can be produced in a timely manner, they are only of direct application for positive identifications when good comparative AM medical information can be located. However, when combined with robust circumstantial information, CT images may also be of use to assist in identification.

Infrastructure and political will: The sociopolitical context within which a disaster occurs greatly influences a jurisdiction's ability to respond. The approach taken and financial investment ultimately impact on the effectiveness of the search and identification of the missing following a disaster. Vast amounts of human and financial resources are invested in identifying missing persons following some disasters compared to others. For example, following the 2001 terrorist attack at the World Trade Center in New York City, a mayoral decree was issued to DNA test every piece of human remains in order to avoid missing a potential identification represented by a small fragment (Mundorff et al., 2009). This resulted in over \$US 970 million spent on the recovery (which took 9 months) and identification process (Marchi, 2004). Similarly, significant effort was invested in identifying the victims of the 2004 Boxing Day tsunami in Thailand (a major tourist destination) compared to victims in Indonesia, Sri Lanka, and other south-east Asian countries affected by the disaster. More recently, the international

community has contributed significant resources to recover and identify the 298 victims of Malaysian Airlines MH17 airline disaster which occurred in July 2014. It can be argued that such differential allocation of resources implies some deceased are viewed as “heroes” (Edkins, 2011) while others remain nameless individuals (Blau, 2006). In the case of the 2005 London bombings, politics dictated priorities: while many of the victims were easy to identify, the focus was directed to differentiating innocent victims from terrorists (Edkins, 2011).

Dead body management: In some mass disasters, the destruction of infrastructure is so extreme and widespread (e.g., entire towns and villages are destroyed) and the scale of deceased individuals is so enormous (e.g., the 2010 earthquake in Haiti where over 230,000 people were killed—Anon, 2010a; or the 2011 Tōhoku, Japan earthquake and tsunami where an estimated 28,500 people were killed—Shibahara, 2011; Anon, 2011) that the task of identifying missing persons becomes overwhelming and ultimately impossible. In such cases, it is advocated that authorities focus on management (rather than identification) of the dead (Morgan, Tidball-Binz, & van Alphen, 2009; Tidball-Binz, 2007) with a view to respectful treatment of the deceased and possible future identification (Morgan et al., 2006). In cases where entire families have been wiped out, the absence of AM data makes identification in such cases impossible.

14.4 Defence Forces: Missing in Action

Compared to individual cases of missing persons or most cases of missing persons following disasters or political, ethnic, or religious violence, the numbers of missing persons following the two world wars and other wars (e.g., Vietnam and Korea) are large. The nature of the battlefield and conflict together with the passage of time between the conflict and the investigation means locating graves is often problematic. In these cases archaeologists and military historians are pivotal in the

initial research. Other items such as individual diaries, old maps, hospital records, and after action reports may also be useful (Lain, 2013).

In military contexts, the passage of time and nature of conflict often result in fragmentary and poorly preserved skeletonized remains. Consequently, forensic anthropology and archaeology play a vital role in the recovery and initial analytical phases. In some instances dental records are of use for identification. However, given the length of time between the event and recovery and preservation and completeness issues, DNA is also a vital tool combined with information gleaned from military and historical records and input from genealogists. Assessment of personal property (e.g., uniforms, equipment, or weapon type) associated with the remains may also contribute to the identification process (Lain, 2013).

The demands of relatives and survivors to locate and identify the remains of servicemen and women missing in action (MIA) (whether for personal reasons or from an employer’s perspective to ensure an individual’s absence is not desertion—Edkins, 2011) have been met with different responses depending on the political context. For example, the Government of the United States of America (USA) has an open-ended commitment (Hanashiro, 2012) and invests millions of dollars each year into running the Joint Prisoner of War (POW)/Missing in Action (MIA) Accounting Command (JPAC) Central Identification Laboratory (CIL) which is the world’s largest forensic anthropology laboratory. The aim of the JPAC is to “to achieve the fullest possible accounting of United States service personnel missing from past wars and conflicts” (Holland, Byrd, & Sava, 2008). Since 1976, the JPAC have undertaken recoveries in over 40 countries investing large scale financial and human resources with the aim of retrieving and identifying all human remains regardless of the preservation. Similar efforts, although at a different scale, are undertaken in other countries, e.g., Australia by the Army Recovery Team (Donlon, 2008; Lain, 2013; MacGregor, 2014).

Investigation into identifying individuals missing in action is not always initiated by governments. For example, a retired Australian

school teacher and amateur historian undertook research into the location of World War 1 mass graves in France (Edkins, 2011). After many years, this resulted in the Commonwealth War Graves Commission (CWGC) overseeing a jointly funded Australian and British Government project in northern France. In 2008, eight unmarked mass graves containing the remains of 250 Australian and British World War I servicemen were discovered at Pheasant Wood, Fromelles. Attempts were made to identify the individuals (Anon. n.d.a; Lycett, 2013; Cox, Loe & Jones *In press*). As of May 2014, 144 individuals had been positively identified (Anon, 2014).

14.5 Missing as a Result of Political, Ethnic, and/or Religious Violence

“Identification of human remains is ... as important as the collection of evidence for criminal investigations. It is a duty of investigators, in recognition of the right to know of concerned families, as enshrined in international humanitarian law” (Tidball-Binz, 2006: 389).

There are over 40 countries throughout the world which have had conflicts resulting in large scale disappearances (Fondebrider, 2012; see also ICRC, 2014a). Typically after peace is restored and there is a transition to democracy, families and communities demand answers to the whereabouts of their missing loved ones. Investigations of missing persons in human rights violations cases are made complicated by a number of factors:

Nature of the incident: While DVI incidents may be open or closed, cases of human rights violations are typically open (see above discussion on DVI) and diachronic, that is, often occurring over many years (Baraybar, 2008: 533). The fact that people were disappeared over a relatively long period of time at various geographic locations makes the location of unidentified remains and ultimately the identification of missing person complex.

Numbers of missing individuals: While defining the exact number of missing persons is often difficult in cases of human rights violations (e.g.,

Table 14.3 Examples of some of the countries affected by political, ethnic, and/or religious violence and the scale of missing persons

Country	Approximate number of missing persons	Reference
Argentina	30,000	Fondebrider (2012)
Colombia	10,000–30,000	Anon. (2010b)
Chile	2279	Anon. (2002)
Cyprus	2000	Sant Cassia (2007)
East Timor	200,000	Blau and Fondebrider (2010)
Guatemala	200,000	Flavel and Barker (2009)
Iraq	300,000	Steel (2008)
Mexico	22,322	AP (2014)
Nepal	5000	MacLean (2014)
Peru	>15,000	ICRC (2014b)
Sri Lanka	12–15,000	Somasundaram et al. (2011)
Former Yugoslavia	>30,000	Huffine et al. (2001)

Blau & Fondebrider, 2010; Kinsella & Blau, 2013), typically the estimated figure is in the thousands (Table 14.3). The scale of missing persons has an impact on the resources required for the investigation and the ultimate success of identifications.

Response time: Typically investigations are undertaken many years after the atrocity/ies in which people went missing occurred. The long time depth not only impacts on the condition and preservation of human remains (see PM data below), but also affects the accuracy of survivors’ memories. Details of the disappearance may diminish over time and important landmarks marking burial locations are lost as landscapes change (Kinsella & Blau, 2013). This in turn limits the utility of the AM data (see below).

PM data: Because of the time lag between disappearances/deaths and investigation of missing persons in cases of political, ethnic and/or religious violence, the unidentified human remains are typically skeletonized. Consequently, the methods of identification are limited (see Table 14.2). In such cases, forensic archaeologists

(e.g., Cox, Flavel, Hanson, Laver, & Wessling, 2008; Hunter et al., 2013; Steel, 2008) and anthropologists have played a vital role in the identification of missing persons. While dental identifications are possible (Brkic, Strinovic, Kubat, & Petrocecki, 2000), in many instances there is a paucity of AM information for many of the victims (see AM data below). Consequently, the application of molecular methods has been incorporated into the identification process in human rights violation cases. Based on techniques developed in the Balkans (Huffine, Crews, Kennedy, Bomberger, & Zinbo, 2001) and refined following the 2001 terrorist attacks in New York, the Latin American initiative for the Identification of the “Disappeared” (LIID) applied genetic testing on large numbers of unidentified human remains in Argentina (Corach et al., 1997; Edkins, 2011; Tidball-Binz et al., 2013). Similar approaches have been implemented in other parts of the world, for example, East Timor (Blau & Fondebrider, 2010) and Spain (Lorente et al., 2001, 2002). However, large scale DNA identification is not only expensive requiring high level expertise but is also potentially prone to risk of false inclusion due to the scale issue (Gornik, Marcikic, Kubat, Primorac, & Lauc, 2002). Access to DNA facilities is again politically directed.

AM data: Similar to AM data collection in DVI scenarios, it is imperative that the person collecting AM data in human rights violations cases has a detailed understanding of the context within which they are working as well as the identification process within this context. The affected populations in many human rights violation cases are often relatively poor and live in rural areas where concepts of health may vary: e.g., what does it mean to have “normal” teeth; to have a fever could mean to be pregnant. Typically, such populations also do not have access to health services (doctor and/or dentist). Consequently, there are no available AM records and where they do exist there are no laws for protection of records (Fondebrider & Blau, 2010). The effectiveness of the AM information must therefore be scrutinized (Quiñones Reyes, 2010).

The importance of establishing credibility and developing trust with the families with missing relatives is vital as in many cases communities have been waiting years for an answer (Baraybar, 2008: 534; Blau, Fondebrider, & Saldanha, 2011). If local forensic teams are undertaking the work in conjunction with government support, the development of trust typically relates to the nature of the authority (which may be considered by some families to have been involved in the violations). If external practitioners are undertaking the work, then trust needs to be developed around the agenda: what are credentials of the practitioners? How long will they work in the area and under whose authority? Why will they be asking questions and taking samples? Where will the information be stored? Who will access the information? When and how often will the practitioners return, and how will they continue to communicate with the families? (Blau, 2015).

Unlike cases of domestic criminal violence where the forensic anthropologist rarely interacts with the family of the deceased, in human rights violation cases the forensic anthropologist is often involved in talking with families about the exhumation and identification processes and collecting AM data (Blau et al., 2011). The involvement of forensic anthropologists in this role initially commenced because authorities typically tasked with interviewing families such as police or government medical officials were, in many contexts, often not trusted by families since government agencies were often involved in perpetrating the human rights violations. While still not normally considered part of the role of the forensic anthropologist in domestic contexts, communicating with families about the limitations and success of their work is increasingly common in cases of religious, ethnic, and/or political violence. Forensic anthropologists’ sensitive and patient communication with families has proven extremely successful both in progressing difficult identifications but also in rebuilding community confidence in what are often complex sociopolitical situations.

Infrastructure and political will: Many countries recovering from political, religious, and/or political

conflict have limited infrastructure and few, if any, have trained forensic experts for the collection and analysis of both AM and PM data. Consequently, assistance with identifying missing persons in these contexts requires internal political will to commence the process as well as external commitment for logistical and financial assistance. While family groups are often clear and united about their need for identifications, government support is often lacking due to competing priorities (health, education, roads, etc.) and/or reticence due to government participation in and/or support for the disappearances (e.g., Kinsella & Blau, 2013; MacLean, 2014; Simmons & Haglund, 2005), or the fear that starting investigations into missing persons may lead to demands for restitution and justice (Edkins, 2011). External support is very much driven by geopolitical relationships (Blau, 2006). Significant international support is typically provided for collection of evidence for international war crimes tribunals focused on cause and manner of death (Baraybar, Brasey, & Zadel, 2007), rather than evidence associated with identification (e.g., Fondebrider, 2002: 889; Stover & Shigekane, 2002; United Nations, 1991). The choice to focus on identification versus the pursuit of justice has significant ethical repercussions (Blau, 2015; Juhl & Olsen, 2006).

Political decisions: In cases of human rights violations questions arise not only about the identification of the deceased but also related to justice and the fight against impunity (Crettol & La Rosa, 2006; López & Umaña, 2007). While the two outcomes are not necessarily mutually exclusive (that is, examining the case of death in a court of law is usually assisted by the identification of the deceased), typically, the investigations are focused on only one of the remits (Blau, 2015). Such political decisions have an impact on the process of identifying the missing, which in turn may also impact on the families of the missing who may never get the identification they are seeking.

In many instances when investigations are undertaken, only a small percentage of the missing are actually identified. For example, following the 1994 genocide that occurred in

Rwanda where an estimated 500,000–1,000,000 Rwandans were killed (McQueen, 2005) investigations were undertaken some 10 years later. Out of nearly 500 individuals examined from exhumations at Kibuye, Rwanda, only 19 were identified (Keough, Simmons, & Samuels, 2004). Depending on the political circumstances, the reality is that identification of all deceased is unlikely. Even in contexts where resources are dedicated to the search for the missing, success in identification is often limited. For example, in Argentina some 10,000 people went missing due to large-scale human rights abuses under a military dictatorship from 1976 to 1983, in what became known as the “Dirty War.” Despite extensive financial support for identifications, only 600 individuals from thousands of skeletons have to date been identified (MacLean, 2014).

14.6 Conclusion

The establishment of occasions to raise awareness about missing persons (e.g., International Day of the Victims of Enforced Disappearances marked on the 30th August each year—Mock, 2014; and Missing Persons Week which is marked during the first week of August each year in Australia—Anon. n.d.b) highlights and acknowledges the ongoing emotional significance for families and communities who do not have information about the whereabouts of a missing relative or friend. This chapter has outlined the range of circumstances where people go missing, either voluntarily or involuntarily, and where unidentified human remains may be located. In principle, identifying missing persons and identifying unknown human remains involves comparing AM and PM data, ideally considering the information from all potentially relevant disciplines (Kringsholm et al., 2001; Kullman et al., 1993). However, in practice, the context in which the persons goes missing and the interconnected variables of scale (numbers of individuals), geography, existing infrastructure and capability, and most significantly political will in each case scenario significantly influences the likelihood of successfully locating and identifying missing persons.

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Missing Persons in Croatia: Incidence, Characteristics and Police Performance Effectiveness

15

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15.1 Introduction

Literature available concerning missing persons addresses this issue in different discourses. Most prevalent are studies of incidence, forensic studies and police guidance manuals. Special attention is given to the issue of missing children. The intention of this chapter is to make a contribution to the overall body of knowledge on the missing persons phenomenon using experience gained in a Croatian context.

The Republic of Croatia gained independence in 1991 and has been a member state of the European Union since 2013. The struggle for independence in the Homeland War resulted in

several thousand registered missing persons, many of whom (1702) have not been found to this day. Several institutions including the police are working on these cases. However, this study does not deal with the persons gone missing in the war or in natural disasters. The focus is on the incidence of disappearance and on the profile of the persons gone missing in the period from 2010 to 2012. This study is a part of a much larger study conducted for the first time in the Republic of Croatia. It focuses on the incidence, socio-demographic, psychological and psychiatric profiles of missing persons, as well as on the reporting and searching for missing persons relating to the police performance procedure, and on the relationships among all these factors. To understand better the context in which people go missing in Croatia, the most essential socio-demographic and economic indicators are supplied in the introductory part.

According to the 2011 Census, the Republic of Croatia has 4,284,889 inhabitants. Out of the total number 2,066,335 are men (48.2%), and 2,218,554 women (51.8%). The average age of the population is 41.7 years (men 39.9 and women 43.4). The masculinity coefficient (the number of men to 100 women) is over 100 for age groups under 39 years. After that it exhibits a constant drop and by age 65 it is drastically lower—in favour of women (ranging from 98 to 28 men to 100 women) (Census of Population, 2013). With regard to education, among the population over

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the age of 15, 30.8% has completed only primary education, 52.6% secondary education, and 16.4% persons have college or university level education. Among men over 15 years of age, 58% are married, 4% divorced, 3% widowed and a high 35% are single. The percentage of married women is even lower—only 53%. The percentage of single women is 24%, divorced 5%, widowed 18% (six times higher than widowed men). This may be accounted for by the fact that women live longer on average than men (Statistical Yearbook of the Republic of Croatia, 2012).

According to Croatian Bureau of Statistics, out of the 3.6 million people over 15 years of age, 41.4% are employed and 8% unemployed. However, the inactive segment of the population makes up a high 50.5% (retired persons, school children, college students, homemakers, etc.) (Statistical Yearbook of the Republic of Croatia, 2012). Croatia's population has 9.58% persons belonging to different minorities: 4.36% Serbian and less than 1% of each of the 21 other minorities (e.g. 0.73% Bosnian, 0.42% Italian, 0.40% Roma, 0.33% Hungarian) (Statistical Yearbook of the Republic of Croatia, 2012).

In recent years Croatia has been afflicted with a long-lasting economic depression, high economic emigration and highly skilled professionals movement to the developed countries of the European Union. Croatia is in the group of five European Union countries with highest unemployment and poverty rates (European Commission, 2013). The US Government states in its Trafficking in Persons Report (2013) that Croatia is a destination, source and transit country for persons of all genders and ages, and victims of human trafficking for the purpose of forced prostitution and forced labour, signifying the importance of connecting the issue of missing persons with committed criminal acts. The Organisation for Security and Co-operation in Europe (OSCE) stresses that in the growing number of cases of human trafficking, the favoured destinations for this type of crime were the countries of old Europe, Russia, Turkey and Cyprus, as well as the Adriatic countries, in particular Croatia and Montenegro. Therefore, the missing persons files include not only Croatian citizens

but also foreign citizens gone missing on the territory of Croatia.

The number of reported missing persons in the Republic of Croatia is permanently on the rise and has become a matter of general public interest. Not all cases are equally serious; there is evidence that at certain times of the year, such as the end of the school year and the tourist season, a higher incidence of missing persons is reported for specific segments of the population. According to Hedges (2002), there is no national uniform method of dealing with these enquiries: the police have different policies, responses, report taking methods, etc. This leads to a varied level and style of response throughout the country. In Croatia, apart from the police, no other institution keeps records or gets involved in tracking down and providing assistance to missing persons and their families. Consolidated data on reported missing persons are classified by the police as a security issue. It is common practise for the police to search for a missing person in partnership with family members, other persons, and government and non-government organisations. Currently, efforts are being made to develop a more consistent, standardised approach to missing persons nationally.

The term 'missing person' is not a concept specifically defined in any of the existing regulations and police legislature of the Republic of Croatia, which impacts the initiation of the search for a missing person. Each situation is assessed individually by the police officer assigned to the case. He/she makes judgements based on his/her experience, training, set of values, prejudices and power of observation. Assessment of each case is affected by the information gathered from the individual reporting the missing person. The publication of the Guidance on the Management Recording and Investigation of Missing Persons compiled by the Association of Chief Police Officers is profoundly important for it elaborates in detail the police and other agencies procedures (2005).

Earlier studies of missing persons carried out by Croatian authors dealt mainly with the persons gone missing during the Homeland War, whereas studies of missing persons in the ensuing peace period have been much more sporadic

and narrower in target. In the course of 2014, a group of researchers at the Croatian Police College (a department within the Ministry of the Interior) and two faculties belonging to the University of Zagreb¹ compiled a wide-based study of missing persons. The most relevant results of the study constitute the body of this chapter.

15.2 Methodology

The sample used in the study included 1724 cases of missing persons reported to the police between 2010 and 2012, representing 34.2% of the total number of reported missing persons in Croatia. Data gathered came from six police directorates (out of the total 20) provided a representative sample of the rate of missing persons reporting and its distribution across the territory of Croatia. The six directorates are based in Zagreb (1), Rijeka (3), Split (2), Osijek (5), Virovitica (20) and Gospić (16) as marked in Fig. 15.1.

Given the relatively stable rate of missing persons reporting in the last decade, the 20 police directorates may be grouped into three categories. In the first category is Zagreb, as the capital, with highest percentage (50%) of reported cases. In the second category are the directorates with the rate of reporting 10–18% (in this sample Rijeka, Osijek and Split), and the third category is represented by Gospić and Virovitica with less than 3% reported cases.

Distribution, per police directorate, of the reported missing persons in this sample is as follows: Zagreb (50%), Rijeka (18.2%), Split (15.5%), Osijek (13.3%), Virovitica (1.6%) and Gospić (1.5%). Every third case (chronologically) in each of the six selected police directorates was processed for the purposes of this study.

Relevant data were gathered using the *Search for Missing Persons* questionnaire with 417 variables grouped so as to assess the incidence, characteristics, motives, reasons and circumstances bearing on the disappearance of the missing

persons and on the ensuing police action. The data were processed using the descriptive statistics, and correlations and differences were computed using Chi-Square tests, contingency coefficients and discriminant analysis. Once approval was granted by the respective police directorates to go ahead with the study, the next step comprised a detailed study of the search files suitable for in-depth analysis.

15.3 Who Goes Missing: Incidence of Missing People and Their Profile

Traditionally, missing persons are graded as vulnerable or non-vulnerable. However, this system only places individuals into two broad groups and does not help to illustrate individual differences and circumstances that make one person more vulnerable than another (Amoore & De Goede, 2005), this fine-tuning being left to an officer's judgement. As there have not been any guidelines upon which to make this judgement, it could be coloured by prejudice, other commitments, time available, level of experience of the officer and many other factors. While the majority of missing persons incidents relate to children, for which there is an extensive evidence base (Biehal & Wade, 2004; Hammer, Finkelhor, & Sedlak, 2002), there is a lack of substantial international research on adult missing persons (Biehal, Mitchell, & Wade, 2003; Newiss, 1999, 2005; Parr & Fyfe, 2012; Patterson, 2005; Payne, 1995). Adults receive little attention from the police and policy makers perhaps due to the common misperception that adults go missing voluntarily (Kiepal, Carrington, & Dawson, 2012).

The increase in the number of reported missing persons in the Republic of Croatia is receiving more attention from the Croatian public and the police, whose work and efforts in tracking down these persons are continually growing as a result. The collected data in Table 15.1 show the *growth* trend of the reported missing persons with certain variations and drops in 2004 and again in the period 2008–2010. In the studied period, the annual missing person average in the

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Fig. 15.1 Croatia—geographic representative sample (Copyright: Author's own image)

Republic of Croatia was 39 persons to 100,000 people. Meanwhile, the number of missing person reports has increased, and in 2013 it was 51 persons to 100,000. Again, these data do not include persons who disappeared during the Homeland War or in natural disasters. As a point of interest, the number of persons gone missing for each 100,000 people in Australia is 15 (James, Anderson, & Putt, 2008).

According to Newiss (1999), in the UK a person is recorded missing by the police approximately every 2 min. It is estimated that one person is reported missing every 15 min each year in Australia (James et al., 2008). Conversely, Croatia has a much lower incidence of missing persons—one person is reported missing every 5 days.

15.3.1 Socio-demographic Status

An earlier study by Šuperina and Dujmović (2011) of missing persons in Croatia in 2001–2002 showed that the majority of the reported missing persons were adults (54.84%), followed by juveniles (35.54%), children (10.7%) and younger adults (8.6%).

In this study, the segment of the reported missing adults constitutes 62.6%, with 9.1% of all cases relating to persons over 70 years of age. Juveniles make up 27.2%, children 10.2%, with only 14 (0.8%) reported cases of missing children under the age of 10. For purposes of comparison, in the UK and USA juveniles make up between 2/3 and 4/5 of all reported missing persons (Parr & Fyfe, 2012).

Table 15.1 The number of the reported missing persons in the Republic of Croatia in the period 2000–2013 with the calculated base and chain index (Copyright: Author’s own image)

Year	No. of missing persons	Base index	Chain index
2000	1247	100.00	
2001	1253	100.98	100.48
2002	1406	112.75	112.21
2003	1639	131.44	116.57
2004	1559	125.02	95.12
2005	1619	129.83	103.85
2006	1702	136.49	105.13
2007	1771	142.02	104.05
2008	1753	140.58	98.98
2009	1733	138.97	98.86
2010	1704	136.65	98.33
2011	1774	142.26	104.11
2012	1928	154.61	108.68
2013	2192	175.78	113.69

Source: Statistics of the Croatian Ministry of the Interior for years 2000–2013

In the UK, Australia and USA roughly equal numbers of men and women go missing (Parr & Fyfe, 2012; James et al., 2008; NCIC Missing Person and Unidentified Person Statistics for, 2009, 2012; America’s Missing Persons by Age, Race and Gender 2014). This corresponds to the numerical indicators in Croatia. Analysis conducted in 2001 and 2002 showed that among the reported missing persons 51.8% were men and 48.19% women.

Relation between age and gender is shown in Tables 15.2 and 15.3.

In this study age and gender have a statistically significant relationship. Given the percentages of women and men in the total sample, women are significantly more often represented at young age (children and juveniles), and men in all categories between ages 25 and 65, covering the working male population.

The participants’ social status impacts all aspects of their lives and functioning in a given environment including risk and protective factors. When compared to the educational status of the general population over 15, the studied sample shows a significant aberration towards a higher level of formal education

Table 15.2 Missing persons distribution by age and gender (Copyright: Author’s own image)

Age (years)	Gender		Total
	M	F	
0–15	93	83	176
	52.80 %	47.20 %	100.00 %
	9.10 %	12.00 %	10.20 %
	5.40 %	4.80 %	10.20 %
15–20	213	256	469
	45.40 %	54.60 %	100.00 %
	20.70 %	36.90 %	27.30 %
	12.40 %	14.90 %	27.30 %
20–25	59	39	98
	60.20 %	39.80 %	100.00 %
	5.70 %	5.60 %	5.70 %
	3.40 %	2.30 %	5.70 %
25–35	169	62	231
	73.20 %	26.80 %	100.00 %
	16.50 %	8.90 %	13.40 %
	9.80 %	3.60 %	13.40 %
35–50	209	91	300
	69.70 %	30.30 %	100.00 %
	20.40 %	13.10 %	17.40 %
	12.20 %	5.30 %	17.40 %
50–65	158	71	229
	69.00 %	31.00 %	100.00 %
	15.40 %	10.20 %	13.30 %
	9.20 %	4.10 %	13.30 %
65–	126	91	217
	58.10 %	41.90 %	100.00 %
	12.30 %	13.10 %	12.60 %
	7.30 %	5.30 %	12.60 %
Total	1027	693	1720
	59.70 %	40.30 %	100.00 %
	100.00 %	100.00 %	100.00 %

Table 15.3 Age and gender contingency measures (Copyright: Author’s own image)

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-square	81.480	6	0.000
Likelihood ratio	82.120	6	0.000
Linear-by-linear association	33.179	1	0.000
N of valid cases	1720		

(secondary school—72.5%; college and university level—15.2%). It is striking here that persons of lower educational status are not a risk group.

Table 15.4 Missing persons distribution by age and education (Copyright: Author’s own image)

Age (years)	Education							Total
	Finished a few grades of primary school	Finished primary school	Finished vocational school	Finished secondary school, grammar school	Finished non-university college	Graduated from faculty or college	Academic scientific degree	
0–15	101	33	42	0	0	0	0	176
	57.40 %	18.80 %	23.90 %	0.00 %	0.00 %	0.00 %	0.00 %	100.00 %
	70.60 %	14.90 %	6.60 %	0.00 %	0.00 %	0.00 %	0.00 %	10.30 %
	5.90 %	1.90 %	2.50 %	0.00 %	0.00 %	0.00 %	0.00 %	10.30 %
15–20	21	63	374	11	0	0	0	469
	4.50 %	13.40 %	79.70 %	2.30 %	0.00 %	0.00 %	0.00 %	100.00 %
	14.70 %	28.50 %	59.10 %	2.30 %	0.00 %	0.00 %	0.00 %	27.40 %
	1.20 %	3.70 %	21.90 %	0.60 %	0.00 %	0.00 %	0.00 %	27.40 %
20–25	4	7	29	31	27	0	0	98
	4.10 %	7.10 %	29.60 %	31.60 %	27.60 %	0.00 %	0.00 %	100.00 %
	2.80 %	3.20 %	4.60 %	6.50 %	20.60 %	0.00 %	0.00 %	5.70 %
	0.20 %	0.40 %	1.70 %	1.80 %	1.60 %	0.00 %	0.00 %	5.70 %
25–35	2	15	66	86	50	12	0	231
	0.90 %	6.50 %	28.60 %	37.20 %	21.60 %	5.20 %	0.00 %	100.00 %
	1.40 %	6.80 %	10.40 %	18.00 %	38.20 %	11.90 %	0.00 %	13.50 %
	0.10 %	0.90 %	3.90 %	5.00 %	2.90 %	0.70 %	0.00 %	13.50 %
35–50	3	28	57	148	28	34	1	299
	1.00 %	9.40 %	19.10 %	49.50 %	9.40 %	11.40 %	0.30 %	100.00 %
	2.10 %	12.70 %	9.00 %	30.90 %	21.40 %	33.70 %	50.00 %	17.50 %
	0.20 %	1.60 %	3.30 %	8.70 %	1.60 %	2.00 %	0.10 %	17.50 %
50–65	5	27	48	105	18	24	1	228
	2.20 %	11.80 %	21.10 %	46.10 %	7.90 %	10.50 %	0.40 %	100.00 %
	3.50 %	12.20 %	7.60 %	21.90 %	13.70 %	23.80 %	50.00 %	13.30 %
	0.30 %	1.60 %	2.80 %	6.10 %	1.10 %	1.40 %	0.10 %	13.30 %
Više od 65	7	48	17	98	8	31	0	209
	3.30 %	23.00 %	8.10 %	46.90 %	3.80 %	14.80 %	0.00 %	100.00 %
	4.90 %	21.70 %	2.70 %	20.50 %	6.10 %	30.70 %	0.00 %	12.20 %
	0.40 %	2.80 %	1.00 %	5.70 %	0.50 %	1.80 %	0.00 %	12.20 %
Total	143	221	633	479	131	101	2	1710
	8.40 %	12.90 %	37.00 %	28.00 %	7.70 %	5.90 %	0.10 %	100.00 %
	100.00 %	100.00 %	100.00 %	100.00 %	100.00 %	100.00 %	100.00 %	100.00 %

Tables 15.4, 15.5, 15.6 and 15.7 show the relationship between education, age and gender.

Tables 15.6 and 15.7 indicate that differences in education with regard to age are statistically significant. It is evident that as age increases so does education. Participants in the age group 20–35 are significantly more often college educated, while participants over 35 more frequently than others have secondary or university education.

Table 15.5 Age and education contingency measures (Copyright: Author’s own image)

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-square	1470.139	36	0.000
Likelihood ratio	1331.681	36	0.000
Linear-by-linear association	383.133	1	0.000
N of valid cases	1710		

Table 15.6 Missing persons distribution by gender and education (Copyright: Author’s own image)

		Gender		
		M	F	
Education	Finished a few grades of primary school	70	75	145
		48.30 %	51.70 %	100.00 %
6.90 %		10.90 %	8.50 %	
4.10 %		4.40 %	8.50 %	
Finished primary school	112	109	221	
	50.70 %	49.30 %	100.00 %	
	11.00 %	15.80 %	12.90 %	
	6.50 %	6.40 %	12.90 %	
Finished vocational school (3 years)	352	281	633	
	55.60 %	44.40 %	100.00 %	
	34.50 %	40.70 %	37.00 %	
	20.60 %	16.40 %	37.00 %	
Finished secondary school, grammar school (4 years)	330	148	478	
	69.00 %	31.00 %	100.00 %	
	32.30 %	21.40 %	27.90 %	
	19.30 %	8.60 %	27.90 %	
Finished non-university college	83	48	131	
	63.40 %	36.60 %	100.00 %	
	8.10 %	7.00 %	7.70 %	
	4.90 %	2.80 %	7.70 %	
Graduated from faculty or college	72	29	101	
	71.30 %	28.70 %	100.00 %	
	7.10 %	4.20 %	5.90 %	
	4.20 %	1.70 %	5.90 %	
Academic scientific degree	2	0	2	
	100.00 %	0.00 %	100.00 %	
	0.20 %	0.00 %	0.10 %	
	0.10 %	0.00 %	0.10 %	
Total	1021	690	1711	
	59.70 %	40.30 %	100.00 %	
	100.00 %	100.00 %	100.00 %	

Table 15.7 Gender and education contingency measures (Copyright: Author’s own image)

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-square	44.774	6	0.000
Likelihood ratio	45.974	6	0.000
Linear-by-linear association	34.289	1	0.000
N of valid cases	1711		

Statistically significant are differences in education with relation to gender. The relative rate of women with incomplete and complete primary

Table 15.8 The most important indicators of the missing persons’ social status (Copyright: Author’s own image)

Has been married	18.9 %
Has lived with parents	32.1 %
Has lived with a child	4.6 %
Has lived in a reform institution	17.2 %
Has lived alone	6.1 %
Unmarried	56.5 %
Widowed	6.7 %
Pupil/student	33.2 %
Unemployed	30 %
Retired	14.7 %

education is higher, whereas in the case of men the rate is higher among men with secondary, college and, particularly, university education.

Other important social status characteristics of the participants (Table 15.8) indicate that they are likely to be three times less often married (18.7 %) than the average Croatian population over 15.

A third, mostly young persons, lives with parents and 36.7 % live with other people (with a partner, child, grandchild, foster parent) or in a care-providing institution (an old people’s home). About 1/5 of the participants live alone. Obviously, a solo lifestyle does not pose a risk factor for disappearance. This suggests that the risk can be attached to the interplay between the quality of life and psychological status, also studied here.

15.3.2 Psychological and Psychiatric Status

Assessment of the psychological and psychiatric status of a missing person relies mainly on the readiness of the individual reporting the missing person to provide relevant information, given that for reasons of confidentiality the police are not allowed insight into any person’s medical records. Proceeding with awareness that the data gathered here are insufficient (50 % unknown, on average, for each variable), it was nevertheless possible to establish this status, at least roughly, from the information in 18 variables. Each variable had five categories (not at all, partly no, unknown, partly yes, mostly yes). Receiving psychiatric treatment (in hospital or surgery) were 29.2 %

participants, with 26.6% actually diagnosed with a mental illness. Suicidal tendencies were exhibited by 7.1%, old age dementia (including Alzheimer’s and Parkinson’s disease) was present in 6.2%, and addiction to alcohol was established in 7.4% cases. Persons suffering from anxiety or depression made up a further 6.3%, while drug addiction was present in 2.1% cases.

The discriminant analysis was used to estimate the linear relationship between a discriminant (dependent) non-metrical variable having two or more categories (age, gender, marital status, life with parents), and linear combination of seven independent metric variables of psychological status (Tables 15.9, 15.10, 15.11, 15.12, 15.13, 15.14, 15.15, 15.16, 15.17, 15.18, 15.19, 15.20, 15.21, 15.22, 15.23, 15.24, 15.25, 15.26, 15.27 and 15.28). The predictor variables do not have normal multivariate distribution but besides the sample size, discriminant analysis is relatively robust even when distributions are contradicted.

In this study independent variables are the variables that characterise the psychological and psychiatric status. They are as follows: X_j —suicidal

Table 15.9 Tests of equality of age group means regarding the psychological and psychiatric status variables (Copyright: Author’s own image)

	Wilks’ Lambda	F	df1	df2	Sig.
<i>Suicidal</i>	0.955	20.282	4	1713	0.000
<i>Alcoholic</i>	0.954	20.772	4	1713	0.000
<i>Anxdepre</i>	0.923	35.702	4	1713	0.000
<i>Mentalill</i>	0.935	29.874	4	1713	0.000
<i>Pshospit</i>	0.945	24.806	4	1713	0.000
<i>Pmedicat</i>	0.956	19.567	4	1713	0.000
<i>Dementia</i>	0.784	118.022	4	1713	0.000

Table 15.10 Eigenvalues, explained variance and canonical correlation of discriminant functions in differentiation of five age groups of missing persons by psychological and psychiatric status variables (Copyright: Author’s own image)

Function	Eigenvalue	% of Variance	Cumulative %	Canonical correlation
1	0.313	66.3	66.3	0.488
2	0.143	30.3	96.6	0.354
3	0.016	3.3	99.9	0.124
4	0.000	0.1	100.0	0.018

Table 15.11 Standardised canonical discriminant function coefficients in differentiation of five age groups of missing persons by psychological and psychiatric status variables (Copyright: Author’s own image)

	Function			
	1	2	3	4
<i>Alcoholic</i>	-0.067	-0.312	0.381	1.091
<i>Anxdepre</i>	0.231	-0.667	0.366	-0.988
<i>Mentalill</i>	-0.424	0.712	0.638	-0.041
<i>Dementia</i>	0.910	0.546	-0.091	0.138

Table 15.12 Structure matrix in differentiation of five age groups of missing persons by psychological and psychiatric status variables (Copyright: Author’s own image)

	Function			
	1	2	3	4
<i>Dementia</i>	0.910*	0.337	0.233	0.071
<i>Mentalill</i>	-0.231	0.551	0.791*	-0.133
<i>Anxdepre</i>	0.390	-0.439	0.727*	-0.355
<i>Phospit</i>	-0.216	0.482	0.711*	-0.042
<i>Pmedicat</i>	-0.124	0.386	0.687*	-0.021
<i>Alcoholic</i>	0.230	-0.420	0.658*	0.581
<i>Suicidal</i>	0.274	-0.285	0.556*	-0.131

Table 15.13 Values of discriminant functions at group centroids in differentiation of five age groups of missing persons by psychological and psychiatric status variables (Copyright: Author’s own image)

Age (years)	Function			
	1	2	3	4
0–15	0.219	-0.293	-0.332	-0.017
15–20	0.093	-0.527	0.103	-0.001
20–25	-0.410	-0.070	-0.131	0.069
25–50	-0.585	0.265	0.019	-0.007
50–	0.910	0.397	0.031	0.003

Table 15.14 Tests of equality of gender group means regarding the psychological and psychiatric status variables (Copyright: Author’s own image)

	Wilks’ Lambda	F	df1	df2	Sig.
<i>Suicidal</i>	1.000	0.087	1	1717	0.768
<i>Alcoholic</i>	0.991	15.570	1	1717	0.000
<i>Anxdepre</i>	1.000	0.005	1	1717	0.943
<i>Mentalill</i>	0.990	16.625	1	1717	0.000
<i>Pshospit</i>	0.988	20.812	1	1717	0.000
<i>Pmedicat</i>	0.988	21.244	1	1717	0.000
<i>Dementia</i>	1.000	0.362	1	1717	0.547

Table 15.15 Eigenvalues, explained variance and canonical correlation of discriminant functions in differentiation of male and female missing persons by psychological and psychiatric status variables (Copyright: Author’s own image)

Function	Eigenvalue	% of Variance	Cumulative %	Canonical correlation
1	0.024	100.0	100.0	0.154

Table 15.16 Standardised canonical discriminant function coefficients in differentiation of male and female missing persons by psychological and psychiatric status variables (Copyright: Author’s own image)

	Function 1
<i>Alcoholic</i>	0.834
<i>Anxdepre</i>	-0.629
<i>Pmedicat</i>	0.697

Table 15.17 Structure matrix in differentiation of male and female missing persons by psychological and psychiatric status variables (Copyright: Author’s own image)

	Function 1
<i>Pmedicat</i>	0.714
<i>Alcoholic</i>	0.611
<i>Phospit</i>	0.564
<i>Mentalill</i>	0.500
<i>Suicidal</i>	0.116
<i>Dementia</i>	0.091
<i>Anxdepre</i>	0.011

Table 15.18 Values of discriminant functions at group centroids in differentiation of male and female missing persons by psychological and psychiatric status variables (Copyright: Author’s own image)

Gender	Function 1
Male	0.128
Female	-0.190

Table 15.19 Tests of equality of marital status group means regarding the psychological and psychiatric status variables (Copyright: Author’s own image)

	Wilks’ Lambda	F	df1	df2	Sig.
<i>Suicidal</i>	0.998	1.428	2	1538	0.240
<i>Alcoholic</i>	0.984	12.808	2	1538	0.000
<i>Anxdepre</i>	0.987	10.305	2	1538	0.000
<i>Mentalill</i>	0.958	34.000	2	1538	0.000
<i>Pshospit</i>	0.951	39.892	2	1538	0.000
<i>Pmedicat</i>	0.947	42.844	2	1538	0.000
<i>Dementia</i>	0.995	4.059	2	1538	0.017

Table 15.20 Eigenvalues, explained variance and canonical correlation of discriminant functions in differentiation of three marital status categories of missing persons by psychological and psychiatric status variables (Copyright: Author’s own image)

Function	Eigenvalue	% of Variance	Cumulative %	Canonical correlation
1	0.066	74.3	74.3	0.248
2	0.023	25.7	100.0	0.149

Table 15.21 Standardised canonical discriminant function coefficients in differentiation of three marital status categories of missing persons by psychological and psychiatric status variables (Copyright: Author’s own image)

	Function	
	1	2
<i>Suicidal</i>	-0.164	-0.534
<i>Alcoholic</i>	0.282	0.564
<i>Anxdepre</i>	-0.059	0.802
<i>Mentalill</i>	0.037	0.743
<i>Pshospit</i>	0.443	-0.192
<i>Pmedicat</i>	0.509	-0.800
<i>Dementia</i>	0.185	-0.032

Table 15.22 Structure matrix in differentiation of three marital status categories of missing persons by psychological and psychiatric status variables (Copyright: Author’s own image)

	Function	
	1	2
<i>Pmedicat</i>	0.912	-0.223
<i>Phospit</i>	0.889	-0.061
<i>Mentalill</i>	0.821	0.035
<i>Dementia</i>	0.260	0.192
<i>Anxdepre</i>	0.210	0.680
<i>Alcoholic</i>	0.339	0.633
<i>Suicidal</i>	0.114	0.210

Table 15.23 Values of discriminant functions at group centroids in differentiation of three marital status categories of missing persons by psychological and psychiatric status variables (Copyright: Author’s own image)

Marital status	Function	
	1	2
Married	-0.148	0.072
Unknown	0.588	0.103
Not married	0.036	-0.291

Table 15.24 Tests of equality of living with parents’ status group means regarding the psychological and psychiatric status variables (Copyright: Author’s own image)

	Wilks’ Lambda	F	df1	df2	Sig.
<i>Suicidal</i>	0.988	10.133	2	1716	0.000
<i>Alcoholic</i>	0.979	18.539	2	1716	0.000
<i>Anxdepre</i>	0.987	11.384	2	1716	0.000
<i>Mentalill</i>	0.954	41.523	2	1716	0.000
<i>Phospit</i>	0.954	41.630	2	1716	0.000
<i>Pmedicat</i>	0.955	40.774	2	1716	0.000
<i>Dementia</i>	0.955	40.562	2	1716	0.000

Table 15.25 Eigenvalues, explained variance and canonical correlation of discriminant functions in differentiation of three categories of living with parents’ status by psychological and psychiatric status variables

Function	Eigenvalue	% of Variance	Cumulative %	Canonical correlation
1	0.073	65.1	65.1	0.262
2	0.039	34.9	100.0	0.195

Table 15.26 Standardised canonical discriminant function coefficients in differentiation of three categories of living with parents’ status by psychological and psychiatric status variables

	Function	
	1	2
Suicidal	-0.026	0.441
Alcoholic	0.381	-0.059
Anxdepre	-0.113	-0.337
Mentalill	0.217	-0.537
Phospit	0.145	-0.340
Pmedicat	0.357	0.204
Dementia	0.525	0.717

Table 15.27 Structure matrix in differentiation of three categories of living with parents’ status by psychological and psychiatric status variables

	Function	
	1	2
Pmedicat	0.749	-0.401
Phospit	0.687	-0.593
Mentalill	0.677	-0.612
Alcoholic	0.538	0.093
Anxdepre	0.421	0.079
Suicidal	0.351	0.265
Dementia	0.645	0.651

Table 15.28 Values of discriminant functions at group centroids in differentiation of three categories of living with parents’ status by psychological and psychiatric status variables

	Function	
	1	2
Lived with parents		
No	0.058	0.176
Unknown	0.539	-0.318
Yes	-0.320	-0.167

(has the missing person shown any suicidal tendencies), X_2 —*alcoholic* (is the missing person an alcoholic), X_3 —*anxdepre* (has the missing person shown any signs of anxiety or depression), X_4 —*mentalill* (has the missing person suffered from any mental illnesses), X_5 —*phospit* (has the missing person been treated in a psychiatric hospital), X_6 —*pmedicat* (does the missing person have to regularly take prescribed psychiatric medications) and X_7 —*dementia* (does the missing person suffer from dementia (Alzheimer’s or Parkinson’s disease, etc.)). Their categories are: (1) absolutely not, (2) mostly not, (3) unknown, (4) mostly yes and (5) absolutely yes.

15.3.2.1 Differentiation of Five Age Groups of Missing Persons by Discriminant Analysis of Psychological and Psychiatric Status Variables

The first discriminant variable is the age categorised as follows: (1) 0–15 years old, (2) 15–20 years old, (3) 20–25 years old, (4) 25–55 years old and (5) over 55 years old.

In order to determine the variables which significantly contribute to the differentiation of groups, F-test for Wilks’ Lambda has been used (Table 15.9).

F-test is significant for all seven variables (values of Sig. smaller than 0.05). That is the indicator of a good selection of seven independent variables.

Discriminant analysis was carried out for five age groups and it resulted in four discriminant functions, but only the first three were statistically significant and consequently yielded three significant eigenvalues. The highest eigenvalue (0.313) shows that the first discriminant function

has the strongest power of discrimination of the four functions. Also, the first two functions account for 97% of the obtained group means dispersion, as compared to the other two functions, which, taken together, account for less than 4% of the dispersion.

The canonical correlation coefficient, measuring the relation between the discriminant factorial coordinates and the grouping variable, shows that 23.8%, that is $(0.488)^2$ of the total variance accounts for the differences among the five groups through the first discriminant function.

The discriminant function coefficients are used for calculating the discriminant score for each case in particular. Taking into account that the first three functions have the highest discriminating power the values of their coefficients indicate as follows:

The size of the coefficients on the first discriminant function indicates the highest discriminant power of the predictor variables *dementia* (X_7), *anxiety or depression* (X_3) and *mental illnesses*. On the second discriminant function such variables are *mental illnesses* (X_4), *anxiety or depression* (X_3), *dementia* (X_7) and *alcoholic* (X_2), and on the third discriminant function are *mental illnesses* (X_4), *alcoholic* (X_2) and *anxiety or depression* (X_3).

The structure matrix coefficient indicates the correlation between each predictor variable and the discriminant function. The values of the structure coefficients obtained are presented in Table 15.12.

The first discriminant function is mostly correlated with three predictors: presence of dementia and partially of anxiety and depression, but also with the absence of mental illnesses. A second function includes variables that indicate the presence of a wide range of mental illnesses and the absence of anxiety or depression and alcoholism. The third function indicates a wide range of psychological difficulties that are not of neurodegenerative diseases nature.

Functions at group centroids show how age groups differ on each discriminant function (Table 15.13).

The greatest differences among age groups are produced by certain tendency of the oldest group to suffer from dementia and partially from

anxiety and depression more than the others. Also, the adult group (25 and more) mostly differs from younger groups regarding the presence of wide range of mental illnesses. Finally, the youngest group of missing persons differs from the others regarding the absence of psychological difficulties that are not of neurodegenerative diseases nature.

15.3.2.2 Differentiation of Male and Female Missing Persons by Discriminant Analysis of Psychological and Psychiatric Status Variables

The second discriminant variable is gender ((1) Male, (2) Female).

In order to determine the variables which significantly contribute to the differentiation of gender groups, F-test for Wilks' Lambda has been used (Table 15.14).

F-test is significant for four variables out of seven (values of Sig. smaller than 0.05 for the second, fourth, fifth and sixth variable).

Discriminant analysis was carried out for two gender groups and it resulted in one discriminant function (and consequently one eigenvalue, 0.024), which accounts for 100% of the obtained group means dispersion.

The canonical correlation coefficient shows that 2.4%, that is $(0.154)^2$ of the total variance accounts for the differences between the two groups through the first discriminant function.

The size of the coefficients on the first discriminant function indicates the highest discriminant power of the predictor variables *alcoholic* (X_2), *pmedicat* (X_6) and the absence of *anxiety or depression* (X_3).

The values of the structure matrix coefficients obtained are presented in Table 15.17.

The discriminant function is defined by three indicators: regularly taking prescribed medications, alcoholism and certain presence of anxiety or depression.

Functions at group centroids show how gender groups differ on discriminative function (Table 15.18).

The most gender differences come from males' more frequent taking prescribed medications, alcoholism and certain presence of anxiety or depression.

15.3.2.3 Differentiation of Three Categories of Missing Person's Marital Status by Discriminant Analysis of Psychological and Psychiatric Status Variables

The third discriminant variable is marital status categorised as follows: (1) Not married, (2) Unknown and (3) Married.

In order to determine the variables which significantly contribute to the differentiation of groups regarding marriage, F-test for Wilks' Lambda has been used (Table 15.19).

F-test is significant for all variables except the first one (values of Sig. smaller than 0.05), which points to good selection of independent variables.

Discriminant analysis was carried out for three marital status groups and it resulted in two discriminant functions and consequently two eigenvalues that are low. The higher eigenvalue (0.066) corresponds to the first discriminant function, which accounts for 74.3% of the obtained group means dispersion.

The canonical correlation coefficient shows that 6.1%, that is $(0.248)^2$ of the total variance accounts for the differences among the three groups through the first discriminant function.

The size of the coefficients on the first discriminant function indicates the highest discriminant power of the predictor variables *regularly taking prescribed psychiatric medications* (X_6), *treated in a psychiatric hospital* (X_5) and *partially alcoholism* (X_2). On the second discriminant function such variables are *anxiety or depression* (X_3), *mental illness* (X_4), *alcoholic* (X_2) and the absence of *regularly taking prescribed psychiatric medications* (X_6), and *suicidal* (X_1).

The values of the structure matrix coefficients obtained are presented in Table 15.22.

The first discriminant function is mostly defined by medical aspects of mental illnesses and partially by alcoholism. A second function includes variables that indicate alcoholism, anxiety or depression and partially suicidal tendencies.

Functions at group centroids show how the marital status groups differ on each discriminative function (Table 15.23).

The greatest differences among missing persons' marital status groups are produced by certain tendency of the unknown marital status group to exhibit medical aspects of mental illnesses more than the others. Additionally, to certain extent the unknown marital status group differs from the others regarding the presence of alcoholism, anxiety or depression and partially suicidal tendencies.

15.3.2.4 Differentiation of Three Categories of Missing Persons Living with Parents' Status by Discriminant Analysis of Psychological and Psychiatric Status Variables

The fourth discriminant variable is living with parents ((1) No, (2) Unknown and (3) Yes).

The variables which significantly contribute to the differentiation of groups regarding living with parents are assessed by F-test for Wilks' Lambda (Table 15.24).

F-test is significant for all seven variables (values of Sig. smaller than 0.05), which indicates good selection of independent variables.

Discriminant analysis was carried out for three groups of living with parents' variable and it resulted in two discriminant functions and consequently two eigenvalues that are. The higher eigenvalue (0.073) corresponds to the first discrimination function that accounts for 65% of the obtained group means dispersion.

The canonical correlation coefficient shows that 6.90%, that is $(0.262)^2$ of the total variance accounts for the differences among the three groups through the first discriminant function.

The size of the coefficients on the first discriminant function indicates the highest discriminant power of the predictor variables *dementia* (X_7), *alcoholic* (X_2) and *premedicat* (X_6). On the second discriminant function such variables are *dementia* (X_7) and *suicidal* (X_1), but also the absence of *mental illness* (X_4), *treated in a psychiatric hospital* (X_5) and *anxiety or depression* (X_3).

The values of the structure matrix coefficients obtained are presented in Table 15.27.

The first discriminant function is mostly determined by medical aspects of mental illness, dementia and alcoholism and partially by depressive and suicidal tendencies. A second discriminant function included dementia and partially suicidal tendencies, as well as the absence of medical aspects of mental illness.

Functions at group centroids show how living with parents' status groups differs on each discriminative function (Table 15.28).

The greatest differences are related to missing persons group whose living with parents status is not known: they have clearly higher scores on the first discriminant function (presence of medical aspects of mental illness, dementia and alcoholism and partially depressive and suicidal tendencies) and lower results on the second discriminant function (presence of dementia and the absence of medical aspects of mental illness).

15.3.3 Motives, Reasons and Circumstances of Disappearance

The above-cited Croatian study of missing persons from 2001 to 2002 lists some of the risk factors in younger population such as poor communication with the family (15.8%), adventurism (10.04%) and family disputes (5.13%). In cases of older persons gone missing, relation was found with mental illness (16.94%), old age dementia and spatial disorientation (84.19%), and somatic disease (7.66%).

In this study motives, reasons and circumstances of disappearance were determined using 34 variables. The information on the assumed reasons for disappearance was given by the reporter. The variables had five categories (not at all, partly no, unknown, partly yes, mostly yes). The most important findings were those on mental illness (21.8%), voluntary abandonment of the usual place of residence and going into hiding (18.2%), psychological disorders (17.9%) and youth rebellion (15.4%). Of the next six assumed reasons or circumstances of disappearance, each one appears between 5 and 8%: problematic family relations, adventurism, loitering, alcohol, suicidal tendencies and inability to care for oneself.

The discriminant analysis is used to estimate the linear relationship between a discriminant (dependent) non-metrical variable having two or more categories (age and gender), and linear combination of ten independent metric variables of motives and reasons for disappearance assumed by the reporting person (Tables 15.29, 15.30, 15.31, 15.32, 15.33, 15.34, 15.35, 15.36, 15.37 and 15.38). The predictor variables do not have normal multivariate distribution but besides the sample size, discriminant analysis is relatively robust even when distributions are contradicted.

In this study independent variables are the variables of motives and reasons for disappearance. They are as follows: X_1 —*voluntar* (voluntarily left home and kept his/her residence a secret), X_2 —*familydis* (family disputes), X_3 —*teenreb* (teenage rebellion), X_4 —*adventure* (love of adventure), X_5 —*loitering* (disappearance related to loitering), X_6 —*alcohol* (disappearance related to alcohol consumption), X_7 —*mentaldis* (mental disorder), X_8 —*mentalill* (mental illness),

Table 15.29 Tests of equality of age group means regarding the motives and reasons for disappearance variables

	Wilks' Lambda	F	df1	df2	Sig.
Voluntar	0.851	74.684	4	1711	0.000
Familydis	0.930	32.083	4	1711	0.000
Teenrebe	0.475	473.590	4	1711	0.000
Adventure	0.769	128.506	4	1711	0.000
Loitering	0.809	100.942	4	1711	0.000
Alcohol	0.964	15.849	4	1711	0.000
Mentaldis	0.980	8.560	4	1711	0.000
Mentalill	0.938	28.491	4	1711	0.000
Suicide	0.982	7.660	4	1711	0.000
Helpdem	0.802	105.351	4	1711	0.000

Table 15.30 Eigenvalues, explained variance and canonical correlation of discriminant functions in differentiation of five age groups of missing persons by the motives and reasons for disappearance variables

Function	Eigenvalue	% of Variance	Cumulative %	Canonical correlation
1	1.301	79.5	79.5	0.752
2	0.292	17.9	97.3	0.475
3	0.032	2.0	99.3	0.177
4	0.011	0.7	100.0	0.105

Table 15.31 Standardised canonical discriminant function coefficients in differentiation of five age groups of missing persons by the motives and reasons for disappearance variables

	Function			
	1	2	3	4
<i>Voluntar</i>	-0.069	0.1	0.201	0.193
<i>Familydis</i>	-0.076	0.098	-0.039	0.333
<i>Teenrebe</i>	0.846	0.093	-0.365	0.23
<i>Adventure</i>	0.235	-0.195	-0.036	-0.361
<i>Loitering</i>	0.282	-0.121	0.662	0.078
<i>Alcohol</i>	-0.148	-0.075	0.306	-0.2
<i>Mentaldis</i>	-0.081	-0.019	-0.342	0.733
<i>Mentalill</i>	-0.193	-0.288	0.314	0.436
<i>Suicide</i>	0.021	0.012	0.263	-0.523
<i>Helpdem</i>	-0.131	1.01	-0.065	-0.006

Table 15.32 Structure matrix in differentiation of five age groups of missing persons by the motives and reasons for disappearance variables

	Function			
	1	2	3	4
<i>Teenreb</i>	0.920	0.128	-0.066	0.235
<i>Adventure</i>	0.478	0.002	0.306	-0.113
<i>Helpdeme</i>	-0.048	0.909*	0.242	0.113
<i>Loitering</i>	0.403	0.088	0.819*	0.165
<i>Alcohol</i>	0.132	0.077	0.624*	0.005
<i>Suicide</i>	0.033	0.170	0.499*	-0.034
<i>Voluntar</i>	0.345	0.205	0.460*	0.206
<i>Mentaldis</i>	-0.103	0.022	0.172	0.673*
<i>Mentalill</i>	-0.201	-0.142	0.362	0.592*
<i>Familydis</i>	0.206	0.242	0.231	0.256*

Table 15.33 Values of discriminant functions at group centroids in differentiation of five age groups of missing persons by the motives and reasons for disappearance variables

Age (years)	Function			
	1	2	3	4
0–15	1.269	0.174	-0.487	-0.036
15–20	1.502	0.047	0.157	0.041
20–25	-0.047	-0.508	0.131	-0.408
25–50	-0.860	-0.529	-0.021	0.051
50–	-1.096	0.910	0.034	-0.011

Table 15.34 Tests of equality of gender group means regarding the motives and reasons for disappearance variables (Copyright: Author’s own image)

	Wilks’ Lambda	F	df1	df2	Sig.
<i>Voluntar</i>	0.992	13.344	1	1715	0.000
<i>Familydis</i>	0.992	14.014	1	1715	0.000
<i>Teenrebe</i>	0.970	53.499	1	1715	0.000
<i>Adventure</i>	0.980	34.806	1	1715	0.000
<i>Loitering</i>	0.998	3.242	1	1715	0.072
<i>Alcohol</i>	0.996	6.395	1	1715	0.012
<i>Mentaldis</i>	0.997	4.941	1	1715	0.026
<i>Mentalill</i>	0.996	6.931	1	1715	0.009
<i>Suicide</i>	0.999	1.101	1	1715	0.294
<i>Helpdem</i>	1.000	0.227	1	1715	0.634

Table 15.35 Eigenvalues, explained variance and canonical correlation of discriminant functions in differentiation of male and female missing persons by the motives and reasons for disappearance variables (Copyright: Author’s own image)

Function	Eigenvalue	% of Variance	Cumulative %	Canonical correlation
1	0.052	100.0	100.0	0.222

Table 15.36 Standardised canonical discriminant function coefficients in differentiation of male and female missing persons by the motives and reasons for disappearance variables (Copyright: Author’s own image)

	Function 1
<i>Teenrebe</i>	0.661
<i>Adventure</i>	0.510
<i>Alcohol</i>	-0.630

Table 15.37 Structure matrix in differentiation of male and female missing persons by the motives and reasons for disappearance variables (Copyright: Author’s own image)

	Function 1
<i>Teenrebe</i>	0.775
<i>Adventure</i>	0.625
<i>Voluntar</i>	0.342
<i>Alcohol</i>	-0.268
<i>Loitering</i>	0.234
<i>Familydis</i>	0.211
<i>Mentaldis</i>	-0.161
<i>Mentalill</i>	-0.140
<i>Helpdem</i>	-0.046
<i>Suicide</i>	-0.029

Table 15.38 Values of discriminant functions at group centroids in differentiation of male and female missing persons by the motives and reasons for disappearance variables (Copyright: Author's own image)

Gender	Function
	1
Male	-0.187
Female	0.277

X_9 —*suicide* (suicidal predisposition) and X_{10} —*helpdem* (helpless situation in which he/she cannot take care of themselves, e.g. lost child, dementia, amnesia). Their categories are: (1) absolutely not, (2) mostly not, (3) unknown, (4) mostly yes and (5) absolutely yes.

15.3.3.1 Differentiation of Five Age Groups of Missing Persons by Discriminant Analysis of Motives, Reasons and Circumstances for Disappearance Variables

The first discriminant variable is the age categorised as follows: (1) 0–15 years old, (2) 15–20 years old, (3) 20–25 years old, (4) 25–55 years old and (5) over 55 years old (Tables 15.29, 15.30, 15.31, 15.32 and 15.33).

F-test for Wilks' Lambda (conducted to assess age discriminability of predictor variables) is significant for all ten predictors (values of Sig. smaller than 0.05), which indicates a good selection of ten independent variables (Table 15.29).

Discriminant analysis was carried out for five age groups and it resulted in four discriminant functions and consequently four eigenvalues, although the first two might be enough to explain almost all group means differences (Table 15.30).

The highest eigenvalue (1.301) corresponds to the first discrimination function, which shows that it has the strongest power of discrimination of the four functions. Furthermore, the first two functions account for 97 % of the obtained group means dispersion, as compared to the other two functions, which, taken together, account for less than 4 % of the dispersion.

The canonical correlation coefficient shows that 56.6 %, that is $(0.752)^2$ of the total variance

accounts for the differences among the five groups through the first discriminant function.

The size of coefficients on the first discriminant function indicates the highest discriminant power of the predictor variables *teenage rebellion* (X_3), *loitering* (X_5) and *love of adventure* (X_4). On the second discriminant function such variable is *helpless situation-lost child, dementia, amnesia* (X_{10}) and partially, the absence of *mental illness* (X_8). The third discriminant function is mostly determined by variables *loitering* (X_5), and partially *alcohol* (X_6) and *mental illness* (X_8), but also partially by the absence of *teenage rebellion* (X_3) and *mental disorder* (X_7). The fourth discriminant function is mostly defined by variables *mental disorder* (X_7), *mental illness* (X_8) and partially by *family disputes* (X_2), but also by the absence of *suicidal predisposition* (X_9) and the *love of adventure* (X_4).

The values of the structure matrix coefficients obtained are presented in Table 15.32.

The first discriminant function is defined by teenage rebellion, and partially by love of adventure, loitering and leaving home voluntarily. The second function includes variables that indicate helpless situation, e.g. lost child, dementia and amnesia. The third function indicates loitering, alcohol consumption, suicide and leaving home voluntarily, and partially love of adventure and mental illness. The fourth function is mostly defined by mental disorder, mental illness and partially by family disputes, as the reasons of disappearance assumed by reporting person.

Functions at group centroids show how age groups differ on each discriminative function (Table 15.33).

The most of the differences stem from the tendency of the youngest groups (up to 20 years old) to show more typical motives and reasons for disappearance such as teenage rebellion, love of adventure, loitering, alcohol consumption and left home voluntarily (especially in relation to the oldest ones). On the other side, the oldest group typical motives and reasons to disappear are more frequently related to helpless situation, e.g. lost child, dementia and amnesia, especially in relation to 20–50 years old group. Finally, some age groups differences are produced by lower scores of the youngest groups on the third (loitering, alcohol consumption, suicide and leaving home voluntarily) and by lower scores of young adults

on the fourth (mental disorder, mental illness and partially family disputes) discriminant function.

15.3.3.2 Differentiation of Male and Female Missing Persons by Discriminant Analysis of Motives, Reasons and Circumstances for Disappearance Variables

The second discriminant variable is gender ((1) Male, (2) Female).

F-test for Wilks' Lambda (conducted to assess age discriminability of predictor variables) is significant for 7 out of 10 variables (values of Sig. smaller than 0.05).

Discriminant analysis was carried out for two gender groups and it resulted in 1 discriminant function (and consequently one eigenvalue, 0.052), which accounts for 100 % of the obtained group means dispersion.

The canonical correlation coefficient shows that 4.9%, that is $(0.222)^2$ of the total variance accounts for the differences among the two groups through the first discriminant function.

The size of the coefficients on the discriminant function indicates the highest discriminant power of the predictor variables *teenreb* (X_3), *adventure* (X_4) and the absence of *alcohol* (X_6).

The values of the structure matrix coefficients obtained are presented in Table 15.37.

The discriminant function is defined by teenage rebellion, love of adventure and partially by the absence of alcohol consumption.

Functions at group centroids show how gender groups differ on discriminative function (Table 15.38).

There is a certain tendency (Table 15.38) that the reasons for disappearance for females, more than for males, are teenage rebellion, love of adventure and the absence of alcohol consumption. According to earlier results showing that females significantly participate in younger groups, those reasons could be associated with the group of young females.

In conclusion, it would appear that adult males of mature age prevail among missing persons. Moreover, they have significantly higher education than females and another of their characteris-

tics is regular consumption of alcohol and drug abuse. Females prevail at young age, as children and juveniles. Manifest mental illness was found most frequently in participants over 55 years of age. However, juveniles of maturing age (15–20 years) were also found suffering from a wide range of mental difficulties not related to somatic disorders.

Figures show that persons gone missing are much less frequently married compared to the Croatian population of corresponding age, but marital status is not a protective factor in disappearance. Namely, married participants exhibit a tendency towards mental illness and alcoholism, whilst those unmarried tend to suffer from depression. Living with parents is not a protective factor for disappearance. Some of the latter participants have manifest signs of mental illness, dementia, alcoholism and suicidal behaviour. The picture is further aggravated in about one-third of cases by life away from family, e.g. in a foster home, in a reform institution or an old peoples' home.

Persons of mature and most productive age suffer with relative significance from psychological disorders and mental illness. Persons of formative age (15–20) exhibit a strong tendency towards antisocial behaviour through abuse of alcohol and vagrancy. Helplessness, i.e. inability to take care of oneself, is most present in the youngest (children) and oldest age group indicating probable parental neglect of children and lack of proper care for the elderly.

At the time of reporting, a third of the participants were in hospital or outpatient psychiatric treatment, and a fifth suffered from some mental illness. In addition, a third of the participants suffered from one of the following problems: alcohol or drug addiction, suicidal tendencies, anxiety, depression and dementia. The most frequent assumed motives and reasons of disappearance given by the reporters when contacting the police are voluntary abandonment of the usual place of residence and hiding, psychological disorder and teenage rebellion (51.5 %). Significantly less frequent are family problems, adventurism, loitering, alcohol, suicidal tendencies and inability to care for oneself.

To conclude, although missing persons in Croatia are far better-educated than the general population, poor social circumstances interacting with mental problems are found to lie behind the circumstances, motives and reasons of disappearance.

15.4 Reporting Missing Persons

There are only a small number of policy-oriented studies that have developed typologies of missing people (see Newiss, 1999) and considered the use of profiling techniques to inform the search process (Shalev, Schaefer, & Morgan, 2009). This problem is compounded by lack of guidance to police officers on what is good practice in dealing with these cases in general. Learning is largely 'on the job' and there is a lack of manuals to which to refer. It is all too easy to fall into the trap of dismissing missing persons as a time consuming, low priority area of policing. For this reason, the functionality of a particular procedure must be continuously checked in theory and in practice (Hedges, 2002).

The investigation into a missing person begins at the point of first notification to the police and as much detail as possible should be established (Guidance on the Management Recording and Investigation of Missing Persons, 2010). After the free-willing statement from the reporter, the police officer asks questions which aim to make the statement of the reporter more precise and updated. In many cases the reports of a missing person are ambiguous and confusing. The willingness of the reporter to disclose intimate or compromising information regarding the missing person or regarding themselves is of crucial importance. This dark figure of missing data frequently proves an obstacle for the police in efficient tracking down and locating a missing person. Following the established protocol comprised of a series of questions, the call handler will gather critical information (Fyfe, Stevenson, & Woolnough, 2014). A badly received report and the lack of information would not only prevent the timely search and finding of a missing person, it would also create a negative public image of the police.

Every report should be assessed and responded to with the appropriate level of priority. It is necessary, therefore, to develop a strategic framework that will help to deliver a problem-solving approach to cases. One of the difficulties in getting the correct response to a missing person report is that there are cases where the individual is at great risk but this is not often obvious from the information obtained when taking the initial report.

When taking a missing person report, it should be remembered that the act of going missing is likely to have been precipitated by a problem in the person's life. This may be related to their personal circumstances or something more sinister (Guidance on the Management Recording and Investigation of Missing Persons, 2010). It often happens that the questionnaires which contain the checking questions make the procedure a routine one, and bring the risk on the non-individualised approach to every case of the missing person.

To set the search measures in motion, the police need the information on the missing person and the circumstances of the disappearance in order to assess the situation and plan a proper course of action. The initial police response is focused on establishing a 'definition of the situation' and, in particular, on assessing whether the person may be at risk (Payne, 1995). To gather the information relevant to cases of missing persons, police officers in Croatia use the Protocol on Receiving the Missing Person Report. Three types of police databases are used in Croatia: the missing persons' registry, the daily activities bulletin of the missing persons and the missing person files kept by the police station for a given territory. These tools are quite useful, because they help the police officer to check which questions s(he) asked and which s(he) failed to ask. In most cases, this is sufficient for the initial, urgent, relevant and efficient search for the missing person (Butorac, Šuperina, & Mikšaj-Todorović, 2013). Evidence to support this may be found in the data collected in this study indicating that the police recorded and were able to identify the motives, reasons and circumstances of disappearance from the reporter in about 80% cases. The study shows that social determinants were predominantly responsible for the disappearance.

In an earlier study by Šuperina and Dujmović (2011), the authors examined the structure of the reporters who notified the police that a person had gone missing (in 2001 and 2002). It was found that in the majority of cases the parents (mother or father) reported the case (48.4%). Reports made by other blood relations raise this percentage to a total of 56.14%. In about 18% cases the reporters were various institutions (e.g. reform institutions for children, old age homes, hospitals and psychiatric institutions).

Data showing the most frequent reporters in this study are shown in Table 15.39.

As in the cited study, the majority of the reporters were parents and blood relatives (57.9%). However, the portion of the reports made by institutions (psychiatric hospitals and reform institutions) is double compared to the earlier data (43.8%). In most cases the report was made by notifying the police station in person (58%), followed by a faxed report (22.6%) and telephone (18%). Family members favour direct contact in notifying the police, whereas institutions choose fax messages to communicate the information on a missing person to the police.

Reporters act relatively promptly when a person goes missing. Table 15.40 indicates the length of time from the moment of disappearance to the moment of notification.

In the first two categories showing how promptly the police were notified, police experience shows that the institution caring for the missing person is the reporter, which corroborates the data in the previous table. In all other cases, specific interpersonal relations between the reporter and the missing person and various

Table 15.39 Reporters notifying the Police (Copyright: Author's own image)

Reporter	%
Reform school for children and juveniles	17.6
Mother	16.8
Psychiatric hospital	15.7
Father	13.3
Other family members	13.3
Son	5.3
Other persons	4.6
Daughter	4.1

Table 15.40 Time between disappearance and notification (Copyright: Author's own image)

Time	%
0–3 h	29.9
3–6 h	12.2
6–12 h	14.1
12–24 h	17.1
1–2 days	14.9
3–6 days	8.2
1–4 weeks	2.3
More than 1 month	1.2

other circumstances are of critical importance. Examination of the data shows that between 12 p.m. and 8 a.m. neither family nor institutions detect that a person has gone missing (detection rate for that time of day is only 1.2–5.5%).

Most typically, reporters detect that a person has gone missing in the hours from 8 a.m. to 12 p.m. and this is the time of day in which they, as a rule, contact the police for help. This supports the earlier argument, derived from the social status and possible reasons and circumstances of disappearance, that absence from home in the late hours of the day indicates that neglect and lack of care are the likely causes of children, juveniles and the elderly going missing.

Section 15.3 provides evidence that the socio-demographic and psychological-psychiatric status of missing persons differ significantly from those in some other countries gathered from available data. As a result, Croatian police have developed their own Protocol on Receiving the Missing Person Report, a useful tool in addressing missing person cases, described in more detail in the section that follows. This study is only the first step in relating the results of empirical research with actual practise, but it will be a helpful tool in amending the Protocol. It is noteworthy that in studies compared, no data are available on who the reporter was or how the report was submitted.

Typically in Croatia the missing person report is given, in the majority of cases, by family members, followed by institutions such as reform institutions for children and juveniles and psychiatric hospitals. Most reporters come to the police station in person and give detailed information on

the personal appearance, socio-demographic, psychological and behavioural status of the person and other relevant context information required by the Protocol on Receiving the Missing Person Report. It is important to note that in 3/4 of all cases reporters report the missing person within 24 h of disappearance.

15.5 Searching for Missing Persons

Since a large number of missing person reports are made to the police annually, they must be given an order of priority, which generally starts in the control room. Supervisors should be aware of the grading of incidents to ensure that the correct level of priority is given. The call taker will have to make a decision, based on the information available at that time, about the level of priority response that the incident will receive. The decision will be based on a graded response policy and an assessment of the risk factors relating to the incident. This risk identification should determine the speed and scale of the initial police response (Guidance on the Management Recording and Investigation of Missing Persons, 2010).

Correct assessment of the situation is based on the information supplied by a reporter and activities undertaken by police and is followed by developing different versions of the incident that, in the end, will suggest a number of approaches to its solution. Different versions of the event will suggest likely or probable explanations of the disappearance, given the existent and non-existent facts relevant to the situation. The number of versions is in direct correspondence with the available facts. In every situation it is important to consider all likely versions of the event in order to gain full insight into the actual chain of events that led to the disappearance. Effectiveness, objectivity and completeness are the goal. Once all versions of the event have been explored, they need to be checked for logic. It is unfortunate that the police in Croatia do not have at their disposal a set of tools to assist in the assessment of the level of risk, as some other countries have (Newiss, 2004, 2005; Force Procedures Into

Reports of Missing Persons, 1998; Missing Persons Policy, 1998; Guidance on the Management Recording and Investigation of Missing Persons, 2010; Interim Guidance on the Management, Recording and Investigation of Missing Persons 2013).

Risk assessment is subjective and depends on the police officer assigned to the case, his/her training and experience, and on the conduct of his/her superior. However, the hierarchical structure of the police force allows the transfer of information between police stations and police directorates. Prompt notification of all competent specialists is possible and timely recognition of high-risk disappearances is practically guaranteed.

Immediately after it has been established without a doubt that the missing person has become the victim of a crime (or if such suspicion is justified), a task force or a larger operative group is formed to proceed with the criminal investigation.

If the missing person is not found within 24 h of receiving the report, a search plan is devised subject to approval from the superior officer. Initial actions include gathering information from the reporter, family or close persons, inspecting/searching the missing person's place of residence, checking other locations where the person might be staying, locating the person's mobile phone, searching the area, etc. as described by Newiss (1999, p. 11). Part of the search procedure is posting the missing person's profile on the website of the Ministry of the Interior. Similar steps are taken by the Australian police force. If the person is not found within a short time and the police assessment indicates the need for more intensive search, a follow-up investigation is instigated (James et al., 2008).

The search organised by the police is coordinated with the efforts undertaken by family members and other close persons. If need be, the police will use their own supplementary resources (special police) and cooperate with other persons, institutions and non-government organisations.

Encouraged by the practises of the Australian police, the Public Relations Office at the Ministry of the Interior has started an interactive portal www.nestali.hr avoiding visual design typical of

police websites. The portal is part of the project known as NENO ([National Register of Missing Persons](#)) containing the names of all missing persons searched for by the police. NENO provides information on the procedure and complex methodology deployed in searching for missing persons. More importantly, it encourages family members, friends and the community to cooperate actively and directly with the police for they are the most useful source of information on the missing person’s habits and lifestyle. The portal has an open profile on Facebook ([facebook.com/nextali.hr](https://www.facebook.com/nextali.hr)).

15.5.1 Results of Searching for Missing Persons

The results of searches for missing persons, including those who returned of their own free will, indicate that 92.1 % of missing persons were found and identified alive. The percentages of the dead and those not found were almost equal (c. 4 %). In 39.5 % cases the persons returned at their own initiative. Police search measures resulted in locating 42.8 % missing persons, while family members and other persons were responsible for finding the missing person in 15 % cases (Table 15.41).

The most common cause of death was natural death (over 3/4) followed by causes such as suicide, accidents and consequences of a violent act (0.2 %). Interestingly, the reporters had no suspicion in any of the reported cases that the missing person may have been the victim of a criminal act. However, the fact that 4 % of the missing persons were not located during this study indicates that their disappearance may have been caused by human trafficking or by an unidentified cause of death.

Table 15.41 Incidence of death and physical injury in found missing persons (Copyright: Author’s own image)

Number of reported missing persons	Consequence		
	Death	Severe physical injury	Slight physical injury
1724	69 (4%)	22 (1.3%)	28 (1.6%)

About 25 % of the found persons needed hospitalisation due to mental health difficulties or physical injury. The police interviewed 41.4 % of the found persons. Apart of reporting persons, other involved persons were interviewed in over 1/3 of all the cases.

15.5.2 Police Search Measures

Police search measures undertaken to locate missing persons were tested using 67 variables. Data were categorised in two groups. In the first was the information gathered from all family members, friends, peers, neighbours, acquaintances and others in the missing person’s social environment. Mothers as source of information appear in a large number of cases (24.3 %), followed by fathers (17.5 %), members of the extended family (18.1 %) and neighbours (14.6 %). In the second group are the activities undertaken by the police *ex officio*, with the most common ones shown in Table 15.42.

The effectiveness of the police and their partners is estimated by the shortest time elapsed between the time of receiving the report and the time the missing person is located (Table 15.43).

Over 1/4 of missing persons is found within 6 h of disappearance, and 61 % is found within 24 h. Consolidated figures indicate that 81.2 % is found within a week. Only 1.9 % of missing persons is found after more than 1 year.

Australian data for the State of Victoria are practically identical with the data given above: 90 % of missing persons are located within 1

Table 15.42 Most common police measures and actions (Copyright: Author’s own image)

Police measures and actions	%
Circulates photographs and information on the missing person to all police stations	66.8
Locates the mobile phone used by the missing person	35
Inspects the home and other places of residence, ascertains the missing person’s movements and use of vehicle	52.4
Patrols road intersections	62.2
Patrols open areas	45.2

Table 15.43 Length of time between receiving the report and finding the missing person (Copyright: Author's own image)

No. of hours/days/weeks	%
0–6 h	27.0
6–12 h	15.4
12–24 h	18.6
1–2 days	7.5
3–6 days	12.7
1–2 weeks	8.4
More than 2 weeks	7.4

week (James et al., 2008). However, UK data are significantly different. According to Parr and Fyfe (2012) up to 80% of missing people return within 24 h and about 1% remain outstanding a year after going missing.

Differences in police effectiveness in finding missing persons in UK and Croatia may be to a great extent attributed to a dramatically higher incidence of persons gone missing in UK (one person missing every two minutes), whereas in Croatia this incidence in one missing person every 5 days. As a result, given the incidence and complexity of the issue, in many countries special units have been formed with specialised expertise, tools and procedures devised to deal with the problem.

15.5.3 Differentiation of Three Categories of Missing Person's Finding Status due to Police Effectiveness by Discriminant Analysis of Motives, Reasons and Circumstances for Disappearance Variables

The discriminant analysis is used to estimate the linear relationship between a discriminant (dependent) non-metric variable having two or more categories (Was the missing person found because of the measures and actions undertaken by the police), and linear combination of 10 independent metric variables of motives and reasons for disappearance assumed by the reporting person (Tables 15.44, 15.45, 15.46, 15.47 and 15.48).

Table 15.44 Tests of equality of missing persons' finding status group means regarding the motives and reasons for disappearance variables (Copyright: Author's own image)

	Wilks' Lambda	F	df1	df2	Sig.
<i>Voluntar</i>	0.965	30.976	2	1703	0.000
<i>Familydis</i>	0.986	12.391	2	1703	0.000
<i>Tenrebe</i>	0.966	30.361	2	1703	0.000
<i>Adventure</i>	0.972	24.446	2	1703	0.000
<i>Loitering</i>	0.960	35.723	2	1703	0.000
<i>Alcohol</i>	0.996	3.350	2	1703	0.035
<i>Mentaldis</i>	0.994	4.829	2	1703	0.008
<i>Mentalill</i>	0.980	17.011	2	1703	0.000
<i>Suicide</i>	0.996	3.657	2	1703	0.026
<i>Helpdem</i>	0.991	7.751	2	1703	0.000

Table 15.45 Eigenvalues, explained variance and canonical correlation of discriminant functions in differentiation of three categories of missing persons' finding status by the motives and reasons for disappearance variables (Copyright: Author's own image)

Function	Eigenvalue	% of Variance	Cumulative %	Canonical correlation
1	0.083	85.7	85.7	0.276
2	0.014	14.3	100.0	0.117

Table 15.46 Standardised canonical discriminant function coefficients in differentiation of three categories of missing persons' finding status by the motives and reasons for disappearance variables (Copyright: Author's own image)

	Function	
	1	2
<i>Voluntar</i>	0.239	-0.001
<i>Familydis</i>	0.105	-0.150
<i>Teenrebe</i>	0.114	-0.265
<i>Adventure</i>	0.184	-0.376
<i>Loitering</i>	0.607	0.435
<i>Alcohol</i>	-0.259	-0.161
<i>Mentaldis</i>	-0.108	0.024
<i>Mentalill</i>	-0.448	-0.178
<i>Suicide</i>	-0.032	0.436
<i>Helpdem</i>	0.025	0.697

Table 15.47 Structure matrix in differentiation of three categories of missing persons’ finding status by the motives and reasons for disappearance variables (Copyright: Author’s own image)

	Function	
	1	2
Loitering	0.703	0.276
Voluntar	0.662	0.071
Teenrebe	0.647	-0.263
Adventure	0.583	-0.207
Mentalill	-0.489	0.119
Familydis	0.419	0.007
Alcohol	0.211	0.137
Helpdem	0.102	0.772
Suicide	0.068	0.532
Mentaldis	-0.234	0.288

Table 15.48 Values of discriminant functions at group centroids in differentiation of three categories of missing persons’ finding status by the motives and reasons for disappearance variables (Copyright: Author’s own image)

Missing person found by the police	Function	
	1	2
No	0.239	-0.041
Not found	0.349	0.676
Yes	-0.337	0.009

The predictor variables do not have normal multivariate distribution but besides the sample size, discriminant analysis is relatively robust even when distribution is contradicted.

In this study independent variables are the variables of motives and reasons for disappearance, defined in Sect. 15.3.3.

Discriminant variable (was the missing person found because of the measures and actions undertaken by the police) is categorised as follows: (1) No, (2) Hasn’t been found and (3) Yes.

In order to determine the variables which significantly contribute to the differentiation of groups regarding police role in finding missing persons F-test for Wilks’ Lambda has been used (Table 15.44).

The F-test is significant for all predictors (values of Sig. smaller than 0.05), indicating a good selection of ten independent variables.

Discriminant analysis was carried out for three groups defined by police role in finding

missing persons and it resulted in two discriminant functions and consequently two eigenvalues (Table 15.45), which were relatively low. The higher eigenvalue (0.083) corresponds to the first discrimination function, which accounts for 85.7% of the group means dispersion.

The canonical correlation coefficient shows that 7.6%, that is $(0.276)^2$ of the total variance accounts for the differences among the three groups through the first discriminant function.

The size of coefficients on the first discriminant function indicates the highest discriminant power of the predictor variables *loitering* (X_5), *mental illness* (X_8), *alcohol* (X_6) and *voluntarily left home* (X_1). On the second discriminant function such variables are *helpless situation-lost child, dementia, amnesia* (X_{10}), *suicide* (X_9), *loitering* (X_5), *adventure* (X_4) and *teenage rebellion* (X_3).

The values of the structure matrix coefficients obtained are presented in Table 15.47.

The first discriminant function is defined by loitering, voluntarily leaving home, teenage rebellion, love of adventure, the absence of mental illness and partially by family disputes. The second discriminant function is mostly defined by suicidal tendencies and helplessness including dementia, amnesia, etc., and partially by mental disorder, loitering and absence of teenage rebellion.

Group centroids show how groups defined by police role in finding missing persons differ (Table 15.48).

Table 15.48 suggests that the most groups’ differences come from the assumed motives and reasons for disappearance of the missing persons who were not found by the police. This group’s motives and reasons for disappearance more frequently are loitering, voluntarily leaving home, teenage rebellion, love of adventure, and the absence of mental illness, but also the suicidal tendencies and helplessness including dementia, amnesia, etc. Such a finding suggests two extreme age subgroups included in this not-found missing persons’ group.

The indicators of police effectiveness in Croatia show the police response to be relatively prompt, the undertaken measures and actions sufficiently comprehensive, and the cooperation and partnership with the community satisfactory.

The greatest challenge for a successful police search present the so-called active cases of missing persons, i.e. those who are unable to take care of themselves (see Tables 15.29, 15.30, 15.31, 15.32 and 15.33), in particular people suffering from dementia and those with suicidal predispositions. The least challenging are the cases of voluntary departure, youth rebellion and adventurism where a certain number of the persons gone missing return on their own or are found by the persons close to them. Consequently, the police primarily direct their efforts and resources towards the most vulnerable and high-risk cases that are not resolved by implementing the initial set of measures.

15.6 Concluding Remarks

This study has helped to establish the profile of missing persons in Croatia. Unlike other studies, only a third of the sample are children and adolescents, however without any recorded cases of abduction. Compared to the general population characterised by an almost equal proportion of men and women, in the missing person population the percentage of men in the study is somewhat higher than that of women, but women are significantly more represented at young age (children and juveniles). It was found that the overall missing person population has better than average education, with men better educated than women. Over one half lives with family or a partner, and the remaining segment of the sample, in almost equal proportion, lives in reform institutions or on their own. However, the presence of close persons or persons who act as social support figures was not found to be a protective factor. Evidence shows that psychological or psychiatric disorders are the determinants responsible for disappearance, particularly in married participants. Missing persons living alone are likely to be suffering from depression. Manifest mental illness is highest in the segment of the missing person population over 55. Similarly, young people of juvenile age (15–20) are also afflicted by a wide range of psychological problems that are not somatic in nature. Disappearance

of younger people corresponds, for the most part, to the findings of other studies, especially in females: teenage rebellion, adventurism, voluntary abandoning of home, loitering and alcohol. In older population, characteristic reasons for going missing is helplessness mainly attributed to dementia, amnesia and Alzheimer's disease.

Given that Croatia is one of the five states in the European Union with highest unemployment and poverty rates, it needs to be emphasised that 4/5 of the missing persons are not part of the working population (they are pupils, students, unemployed, retired) and are therefore financially dependent on family who should look after their welfare, or they live in care-providing institutions. The quality of care that families can provide is questionable, however, many find themselves in jeopardised situations after losing their job or if their income is too low. In the context of general deterioration of the social and economic situation, all age groups are affected and it has become apparent that their emotional and cognitive ability to cope with crises in their lives is deficient.

In most missing person situations, reporters are family members who notify the police in person within 24 h of disappearance. They supply information required by the protocol and missing person report. These tools are quite useful because they help the police officer to check which questions s(he) has asked and which s(he) has failed to ask. In most cases the gathered information is sufficient to initiate urgent and efficient search for the missing person. Evidence shows that in about 80% cases in this study the police were able to reconstruct and identify the motives, reasons and circumstances of disappearance from the information provided by the reporter. In this respect, the study has shown that the reports predominantly establish social determinants.

However, in individual cases there is a risk of error that may be caused by preconceptions, unjustified premature judgements, stereotyping and halo effect with regard to the reporter and/or missing person, and equating or generalising a particular incident with earlier similar events. Moreover, the police in Croatia have no tools to

assist in risk assessment as some other states do. Development of parameters such as these is one of the future goals of this project.

Indicators of police effectiveness in Croatia show a relatively prompt response by the police, adequacy of the spectre of measures and actions undertaken, and a satisfactory degree of partnership and cooperation with the community. Police resources are primarily directed towards active, most vulnerable and high-risk cases not solved by implementing only the initial set of measures and actions. Given that the incidence of missing persons is growing (base index in 2013 compared to 2000 is 175.78), brought about by socio-economic deprivation, it is most likely that permanent special units will need to be formed for this specialised line of work and a set of operating tools and procedures will need to be developed for these units to follow. Their work will be all the more important given that non-government organisations in Croatia as a rule do not provide any assistance in any stage of search for missing persons and neither do they offer support to families and missing persons once they have been found.

A portion of data gathered for the purposes of this study has been analysed in hope to construct a better picture of the profile of missing persons, and to ascertain the quality of reporting and searching for missing persons. Starting from the fact that both the missing persons phenomenon and the society's response of each country are related to the socio-economic and cultural characteristics of the certain social environment, this study comprises the most important characteristics of missing persons of all ages in the respective context. It points to the most effective police search measures and actions with regard to these characteristics as well. However, there is a serious lack of similar comprehensive studies. Studies of incidence, forensic studies and policy guidance manuals with special attention given to the issue of missing children in existing publications are predominant. In this regard it would be beneficial to carry out extensive comparative studies including different profiles of missing persons and the evaluation of the police work in relation to the profiling results. The overall

contribution of the such studies would be to exchange experience and knowledge in order to develop and employ a best evidence-based practice.

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Investigation of Long-Term Missing Persons as Cold Case Homicides: An American Perspective

Rachel Walton and Silvia Pettem

16.1 Introduction

In the United States, most criminal homicide investigations have historically begun with the response of officers to the finding of a body and a crime scene. From these point-of-origin beginnings, investigators developed cases and forensic evidence, while also identifying and interviewing witnesses and others with potential knowledge. In this course, investigators built their case from the ground up, documenting their efforts according to department or agency protocol. Notes, reports, sketches, and photographs became the case file. In doing so they came to know and identify involved persons and relationships as they mentally constructed their investigative plan. Due to the severity of criminal homicide/murder, most agencies traditionally spared little expense to solve the case. Similarly, reports of missing persons began in much the same way, but given exigent circumstances such as large-scale publicity or public status of the missing person, large-scale devotion of agency resources and investigative follow-through was often minimal or lacking.

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When investigators identified a perpetrator in a homicide and compiled the evidence that allowed prosecutors to file appropriate criminal charges, the police agency moved the case status from *open* to *closed* in their records. If, however, they were unable to garner sufficient evidence to identify, arrest, and charge a perpetrator, the case remained open and “unsolved.” With no new investigative leads, investigators moved on to other cases and these homicide investigations were archived, pending development of new investigation. As new cases and department priorities shifted, these unsolved cases became cold case homicides with little, if any, proactive effort. Similarly, missing persons cases were handled in much the same way, but often in a much-abbreviated form. This has been the traditional paradigm.

Sometimes, however, there is no body. Indeed, there is no evidence that a criminal homicide has occurred. The person has just disappeared. In decades past, such circumstances did not necessarily attract much departmental interest or effort. This was evidenced by only minimal documentation and little, if any, follow-up investigative effort. As a young new officer in the late 1960s, the author observed that, not uncommonly, agencies mandated a 24-h waiting period before they would take a missing persons report. With young persons, many departments surmised that they were willful disappearances/runaways and would return in a day or so. Today, research and statistics suggest that three-quarters of abducted children that

are killed are murdered within the first 3 h (Brown, Keppel, Weis, & Skeen, 2006; Hanfland, Keppel, & Weis, 1997). Investigation was minimal, and documentation the same.

As a result, two things happened. The persons never were seen again, and the paperwork was eventually archived, destroyed, or disappeared. These and other issues plague, and confront, investigators who reinvestigate both types of unsolved cases today, often many decades later. The application of cold case homicide investigative methodologies and techniques, as they can be applied to long-term missing persons, may assist in the reinvestigation of these cases.

As the field of forensic science has evolved in the past decades and homicide rates have declined, many law enforcement agencies have initiated programs, including the establishment of cold case investigation units to review these unsolved homicide cases, some dating 50 years or more. Experienced investigators and academic research have identified two primary solvability factors that have facilitated success in this arena. These are (1) changes in technology and (2) changes in relationships with the passage of time. Exploitation of one, or both, has led to many heretofore-unsolved cases being resolved and perpetrators held responsible for crimes they once thought they had eluded (Walton, 2006).

16.2 American Cold Case Homicide Protocols

This chapter begins by exploring the utilization of these factors, combined with old-fashioned “shoe leather” investigative methods, to resolve heretofore previously investigated long-term missing persons cases, utilizing means and techniques invoked in cold case homicide investigations. Too often, sadly, the long-term missing persons are homicide victims. They just were not investigated as homicides.

Such was the case of Surette Clark, a 4-year-old Navajo girl. Wayne Clifford Roberts, the child’s step-father, had murdered her in 1970, in Phoenix, Arizona, then fled to Canada with the child’s pregnant and terrified mother. Surette was never reported missing, but, in 1979, a child’s

remains were found in Tempe, a nearby city. The remains were misidentified as Caucasian, then put on an evidence shelf and forgotten. Meanwhile, Roberts, the step-father in Canada, confessed to family members that he had killed Surette. In 1993—23 years after the crime was committed—the man’s sister could no longer keep quiet and contacted police. Three years later, an Arizona court convicted Roberts of second-degree murder, even though no body had been found. Officials searched for Surette’s remains even during Roberts’ trial, but a DNA profile of “Little Jane Doe” (the child’s remains found in Tempe) was not compared with DNA from Surette’s mother and her biological father until after Roberts’ conviction. In 2010, 40 years after Surette’s murder and shortly after Roberts was released from prison on parole, police identified “Little Jane Doe” as Surette Clark.

What IS a “*long-term missing person*?” As in cold case homicides, the definition is that which the individual agency designates such to be, and there is no universally accepted designation. Some consider them “*long-time missing persons*” while others denote them as “*long-term missing persons*.” As utilized by the New Jersey State Police, a Long-Term Missing Person is “*any person that has remained the subject of a missing person investigation for over thirty (30) days*” (New Jersey State Police, 2007).

The California Peace Officers Standards and Training guidelines for investigation of such cases suggests nine categories and definitions. These are (1) Catastrophic Missing, child or adult reported missing and assumed to be victim of natural or man-made disaster; (2) Dependent Adult, an adult reported missing and who has physical or mental limitations, such as Alzheimer’s disease; (3) Lost, a child or adult reported to have strayed away and whose whereabouts is unknown; (4) Parent/Family abduction; (5) Runaway, a child under 18 years of age who is reported missing but has left of own free will or rejected by their family; (6) Stranger abduction; (7) Suspicious Circumstances, child or adult reported missing and circumstances give rise to belief that foul play may be involved, or the person is a danger to his/herself, due to physical/mental/emotional conditions, or the disappearance is out of character for the individual

and no known reasons can be determined; (8) Unknown, a child or adult reported missing but insufficient facts to determine circumstances; and (9) Voluntary missing adult, an adult reported missing but has left of his/her own free will. Each of these categories will entail individualized investigative methodologies (California Commission on Peace Officers Standards and Training, 2011).

16.3 Case Reactivation

As in cold case homicides, long-term missing persons' cases may be reactivated, and arise to active investigation status, due to a number of causes. These include:

- Inquiry by a family member, friend, or one acting upon their behalf to inquire if anything new has transpired in their case
- New information brought to attention of law enforcement by family member or friend and which may furnish new leads to investigation
- New information furnished by member of the public
- Institutional knowledge of detectives. This includes previous investigators who previously worked on the case and approach their current counterparts to undertake a fresh review
- Individual investigator curiosity
- Secondary information from other investigations
- Proactive effort on part of the law enforcement agency to reinvestigate these unsolved cases
- Those with legal problems providing information to mitigate their own case
- Discovery of human remains and identification by DNA or other methods
- Media reports
- Political pressure
- And sometimes purely by accident (Walton, 2006)

Whatever the reason for reactivating a long-term missing person's case, as in cold case homicides, basic steps must be considered. These include:

- Locating and reviewing the original case file and evidence
- Assignment of appropriate personnel
- Administrative and supervisory concerns

- Preliminary file review and development of investigative plan
- Investigation (including forensic review)

16.3.1 Locating Original Documentation

Agency size, history, protocols, and plain human behavior may make this relatively easy, or an investigative mission on its own. Past patterns and practices affect file retention. While some agencies may have retained files in an orderly and retrievable manner over the decades, others routinely destroyed paperwork after a designated period of time. Possible locations include:

- Current records storage facilities and location
- Archived records storage facilities, both on- and off-premises.
- Agency property/evidence facilities
- Off-site warehouses and storage facilities

When searching for files that are not readily available, investigators may seek to identify and contact prior personnel, active or retired, who may have knowledge of file and evidence whereabouts. Secretaries and clerks are often a treasure trove of knowledge. With the advent of computers and their usage by law enforcement beginning in the late 1970s and early 1980s, some agencies were slow to incorporate this new technology. Depending upon the age of the missing person's case, file documentation may have incorporated computerized records, paper documentation, or a combination of both. As technology has continued to expand, agencies discarded generations of hardware and software. As a result, if such older technology such as 5.25-in. floppy discs or older operating systems is encountered, it is recommended that investigators seek appropriate technology support.

16.3.2 File Reconstruction: Missing and Unable-to-Locate Files

Absent finding the original file, such information may be reconstructed beginning with name of missing person and date of disappearance, if

known. Identification information may or may not be learned by running the victim through available databases. Investigators may review news media (including both print and film/video-of the period regarding the disappearance and investigation) to begin reconstructing what was reported. Investigators are encouraged to identify each person interviewed by media, as well as their statements. These sources may be maintained in libraries and universities, newspaper “morgues” or broadcast facilities, and media archives found on the internet. As the investigation progresses, and these persons are located and reinterviewed, it may be important to note, and account for, discrepancies or variation between past and current statements.

16.3.3 File Review and Investigative Plan

When the original file is retrieved, it may or may not be organized in compliance with current agency requirements. Investigators are encouraged to make a duplicate copy of the original documentation and use this for their working copy, ensuring the retention and integrity of the original file as retrieved. Investigators may need to reorganize the file if it was discovered in a disorganized condition, but are advised never to discard anything. When the file is located and reviewed, it is suggested that investigators consider the following:

- Identify and confirm the agency as the appropriate jurisdiction for the investigation.
- Write your questions and thoughts down NOW, do not wait until later. They may be answered as your review progresses, but if not, these may be the beginning of your investigative plan.
- Look for “*While You Were Out*” and telephone messages or other contacts from civilians or officers that were never returned. In cold case homicides, such unreturned calls, when now followed up, have not uncommonly provided the vital clues need for case resolution.
- Experienced investigators have found that it is not uncommon in cold case homicide investigation that the perpetrator’s name is in the file within 30 days of the beginning of the original homicide investigation.
- When documents are located that suggest interaction with other agencies, such as route slips or color copies of forms that were designed for routing to specific units, i.e., items such as burglary detail, indicating copies of documents sent to or received from other agencies, contact the agency so as to review its files and compare with what you have, as well.
- Identify all persons noted in the investigation, and ascertain if they were interviewed, and to what extent. It is suggested that, as in cold case homicides, all persons (including officers and similar personnel) be located and reinterviewed. In the course of this review, investigators may find it helpful to construct a biography sheet for each individual in the investigation, past and present. This provides a ready reference for contact as well as a description of his/her role in the investigation (see Fig. 16.1).
- Evidence review. Identify what was documented as being of evidentiary value at the time, and seek to locate and visibly inspect that physical or biological evidence. Cold case investigations are a matter of teamwork, and this includes our partners in the laboratory. What was unknown for forensic value in decades past may open new doors for investigation today.
- In addition to the evidence review, examine any photographs that may be in the file and understand their purpose. These photos may be of assistance in reconstructing a neighborhood canvas. Are their pictures of:
 - The missing person? What is the similarity of their likeness in the photo to when they disappeared?
 - Identified and unidentified persons?
 - Places and locations relative to the disappearance?

INDIVIDUAL BIOGRAPHY SHEET	
Case No. _____	Case Name _____
<input type="checkbox"/> New Witness <input type="checkbox"/> Original Participant <input type="checkbox"/> Relative of Participant <input type="checkbox"/> Other <input type="checkbox"/> Role	
NAME: _____	
DOB: _____	POB: _____
DOD: _____	POD: _____
Current Address: _____	
Current Telephone: _____	
Previous Addresses/Time of Offense: _____	
<div style="border: 2px solid black; width: 200px; height: 80px; margin: 0 auto; display: flex; align-items: center; justify-content: center;"> PHOTO/DRIVERS LICENSE </div>	
Father: _____	Address/Phone: _____
Mother: _____	Address/Phone: _____
Notes: _____	
Figure No. _____	

Fig. 16.1 A biography sheet provides quick access and summarizes information about individuals and their roles in investigations (Copyright: Walton, 2006)

16.3.4 Supervisory and Personnel Concerns

Optimally, these investigations will involve experienced detectives whose “people skills” as well as knowledge of investigative methods and protocols will facilitate investigative efforts. These personnel are analytical. They know how to identify and ask the right questions, to listen, think, and act objectively, and are familiar with

past and present agency means and methods and organizational construct. They are knowledgeable of agency report and documentation protocols. It is *strongly advocated* that personnel assigned to these long-term cases have homicide investigation experience, a background that enables them to recognize matters in the long-term missing persons investigation that might otherwise go unnoticed by one not so experienced.

Similarly, supervisors of investigators in this area must understand that reactivation and investigation of these cases necessitates finding or reconstructing the file, reinterviews of family and friends, as well as interviews of persons not previously associated with the case. This may entail travel to all parts of the country, with attendant expenses, including travel, lodging, and overtime. By their very nature, investigators will need time to learn the case from reading what was—and was not—documented in the previous investigation(s). Investigators will need to locate and reinterview previous law enforcement and similar personnel identified as having been involved in the previous investigation, and seek to learn if they retain any documentation or unrecorded information about the case. In addition, as these cases develop, other personnel may have to backfill and carry part of the case load of missing person investigators while they focus on their cases. All of this takes time, and potentially financial expenditure and personnel allocation may be necessitated as well as adjustments in case load.

16.3.5 Investigative Plan

During this review, the investigator attempts to understand what was known, and what needs to be learned as the investigation moves forward. As in a cold case homicide, the investigator seeks to learn the “*who/what/how/why/when and where*” aspects of the case, as well as “*M.O.M.*”—Who had “*Motive-Opportunity-Means?*”

- Who—*Is my victim? My suspect? Witnesses? Are unidentified others not previously contacted?* Learning as much about the victim as possible may open avenues of investigation heretofore unknown.
- What—*Happened to my victim? Evidence do I have?*
- Why—*Did it happen? Is my victim’s disappearance voluntary or involuntary?*
- When—*Did it happen?*
- How—*Did it happen? Did my victim disappear? Is this a case of foul play?*

- Where—*Did my victim disappear from? Was my victim last seen? By who and under what circumstances?*

16.3.5.1 Motive–Opportunity–Means (“M.O.M.”)

In addition, the investigator needs to learn, and confirm:

- Who reported my victim missing? During the investigation, it is prudent to recontact this person(s) as well as others involved in the original investigation. Current statements should be analyzed and compared to the original statements and any discrepancies noted and investigated.
- Date and time reported? Date and time last seen? By whom? Where? Relationship?
- Where was the victim reported missing from?
- Exactly what were original officers told?

The most frequently asked question at the outset in a cold case homicide investigation is “*Do we notify the victim’s family?*” The answer to this is very subjective. Families of these victims have ridden an emotional roller coaster since the event. If the case goes unsolved, the emotions of the events are brought to the surface once more, and again, no resolution. Sometimes, however, family members or those close to the family may have been involved, or have knowledge, and they are alerted to the fresh investigation.

However, and depending upon circumstances, contact with the family is, suggestively, a primary investigative activity in these cases, and the passage of time may increase solvability. While such contact may also open the flood gates of emotion, it is important to ascertain if family members heard or became aware of anything in the subsequent years that investigators may not be aware of, and to confirm that which is already known or to learn new information about the victim or others. What might have been insignificant conversation or information to them at the time and not conveyed during the initial investigation, or learned subsequently, might be the key information needed to successfully resolve the case today.

If the victim had younger siblings or friends, were they interviewed? When and where, and in the presence of whom? It is worth noting that with the passage of time, and potential maturity and growth, these siblings or other young persons may now reveal information that they were previously afraid to disclose. As with the sister of the killer of the Navajo girl, Surette Clark, family name or fear of disclosure of something may have inhibited revealing to original investigators information that might have been important to the investigation. Such examples might include family dynamics, such as sexual abuse, which may have been a factor in the individual's disappearance.

16.3.6 Neighborhood Canvas and Scene Inspection

According to Geberth (1996), a neighborhood canvas is a door-to-door inquiry or brief interviews of persons on the street by which investigators attempt to learn information about a specific incident. If known (or ascertained from the family), the investigator may revisit the location where the missing person was last seen. Given the passage of time, construction may have altered the scene, and people come and go, but by visiting the location, the investigator may identify possible locations of witnesses and potential locations for disposal of human remains. Investigators should keep in mind and not overlook that many persons often live in their same locations for many decades.

If the neighborhood has changed significantly during the interlude between the victim's disappearance and the reactivation of the investigation, investigators may reconstruct the neighborhood or location by consulting records of:

- Building and Planning Departments
- Water and other civic services
- Fire and Police
- Aerial photographs
- City/County directories for specific years
- Other sources specific to the government entity

By reconstructing who lived where at the time the victim went missing, investigators may locate

and interview persons who might offer investigative leads. Often, if a canvas was done at the time of the homicide (or missing person), it was all too common that if no one was home at the time the officer knocked on the door, no follow-up occurred and the potential witness went without contact.

16.3.7 Investigation

In cold cases, it is suggested that investigators:

- Identify, locate, and reinterview all investigators and personnel involved in original investigation. During this, investigators should attempt to learn if these personnel have any documents or other evidence pertaining to the case, and any information that they may not have reduced to written documentation.
- Identify and review similar homicide or missing persons cases within the area and the region to try to establish links between cases.
- Identify and explore individuals arrested or convicted for offenses both before and after the critical time period that may suggest potential involvement
- Interview/reinterview family members, and identify the reporting party as well as friends, associates, and others who are known to have been contacted during the initial investigation.
- Check local coroner and medical examiners in this jurisdiction as well as surrounding jurisdictions for unidentified human remains discovered since/about time victim went missing. Do they retain:
 - DNA samples as well as dental or skeletal X-rays, and fingerprints?
 - Photographs from autopsy, including scars/marks/tattoos?
 - A detailed inventory of any clothing or jewelry found on the deceased may aid in identification.
- Does the jurisdiction have access to, or is there in existence, a state or national registry for missing persons?
 - Is there familial DNA on file? Has a Family Reference Sample Kit been obtained?
 - Was the missing person's effects examined for DNA? Sources of such might include

clothing, toothbrush, hairbrush. If not, the victim's family may have retained such items and investigators are urged to explore this avenue of investigation.

Other avenues for investigation include search for indications of:

- Bank account activity
- Arrest or police contacts
- Social Security or other government financial activity
- Requests for high school or college transcripts
- Drivers license or identification card activity
- Who gained financially from the victim's disappearance?
- Did anyone obtain a legal finding of death?
- Did anyone move away shortly after the victim disappeared?
- Did anyone exhibit unusual or strange behavior after the victim disappeared?

16.4 Behavioral Analysis

During the investigation, investigators may seek experienced assistance in understanding behavioral aspects of both the victim and any persons of interest who may be developed. In the United States, many state criminal justice agencies as well as federal law enforcement agencies include personnel specifically trained and experienced in behavioral analysis as exhibited at the crime scene, or in individual behavior.

Learning as much about the victim as possible is important in these investigations, and investigators may consider a "victimology assessment." This may initially be undertaken by an experienced investigator to help identify whether this was a voluntary disappearance or any of the nine categories previously noted by the California POST report types. As in cold case homicides, investigators seek to identify who might have had "*MOM*," and assessment of the victim might also include inquiry into:

- Financial situation
- Marital/sexual relationship

- Family issues (including custody)
- Business concerns and pressures
- Review of Facebook and other social media (if applicable)
- Emotional issues and mental state
- High-risk lifestyle, including prostitution, alcohol, and drugs
- Health issues

If the missing person had a computer and it was never analyzed and, perhaps, still in the possession of family members or others, a forensic examination is suggested. Cold case homicide and long-term missing person investigations involve teamwork and cooperation among many disciplines, and knowledge of available resources to compliment the investigation. Among these are government resources for long-term missing persons and cold case homicides as well as nongovernment sponsored organizations.

16.5 Cooperation

With the growth and expansion of police agencies, organizational practices often lead to specialized units, sometimes located separately from central headquarters. These specialized units can include homicide, robbery, sexual assault, missing persons, and more. As a result, communication can suffer. In addition, personality conflicts can sometimes exacerbate this situation. As a result of these and other circumstances, case resolution can suffer due to lack of communication. In larger agencies, those tasked with missing persons investigations do not always receive the same allocation of resources, or perhaps prestige, as those charged with homicide investigations. In reality, long-term missing persons are not uncommonly homicide cases. Recognizing their physical and organizational practices inhibited efficiency in this regard, homicide and missing persons administrators in a large west coast city arrived at a solution to minimize these deficiencies. At their regular meetings and reviews of missing persons cases, experienced homicide investigators became part of the review team and were given authority to assume responsibility for

the investigation of long-term missing persons cases when, in their opinions, the case circumstances warranted homicide levels of expertise and investigation. This practice has proven successful in agencies such as the Los Angeles Police Department.

16.6 Technology and Innovations

As noted earlier in this chapter, the application of cold case homicide investigative methodologies and techniques can be, and should be, applied to the reinvestigation of long-term missing person cases. In addition to the traditional approach, however, Americans have developed, and are using, several new and innovative resources at the federal, state/local, and volunteer levels as described on the following pages.

16.6.1 Federal

Multiple federal agencies and programs are available to assist in the investigation of cold case homicides and longtime missing persons.

16.6.1.1 Federal Bureau of Investigation (FBI)

This agency maintains numerous programs and databases which may assist in these investigations. The Behavioral Sciences Unit at the FBI Academy assists local agencies in reviewing circumstances of these cases, analysis of behavioral characteristics, as well as consideration of investigative plans.

16.6.1.2 NCIC

The National Crime Information Center (NCIC) is a computerized nationwide information system supporting criminal justice agencies and is available to law enforcement 24 h a day, 365 days a year. It consists of a series of specialized files, including those on property and persons. An archive of entries is also kept in an offline system. While all file indices may be of assistance during the course of these investigations, a Missing-Person's file was originated in 1975, using defined

criteria. These include whether the missing person is a juvenile, endangered, disabled, or the disappearance is involuntary or due to catastrophic circumstances or other factors. In addition, NCIC has also maintained an Unidentified-Person file since 1983 and a national Sex Offender Registry file since 1999. The Integrated Automated Fingerprint Identification System (IAFIS) was introduced in July, 1999. These systems incorporate data held at state levels as well as federal levels.

16.6.1.3 CODIS

The Combined DNA Index System (CODIS) became operational in October 1998. This tiered system is the national DNA database into which are entered DNA profiles from (1) forensic unknowns at crime scenes; (2) convicted offenders who are required to provide such samples; (3) Missing Persons; (4) Unidentified Human Remains; and (5) Relatives of Missing Persons.

16.6.1.4 National Center for the Analysis of Violent Crime (NCAVC)

This unit provides behavioral-based investigative support for local, state, national, and international law enforcement. It consists of five units, including those units tasked with providing behavioral analysis for crime against children and crimes against adults. Within this center is the Violent Criminal Apprehension Program (VICAP). It consists of a database and tools available to law enforcement for investigation and linkage of missing person and unidentified human remains cases as well as homicide and other offenses. These sources enable law enforcement to associate cases that are dispersed geographically and might not otherwise appear to be connected. For further information, see <http://www.fbi.gov>.

16.6.1.5 National Center for Missing and Exploited Children (NCMEC)

This organization, a partnership between public and private resources, works with law enforcement on issues related to long-term missing, missing, and sexually exploited children. Founded in 1984 as the result of high profile

missing children cases, it provides investigators with a number of resources. In addition to a national toll-free hotline and assistance in current case investigations, this partnership offers resources to law enforcement including:

- Forensic Services Unit. This unit offers a variety of technologies and disciplines to aid in investigation.
- Biometrics Team. Provides assistance in “*identification of unknown children through collection and sharing of enhanced data and biometrics.*” (www.missingkids.org). This effort partners with NCIC and NamUs, the National Missing and Unidentified Persons System (see below). Their efforts include ensuring that DNA has been collected and profiled from missing and unknown children and searched accordingly in databases.
- Facilitating collection and loading of odontological and fingerprint imagery into appropriate databases.
- Preparation and distribution of posters documenting personal property found with deceased children.
- Forensic imaging and Age Progression.
- Forensic art.
- For further information, see <http://www.missingkids.org>.

16.6.1.6 National Missing and Unidentified Persons System (NamUs): A Dual Database for the Missing and Unknown

The dual databases of NamUs comprise a national centralized repository and resource center for missing persons and unidentified decedent records. The NamUs System is managed and administered by the University of North Texas Health Science Center under the direction of the federally funded National Institute of Justice. The user-friendly investigative tool is a free online system that can be searched by medical examiners, coroners, law enforcement officials, and the general public from all over the country. NamUs-MP contains data on missing persons, while NamUs-UP contains information on the

remains of unidentified persons. A third database is the Unclaimed Persons databases. Each of these databases is accessible from the NamUs System’s home page www.namus.gov/.

Paula Beverly Davis and Englewood Jane Doe: A Namus Success Story

On August 8, 1987, 21-year-old Paula Beverly Davis visited her parents’ home in Kansas City, Missouri (Fig. 16.2). The outgoing and pretty brunette had married and moved out of her parents’ home, but she had separated from her husband and, at the time of her disappearance, lived in the Kansas City area in an apartment with a female roommate. At 3 a.m. on the morning of August 9, 1987, Paula’s roommate called the Beverly household, saying that Paula had not come home as expected. The roommate had last seen her at a truck stop near the exit at Oak Grove, Missouri, on Interstate 70. Within hours, Paula’s



Fig. 16.2 Paula Beverly Davis was reported missing from Kansas City, Missouri, on August 9, 1987. With the NamUs System, her remains were identified 22 years later (Copyright: Pettem, 2013)

mother went to her local police department where she filed a missing person's report, even specifying that her daughter had two tattoos: a unicorn on her right breast and a red rose with green leaves on her left breast.

Twenty-two years later, shortly after the launching of the National Missing and Unidentified Persons System (NamUs), Paula's two tattoos would connect the missing young woman with a Jane Doe found nearly 600 miles away.

On August 10, 1987, one day after Paula's mother had reported her daughter missing in Missouri, an unidentified white female's semi-nude body was found near an eastbound ramp off Interstate 70 in Ohio. The Montgomery County Coroner's Office, in Dayton, Ohio, examined Jane Doe and estimated that she was between 17 and 25 years of age, approximately 5-ft.-5-in. tall, and weighed 125 lb. The cause of her death was "ligature strangulation." The coroner's report noted her physical description, including mention of a tattoo of a unicorn on her right breast and a red rose with green leaves on her left breast. But no one, at the time, connected her with the woman missing from Missouri.

Ohio authorities relegated their unidentified victim to an obscure burial ground for the county's indigent, owned by the city of Dayton, a classic "potters' field"—a Biblical reference for the final resting place of the poor. When a reporter for the *Dayton Daily News* visited the cemetery in 1999, he called it a "no-frills burial ground for the penniless and forgotten."

As the number of burials at the cemetery continued to increase, Jane Doe was not entirely forgotten. Englewood Police Department Sergeant Mike Lang had started his law enforcement career as a dispatcher when he was still in college. Even then, he got teletypes with possible leads on the unknown victim, but none of the tips led to her identification.

Unfortunately, the above scenario—a missing person in one state and unidentified remains in another—is still far too common. In the spring of 2009, however, the situation began to change when the Montgomery County Coroner's Office entered descriptions of its handful of unidentified remains cases, including Englewood Jane Doe,

into NamUs-UP. This unidentified persons database is linked to the missing persons database, NamUs-MP, to form the National Missing and Unidentified Persons System, funded by the National Institute of Justice (NIJ).

A few months later, in October 2009, Paula's two sisters learned of the NamUs System—the first government-sponsored databases of their kind that allow access not only to law enforcement, medical examiners, and coroners, but *also to the general public*. With a copy of Paula's missing person report, they typed in the pertinent information and quickly read through the first nine possibilities. They ruled them all out, then got to the very last profile which was a description of the unidentified female found in Ohio, complete with the same distinctive tattoos. The search only took about 30 min, and the sisters immediately knew they had found Paula.

Paula's mother had died in 2005, not knowing what happened to her oldest daughter. On December 11, 2009, a DNA comparison with Paula's father positively identified the Ohio victim as Paula Beverly Davis. Eventually, her remains were exhumed, cremated, and moved to the cemetery where her mother is buried. The young woman was found through a well-filled-out missing person's report, DNA technology, family members who searched the NamUs-MP database, and a coroner's office that diligently entered all of the components of the unidentified remains into the NamUs-UP database.

The identification of Englewood Jane Doe as Paula Beverly Davis is an excellent example of how the National Missing and Unidentified Persons System (NamUs) is capable of tying together a coroner's office with both law enforcement and a family. For 22 years, Paula's family, as well as her local police department, had no information at all. In Ohio, the Montgomery County coroner's investigators and the Englewood police detectives were stumped, until Paula's sisters—members of the general public—sat in their own living room and searched for Paula.

The Missing Persons Database (NamUs-MP) contains information about missing persons that can be entered by anyone. Before the case is

posted, however, the information is verified with law enforcement, given an NCIC number, and sensitive material is restricted. NamUs-MP provides a user with a variety of resources. Of specific importance to financially strapped agencies is *free* (taxpayer-funded) forensic services, including DNA testing along with other forensic services including odontology, anthropology, and fingerprint analysis. The DNA testing is conducted at the University of North Texas Center for Human Identification (UNTCHI), which provides family reference-sample kits—at no charge—to any jurisdiction in the country. Other efforts include training law enforcement officers, medical examiners, judges, and attorneys on forensic DNA evidence.

The Unidentified Persons Database (NamUs-UP) contains information entered by medical examiners and coroners. Unidentified persons are people who have died and whose bodies have not been identified. Anyone can search the NamUs-UP database using characteristics such as sex, race, distinct body features, and even dental information. Again, at the discretion of medical examiners and coroners, sensitive material (such as a photograph of a decomposed body) may be restricted and thus not viewable by the public. All that Paula's sisters did was perform a simple search in NamUs-UP, the unidentified persons database. The system was so new, at the time, that Paula's missing person case had never been entered into NamUs-MP, the missing persons database. *If* Paula's missing person case had been in NamUs-MP, her identification with Englewood Jane Doe may have been discovered even earlier.

The newly added UnClaimed Persons database (UCP) contains information about deceased persons who have been identified by name, but for whom no next of kin or family member has been identified or located to claim the body for burial or other disposition. Only medical examiners and coroners may enter cases in the UCP database. However, the database is searchable by the public using a missing person's name and year of birth.

In addition, whenever a new missing person or unidentified decedent case is entered into NamUs, the system automatically performs cross-matching comparisons between the databases, searching 24 h a day, 7 days a week for matches

or similarities between cases. Automatic matches are not viewable by the public, but the feature can be very helpful to medical examiners and coroners and to law enforcement.

The first resolved case from an automatic match was the identification of Ronald Lee Norman, of Detroit, Michigan. Ronald, age 42, lived in an adult care facility due to a disabling head injury. On December 8, 1991, he went for a walk and never was seen alive again. Police took a missing person report and filed it away. On April 24, 1992, two fishermen came across a male body floating in Lake Erie. The medical examiner determined that the victim's cause of death was drowning, and the unidentified man was buried as a "John Doe" in a local cemetery.

In February 2011, 19 years after Ronald was reported missing, police and medical examiners began entering their agencies' unidentified cases into the then-relatively new NamUs databases. Shortly after they entered the John Doe found in Lake Erie, the NamUs System automatically flagged it as a potential match to Ronald Lee Norman. When an investigator compared the unidentified and the missing person cases, he noticed that Roland and the John Doe had similar features—specifically missing teeth, a skull injury, and similar clothing. A few weeks later, the Monroe County, Michigan, Medical Examiner made the positive identification (NamUs Success Stories, 2014).

16.6.2 State/Local

16.6.2.1 Colorado Cold Case Review Team

More localized cold case homicide review teams have been successful. Created and mandated by the Colorado legislature in 2007, this unfunded unit operates under the auspices of the Colorado Bureau of Investigation. It addresses cold case homicides and long-term missing persons. At a meeting of assembled members, an agency presents its unsolved case, most often in PowerPoint® format, after which review team members ask questions and offer suggestions. The presenting agency subsequently is emailed an electronic account of the presentation as well as a list of the

questions asked and suggestions given by the team. As with the Vidocq Society noted below, all matters are confidential within law enforcement. Meeting two to four times a year, it includes representatives from:

- Prosecutors' offices
- Forensic disciplines
- Homicide investigators
- Behavioral experts
- Victim advocates
- Forensic pathologists

16.6.2.2 Cold Case Playing Cards

In any type of investigation, it is always prudent to go to the source with the most information. That's what an agent in the state of Florida did when he developed the concept of cold case playing cards. The only difference between the new cards and an ordinary deck of 52 playing cards is that each cold case card carries a brief write-up on an unsolved homicide or a long-term missing person, along with a photograph of the victim. The cards are the only decks available for Florida inmates to use in all of the state's prisons.

Law-enforcement's use of these playing cards as an attempt to solve long-term missing persons and cold homicide cases was the brainchild of Tommy Ray, a native of Auburndale, Florida, who started working cold case homicides in 1982 for the Polk County (Florida) Sheriff's Office and then became a special agent with the Florida Department of Law Enforcement (FDLE).

In 2005, Ray recruited a group of crime-solving professionals who meet monthly to collaborate on the county's many unsolved murders. The group also maintains a website that lists more than 150 Polk County cases of unsolved murders and unidentified remains, as well as long-term missing persons whose cases may have turned into homicides. The team had been impressed with playing cards distributed in 2003 by the United States military to United States troops stationed in Iraq. Those cards featured Iraq's most wanted fugitives, in which Saddam Hussein (executed in December 2006) was the Ace of Spades.

The group distributed its first deck of cards in the Polk County Jail and had almost immediate

success. In November 2005, local officials arrested two individuals for the 2004 fatal shooting of Thomas Wayne Grammar. The tip came from an inmate who saw Grammar's playing card and remembered another individual confessing to the crime, but until the inmate saw the card, he had not believed that the crime actually occurred. "Jails are the Internet of unsolved crimes," CBS News correspondent Mark Strassmann said in a television news report outside the Polk County Jail in March 2006. "Prisoners know things, they hear things, and sometimes they talk."

Spurred on by success at the local level, Ray took the idea to the state. In July 2007, the Florida Department of Law Enforcement (FDLE), Florida Department of Corrections (DC), and the Florida Attorney General's Office announced that the agencies had teamed up with the Florida Association of Crime Stoppers and developed two statewide decks of cards—featuring 104 unsolved cases. At first the cases were assigned to the card by how old the crimes were—Aces and Kings for the oldest—but now the numbers and suits on the cards are randomly assigned. According to the FDLE's press release at the time, approximately 100,000 decks of cards were distributed to 93,000 inmates in 129 state prison facilities.

The cards were funded by the Crime Stoppers Trust Fund, administered by the Florida Attorney General. The Trust Fund had been created in 1998 when the Florida Crime Stoppers Act was passed by the state legislature. A toll-free number is listed on each card, and offenders are given access to telephones so they can call in new information. As with all Crime Stoppers initiatives, no identifying information is obtained from the callers—the callers are free to remain anonymous. According to Ray, the playing cards are well received by the prisoners: "The inmates are fascinated by them," he said. "They've told me that if the cards were about drugs or thefts, they would keep their mouths shut, but unsolved murders and long-term missing persons are different, as the victims could be one of their family members."

Within months, two murder cases were solved as a result of the first edition of the statewide decks—James Foote and Ingrid Lugo. Foote was

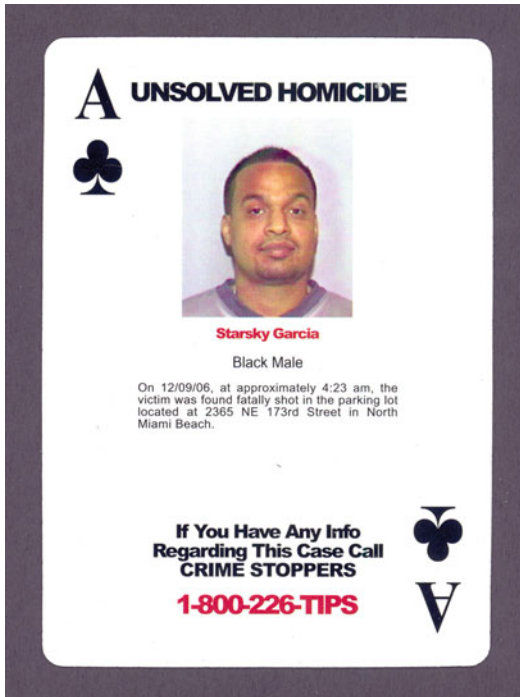


Fig. 16.3 The unsolved homicide of Starsky Garcia is featured on a Florida cold case playing card (Copyright: Pettem, 2013)

the first. He had been found dead on November 15, 2004, from a single gunshot wound to his chest. His killer was arrested in October 2007, after an inmate at the Columbia Correctional Institution Annex in Lake City, Florida, saw Foote's cold case playing card (Fig. 16.3) and alerted authorities. "This arrest is a good example of just how far creative-out-of-the-box thinking can go toward fighting and solving crime in our communities," stated Florida Attorney General Bill McCollum in a FDLE press release at the time.

Lugo, the second statewide case solved, had been murdered on December 13, 2004, nearly a month later than Foote, and was strangled in a retention pond in Manatee County. An inmate at the Cross City Correctional Institution in Cross City, Florida, saw the cold case playing card featuring Lugo and contacted Crime Stoppers to report the involvement of the victim's ex-boyfriend, a former inmate (on forgery charges) at the same institution.

Since then, the original founding agencies have produced additional decks which have been distributed to all of the approximately 65,000 inmates in all 67 county jails and to all of the approximately 141,000 supervised offenders reporting in through the state's 156 probation offices. FDLE Commissioner Gerald Bailey called the cards "a creative and well-crafted approach to investigating some of Florida's toughest cases."

Following the Florida model, cold case playing cards have been produced in several other states including Texas, South Carolina, California, Washington, Kansas, Oregon, New York, Kentucky, Minnesota, Oklahoma, Maryland, Virginia, Missouri, and Colorado, as well as in the state of Queensland, Australia. "Working cold case homicides is the most challenging as well as the most rewarding thing I have done in my 39 years of law enforcement," said Tommy Ray. "These cards show that you're never too old or too young to think of new ideas in solving these most heinous of crimes" (Pettem, 2013).

16.6.2.3 Volunteers: How They Can Help

During frontier times in the American West, when a sheriff, for instance, had to chase a horse thief or track down an outlaw, he formed an armed citizen posse. That was an innovative use of volunteers in time of need. Today, many agencies face budget cuts and/or are understaffed. At the same time, they have backlogs of cold cases that may only get looked at in the investigators' limited spare time, or the cases get passed on from one investigator to another. These situations call for a return to the same kind of action as in the "old days"—the use of volunteers.

Volunteers already assist law enforcement in many ways. When researching cold case homicides and long-term missing persons:

- Volunteers come with different perspectives. After taking a cold case off of the shelf, a volunteer with a fresh pair of eyes—a valuable asset in cold case homicide and long-term missing person reviews—may uncover inconsistencies, discover gaps in the documenta-

tion, or even find telephone messages that were never returned.

- Volunteers have the time to do background work (such as chronologically arranging the contents of case files, making spreadsheets of family members, creating witness lists, and looking up current contacts) that allow detectives to focus on their jobs.
- Volunteers can offer specific skills, such as people searching, historical research, software expertise, or even web design.
- Volunteers are willing to work for free. Why? Some may be working toward a new career or following a specific interest, while others may simply want to make contributions to their communities.
- Volunteers have a passion for their work—otherwise they would not be there.

Some volunteers are retired professionals or interested civilians of all ages and occupational backgrounds who work in the Detective Sections of individual agencies. Others range from graduate student interns and students in college groups—to retired law enforcement officers and FBI agents who have become bored with retirement and want to get back in the action. The students often follow a career path in criminal justice, while the retirees get a chance to continue doing the jobs they loved and are trained for, without putting in long hours. Volunteers can be recruited, too. Already vetted and interested persons may be as close as one's agency's citizens' academy.

The use of volunteers in cold case research varies by agency. Some agencies will only work with retired officers, while others welcome individuals they trust, providing the civilians have been vetted, undergone background checks, and sign confidentiality agreements. Obviously, agencies have legitimate concerns as to the protection of the integrity of their cases, but they can set mutually agreeable boundaries on activities such as access to case files and/or law enforcement-only websites. With signed agreements, volunteers, as well as their supervisors, know where they stand (Regensburger, 2001).

As noted in Regensburger's magazine article, agencies planning to use volunteers in their cold case units should:

- Keep an open mind with respect to using civilian volunteers, particularly professionals.
- Make use of the talents and strengths of each volunteer. (Look for those who are detail-oriented and possess good organizational skills.)
- Develop a set schedule for the volunteer.
- Allow the volunteer access to case files in return for signing a confidentiality agreement.
- Develop clearly identifiable tasks for the volunteer to perform.
- Make the volunteer feel he or she is part of the team.

The Volunteers in Police Service (VIPS) Program is a resource for law enforcement agencies who do not have well-developed volunteer programs or who would like to start their own. The program was developed in 2002 by the International Association of Chiefs of Police (IACP), in partnership with the White House Office of the USA Freedom Corps and the Bureau of Justice Assistance, Office of Justice Programs, United States Department of Justice. VIPS publishes a newsletter addressing the issues related to law enforcement volunteer programs and also provides lists of policies and procedures, including drafts of confidentiality agreement forms. The following list itemizes some of the VIPS' resources from its program's website (International Association of Chiefs of Police, 2014).

- An online directory of law enforcement volunteer programs
- A resource library of sample documents, forms, and materials from law enforcement
- Volunteer programs and other sources
- A resource guide, "Volunteer Programs: Enhancing Public Safety by Leveraging Resources," to assist in the implementation or enhancement of an agency volunteer program
- A model policy on volunteers
- Training and educational seminars for law enforcement

- No-cost technical assistance and mentoring for law enforcement agencies
- Educational videos
- VIPS Focus series—innovative volunteer programs covering a wide range of volunteer management issues and subject areas

In addition to volunteers who primarily work at their desks, others who assist law enforcement agencies in their search for missing persons and/or recover the remains of long-term missing persons do so in the field. Two search groups, among the many specialized, and independent, volunteers, are discussed below.

16.6.2.4 Vidocq Society

In the United States, citizen participation is encouraged and expected. Numerous private organizations support law enforcement efforts in the area of cold case homicides and long-term missing persons.

Founded in the early 1990s, the Vidocq Society is a volunteer organization consisting of active duty and retired experienced law enforcement and forensic personnel, as well as other disciplines, that meets in Philadelphia each month to review unsolved homicides presented by law enforcement agencies from around the nation. The members contribute their experience and expertise, pro bono, to assist agencies in the resolution of these cases, many of which are decades old. Recognized by the U.S. Department of Justice as a viable cold case resource, further information may be found at <http://www.vidocq.org>.

16.6.2.5 Texas EquuSearch

The Texas EquuSearch (TES) Mounted Search and Recovery Team was founded in August 2000 in order to provide volunteer horse-mounted search and recovery for lost and missing persons. It is now among the few specialized volunteer teams that offer law enforcement assistance in undertaking searches for missing persons presumed to be dead. The Team initially formed in the North Galveston County area and is dedicated to the memory of Laura Miller, the daughter of its founding director, Tim Miller.

In 1984, Laura—a pretty 16-year-old with shoulder-length brown hair—was abducted when talking on the telephone at a convenience store. One-and-one-half years later, the teenager's skeletal remains (along with those of another young woman) were found in a dumping ground. In the 1990s, there were several more murders of young women in the area, and Miller would go to the spots where they had been found to see if he could find similarities with Laura's murder. Then he started meeting with several of the families. Before long, someone suggested that, since he was a horseman, he should start a mounted search-and-rescue operation, which he did.

Unlike other search-and-rescue organizations, TES not only utilizes the skills and abilities of horseback riders, but the group can quickly marshal a large force of volunteers, and they are flexible enough to accept assistance from a variety of disciplines and is funded solely by donations (Wells, 2007).

Members of the Team include business owners, medics, firefighters, housewives, electricians, students, former FBI and law enforcement, current law enforcement, former and current U.S. Marshals, and all walks of the military. In addition to using horses, they also search on foot, with ATVs, with dogs, on boats, and in the air. To date, the organization been involved in more than 1100 searches in 42 states and several foreign countries, has returned more than 300 missing people to their families, and has found the remains of at least 103 missing persons (Texas EquuSearch. <http://texasequusearch.org/>).

16.6.2.6 Ralston and Associates

Consider, too, the underwater search and recovery missions of Gene and Sandy Ralston, founders of Ralston and Associates, an environmental consulting firm specializing in water-related services in Boise, Idaho. For nearly three decades, the couple has traveled, and continues to travel, throughout the United States and Canada—without pay—in order to search for and recover drowning victims. All the Ralstons ask in return is reimbursement of the expenses of pulling, behind their motor home, their boat and side-scan

sonar equipment. Since 1983, they have located the remains of more than 90 people.

In their many years of searching for and recovering drowning victims, the Ralstons have learned that some families want their loved ones to rest in peace where they are, while other families are unable to fully go through the grieving process until they have physical remains to bury. The recoveries are numerous and are only made at the request of the families and with the cooperation of law enforcement.

Gene Ralston says that he has seen the anguish of the families waiting for their loved ones to be found, calling it a “long, agonizing and wearisome time for a family to go through.” He added, “The feeling is likewise hard to describe. We are very elated we can bring some measure of resolution. I don’t like the word ‘closure’ [since] there is never a ‘close’ to incidents like this—to a family’s grief—but it is a bittersweet feeling. Many families we have helped stay in contact with us to let us know how they are doing and continue to express their appreciation for our efforts” (Pettem, 2013).

16.7 Conclusion

In conclusion, twenty-first century investigations of cold case homicides and long-term missing persons combines the best of old fashioned shoe-leather detective work, as well as advanced technology and innovative programs at local, state, and federal levels. These have come together to enable investigators to resolve previously reported and investigated cases, which—had they been easy—would have been solved in the first place.

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Estimating the Appearance of the Missing: Forensic Age Progression in the Search for Missing Persons

James Michael Lampinen, William Blake Erickson,
Charlie D. Frowd, and Gregory Mahoney

17.1 Introduction

According to the National Crime Information Center, there are approximately 85,000 active investigations for missing persons in the United States at any given time (NCIC, 2014). Approximately half of those cases involve missing juveniles. Most of the time, these cases are resolved quickly (Finkelhor, Hammer, & Schultz, 2002; Finkelhor, Hammer, & Sedlak, 2002; Hammer, Finkelhor, & Sedlak, 2002; Plass, Finkelhor, & Hotaling, 1997). However, in an important subset of cases, a person may go missing and may remain missing for a long period of time (Allen, 1990). Figure 17.1 shows a scatter plot from Lampinen, Arnal, Courtney, and Adams (2009) showing current age as a function of age the person went missing; this is for cases listed with the National Center for Missing and Exploited Children in the United States. The typical missing person in this archival study went missing when

he or she was approximately 12 years old and has been missing for approximately 8 years.

Long-term missing person cases are frustrating for both law enforcement and for the loved ones of the person who went missing (McQueen, 1989). As noted by John Rathbun, “when the cases pass the 1-year anniversary, it’s like everything dies on the vine. Like a magical switch turns off. No calls. No tips. No leads. And the case just withers away. Parents, and understandably so, get upset with the police because we have not kept their kid’s case alive. They ask why we aren’t trying harder. But in all honesty, the investigative team is not very active at this point. All the spade work has been done. The formal leads have been checked. The suspect’s profile has been searched. They’ve had a whole year or more to work the evidence. Officers still are concerned about the unsolved cases, but there is no point redoing all that work when there is no new direction to go...” (cited in McQueen, 1989).

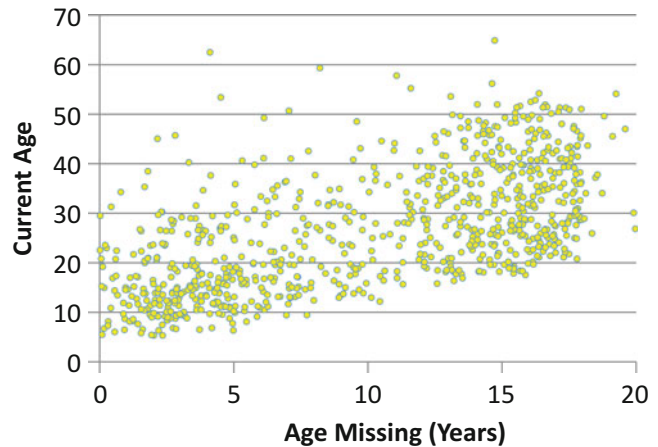
Efforts to find missing persons often rely on releasing the picture of the missing person in the hopes that someone will recognize the individual (Lampinen, Arnal, Culbertson-Faegre, & Sweeney, 2010; Lampinen, Peters, Gier, & Sweeney, 2013; Pashley, Enhus, & Leys, 2010). This strategy becomes more complicated in long-term missing persons cases because appearance can change dramatically with the passage of time (Feik & Glover, 1998). One approach to dealing with this issue is to have experts create images

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Fig. 17.1 Scatter plot showing current age as a function of age missing for cases listed with the National Center for Missing and Exploited Children in the United States (reconstructed from Lampinen et al., 2009)



depicting what the missing person may currently look like. These pictorial estimates of current appearance are called forensic age progressions (Taylor, 2001). The archival study mentioned above found that age progressions are used in approximately one-third of the cases listed with NCMEC in the United States and are more likely to be used the longer the person has remained missing (Lampinen et al., 2009).

Despite the prevalence of their use, there is a dearth of research on the effectiveness of age progressions and ways of maximizing the effectiveness of age progressions. In the following sections of this chapter, we begin by describing what is known about how faces change over time. We then discuss techniques used to create age progressions. These include both techniques used by forensic artists when they create age progressions, as well as computer-based techniques that have been developed to automate the age progression process. Next, we discuss some of the challenges faced by any age progression technique and consider the empirical data on the effectiveness of age progressions. Finally, we outline some of the new techniques that are being developed for producing age progressions and offer future directions for research.

17.2 How Faces Change Over Time

Age-progressed images of missing persons are created under the assumption that an image approximating the impact of age-related changes

over time must be made to optimize recognition of a person whose most recent photograph is outdated. To fully understand this logic and to appreciate the challenges faced by forensic imaging specialists (which will be discussed in greater detail later), this section presents a brief overview of the major changes faces undergo with aging and development.

17.2.1 Development from Infancy to Adulthood

Our description of the early stages of facial growth is based largely on the work of dental surgeons Gillgrass and Welbury (2012). Development of the face begins with the rest of the body in the earliest weeks after conception. This occurs when neural crest cells migrate from the neural fold to a location that will eventually become the brain structures, skull, and the soft tissues found inside and outside of the skull. During the fourth week of development, these cells form a series of six arch-shaped structures that will eventually become every internal and external component of the head and neck. The top two of these will become the muscular, nervous, arterial, and skeletal features of the face. These structures grow and fuse with one-another over the course of prenatal development through processes whose genetic triggers are not well understood (Richman & Lee, 2003). Under normal development, a recognizably human face is observable by week 10. Later, during the fetal

stage, bones form through the process of ossification, either from an initial cartilage prototype (called endochondral ossification) or without one (called intramembranous ossification). The final result is a heavy, solid structure that will protect the brain and survive traversal of the birth canal.

From birth to adulthood, many dramatic changes occur during a number of processes collectively called anabolic growth (Ramsey, Marcheiva, Kohsaka, & Bass, 2007), which refers to the normal development and maturation of the face and skull. The most obvious of these changes is the rapid growth of the cranial vault, which must grow quickly to keep pace with the young child's developing brain (Gillgrass & Welbury, 2012). The brain will reach 90% of its eventual adult size by 5 years, and the higher rate of growth in the cranial vault compared to the lower facial structures is responsible for children's bulbous, round skulls compared to adult skulls. An important consequence of this bone growth is that it necessitates the movement of the ocular orbits. Here, the expanse between the inner corners (or, intercanthal distance) reaches its final adult distance by 3 years (Sadler, 1986), with further growth to the orbits taking place on the outer edges as the eyes grow. Also, during these years, some of the bone formation that began during the prenatal period completes as cartilage structures in the cranial base harden (Gillgrass & Welbury, 2012).

Before outlining childhood growth of bones in the skull, we will pause to describe the major ones that affect facial appearance. Nine of the cranial bones comprise the face, which will be described here in a top-to-bottom order corresponding to Fig. 17.2. First is the frontal bone, which is a large dome-shaped bone covering the frontal lobe of the brain and forming the solid structure underneath the forehead. Second is the parietal bone, which extends back along the side of the skull and lends its name to the brain's parietal lobe underneath. Next is the sphenoid bone, most of whose structure lies within the skull and makes up the interior ocular orbits. The temporal bone, like the parietal bone, runs mostly along the side of the skull and covers its corresponding brain lobe. Next is the nasal bone, which lies above the nasal opening like a hood to which the

Facial Bones

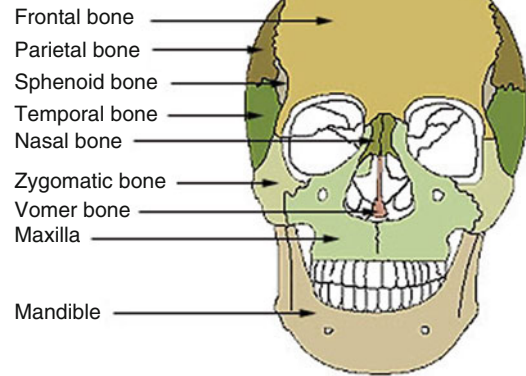


Fig. 17.2 Major bones of the skull that contribute to facial appearance (Copyright: National Cancer Institute, 1999)

nasal cartilages attach. Next is the zygomatic bone, which along with the maxilla builds up the solid structure under the cheeks. The vomer bone lies inside the skull, but its location and size determine the shape and size of the nose, making it very consequential to facial appearance. Below this is the maxilla, which is a plate-like bone covering the front of the face and forming the bottom and sides of the nasal opening as well as the upper jaw that holds the upper teeth. Below the maxilla is the mandible, which holds the lower teeth and is connected to the rest of the skull via ligaments holding it to the sphenoid bone's structure on the bottom and interior of the skull.

The general means by which bones in the face develop into their adult forms occurs through two major processes: displacement and remodeling (Gillgrass & Welbury, 2012). Displacement, also called translation, is the simple process where bones in the face change their relative positions as a function of growth elsewhere on the face. This process is the simpler of the two, as position of a bone can change without any other change to the bone itself. Remodeling, on the other hand, is a highly dynamic and interdependent process where bones of the face change size and shape through deposition and resorption at the sutures along their edges. Deposition refers to the gradual outward growth along the edges of a facial bone, which could result in pushing the neighboring bone away or forcing it into resorption. Resorption,

then, refers to the gradual breakdown along the edge where deposition from a neighboring bone is taking place. Without these distinct growth processes, the bones would simply separate along their sutures as the brain grows, providing little protective structure.

These processes' visual effect is that the round skull of a child gradually growing outward and downward after age 5. It then elongates laterally in a process referred to as cardioidal strain, so named because the adult skull profile takes on a heart-like shape (Pittenger & Shaw, 1975). Outward growth is exacerbated as nose cartilage accumulates, producing a more pronounced nose that continues to grow into and throughout adulthood. Soft tissue changes on the surface of the face—particularly around the cheeks, lips, and nose—accentuate skull shape underneath. All of these processes come to completion at around 20 years (Enlow & Hans, 1996).

17.2.2 Further Changes in Adulthood

From age 20 to age 50, most changes to the face are subtle textural changes to the skin (Albert, Ricanek, & Patterson, 2007). These include lines and wrinkles extending outward from the corners of the lips and eyes and horizontally along the forehead. Changes to complexion also take place, as the even skin tone of youth takes on a blotchy, uneven pattern. After age 50, these changes continue at a more rapid pace and are accompanied by sagging of the skin as it loses its elasticity and vertical shortening of the lower half of the face due to gum deterioration. All the while, nose and ear cartilage continues to grow, creating an older face that is almost a caricature of its younger adult form. A great degree of individual differences dictate the exact timing of any of these changes, but the generic sequence is the same across races and ethnicities.

Unlike the changes that arise during prenatal and neonatal development, the causes of changes to the adult face are well documented (e.g., Albert et al., 2007). Intrinsic changes occur naturally due to a blend of genetics, gravity, use of hyperdynamic facial expressions (e.g., smiling), and

imperfect reproduction of cells as long periods of time elapse. In other words, normal “wear and tear” will eventually take a toll on facial appearance. Extrinsic changes, which will be described in more detail later in this chapter, stem from behaviors that go beyond intrinsic factors. These include overexposure to direct sunlight, drug and alcohol abuse, sleep deprivation, and high levels of stress in adulthood. Generally, these behaviors incur a premature onset to intrinsic changes.

17.3 Techniques for Creating Age Progressions

Age progression is an umbrella term used to describe a family of techniques that have been developed for creating pictorial estimates of a person's current appearance based on both outdated photographs and other photographic evidence. Most age progressions produced in actual missing persons cases are produced by forensic artists with specialized training in facial aging (Taylor, 2001). Techniques have also been developed in computer science to digitally age faces (Lanitis, Taylor, & Cootes, 2002; Sadler, 1986). We provide a brief review of these techniques below.

17.3.1 How Forensic Artists Create Age Progressions

Of all of the forensic art disciplines, age progressing or regressing a subject could be considered the most consistently difficult. Professional forensic artists generally adhere to established procedures but in the end, forensic artists also incorporate judgment, intuition, and artistic skill. Age progression can be categorized into two types, adult age progressions and juvenile age progressions (Taylor, 2001). Age progressions of adults are typically attempted to update the appearance of a fugitive sought by a law enforcement agency. Juvenile age progressions are appropriate when juveniles have been abducted, either by known individuals (often a parent) or by strangers, or when a juvenile may be considered a runaway. Many artists consider adult age pro-

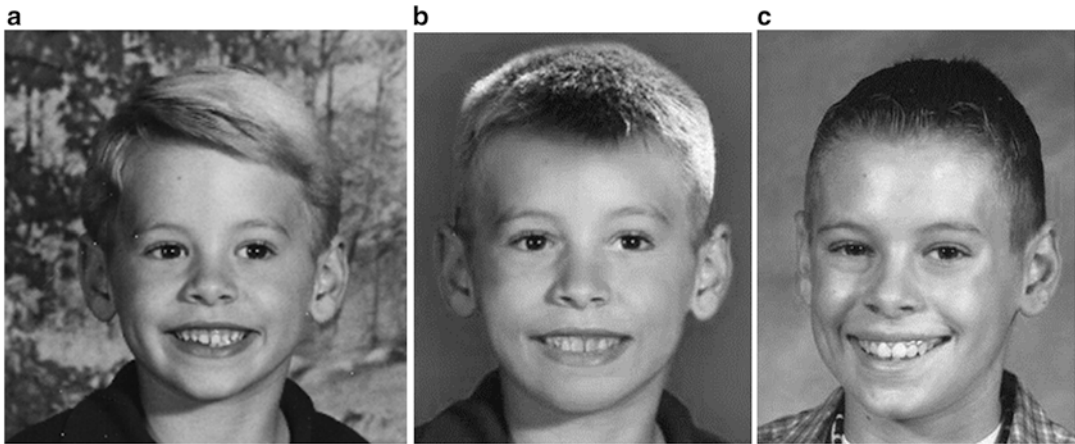


Fig. 17.3 Example of age progression produced by a forensic artist. (a) Shows photograph of child at age 5; (b) Shows age progression from age 5 to 12. (c) Shows actual

appearance of child at age 12 (Copyright: Author's own photograph)

gressions easier in that the face has fully matured where facial features, facial lines, and permanent marks need only to be modified rather than be predicted. However, the process described herein will focus more on juvenile age progression as it's more often attempted in practice. An example of a juvenile age progression produced by a forensic artist is shown in Fig. 17.3.

Current age progression techniques rely on the artist having a sound understanding of the principles of craniofacial growth and development outlined above (Mullins, 2012). Additionally most practicing forensic artists make use of genetic prediction. Genetic prediction involves using the appearance of biological relatives at the age the child went missing as well as at the child's current age to make inferences about what the missing person currently looks like. The use of growth norms is uncontroversial; however, there is some disagreement about whether genetic prediction is a sound practice. Scott Barrows and Lewis Sadler, credited with the first successful juvenile age progression in 1985, argued that juvenile age progressions should only utilize quantifiable growth data since genetic prediction can be too variable (Sadler, 1986; Taylor, 2001). However, the forensic artists who work at the National Center for Missing and Exploited Children (NCMEC), the largest missing persons organization within the United States, strongly

believe in utilizing genetic prediction in conjunction with craniofacial growth and development norms (Mullins, 2012).

Within the USA, most forensic artists tend to follow the NCMEC model (Blythe & Woodforde, 2007). The first step involves an interview with parents or guardians of the missing subject. Aside from gathering photos, and background information, the artist also attempts to get family input about the subject's personality, and how they view the missing person (Gibson, 2008). For instance, the family may see certain familial resemblances that a photo may not adequately convey. The artist obtains the best possible photo of the subject at the age they have gone missing. A set of reference photos of family members are typically also obtained. This set of reference photos will typically include photos of biological parents and siblings, but may also include photos of grandparents, aunts and uncles, and possibly other family members. In some cases, it may not be possible to obtain photographs of all biological relatives. For instance, in scenarios where one parent has abducted the child, the family of the abducting parent may not be cooperative. In that instance it is possible that the only available images will be from, and of, just one parent and their family.

Where possible forensic artists obtain photos that are in focus, high resolution, and of a frontal view with all features visible. With that said, the

forensic artist may not always be able to obtain an ideal set of images to work from, thus contributing to the difficulty of consistently producing accurate age progressions. Forensic artists attempt to match the ages of the family member with the subject's age at their disappearance and their contemporary age. Meaning, if the juvenile is missing at the age of 5 and they've been missing for 7 years, then the artist attempts to obtain photographs of family members at the ages of 5 and 12 years of age, or as close to those ages as is possible. Where circumstances dictate that the photos sought are not available, or where those provided are of very poor quality, forensic artists sometimes utilize other images (Gibson, 2008). Using the age progression of 5 years to 12 example above, the forensic artist is looking for similar features within the photos they've collected. The child may have had eyes that look like his grandfather's eyes at the age of 5, a mouth and ears that looks like his mother at 5, their father's nose at the age of 5, and let's say the chin of a younger sibling at that age. The artist would then look at photos of all these subjects at the age of 12 to see how those features developed over 7 years.

With a final set of images selected, the age progression can begin. The description here will be specific to using photo-editing software, though it can be translated to sketching methods with some imagination. For the example already given of age progressing a subject from 5 to 12 years old, the artist would adhere to facial growth principles and elongate the lower 2/3rds of the face by selecting, copying, and pasting that portion of the face, and lowering it appropriately. This lengthens the nose as well as making the lower face grow downwards. The two images are then blended together. The face will be broadened slightly and bony features such as the cheek bones and jawline will be made to appear more angular and defined. The neck elongated and in the case of a male subject, an Adam's apple might be indicated (Mullins, 2012). The forensic artists will make the eyes slightly narrower in appearance and set a bit deeper in the socket, and the mouth will be widened as well. The artist will develop eyebrows and darken if necessary. Often lighter colored hair will darken as one ages. The

artist can use portions of the other familial reference images to composite in. For example, if the eyes from a biological relative are similar at the age of 5 to the subject in question, then the eyes from the reference image may be used within the age progression, provided they are similar in lighting, color, and texture to the original subject image. Having said that, the artist will attempt to maintain the unique likeness of the individual, which necessitates incorporating as many of the original features as is possible (Blythe & Woodforde, 2007).

Forensic artists will also tackle difficult to predict aspects of appearance such as hairstyle, typically by giving the image a non-distinct, typical, hairstyle for the age group (Sadler, 1986). Similar approaches will be used to provide an estimate of clothing. The artist also needs to deal with any medical conditions the child may have and how that may affect their appearance under the circumstance.

17.3.2 Computational Approaches to Age Progression

Although most age progressions produced in actual cases are produced by forensic artists (Taylor, 2001), interesting and potentially useful approaches have been developed within computer science. Early computational methods for forensic age progression followed from the work of Scott Barrows and Lewis Sadler. Their approach (Sadler, 1986) led to a computer model of Caucasian facial growth patterns involving approximately 15 facial bones and over 100 facial muscles, while making reference to around 50 coordinates (facial "landmarks") in the frontal plane (e.g., specifying outer corners of each facial feature).

The basic approach developed by Barrows and Sadler involved obtaining measurements of linear facial dimensions from the target photograph of the missing child (e.g., jaw width, nose width, nose length, distance between inner corners of eyes, outer corners of the eyes) and then modifying those facial dimension-based anthropometric norms (Brown, 1987). For example, anthropo-

metric norms indicate that for the average European Caucasian male, nose width is 28.39 mm at age 5 years and 32.57 mm at age 12 (Weinberg & Mazaila, 2014). Thus, in age progressing a Caucasian male's face from age 5 to 12, the nasal width would be increased by approximately 15% (i.e., $32.57/28.39$). A contrasting model by the FBI allowed age progressions to be created with reference to hereditary information from the appearance of biological parents (Taylor, 2001).

Although the approach developed by Barrows and Sadler and then extended by the FBI was initially met with much enthusiasm (McQueen, 1989), in subsequent decades a number of other computational approaches have been developed based on increasingly sophisticated understanding of digital face representation. Although a number of such approaches have been developed, in the present chapter we provide detail about some prototypical methods that are used. In contemporary computer models of facial aging, the basic approach is to represent the way in which faces typically change in appearance, pre- and postadolescence, as required, and with increasing adult age (e.g., Burt & Perrett, 1995). Calculation of central tendency is usually carried out using an image-averaging process for digital photographs of faces captured at different ages—for example, at 10, 15, and 20 years. Given obvious differences by gender, separate averages are created for male and female faces.

The initial step in this process is to obtain images of photographic subjects by age and gen-

der in a standard format: taken under consistent lighting conditions with subjects depicted in a front-face pose and neutral expression. Once images are collected, an initial subgoal is to create an average face for each of the ages being represented. However, simple pixel-by-pixel averaging across standardized images, even when grouped by subject age and gender, produces blurry impressions. This is because internal facial features (eyes, nose, mouth, etc.) do not occupy the same physical location on every face used for calculating the average. This undesirable outcome is overcome by placement of facial landmarks around the outline of facial features: coordinates are placed correspondingly on every image. An average “shape” template is then calculated as the mean x and y coordinates for the set. Next, standard image-manipulation software (e.g., Steyvers, 1999) can be used to elastically stretch or “morph” all images to the average shape template, to bring individual features into register. Pixel averaging of these “shape-free” images now produces a single face with clearly defined features, as illustrated in Fig. 17.4.

Shown are images of a Caucasian male: (a) average template at 15 years, (b) average template at 20 years, (c) randomly generated (synthetic) face at 15 years, and (d) computer-generated age progression by applying scaled vector difference of (a) and (b) to image (c).

Shape templates must contain sufficient images to avoid “pictorial” aspects from being revealed (Bruce & Young, 1986): e.g., a specific pose or facial expression presented by a photo-



Fig. 17.4 Aging example (Copyright: Author's own image)

graphic subject. In practice, upwards of 40 images of different people are sufficient, to result in averages that are appropriately nonidentity specific. Influence of hair is not used as it is impossible to align hair using this process (and texture templates represent hair as a blurry feature). This outcome is not itself problematic as hair cannot usually be estimated accurately for forensic age progression.

Creating an age progression using this technique requires templates at relevant age points. For a person missing for a decade since he or she was 15 years old, for example, templates at 15 and 25 years are needed. Using arguably the easiest method, the numerical difference between shape templates is calculated as a mathematical vector and used to morph an outdated photograph; this basic idea is also applied to the difference between texture templates and morphed outdated image (internal-features region). As can be seen in Fig. 17.4, the result is an age progression for shape information in the entire face and texture information in the internal features.

There are issues with this approach. With the exception of labio-nasal folds that appear in a fairly consistent location, wrinkles, pores, and other age-related information are poorly represented in texture templates and so intended progressions appear too young—although this effect can be reduced by caricature of the difference between specific texture averages (see Burt & Perrett, 1995). A second established issue is that faces age differently as a result of genetic and other lifestyle factors such as sunlight, diet, exercise, and smoking. A complementary approach might account for changes of this nature when attempting an age progression. Frowd, Bruce, McIntyre, and Hancock (2006) asked human observers to judge a corpus of 200 training faces along psychologically relevant variables (e.g., health, face weight, and level of suntan). Separate templates were created, as described above, for items which were frequently judged to be at the “high” or the “low” end of the relevant scale, to create pairs of vectors for shape and texture. Applying template changes to an outdated image provides a sequence of plausible representations for each scale (Fig. 17.5), multiple sequences can

easily be combined into a single moving image (e.g., such as an animated GIF).

The algorithms described above are valuable for indicating age-related changes to an outdated photograph. They do not, however, provide an acceptable solution for guiding an age progression based on facial information from biological relatives. What is needed now is a method to parameterize faces of outdated persons and their relatives. This basically means giving each face a compact set of numbers, each of which represents a common property (such as face width, weight, and age) and so can be combined meaningfully, in much the same way as genes combine to pass on characteristics of biological parents. One possibility is for a proportion of coefficients (face “genes”) from related individuals to be transferred to coefficients of an outdated photograph.

There are many methods to parameterize faces and here we focus on the most popular, Principal Components Analysis (PCA), itself known to represent faces well (Sirovich & Kirby, 1987). PCA is a statistical modelling technique which provides a set of orthogonal bases to describe a set of data. Each of the bases, or “eigenvectors,” is constructed by PCA in such a way as to account for as much variance in the data as possible: the first eigenvector captures the most variance, which turns out to be the average across the set, with the second eigenvector capturing the most variance remaining, and so forth. Subsequently, eigenvectors can be combined using a set of weights (“eigenvalues”), produced as part of the PCA, to allow original data to be recovered.

For a database of faces, separate PCA models are built for facial coordinate (shape) and pixel (texture). As for the “algorithm” approach described above, each face in the training set requires location of common facial features; each of these faces is then morphed (usually) to the average shape template of the set, to provide suitable texture for PCA (Craw & Cameron, 1991). Also, as the external-features region containing hair is not suitable for modelling, it is usual practice for texture to be represented by internal features—the central region of the face containing eyes, nose, mouth, etc. Once internal features



Fig. 17.5 Image sequence showing transformations by suntan (*top row*) and health (*bottom row*). A computer-generated likeness is shown in the center image, with the

negative transform to the *left* and the positive transform to the *right* (Copyright: Author's own image)

have been created from the model, this region can be blended into the external part and then appropriate shape changes applied to the entire image (Fig. 17.6).

Eigenvector coefficients in a PCA model have global influence on facial appearance, and some are interpretable (Hancock, Bruce, & Burton, 1998). Shape components may code for head-up/down and face width, while coefficients for texture may be related to health. For training sets that change markedly by age of face, PCA components will represent aging effects; similarly, for mixed-gender training sets, a necessity for age progression involving biological parents, eigenvectors model variation from male to female. It is perhaps worth mentioning that some models (e.g., Hutton, Buxton, Hammond, &

Potts, 2003; Lanitis et al., 2002; Scandrett, Solomon, & Gibson, 2006) define specific locations in PCA space to create a vector for age progression, similar to the algorithm approach we described earlier.

More generally, the approach of defining points in face space is used to represent outdated and familial photographs. It involves computing the best fit of the relevant eigenvectors, to “project” a face into the space, and requires that the model generalizes well to novel items: hence the importance of a representative training set. Projection into face space necessarily leads to some mismatch and, to avoid such error, it may be preferable to actually build the PCA space including outdated and familial photos. In either case, the result is a set of coefficients for shape and texture

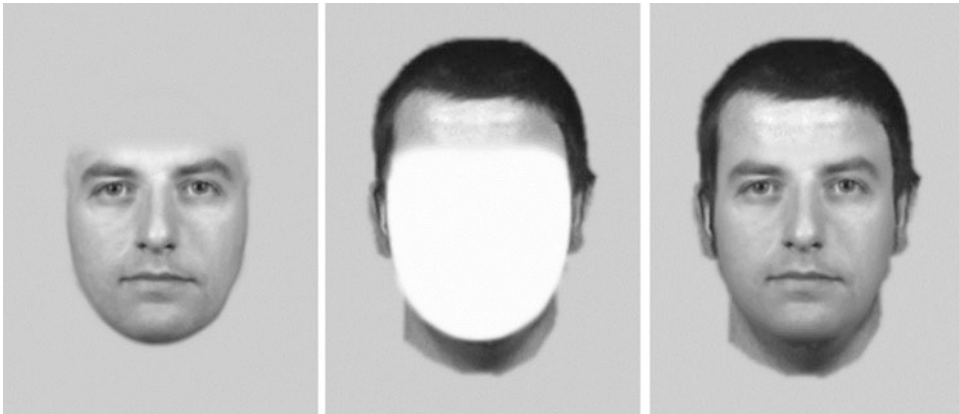


Fig. 17.6 Production of a randomly generated face. Shown are internal features (*left*) of a synthetic face, a set of external features (*center*) and combined (*blended*) image (*right*) (Copyright: Author's own image)

which represent faces of the missing and related persons. As mentioned above, one can now substitute a proportion of coefficients from an outdated photograph with coefficients of biological parents: when eigenvectors are recombined (now based on new weightings), the resulting face(s) should have increased genetic influence.

It is desirable to have eigenvectors with generic pictorial properties. As mentioned above, PCA models are often constructed from front-face photographs taken under consistent lighting and expression. Images which differ substantially from this standard are unlikely to project satisfactorily in the model. One solution is to deliberately introduce pictorial variation. Including photographs in the training set where lighting varies considerably between one face and another, for instance, leads to eigenvectors in the texture model that fit to this type of pictorial property; the same principle applies to lighting sources (natural, camera flash, fluorescent), head pose and facial expression. There are several implementations that model and control for such psychological variables (e.g., Blanz & Vetter, 1999; Cootes, Edwards, & Taylor, 2001; Frowd, Bruce, Smith, & Hancock, 2008; Scandrett et al., 2006).

In a recent implementation of the authors', faces were created by a forensic artist as sketched images copied directly from some 50 male and 50 female photographs. The artist sketched in a standardized format for pose, expression, and lighting, so as to limit errors of model fitting

when attempting to project images into face space. For the same reason, faces were sketched without glasses, heavy facial hair or occlusions, all of which featured in photographs given to us by members of the public for a recent project. We were also careful to render faces in reasonable detail, to avoid recognition deficits which accompany sparse representations (e.g., Benson & Perrett, 1991; Bruce, Hanna, Dench, Healey, & Burton, 1992; Davies, Ellis, & Shepherd, 1978). Photographs were of people who were about 20 years of age, to control for aging in this particular model.

In Fig. 17.7, we illustrate the effect of using the sketch-based model to incorporate 20% of face "genes" (coefficients), selected randomly, from biologically related parents. The strong family likeness in the resulting age progression is apparent. In a further application, we also illustrate a simple face-breeding algorithm (Frowd et al., 2008) where coefficients from two biologically related parents are combined several times, each time using a different random mix of face genes. Our test of this approach is still ongoing, but we believe it provides a reasonable way of modelling genetic influences on facial aging. Research in several laboratories is continuing to work on creating computer-based models of facial aging. In our own view, computational approaches are best thought of as a method that can be usefully integrated with the work of trained forensic artists in producing age progressions.



Fig. 17.7 Face-breeding example using a sketch model. Image on *left* and *center* are “parent” faces and an example of their “offspring” is shown on the *right* (Copyright: Author’s own image)

17.4 The Challenges Involved in Age Progression

Whether produced by a human artist, a computer algorithm, or some combination of the two, forensic age progression faces a number of challenges. Accurately predicting the current appearance of an individual based on images that are 5, 10, 20, 30, or more years old is a nontrivial technical challenge. Below we discuss four of these challenges.

17.4.1 Variability in Growth Rates

Age progression techniques typically involve applying knowledge of typical craniofacial growth rates to a known photograph in hopes of providing an accurate estimate of the missing person’s current appearance. The reasoning behind this approach is sound, as the population mean growth rate provides the best estimate of the current appearance of an individual within that population. In this sense, age progression is a statistical prediction of growth. Although one can derive population averages of growth rates based on data from anthropological and dental studies, those averages are just that, averages, and may or may not adequately capture the growth that occurs in any particular case. As noted by Houston (1979), “...detailed and accurate indi-

vidualized growth predictions are not possible. The best that can be done is to base treatment planning on the existing facial patterns, allowing average growth changes for the groups to which the patient belongs” (cited in Buschang, Tanguay, LaPalme, & Demirjian, 1990).

For example, Buschang et al. (1990) conducted a longitudinal study of lower jaw sizes from ages 11 to 15 for both boys and girls. The mean growth rate was 0.21 cm/year for boys and 0.22 cm/year for girls in their early teen years. Importantly, there was large variation between individual children: standard deviations were 0.12 cm/year for boys and 0.13 cm/year for girls. Similar growth rates are available for a (wide) range of other facial characteristics. Variability in growth rates tends to become compounded across the years, making prediction even more difficult. Variability in craniofacial growth rates across individuals is problematic because it is known that human face recognition is very sensitive to relatively small changes in configural features of faces (Maurer, Grand, & Mondloch, 2002).

17.4.2 Variability in Inheritance Patterns

Forensic artists typically make use of images of biological relatives of the missing person, based on the idea that members of a family often look

similar to one another. The approach makes sense in that individuals who are genetically related do tend to share similarities in appearance. Siblings are typically rated as being more similar to each other than non-siblings (DeBruine et al., 2009) and more generally, ratings of facial similarity are correlated with degree of genetic relatedness of two individuals (Alvergne, Faurie, & Raymond, 2007, 2009; DeBruine et al., 2009; Maloney & Dal Martello, 2006; Nesse, Silverman, & Bortz, 1990).

Although this general pattern of results suggests that using family resemblance in age progression may be promising, it is far from a simple matter to determine exactly how to apply family resemblance in specific cases and to particular facial features. For instance, Alvergne et al. (2007) found that which parent a child looks most like can vary across age, particularly for boys. Sadler (1986) argued that basing age progressions on family resemblance to known biologically related exemplars was unlikely to be helpful in producing accurate age progressions; “therefore, the outcome of predictions based on genetic arguments, when all is said and done, is that your children may or may not look like you and that outcome is not very useful information.” At the very least, the results suggest much judgment is required in order to determine exactly how to make use of family resemblance information.

17.4.3 Variation as a Function of Environmental Factors

Matters are further complicated because environmental factors may strongly influence appearance. These changes are problematic because whether or not the individual has been exposed to these factors is not known and may not be knowable. Has the person gained weight or lost weight? Has the person suffered from malnutrition? Has the person undergone any major health problems or diseases? Does the person smoke, drink, or use other drugs excessively? Each of these factors can have large impacts on a person’s appearance and how they

age, and yet these factors are very unlikely to be known by authorities (Albert et al., 2007).

To take just one example, consider the effects of smoking on appearance. Studies have shown that long-term smoking is associated with skin damage including premature wrinkling (Ortiz & Grando, 2012) and breakdown of collagen which causes the skin to sag (Lahmann, Bergemann, Harrison, & Young, 2001). Smoking can increase the risk of psoriasis, a condition associated with inflammation of the skin (Metelitsa & Lauzon, 2010; Naldi et al., 2005). People who have been smoking for long periods of time may experience a hollowing of the cheeks produced by a habit of taking drags off cigarettes (Ortiz & Grando, 2012). Smoking can also produce bloodshot eyes and can damage hair (Gatherwright, Liu, Gliniak, Totonchi, & Guyuron, 2012; Satici et al., 2003). Dental problems are also associated with chronic smoking including yellowing of the teeth and tooth loss which may change the appearance of the face (Axelsson, Paulartder, & Lindhe, 1998).

Recognition can also be influenced by transient changes made by individuals in their own appearance. Hairstyle in particular provides a problem in age progression because it can vary a great deal, can have a large impact on recognition and is unknown by the professional doing the age progression (Patterson & Baddeley, 1977; Righi, Peissig, & Tarr, 2012; Sadler, 1986). Changes in facial hair present similar problems (Righi et al., 2012). Cosmetics can also have a large effect on the appearance of a face by either emphasizing or hiding features and can have large effects on facial recognition (Ueda & Koyama, 2010). Yet forensic artists are unlikely to know the degree to which a particular missing person uses cosmetics, what particular cosmetics are used, and how they are applied. Faces may also look quite different depending on whether or not glasses are worn (Freire & Lee, 2001; Righi et al., 2012; Terry, 1994). Forensic artists can at best guess whether the person being sought wears glasses. Each of these changes of appearance can have a large impact on recognition but will not typically be predictable by forensic artists producing age progressions.

17.4.4 Recognition of Outdated Images

The purpose of an age progression, at least partly, is to aid in the identification of a missing individual. In evaluating the effectiveness of age progression as a technique, it is important to consider what alternative it is being compared to. The most obvious alternative to 2015.

Studies suggest that recognition based on current images is ideal, however, recognition based on outdated images still considerably exceeds chance (although see Kimbrough, Bornstein & Bryden, 2013). For instance, in Seamon (1982), participants viewed pictures of college faculty from 1974 and completed a recognition memory test in which the test pictures were from 1966. Some of the test pictures were of faculty who had been studied previously and some of the test pictures were of faculty who had not been studied previously. Participants were able to recognize the photographs well above chance. In a second experiment, Seamon reversed the direction by having participants study pictures of the faculty members when they were younger (i.e., from the 1966 yearbook) and were tested with pictures of the faculty members when they were older. Again, participants were able to recognize the photographs well above chance. In another experiment, Seamon presented participants with photographs of students from infancy to adulthood and asked them to sort the photographs based on identity of the individuals. Performance on this sorting task was also well above chance across all age ranges. Our own research has found that recognition based on outdated images typically exceed chance by approximately 20%, which is considerably lower than recognition based on a current photograph (Lampinen, Arnal, Adams, Courtney, & Hicks, 2012; Lampinen, Miller, & Dehon, 2012). The result of this research suggests that for age progression to provide added value, it needs to produce likenesses that are sufficiently similar to the targets appearance so as to exceed the recognition that can be achieved by the human visual system on its own.

17.5 Scientific Research on Effectiveness of Age Progressions

Given the inherent difficulties in producing age progressions that are useful in missing person's recovery efforts, it is important to rigorously evaluate the effectiveness of age progressions. Yet, relatively little research has systematically done so. The research that has evaluated age progressions has produced mixed results but is seriously incomplete in terms of the range of situations that have been examined.

Anecdotal evidence provides some support for the claim that age progressions can help lead to recoveries. In a much cited case, two girls had been abducted by their noncustodial father in 1977 (McQueen, 1989). Approximately 8 years later, outdated photographs of the two girls were used by Barrows and Sadler to develop age progressions of the two girls. These age progressions were shown on television and within 10 min of airing, police received tips from neighbors and school officials indicating that they recognized the girls. These tips ultimately led to the recovery of the girls.

Although anecdotal evidence provides some support for the use of age progressions, controlled scientific studies have produced more mixed results. In one recent study, researchers obtained photographs of volunteers at ages 7 and 12, as well as pictures of the volunteers biological relatives (Lampinen, Arnal, et al., 2012). The researchers provided the images of the volunteers at age 7, as well as the reference photos showing biological relatives, to professional forensic artists recommended by law enforcement. The forensic artists provided age progressions of the volunteers from age 7 to age 12. Once the age progressions were obtained, an experiment was conducted to examine whether the volunteers could be recognized based on the age progressions. Participants were asked to imagine that four children went missing several years ago and were now 12 years old. In the *current photo condition*, participants studied four pictures of children at age 12. In the *outdated photograph condition*, participants studied four pictures of

children at age 7. In the *age progressed condition*, participants studied pictures of four children that had been age progressed to age 12. After this study session, participants viewed 44 pictures of children who were 11–12 years old. Four of the pictures were new pictures of the “missing children” and 40 were foils. Researchers asked participants to imagine that they were working as camp counselors and that they were separating children into two teams (a P team and a Q team). They were told to maintain an equal number of boys and girls on the two teams. Participants were told that if they saw one of the “missing” children they should press the “H” key to “alert the authorities.” Following this task, participants made selections from four eight-person target-present lineups. Recognition exceeded chance for all three conditions, with the current photo condition resulting in the best performance. Recognition based on age progressed images did not significantly differ from recognition based on outdated images (see Fig. 17.8). Other research confirmed this basic finding (Charman & Carol, 2012; Lampinen, Miller, et al., 2012).

One limitation of the above studies is that they relied on limited age ranges and limited numbers of forensic artists. It is possible that age progressions are more effective across certain age ranges, or that certain forensic artists or approaches are more effective than others. In order to address this issue, Lampinen, Erickson, Frowd, and Mahoney (2015a) recruited eight forensic artists with training in age progression to participate in the project. These forensic artists were provided with materials from eight adult volunteers who provided photographs of themselves at ages 5, 12, and 20, as well as pictures of their biological relatives at those ages. Each artist created age progressions from across the 5 to 12 and 5 to 20 age range for half of the volunteers and across the 12–20 age range for the other half of the volunteers. Thus, for each volunteer, there were age progressions created by four different trained forensic artists for each of the three age ranges. A group of participants was then shown these age progressions next to an actual photograph of the target at the terminal age and were asked to rate the similarity of the age progression to the target.

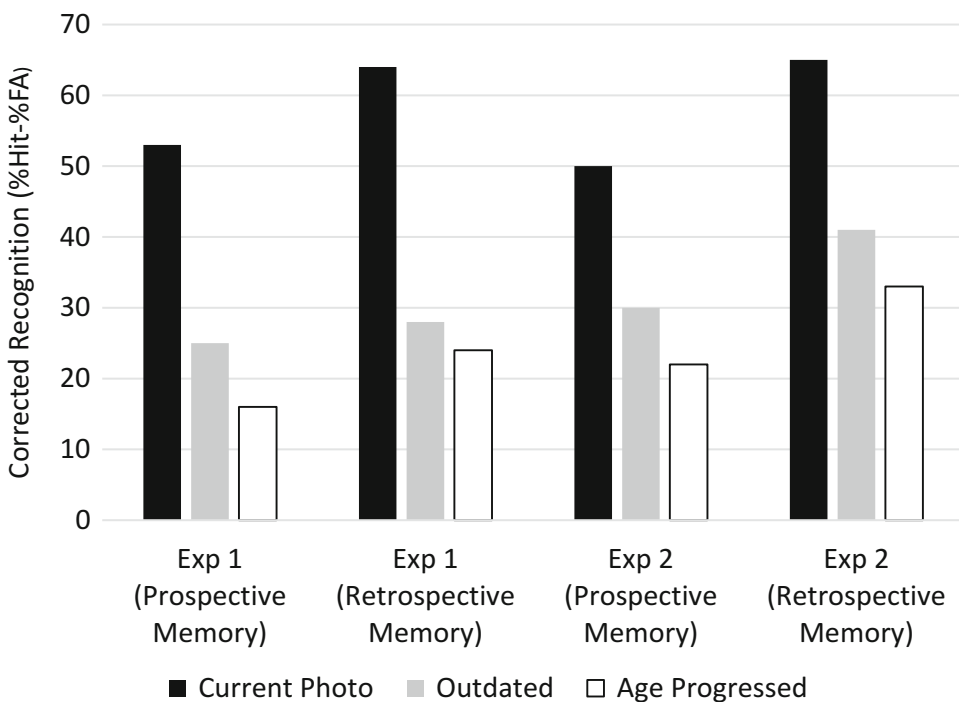


Fig. 17.8 Recognition based on age progressed images to current and outdated images (Copyright: Author’s own image)

Additionally, each age progression was presented next to a photograph of a person who matched the general description of the target but who was not the target (i.e., description-matched foil), and participants were asked to rate the similarity of those photographs as well.

The main findings of this study were as follows. First, the rated similarity of age progressions to targets was significantly greater than the rated similarity of age progressions to description-matched foils, indicating that age progressions were capturing some aspect of the target person's appearance. Second, although the rated similarity of age progressions to targets was higher than the rated similarity of age progressions to foils, overall similarity of age progressions to targets was not especially high in absolute terms. Note that the midpoint of the scale ranged from (1) extremely dissimilar to (7) extremely similar, with the midpoint of the scale reading (4) neither similar nor dissimilar. The mean similarity between age progressions and targets was about 4.3, just barely over the midpoint of the scale. Third, rated similarity of age progression to targets was higher when the age range was small (i.e., 5–12, 12–20) than when the age range was large (5–20). Fourth, there was a great deal of variability between artists in terms of how close their age progressions came to matching the current appearance of the target.

These findings led us to ask how important experience and training was to producing age progressions. To examine the issue, we recruited a set of undergraduate art majors who were recommended by art faculty based on their ability in portraiture (Lampinen, Erickson, Frowd, & Mahoney, 2015b). The students were thus skilled in portraying identity, but had no specific training in facial aging or in specific techniques used by forensic artists in producing age progressions. We provided these art students with the same materials we had provided the forensic artists for the 12–20 age range and asked them to produce images showing what the individuals might look like at age 20 (i.e., age progressions). We then compared similarity between age progressions created by student artists and age progressions created by professional forensic artists. The find-

ings were intriguing. The rated similarity between age progressions and targets did not significantly differ for those age progressions produced by the undergraduate artists than the age progressions produced by the forensic artists. However, the age progressions created by the student artists were rated as being more similar to the description-matched foils than were the age progressions produced by the forensic artists, indicating that the professionally created age progressions did a better job in discriminating between the target and people similar to the target. Follow-up research indicated that the age progressions produced by the forensic artists included more detail than the age progressions produced by the undergraduate artists.

In addition to asking the question of whether age progressions match the appearance of the target individual, it is also informative to ask the degree to which age progressions of the same individual produced by different artists will be similar. To examine this issue, we provided participants with pairs of age progressions produced by different artists and asked them to rate the similarity of the images to each other (Erickson, Lampinen, Frowd, & Mahnoey, 2015). The results indicated that age progressions produced by different artists were often not especially similar to each other. Most similarity ratings between pairs of age progressions were just barely above the midpoint of the similarity scale (i.e., slightly above a rating of “neither similar nor dissimilar”). Degree of similarity depended upon age range, with greater inter-artist similarity for the shorter age ranges (i.e., 5–12; 12–20) than for the longer age ranges (i.e., 5–20).

17.5.1 New Approaches

In addition to examining the effectiveness of age progressions produced by forensic artists, our research group has also been working on new techniques to improve the effectiveness of age progressions. In a recent study we examined whether morphing age progressions produced by different artists might be an effective technique. Morphing is a technique for averaging together

two facial images (Steyvers, 1999). Prior research has shown that when composites are produced by the recollections of two different witnesses to the same crime, a morph of the two composites will often produce a better likeness than the individual composites (Bruce, Ness, Hancock, Newman, & Rarity, 2002). The logic behind this approach is that each witness's recollection is likely to diverge from the actual appearance of the culprit in more or less random ways. Because a morph is an average of the two composites, it emphasizes areas of agreement between the two witnesses and de-emphasizes areas of disagreement. The same logic should apply to age progressions. Since each forensic artist is likely to make slightly different assumptions and use slightly different techniques in aging a photograph, morphing together age progressions from multiple artists should emphasize areas of agreement between the artists and de-emphasize areas of disagreement. Findings indicate that morphed age progressions produce likenesses that are better than the average of individual age progressions and are as good as the best age progression in the set (Lampinen et al., 2015a).

We have also recently been exploring the *Predict Your Child* algorithm developed by Frowd, Bruce, Chang, et al. (2008). *Predict Your Child* takes photographs of biological parents and randomly combines holistic features of the parents in order to obtain images of potential children. The algorithm has been shown to produce facial images that show a family resemblance with the parents and in at least one case has produced an image similar in appearance to an actual child of the parents. Because parents can produce multiple offspring that differ in a variety of ways, we have been exploring ways of constraining the images produced. One technique we are currently testing involves including artist produced age progressions in producing the *Predict Your Child* images. This technique is currently being tested by our research group.

As noted above, there are considerable sources of variability in facial aging that make accurate prediction of a missing person's current appearance difficult. Such sources of variation include potentially large variation in growth rates, inheri-

tance patterns, and environmental sources of variation. Age progressions, at best, provide a prediction of current appearance, but given the sources of variation this prediction is unlikely to be perfect. Consequently, it may be better to provide the public with a variety of images of the missing person's possible appearance. We are currently undertaking a program of research aimed at testing the effectiveness of this approach.

17.6 Conclusions

In most cases, when a child goes missing, he or she is recovered relatively quickly. However, there are some cases where a child may go missing and remain missing for a long period of time. When this occurs, law enforcement and missing persons agencies will not have a current photograph depicting the child's current appearance. Although people retain some ability to recognize individuals based on outdated images, the use of outdated images is far from ideal or even intuitive. Yet, research on the effectiveness of age progression in producing recognition has shown that it is far from a magic bullet in producing recognition. Although in some cases, age progression may produce useful leads that result in recoveries, other cases show that age progressions may not provide an adequate match to current appearance. This is not a function of the lack of skill or dedication on the part of the forensic artists who produce age progressions; rather, it is a function of the inherent difficulty of the task. Facial aging is a noisy process and accurate prediction of a person's current appearance based on an outdated image is a nontrivial technical challenge. Making the process even more difficult for forensic imaging specialists is that they typically never know if an age progression made for a cold case is actually an accurate representation of the person's current appearance.

Despite these difficulties we remain optimistic that age progression techniques can be refined in order to increase their utility. Careful use of craniofacial growth norms may help pinpoint a person's current appearance, but even then growth rates and environmental influences can produce a

great deal of variability that is difficult to predict. However, as with any technique designed to help recover missing persons, it is vital that systematic research proceed, on the ways of maximizing effectiveness.

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18.1 Introduction

Forensic archaeology can be defined as a subfield of forensic anthropology or archaeology that uses archaeological methods and theory to answer legal questions (Connor, 2007; Dirkmaat, 2012a, 2012b; Dirkmaat & Adovasio, 1997; Haglund, 2001; Hunter, Simpson, & Sturdy Colls, 2013). Often these questions relate to deceased individuals recovered from outdoor scenes or fire scenes, but forensic archaeologists can also assist in the recovery of various types of buried or concealed evidence, such as clothing, tools, drugs, money, and weapons. In the USA, the discipline of anthropology is rooted in a four-field tradition that includes archaeology, as well as sociocultural, linguistic, and physical (biological) anthropology. Although forensic anthropology in the USA focuses primarily on physical

anthropology (especially human skeletal biology), it typically also includes education and training in both archaeological method and theory. Thus, many forensic anthropologists in the USA have significant experience in forensic archaeological methods and techniques, especially as applied to outdoor scenes and fire scenes (Cabo & Dirkmaat, 2015; Dirkmaat, 2002). This contrasts with education and training in the UK, where forensic archaeology and forensic anthropology are two distinct fields; the former is a more specialized subfield of archaeology, focused on search and recovery of buried or concealed remains, while the latter involves the analysis of human skeletal remains. Thus, forensic archaeologists trained in the UK may have substantial experience in multiple areas of archaeology and related disciplines (e.g., geophysics), and they may also be cross-trained in both forensic archaeology and forensic anthropology (Cabo & Dirkmaat, 2015). Groen, Márquez-Grant, and Janaway's (2015) recent edited volume compares and contrasts the practice of forensic archaeology in a global context, and the interested reader should refer to this comprehensive volume for more information on the variations in education and training in forensic archaeology.

Regardless of education, training, and expertise, the value of forensic archaeology as a professional field of study has been clearly recognized over the past three decades. There is now a burgeoning literature, an increase in the

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number of programs offering advanced degrees focused in this area, and a rise in the global involvement of forensic archaeologists in assisting local jurisdictions with domestic casework, international and nongovernmental organizations in larger-scale humanitarian projects (such as the investigation of genocide and recovery of war dead from current and past conflicts), and both domestic and international agencies in mass fatality incidents (Cabo & Dirkmaat, 2015; Groen et al., 2015; Hunter et al., 2013).

Forensic archaeology emerged from a need for proper methods and techniques to search for, locate, document, excavate, and interpret human remains following a number of high-profile missing persons cases where victims were buried in clandestine graves (e.g., the Moors murders and Fred and Rosemary West murders in the UK and the John Wayne Gacy murders and the Branch Davidian Compound excavation in the USA; Dirkmaat, Cabo, Ousley, & Symes, 2008; Cabo & Dirkmaat, 2015). While crime scene methods were well established and rigorous for processing indoor scenes, there was little awareness that detailed protocols also existed that dealt specifically with outdoor scenes, particularly those involving an extended period of time between death and discovery of the remains (Dirkmaat, 2012a). Forensic archaeological methods and techniques involve a holistic approach to both outdoor and fire scenes and are ideally suited for the search, location, and recovery of human remains and evidence. Forensic archaeologists are well versed in understanding the role of the physical and biological environment on the preservation of surface-scattered, buried, and burned remains, and this taphonomic focus is crucial in the reconstruction of the sequence of events at a death scene. Specific details about the method of disposal of a corpse, differentiation of primary versus secondary graves or disturbed grave sites, and the relationship between human remains and associated forensic evidence can be revealed through careful and systemic forensic archaeological methods. Rather than treating a death scene as disturbed and lacking meaningful context, forensic archaeologists focus on reconstructing all processes that occurred from the

time of deposition of a corpse to the time of its recovery (Sorg & Haglund, 2002). Therefore, forensic archaeological methods provide the best means for locating and carefully excavating human remains related to missing persons cases.

This chapter outlines the key stages involved in the search, location, and recovery of human remains from medico-legal contexts. Although we review well-known traditional methods, we also discuss more recent advances in forensic archaeology that will be of interest to investigators who work missing persons cases, especially with regard to domestic forensic cases. A more detailed discussion of method, theory, practice, and techniques in forensic archaeology can be found in a number of recent textbooks (e.g., Connor, 2007; Cox, Flavel, Hanson, Laver, & Wessling, 2008; Dupras, Schultz, Wheeler, & Williams, 2006; Fibiger & Ubelaker, 2016; Hunter et al., 2013).

18.2 Planning Stage

18.2.1 Law Enforcement Investigation

Domestic forensic cases typically begin with the investigative work of law enforcement personnel. Both the direction and the methods used in an investigation will shape how search and recovery efforts are approached. In addition, the success of a search and recovery effort often relies heavily on the quality of the pre-search investigation conducted by law enforcement in conjunction with a variety of forensic specialists. Gathering available witness statements, conducting record searches, and the acquisition of appropriate resources are all integral parts of the preliminary investigation (Connor, 2007).

18.2.1.1 Witness Statements

When available, some of the most important pieces of information collected prior to a search are witness statements. Information gathered from individuals who have knowledge of, or who played a role in, the crime being investigated can provide details on both the context of the crime in

question and ultimately the disposal of the body. Witness statements may aid a missing persons investigation by providing the following information: the identity of the victim, potential trauma to the remains prior to or around the time of death, the location of the decedent, information related to the location and method of body disposal, and subsequent tampering of the crime scene. When this information is not readily available (because these questions have not been asked), forensic archaeologists should consider asking law enforcement to re-interview witnesses if possible.

Witness statements also can aid in defining the approach to be taken by both law enforcement and forensic professionals (Hunter et al., 2013). As discussed later, all recoveries include planning and preparation of both the equipment and personnel needed for the investigation. Information gleaned from individuals familiar with the context help establish the approach to a scene and the safety considerations for the team. For example, if information from a witness indicates that the body was deposited in a shallow grave, the recovery approach will probably call for the use of hand tools (such as trowels or shovels) in order to minimize the potential for causing postmortem damage to the remains. By contrast, if witness information suggests a deep burial, heavy machinery operated under careful supervision of a forensic archaeologist may be required.

18.2.1.2 Record Searches/Desk-Based Assessments

Record searches are often used to gain information about the location of a proposed search as part of desk-based assessments. Property histories, maps, aerial photographs, and satellite imagery of the general location can help narrow the search area. This information helps define the characteristics of the search area that would have been navigated by perpetrators. It can also help investigators note changes to the property that occurred between the time that the crime occurred and the search for human remains. Alterations to the landscape include new structures, disturbed areas of ground soil, plant growth, and standing or flowing water patterns.

As an example, a search in Seaside, California, in 2010 relied heavily on record searches of the surrounding area to establish a connection between areas of interest to search teams and areas known to the suspect. The search was part of an ongoing cold case investigation into a suspected 1980 disappearance of a teenage girl from the local area. The 2010 search area involved a hillside with significant vegetation overgrowth. Record searches in this case helped establish a timeline for changes to the landscape over time. The search area was located in the vicinity of the Fort Ord Military Base (Fig. 18.1). While the military base was officially closed in 1994, the suspect had a known association with the base in 1980 when it was still in operation and a connection to the hillside in question. Records showed that an elementary school, in operation from 1998 to 2001, had been constructed south of the hillside, while a new housing development was added to the north. Both changes affected the search area. For example, the original military barracks were demolished and were replaced by a residential neighborhood a year prior to the search. In addition, aerial photographs indicated changes to the hillside due to a previous search of the area conducted in 2008. This previous search involved extensive digging with heavy machinery. The information gleaned from the records search helped to define the search area based on the original 1980 landscape as well as disturbances that could be attributed to other subsequent activities in the area. Despite a thorough and systematic search, no human remains were located. Further investigation into the case suggested that the missing girl may have actually been a runaway and may be alive and well living in another state.

Geology maps, historic and current photographs, and other geotechnical records may also assist in determining how landscapes have changed over time, whether or not it was possible for a perpetrator to have dug a grave in a particular area, whether areas would have been in the line of sight of or concealed from surrounding properties and public spaces, and whether known archaeological sites of historic importance exist within a search area. By building up a detailed



Fig. 18.1 Aerial photograph showing the general search area (red oval) near Seaside, California. The structure below the red oval was a school in operation between 1998 and 2001 that was built on land previously belong-

ing to the Fort Ord Base. The houses directly above the red oval represent a new housing development in the location of what was once base housing. (Copyright: Google Maps)

profile of a landscape (be it large, e.g., a moorland, or small, e.g., a backyard), it will be possible to prioritize search areas according to the likelihood that a burial could have occurred in given locations within it. In the UK, forensic archaeologists commonly use a traffic light system (RAG system) to categorize zones within a search area, with red being the highest priority and green being the lowest, based on a number of variables derived from record searches and police intelligence (Donnelly & Harrison, 2013).

18.2.1.3 Resources

One of the final stages of preparation prior to in-field investigation and/or recovery efforts is the identification of the resources that will be needed in the field, including both personnel and equipment. The search for and recovery of human remains are often complicated aspects of the investigative process. While establishing the

context for the search is the responsibility of law enforcement, the actual recovery of surface or buried remains usually requires help from outside resources such as volunteer search and recovery teams, forensic archaeologists and anthropologists, forensic entomologists, remote sensing experts, and heavy equipment operators (Connor, 2007). When consulted, expert consultants will usually aid law enforcement in establishing a pre-excitation equipment checklist as well as addressing safety concerns (see Sect. 18.2.3 below).

18.2.2 Notes, Photography, and Mapping

An important component of any forensic archaeological investigation is consideration of the methods employed to document the scene.

The archaeological recovery of human remains, whether they are found on the surface or buried, is inherently a destructive process that cannot be undone; once a scene is processed, it is forever altered from its original state. Thus, it is key that all stages of the recovery effort are carefully documented. Likewise, it is important to thoroughly document search processes so that a complete and accurate record of any discoveries, as well as any areas that can be eliminated after being searched, is created.

Three commonly used methods for scene documentation include note-taking, photography, and mapping. Before any search begins, investigators need to establish a plan of action for who will be responsible for documentation and how it will be handled throughout the search and recovery effort. Note-taking is used to document scene characteristics, personnel present on scene, a time-log of the activities, the methods employed, and a catalog of evidence discovered during the process. Photography is used to document the overall scene, the search and excavation process, and any human remains or evidentiary items found during the search. Increasingly, 360° photography or videography is being used to capture more detailed scene images, and these are particularly valuable for the Electronic Presentation of Evidence (EPE) in court. Scene measurements and mapping allow investigators to associate physical landmarks near the scene to the recovered human remains and evidence. While measurements using meter tapes represent the most traditional method for scene mapping, the application of digital surveying equipment has allowed forensic archaeologists to increase the accuracy of scene measurements. These tools include total stations, handheld/differential kinematic GPS units, and other remote sensing equipment such as terrestrial and airborne LiDAR. Combined with applications such as GIS (geographic information systems) that allow the data to be associated with topographic and aerial maps, the result is an accurate visual representation of the scene. Figure 18.2 shows an example of a surface scatter of human remains from a riverine environment. The spatial location of each skeletal element was

recorded using a handheld GPS unit (accuracy within 10 cm), and all data were plotted on a topographic map using GIS.

18.2.3 Personnel and Equipment

18.2.3.1 Site Safety

Every scene or search area presents varying types of safety concerns for search personnel. These concerns can include the physical environment; weather conditions; excavation equipment; chemical or biological hazards; hazardous plants, animals, and insects; and any physical or health limitations of individual team members. Addressing the potential hazards associated with a search for human remains is a necessary part of pre-search and pre-recovery planning (Anderson et al., 2008). While each agency or organization involved in a search may have different standard operating procedures regarding health and safety, all are responsible for ensuring that search personnel are briefed on likely hazards prior to the actual search and recovery operation. Release of liability forms as well as medical information forms is typically required of all participating in a scene investigation. Preparation for a field operation also includes making sure necessary personal protective equipment (PPE) is available and a plan of action is in place for emergency medical assistance.

18.2.3.2 Team Roles

While archaeological projects usually span months to years, forensic archaeology scenes are processed within a much more limited timeframe. To fit within the investigative parameters associated with the legal system, the methods employed by forensic archaeologists and anthropologists balance thorough documentation of a scene with expedient evidence collection. As such, assigning roles and responsibilities to each team member prior to the actual search and recovery effort is an important component of the planning stage. Ideally, each team member is equally capable of all typical search and recovery tasks. The ability to rotate certain tasks between group members

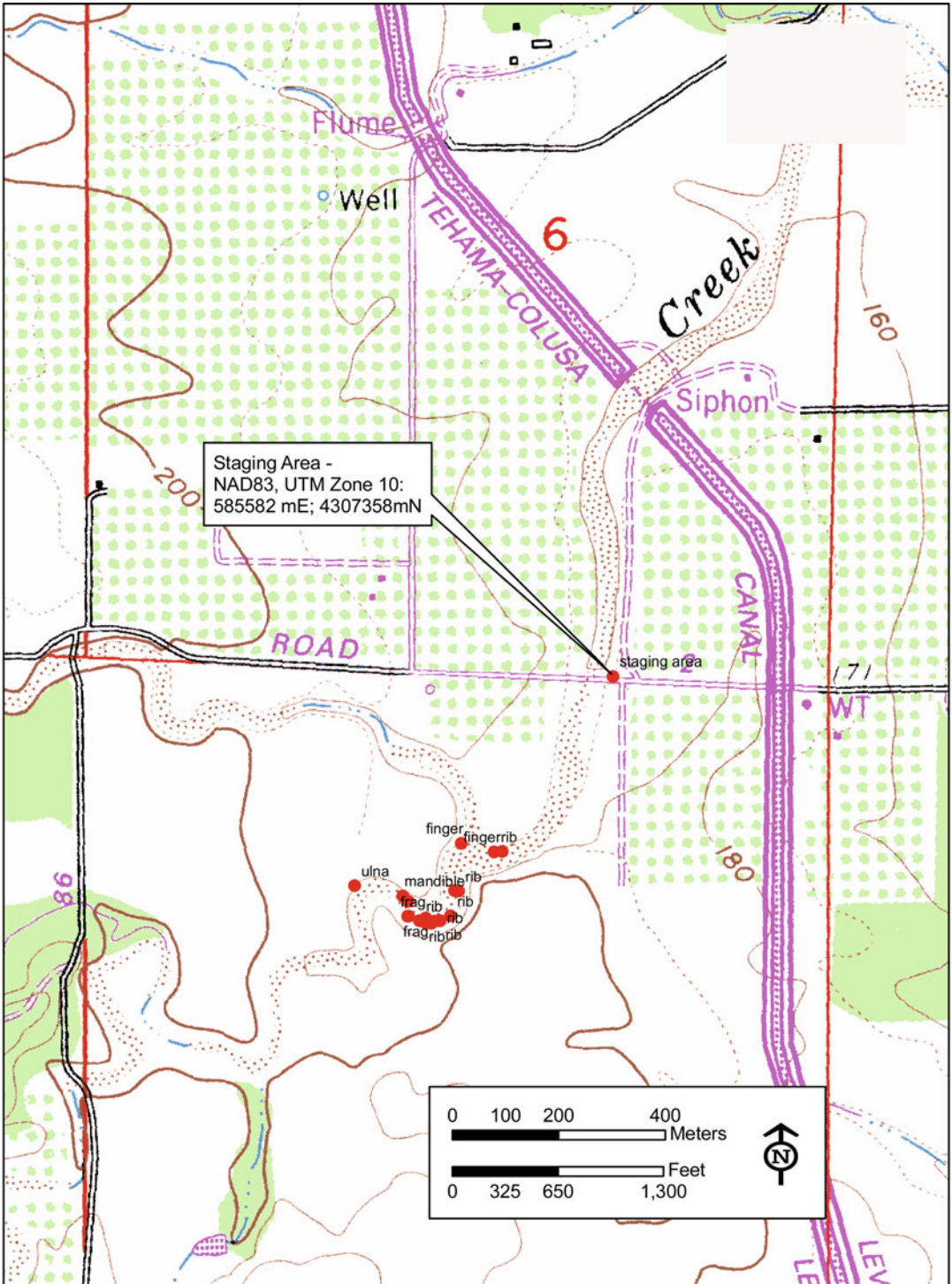


Fig. 18.2 Topographic map showing GIS data of the location of individual human bones recovered (red dots) from a seasonal creek in Yolo County, California (accurate to 10 cm). The bones in this case were transported through fluvial activity. (Map created by Kevin Dalton)

helps combat team fatigue, especially on operations that last several hours or days. Typical tasks associated with forensic archaeology efforts include note-taking, photography, excavation, sifting, collection of evidence, and mapping (Dupras et al., 2006).

18.2.3.3 Equipment

The equipment needed for the recovery of human remains will vary from scene to scene. If, for example, the operation involves the excavation of a deep clandestine grave, heavy machinery (such as a backhoe) might be needed for the initial stages (Ceker & Stevens, 2015). Coordination between all agencies involved in a search and recovery effort helps ensure that all necessary equipment is available. It also ensures that the investigation is not limited or compromised because of missing equipment. Common equipment needed at the outdoor forensic scene includes tools used during the search for remains (e.g., probes, pin flags, flagging tape, compass), tools used for excavation and evidence collection (e.g., trowels, shovels, brushes, screens, a range of packaging materials, etc.), and tools used for scene documentation (e.g., compass, line level, measuring tapes, cameras, etc.) (Christensen, Passalacqua, & Bartelink, 2014; Connor, 2007; Cox et al., 2008; Dupras et al., 2006).

links between the victim and the offender. Some cases with which forensic archaeologists may become involved will relate to crimes that occurred relatively recently. Others will have a considerable time window between deposition and search. Therefore, forensic archaeologists may find themselves in a wide variety of case scenarios, all of which will require a unique search strategy.

As a general rule, search strategies should be designed so as to provide the best chance of locating human remains and any associated evidence. Forensic archaeologists should be involved in the search process as soon as possible when buried, scattered, or burned remains are suspected, and they should work closely with law enforcement personnel to decide upon the most appropriate methodology moving forward. In the authors' experience, all too often, forensic archaeologists are only consulted once remains have been found or after search areas have been cleared. This is often due to the misconception that forensic archaeologists are only specialists in excavation and recovery. As demonstrated throughout this chapter, this is not the case, and their involvement during the early stages of search will almost certainly allow investigations to be more focused.

18.3 Search and Location

In some missing persons investigations, law enforcement will be in possession of concrete information which suggests that an individual is deceased and that their remains and/or associated evidence have been buried or hidden. In others, burial or deposition through other means will only be suspected. Information about the exact location of the deposition site may be equally varied: sometimes a precise location will be known, but, often, large areas will need to be searched. A known offender may be in custody or, in longer-term cases, may have been charged or convicted. Alternatively, law enforcement may have no suspects and/or may be relying on the successful location of a body in order to provide

18.3.1 Defining Scene Parameters

One of the most challenging aspects of processing outdoor scenes is determining the actual boundaries of the scene. For an intact body located on the surface or a buried body whose location is known, the scene may be circumscribed to a small area. However, in instances where remains have been scattered or disturbed from their original context due to animal scavenging or natural forces (such as moving water), the boundaries of the scene become less obvious. In cases where little in the way of specific intelligence has been provided by law enforcement agencies, it may be extremely difficult to define search boundaries, and multiple scenes may become the focus of search. In many outdoor scenes, clothing, trash, and other types of material

remains may be present, yet their connection to the death scene may be unknown. Although complete collection of all *possible* evidence would seem to be ideal, this may result in a tremendous backlog for the lab analysts who are required to process items unlikely to have evidentiary value. Thus, the forensic archaeologist working in conjunction with investigators and other forensic specialists must decide what to include and exclude as potential evidence *at the scene*.

Forensic archaeologists are keen to pay attention to differential states of preservation of potential evidentiary items, as well as assessing the context of possible evidence in relation to human remains. This information will aid in determining what items are likely to be of forensic significance versus items that are unlikely to be associated with the scene. For many outdoor scenes (e.g., surface scatters, buried bodies, fire scenes), it is advisable to treat a larger area as the recovery scene instead of only the immediate area where remains are discovered as remains and associated physical evidence and personal effects may have shifted from their primary depositional context. It is important to be flexible during the recovery phase as remains and associated evidence may be found outside the bounds of the original scene parameters. Expanding the scene beyond its initial parameters is a relatively easy way to deal with the discovery of new evidence. If scenes are eliminated as body deposition sites during the search process (as is often the case in large-scale or ambiguous locations or in cases where witnesses have failed to provide detailed/concrete information), forensic archaeologists must provide a detailed rationale for expanding original search areas. In the UK, such decisions are made in conjunction with a POLSA (police search advisor), crime scene manager, and senior investigating officer (SIO). Once the scene parameters have been determined, it is important for law enforcement personnel to ensure the security and integrity of the scene.

18.3.1.1 Survey and Search Patterns

An initial walkthrough may be necessary to assist with defining search boundaries. This process is in effect a reconnaissance visit, during which the ground cover, natural and human-made boundar-

ies and obstacles, the presence of surface evidence, and other factors that may impact the search are evaluated. It is vitally important that this process is documented using contemporaneous notes and photographs and that care is taken not to disturb any evidence that might be present. Once the search parameters have been defined, all searches should include a systematic walkover survey to identify and record the presence of surface evidence. A line search, where one or several people walk in equidistant transects across the search area, or a grid search, where two or more people walk in overlapping, equidistant transects to form a grid, is strongly advised (Dupras et al., 2006). Any evidence or potential indicators that are observed during this search process should be clearly marked, e.g., with a flag or other scene marker, and then recorded manually and/or digitally, e.g., using a Total Station or GPS (see Sect. 18.4.3) to create a detailed plan of the scene. A detailed search log should be maintained throughout to document observations and recommendations. Photographs (using appropriate scales) must be taken of each feature, and any evidence should be seized in collaboration with the relevant crime scene personnel. The procedures for doing so are described in Sect. 18.4.5 and in 18.5.3 in relation to scattered human remains.

18.3.1.2 Taphonomic Markers and Microbiological Change

In cases involving burial, the disturbance caused by the excavation of a grave will have a number of effects on the landscape that should be detectable during scene searches. These indicators, known as taphonomic markers, take many forms, and some or all of them may be visible depending on the time since deposition, the condition of the remains, the nature of the burial environment (e.g., its geology and vegetation cover), local weather conditions, land use, and attempts by the perpetrator to disguise the grave (Hochrein, 2002; Hunter et al., 2013).

18.3.1.3 Visibility of a Grave

Digging a grave will loosen and aerate the soil meaning that, when it is reinterred following the deposition of human remains, it will present a

different visual and geophysical signature than the surrounding soil. Since the soil will rarely fit back into the grave in its entirety, in the early stages of an investigation, soil mounds may indicate the presence of a deposition site. As the soil settles in the grave (known as sedimentation) and the body decomposes, a visible depression may instead appear. The disturbance caused by digging a grave will also affect the vegetation directly above it. First, the vegetation and turf that must be removed in order for the offender to access the soil below will rarely be placed back over the grave without looking out of place, although this does depend on the nature of the vegetation and the precision employed by the person that replaces it. Bare earth or displaced vegetation could, therefore, be an indicator of ground disturbance, as could marks caused by the offender trampling down the grave fill. As the time since deposition increases, it may be more difficult to detect these changes because the vegetation may regrow. The species of vegetation growing over an area may also be altered by the loosening of the soil, the microbiological changes caused by decomposition of a corpse (see below), and the insertion of other materials into a grave. The growth of vegetation may be stunted in graves where a body is wrapped or where materials such as paving slabs, concrete, or corrosive chemicals were placed inside. Conversely, when an unwrapped body is buried close to the surface, the increase in nutrients may lead to increased vegetation growth. Different types of vegetation may colonize a grave at different stages of the decomposition process, and their detectability may depend on the season in which a search takes place.

18.3.1.4 The Effects of Decomposition

In the immediate period after death, putrefaction occurs, during which there is an increase in bacteria that breaks down the tissues of the body. Initially, this will cause the body to bloat and will result in the purging of bodily fluids from cavities such as the anus, groin, ears, nose, and mouth. This results in the leaching of body fluids and bacteria into the area immediately surrounding

the body. If a body is within a grave, these fluids will leach through the grave sides and base, resulting in the discoloration and modification of the soil pH, moisture content, and levels of nitrogen, phosphorus, and volatile fatty acids present in the surrounding soil (Carter, Yellowlees, & Tibbett, 2007; Tibbet & Carter, 2008). This cadaver decomposition island (CDI) may be visible when the topsoil is removed during excavation, or, in some cases, it may be visible on the surface as leachate permeates the ground surface. Most often, leaching will result in visible changes to the vegetation above the grave, as the balance of microorganisms in the soil is altered. Alternatively, the decomposition process may attract insects and animals—the former may colonize the grave and its immediate environs, while the latter may bring remains to the surface—and this too may act as a useful indicator during searches. Where remains are on the surface to begin with, the leaching is even more likely to produce a visible CDI. Being above ground, the CDI will also likely attract animals and insects to the body. Soil analysis to determine the presence of volatile fatty acids has proven effective in cases where a burial is suspected but where a body has been removed, e.g., where there is a primary and secondary grave site or in cases involving scavenging. Techniques such as gas chromatography mass spectrometry (GCMS) can detect the presence of biomarkers in the soil, even when the body itself has long since been removed (Larizza & Forbes, 2013). As well as acting as a useful indicator during search, research has shown that CDIs may also be useful in estimating the post-mortem interval (PMI) because of the presence of these biomarkers (Benninger, Carter, & Forbes, 2008).

The heat produced during decomposition may also be detectable using thermal imaging. If the period between burial and search is known to be a matter of days or weeks, thermal imaging (usually mounted from an aircraft) may present an optimal method to search large areas of terrain (Hunter et al., 2013). This can be coupled with aerial photography in order to observe visible changes to vegetation growth or visibly disturbed

ground from the air. These methods are particularly useful when large areas need to be searched, and they have the added advantage that they can be undertaken covertly.

18.3.1.5 Recording Taphonomic Markers

If taphonomic markers are observed during scene searches, they should be photographed, and their positions (in relation to other markers, search boundaries and pertinent landscape features) should be recorded manually or digitally (Sect. 18.4.3). An accompanying search log should document the key characteristics of the markers, including their size, appearance, and orientation. The presence of taphonomic markers and other surface evidence may allow the search boundaries to be redefined and greater or lesser priority placed upon particular areas. Such recommendations should be discussed with law enforcement personnel and thoroughly documented in the search log.

18.3.1.6 Winthroping and Burial Scenario Profiling

When concealing human remains, offenders will be consciously or unconsciously guided by, or make use of, natural and man-made landscape features. For example, topography, ground cover, and geology may influence an offender's ability to conceal a body in particular locations or facilitate an easier means of doing so. Offenders do not plan on getting caught, and, therefore, they will often select burial sites that they believe will reduce the chance of detection. This means that burial sites are usually concealed from view and passing traffic (foot and vehicle). Therefore, generally speaking, it is far more likely that a grave will exist close to a hedge line of a field than in its center. Pathways or clearings might provide easier access to an area, and, at mixed-use sites, certain activities might preclude access. Walkover surveys should involve an assessment of these factors (known as 'winthroping'), and forensic archaeologists should consider other influences such as the offender's age, build, physical fitness, and access to a vehicle/machinery when identifying the

likelihood that a burial could have taken place in a specific location.

The presence of large trees, rocky outcrops, or other distinctive elements may present an offender with an opportunity to use the landscape as a means of marking a scene so they can return to it later. The way in which this occurs will be influenced by factors such as whether a crime has been preplanned and whether an offender intends to return to the scene. In a well-known case in the UK, offenders Ian Brady and Myra Hindley buried the bodies of their victims in front of prominent rock formations and photographed themselves at these locations in order to provide both physical markers and "keepsakes" of their crimes. Forensic investigators subsequently used these photographs as part of searches in the 1960s, 1980s, and 2000s in an attempt to find their victims (Hunter et al., 2013, p. 28; Staff, 2013). Therefore, forensic archaeologists should evaluate whether markers may exist (drawing upon police intelligence) and undertake a search for these as part of walkover surveys. Any potential markers should be recorded in the same way as taphonomic markers, as outlined in Sect. 18.3.1.5 above.

18.3.2 Geophysical Methods

In order to narrow down a search area further, it may be appropriate to utilize geophysical techniques. Forensic archaeologists may be cross-trained in these methods, or they may suggest the deployment of a forensic geophysicist with whom they will work closely. Geophysical survey techniques offer the opportunity to detect the subsurface "anomalies" caused by the excavation and backfilling of a grave (Cheetham, 2005). The aeration of the soil, the creation of a grave cut, and the deposition of a body and other materials within the grave will all potentially exhibit a geophysical signature. While no geophysical technique will detect a body per se, trained operators are able to interpret these anomalies and prioritize them for further investigation based on comparison with intelligence and the results of desk-based research and walkover surveys.

Each method should be carried out in a grid pattern in order to ensure systematic coverage of a chosen search area (Conyers, 2013). A range of geophysical techniques exist, all of which detect different properties and further allow search areas to be examined without disturbing the ground.

Ground Penetrating Radar (GPR): This technique emits electromagnetic pulses and detects the speed and strength of their return. Using a range of different antennas, it is possible for GPR to penetrate both shallow depths and several meters deep. Two- and three-dimensional profiles provide a detailed record of buried remains and allow anomalies to be measured and characterized. Real-time data collection and its ability to penetrate through a wide range of surface and buried material, including concrete, make this technique suitable for an equally diverse set of terrain types and for rapid survey. Its main limitations lie with the need for a relatively flat survey area, devoid of obstructive vegetation, and the large amounts of post-processing required for interpretation and data presentation (Conyers, 2013).

Resistance Survey/Resistivity: By emitting an electric current into the ground and measuring the amount of resistance to it, this technique is capable of detecting shallow subsurface remains. As a general rule, solid features such as walls will exhibit high resistance, while loose, aerated features such as pits or ditches will exhibit low resistance. A grave may exhibit both high and low resistance, owing to the presence of a body mass and the aeration of the soil caused when excavating it, which can sometimes make interpretation difficult. Likewise, this method cannot penetrate through concrete or other solid surfaces, and it is only capable of penetrating shallow depths. A standard twin-probe array will, for example, rarely survey to a depth of more than 1 m. However, resistance survey represents a rapid way to detect shallow subsurface features, and the data it generates requires less processing than GPR. This makes it a valuable tool in forensic searches where a rapid assessment of a landscape is required (Watters & Hunter, 2005).

Magnetometry: When a grave is excavated or when remains are burned, a permanent change

occurs in the earth's magnetic field. This contrast between the magnetic properties of buried remains and the surrounding subsoil may be detectable using a magnetometer or gradiometer. Likewise, metal objects or any other buried remains exhibiting magnetic properties are detectable using this technique. Unlike GPR, magnetometry can only detect shallow subsurface remains. It also requires an open survey area, devoid of any surrounding metal, and the operator must also refrain from introducing metal "interference" on their clothes or belongings (Cheetham, 2005). Therefore, magnetometry is rarely recommended in the search for clandestine burials, as there is almost always surrounding metal, except in the most remote of locations.

Because each of these techniques detects different properties, the use of multiple, complementary methods should be considered. This will of course be dependent upon time and budgetary restrictions. It is also important to bear in mind that the police will be bound to investigate each "anomaly" identified in the course of geophysical surveys in order to eliminate a search area. That said, this often still remains a more expedient and efficient option than excavating large areas, and so geophysical survey should at least be considered as a precursor to excavation in the context of the specific requirements and circumstances of each investigation.

18.3.3 Cadaver Dogs

In cases where specific grave locations are unknown, cadaver dogs may offer an effective search solution. Cadaver dogs are specifically trained to recognize and respond to the presence of human remains. Although it is not known exactly what cadaver dogs detect, they are trained to distinguish between human remains and those of animals (Rebmann et al., 2000). Once a search area has been identified, cadaver dog handlers will vent the ground and facilitate a systematic examination of the scene. Dogs will usually indicate the presence of remains by providing an indicator such as barking, sitting down, pawing at the

ground, or placing their nose firmly into the handler's vent holes. Exactly which indicator is provided depends upon their training. A detailed overview of the use of cadaver dogs in missing persons investigations is provided in Chap. 19, and the reader is referred to this for a more detailed discussion of the operational capabilities of cadaver dogs. In the context of this discussion, it is important to highlight that cadaver dog handlers and forensic archaeologists should work together in order to target specific locations of interest. Once cadaver dogs have positively indicated the presence of remains, forensic archaeologists can subsequently examine and/or excavate each area in turn to confirm whether human remains are in fact present.

18.3.4 Low-Tech Methods

18.3.4.1 Probing

A traditional method often used in the search of clandestine graves in the USA is the use of a metal or fiberglass soil probe (Morse, Duncan, & Stoutamire, 1983). The tool used as an archaeological probe is usually a thin T-shaped metal bar, measuring approximately 1.2 m in length. Probes tend to be lightweight with a pointed tip and can be insulated to protect against electrical currents. Probes are used to detect differences in soil compaction and will move more easily through subsurface material that has been previously disturbed due to soil mixing (Connor, 2007). While probes provide an efficient method to quickly identify potential burial sites, they also may induce postmortem damage to buried remains in the process. Proper employment of the probe is dependent on training and experience. Most often, the probe is slowly forced through layers of soil to test for resistance and depth of disturbances (Fig. 18.3). Typically, within a given search area, the probe will systematically be inserted at regular intervals along a search pattern or grid to find areas of interest or to define the edges of a known burial site. However, the



Fig. 18.3 The employment of a soil probe to define grave boundaries within a historic cemetery. (Copyright: Colleen Milligan)

use of soil probes is discouraged in some other countries, such as the UK.

18.3.4.2 Test Pits and Trenches

Test pits and trenches are often employed to gain information about areas of soil disturbance, the presence or absence of human remains, and the dimensions of a grave pit. Test pits and trenches are usually standardized in regard to size and the interval between pits or trenches and can be excavated with various types of equipment (Fig. 18.4). Both hand tools and heavy equipment may be



Fig. 18.4 Forensic recovery team employs both test pits (*red circles*) and trenching (*red arrow*) in the search for a burial site near Redding, California. (Copyright: Human Identification Laboratory, CSU, Chico)

employed depending on the area in question and the suspected depth of human remains or potential evidence. Test pits are generally excavated with hand tools at regular intervals to gain information about subsurface soil characteristics and the presence or concentration of potential items of interest. Likewise, trenching is often employed to gain information about characteristics of a site or to determine the extent of an area of soil disturbance, such as a grave outline. While trenches can be created using hand tools, it is also common to use heavy machinery, such as a backhoe with a straight-edged bucket, to quickly establish a deeper soil profile. A commonly used method in the UK is half-sectioning, which involves excavating half a potential feature in order to define its edges, likely orientation and contents. This has the advantage of minimizing the disturbance of a feature until its nature, and more importantly the nature of the material bur-

ied within it, has been ascertained. Excavation of the second half of the feature will usually proceed after the first half has been fully excavated, in order to eliminate the entire feature as a clandestine burial location or in order to recover the evidence that exists within it. If human remains are present, the excavation of both halves will cease until permission has been granted by a pathologist to continue (Powers & Sibun, 2014; Sect. 18.6).

18.4 Excavating the Scene

The processing of an outdoor forensic scene or fire scene is a multistage process that should proceed in a systematic, controlled manner. This involves following proper excavation methods; screening grave fill; mapping remains, features, and associated physical evidence; scene docu-

mentation (e.g., notes, photographs, and scene measurements); evidence collection; and maintaining chain of custody.

18.4.1 Excavation Techniques

Once located, it is important to photograph the scene extensively prior to disturbing the area. Note-taking should be used to document each stage of the excavation, including the different roles of each team member. Once the scene has been documented, the surface around the burial site should be carefully denuded of any vegetation using shovels and trowels. This vegetation and soil should be placed into buckets to screen for possible evidence, personal effects, or human remains. For buried bodies, trowels should be used to scrape the soil to reveal the demarcation between the undisturbed soil and the grave fill. Where multiple layers exist within the grave, each should be documented and given a unique identifier. Once the grave outline is defined, carefully troweling along with the use of small, handheld whisk brooms can be used to make the outline more visible. The outline should be photographed, measured, and recorded in notes before further excavation ensues. A baseline or grid system should then be established to map the human remains, evidence, and personal effects associated with the scene (Sect. 18.4.3). Excavation should proceed in a controlled manner, with the grave fill soil being removed with small hand tools, such as trowels, plastic scoopers, brushes, wooden tools, and dust pans. All soil should be placed in buckets labeled with information regarding the location within the grave. It is preferable to document evidence, personal effects, and human remains *in situ*; however, it is not uncommon for items to be discovered during the screening process (Dupras et al., 2006). Care should be taken to only remove the loose grave fill and to not destroy the grave wall features. Tool marks created from the digging implements may be present in grave walls and on the grave floor and should be preserved for photography and measurements where possible (Christensen et al., 2014; Hochrein, 1997). In

addition, insect and botanical evidence should be recorded and preserved for future analysis.

Once the remains are located, wooden or plastic tools and soft brushes should be used to expose the corpse or skeleton. Care should be given to not dislodge or remove skeletal elements from their original position if possible. Once exposed, the remains should be documented with notes, a burial sketch (to scale), photography, and measurements (Sect. 18.4.3). In the USA, the discovery of human remains is immediately reported to the scene of crime officers, who will then notify the coroner's or medical examiner's office. Although procedures vary substantially, most often the excavation will be conducted without the direct involvement of a pathologist on scene. In the UK, the discovery of human remains means that excavation must immediately cease until a Home Office Pathologist has been consulted and gives permission for forensic archaeologists to proceed with the excavation and recovery (Powers & Sibun, 2014). In almost all cases, the Home Office Pathologist will attend the scene to document and assist with the recovery of the remains. If intact, the body can be lifted by team members onto a stiff board and then transferred into a body bag. However, if the remains are skeletal, each body region should be lifted separately and placed into paper bags. Left and right hands and feet and ribs should be bagged separately. The skull should also be bagged separately to keep any small skull fragments or teeth from being lost. After the remains have been removed, the remainder of the grave fill should be removed and screened. The final clean grave should be recorded with notes, photography, and mapping, including evidence of tool marks on the grave walls or floor. A final photograph is of critical evidentiary value since it shows that the grave is completely empty.

18.4.2 Screening

All soil removed from the scene should be screened for evidence, personal effects, and remains. For most scenes a 1/8 in. screen should be used to sift the grave fill soil. However, a

1/4 in. screen may be better suited some types of thick clay soils. If possible, a nested screen design can be used where soils and other materials can be separated based on their different particle sizes. This is especially useful for locating trace evidence (hair and fibers). The screening operation should take place away at least a few meters away from the grave site to avoid dust blowing back into the excavation. It is ideal to have more than one person helping to clear each screen. A tarp should be placed underneath the screen to contain the grave fill soil. This will facilitate replacing the soil back into the grave at the end of the excavation.

18.4.3 Mapping

For mapping the scene, a primary datum should be established. This usually is a fixed landmark such as a building or large tree located near the scene. Once the datum is established, a baseline or grid system can be set up to map in human

remains, evidence, and personal effects (Christensen et al., 2014; Connor, 2007; Dupras et al., 2006). The location of the primary datum should also be recorded using a GPS unit and should be mapped in relative to the baseline or grid system. A baseline should minimally consist of a string of known length tied in between two stakes and set up along the long axis of the grave (with a recorded compass measurement). A line level is affixed to the baseline to ensure that it is level. The height above the ground surface also should be recorded and later subtracted from all depth measurements. One stake can be assigned as x and the other as y . Measurements made from x and y to the item to be mapped can be made using two tape measures using trilateration (Fig. 18.5). Another string and line level should be affixed to one corner of the baseline to ensure that x and y measurements are level with the baseline. Depth measurements, z , are taken from the point of intersection of x and y . This information should be recorded in a survey log to ensure that spatial information regarding the recovery scene



Fig. 18.5 Grave excavation simulation showing a skeleton being mapped using trilateration. (Copyright: Human Identification Laboratory, CSU, Chico)

is preserved. Grid mapping methods provide better control and less measurement error and involve setting up a grid and using quadrants over the grave site. Stakes are placed at regular intervals, and strings with line levels are used to ensure the grid is level. This mapping is especially useful for disarticulated remains and for fire scenes where there is a greater degree of fragmentation and dispersal of remains. Other mapping methods include triangulation, azimuth mapping, or use of a theodolite. Total stations or differential GPS systems are increasingly used to record burial sites and scattered remains, since they provide the opportunity to accurately record positional data with sub-millimeter accuracy (see examples in Christensen et al., 2014; Dupras et al., 2006). These methods provide a digital representation of a scene and the evidence within it. In the UK, this equipment is commonly used by road traffic investigators, and so forensic archaeologists will sometimes request these specialists attend a scene to assist with recording deposition sites. Their use is dependent upon factors such as line of sight between the instrument and evidence (Total Station) and satellite reception (GPS), and neither might be a suitable substitute for manual planning methods when very small or highly commingled remains are present. Terrestrial laser scanners, commonly used in mainstream archaeology to record landscapes and objects, can also be used to capture deposition sites in three dimensions (Vosselman & Maas, 2010). This technique has not been widely used to record clandestine burials because of the costs and expertise required to collect and process the data. However, as the quality of data captured using this method continues to improve, data collection in this way offers the possibility to create a three-dimensional visualization of crime scenes, grave edges, tool mark and footwear impressions, human remains (and the evidence of trauma they exhibit), and other evidence types, preserving the scene by way of record and offering the opportunity to re-interrogate the scene long after the recovery process is complete. In relation to all the methods described above, the specific mapping method used will depend on the scene context and characteristics, the terrain, and the timeframe in which to complete the scene recovery.

18.4.4 Scene Documentation

As mentioned above, scene documentation should include extensive notes, photography of the area, scene, and recovery process and also mapping (Connor, 2007). Careful and accurate recording of the datum, baseline or grid system, and the location of human remains, personal effects, and evidence is crucial for reconstructing the crime scene and eventually for their evidentiary value in court. If these data are collected accurately, then the report should hold up to scrutiny in the courtroom. Using standardized recording forms for mapping, sketching and note-taking are critical and should be developed well in advance of the recovery. The forms should minimally include an inventory sheet for the remains and personal effects, a photography and evidence log, a survey log, and gridline paper for sketching the scene.

18.4.5 Evidence Collection

In many jurisdictions, evidence collection is conducted by law enforcement personnel. However, forensic archaeologists should be prepared to collect evidence at the scene. All evidence should be assigned a unique identification number, which should track the evidence through all stages of recovery and analysis. Evidence information may include a jurisdiction name, case number, date, and other case pertinent information. All evidence should be photographed in situ where possible, with an evidence label card, a visible scale, and a north arrow. The evidence should be mapped in relation to the baseline or grid system or using a theodolite, total station, or other digital recording techniques. The evidence log, photography log, survey log, and notes will provide the principle record of the evidence. Once everything has been recorded, the evidence item can be removed and placed into an evidence bag and sealed.

18.4.6 Chain of Custody

It is critical to maintain chain of custody of evidence throughout the entire recovery process and during transportation and storage. Evidence is

typically placed in paper or plastic bags or plastic containers with an evidence label that includes the pertinent case information. Evidence should be sealed with evidence tape and should include the date and initials of the person who last handled the item. This should be done each time evidence is accessed. However, for human remains, this may be impractical and may also cause further degradation to remains. In these instances, it is best to leave the skeleton on an analysis table within a locked, secure laboratory facility where access is monitored. Once the case analysis is complete, the remains can be resealed within evidence boxes and stored in a secure evidence room until such a time that they are returned. Other evidence types, such as metal and leather, will also require alternative handling, packaging, and storage. Forensic archaeologists should be able to advise law enforcement regarding the most appropriate recovery and packaging techniques.

18.5 Recovery Scenes: Three Case Studies

18.5.1 Buried Remains

In August of 2012, the California State University, Chico Human Identification Lab (HIL) was called to assist a local county sheriff's office with the recovery of a buried body on private property in northern California. The multi-acre rural property was situated in the foothills of the Sierra Nevada Mountains and contained an illegal marijuana grow, a methamphetamine lab, and a butane hash oil lab. Prior to the search, an informant stated that an earlier homicide occurred on the property and that the body was buried on-site. A ground survey with a search and rescue team and cadaver dogs subsequently located an area of interest. The HIL team consisted of two faculty members, one staff member, and four graduate students.

A backhoe with a straight-edged bucket was used to scrape away topsoil to delineate the area of disturbance (Fig. 18.6). Once an area of inter-

est had been defined, the backhoe was used to slowly remove approximately seven to 15 cm of soil at a time (Fig. 18.7). The grave fill consisted of clay-based soil, mixed rocks and pebbles, and scattered fragments of charcoal. At a depth of 123 cm, the backhoe uncovered the top of a quilted blanket resting on top of the decedent. The backhoe was subsequently used to expand the area surrounding the remains to facilitate a hand excavation. Once the remains were located, the rest of the excavation proceeded with small hand tools to avoid damaging the remains. The excavation exposed an intact, clothed corpse, which was buried face down in a fetal position. The body depth ranged from 123 to 148 cm. Plumbing tape was wrapped around the decedent's mouth, zip ties and handcuffs were used to restrain the arms, and the decedent's pants were pulled down around the ankles, possibly to restrict movement of the legs. A pair of shoes was found alongside the body.

All material from the pit was screened using a 1/4 in. mesh (Fig. 18.8). Once the body was photographed and mapped in situ, it was removed from the grave and placed in a body bag for transport to the local coroner's office. Following removal of the body, hand tools were used to excavate the bottom of the grave pit, which was composed of shale bedrock. The profile showed that a small backhoe had been used to create the grave in a north-south direction. The decedent's feet were located on the north-end of the grave shaft, while the head was located on the deeper south end. The bottom of the pit was 52 cm in diameter. For this 14 h excavation, personnel rotated responsibilities throughout the process. Recovery tasks included photography, note-taking, excavation, screening grave fill, use of a metal detector, and mapping. The team worked closely with the sheriff's office to document the scene, collect evidence, and maintain the chain of custody for the body and associated evidence.

The recovery process included several notable safety concerns. The first was the use of a backhoe. The use of heavy machinery was handled by a set of qualified and skilled operators, where one driver operated the controls and another worked



Fig. 18.6 Grave site with topsoil removed. The area of disturbed soil (*red circle*) is visually distinct by the difference in soil coloration with surrounding matrix (Copyright: Human Identification Laboratory, CSU, Chico)

in tandem with a recovery team member as a spotter during excavation activities. The use of spotters ensured that the backhoe did not come into contact with the remains. The second concern came with the uncovering of the blanket, which was covered by an unknown white, crystalline substance that had been poured into the grave and around the body. An informant suggested that the unknown substance could be lye. The level of personal protective equipment used for the excavation was increased to respond to the presence of this potentially hazardous material. The third concern was the depth of the excavation. The area surrounding the body was expanded and graded to allow for multiple team members to safely climb in and out of the grave shaft while excavating. The final concern was the length of time required for a successful removal of the body. Hunger, dehydration, and fatigue were monitored throughout the operation.

18.5.2 Surface-Scattered Remains

In August of 2009, the HIL team was called out to assist in the recovery of a surface scatter of human remains. The remains were located in a heavily wooded area within a dry seasonal pond. The scene was located adjacent to a homeless camp known for extensive drug activity. The recovery team consisted of a faculty member, a lab supervisor, five graduate students, and three undergraduate interns. Although the majority of the remains were located on the surface of the ground, several elements were partially buried within tiny drainage channels (5–10 cm wide) associated with the seasonal pond. Most of the extensive and thick vegetation at the scene was removed by the team with gardening shears and trowels to allow for greater visibility of the disarticulated remains (Fig. 18.9). A hand-and-knee surface survey was then conducted, and pin



Fig. 18.7 Forensic archaeology team members using hand tools to expose the grave outline. The trapezoid outline is delineated by the lighter border of undisturbed soil. (Copyright: Human Identification Laboratory, CSU, Chico)

flags were used to mark the location of each skeletal element. A small-scale hand excavation was conducted to ensure a thorough recovery of the remains. All bones were mapped in situ and photographed prior to their removal. The skeletal elements showed extensive evidence of sun bleaching, surface weathering, and carnivore scavenging damage. The recovery effort successfully located about 90% of the skeleton, including a complete skull. Although no clothing, personal effects, or evidence was recovered from the scene, the biological profile assessment led to a missing persons case and eventually to a positive identification of the decedent.

18.5.3 Fire Scene Recovery

In June of 2013, the HIL received a request for assistance from a local county sheriff's office with the recovery of three bodies from a suspicious vehicle fire. The vehicle, fully engulfed in flames, was discovered in the foothills of the Sierra Nevada Mountains. Once the fire was extin-

guished by the California Department of Forestry and Fire Protection (Cal Fire), three burned bodies were discovered within the vehicle. The vehicle was subsequently moved to a sheriff's department facility to process the scene and to excavate the remains.

The responding HIL team, consisting of one faculty member and one staff member, worked in conjunction with CAL FIRE personnel, the county sheriff's office personnel, and the county forensic pathologist to document the bodies in situ prior to their removal from the vehicle. Upon removal, it was determined that two teenage males were located in the trunk of the vehicle, and one adult female was found lying across the backseat. The bodies and associated evidence were designated as Jane Doe #1, John Doe #1, and John Doe #2. No tools were used for the removal of each body. Given extensive thermal damage, identifiable bone fragments associated with the head and extremities of each decedent were collected by hand. Each body and associated fragment were placed in separate body bags and removed to the county coroner's office.



Fig. 18.8 Forensic archaeology team members sifting grave fill. Team members systematically rotated between sifting and grave excavation tasks throughout the recovery operation (Copyright: Human Identification Laboratory, CSU, Chico)



Fig. 18.9 Forensic archaeology team members removing vegetation from the scene to expose human skeletal remains located on the surface of a dry seasonal pond (Copyright: Human Identification Laboratory, CSU, Chico)

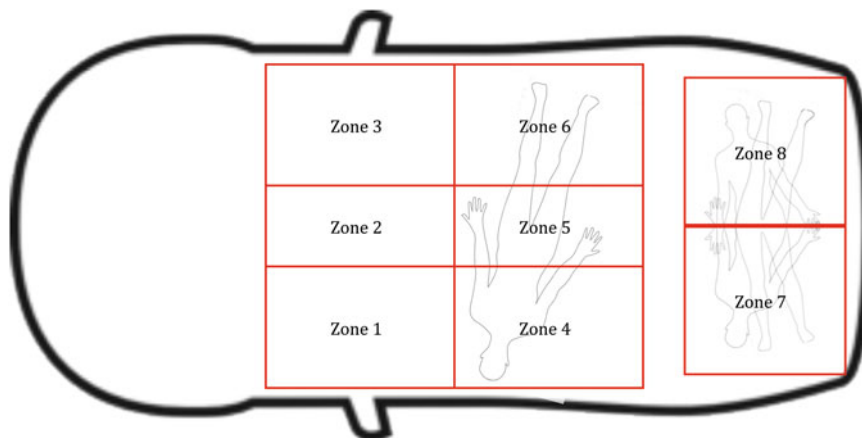


Fig. 18.10 Outline of burned car with evidence zones (red boxes) and the position of recovered bodies (gray body outlines) (Copyright: Colleen Milligan)

Following the removal of the bodies, the vehicle was moved to the county sheriff's office for evidence collection. A HIL team, consisting of one faculty member, one staff member, and one undergraduate lab intern, returned to assist in the final processing of the vehicle. The vehicle was divided into eight evidence zones for processing (Fig. 18.10). These zone distinctions were used to systematically search for bone fragments and evidence. Each zone was excavated individually using hand tools, and all collected debris was screened. The sifting process was divided into two stages with debris screened first using 1/4 in. mesh to remove large items and subsequently screened using 1/8 in. mesh to remove small items.

The safety concerns associated with a vehicle fire differ slightly from burial or surface-scattered scenes. In this case, full personal protective equipment was used given the potential of encountering hazardous materials in the burned car debris and the need to avoid cross-contamination of evidentiary zones. In any fire, the materials consumed often include wood, metals, plastics, cloth, and foam material. Masks were utilized to minimize the inhalation of both particulates and any remaining fumes. The last major safety concern was the high number of

sharp edges found in the vehicle's metal frame. Only one team member at a time moved around within the vehicle to maximize the space available and avoid movements that could result in injury.

18.6 Legal Procedures

The importance of careful scene documentation is often more fully realized at the latter stages of an investigation, especially for homicide cases that end up in the courtroom. Although the actual scene recovery may not be challenged in court, forensic archaeologists should be prepared to testify as expert witnesses in regard to the methods and techniques employed during the recovery, as well as their interpretations of the scene context. Attorneys on the opposing council will try to identify errors or shortcuts in methods or documentation employed at the scene. The forensic archaeologist should be prepared to defend their use of a set of standard operating procedures and any instances where practices in a given case deviated from standard procedures. The courtroom is by its nature adversarial, and it is not uncommon for an expert witness to experience harsh questioning from the opposing council. Regardless of

the circumstances, forensic archaeologists are ethically and morally bound to provide scientifically supported testimony regarding the methods and techniques utilized at a recovery scene as well as their scientific interpretations regarding the scene context. All notes, photographs, measurements, sketches, and reports may be admitted as evidence into the courtroom. In cases where the recovery and analysis of the human remains were conducted by the same person, it is important to be forthcoming with any biasing information provided to the analyst prior to assessment of the remains. The legal process can vary widely between jurisdictions within a single country and especially between different countries (Groen et al., 2015). Here we briefly review the relevant aspects of the legal process in the UK versus the USA.

18.6.1 United Kingdom

Violent or suspicious deaths in the UK are investigated jointly by the police, an appointed Home Office Pathologist, and a local HM Coroner. Forensic archaeologists may be brought in to assist as expert witnesses in cases involving buried or concealed human remains, although there is currently no legal statute which stipulates that this is an essential requirement. This is an unfortunate reality owing to the loss of evidence that will undoubtedly occur when trained specialists are not used. Forensic archaeologists in the UK are not commonly employed by police forces, although there are some police officers who do have forensic archaeological training. More often, forensic archaeologists are employed by private forensic service providers or by universities, and they are then sub-contracted as expert witnesses on a case-by-case basis. Trained forensic archaeologists can apply to become a member of the UK Forensic Archaeology Expert Panel, overseen by the Chartered Institute for Archaeologists and endorsed by the UK Home Office. Members are required to comply with the *Standards and Guidance for Forensic Archaeologists* (2014), as well as national legislation and guidance signposted therein such as:

the *Human Tissue Act* (2004) regarding the treatment and retention of human remains and the *Criminal Procedure and Investigations Act* 1996 and *The Disclosure Manual* (2005) regarding record-keeping, retention, and disclosure of documentation compiled during search and recovery. Forensic archaeologists are also affected by the *Police and Criminal Evidence Act* (PACE) (1984), which stipulates that police have an initial 24 h and (upon application) a maximum of 96 h to question a suspect. When bringing charges against a suspect depends upon locating human remains or other evidence associated with concealment, forensic archaeologists will find themselves under the pressure of the “PACE clock” during the search and/or recovery process.

When human remains are discovered in the course of missing persons investigations, the police and forensic archaeologists are legally bound to immediately inform a Home Office Pathologist and HM Coroner and to cease recovery efforts until advice has been sought from them. The pathologist will usually attend the scene, examine the body and associated evidence in situ, and supervise the recovery process before accompanying the body to the mortuary and undertaking the postmortem examination (Home Office, 2016). The HM Coroner will then assume responsibility for conducting an inquest, drawing upon evidence provided by law enforcement, forensic specialists (including archaeologists and anthropologists as appropriate), and the autopsy results. They are also legally responsible for releasing the body of the deceased to the family for reburial (Ministry of Justice, 2014).

18.6.2 United States

In the USA, death investigations are conducted either by a coroner’s office or by a forensic pathologist (medical examiner). The coroner system in the USA traces its origin to medieval England and initially involved individuals who worked under the authority of the crown to conduct judicial matters. The modern coroner system is followed in more than half of US states,

with the remainder following a regional medical examiner system. One variation of the coroner's system is the sheriff-coroner system used in California. Under the sheriff-coroner system, the sheriff (an elected official who often lacks medical training) is responsible for conducting a death investigation and can determine whether a particular case will be investigated as a potential homicide. Deaths that occur within the county or local area are then autopsied by a forensic pathologist at a local morgue. Under the medical examiner system, a forensic pathologist has the authority to determine whether an investigation (including autopsy) will occur for a given case. Deaths that occur within a certain geographic area fall within the purview of a regional medical examiner's office. Many states also use a hybrid coroner-medical examiner system for death investigation.

The fragmented nature of death investigation in the USA has resulted in a high level of variation in the qualifications of expert witnesses and in the quality of crime scene documentation. For example, three different standards are used in US courts to determine eligibility of an expert witness to testify. The earliest was the 1923 ruling, *Frye v. United States*, which argued that there must be general scientific acceptance of a method or technique for it to be admitted into court. The *Frye* ruling was followed up in 1975 by the *Federal Rules of Evidence: Rule 702*, which was enacted by US Congress. *Rule 702* expanded on the language in the *Frye* ruling, and indicated that expertise could be defined based on knowledge, skill, experience, training, or education (Christensen et al., 2014). Although this helped to clarify the qualifications of an expert witness, it left the door open for nonscientific expertise to be admitted into the courtroom. In 1993, the US Supreme Court ruled on *Daubert v. Merrell-Dow Pharmaceuticals, Inc.* Known as the *Daubert* standard, the ruling provided more specific guidelines for expert witness testimony. *Daubert* requires that the technique follows the scientific method, has been subjected to peer review, has known or potentially known error rates, has applicable professional standards, and is generally

accepted by the scientific community (Christensen et al., 2014; Connor, 2007). About two-thirds of the US states have now adopted *Daubert* guidelines, and these states give judges the authority to determine whether a particular witness and their findings will be admitted into the courtroom. Regardless of which standard is followed, forensic archaeologists working within the USA should be intimately familiar with the legal system as it pertains to qualifying expert witnesses and their testimony.

18.7 Summary and Conclusions

As outlined in this chapter, forensic archaeology has emerged as a distinct field of study with a well-established suite of methods and techniques aimed at locating, excavating, mapping, and documenting human remains and associated evidence within their depositional context. Forensic archaeologists rely on both low-tech and high-tech methods in search and recovery operations and have increasingly incorporated advanced applications within geophysics and GIS as part of their standard field kits. Forensic archaeology utilizes a holistic approach to locate and recover missing persons and will continue to embrace new technologies and approaches that facilitate rapid location and recovery of victims of homicide. Investigators should utilize forensic archaeologists as well as other relevant experts in all stages of a search and recovery effort, including the planning stages. Greater reliance on the expertise of forensic archaeologists will increase the likelihood of a successful outcome in resolving missing persons cases.

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Mick Swindells

19.1 Introduction

The best thing about using a detection dog is that they have the ability to think, the worst thing about using a detection dog is that they have the ability to think.

Almost since time immemorial, dogs have been used to assist mankind. From the very first dogs used to protect livestock and homes, man has realized the advantages of using a dog's inherent abilities. As our lifestyles changed so did the role of the dog. In the place of protecting our livestock, our modern-day dogs were used to protect our buildings, and dogs were incorporated into the family, not as a deterrent, but as family members.

With this 'modernisation' came changes in the 'design' of the dog. Feral dogs gave way to dogs with certain characteristics like long hair, floppy ears, different colours and reduced/increased size. Conversely some dogs were bred for certain tasks, Bernese Mountain dogs for pulling carts as one example. Herein lies a fundamental difference between the handler who decides to train his/her pet as a detection dog and the 'professional' trainer who buys a dog for its capabilities.

I have often been told by a doting owner 'my dog will only eat fresh prime steaks', I am not surprised if the owner is stupid enough to feed the dog so lavishly. However, the dog will eat the cheapest can of dog food if its life depended on it. We have all heard of the expression 'as sick as a dog'. Some dogs, especially those fed on prime steaks, will often regurgitate their food. This is caused by the food being too rich for the enzymes in the dog's stomach to break down in the first instance. In addition, we know that dogs like to bury bones. Although this trait is less common with modern dogs, it is a fact with more feral breeds. This behaviour is not because the dog has a 'squirrel instinct' and will store food for leaner times, but it is another way of allowing the ground bacteria to make the bone more digestible.

So here, thanks to Mother Nature, we have the perfect cadaver detection dog. A dog with the inherent ability to locate rotting buried food. You will note that I have purposely referred to the 'target' as 'food'. The reason will become evident.

This chapter will look at how cadaver detection dogs are trained and used in the modern age by utilizing their most basic instinct to find food. It will focus on good and bad traits in training and how these can impact on operational searches during missing person's investigations. The chapter will also seek to inform the reader about some aspects of search dogs' capabilities that are not commonly known, such as blood detection

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or submerged body detection. Case studies will also help to show how the training of the dog and handler have influenced investigations and their ultimate outcome. Moreover, it is hoped that the reader will have caused to consider the use dogs in any search based on the capabilities outlined herein.

19.2 Training a Cadaver Detection Dog

All detection dogs—whether blood, semen, narcotic or explosive detection—need to have a ‘target scent’ imprinted into their memory bank. Notwithstanding the remarks above, cadaver detection dogs are no different. Dogs have to be trained to ignore other meat scents, takeaways, roadkill and other distractions and only to focus on the scent we want the dog to locate. This can be achieved in various ways. Some handlers like to introduce the dog to various distraction scents at an early stage in its training (Rebmann, 2000). If the dog shows any interest in the scent, it is not rewarded but is taken away from it. Other handlers, myself included, like to only concentrate on the scent of a pig. This method has the effect of brainwashing the dog. Several times during operational searches, we have encountered buried pet animals, dogs, cats and rabbits, which my dog has totally ignored.

In all dog training, it is important to train the dog on the genuine ‘target scent’. For example, if we wish to train a dog to locate cannabis, we hide cannabis and not a pseudo-cannabis scent which may differ ever so slightly than the real thing. However, because of the Human Tissue Act 1961 and subsequent iterations of it, it is not possible to use human body parts to train dogs in the UK. Other countries around the world are more relaxed in their laws concerning the use of human body parts. For instance, there is the famous ‘body farm’ in Tennessee, USA. Whilst the availability of human body parts is an advantage to the handler, the way the parts are often used in training is detrimental. Human body parts are, by nature, difficult to obtain. Handlers who are allowed to possess them do their utmost to

preserve them. I have heard handlers say that their dog can locate a body part they have had for years whilst in effect what they are saying is their dog can locate an old part in a modern “grave”. In reality the two seldom go together. In addition human body parts are often frozen when not being used. This again is unnatural and affects the decomposition of the part. Therefore, whilst the use of body parts is an advantage, the only way to maximize the advantage is to bury the parts in a controlled training ground.

Therefore, in the UK, we have to use alternatives. Most police forces in the UK now use pigs as a replacement. It has long been established that pigs have similar anatomical characteristics to humans. We are both omnivores, have similar digestive organs, similar skin construction and (sadly) similar mass. Pigs are also widely available. Most pig farmers will incur natural deaths amongst their stock at various ages so it is possible to obtain neonatal carcasses as well as fully grown pigs.

Some agencies like to use ‘pseudo-scents’ to train their dogs. These scents are an attempt to synthetically reproduce the scent of a cadaver. Unfortunately there is a lack of independent publications regarding the validity of these scents to make them truly trustworthy, hence their lack of use in the UK. These scents also come in various ‘formulations’ from corpse scent to post-putrefaction scent. If we agree that these scents are accurate, we have to ask ‘at what stage post-mortem are they accurate.... 1 week, 1 month, 1 year’? Whichever stage they are accurate, they can only be likened to a photograph; they are only accurate for the split second the camera shutter closes.

Pigs on the other hand can be used in various stages of decomposition. Training a dog to locate these can be likened to a video; it is accurate for a longer period. It is also possible to use pigs to replicate real-life concealments, by placing wrappings around the carcass, by burning or by inflicting trauma (after the pig’s death). All these factors will affect the rate of decomposition and the interaction of the carcass with its environment, something not achievable by a synthetic scent. An important factor is that all the dogs I



Fig. 19.1 Preparation of a pig grave (Copyright: Mick Swindells)



Fig. 19.2 Wrapped pig in a grave (Copyright: Mick Swindells)

have trained on pig meat have subsequently found human remains in operational searches. Figure 19.1 below shows the preparation of a pig grave, whilst Fig. 19.2 shows a wrapped pig, during cadaver dog training.

Having established the need to train the dog to locate pig meat, we now have to look at how we accomplish this.

In the initial stages, this is achieved by allowing the dog to hunt for small pieces of pig meat and to eat them. This is obviously fun for the dog, but it also teaches the dog that the 'reward' is located in the long grass and not in the handler's pocket. Therefore, the dog learns to work to please itself and not the handler. This is a very important criterion, as when the dog becomes operational it reduces 'false positives'. 'False

positives' are when an investigative tool gives a positive response to something which is either not present or to something which is present but is not the target. Whilst a 'false positive' from an instrument (e.g. ground penetrating radar) may be easy to decipher, a 'false positive' from a dog is usually harder to understand. Some dogs trained on a clicker or to work for a ball soon learn that by giving the correct signals, not necessarily the correct indication, they will receive the ball and be returned to the comfort of their kennel/van. Alternatively, a dog may indicate the presence of a body, but further investigation may reveal nothing. I have experienced this situation many times, and often the dog will indicate the same negative ground for many days. This would tend to convince me that there is some scent present in ground, probably organic, close enough to the scent of a cadaver to convince the dog it is correct.

Whilst 'false positives' are obviously operationally problematic in terms of time, expense and deflecting the investigation to the wrong area, they can also have major implications for the victim's family. Many people still see the dog as being the ultimate search tool. They trust the dog's response more than any other search tool. Therefore, if they are told a dog has given an indication, it becomes very traumatic for them to be later told that it was a 'false positive'. Likewise, if the press are initially told of an unsubstantiated indication, this only serves to devalue the credibility of the dog team.

By allowing the dog to hunt for pieces of pig meat and to eat them, the dog learns another lesson—that other similar scents do not provide the same reward. Once the dog is indoctrinated in hunting for a piece of pig meat, small barriers can then be placed in its way, i.e. by placing the meat in a small probe hole. This will have the effect of increasing the dogs desire to obtain the 'food' and also to establish a clearly recognizable signal to the handler that the dog has located the scent, by digging the ground to get to the meat. As we will see later, it is important for the dog to search every part of the designated search area. This is achieved by placing probe lines throughout the area and by probing at designated distances, as shown in Fig. 19.3. The distance between the



Fig. 19.3 Line being probed prior to search (Copyright: Mick Swindells)



Fig. 19.4 Dog working the probe line (Copyright: Mick Swindells)

probe holes is based on various factors: the age of the concealment, the size of the target and the ground conditions. As a simple analogy, a non-smoker walking into a room can tell immediately if someone has smoked in that room, but the scent plume in the room is far bigger than the cigarette butt. Similarly, when an area is searched by a dog, the area contaminated by the corpse is often bigger than the body itself. Other factors which would affect the distribution of the scent would be wrappings around body, including clothes, and the manner of death. A person suffering trauma will decompose differently to a person poisoned or strangled, and therefore the distribution of scent would be different.

By continuing with this method, we can build up the number of probe holes the dog has to search before it comes to the hole containing the pig meat (Fig. 19.4).

The method of rewarding the dog, by allowing the dog to eat the ‘find’ *in training*, is often contentious amongst handlers. Obviously the dog should never be allowed to interfere with the

corpse in operational circumstances, and the handler should remove the dog at the first sign of digging. This can be simulated in training, but great care should be taken as to when and how this is done. To take the dog away from the scent at too early a stage or too harshly will only demotivate the dog. If this is done in training, it is good practice to place the dog over another search area soon afterwards and allow it to eat the find. We must always remember that the prime objective *in training* the dog is make the dog believe that the target is out there somewhere and that the dog can eat it when found. Removing the dog from the target (operationally) should come as a shock to the dog. The alternative is for the handler to reward the dog with a ball or other toy. However, as previously stated, this has the effect of promoting “false positives”.

Whilst these exercises are sufficient for the initial training, there has to be a time when the dog is asked to locate a buried carcass. The correct time to ask a dog to complete this task can only be determined by a suitably qualified instructor.

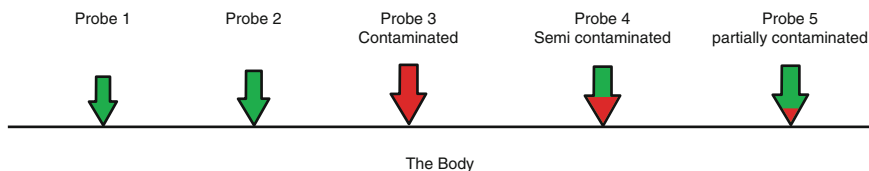


Fig. 19.5 Effects of contamination on a probe (Copyright: Mick Swindells)

Prior to the initial training, sufficient pig carcasses should have been buried for this purpose. These carcasses can be a mixture of naked pigs and clothed pigs (as in Fig. 19.2). By continuing this method, the dogs will soon learn to recognize the smell of various stages of decomposition.

Cross-contamination by carrying the scent from a contaminated probe hole to a ‘clean’ area is an issue. However, this is easily overcome by ensuring the dog searches the probe holes in the same order as they were probed. This will result in the dog reaching the correct probe hole first and not at cross-contaminated hole (Fig. 19.5).

19.3 Operational Searches with Cadaver Dogs

19.3.1 Searching for Buried Remains

At the time of going to press, there are no ‘operational standards’ for police cadaver detection dogs in the UK. Therefore, the decision as to when a dog can be deemed ‘trained’ is often one for the local police force. Most police forces will ask for a suitably trained handler from a neighbouring force to oversee a final assessment, but it should be remembered that standards and abilities will vary.

For my part, I only ask two questions of the team (dog and handler): (1) Can they locate concealed human remains in a scenario they are likely to encounter operationally? (2) Can the evidence be retrieved intact? You will note that there is no stipulation as to the way the dog indicates the remains nor as to the age or concealment method of the ‘find’, merely that it is a scenario they are likely to encounter operationally. This prevents the team being tested in ridiculous conditions in unrealistic scenarios.

No operational search can be conducted without good intelligence from the investigating officers. Whilst, for investigative reasons, these officers may not wish to impart all the information they have on the case, it is important that the search team has sufficient knowledge of the circumstances to formulate a search strategy and to envisage the type of indication their dog will present.

Human remains can be concealed in almost any terrain. Their concealment normally relies on the offender’s knowledge of the area and his/her ability to conceal the body. In the case of Frederick West (1992), he was a builder and had control over the concealment site, his house. In the case of the Moors Murderers (Myra Hindley and Ian Brady), they used areas of moorland where they often picnicked. Therefore, it is necessary to train the dog to work in as many different terrains as possible.

More recently, senior investigating officers have tended to operate a multidisciplinary approach when searching for human remains. Other disciplines can include geophysics, foot search personnel, forensic archaeologists and forensic anthropologists (Hunter, Simpson, & Sturdy Colls, 2013). It is important that the use of the dog complements these other techniques rather than hinders them. To this end, the use of probe lines helps to coordinate the searches made by the dog and other techniques when searching for buried human remains. The correct use of the lines means that the area can be searched in its entirety and the results of different techniques overlaid. This is particularly useful when geophysical methods are employed since these also operate in a line pattern (Cheetham, 2005).

Most large search areas are divided into 20 m square grids. When searching, the probe lines are commonly placed one metre apart. This is an easy distance for the dog and handler to walk



Fig. 19.6 Plan of search area (Copyright and edited with permission of ICLVR)

between the lines, although this distance can be shortened when searching for small or very old targets. Probe holes can then be placed along the length of the probe line. Again the distance between the holes can vary depending on the target. In the case of a grid being searched with lines at one metre spaces and holes at 0.5 m intervals, this results in 800 probe holes per grid (861 if searching an isolated grid because of the '0' lines). In effect, this is 800 searches for the dog per grid. In good terrain a team can search 3 grids per day (roughly the size of half a football pitch) meaning the dog searches 2400 probe holes per day. It is vitally important that the dog searches the last probe hole of the day to the same extent as the first, so mental as well as physical stamina is vital when choosing the correct dog to train.

Figure 19.6 details a typical search area. Each grid is 20 m square, and areas of high priority have been outlined by the investigative team.

A well-trained dog will not be fazed by the scent of other persons in the search area, as it will only focus on the scent of decomposition (Fig. 19.7).

19.3.2 The 'Scent of Death'

The issue of the 'scent of death' is one that must be addressed. This terminology came to the fore in the search for Madeline McCann in Portugal in 2007 (Daily Mail Newspaper, 2007, September 26).

There the investigators focused on the 'scent of death' as indicated by the search dog, even though forensic examinations for tangible evidence on the articles allegedly possessing this scent proved negative.

There is no doubt that a 'scent of death' or residual scent can exist in some circumstances, but to what extent and how long after the article was in contact with the deceased is a matter of conjecture. I have experienced one similar indication by my dog. The dog gave a clear indication in the study of a large house and in the rear of one of the family cars. Forensic examinations of the room and car proved negative, but the offender later admitted that he had strangled his wife, kept her body in the study overnight, and then moved it in the family car the following morning (R v Gillford-Hull, 2006). Although the date of my search was 5 days after the offence, I have serious doubts that the scent would remain much longer.

In the case above, the investigation team was fortunate that the offender admitted the offence in full. It is an unwritten rule that the evidence of a dog will not be accepted at court unless corroborated by other evidence (the perpetrator's confession). Therefore, whilst it is important to recognize this 'phenomenon', due emphasis should be placed on its importance. Overemphasis on such indications by a dog can lead the investigation to go down blind alleys, thus wasting valuable time and resources.

19.4 Crime Scene Detection Dogs

Crime scene detection dogs are normally trained to detect blood and semen (Ensminger, 2011). These dogs are normally used to search large areas to establish the scene of the crime, but they can also be used to 'sweep' a known site after traditional searches by crime scene investigators (Stejskal, 2013). Their use may be appropriate in cases where the victim is presumed to be alive and for those where they are presumed deceased.

Because the targets in these searches are often minuscule and vitally important to the investigation of the crime, it is essential that the dog does not

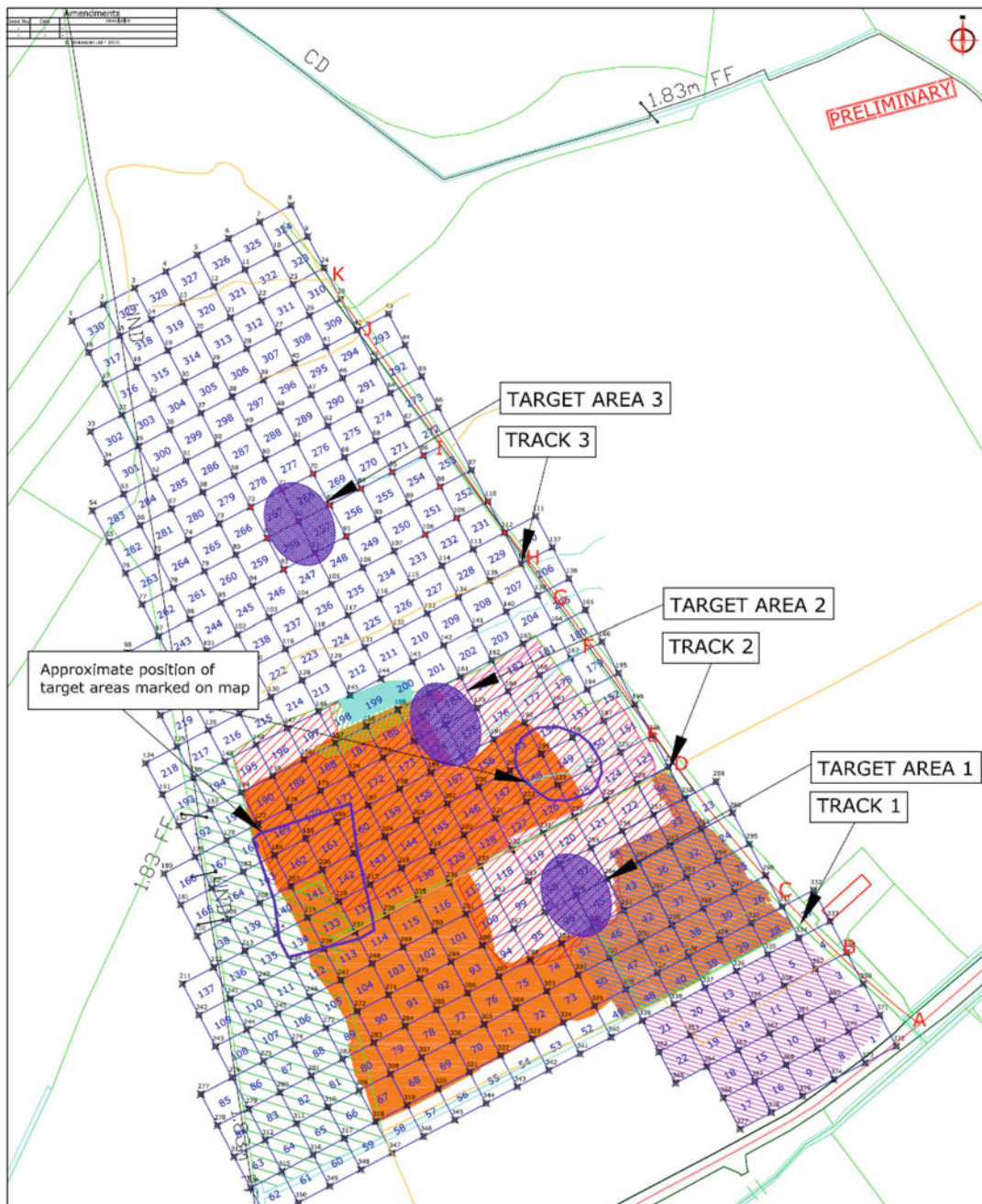


Fig. 19.7 Dog working a probe line (Copyright: Mick Swindells)

destroy the evidence during its indication. To this end the dog is trained to ‘freeze’ on the target and not to come into contact with it. This is achieved by rewarding the dog with a ball on a correct find. Some handlers also prefer to combine

the reward with a ‘clicker’ to reinforce the indication.

Unlike cadaver detection, the target scents are normally on the surface or near surface. Therefore, it is important that a dog with a good



Fig. 19.8 Pie chart showing success rate of blood searches (Copyright: Rodrigues, 2009)

methodical search temperament is chosen for the task. A well-conducted search can be likened to searching a minefield; the dog must search the area in front of it before progressing further. If this is not achieved, it is possible that the dog will inadvertently come into contact with the target scent and either destroy or move it.

In 2008, I took part in a series of experiments at Bradford University to determine the quantity of blood and putrefied body fluids capable of being detected by a trained dog. The experiments also looked at the consistency of the dog's detection based on the quantity of the sample, age of the sample and the medium the sample contaminated (Rodrigues, 2009). Distraction scents, coffee and coke (the drink) were used for their protein and sugar content. These distractions were chosen by the author of the study based on their chemical composition similarity to blood and other body fluids. As can be seen from the graph below (Fig. 19.8), the dog displayed a high percentage of successful finds (84%). The quantity of the samples ranged from 0.25 ml down to 0.001 ml of fluid on absorbent and nonabsorbent mediums and conducted in interior and exterior environments (Fig. 19.9).

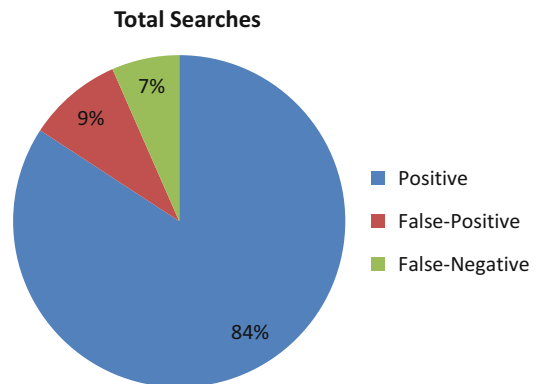


Fig. 19.9 Dog and handler performing experimental exterior search (Copyright: Mick Swindells)

Graph 13 Team 2 Total searches: blood and putrefactive fluids; bricks and laces; quantities: 0.25 ml, 0.5 ml, 0.005 ml and 0.001 ml; interior and exterior environment

In many cases the offender will have tried to clean the area of the crime to avoid detection. Therefore, a successful dog will have been trained to detect diluted quantities of the target. This dilution does not involve the use of detergents or other cleaning fluids. If we were

to use detergents in training, there is the danger that we are training the dog to detect the detergent and not the blood, and, as these cleaning fluids will not be standardized (type and quantity) amongst the criminal fraternity, it makes their inclusion pointless. Therefore, a dilution of a ratio of 1:200 water is a normal training requirement.

An example of the operational usefulness of a crime scene detection dog can be seen in the following case:

Late one night in a north of England town, a woman was seriously assaulted in the front passenger seat of a car. The car was parked in a rear alleyway. The woman managed to escape her attacker and ran off. Not knowing her whereabouts, she ran for several minutes before she was able to summon help.

At 11 am the following morning, a CSI detection dog was called to the scene. An area of approximately 1 km of alleyways had previously been searched by crime scene investigators searching for evidence, to no avail. The dog commenced the search, and, after a distance of approximately 500 m, it alerted on a drop of blood and human hair (Fig. 19.10).

Because of the position of the finds in relation to the alleyway, the direction the car was facing was determined. An examination of CCTV cameras revealed the cars registration number, and the offender was arrested 200 miles away.

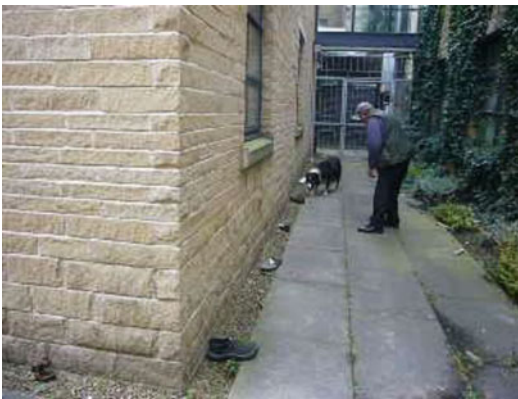


Fig. 19.10 Human hair and blood at a crime scene (Copyright: M Swindells)

19.5 Submerged Body Detection Dogs

Although not common in the UK, submerged body detection dogs are specially trained to detect bodies submerged in water (Osterkamp, 2011). The benefits of a properly trained dog to detect bodies under the surface cannot be underestimated.

Such dogs are trained to ride on the front of a small boat and to sniff the water surface (Fig. 19.11). What the dogs actually detect is still a matter of conjecture, however suffice to say that they can detect bodies up to 10 m below the surface. These dogs have the ability to search large areas of water quickly, thus reducing the time for body recovery and preserving evidence.

This type of searching is totally unique as it involves the scent travelling through two mediums, water and air. When performing searches, consideration has to be given to the direction of the water current and wind direction. As a result some searches are best performed from the bank of the water. Whilst this discipline works well in fresh water—lakes or rivers—it is not so effective in salt water. This is because of the density of the saline water.

An example of the operational usefulness of a submerged body detection dog can be seen in the following case:

In Malaysia, a landslide hit a small village resulting in one man being swept into a swollen river. Because of the ferocity of the river current, the body of the victim was carried several kilometres. Officers from the Malaysian Fire and Rescue



Fig. 19.11 Submerged body detection dog training in Malaysia (Copyright: Mick Swindells)

Fig. 19.12 Body being recovered from a river
(Copyright: Mick Swindells)



Service, who handle the search dogs, attended the river some days afterwards and commenced a search approximately 10 km downstream from the village. On the second day of searching the dogs alerted to a scent in the river. Subsequently the body of the victim was recovered 5 m from the dog's indication (Fig. 19.12). In this instance the quick recovery of the victim was essential to provide 'closure' for the family and to allow a religious burial. In criminal cases the timely recovery of a body concealed in water would vastly assist investigators in recovering vital evidence and identifying the offender.

19.6 Field Crafts

All good dog handlers will have received some training in field crafts. I have defined field crafts as the *ability to detect an unnatural change in the natural environment*. Whilst this definition sounds very 'rural', it can be used in any environment, indoors and outdoors.

The practitioner's ability to use field crafts is of vital importance in any search scenario. The use of field crafts has been discussed in numerous other publications (Hunter et al., 2013; Hunter & Roberts, 1996; Killam, 2004), but whilst these tend to only reference buried remains, the same

principles can be used in surface depositions and crime scene detection.

In 1997, I was involved in the search for a missing 5-year-old girl Rosie McCann thought to have been abducted by her mother's boyfriend, Andrew Pountley. Pountley was arrested within hours of the girl's disappearance, and a search of his house revealed a blanket contaminated with several items. These included brick dust, industrial plant fertilizer, the leaf off a Chinese pot plant and ornamental stone chippings. It was thought that the child was murdered in his house shortly after her abduction. The investigation was being conducted by a neighbouring police force, and I was tasked some 7 weeks after the disappearance to search a local park. The senior investigating officers' (SIO) rationale for me searching the park was that two of the items mentioned above, brick dust and fertilizer, were found in the park. The park however was approximately 3 km from Pountley's home and he did have access to a vehicle.

My initial thoughts were that the park did not hold the answer to locating the child's body. Apart from the fact Pountley did not have vehicular capability to remove the body and the fact that important items such as the ornamental stone and the leaf were not present in the park were to me of vital importance. Managers of public parks are very conscientious about the items they purchase

for the park, and this tended to make me think the items can come from another location. One and a half days of searching with my dog reinforced my beliefs when nothing was found.

As a result of this, I again attended the incident room, and a further view of the town's map revealed the presence of a disused railway line close to Pountley's home (within 400 m). In addition I was able to find out that this railway line had recently been landscaped and was now a public footpath. More importantly, Pountley could access this area from his home without crossing any major roads.

On the second day of searching this railway line, I was conducting a field craft search, without my dog. I would always advocate conducting field craft searches without other distractions such as dogs or mobile phones. During this search, I came across an area where once a building had stood. The area had been subject to some 'fly-tipping'. In one corner of the area, an old door had been propped horizontally against a wall; behind the door was a large sports holdall, in very good condition. This holdall was out of context with the other items in the area; it was 'unnatural in the natural environment' and contained the body of Rosie. A subsequent search of

the area revealed the other items found on the blanket, having been tipped in the area by local residents. Pountley was subsequently convicted of the rape and murder of the child and given two life sentences (R v Pountley, 1997).

Prior to my involvement, 100 police officers had searched for 7 weeks in an attempt to locate the body. Had field crafts been employed there would have been a substantial saving in time and expense.

Another basic example of field craft is to look at the carpet when you move the furniture to clean. Invariably the carpet will have indentations caused by the feet of the chair. When the carpet was first purchased, these indentations did not exist so they are an 'unnatural change in the natural environment'. Similar marks, or lack of, can indicate a change in the environment, which may be significant during a search.

Most surface signs are more subtle. These can involve flourishing or stressed vegetation, substrata on the surface, spoil, mounds or depressions and change in the water table; in fact the list is endless. Figure 19.13 shows the effects of two pig burials on the vegetation in an arid environment (Colorado, USA). The graves are distinguishable

Fig. 19.13 The effects of buried pigs on the vegetation (Copyright: Mick Swindells)



Fig. 19.14 The effect of a mass grave on the vegetation (Copyright: Mick Swindells)



by the yellow flowers, which can only be found above the graves.

Figure 19.14 shows a similar effect on the vegetation above a mass grave in Bosnia. The photograph was taken in 1998 approximately 5 years after the burials.

Further information about field craft during search can be found in Chap. 18.

19.7 Considerations

The definitive book on dog handling has not, and will not ever be written as every dog and handler have different traits.

As I have tried to portray, dogs can be a useful tool in the search for concealed human remains and/or evidence associated with the crime. A well-trained dog will be capable of locating evidence without compromising its integrity. In some instances the dog can locate evidence incapable of being detected by humans, e.g. residual scent or minute quantities of blood.

It must be remembered however that most dog handlers have a tendency to overestimate the capabilities of their dog. This is natural as they have put time, effort and money into training the animal. However, the ‘professional’ handler will always be able to show a dog’s training record book. This book should be

viewed by any agency wishing to employ the services of a dog team.

It should also be remembered that dogs, like people, have good and bad days. A competent handler will not be afraid of declaring his/her dog unfit for work, whilst a bad handler will continue to ‘flog the dead horse’. Invariably a dog which is not working to its full potential will distract the investigation away from the true course in the same way as a ‘false positive’ would.

At the start of this chapter, I outlined the fact that the best thing about using a dog as a search tool is its ability to think. This is true for a well-trained dog, who will often work tirelessly to solve a problem. Unfortunately dogs which have not received the correct training can also give a solution to the problem by giving a false indication to end the search. The training of dogs is very subjective and can almost be likened to an art form. In addition the purpose of the dogs training can differ. Some agencies require a dog to locate live people, whereas others only want a dog to locate buried remains and not blood. The use of dogs in an investigation can also be determined by the SIO’s willingness to employ them. Some SIOs are fans, whilst others treat them with skepticism. The only way this skepticism will be overcome is by handlers being totally open about their and their dog’s abilities.

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Stefano Vanin

20.1 Introduction

Insects (Insecta) represent the most abundant taxonomical group among living animals. Several hypotheses have been suggested about the real number of species of this taxon,¹ and the majority of them fix the number in millions of species (Zhang, 2011). This number is enormous compared with the small number of vertebrate species described (around 60,000),² and the number of new species described every year counts only a few vertebrates compared to thousands of insects. This huge diversity in the number of species is the cause and the result of the colonization carried out by the insects of all the subaerial environments. In addition, it is worth mentioning that some species have also been able to colonize the floating algae in the oceans and some species became ecto- and endoparasites or parasitoids of other living organisms, human included.

Insect radiation and spread is due to (1) the presence of an exoskeleton that protects the insects from the external mechanical stresses and helps to prevent the loss of water, (2) the presence of two pairs of wings that allow insects to spread very far from their place of birth, and (3) the physiology and the high fertility of insect species.

Insects, colonizing all the ecological niches, are able to use a large spectrum of resources as food. Depending on their diet, insects (like other animals) can be defined as phytophagous (species that use plant as food source), carnivorous (insects that feed on other animals), or omnivorous (species without a specific food preferences). Saprophagous and scatophagous or coprophagous species, that use decomposed organic matter or excrements as pabulum, play a fundamental ecological role in the recycling of the nutrients. The species able to colonize a body after the death belong to the saprophagous group.

After the arrival of the first colonizers on the cadaver/carrion, predator and parasitoid species (carnivorous) can attack the first carrion feeders, creating a complex food web on the body and in the surrounding area. The most important taxa that colonize a body after death belong to the Diptera (flies) and Coleoptera (beetles) orders, while members of the Hymenoptera order (wasps, ants, etc.) appear on the body mainly as predators or parasitoids of other species. Moths (Lepidoptera) can colonize bodies in the skeletonization phase.

¹Taxon (plural=taxa) indicates every taxonomical group (e.g., species, genus, family, order, phylum, etc.).

²Vertebrates include mammals, birds, reptiles, amphibians, and fishes.

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In this chapter, the entomological approach is presented in order to underline the potential of this discipline in missing persons investigations.

20.2 Colonization of a Corpse

The colonization process of a dead body by insects and other arthropods (e.g., mites) follows a general predictable order with differences depending on the geographical areas, cadaver location, and seasons (Campobasso et al., 2001). The general pattern of colonization, first described by Megnin in 1887 and further investigated by several other authors (e.g., Payne, 1965; Wyss & Cherix, 2006), can be summarized in a series of waves. The first wave of colonization consists of Diptera, mainly Calliphoridae (*Calliphora* spp., *Lucilia* spp., *Phormia regina*, *Protophormia terraenovae*, *Chrysomya* spp.), Muscidae (*Musca* spp., *Muscina* spp.), and Sarcophagidae (*Sarcophaga* spp.), which are able to colonize the fresh tissues. During active decomposition (butyric, caseic, and ammoniacal fermentation), species of flies belonging to different families colonize the body: Fanniidae (*Fannia* spp.), Piophilidae (*Piophilidae casei*, *Stearibia nigriceps*), Phoridae (*Megaselia* spp., *Conicera* spp., *Diplonevra* spp.), Syrphidae (*Syrpita pipiens*, *Eristalis* spp.), and Stratiomyidae (*Hermetia illucens*, *Sargus bicolor*). Some beetles in the families Cleridae (*Necrobia* spp.), Nitidulidae (*Nitidula* spp., *Omosita* spp.), Dermestidae (*Dermestes* spp.), and Histeridae (*Hister* spp., *Saprinus* spp.) also colonize. During advance decay and the skeletonization phase, species of the previous order and families colonize remains along with beetles in the family Tenebrionidae (*Tenebrio molitor*), clothes moths in the families Pyralidae and Tineidae (*Tineola bisselliella*), and mites (Acari).

As previously reported, this list of species can present some differences depending on environmental and geographical factors. Accessibility of a body can play an important role in the body decomposition and insect colonization/succession. Campobasso et al. (2001) reported a general series of factors that can affect the general pattern

of decomposition and colonization of a body, whereas Reibe and Madea (2010a, 2010b) and Bugelli et al. (2015) pointed the attention to some factors affecting the colonization of a body in indoor conditions.

Temperature can be considered the most important factor both in the colonization process and in the insect development rate that is used to evaluate the age of the insects collected from the body or the crime scene. As a result, temperature affects the estimation of the minimum time since death (=colonization time). Forensic entomology, as a discipline, is mainly known for its utility for the estimation of the postmortem interval (PMI), the determination of the season of death (in old and cold cases), and the identification of body transfer that may have occurred after death. By definition, forensic entomology is the application of the knowledge about insects in any judicial matter³ or investigative process (Amendt et al., 2007; Amendt, Krettek, & Zehner, 2004; Smith, 1986). In the past, the main questions, to which the entomological approach has given answers, were “when?” and “where?”

In the last decades, the development of DNA techniques and methodologies and the increase in the knowledge about entomotoxicology have opened the doors to further applications of the entomological approach in the forensic field with an important application in the identification of human remains. The result is that the entomological approach can nowadays also make an important contribution to answer at the questions “who,” “how,” and “what.”

20.3 The Insect's Developmental Cycle

Before analyzing how insects can play an important role in human identification process, it is worth discussing some aspects of insect development and activity. The insects involved in carrion/cadaver decomposition (Diptera and Coleoptera) have a holometabolous development

³In this chapter, only forensic entomology of medicolegal interest is considered.

Fig. 20.1 Pupae of *Phormia regina* among the fibers of the blanket covering a cadaver (Copyright: S. Vanin)



composed of four stages: egg, larva, pupa, and adults. Adults are responsible for the reproduction and dispersion of the species (only adults have wings and developed reproductive organs).

The embryogenesis of the insects happens in the egg. In the larval stage, there is the growth of the organism that terminates with the pupal phase when the metamorphosis of the organism allows the rearrangement of the tissues and the final emergence of the adult that, after mating, will lay eggs and the cycle previously described is continued. This general scheme shows some differences between flies and beetles. The most important difference between flies and beetles worthy of being mentioned for the purposes of this chapter is the formation of the pupa, with the pupariation process occurring only on flies. The beetle pupae in fact are not wrapped into the pupal cage like in the Diptera Schizophora (e.g., Calliphoridae), where the skin of the third instar larva becomes a resistant barrel, called puparium, in which the metamorphosis happens after a sclerotization⁴ process.

After the adult emergence, the puparium remains at the crime scene or on the body, depending where the pupation happened. In the majority

of species, the larvae move away from the body to pupate in order to find a more favorable environment: dry, protected, lower bacterial charge, and lower risk of predation. However, some species, also belonging to the Calliphoridae, e.g., *Phormia regina*, *Protophormia terraenovae* (Calliphoridae), *Hydrotaea* spp. (Muscidae), and *Megaselia scalaris* (Phoridae), pupate on the cadaver especially among the clothes (Figs. 20.1 and 20.2).

Puparia that after the emergence remain on the body or on the crime scene can be collected after decades, centuries, or even thousands of years after the adult emergence. Examples of these findings are reported in the literature concerning mummies, both natural and anthropogenic (Couri, et al., 2008; Huchet, 1996, 2010; Huchet et al., 2013; Huchet & Greenberg, 2010) (Fig. 20.3).

The chitin, the main component of the insect skin, is very stable and resistant to degradation. Fragments of puparia of *Protophormia terraenovae* have been found with fragment of beetles in good condition from late-glacial woolly mammoth carcasses (*Mammuthus primigenius*) (Lister, 2009). It is worth mentioning that insects use the cuticle as a sort of storage compartment for toxic or catabolites. These molecules are fixed among the cuticular structures and can persist for long time. Pupal cages being composed by the last skin of the larva can also preserve catabolites and drugs from the flesh ingested by the larva

⁴Sclerotization is a biochemical process that involves the creation of cross-linkings between adjacent proteins of the cuticle. This process results in the darkening and stiffening of the cuticle.

Fig. 20.2 Empty puparia of Muscidae (*Hydrotaea capensis*) on the clothes of a skeletonized body found several years after the death (Copyright: S. Vanin)



Fig. 20.3 Empty puparia of Muscidae (*Hydrotaea capensis*) and Calliphoridae (*Calliphora vicina*) on a 500-year-old natural mummy. The specimens are perfectly preserved (Copyright: S. Vanin)



during the last instars where, in the majority of the carrion feeder species, the majority of food is ingested.

20.4 Insect's Seasonality

The activity of insects depends on environmental factors, with temperature, day length (photoperiod), and humidity playing the most important role for some species. Because of the differences in temperature and photoperiod during the year, which are particularly evident in the subtropical, temperate, and subpolar regions, insects show specific seasonalities (phenologies) in their activity. As well, saprophagous species, attracted by bodies and carrions, follow this rule. Some species are active only in the colder seasons other in the warmer. Flesh flies (Sarcophagidae) and

Lucilia sericata among the bottle flies (Calliphoridae) are examples of summer body colonizers in contrast to the species of the genus *Calliphora* that are active during the spring and autumn (Bugelli et al., 2015; Vanin et al., 2008; Vanin, Gherardi, Bugelli, & Di Paolo, 2011). In North England, *Protophormia terraenovae*, for example, is mainly active at the end of the spring and beginning of the summer (Vanin unpublished data), whereas in Southern Europe, *Chrysomya albiceps* is mainly an end of summer/autumn species (Fig. 20.4). In the last few years, the rapid increase of the temperature (so-called global warming) is having an important impact both on the distribution and seasonality of insects. Species with southern distribution are moving to northern regions, whereas other species are shifting their temporal appearance (Turchetto & Vanin, 2004, 2010).

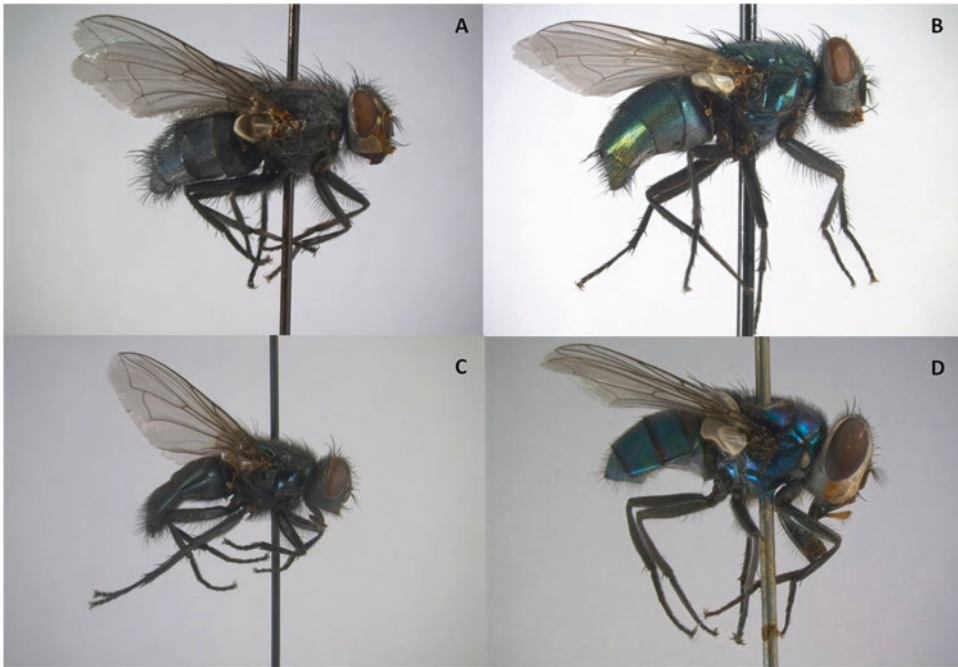


Fig. 20.4 Adult flies of the Calliphoridae family: (a) *Calliphora vicina*, (b) *Lucilia sericata*, (c) *Protophormia terraenovae*, (d) *Chrysomya albiceps* (Copyright: S. Vanin)

20.5 PMI or Season of Death Estimation and Human Identification

When human remains are discovered, the estimation of the time since death and/or the estimation of the season of death, especially in old cases, can play a fundamental role in determining both the identity of the deceased and possible routes for investigation of the case.

The study of the insects that have developed on a cadaver allows the estimation of the time of colonization that corresponds to the minimum postmortem interval (mPMI). This estimation can be done using two different approaches depending on the time since death: in the case of long time (weeks/months), the waves of colonization approach, previously described, are used, whereas, in the case of shorter period, the estimation of the age of the insects belonging to the first waves of colonization allows a more precise estimation. The age of the insects can be estimated because it

is species specific and temperature dependent. If the species collected from the cadaver or from the scene have been correctly identified and the temperature before the body discovery is known, the estimation can be done using specific developmental tables or plots (isomegalen and isomorphen diagram) or an ADD-/ADH-based approach (Amendt et al., 2007). The accuracy and precision of the mPMI estimation depend on the goodness of the temperature reconstruction, on the correct species identification, and on the availability of developmental date at regional scale. The temperature reconstruction is based on the collection of data from the closest and most similar (same altitude and exposure) meteorological station to the crime scene and the comparison with temperature recorded for at least 3–5 days on the crime scene using calibrated data logger (Amendt et al., 2007). On the other hand, the correct species identification can be based both on the analysis of morphological characters and on the DNA sequencing. The most commonly used gene for the identification of species of forensic interest has been

COI although several other genes can be used (*cytb*, *COII*, *period*, etc.) (Wells & Stevens, 2008).

Estimations based on insect analysis can be used to shorten the missing people lists. Several countries have missing persons databases with the indication of the “last seen alive time,” so the entomological estimation can drive the research to a smaller sample of individuals. This approach has been used in a project related to the identification of WWI soldiers. The remains of a young Italian soldier were found under a few centimeters of soil in the Prealps, in one of the most important battle areas of the Strafexpedition also known as Frühjahrsoffensive or Südtiroloffensive (1918). However, historical military reports indicated that battles were fought in this area from the spring of 1916. The anthropological analyses of the skeletonized remains revealed that death was caused by the perforation of the skull by a grenade fragment. Several puparia, in a hyphae matrix,⁵ were found in the ammunition pouches of the soldier among the unused bullets. All the puparia were open indicating the emergence of the adults: no adult fly fragments were found on the remains, inside the ammunition pouches or in the excavated soil. The entomological samples were identified as belonging to *Protophormia terraenovae*, *Phormia regina* (Calliphoridae), and *Fannia canicularis* (Fanniidae). The analysis of the species phenology and ability to colonize a body exposed or covered by soil allowed the following conclusions: (1) the colonization occurred at the end of the spring, and (2) the body remains exposed for a long time, allowing the flies to emerge (evidence of an Italian army retreat instead of a successful attack). These observations, along with the analysis of the grenade fragments and other historical information, were important to focus the further investigations and identify the remains (Vaninet al., 2010).

20.6 DNA Extraction for Human Identification

When people refer to “forensic entomology without a body” in the majority of the cases, they are considering the “stored product” or the “urban entomology.”⁶ These two branches of “forensic entomology” do not concern the study of human remains but food or building pests, like mealworms, cockroaches, bed bugs, and other arthropods. However, the development of the molecular techniques for human identification that started with DNA has opened new perspectives in forensic entomology. In the case of crime scene “without the body” that can have been moved by the perpetrators of the crime before the arrival of the police, the presence of immature stages of carrion-breeding species can allow the recovery of the victim’s DNA and give an estimation of when the body was removed. During the feeding process, larvae initially store the food into the crop sac of the foregut. The analysis of the size of this region of the digestive tube allows an estimation of the time since the last larval meal. After 72 h, the crop sac is completely empty, whereas at 24 and 48 h, some food is still detectable in this organ. The isolation of the crop sac allows the extraction of human DNA belonging to the cadaver (or cadavers) on which the larva may have fed (Campobasso et al., 2005; Li et al., 2011; Linville et al., 2004; Wells & Stevens, 2008).

Recent advances in DNA technology have even recently allowed the characterization of human DNA from empty puparia. In the protocol used for this extraction, puparia were cleaned initially with a swab moistened with sterile distilled water. A second dry swab was then used to remove traces of water and external contamination. The authors of this work suggested that the origin of victim’s DNA can be from the internal surfaces or within the cuticular material, but they

⁵Fungi develop in long filaments called hyphae that when branching in mass can create a cotton-like structure called mycelium.

⁶“Stored product forensic entomology” deals with the contamination of food and other human goods by insects. “Urban forensic entomology” concerns the presence of insects in buildings and other environments used by people.

exclude an external contamination (Marchetti et al., 2013). This point is particularly important to exclude any external contribution to the human DNA extracted from the puparium and so doing it increase the level of reliability of this protocol. If some studies have been carried out in order to understand for how long the DNA for species identification can be extracted from puparia (Mazzanti et al., 2010), this information is not yet available for the human DNA from puparia. Further research will contribute in answering this question. It is also important to mention that human DNA has been successfully extracted and characterized from the gut of blood-feeder insects and other arthropods like lice, fleas, and ticks (Kreife & Kempfer, 1999; Mukabana et al., 2002; Mumcuoglu et al., 2004).

20.7 Toxicological Information from Insect

Knowledge about the toxicological condition of a cadaver can identify if death occurred due to natural causes or because of an intentional act (suicide or homicide) and represents additional information that can be used in the identification process. The finding of cocaine traces in the remains of a potential cocaine addicted will support other evidences (biological profile, circumstantial evidence, etc.) in the identification process.

As previously discussed in the human DNA paragraph, drugs and metabolites can be detected from an insect that has fed on the cadaver. Drug extraction from larvae is a routine practice in several toxicology laboratories, and drug extraction follows the procedures commonly used for human tissues. The use of insects (and their remains) can be particularly important when tissues are no longer present on the remains and can allow determination of the drugs that were present in the body at the time of death, particularly those that have undergone distribution to the muscles and other soft tissues. In a case reported by Bugelli et al. (2015), toxicological analyses were performed on the liver, kidney, gastric contents, and larvae collected from the cadaver of a 36-year-old woman revealing the presence of

cocaine, methamphetamine, and tricyclic antidepressants on all the samples. Barbiturates were detected only from the gastric content. All the substances were detected from the larvae, except barbiturates (as would be expected from the tissue/stomach content results) with a maximum concentration ratio (tissue vs. larvae) for cocaine and a minimum for tricyclic antidepressants. This result is consistent with the localization of the larvae on the body that mainly feed on the oral and nose mucosae. Cocaine is usually taken by oral or nasal consumption and can remain attached to the mucosae. In contrast, tricyclic antidepressants are mainly absorbed at the gastrointestinal level. In a case of homicide-suicide, the toxicological analyses performed on the larvae collected from two children were positive for diazepam and its metabolites (nordiazepam and oxazepam), whereas the analyses performed on the samples from their mother were negative, confirming the analyses performed on the burned tissues of the victims and the CCTV records (Stefanelli et al., 2015).

Drugs can be detected not only from larvae but also from other insect states or from insect excrements. In 1994, Miller and colleagues performed toxicological analyses on empty fly puparia, beetle fecal material, and cast beetle skins collected from the mummified remains of a middle-aged white female. The body was mummified with some loss of tissues and considerable insect activity including a combination of mummified integument, adipocere, and filamentous insect frass. Numerous prescription vials, most of which were empty, were found near the remains. Empty fly puparia, beetle fecal material, and cast beetle skins were analyzed for both amitriptyline and nortriptyline. The results showed that amitriptyline concentrations were greater in puparia than in exuviae or beetle fecal material (Fig. 20.5). This may be explained by the food source preferences as skin beetles (*Dermestidae*) feed primarily on dried integument, whereas scuttle flies (*Phoridae*) have a preference for soft tissues where acute drug concentrations are likely to be higher. In this case, the authors suggested that, for the drugs to be released when working with puparia, the protein/chitin matrix needs to

Fig. 20.5 Dermestidae frass and exuviae on a partially mummified thorax (Copyright: S. Vanin)



be broke down, which requires strong acids or bases to be used for the breakdown of the matrix (Miller et al., 1994).

20.8 Conclusion

Despite being underestimated in the human identification process, insects can provide useful information to reconstruct ante-, peri-, and post-mortem events. In so doing, they represent important elements for victim identification. In addition to indirect information (e.g., mPMI, season of death estimation, body transfer, etc.), insects can provide DNA and toxicological information of the victim. This aspect is particularly important when the body has been removed before the arrival of the police. The analysis of insects from the crime scene is becoming more and more popular, but further research is needed in order to understand the complete potential of the insects in human identification and to take advantage of the entomological approach. However, only teamwork, based on a continuous and close interaction between all the specialists involved in the criminal investigation, is the winning strategy for better understanding and reconstructing criminal events and identifying missing persons.

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Forensic Palynology and Environmental Profiling in Missing Persons Investigations

21

Tony Brown

21.1 Introduction

Forensic palynology is one of the most commonly used environmental techniques in forensic science and has frequently been used in missing persons investigations (Brown, 2000; Brown, Smith, & Elmhurst, 2002; Ruffell & McKinley, 2008). This chapter reviews the history, use and recent advances in forensic palynology and related environmental forensic techniques. The emphasis of this review is on forensic palynology, which is taken here to include the use of pollen and fungal and algal spores (collectively also known as palynomorphs) in criminal cases, particularly murder or missing persons cases where foul play is believed to have taken place and some forensic material is available. Reference will also be made to other related environmental materials such as plant remains (macro-remains), soils and sediments. The chapter commences with a brief history of forensic palynology and the scientific basis of the technique with an emphasis on environmental profiling and sample matching using vehicles, clothes and shoes. Then the two case studies will be described, one from an historic double missing persons and homicide

case and the other a more recent missing persons/homicide case, both from the UK. Finally, recent and future developments are discussed. One of the purposes of writing this chapter is to overcome the relative lack of academic literature in this subdiscipline, which is largely caused by the confidential nature of most investigations.

21.2 A Brief History of Forensic Palynology

The ‘discovery’ that pollen and spores were preserved in rocks, sediments and soils by Scandinavian geologists in the late nineteenth century started the scientific field of palynology. Lennart von Post (1884–1951) published the first modern pollen diagram c. 1916 from his work on southern Swedish mires with the aim of elucidating climate change in the recent past. Several early palynologists realised that pollen and spores might be used in criminal cases, and particularly Gunner von Erdtman. However, the first documented use appears to be two cases in 1959. In one case in Sweden, soil washed from the clothing on a murdered woman was sent to a palynologist at the University of Sweden to examine. This was compared with control samples collected from areas near the body, but these control samples did not match pollen on the clothing of the victim and this indicated to the police the victim was killed at another location (Bryant Pers. comm.). The more

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famous case is that of a passenger who disappeared from a boat cruise along the Danube. A suspect's cabin was searched and muddy walking boots found. These were sent to Dr Wilhelm Klaus at the University of Vienna. Mud on one boot contained common riverbank types (alder and willow) but also a Miocene-age pollen grain of hickory (*Carya*). From knowledge of the Tertiary outcrops along the river and control samples taken along boat's route, Klaus was able to identify only one location where a Miocene outcrop was exposed with the same assemblage of pollen grains. The suspect was taken to this location, was so shocked he admitted to the murder and showed police the shallow grave where the body was buried.

As we will see later, this early use is prophetic in that it involves not only a missing person case but also modern and geological pollen from a unique location. In the UK, the use of forensic palynology increased during the early 1990s due to work by Pat Wiltshire for various police forces, early work by the author (also in the early 1990s) and also the appointment of several scientific co-ordinators to police forces who had a background in scientific archaeology. This uptake continued as forensic science and forensic archaeology courses included environmental and geoforensic techniques in the curriculum. The use of forensic palynology in the USA has been highly variable State to State (Bryant, Jones, & Mildenhall, 1990; Stanley, 1991; Milne, Bryant, & Mildenhall, 2005; Bryant & Jones, 2006) as it has been within mainland Europe. The country with the highest uptake, to the point of routine use, in the 1980s and 1990s was New Zealand due largely to the work of Mildenhall (1990) and Horrocks and Walsh (1998).

Although this review will concentrate on the use of forensic palynology for missing persons searches and serious criminal cases, forensic palynology has a wide variety of uses including some highly specialised applications (Table 21.1). Table 21.1 also lists a number of archaeological and anthropological studies that have used palynology in a forensic manner. It should be noted that a number of these examples have now been questioned or even disproved and this constitutes a warning to scientists about the more indirect use of the technique where several assumptions are involved.

Table 21.1 Uses of forensic palynology and forensic palynological archaeology (Copyright: Author's own image)

Subject of the investigation	Reference/source
Missing persons, body location and scene matching from samples on suspects' shoes, clothes, etc.	Rawlins et al. (2006); references in this chapter
Vehicle history in criminal cases	Brown et al. (2002)
Season of death of mass grave victims on the Eastern Front and turbinates pollen content	Sziber, Schubert, Schoning, Krause, and Wendt (1998); Wiltshire & Black, 2006
Illegal badger digging (RSPB)	Author (unpub.)
Wildlife crime	Morgan and Bull (2007); Ruffell and McKinley (2008)
Origin determination in illicit drugs (e.g. cannabis resin, cocaine)	Milne et al. (2005); Bryant and Jones (2009)
Document forgery through pollen content of the ink (Frei, 1960s)	Bertino (2010)
Theft of plants from a nursery	Author (unpub.)
Fraud and purity determination of honey (melissinopalynology)	Bryant (2000), Bryant and Jones (2001), Petersen and Bryant (2011)
Indecent behaviour	Ruffell and McKinley (2008)
Archaeological 'forensic' studies	
Origin of the Turin Shroud work by Max Frei (now disputed)	Bryant (2000)
Ötzi (the Ice Man) murdered in the Alps 3300 BC (spring)—last meal and time of death evidence	Rollo Ubaldi, Ermini and Marota (2002)
Roman vineyards in Midland England?	Brown, Meadows, Turner and Mattingley (2001)
Flowers at the Shanidar Neanderthal grave (very important debate on relationship between <i>Homo sapiens</i> and <i>H. neanderthalensis</i>) now disputed	Solecki (1975) but see Sommer (1999)

21.3 Why Forensic Palynology Works

Forensic palynology works for three main reasons: the robustness of pollen and spores, the easy transfer of pollen from the environment onto items of forensic interest (body, clothes etc.) and the local bias of palynological signatures (Wiltshire, 2006). Most, but not all, pollen and spores are highly resistant to destruction due to the fact that the cell

wall that contains the genetic material is made of two or three layers of an extremely resistant natural polymer called sporopollenin (Brooks & Shaw, 1978). This polymer, which is chemically similar to polypropylene, is resistant to most acids and some alkalis (Traverse, 1988). The result is that pollen can be extracted from some rocks back to the dawn of flowering plants. However, most pollen is eventually destroyed by bacteria, physical abrasion and/or oxidation. This is the reason that in nearly all biologically active soils the pollen is preserved within the top 2 cm representing the last few years, although this varies with both soil type and pollen type (Havinga, 1984; Moore, Webb, & Collinson, 1991; Horrocks & Walsh, 1999). There are many ways pollen can be transferred from plants to an exhibit or body. The most obvious is by direct contact, such as between clothing with flowering plants (active transport). The second is by direct dry or wet air-fall from the atmosphere (passive transfer) and the third is contained within soil that is picked up by clothing, a tool, vehicle, etc. It turns out that the textiles that make up most clothing, both natural and artificial, are good active and passive traps for pollen and will hold pollen until it is washed vigorously (Zvada, McGraw, & Miller, 2007). As Rowell (2009) notes, 'clothing is an excellent collector of pollen and spores as they become trapped in the fabric weave when clothing is brushed against flowering plants, comes in to contact with dust, soil, or airborne pollen'. Simulation studies have shown that pollen on clothing accumulated from different parts of a small area (e.g. garden) with pollinating plants can reconstruct the pattern of vegetation in that area with a remarkable degree of spatial precision (Rowell, 2009). More recent simulation experiments by Jantunen and Saarinen (2011) have shown that, after walking in grassland, 68 pollen grains cm² were recovered from clothes using tape samples and that the amount of grass pollen, and especially pollen from insect-pollinated plants, increased from the shirt down to the shoes. They also showed that the pollen concentration on clothes aired outdoors depended on the concentration of the ambient air and the texture of the fabrics with highest concentration on furry fabrics and wools. This study, which was conducted to investigate allergenic pollen transport into houses, also found that a

significant proportion could be removed by shaking the clothes before taking them indoors. In a similar simulation study, Riding, Rawlins, and Coley (2007) looked at the retention of palynomorphs on footwear (Dr Martens-type boots and Wellington boots) at six differing rural sites within the same region. Soil from a single visit had a characteristic signature, but when mixing occurs from wearing footwear at different sites, the palynomorph content of the boots predominantly reflects the last site visited. However, mixing still causes increases in diversity and small variations in certain pollen types. This reinforces the need for footwear to be impounded as soon as possible after a crime has been committed.

The generally good match between sites and soil on footwear is due to the strong local bias of soil pollen—a problem for palaeoecologists and archaeologists but a positive benefit for forensic science. In palynological terms, crime scenes are nearly all very small scenes and as such will recruit the majority, but not all, of their pollen and spores from a very small area of 10 s rather than 100 s of metres (Jacobsen & Bradshaw, 1980; Sugita, 1994). These three characteristics of pollen and spores make them particularly useful in part due to the frequent disposal of bodies in highly vegetated areas (e.g. woods, scrublands, fields etc.)—even when crimes were originally committed in urban areas or indoors. Another reason why forensic palynology remains valuable is that in many cases DNA is either unavailable or inadmissible in court, such as in interpersonal crimes that involve a pre-existing relationship between the complainant or victim and the accused.

21.4 Methods and Palynological Uncertainties

The sampling procedures for forensic palynology vary with the material to be sampled and are outlined in Brown (2008) and summarised in Table 21.2. If samples are taken from a suspect, then they can be used to either produce a vegetation profile of an unknown site and to direct searches, or provide evidence that the suspect had been at a known site. This is environmental profiling (Brown, 2008) or biological profiling *sensu*

Table 21.2 Sampling and processing procedure for different materials (Copyright: Author's own image)

Sample type	Typical sampling procedure	Typical chemical extraction procedure
Mud/soil from vehicle	If possible layer by layer directly from vehicle (wheel arches, lower chassis, underside, footwells)	Removal of carbonates, triple sieving, hydrolysis, acetylation, mounting
Control sample—soil or sediment	Small sample of topsoil (1–2 cm ³)	As above
Fabric/clothes—heavily soiled	Peel mud/soil off fabric	As above
Fabric/clothes—lightly or not-soiled	Hand washing with addition of Calgon or sodium hexametaphosphate	As above if enough or just acetylation
Fabric/clothes—lightly or not-soiled	Adhesive tape (as used for fibre analysis)	Direct light microscopy but see text
Turbinates (deceased)	<i>Post-mortem</i> dissection then nasal washings, centrifuge	Standard chemical procedure including both hydrolysis and acetylation (Wiltshire & Black, 2006)

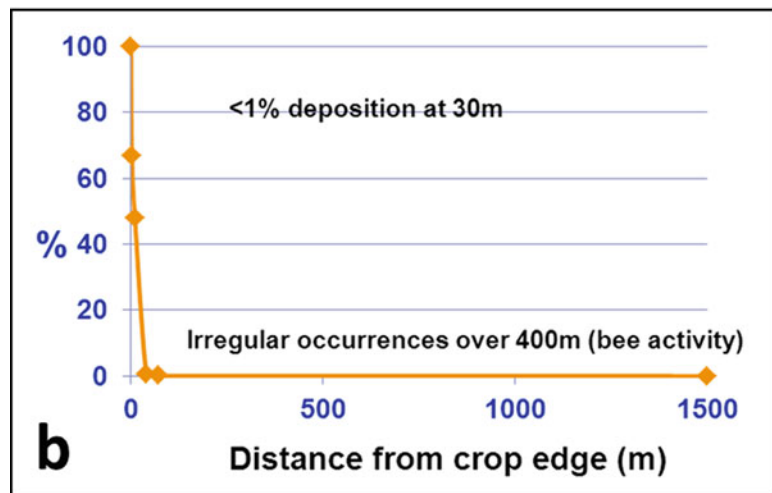
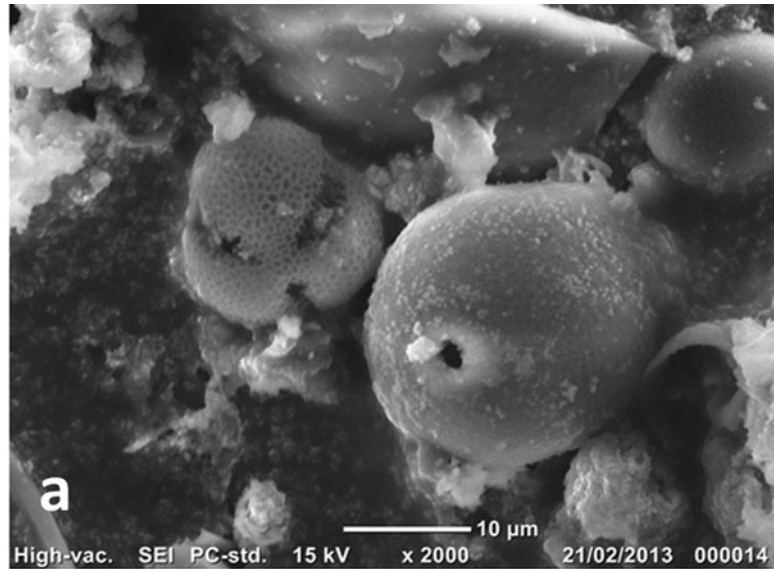
Wiltshire (2006). It is likely that in both cases control samples from the crime scene will be required in order to establish a match with the samples from the suspect or in some cases the victim. Control samples do not have to be large, but their exact location must be known in relation to the crime scene. Contamination should not be a problem if disposable instruments (tweezers, forceps, etc.) are used, samples are not taken during rainstorms and samples are kept in pollen-free plastic bags or glass vials. These samples should then be kept in a dark and cool environment and ideally in a refrigerator, mortuary container or freezer. Freeze-drying is also possible as there appears to be no evidence of any adverse effects on palynomorphs. The high levels of anaerobic bacteria and fungi in mass graves complicate sample storage because continued growth has been observed in cold stores if the temperatures even briefly rise above 2–4 °C. If cold storage is not available, then samples can be air-dried, but this may damage pollen. Samples for mineralogy and elemental analysis may also be dried or freeze-dried and stored. Ideally, samples should be split on-site with retention of one-half in the field or at the mortuary. For transport, small samples should be packed into padded bags and sealed, whilst larger samples may require crating. In relation to international work, it should be noted that the importation of soil into many countries requires specific permissions and licences.

The extraction methods used in forensic palynology are essentially those used in geological or Quaternary Science (e.g. Barber, 1976; Moore et al., 1991 or Branch, Canti, Clark, & Turney, 2005) but with modifications for particular circum-

stances. As Table 21.2 shows, mud or soil from clothing, shoes, vehicle, etc. can be subjected to a chemical process involving both hydrolysis (with hydrofluoric acid) and acetylation. However, there are less involved methods for clean clothes and organic materials such as macroscopic plant remains, where the pollen can be washed off and a cut-down chemical procedure followed. It is possible to replace the chemistry with forms of density separation (Nakagawa et al., 1998); however, these can be difficult and risky to use with the very small samples that are common in forensic work.

The identification of pollen and spores must be undertaken in a palynology laboratory with research-grade visible light microscopes, capable of 1000× magnification and with a comprehensive reference collection. Forensic palynology is taxonomically demanding for two reasons. Firstly, the diversity of pollen and spores is greater than most palynologists are used to due to the large number of exotic types that exist in most countries today. The second reason is that it is the rarities, including these exotics, that can have the highest value in obtaining a statistically strong match. This means that problems can arise with types that are difficult to identify to the species level, particularly the cereal grasses and other herbaceous groups (e.g. the Apiaceae). However, this problem is now eased by the greater availability of environmental scanning electron microscopes (ESEMs) which are far easier and faster to use than conventional SEMs as coating samples are not essential. In Case Study 21.3 below, an ESEM was used to confirm that grains on both clothing and from soil was oilseed rape (*Brassica napus*) rather than

Fig. 21.1 (a) ESEM of oilseed rape pollen behind a large grass pollen grain, (b) the dispersal of oilseed rape pollen from a flowering crop (data from Hüsken, 2007)



another member of the Brassicaceae family (Fig. 21.1). If the concentration of palynomorphs is high enough, then 500 grains should be counted. If not, as many should be counted as is practical. However, if this is low (under 250), then the evidential power of the sample will be reduced. Although not required in forensic work, the addition of an exotic maker (e.g. *Eucalyptus* or *Lycopodium*) can give valuable information on the sample concentration. Even with a large count and highly experienced palynologists, two counts from the same sample will not be identical due to the random occurrence of types, and so, this is where the maximum likelihood ratio concept as

outlined by Horrock, Coulson and Walsh (1998) can be particularly valuable. It is generally more useful than a simple probability-based approach in that both the match and the frequency of such a match in nature are considered.

The common occurrence of palynomorphs in soil or sediment allows other geoforensic methods to be used alongside palynology, including both other biological contents (such as diatoms, insects or testate amoeba) or geological components (Pye & Croft, 2004; Ruffell & Wiltshire, 2004; Ruffell & McKinley, 2008). The most unchangeable soil and sediment characteristic is its mineralogy, and its advantages have been discussed by Rawlins

et al. (2006). Mineralogy is largely the result of a soil's geological history and cannot be altered by organic decomposition in the short term (i.e. within the effective forensic timescale). The most time- and cost-effective, as well as robust, method is X-ray diffraction (see Herz & Garrison, 1998, and James & Nordby, 2003, for details of this technique). Standard procedures are followed with crushing, pelletisation and glycolation if required for detailed analysis of clay mineralogy. Although non-destructive scanning methods are increasingly being used in earth sciences (e.g. Itrax pXRF), they are not as accurate as modern synchrotron XRD alongside SEM studies of the material. It is also possible to combine palynology with other geoforensic data using statistical

methods such as principal component analysis or logistic regression; however, this is rarely done in forensic cases due to both the problems of explaining such approaches to a jury (or judge) and the statistical nature of such an approach. However, this is an approach that should receive more research within environmental forensic science.

21.5 Case Studies

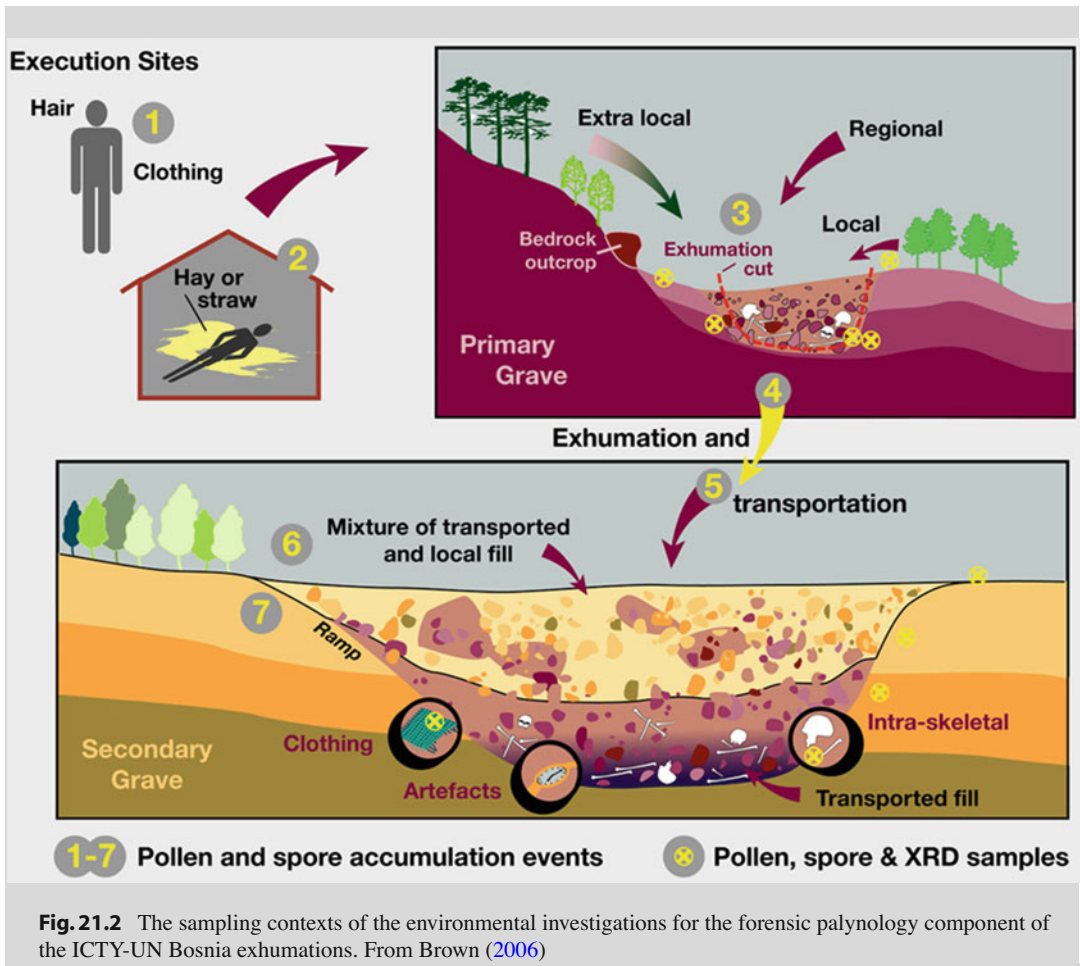
This section presents three case studies all of which involved missing persons cases prior to homicide being proven. In one case study (No. 2), the victim's bodies were found after a redirection of the missing persons search using forensic palynology

Case Study 21.1: The Use of Forensic Palynology after the Yugoslavian War in Bosnia

The multicomponent environmental approach was used in the forensic palynology undertaken in Bosnia from 1997 to 2003 as part of the prosecution investigations on behalf of the United Nations International Criminal Tribunal for the former Yugoslavia (UN-ICTY) by the author (Brown, 2006). Although this was not a typical missing persons case and although the UN did have a missing persons list, the approach, procedures and protocols used are all those that would appertain to most missing persons cases (Brown, 2008). This is because the aim of the work was to provide evidential links between the ultimate (secondary or even tertiary) burial sites and the original mass graves or execution sites. In practice, this involved the location and exhumation of seven former mass graves (primary sites) dug following the fall of Srebrenica in July 1995. These primary mass graves were secretly and hurriedly exhumed three months later and most of the bodies, or body parts, transported and reburied in a large number of secondary sites many of which were subsequently exhumed by UN-ICTY. The aim of the pollen and soil/sediment studies was to provide the environmental profile of the original site of the samples and use this to match the relocated bodies to the original mass graves. This matching involved

understanding the possible pathways of pollen from the landscape to the final gravesite (Fig. 21.2) just as would apply although in an inverted fashion in a missing person's case. In this case, this was part of completing the chain of evidence, providing evidence of the scale and organisation of the original atrocities and the subsequent attempts to conceal the evidence. All the primary sites were located in areas of contrasting geology, soils and vegetation, and this allowed matching of the sediment transported in intimate contact with the bodies to the original burial sites, which in some cases were also the execution sites.

In all, over 24 sites were investigated, over 240 samples collected and analysed under low-power microscopy and 65 pollen subsamples fully analysed. The pollen and sediment descriptions were used in conjunction with the mineralogy (using XRD) of primary and secondary sites in order to provide matches. These matches were then compared with matching evidence from ballistic studies and clothing and found to agree in all cases providing a scientific evidence supporting the prosecution case. The evidence was used in court and is now in the public domain (<http://www.icty.org/>). It is believed this was the first time forensic palynology and environmental profiling techniques were used in a systematic manner in a war crimes investigation.



Case Study 21.2: Rutland Water Missing Persons/Double Murder Case

On 18th November 1993, concerns were raised about the disappearance of a retired couple who had not been seen for over a week in the village of Hambleton adjacent to Rutland Water, in Central England (Fig. 21.3). Since this was unusual, their house was visited by the police who encountered the couple's adult son who said this parents had gone away, although he did not know and offer any other details. Being suspicious on the 19th November, the police searched the bungalow. In the bathroom, blood was located, and a forensic scientist determined that 'a significant event' had taken place. A spot of blood was also found in the couples' car, a blue Rover. The car was then

taken to the Forensic Sciences Service (FSS) laboratories where it was inspected. Although the chassis was clean, the car showed evidence of having been off-road with soil and recently living plant material in the wheel arches and in the footwells. Police enquiries established that the couple were fastidiously neat and tidy and they employed a local man to clean the vehicle regularly. By this stage, 2 weeks had passed and the bodies still had not been found, although the son had been arrested on suspicion of murder. Watercourses had also been searched, and search teams had been out in a wide area around Rutland Water. However, inspection of the coarse fraction inorganic inclusions from the wheel arches revealed quartz, calcite, ironstone, chert, calcite ooids

(from Lincolnshire limestone), coated roadstone and monofilament nylon. The fine fraction mineralogy (XRD) largely supported this geology with calcite, quartz, goethite, rutile, kaolinite, chlorite and illite being present. Coarse fraction organic remains included grass (an unidentified small leaved sp.), oak, alder, hawthorn, a spangle gall of oak (PL5 front offside wheel arch) and the moss *Eurhynchium swartzii* which is a calcicole species common in hedges and woodland. Rutland Water is on a geological boundary between Triassic Mercia Mudstone in the west and Lincolnshire limestone in the east and this data alone was enough to suggest that the vehicle had been to a wooded location on the Lincolnshire limestone, which was probably frequented by anglers (monofilament nylon). The palynology proved to be even more revealing.

Although all the samples were dominated by grasses (Poaceae), the other types present were more useful with strong indications of the nearby presence of oak (*Quercus*), birch (*Betula*) and hazel (*Corylus*) with a background level of pine (*Pinus*). Given the overrepresentation of grass and pine, this strongly indicated that the material had come from either a small woodland or copse or near to such a woodland, on the Lincolnshire limestone. However, more valuable evidence came from some less common pollen types and particularly the occurrence in all the samples of horse chestnut (*Aesculus hippocastanum*). This species produces little pollen as it is insect pollinated and it is also a non-native in the British Isles. Using data in the Leicestershire and Rutland Naturalists Trust woodlands database, the most likely woodlands were ranked in terms of their match to this profile. The closest were Burley Woods and Armley Wood, and on 1st December (the next day), the bodies were found in Armley Wood. They had been buried on the outer edge of a parking area within the wood used by anglers, and a 'cairn' of soil had been constructed in order to hide them. Reconstruction

of the scene allowed one anomaly in the pollen data to be explained. This was that one of the wheel arches PL5, the front offside, had far higher levels of oak pollen than the others and it also had produced the oak spangle gall. The reconstruction showed that if the vehicle had been reversed onto the outer bund of the parking area in order to allow the bodies (the male was 140 Kg in weight) to be placed where they were, the front offside wheel would have been only 1.5 m away from the trunk of an oak tree, thus resolving this apparent anomaly. There was no DNA evidence and so this data formed the bulk of the circumstantial evidence in the case, which led to the conviction of the son for the murder of his parents. Although this case is now 20 years old, it is used here to show how several lines of evidence can be used in addition to palynology to redirect a search and provide strong prosecution evidence. In fact the case also had many false trails, such as geophysical evidence of digging in the couple's garden, which turned out to be due to the son transporting garden soil to the grave site, rather than an attempt to bury the bodies in the garden.

Case Study 21.3: Midland Arable Field Missing Persons/Murder Case (2010)

On 6th June 2010, a young woman was reported missing under suspicious circumstances by a close friend and this led the local police to suspect possible criminal activity. A suspect was interviewed and released and then later arrested after it was suspected that he might have visited a significant location that could be related to the missing person enquiry. Subsequently, on the 17th June 2010, a search of the area revealed the highly decomposed body of the missing woman, which was discovered in a field close to a minor road approximately 4 km outside the urban area (Fig. 21.4). At this location, plant material was found on the road along with signs of entry to the field and this material was 100% sampled. Samples were also taken from the suspect's

vehicle (foot mats and footwells) and the clothing he was wearing when he was arrested was retained (including open-backed sandal-type shoes) and subsequently sampled by washing for palynomorphs. The scene was visited by the author for the purpose of taking soil samples and vegetation mapping. By this time, the field had been ploughed and so only samples from the surrounding arable verges, field entry point and road verges could be taken. Again, in this case, DNA was not available due to the highly advanced state of decomposition of the body.

Although the field had been ploughed, abundant piles of dead oilseed rape (*Brassica napus*) indicated that this had been the crop cultivated earlier in the year and this was confirmed by the farmer and by the crime scene photographs taken at the time of the discovery of the body. The field had a relatively plant-rich fringe to a line of trees which formed the southern field boundary to the road. This was an outgrown hedge and consisted of hawthorne (*Crataegus monogyna*), sloe (*Prunus spinosa*), dog rose (*Rosa canina* agg.) with Ivy (*Hedera aquifolium*) and ash (*Fraxinus excelsior*). Additionally, on the field side was a small patch of brambles (*Rubus* sp.). The verge at the east end where entry to the field was easiest (Fig. 21.3) was dominated by grasses but also had remains of stinging nettles (*Urtica dioica*), common cleavers (*Galium aparine*), white deadnettle (*Lamium album*) and cow parsley (*Anthriscus sylvestris*). The road itself was fringed by typical grass-rich verges and to the south of the road was an area of woodland and gardens which were noted to contain the following species: sloe, Scots pine (*Pinus sylvestris*), ash, oak and cedar (*Cedrus* sp.) with an understory of brambles and bittersweet or woody nightshade (*Solanum dulcamara*). A plant survey of these gardens was not conducted due to the distance from the body (>40 m) and shielding from the outgrown hedge. The field was on Boulder clay (Pleistocene) over Triassic Mercia Mudstone geology, which produces a loam soil with

enough clay for soil to clod and adhere to clothing when damp.

The local police submitted five items of clothing, one sample of hair combing, six vehicle samples and ten plant and plant/soil samples. Further samples were collected by the author from the most probable entrance point to the field. When the crime scene was visited after the arrest of the suspect, it was apparent that a vehicle had been parked opposite a gap in the hedge and plant material was strewn across the road from that gap towards the tyre tracks of the vehicle. This sample (Table 21.3, X1061 ZF4) was almost entirely composed of common cleavers (*Galium aparine*) with some small grass leaf fragments. A separate mass of road plant debris was composed of tall fescue (*Festuca arundinacea*, X1071 ZF5). Samples of plant material from the top of the post past which access would have had to have been made contained both cleavers and tall fescue. A sample from the path to the location of the cadaver contained both cleavers and the oilseed rape crop as well as remains of former crops and species typical of arable-field edges. It was noticeable at the time, and upon later inspection, that the area around the most probably entry point into the field was dominated by a mass of cleavers and stinging nettles. A sample from the end of the pathway leading to the cadaver was largely a mass of oilseed rape and samples from the verges adjacent to the tyre tracks included tall fescue and typical verge species. These samples were then compared with samples obtained from the clothing and the vehicle taken by the police after the arrest of the suspects. These included black socks, tracksuit bottoms, footwell samples and samples washed off foot mats. In addition, Table 21.3 summarises the results that are given in from soil control samples taken by the police and an additional sample taken by the author.

The sample from the suspect's black socks (X374, X375) produced a high quantity of palynomorphs dominated by Poaceae (47%), *Urtica* (27%), *Sinapis* t. (9%), *Anthriscus*

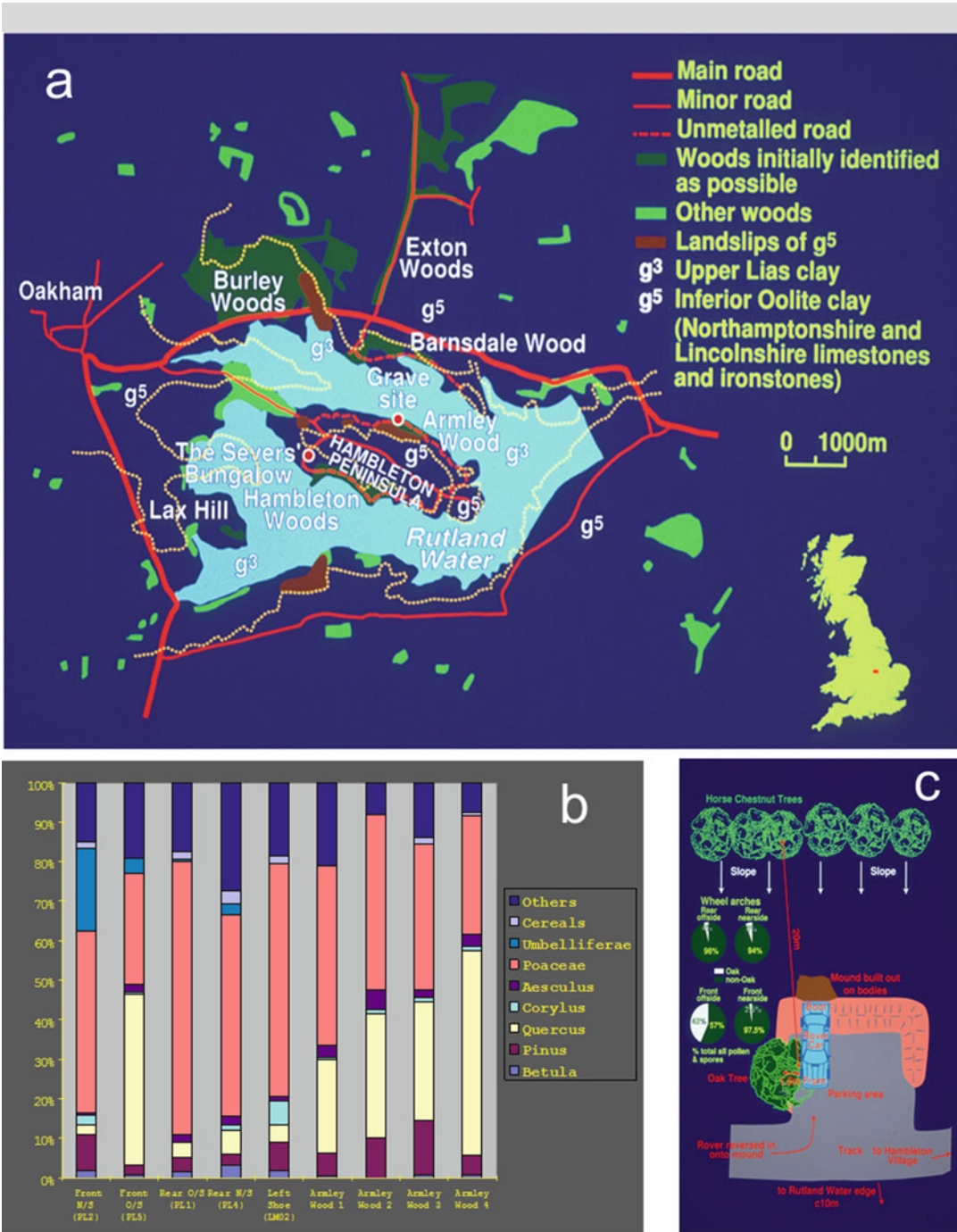


Fig. 21.3 (a) The location map and pollen evidence from the Midland double murder case (Case Study 21.1); (b) the a summary of the pollen data and (c) the reconstruction of the vehicle location at the crime scene (adapted from Brown et al. (2002))

Table 21.3 Case Study 21.2 samples

Type	X374+375 (socks)		X371 (track suite)		X171 pass. foot mat		X1028 driver's side front footwell		X170 driver's side foot mat		X1077 under head		X1078 below feet		X1076 next to feet		X1074 to right of body		AGB4 by entry point		
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	
Trees	9	1.2	1	+	154	45.2	34	9.0	125	27.4			3	+					1	+	
<i>Acer</i>																					
<i>Aesculus</i>																					
<i>Betula</i>	12	1.2	12	+	96	28.2	38	10.1	86	18.9	5	+	1	+	4		4		2	+	
<i>Carpinus</i>																					
<i>Cedrus</i>			2	+							1	+	1	+	2	+					
<i>Picea</i>			1	+							2	+					1				
<i>Pinus</i>	6	+	19	1.0	13	3.3	9	2.4	33	7.2	20	3.8	10	2.0	14	2.6	15	2.9	32	14.0	
<i>Ulmus</i>										1	+			1	+						
<i>Quercus</i>	5	+	12	+	11	3.2	1	+	42	9.2	7	1.3	2	+	4	+		1	2	+	
<i>Alnus</i>	5	+	5	+	3	+	1	+	11	2.4			1	+	4	+		1	4	1.7	
<i>Fagus</i>	1	+	5	+	1	+			6	1.3			2	+							
<i>Fraxinus</i>	6	+	14	+	5	1.4	4	+	15	3.2	22	4.2	14	2.8	6	1.1	5	6	6	2.6	
<i>Populus</i>																			1	+	
<i>Juglans</i>			1	+																	
<i>Castanea</i>																					
<i>Eucalyptus</i>																					
Total trees	44	5.9	80	4.5	301	88.5	89	23.7	329	72.0	57	10.9	35	7.0	31	5.9	28	5.5	50	21.9	
Shrubs																					
<i>Cornus</i> t.					5	1.4															
<i>Corylus avellana</i> t.	3	+	9	+	8	2.3	13	3.4	23	5.0	3	+	1	+	2	+	2	+			
<i>Prunus spinosa</i> t.	3	+	9	+	1	+	5	1.3	3	+	1	+							1	+	
<i>Crataegus</i>	1	+	9	+	15	8.8	8	2.1	22	4.8	1	+									
<i>Salix</i>	2	+	5	+	2	+	1	+	4	+			2	+	2	+					
<i>Sambucus</i>			1	+													2	+			
<i>Hedera</i>																					
<i>Daphne laureola</i>																					
<i>Lonicera</i>																					
Total shrubs and epiphytes	9	+			31	8.8	30	8.0	57	12.5	7	1.3	6	1.2	9	1.7	3	+	3	1.3	

(continued)

(3%) with *Betula*, *Acer* and *Galium* (all over 1%). This is an unusual assemblage as whilst high Poaceae is common on clothing, especially in the summer, such high levels of *Urtica*, and *Sinapis* t. are unusual. *Urtica* as a pollen type includes the species of *Urtica dioica*, *Parietaria judaica* (wall pellitory) and *Urtica urens* (annual nettle). Out of these, *Urtica dioica* is by far the most common and typical of verges, hedges and field boundaries on most soil types. The *Sinapis* type pollen type is a subdivision of the Brassicaceae and includes *Brassica napus* and several other taxa including *Sinapis* (e.g. *Sinapis alba*) and other genera some of which are common in the landscape such as *Cardamine pratensis* (cuckoo flower or lady's smock). However, comparison with type material of *Brassica napus* held in the Palaeoenvironmental Laboratory at the University of Southampton (PLUS) showed the pollen to be identical. Furthermore, since these genera are predominantly insect pollinated, very large quantities of the pollen would only be associated with a flowering crop (Fig. 21.1). The presence of clumps of *Sinapis* t. pollen and immature *Sinapis* t. pollen grains in this and the X371 (tracksuit bottoms) sample also strongly suggests direct contact and transmission from the flowers of a crop. The high levels of both are almost certainly the result of direct pollen transfer from plants to the socks. This was probably greatly increased by the combination of woolly socks with open-backed sandal-like shoes. Also noteworthy is the presence of *Anthriscus* and *Galium*, both of which are typical verge species. The levels of *Sinapis* t. and *Urtica* are most likely to have been accumulated by walking through a field of oilseed rape or another tall Brassicaceae and a patch of stinging nettles. Despite being almost completely unsoiled, the blue polyester tracksuit bottoms (X371) produced a large quantity of pollen. The pollen assemblage is dominated by *Urtica* (47%), *Sinapis* t. (20%), grasses (17%), *Anthemis* t. (2%) and *Galium* (>1%) with *Pinus* being the only tree over 1%

(Table 21.3). This is again an unusual assemblage as, whilst high Poaceae is common on clothing, especially in the summer, such high levels of *Urtica* and *Sinapis* t. are unusual, and the high levels of both are almost certainly the result of direct pollen transfer from plants to the tracksuit trousers. The levels of *Urtica*, *Sinapis* t. and *Galium* are most likely to have been accumulated by walking through a patch of nettles and cleavers, before or after walking through a field of oilseed rape or another tall Brassicaceae. The driver's side front footwell sweepings (X1028) produced a diverse assemblage dominated by herbaceous pollen (68%) but with a high variety of trees and shrub types. The herbaceous types are dominated by *Urtica* (57%) with Poaceae (4%) and high *Sinapis* t. (>2%). Also present is *Galium*. This assemblage is a typical urban and suburban assemblage with a high number of introduced and hedgerow taxa and typical scrub and ruderal herb types but to which has been added an unusually large number of *Urtica* and *Sinapis* t. pollen grains. The driver's side front foot mat (X170) also produced a diverse assemblage dominated by tree pollen (72%) but also had unusually high *Sinapis* t. (2%) with *Urtica* and *Galium* also present. In contrast, the passenger's side front foot mat (X171) although also dominated by tree pollen (88%) contained no *Sinapis* t or *Urtica* grains despite a total pollen count of 341 grains. Also noticeable was the high quantity of *Acer* pollen (45% TLP) which is most likely to be *Acer pseudo-platanus* (sycamore), which is a typically planted urban and semiurban spaces and could have been accumulated from many areas within the region. This is supported by the significant presence of *Cornus* t. (dogwoods), which is typically planted in suburban and urban spaces, parks and gardens.

The plant material samples are entirely consistent with the exit from the field close to the cadaver location of a driver of the car parked on the verge opposite. The samples from the vehicle interior were in general typical of the

suburban to rural nature of the local area but the difference between the passenger and driver mats suggested that the driver had also visited a location producing *Sinapis t.* and *Urtica* pollen. The pollen samples from the suspect's socks and clothing are also fully consistent with the wearer having visited, or been present at, the gravesite and entered through the gap in the wire fence to the east end of the outgrown hedge and through a patch of common cleavers and stinging nettles, i.e. through the suspected entry point (Fig. 21.4). This is consistent with the mass of common cleavers found in the road by local police and with the presence of *Sinapis t.* on the driver's side footwell sweepings (X1028) and driver's side footmat (X1070) but not on the passenger's footmat (X1071). The mechanisms for pollen transfer in this case are largely direct contact transfer from flowering plants onto the clothing and thence to the vehicle interior. It is likely that the pollen transfer from the site to the socks and tracksuit trousers occurred shortly before they were seized by the

police as washing would have reduced the high concentrations of pollen. The control samples taken around the body by the police (X1077, X1076, X1078, X1074) all confirm the large quantities of *Sinapis t.* pollen being shed in the field from the oilseed rape crop and this is both checked and confirmed by the control sample analysed by the author (AGB4), which also confirms the high concentration of *Urtica* and *Galium* pollen at the suspected entry point to the field. In conclusion, the samples analysed from the socks and tracksuit, along with the samples from the vehicle interior and the plant remains found in the road, are fully consistent with, and explained by, the driver of the vehicle having entered the field in which the body was found over the gap in the fence to the east of the hedge, having walked through the oilseed rape crop, and then returned to the vehicle dragging plant material, particularly cleavers, out with him/her. This evidence was the major part of the successful prosecution of the accused in 2011.

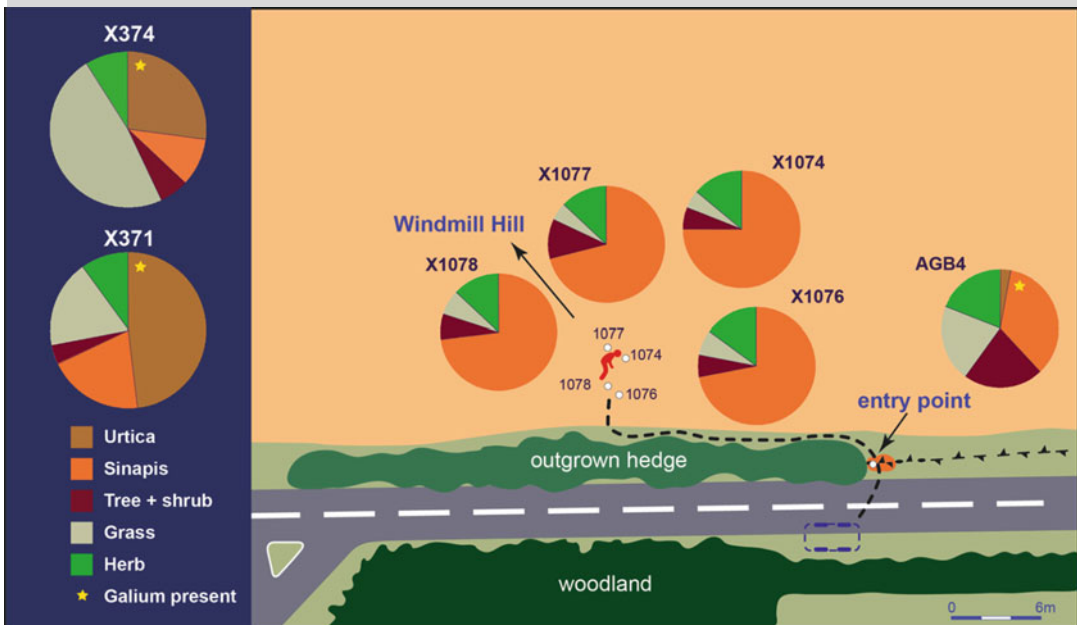


Fig. 21.4 The crime scene with suspects summarised pollen profiles (socks and track suite bottoms) from the Midland arable-field murder case (Case Study 21.2) (copyright: author's own image)

21.6 Recent and Future Developments

For some time, palynologists have noted and used algal and fungal spores for palaeoenvironmental reconstruction in addition to fern (Pteridophyte) and moss (Bryophyte) spores. In palaeoecology, this has largely been based upon the pioneering studies by Bas van Geel (2001) and most of the spores are of fungal origin. This is now part of the growing subfield of forensic mycology which is the forensic use of fungi which include blights, moulds, mildews, plant and human pathogens, lichens, rusts, slime-moulds, truffles and yeasts (Hawkesworth & Wiltshire, 2011). Potential applications of forensic mycology include estimating post-mortem interval, ascertaining time of deposition, cause of death, cause of hallucinations, cause of poisoning, biological warfare and locating buried corpses (Hawkesworth & Wiltshire, 2011). It is in this last application it can be used in with forensic palynology since the preparation procedures are common to both types of microfossil. If active transfer pollen is obtained very rapidly after being accumulated (within 3–4 days), then it is theoretically possible to DNA type the pollen back to the plant (Kraaijeveld et al., 2015). Another development that has great forensic potential is a combination of palynology and soil or environmental DNA (eDNA); indeed eventually this could replace the use of palynology altogether. It is based upon the use of sedaDNA metabarcoding which is the identification of sedaDNA sequences from extracellular DNA (Taberlet et al., 2007; Yoccoz, Brathen, Gielly et al., 2012) providing a list of all the plants that are present in the area. First used in studies of palaeo-biodiversity (Hebert, Cywinska, Ball, & deWaardet, 2003), this approach has been shown to track variation in the abundance of plants and domestic animals providing a potentially unique characterisation of a location even over long-time periods (Giguët-Covex et al., 2014). It is therefore theoretically possible that if a sample of soil was analysed, a full vegetation profile could be produced which could be compared with modern distribution data or a botanical survey of the crime scene.

21.7 Conclusions

Forensic palynology can be used in missing persons case to both locate an unknown site (scene of crime or body) and as a robust technique for deriving potentially strong circumstantial evidence links between clothing, shoes, vehicles or tools and a crime scene. The main problems in its use to direct searches is the appreciation by investigating authorities (police and security forces) that it could be valuable and then access to palynological services in the short timescale that usually appertains. Technical development in forensic palynology has led to both improved extraction methods and increasing taxonomic precision. It is also possibly best used in combination with other environmental data such as other biological microfossil data or geological data such as mineralogy. However, its take up both globally and nationally is still very variable. Forensic palynology remains valuable at least in part due to the limitations of standard DNA analyses. However, in the medium to long term, it may be combined with environmental sedaDNA as part of an even more powerful approach to environmental profiling.

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22.1 Introduction

Human identification by DNA analysis in missing person cases typically involves comparison of two categories of sample: a reference sample, which could be obtained from intimate items of the person in question or from family members, and the questioned sample from the unknown person—usually derived from the bones, teeth, or soft tissues of human remains. Exceptions include the analysis of archived tissues, such as those held by hospital pathology departments, and the analysis of samples relating to missing,

but living persons. DNA is extracted from the questioned and reference samples and well-characterized regions of the genetic code are amplified from each source using the Polymerase Chain Reaction (PCR), which generates sufficient copies of the target region for visualization and comparison of the genetic sequences obtained from each sample. If the DNA sequences of the questioned and reference samples differ, this is normally sufficient for the questioned DNA to be excluded as having come from the same source. If the sequences are identical, statistical analysis is necessary to determine the probability that the match is a consequence of the questioned sequence coming from the same individual who provided the reference sample or from a randomly occurring individual in the general population. Match probabilities that are currently achievable are frequently greater than 1 in 1 billion, allowing identity to be assigned with considerable confidence in many cases.

The genetic analysis may analyze all major classes of genetic material, including autosomal (non-sex-chromosome), X-chromosome, and Y-chromosome targets in the nuclear genome, as well as from the mitochondrial genome. Statistical analysis is underpinned by theoretical and empirical research in population genetics, which allows the frequency of DNA sequences from these particular regions of the genome to be estimated with confidence for various populations. Where reference samples arise from family

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members, a further level of complexity and inference is required. Nevertheless, statistical random match probabilities that are highly discriminating can still be obtained.

In this chapter, the development of genetic approaches to forensic human identification will be discussed in a variety of contexts, including the analysis of skeletal remains and other trace evidence. The use of autosomal, X and Y chromosome genetic *loci* and maternally inherited mitochondrial DNA in relationship analysis will be briefly reviewed. More recent advances in the application of single nucleotide polymorphisms (SNPs) and next-generation sequencing (NGS) to human identification, particularly in the development of ancestry informative markers (AIMS) and externally visible characteristics (EVCs), will also be introduced, with related socio-ethical issues. A range of case studies are used to illustrate application of these technologies.

22.2 DNA Extraction, Purification, and Characterization

Forensic DNA analysis requires the extraction and purification of DNA from both reference and questioned samples. These are intended to release the double-stranded helical DNA molecule from the cellular and biomolecular structures within which it is normally constrained—or from their break-down products—and to accumulate it in sufficient quantity and purity that will allow sequences within it to be characterized.

Methods for extraction and purification of DNA from biological samples collected *in vivo* are well established and routine (Lee & Ladd, 2001). Sources may include blood, hair, hair roots, saliva, semen, and so forth. Samples collected from *postmortem* remains may also be analyzed, although they may sometimes be problematic. DNA break-down or diagenesis following death may advance rapidly in a time and environment dependent process. In many cases, collection of peripheral blood samples is impaired, and viable material may be restricted to the soft and hard tissues. In hot and humid climates, skeletonization can occur in as little as a

few days. DNA may be fragmented and chemically modified. In such conditions, “low-template” DNA analysis may be necessary.

The quantity of DNA recovered varies according to the source. In peripheral blood, for example, 20,000–40,000 ng/mL of DNA may be present and in semen 150,000–300,000 ng/mL. As sperm cells contain haploid DNA—having unpaired chromosomes, semen samples generally contain half the number of copies of a particular genetic target compared with their diploid counterparts found most other cells of the body.

Hair and bone contain much smaller amounts of DNA. Plucked hair routes may yield 750 ng DNA, whereas naturally shed roots may yield only 1–12 ng. Bone may yield 3–10 ng/mg of DNA depending on the bone condition, which under a range of conditions may be sufficiently poor that little or no DNA may be detectable—typically this amount will be below a threshold of about 1 ng of DNA.

In forensic investigations, DNA may be recovered from any of these sources and from biological material deposited at a scene of crime. Pathology specimens in the form of formalin fixed paraffin embedded (FFPE) tissues are preserved for decades and are sometimes an excellent source of DNA, however fragmented (Funabashi et al., 2012).

Characterization of the purified DNA is targeted at well-understood regions of the nuclear and mitochondrial genomes known to vary sufficiently in populations that they may permit individuals to be distinguished one-from-another. A powerfully discriminating method of human identification from DNA was first developed by Alec Jeffreys, Wilson, and Thein (1985) and was based on the observation of mini satellites—highly varying regions of the human genome that could have a unique pattern for each individual—that could be used as “DNA fingerprints.” At the same time, Kary Mullis (Saiki et al., 1988; Saiki, Bugawan, Horn, Mullis, & Erlich, 1986) developed a method of amplifying DNA by enzyme catalyzed molecular copying of a target region in a process referred to as the Polymerase Chain Reaction (PCR). Combining the two methods permitted DNA fingerprints to be amplified from

scene of crime trace evidence with the aim of comparison with the same regions in the suspect, a breakthrough of enormous significance for forensic science and the justice system.

Following Jeffreys' discovery, other highly varying regions—microsatellites, specifically, short tandem repeats (STRs)—have been adopted as the target of choice in DNA profiling. As the name suggests, these consist of short sequences of DNA in which pairs of the four bases—Adenine, Guanine, Cytosine, and Thymine—from which the molecule is constructed are repeated a number times in tandem—for example, ATATATATATAT or GCGCGCGCGCGCGC. STR *loci* can easily be amplified and distinguished by capillary electrophoresis (CE) which allows them to be separated on the basis of their molecular weight—which differs according to the base composition and repeat number of the STR allele concerned. STR *loci* have been chosen from different autosomes (non-sex-chromosomes) as this means *loci* are not linked as they would be in neighboring regions of the same chromosome and the product rule can be used in statistical estimates of frequencies in populations (Evelt & Weir, 1998). STRs have also been characterized and applied in analysis of the X and Y chromosomes (X- and Y-STRs, respectively). In each case, the surrounding DNA sequences are sufficiently well understood that known short flanking sequences can be used as templates for the DNA primers that are essential to initiate the copying of the target region in PCR.

22.3 DNA Profiling Using Amelogenin and STR LOC/

Current routine approaches to human identification using DNA profiling are largely based on STRs, supported by analysis of the amelogenin *locus* (see Butler, 2005, 2012). Amelogenin is a protein found in dental enamel. The amelogenin gene is located on the sex chromosomes and shows DNA sequence length differences between the X and Y chromosome analogues, which can be used to assign the sex of the individual. The X allele contains a deletion of six base pairs and

produces a smaller fragment when amplified by PCR. When the PCR products are analyzed, the female individual with two X chromosomes will show a single band while the male will show two bands, equating to the X and Y chromosome products, respectively. Primers for amelogenin PCR are chosen to complement templates that flank short sequences within the *locus* that will contain the six base pair deletion if present—for example, products of 106/112 or 212/218 base pairs—providing an advantage with respect to degraded DNA samples or when limited quantities of substrate are available. STR *loci* chosen are typically within a range of 120–350 base pairs. The simultaneous amplification or “multiplexing” of several different *loci* in a single PCR tube makes the approach economical with respect to time and material, and—importantly—efficient use of the available sample.

In Chakraborty, Stivers, Su, Zhong, & Budowle, 1999, regarded 13 STR *loci* as adequate for most problems related to human identification and rightly predicated STRs would continue to be used as part of the DNA profiling and data banking projects that were growing around the world. The 13-*locus* combined DNA Index System (CODIS) emerged as a standard in the USA and several other jurisdictions. Multiplexes have continued to grow, however, due to their greater discriminating power. Various systems constructed around a shared set of core STR markers have arisen permitting some compatibility in databasing and statistical analysis (Butler, 2015). In the UK, the ten-*locus* Second Generation Multiplex Plus (SGM Plus) system is currently being superseded by DNA-17 in England and Wales and DNA-20 in Scotland. These systems are highly optimized for reliability and efficiency in PCR amplification, and tend to target smaller substrate sequences than their precursors—increasing their sensitivity and utility, especially in the analysis of trace evidence. The systems incorporate selective fluorescent dye labelling of PCR products facilitating laser-based allele characterization and quantification—visualized as a peak on an electropherogram graph—and automated allele assignment during CE. Routine DNA profiling is now a largely

automated process. Statistical match probabilities frequently exceed 1 in 1 billion, making human identification assignments—essentially, judicial rather than scientific decisions—straightforward, in criminal and civil cases, including those involving missing persons.

22.4 Relationship Analysis

Human identification can rely on comparison with DNA sequences amplified from near relatives, rather than from a directly derived reference sample. In the case of a missing child, for example, the reference samples may arise from the father and mother. Because of the use of DNA analysis in paternity testing, procedures for relationship analysis are routine.

The basis of paternity and maternity testing is the fact that in the absence of a mutation, the child receives from each of the parents one allele of each *locus* analyzed. The assignment of paternity or maternity is based on the observation of alleles shared and not-shared between the child and the known parent and—in the event the questioned individual cannot be excluded—on statistical calculations: the most common test used being the “paternity index.” Occasionally, the genetic relationship analysis is complicated by the absence of a reference sample from one of the ‘trio’ of the mother, son, and supposed father. Although uncertainties may arise, the analyses can achieve high levels of resolution. Adding profiles of other relatives of the first degree—such as grandmothers or grandfathers, or brothers of the alleged father—can increase the statistical reliability in these cases (Evetts & Weir, 1998).

Relationship analysis can be applied to the identification of a person—living or deceased—by inference based on the known DNA profiles of near relatives. Lineage markers, such as the STRs of the X and Y chromosome may also be used.

22.4.1 Y-STR Analysis

In forensic laboratory analysis, the polymorphic STR markers of the Y chromosome are used because of their male specificity (Bosch et al.,

2002; Gill et al., 2001; Henke et al., 2001). Initial studies with Y-chromosome DNA used a set of 7–9 STR *loci*, which has increased to approximately 17 (see Martín et al., 2004; Chemale et al., 2014) with a three-multiplex reaction available that amplifies 19 *loci* (Bosch et al., 2002).

These targets are particularly useful in cases of rape or sexual assault and in paternity investigations where the child is male. In the latter case, as a supplement—or, for example, in the absence of a reference sample from the father—inference may be made using other paternal lineage relatives, such as brothers or cousins, and so on. In missing person investigations, paternal lineage relationships may be assessed in a similar way.

22.4.2 X-STR Analysis

The STR markers of chromosome X may efficiently complement the analysis of autosomal and Y chromosome STRs. Relative to autosomal markers, X-STR markers are characterized by higher values of the mean exclusion chance (MEC), the statistic used to estimate the power of exclusion. In other words, they have a higher exclusion capacity in some situations, such as in analyses involving blood relatives in the absence of a profile from the alleged father, among other scenarios.

The X-STR *loci* applied in human identification tests (see Szibor et al., 2003) are located in regions where recombination between the X and Y chromosomes does not occur, but where recombination does occur between the paired X chromosomes of women, ensuring variability in the population of the markers concerned. Chosen X-STR regions recombine in the same way as the autosomes, permitting a model that allows the haplotype to be directly determined. X-STR analysis can be applied to the investigation of maternity and—in some situations—paternity.

22.4.2.1 X-STR Analysis in Maternity Testing

In maternity testing, X-STR analysis can be applied in cases where kinship between a woman and supposed son is questioned. For males, the X chromosome is identical to one of the two X

chromosomes possessed by the mother. For example, a case was reported in China (Li et al., 2012), where a woman wanted to adopt a child and was asked to undertake a maternity test to see if there were chances that the woman could be the child's biological mother. A comparative test of 46 autosomal STRs was carried out and it was concluded that the woman and the boy shared at least one allele at all 46 *loci* tested. Nevertheless, actual motherhood could not be confirmed. Further tests were carried out using X-STR and maternally inherited mitochondrial DNA (see below), essential to exclude motherhood. The X-STR *loci* were analyzed and maternity was excluded. Certain population groups appear relatively homogenous in X-STR variation, including the Chinese (Li et al., 2012). In contrast, recent studies by Ribeiro-Rodrigues et al. (2011) reveal heterogeneity of X-STR variation among Brazilian samples.

22.4.2.2 X-STR Analysis in Paternity Testing

In paternity testing involving blood relatives, X-STR markers are more efficient than autosomal. An illustrative example is the case where suspicion about the paternity of a child involves both the father and son. That is, both the father and son are suspected of being a girl's father. Father and son have X chromosomes of different maternal origin as their X chromosomes are from different women. Differences in X-STR markers when compared to the child will allow identification of the real father from the two candidates. Another illustrative example is a case where the putative parent may be one of two brothers. In this case, the chance of inheriting a single reference allele X is 0.5 (50%), which is equal to the probability of two alleles of the same locus on an autosome, reducing the advantage of using X-STR *loci* to that of autosomal STRs.

In certain cases of rape and incest, the woman may choose to opt for abortion. In this context, it is possible to undertake fetal paternity testing using X-STRs. There is no advantage to using X-STRs if the fetus is male. If the fetus is female, there are methodological complications with regard to the collection of samples from the fetus.

In the 6–8 week period, fetal tissue may be difficult to exclusively identify, and dissection may yield a mixture of maternal blood and other tissues. The dissection of chorionic villi is usually undertaken, yielding samples consisting of a mixture of fetal and maternal DNA. To overcome these difficulties, both autosomal and X-STR analysis can be used for comparison with the suspect sample. The markers of the X have the greatest power of exclusion under these circumstances. Although, in a case of incest, little can be expected from the analysis of X-STR as all fetal alleles correspond to maternal alleles.

So-called *deficient* paternity cases show the greatest advantage for X-STRs (Trindade-Filho, Ferreira, & Oliveira, 2013). In the absence of a biological sample from the alleged father, DNA from relatives becomes a necessary prerequisite for X-STR analysis. The approach is based on the fact that sisters of the same father have the same paternal X chromosome. The investigation of two sisters or half-sisters X-STRs has the power of paternity exclusion when four different alleles or haplotypes are detected. That is, four alleles present on the X chromosome that are divergent from those present in the profiles inferred from relatives are sufficient to exclude the individual for whom there is no reference sample to be the biological father. In this scenario, the alleged paternal grandmother's profile is helpful as all contributing alleles can be determined by investigating X-STRs and the MEC can be calculated in the same manner as that used for autosomal markers. If the grandmother's profile is not available, the alleged father's X-STR genotype can be reconstructed to some extent from offspring, if they include women. Better information can also be obtained if the alleged father's brothers' reference profiles are available and the grandmother is heterozygous for X-STR loci studied. This is because the brothers of the alleged father may carry different alleles. On the other hand, if siblings share the same alleles, the mother can be both homozygous or heterozygous for the corresponding *locus*.

The discriminatory power of X-STR analysis depends on the sexes concerned and is normally of equal value to autosomal STRs when female samples are compared to others that are also

female. However, when male individuals are investigated in comparison with reference samples that are also male, the discriminatory power of the X-STR markers is usually lower than that of autosomal STRs. This is due to the fact that the male X-chromosome analysis can rely on only one allele at each STR *locus*.

It is important to note that despite current understanding of the genetics of X-STR markers and their considerable potential in complex cases of identification from relatives, they are not commonly in routine use, but because X-STRs are especially efficient in cases where desired reference samples of supposed parents are unavailable, a growing demand for their use can be anticipated. X-STR markers also offer utility in efforts to reunite families separated in the context of war or migration.

22.4.3 Mitochondrial DNA Analysis

Mitochondrial DNA (mtDNA) sequences are obtained from the mitochondria—energy producing organelles present in most human cells. Each mitochondrion contains a circular DNA molecule of 16,569 base pairs, including a noncoding region—the D-loop, which is highly variable between individuals who do not share a maternal relative. As mtDNA is maternally inherited, sequences are essentially identical in individuals of the same maternal lineage. The first full mtDNA sequence was established from a single individual of European descent by Anderson et al. (1981), and is known as the Anderson sequence or Cambridge Reference Sequence (CRS). With improvements in DNA sequencing technology in subsequent decades, the original material evaluated by Anderson and coworkers was re-sequenced to enable robust understanding of the reference sequence (Andrews et al., 1999).

About 1000 mitochondria are present in most cells, meaning that mtDNA sequences are present in two or three orders of magnitude more than their nuclear—autosomal, X chromosome, and Y chromosome—counterparts. This simple distinction means that they can more readily be recovered from highly degraded forensic and

archaeological specimens. MtDNA analysis is a powerful tool for identifying individuals as a supplement to the analysis of nuclear DNA or when analysis of nuclear DNA is not possible.

MtDNA analysis has been applied to DNA samples of archaeological age, showing that significant amounts of genetic information can survive for long periods in bone (Hagelberg & Clegg, 1991). MtDNA analysis of bone fragments of 26 skeletons belonging to the Goeldi Museum collection in Pará, Brazil, for example, resulted in successful typing in 18 of the total of 26 individual Pre-Colombian Amerindians dated to 500–4000 years ago (Ribeiro-dos-Santos, Santos, Machado, Guapindaia, & Zago, 1996). In Sicily, both mtDNA and amelogenin sequences were analyzed to identify the remains of the family of Prince Branciforte Barresi—who lived in the sixteenth and seventeenth century. Molecular genetic analysis was consistent with historical expectations, although it was not possible to demonstrate directly that they were indeed the prince's remains, due to the unavailability of living maternal relatives. Bone microstructure showed evidence of good preservation (Rickards, Martínez-Labarga, Favaro, Frezza, & Malleoni, 2001).

In forensic investigations, human skeletal remains belonging to the US servicemen who were missing from the Vietnam War were identified by analysis of mitochondrial DNA (Holland et al., 1993). In Argentina, skeletons of individuals killed during the military dictatorship of 1976–1983 were recovered and having proved resistant to routine STR analysis, were more successfully analyzed using mtDNA (Corach et al., 1997).

22.5 Single Nucleotide Polymorphisms

A further class of genetic markers known as Single Nucleotide Polymorphisms (SNPs) have been described, which opening up further possibilities in forensic human identification (Daniel et al., 2015; Eduardoff et al., 2015). As their name implies, SNPs are normally the result of a single base difference and since each SNP *locus* typically has only two alleles, a greater number of

targets are needed to achieve the discriminating power of STR *loci*—which have multiple alleles. Computer analysis has shown that an average of 25–45 SNPs *loci* would be required to produce a random match probability similar to the 13 core STR *loci*. The actual number may vary in practice, as many SNP *loci* have variable frequencies in different populations. A 50–100 SNP panel may be needed to achieve the same power of discrimination and problem solving ability that can be obtained with 10–16 STR *loci* (Kidd et al., 2006). The prospects for typing 200–300 SNPs in a single reaction are promising, however, and are achievable using Next Generation Sequencing (NGS) systems (Seo et al., 2013).

SNPs are abundant in the human genome and have been used in linkage studies of genetic diseases. PCR products of SNPs may have a size of less than 100 base pairs, making them most suitable for analysis of degraded samples, in which fragments of the sizes needed for STR PCR are not present. SNPs have the potential to be used in multiplexes and sample processing and data analysis can be automated, a process facilitated by the absence of extraneous “artifacts” sometimes found in STRs.

Furthermore, SNPs offer further potential for use in the prediction of the ethnic origin of the subject and of certain physical characteristics.

22.6 Next Generation Sequencing

Next Generation Sequencing (NGS) is a technology via which amplified DNA may be rapidly and extensively sequenced, without the need for relatively time-consuming CE and with the advantage that the DNA sequence is analyzed directly rather than from the fragment size inferred from the peak position detected on an electropherogram. NGS-based genotyping has a range of potential applications in forensic science (Yang, Xie, & Yan, 2014). It has been applied to forensic STR (Bornman et al., 2012) and mtDNA analysis (Parson et al., 2013), and offers the potential for analysis of whole mitochondrial genomes. Forensic NGS analysis of ChrY may offer greater resolution than routinely

achievable using Y-STRs (Van Geystelen, Decorte, & Larmuseau, 2013). NGS is more readily suited to SNP analysis as it can easily detect polymorphisms in sequences. NGS-based forensic systems may attempt to incorporate traditional STR assignment, however, due to the legacy of STR-based systems and databases, which are world-wide.

22.7 Ancestry Informative Markers and Externally Visible Characteristics

Recent and current research in forensic genetics offers the possibility of estimation of biogeographic ancestry and characteristics of physical appearance from trace evidence. It has been known for many years that gene frequencies vary in populations (Cavalli-Sforza, Menozzi, & Piazza, 1994), offering the potential for localizing the source population from any particular profile (Novembre et al., 2008). Certain polymorphisms appear to be restricted to individual populations and are sometimes referred to as “private polymorphisms.” A number of difficulties arise with ancestry estimation, however. Private polymorphisms, for example, tend by their very nature to be so rare that they are unlikely to have wide utility in forensic investigations, whereas more frequently occurring polymorphisms may lack sufficient resolution to any particular population to make an unequivocal assignment. Despite such drawbacks (Rosenberg, Li, Ward, & Pritchard, 2003), a number of studies have identified potential ancestry informative marker sets, including those based on SNPs (Huckins et al., 2014; Kidd et al., 2011; Lao, van Duijn, Kersbergen, de Knijff, & Kayser, 2006; Phillips et al., 2014).

The potential for estimation of characteristics of physical appearance have centered on research on melanin pigmentation, where polymorphism in the genes of melanogenesis has been investigated with the aim of identifying SNPs that can be used to estimate hair and iris color (see Maroñas et al., 2015 for a recent review). The genetics of face shape has also been studied—again with the aim of identifying candi-

date SNPs affecting facial appearance (Claes et al., 2014; Liu et al., 2012).

A number of problems are likely to persist in the forensic application of AIMS and EVCs. Complex genetics means that—with certain exceptions, as may apply in the case of red hair (Valverde, Healy, Jackson, Rees, & Thody, 1995)—assignment of color or ancestry can only be made with limited resolution. Migration and admixture may confound investigative value, and ancestry can be based at least as much on culturally or cognitively held beliefs as on a genetic pedigree. The presumption of a relationship between pigmentation and genetic ancestry (Shriver et al., 2003) and perceived ancestry may be valid, but has the potential to profoundly confound understanding. In Brazil, for example, admixture has been such that assignments of ancestry on the basis of color, STR, X-STR, and mtDNA diversity are frequently contradictory (Godoy et al., 2011; Ribeiro-Rodrigues et al., 2011; Soares-Vieira et al., 2008). Ancestry can be perceived and self-perceived differently by different individuals, and investigators and forensic scientists are likely to have to negotiate the issue of “racism,” whether real or apparent (M’charek, 2013).

22.8 Low-Template DNA Analysis

Forensic specimens encountered in missing person investigations arise predominantly from skeletal material and trace evidence, which is frequently a challenging target for DNA analysis due to *postmortem* diagenesis, which reduces the quantity and quality of DNA available for analysis. The DNA molecule is frequently fragmented and chemically modified, and is found in the presence of other molecules which impede extraction and purification, and inhibit the PCR reaction.

A good deal of research has been dedicated to overcoming problems of DNA recovery and amplification from skeletal remains and trace evidence (Davoren et al., 2007; Evison, Smillie, & Chamberlain, 1997). Extended-cycle PCR, widely used in ancient DNA studies, was adopted in forensic science in the 1990s where it is typi-

cally described as “low-template” or “low copy number” DNA analysis (Gill, Whitaker, Flaxman, Brown, & Buckleton, 2000). Careful optimization of the parameters of the PCR reaction is accompanied by additional cycles, which theoretically double the quantity of DNA generated with each reiteration.

Understanding of patterns of DNA diagenesis in different parts of the skeleton and in different environments may offer a route to improved low-template DNA analysis from challenging specimens. While histological studies of bone indicate that diagenesis is promoted by fungi and other microorganisms (Collins, Nielsen-Marsh, Hiller, Smith, & Roberts, 2002; Hackett, 1981), and that these processes may advance rapidly in hot and humid climates (Iwamura, Oliveira, Soares-Vieira, Nascimento, & Muñoz, 2005), there is also evidence for DNA survival (Iwamura et al., 2005, 2004; Iwamura, Soares-Vieira, & Muñoz, 2004), which may be greater in certain parts of the skeleton (see Callaway, 2015). Progress has also been made on the recovery of DNA from historical FFPE specimens (Gillio-Tos et al., 2007).

22.9 Standards and Regulation

In the United States, the old “RFLP” technology was replaced with STRs in 1997, increasing efficiency in the order of four times (Schneider, 1997). The Forensic Science Division of the FBI selected 13 STRs *loci* of the CODIS system for inclusion in the American convicted individuals database. The thirteen STR *loci* that are part of this system are: VWA, FGA, D8S1179, D21S11, D18S51, D13S317, D7S820, D16S539, D3S1358, D5S818, TH01, TPOX, and CSF1PO. If there is a match between two samples at the 13 CODIS *loci*, statistical calculations typically indicate that these samples are from the same individual or from a random individual who is present in the population at a frequency of only one in several hundred million or more (Ban, 2001). Use of standardized kits and instrumentation frequently improves efficiency in the analytical processes. Automation may permit analysis of 10,000–20,000 samples per year, with high levels

of efficiency and quality, and with low costs and a minimal response or “turn around” time (Steinlechner & Parson, 2001).

Recognition of a need for criteria and standards for DNA typing within the forensic community in the United States resulted in the formation of a national group of forensic scientists in the late 1990s, called TWGDAM (Technical Working Group on DNA Analysis Methods). This group published a series of standards for forensic DNA typing, including the Guidelines for Quality Assurance Program for DNA Analysis (NRC, 1992, 1996). From October 1998, conformity with the national guidelines for forensic DNA testing in public laboratories—also known as the FBI standards or national standards—became mandatory for certification and accreditation. These standards include national quality assurance programs encompassing laboratory organization and administration, facilities, sample handling control of evidence, validation of laboratory methods and analytical procedures, calibration and maintenance, proficiency testing, and standards for evidential statements and standards of suppliers. The European DNA Profile Group (EDNAP) began in 1989 as an informal association of European laboratories, normally police organizations and University laboratories who performed forensic work. This group represents the European Community and nonmember countries of Eastern Europe. Its main objective is the standardization of DNA typing, achieved by performing exercises among members of the group to ensure comparability of genotyping results (Schneider, 1997). A Spanish and Portuguese Group (GEP) promotes standards via the International Society for Forensic Genetics (ISFG) and Latin American countries host a Latin American Working Group, as well as promoting national standards (CNP, 2001). In Brazil, the Brazilian Society of Legal Medicine established the first guidelines for paternity testing in 1999 (Bydlowski, Moura Neto, & Muñoz, 1999). The Integrated Network of Genetic Profile Banks (RIBPG) was formalized through the Law Decree No. 7950 of 12 March 2013. The RIBPG is intended to support criminal investigation and the identification of missing persons, and facili-

tate the exchange of genetic profiles obtained in official laboratories in the interests of justice (MDJ, 2014).

A number of publically available online databases have been established containing reference population data for autosomal STRs (NIST, 2016a), X-STRs (ChrX, 2016), Y-STRs (YHRD, 2016; Y-STR, 2016), SNPs (NIST, 2016b), and mtDNA (MITOMAP, 2016). The X-STR database (ChrX, 2016), for example, contains X-STR data for use in forensic practice, anthropological studies, and other genetic research. In the database, one can find various information such as genetic and physical location, repeat structure, nomenclature, allelic mutation rate, and population frequency of the STRs. Population data are classified according to one of seven metapopulations—Europe, Asia, Latin America, North America, Africa, Oceania-Australia, and Arctic—and imply information indicating ancestry. In addition, the site hosts software that calculates various statistical parameters of interest in forensic investigation.

22.10 Case Studies

22.10.1 Identifications of Joseph Mengele and the Romanov Family

One of the earliest applications of forensic DNA fingerprinting analysis in the identification of missing persons was in the notorious case of Dr. Josef Mengele of the Auschwitz death camp. Bones found in a grave in Embu, São Paulo, were examined by a Brazilian team,¹ who completed a biographic profile—estimating age, sex, ancestry, possible cause of death, and so on—from the remains. They noted a conspicuous injury to the right acetabulum, corresponding to a fracture of the superior margin which had ossified to form a spur. This injury was consistent with a motorcycle accident that Mengele was known to have been involved in. It was confirmed by orthopedic surgeons and pathologists to have been caused by

¹Dr. Daniel Munoz, Dr. Marcos de Almeida, and Dr. Moacir da Silva.

indirect injury due to a violent impact to the knee having been projected up through the femur to its socket in the pelvis. The resulting fracture is typical of those encountered following impact to the flexed knee while in a sitting position riding a motorcycle.

Histopathological analysis of a cavity observed in the right maxilla indicated inflammatory osteological reactions typical of a dental abscess. Repeated mixed agglutination tests showed the blood to type to be ABO-A, corresponding to the classification in Mengele's SS records (Dr. Marcos de Almeida personal communication). DNA was extracted from the femoral shaft of remains exhumed in Brazil by Jeffreys, Allen, Hagelberg, and Sonnberg (1992). Comparison with reference samples from Mengele's wife and son indicated a pattern consistent with paternity at 10 microsatellite *loci* with a random match probability in unrelated Caucasian individuals of 1 in 1800. The authors noted that their method was successful in overcoming the presence of strong inhibitors of PCR.

Gill et al. (1994) reported the genetic analysis of remains recovered in Ekaterinburg believed to be those of the Russian royal family, the Romanovs. In this analysis, both autosomal STR and mtDNA analysis were undertaken allowing the results compared with reference sequences obtained from a living maternal relative. The findings were consistent with the remains being those of the Tsar, Tsarina, and three of their five children. In a subsequent analysis of remains later found nearby, Coble et al. (2009) reported the probable identification of the two other missing Romanov children using mtDNA, and autosomal and Y-STR analysis.

22.10.2 Missing, Presumed Dead: A Fraudulent Insurance Claim

The family of an adult white male (DLF) notified the police of their son's disappearance. After a few weeks, a corpse that presented characteristics similar to those of DLF was found in

advanced stages of decay and was identified by the family as being DLF. The family then filed a claim for the life insurance that DLF had taken out just before he disappeared. Suspicions were raised about the identity of the corpse, because identification had been done only visually, and because the insurance policy had been taken out just prior to DLF's disappearance. The insurance company requested a *postmortem* examination for identification. As the corpse had been cremated immediately after identification by the family, biological material that was encrusted on two projectiles removed from the body was used for analysis (see Fig. 22.1). The dried blood provided enough genomic DNA for PCR-based typing of HLA-DQA1, D1S80, HUMCSF1PO, HUMTPOX, HUMTH01, D3S1744, D12S1090, D18S849, and amelogenin (Soares-Vieira, Billerbeck, Iwamura, Cardoso, & Muñoz, 2000, Soares-Vieira, Muñoz, Iwamura, & Billerbeck, 2001). Results of genotyping from the corpse presumed to be that of DLF were then compared with that of his alleged biological parents, revealing genetic incompatibility (Fig. 22.1).

22.10.3 X-STR Analysis in the Case of a Missing Child

Relationship analysis relies heavily on the understanding of genetic variation in the relevant population. In Brazil, issues of historical admixture require collection of data for local comparison—such as for X-STRs (Auler-Bittencourt, Iwamura, Lima, da Silva, & dos Santos, 2015).

Tables 22.1 and 22.2 illustrate a relationship analysis conducted using a 15 autosomal STR analysis with an additional 12 X-STR multiplex, offering further statistical resolution. Table 22.1 shows the results of autosomal STR analysis of the remains of a body believed to be a missing child, her paternal half-sister SMIP, her mother, and the reconstructed profile of the alleged father. Table 22.2 shows the results of X-STR analysis in the same case.

Fig. 22.1 (a) Two projectiles removed from the body of unknown identity; (b) D1S80 analysis showing the profile of the DNA extracted from blood sample encrusted in the projectiles (*lanes 2 and 3*); (c) the comparison of the DNA samples from the mother of DLF (*lane 2*), the father of DLF (*lane 3*), and one of the two projectiles (*lane 4*) (Copyright: Authors' own image)

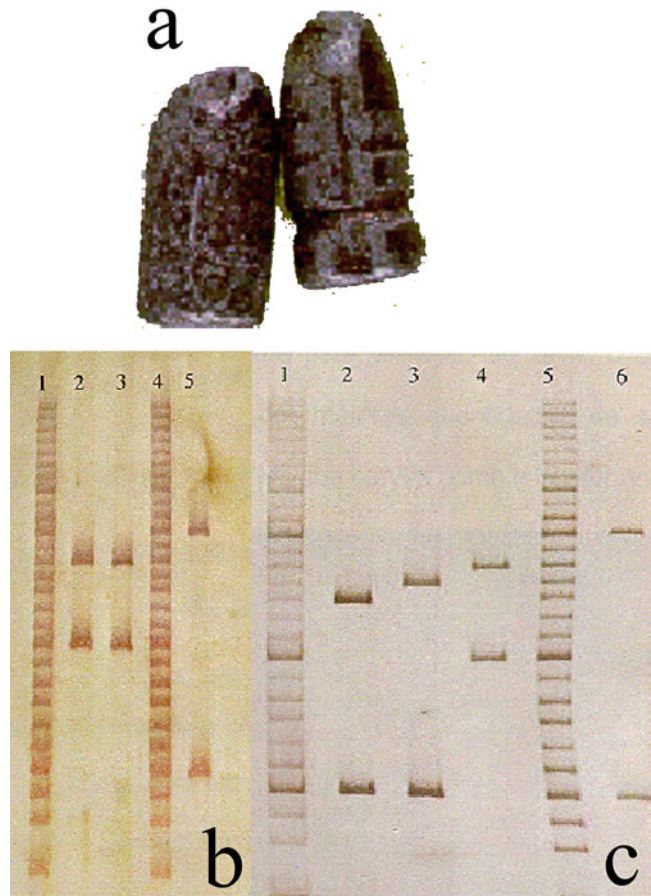


Table 22.1 Results of autosomal STR analysis

Locus	Mother of SMIP		SMIP		Reconstructed profile of alleged father		Remains of supposed missing child	
D8S1179	10	13	12	13	12		13	14
D21S11	28	31	29	31	29		29	29
D7S820	9	12	9	12	9/12		9	12
CSF1PO	11	12	12	12	12		11	11
D3S1358	15	15	14	15	14		14	16
THO1	6	7	7	10	10		9.3	10
D13S317	12	13	8	13	8		8	13
D16S539	12	14	9	14	9		9	14
D2S1338	19	20	19	22	22		19	20
D19S433	13	14	13	14	13/14		13	14
vWA	15	18	16	18	16		16	17
TPOX	8	11	8	8	8		8	8
D18S51	13	17	15	17	15		15	17
D5S818	11	11	11	11	11		11	12
FGA	19	23	19	23	19/23		20	22
Penta E	5	7	7	13	13		5	13
Penta D	10	10	10	22	22		12	22
AMEL	X	X	X	X	X	Y	X	X

Table 22.2 Results of X-STR analysis

Locus	Mother of SMIP		SMIP		Reconstructed profile of alleged father		Remains of supposed missing child	
DXS7132	13	15	11	15	11		11	12
DXS7423	15	15	15	15	15		15	16
DXS7133	10	13	9	10	9		9	11
GATA172D05	10	10	10	11	11		10	11
DXS7130	12	14.3	12	15.3	15.3		11	15.3
DXS6800	18	20	16	20	16		16	20
GATA31E08	10	12	9	12	9		9	10
HPRTB	13	14	12	13	12		11	12
DXS6789	21	21	21	21	21		20	21
DXS9898	8.3	11	8.3	12	12		11	12
DXS9895	13	15	14	15	14		14	16
DXS10011	39	39	39	42	42		36	42

22.10.4 Deficiency Paternity Testing in a Suspected Homicide Where No Body Has Been Found

Barbaro, Cormaci, and Barbaro (2006) report on the case of a girl who had been missing for several years in a case of deficient paternity testing—that is, when no reference sample is available for the supposed father. In this case, the authors used X-STR analysis to compare the profile of a sample of hair believed to have come from the girl with the profiles of her mother and sister. Analysis of the latter profiles allowed the X alleles of the father to be reconstructed, and the X-STR profile obtained from the hair—recovered from the premises of an individual implicated in another homicide—was found to share the same paternal X alleles, confirming identity in a case of “special reverse paternity” testing.

22.10.5 Missing Persons and Humanitarian Investigations

The latter part of the twentieth century saw a number of humanitarian investigations of alleged homicides committed during war or civil strife.

In 1999, Spain commenced official implementation of a program to try to identify human

remains from the Civil War of 1936–1939 that could not be identified by the use of traditional forensic methods. Recognizing the importance of accurate recording and retention of information, the Phoenix Program used two independent sources of mtDNA data that could automatically be compared and cross-matched at identical or similar sequences. Comparison was facilitated by the use of a reference database populated with sequences of mtDNA from volunteers who were maternal relatives of missing persons and a questioned database populated with mtDNA sequences obtained from the remains of unknown individuals (Lorente et al., 2001, 2002).

In Yugoslavia, 30,000 people are believed missing as a result of the conflicts of the 1990s. In 2000, the International Commission on Missing Persons (ICMP) was established in an attempt to carry out human identification through a network of agencies in the former Yugoslavia. DNA laboratories in Bosnia and Herzegovina, Sarajevo and Banja Luka initially focused on blood typing from reference samples using multiplex STR and mtDNA systems using a “dot-blot” method developed by Roche (Huffine, Crews, Kennedy, Bomverger, & Zinbo, 2001).

In Brazil, as in other Latin American countries, investigations have begun into alleged human rights abuses of the military governments of 1964–1985. In December 1995, President Fernando Henrique Cardoso signed Law 9140,

providing for “the recognition of persons missing as a result of participation or alleged participation in political activities in the period from September 2, 1961 to August 15, 1979”. In the intervening 20 years, numerous investigations have been undertaken including some supported by forensic DNA analysis. This has led so far to the identification of only two individuals among 437–475 formally acknowledged to be missing persons—the true number may be much higher—leading relatives of victims, lawyers, and other commentators to suggest that the Brazilian government is disingenuous in its claims to wish to offer justice to victims as part of the transition to democracy (Guimarães et al., 2016a; Guimarães et al., 2016b).

Also undertaken in Brazil is the Projeto Caminho de Volta (Pathway Home Project), directed at the identification of missing children and adolescents, many of whom have become homeless and involved in crime (CDV, 2016). This program also uses a database approach, in which an online system can be used to register the details of missing persons and their relatives, supported by DNA databases of profiles derived from reference. Although positive outcomes have so far been limited, the Brazilian integrated DNA database RIBPG (Rede Integrada de Bancos de Perfis Genéticos) is now being uploaded with CODIS profiles of missing persons by Brazilian Federal Police, which may be more promising for effective identification in future.

22.11 Conclusion

Applications of DNA technology in human identification and relationship analysis have grown rapidly since the work of Alec Jeffreys in 1985. Substantial efforts have been made to identify human remains following homicides and natural deaths, as well as following wars, internal conflict, mass disasters, and other cases of widespread fatality. In many cases, DNA analysis can provide a near-definite answer to questions of identification. Forensic genetics has a range of roles in missing person cases, including homicides and human rights related investigations. It is also important in

the investigation of living missing persons cases, including trafficked children and persons displaced due to conflict and migration. The forensic science processes do not occur in a vacuum, however, and their success is influenced by many political and socioeconomic factors.

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23.1 Trace DNA

23.1.1 What Is Trace DNA?

Trace DNA has been defined as ‘any sample which may fall below the recommended thresholds at any stage of the process—detection, collection, extraction, amplification and interpretation’ (van Oorschot, Ballantyne, & Mitchell, 2010). What defines trace will, therefore, depend on methodological developments and those employed. Trace DNA can come from relatively large quantities of biological fluids or tissues that have degraded due to environmental factors and time, or from relatively small quantities of biological sample where very little has been deposited, or the deposit was smeared over a wide area and only a small portion collected.

Given the sensitivity of current DNA profiling methodologies, biological trace samples targeted for collection are often not readily detectable with the naked eye. Invisible touch samples are often referred to as trace samples, and whilst in many cases they are, they can also often provide relatively high quantities of DNA (van Oorschot, Glavich, & Mitchell, 2014). What ‘trace’ is, therefore, requires context-specific definition in each case.

Wherever possible in missing person and disaster victim identification cases, the use of trace DNA should be avoided. Complications can arise from the low quantity and/or quality of material impacting on the ability to generate useful DNA profiles and complicating statistical evaluation of results. However, in some instances only trace material will be available. Methods to maximise its recovery and amplification success, and ensure the accuracy and quality of profiles, are described below.

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23.1.2 Sources of Trace Sample

The selection of appropriate items for recovery of DNA is critical in ensuring the success of subsequent profiling. If remains have been discovered, blood, muscle, bone and teeth can be targeted, all of which can provide large quantities of DNA. However, where fragmented and comingled remains are found, it is necessary to subsample remains, preferably from internal surfaces where contamination can be minimised. In extreme cases, post-mortem samples may be of a trace nature, particularly when the DNA has been affected by weather, burial, water, fire, chemical or animal/bacterial/fungal degradation (Alonso et al., 2005; Edson, Ross, Coble, Parson, & Barritt, 2004). In some cases, only traces of the victim may remain, in the form of blood stains, shed hairs or touched objects. Likewise, where high-quality ante-mortem reference samples are unavailable, it may be necessary to target items such as combs, clothing, used cups and cigarette butts (Prinz et al., 2007). In such instances, it is likely that only trace DNA amounts will be recoverable. Selecting samples based on likely amount of DNA present, and estimated profiling success, can help minimise time and cost of investigations. Table 23.1 provides a recommended hierarchy for victim, investigative and ante-mortem reference sampling. Samples taken from items in the moderate and low quantity or quality sections may result in trace DNA quantities.

Where possible, items which may be used by, or in contact with, multiple people should be avoided. Although commonly touched items and surfaces such as door handles and steering wheels may provide sufficient DNA for profiling, they are more likely to contain DNA from more than one individual, complicating interpretation. For investigative samples, to establish location, activity and in some cases timelines, standard forensic sampling strategies, analysis, and interpretation procedures should be followed.

Table 23.1 A rough guide for sample targeting to maximise DNA collection potential from personal items

DNA obtainable	Commonly available	Possibly available
High quantity & quality	Tooth brushes	Guthrie/PKU blood cards
	Razors	Laboratory specimens
Moderate quantity and/or quality	Hair brushes/combs	Used cups/glasses/drink bottles
	Pillowcases	Cigarette butts
	Inner clothing (underwear, socks, etc.)	Caps/hats
	Wallets/purses	Gloves
	Mobile phones	Eye glasses
		Lipsticks
Low quantity and/or quality		Watches
	Jewellery	Nail files/clippers
	Outer clothing	Firearms/tools
	Shoes	Lighters
	Towels	Cosmetic containers
	Backpacks/bags	Pens

Source: Data sourced from (Harbison, Fallow, & Bushell, 2008; Prinz et al., 2007; Raymond, van Oorschot, Gunn, Walsh, & Roux, 2009; van Oorschot et al., 2014 and unpublished data)

23.1.3 Impact of Using More Sensitive DNA Profiling Systems

The recent adoption of more discriminating and sensitive short tandem repeat (STR) DNA profiling systems such as PowerPlex 21 (Promega) and GlobalFiler (Life Technologies) provides the advantages of an improved ability to acquire profiles from trace samples and increased discrimination power. However, with these advantages come the greater likelihood of detecting background or contaminating DNA. This problem can be somewhat alleviated by appropriate sample selection and targeting, collection of substrate negative controls and reference samples from known other users to aid in determining

major component/user, and the use of continuous interpretation software to aid in mixture deconvolution.

23.2 Sample Collection Methods

23.2.1 General

The collection of trace DNA is dependent on the type of biological sample being targeted and the object and/or substrate it is located on/in.

Collection of samples from bone, teeth and hair are the subject of other chapters so here we will focus on trace samples originating from biological fluids (e.g. blood, saliva, semen), tissue samples or touch found on objects. These samples are commonly collected using swabbing or tape-lifting techniques. Swabbing tends to be the method of choice when collecting from hard non-porous surfaces, but can also be suitable when collecting from fabrics, particularly when the normal wearer's/user's profile is desired. Tape-lifting tends to be the method of choice when collecting from fabrics but can also be used when collecting from some hard surfaces.

Rather than either taping or swabbing stains from clothing, the clothing can be excised and DNA extracted directly from the stain. This may help increase overall DNA recovery but does damage the exhibit, which may not always be desirable. In instances where excision is not an option or where the object is porous or rough, an alternative collection method may be the use of the wet-vacuuming technique (Garrett, Patlak, Gunn, Brodeur, & Grgicak, 2014). Tape-lifting from clothing/fabric objects should predominantly be utilised when the last known wearer/user is desired as it is generally more efficacious at obtaining reduced mixtures compared to excising. When dealing with very small items such as ear-, nose- and tongue-studs, one can also consider extracting directly from the item.

23.2.2 Swabbing

Swabs need to be dampened with a wetting agent, usually sterile water, prior to swabbing and the

moisture left on the substrate should be collected by the initial swab or a second swab. Many use the double swabbing method (Pang & Cheung, 2007). However, the use of a dry second swab is unlikely to collect much additional sample if no moisture remains on the substrate. We recommend that in such situations the second swab is also slightly moistened and that swabbing continues until the whole surface area has been retraversed and no moisture is left on the substrate. Uncollected moisture is likely to contain suspended biological cells and/or DNA so should not be left behind. After being moistened the swab should traverse the whole target area, applying reasonable pressure, multiple times while holding it at an angle, and rotating regularly, to ensure maximum contact with the swab's surface area. Swabs should be either returned to their storage tube and frozen when still wet, or dried as quickly as possible in a vented tube, or otherwise contained, to avoid microbial growth and limit DNA degradation.

Several types of swabs are available. Differences relate to features such as swab material, swab size and shape, and design/packaging. Most perform well for collecting general biological samples but some perform better than others depending on the biological source and/or substrate it is on [Verdon, Mitchell, & van Oorschot, 2014a]. These efficiency differences can become relevant when targeting trace samples. It has been suggested that a forensic practitioner has multiple types of swabs at hand so that the best fit-for-purpose swab can be used in a given situation [Verdon et al., 2014a].

23.2.3 Tape-Lifting

There are also different types of tape that can be used to collect samples, although to a lesser extent than swabs. The main difference is their adhesive strength (Verdon, Mitchell, & van Oorschot, 2014b). Some tapes come in standard sizes whilst others are taken from a roll and can be configured into different sizes. Strips from rolls need to have the ends double folded to assist application and removal from surfaces. One needs to be cognisant of contamination risks and

careful when preparing these tape-lifts. It is important to be aware of the relative collection potential, the optimal number of times one should reapply a tape to the same area, and the surface area it can collect from effectively before further pick-up becomes very limited and the tape may require replacement depending on the total area to be collected from.

An alternative to a strip of tape with double folded ends is the use of stubs (De Bruin, Verheij, Veenhoven, & Sijen, 2012), i.e. the tape of a specific size is adhered to a disk which in turn is attached to a short stick and holder (as used in gunshot residue collection) that allows easy handling, consistent application of pressure and limiting contamination risk. The holder can cofunction as a lid to protect the collected sample during storage and before DNA extraction. Because tape lifting does not require the use of a wetting agent, there is no need to store tape lifts in containers with airflow to assist drying before or during storage.

23.2.4 Collecting Within Sample Boundaries

Knowledge of a stain's boundary is important as one should not collect beyond it. Firstly, if the target stain is on a surface that contains background DNA, this background DNA is likely to also be present beyond the boundary of the target stain. Presence of non-target DNA in any target sample may complicate profile interpretation and diminish its exclusionary or inclusionary power/capacity. The presence of interfering background DNA can be minimised by ensuring sampling remains within the boundary of the target stain.

Secondly, going beyond the boundary could lead to some of the target DNA collected by the device being transferred back to the substrate, in an area beyond the original boundary, and thus cause loss of some of the limited target DNA available. Transfer to the other areas of the exhibit could also contaminate other adjacent samples from potentially different sources that are to be subsequently targeted and collected.

23.2.5 Cell Targeting Within a Sample

In some instances the target cells may comprise a minor component within a mixture of biological sources collected and representing a sample for analysis. The DNA from each of the sources within a sample is co-extracted. Whilst sufficient DNA may be present to generate a profile if it was the only source, any amplified product derived from the minor component could be swamped by the major component(s) such that no or a limited profile of the minor component is observable. Methods such as laser microdissection [Vandewoestyne & Deforce, 2010; Vandewoestyne & Deforce, 2011] and FACS [Di Nunno et al., 2003; Schoell, Klintschar, Mirhashemi, & Pertl, 1999; Verdon, Mitchell, Chen, Xiao, & van Oorschot, 2015) are being developed to preselect cells of interest prior to extraction, however, further research is required before these can be applied to compromised samples. Although rarely relevant in missing persons investigations, collection of such mixed samples should be avoided and only be considered as a last resort.

23.3 DNA Extraction and Profiling

23.3.1 Extraction and Quantitation

There are various means of extracting DNA from the collection devices or directly from the object/excised material, including DNA IQ (Promega) and Prefiler (Life Technologies). Whilst all are adequate when dealing with samples containing plenty of DNA, each laboratory should optimise their extraction procedures specifically for trace samples to ensure as much DNA is collected from a sample as possible.

Furthermore, it is important that the collected DNA is contained within a small volume to provide the highest possible concentration of DNA. Depending on jurisdictional requirements, this may need to be balanced with the need to retain an appropriate minimum portion (e.g. 50%) of extract volume so that sufficient sample remains for additional profiling if required. As

most amplification kits allow maximum volumes of template DNA of 15–25 μL , final extract volumes should ideally be no more than 50 μL when dealing with trace samples.

When dealing with normal samples it is important to be aware of the DNA concentration within the extract so that the optimum quantity can be used as template DNA within the PCR reactions. Depending on the kits used, this optimum template quantity is usually approximately 0.5–1 ng. If unsure of the sample being trace, it can be useful to quantitate. If confident that you are dealing with a trace sample, one could argue to skip the quantitation phase and proceed directly with the amplification stage using the maximum volume as template. This approach has the added advantage of not wasting the 1 or 2 μL of DNA extract needed to perform the quantitation, but may lead to over-amplification if sampling has inadvertently collected non-trace level DNA.

It is important to note that as the profiling systems have become more sensitive, it is common to still obtain a profile from samples that gave a negative quantitation result using systems such as Quantifiler (Life Technologies). If knowledge of the quantity of amplifiable DNA within a trace sample is desired, the use of a more sensitive quantitation systems, such as Quantifiler Trio (Life Technologies) or PowerQuant (Promega), is recommended.

23.3.2 STR and SNP Profiling

The standard means of generating a DNA profile is PCR amplification of a set of core STR markers. Each of these is highly polymorphic and, when a series of independent markers are typed concurrently, or subsequently from the same source of template DNA, a DNA profile is generated that is extremely discriminating. Currently used common STR profiling kits such as PowerPlex 21 (Promega) and GlobalFiler (Life Technologies) include 20 and 22 autosomal STRs, respectively, that provide likelihood ratios in the realm of 1.0×10^{26} – 1.0×10^{27} . This makes them a very powerful tool to exclude or include a person as the source of the collected sample.

Furthermore, the previously mentioned kits are designed to readily generate profiles from small quantities of DNA (0.1–0.5 ng) even in the presence of substances that, when using older kits, inhibited the PCR. These new kits also include STRs that are shorter than the traditional amplicon size allowing profiles to be more readily generated from degraded DNA.

Improved sensitivity, overcoming inhibitors and inclusion of shorter amplicons in STR kits have reduced the need to consider the use of single nucleotide polymorphism (SNP) markers to generate profiles from degraded samples. In many instances the generation of a STR profile is preferable to SNP profiles for individualisation purposes. Most, if not all, criminal and missing person databases are composed exclusively of a core set of STR profiles, allowing easy and automated comparison between reference samples, evidentiary samples and post-mortem samples. Nonetheless, there may be instances where samples are so severely degraded that SNPs become the preferred means of generating a useful profile. For such situations, many more SNPs need to be amplified and typed than STRs because their individual discrimination power is less. There are, however, good SNP marker sets available, e.g. SNPforID 52plex (Sanchez et al., 2006). If typing the target sample using SNPs then the DNA from the persons and/or samples one wishes to compare the profile to will also need to be profiled using the same SNP markers.

23.3.3 Use of mtDNA for Severely Degraded Samples

If the samples are so severely degraded or template amount so limited that nuclear DNA STR and SNP markers are not readily obtainable, then mitochondrial DNA can often provide usable comparison data. This can be achieved by sequencing a segment of mtDNA or specific SNPs within the mtDNA (Kline et al., 2005). The profile may not be as discriminating as autosomal STRs or SNPs (because of the relatively limited variation within populations and the fact that mtDNA is maternally inherited) but is more

readily generated from degraded material because of its circular nature and high copy number within each cell (Kayser, 2007).

23.3.4 Use of Y-Chromosome in Missing Person Identifications

Another approach that can provide genetic information of probative value is the use of Y-chromosome STRs analysis available through the use of kits such Y-filer Plus (Life Technologies) or PowerPlex Y23 (Promega). This is especially useful when unable to detect, only partially detect, or unable to discern the male derived component when using standard autosomal STRs and SNPs (Roewer, 2009). Whilst the discrimination power of Y-STR analysis is not of the same magnitude as the series of autosomal STRs used, because they are less discriminating (individually and collectively) and because most of the Y is inherited as a single unit without recombination, the probative value is often still sufficient to assist investigations. Y-chromosomal information can also be used to rapidly eliminate individuals from belonging to a lineage in kinship analysis, to group victims based on shared Y-chromosome haplotypes, and to provide additional power to STR and SNP analysis. The inclusion of rapidly mutating Y-STRs in newer Y-STR kits allow both the linking of related males through the standard Y-STR panels, and increased probabilities of discrimination between both related and unrelated males with more polymorphic markers (Ballantyne et al., 2012; Ottaviani, Vernarecci, Asili, Agostino, & Montagna, 2015; Purps et al., 2014).

23.3.5 Statistical Evaluation of Trace DNA for Missing Person Investigation

The methods for statistical evaluation of profiles vary widely depending on the nature of the investigation and comparison. If adequate ante- and post-mortem samples are obtained, even if

composed of partial profiles, a likelihood ratio or random match probability may be calculated as per standard forensic procedures (Taylor, Bright, & Buckleton, 2013). However, if comparisons are conducted within a closed population (such as for disaster victim identification situations), if multiple related individuals are involved, or if kinship analysis is required for ante-mortem comparison, additional considerations and methods are required (Brenner, 2006; Brenner & Weir, 2003). All such evaluations are complicated by partial profiles, as are often typical from trace DNA.

A relatively high number of STRs are required to reach the desired threshold for DNA identification. For example, the use of nine highly polymorphic STRs was insufficient to provide definitive identification of related victims in an Australian bushfire (Hartman et al., 2011), while even 21 STRs were insufficient for a paternity case (Goodwin et al., 2004). When working with trace DNA, the likelihood of obtaining partial profiles of less than 21 STRs is high. In such cases, there are several possible options available to increase the probity of results: replicate amplifications and consensus profiles, the use of continuous interpretation software, combining STR, SNP and uniparental data, and the application of prior odds can all assist in cases of partial trace profiles.

The use of replicate amplifications for trace DNA analysis is common practice for many forensic laboratories, to ensure potential drop-in and drop-out do not result in false allelic inclusions or exclusions (Benschop et al., 2011). Likewise, continuous systems such as STRmix can deconvolute mixtures, or generate consensus profiles from replicates, without the loss of information from loci where dropout may have occurred. For partial profiles, such methods can greatly increase the usable information (Taylor et al., 2013).

In cases where suitable autosomal STR profiles cannot be generated, it is possible to combine information from STRs, SNPs, mtDNA and Y-STRs to calculate a combined probability of identity. Information from some of these marker types were combined for samples from victims of

World Trade Centre disaster (Biesecker et al., 2005). Automated systems such as Bonaparte (van Dongen, Slooten, Slagter, Burgers, & Wiegerinck, 2011) can calculate pedigree likelihood for both closed systems, where reference samples are available, and from missing person databases utilising both autosomal and uniparental markers.

For trace DNA, and the partial profiles obtained from it, the use of prior odds in the calculation of the probability of identity can greatly assist in identification. It is common in mass disaster identification situations to use the number of victims to effectively reduce the candidate pool, but additional independent information such as post-mortem interval, eye-witness accounts, gender and phenotype can also be used (Budowle, Ge, Chakraborty, & Gill-King, 2011).

23.4 DNA Contamination

23.4.1 General

DNA contamination events involving those who may have come into close proximity and/or handled an object being sampled post-deposit and pre-sampling, as well as any post-sampling contamination, can potentially damage the value of the sample collected. Such DNA contamination events have become more readily detectable due to use of more sensitive typing systems.

23.4.2 Sources of Contamination

Extraneous DNA can easily be unwittingly added to the target sample during examination, collection and/or processing of the item from which the biological sample is being collected for DNA profiling. This contamination can occur through handling without gloves, handling with dirty gloves, speaking or coughing over it without wearing a mask, holding it against unclean clothing, placing it on unclean surfaces, touching it with unclean tools or processing it in non-DNA free tubes and solutions (Ballantyne, Poy, & van Oorschot, 2013; Poy & van Oorschot, 2006;

Szkuta, Harvey, Ballantyne, & van Oorschot, 2013). Detection of any contaminating DNA is more likely when the target sample is of trace origins and when more sensitive profiling methodologies are employed.

Inappropriate packaging of exhibits is a further contamination risk. Combining multiple exhibits within the same packaging increases the risk of DNA being transferred from one exhibit to another (Goray, van Oorschot, & Mitchell, 2012). Such an occurrence is usually highly undesirable. It is important that exhibits be packaged in a manner that limits transfer of DNA from one area of the exhibit to another area of the same exhibit or to the inside of the packaging. The latter could mean the loss of potentially useful DNA to the extent that the sample collected from the exhibit becomes trace in nature, reducing the chance of acquiring a full DNA profile.

The conduct of non-DNA related examinations on an item prior to sampling for DNA—such as fingerprinting, drug sampling, document examination, and some damage analyses—increases the risk of DNA contamination due to: (A) extra handling of the exhibit; (B) contact with tools that may not be DNA-free, e.g. fingerprint brushes [van Oorschot, Treadwell, Beaurepaire, Holding, & Mitchell, 2005] and (C) specialists within non-DNA related disciplines not always being as familiar with and/or attentive to procedural requirements to limit DNA contamination risk. If the retrieval of trace DNA is attempted, knowledge of prior examinations and how they were conducted will be beneficial when evaluating any profiles obtained through DNA analysis.

23.4.3 Impact of Contamination

Any contaminating DNA can create a mixture profile, which decreases the probative value of the target sample. Contaminating DNA may mislead investigators to think that multiple individuals are involved in an event or mistakenly think that the sample is from someone else, misdirecting valuable resources and potentially leading to inappropriate, incorrect or less definitive conclusions.

23.4.4 Means of Limiting Contamination

Contamination risk post-deposition of the target DNA can be limited by applying appropriate risk limiting procedures. These include:

- Limiting access to scene, exhibit and examination areas.
- Collect samples as soon as possible after discovery and as a priority relative to most other types of examinations.
- If an exhibit requires packaging ensure that each exhibit is packaged separately and appropriately.
- Wearing of appropriate personal protective equipment, including mask, gown and gloves.
- Changing of used gloves prior to touching any exhibit. Assume gloves are dirty any time after touching the exhibit, self or any object that is not DNA-free.
- Regular changing of mask and gown.
- Ensure any surface an exhibit is placed on is DNA-free by appropriate cleaning and/or use of DNA-free underlays.
- Ensure all tools coming in contact with the areas to be sampled are DNA-free.
- Assume that paperwork, pens and keyboards are not DNA-free, thus limit contact with them during examinations and change gloves after use prior to retouching exhibit.
- Minimise handling of exhibit and try to restrict handling to areas not to be sampled.

Furthermore, the negative consequences of post-deposition derived contamination can be limited by initiatives that will facilitate its detection as well as root-cause analyses:

1. Employment of negative controls in as many steps as possible within the analytical process.
2. Ensuring that records are kept of all individuals who had contact with the relevant item/sample since discovery (including who, when and where).
3. Accumulation of DNA profiles of the same type (i.e. using the same genetic markers that

were generated from the sample), from all investigators/handlers and others that have access to the examination areas, on an accessible elimination database. Follow this by checking the profile of the sample against the database for the possibility that it originated from any individuals on the elimination database.

4. Checking the profile against other profiles generated from items examined just prior to the item in question by the same examiners and/or in the same locations.

23.5 Use of Trace DNA in Missing Persons Investigations

23.5.1 Disaster Victim Identification

DNA profiling methods have contributed significantly to disaster victim identification operations over recent decades. This has been assisted by the ability to acquire ante-mortem (AM) profiles from trace DNA samples from personal objects as well as post-mortem (PM) profiles from tissue samples that may have been compromised by environmental factors such as fire and water. Success in acquisition of AM and PM samples is however dependent on the circumstances. For example, the collection of AM samples was made difficult in the 26th of December South-East Asia Tsunami as a result of many personal effects being swept away from their possession as well as their homes (locals) or accommodation (tourists). AM samples were, however, still collected from the homes, schools or workplaces of many of the foreigners in their country of origin (Wright et al., 2015; Wright, Mundorff, Chaseling, Maguire, & Crane, 2015). Relative to some other disasters, where the PM samples can be difficult to acquire due to fragmentation of the bodies and/or severely compromised by fire, the PM samples in the South-East Asia Tsunami DVI process were more readily obtainable as the bodies were still whole and not compromised by the effect of the water and heat (Wright, Mundorff, Chaseling, Forrest, et al., 2015; Wright, Mundorff, Chaseling, Maguire, et al., 2015).

23.5.2 A Missing Person Case

On December 6, 1995, the body of 17-year-old Krystal Lynn Beslanowitch was found along the Provo River near Midway in Utah, USA. A granite rock with fresh blood stains was found close to her body and assumed to be the murder weapon. At the time limited evidence was available and there were no solid leads or suspects. The case went cold but the bloodied rock was retained.

Over time DNA typing techniques improved, as did the awareness of the ability to acquire profiles from touched objects, so in 2008 a sample was taken from the rock in the hope of collecting sufficient ‘touch DNA’ to produce a DNA profile of the handler of the rock. A partial profile was generated. In 2013 other DNA samples taken from Beslanowitch’s body generated profiles that were matched to Joseph Michael Simpson, whose DNA profile was available as a consequence of a previous conviction. Soon thereafter, with the availability of a new technology that allowed for better collection of available DNA from objects like rocks, the rock was resampled using the M-Vac system (Bradley, 2014; M-Vac Systems Inc, 2013). This yielded sufficient DNA to generate a full profile using the then current profiling system.

To increase the weight of evidence a fresh sample from Simpson was required that could be compared to the newly acquired full profile generated from the rock. To obtain such a sample a covert sample was collected from a butt of a cigarette he had been smoking.

Using the fresh evidence collected from trace samples Simpson was charged with murder.

23.6 Conclusions

Many samples that may be helpful to missing persons cases are not trace samples and these should be preferred before contemplating the need for trace samples. However, when the collection of trace samples is the last resort, recent improvements in collection options and developments in the sensitivity and discrimination power

of available DNA profiling kits means that this can be very rewarding. When dealing with trace samples, appropriate sample collection and processing methods need to be applied, care must be taken to limit contamination, and good record keeping and availability of an all-inclusive DNA elimination database are essential.

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The Advantages of Noncriminal Genetic Databases in Identifying Missing Persons and Human Remains

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24.1 Missing Persons Identification

Missing persons and unidentified human remains constitute a major global problem. In recent years, many studies and governments have addressed the issue of missing and unidentified human remains. Forensic DNA databases are now well established in many countries in the world. Rules on what data can be collected and

stored and how it can be used differ greatly between different countries. As DNA sequencing technology advances and becomes cheaper, there are plans to set up new databases or expand existing databases in many countries.

24.1.1 Forensic Genetics and Challenging Samples

Since the advent of forensic DNA analysis, there have been two main objectives: (1) the identification of those who could be the source of biological evidence, which includes associations of individuals due to some alleged kinship and (2) to exclude individuals wrongly associated with evidence. The generation of reliable genetic profiles from unknown and reference samples, systematic and objective interpretation practices, and a statistical evaluation of the results are tantamount to a robust forensic DNA identification program. These criteria were envisioned 25 years ago by the scientists that developed this field. Moreover, the standards of practice used for forensic DNA typing are dramatically impacting in a positive way by increasing the standards of criminalistics. Concepts and topics related to quality control and assurance, method validation, proficiency tests, documentation, and statistical evaluation, etc. are being evaluated by forensic scientists in other disciplines to improve quality and reliability of their areas of forensic science. A further

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discussion on the direction of the forensic sciences can be found in the National Academy of Science Report on *Strengthening Forensic Science in the United States: A Path Forward* (Edwards & Gotsonis, 2009).

Because of the success of forensic genetics in identification of sources of biological evidence, developmental and innovative progress continues with more expectations of assisting investigators. Some future endeavors include genetic predictions of the phenotype of an individual derived from: DNA profiling of human remains, blood stains or other biological samples; determination of factors related to cause of death; improved capabilities to type severely damaged biological samples; the ability to use maternal circulating blood in order to genotype an unborn fetus; the discovery of novel genetic markers for identity testing and bioancestry; and estimation of time of death based on mRNA analysis. These potential applications were not too long ago the substance of science fiction. However, current efforts to continuously expand existing genetic databases in order to develop investigative leads in real-time are driving developments in human DNA identity testing. Large databases house DNA profiles from convicted felons (and in some jurisdictions arrestees), from forensic evidence, human remains, and personal and family reference samples of missing individuals. There is a demand to further expand the scope of these databases to help develop more investigative leads for solving crime. This need has motivated the community (government, academia, and industry) to work collaboratively to develop and validate standard DNA typing kits that contain the reagents necessary to type core identity genetic markers and the concomitant automation of a number of processes (extraction, quantification, amplification and to some degree interpretation of the results) to facilitate genotyping. The ability, for example, to type a reference blood or buccal sample without extracting the DNA away from interfering compounds would not have been imagined possible a few years ago and yet today such technology is readily available (Carpi et al., 2011; De Vargas Wolfgramm et al., 2009).

24.1.2 Strategies for Missing Persons Identification

The identification of human remains belonging to missing persons is one of the main challenges for forensic genetics globally. In situations when other forensic techniques (e.g., dactyloscopy, anthropology, odontology, medico-legal examinations) provide limited information to support or refute potential associations, DNA typing can be extremely valuable. Human DNA, in theory, can be recovered essentially from any tissue (e.g., soft tissues, bones, teeth, and hair) provided that these biological samples have not undergone considerable decomposition and contamination. Human remains are exposed to myriad environmental insults, as occurs with all forensic biological evidence. The result is that samples can be limited in quantity, degraded, and contain contaminants that affect the ability to DNA type the samples. The often-compromised samples that are encountered in missing persons identification are bones, teeth, and hair, as well as poorly preserved corpses such as those found in water, buried, or burned. It is very challenging, if not impossible, to extract genetic information from severely compromised DNA samples.

To expand DNA typing capabilities on such challenging samples efforts are underway to extract more DNA from these materials, repair damaged DNA to generate more viable templates, improve the PCR conditions to overcome troubling stochastic effects, and develop alternate protocols for enhancing sensitivity of detection. Understanding the mechanism of degradation processes can provide insight into avenues for repairing DNA. Currently, attempts to repair DNA have come primarily from the ancient DNA arena where there is a greater chance that the bases in the DNA have been chemically altered.

In addition, because persons of the same family—and those of their extended families, such as uncles, cousins, etc.—share more genetic variants than unrelated individuals, relatives can provide reference samples for the identification of unknown samples to develop potential investigative leads for law enforcement through familial

searching. Lastly, DNA analysis can be a powerful exculpatory tool eliminating wrongly associated individuals, reducing the number of suspects for a crime, and redirecting resources to more viable avenues of investigation.

24.1.2.1 Autosomal STR Markers for Missing Persons Identification

The standard genetic markers used in essentially every forensic DNA typing laboratory in the world are autosomal short tandem repeat loci (STRs) (Kimpton et al., 1993; Phillips et al., 2011). The standard operating procedures employ a set of 10–17 STR loci, which provide a high level of genetic diversity and resolution for identity testing (Collins et al., 2004; Cotton et al., 2000; Krenke et al., 2002). Several STR database systems have been created, including the Combined DNA Index System (CODIS) utilized in the United States. This system currently uses a standard set of 13 STR loci, which are highly polymorphic, genetically unlinked and reside in noncoding regions (Budowle et al., 2001). Commercially available kits, such as AmpFLSTR® Identifiler® PCR Amplification Kit (Life Technologies, Foster City, CA), or the PowerPlex® 16 System (Promega Corp., Madison, WI), enable analysis with high quality materials and forensic samples. These kits, and STR loci, have been used extensively for identification of human remains as well as in kinship cases, such as paternity testing and family reconstructions. These STR alleles are routinely analyzed by multiplexed PCR followed by capillary electrophoresis (CE)-based separation (Jobling & Gill, 2004). New kits have been developed combining CODIS markers and the ones included in the European Standard Set and highly polymorphic markers as SE33 locus such as AmpFLSTR® NGM Select™ (Life Technologies, Foster City, CA), PowerPlex® 21 System (Promega Corp., Madison, WI) or Investigator ESSplex SE (Qiagen, Hilden, Germany). Furthermore, kits including autosomal STR markers plus autosomal INDELs and Y-chromosome STRs are now available (GlobalFiler® STR (Life Technologies, Foster City, CA) and PowerPlex®

Fusion Systems (Promega Corp., Madison, WI)). However, it is important to set up standard protocols of STR typing in order to create global DNA databases and worldwide identification of missing persons.

24.1.2.2 Lineage Markers for Missing Persons Identification

While these STRs apply to the majority of biological evidence analyses, there are situations where autosomal STRs cannot yield sufficient information. Evidence, such as mixtures with a large amount of female DNA and a small amount of male DNA, and kinship cases where the reference sample derives from a relative separated several generations from the individual of interest require other markers, e.g., Y chromosome and X-chromosome STR markers or mitochondrial DNA (mtDNA).

Lineage-based systems provide additional power because of their unique biological qualities compared with autosomal markers. Additionally, when performing familial searching, i.e., searching for relatives of the true source of the sample, these lineage markers are extremely useful for reducing the number of adventitious associations in candidate lists.

mtDNA sequencing is used to strengthen the genetic evidence when there are maternal relatives available to serve as references (Alvarez et al., 2007). mtDNA, inherited through the maternal line, has a special property that makes it particularly useful for samples that are severely degraded and/or of limited quality, such as human remains in missing persons and mass disaster cases. There are hundreds to thousands of mtDNA molecules in a cell, compared to only two copies of nuclear autosomal genetic markers (Carracedo et al., 2000). Thus, when STR typing does not yield a result, there still is a good chance to obtain a result via mtDNA typing. mtDNA typing is invaluable to missing persons identifications. But it is a laborious, costly, and time-consuming process. New technology exploiting electrospray ionization mass spectrometry with the PLEX-ID system (Abbott) enables automated, high throughput mtDNA analysis (Ivanov, 2010). A power of discrimination

approaching that of Sanger sequencing is achieved but with a much reduced cost. In addition, some of the vagaries of mtDNA sequencing, such as the inability to analyze heteroplasmic regions and mixtures, are overcome with the PLEX-ID (Ivanov, 2010).

A few Y-STRs together with autosomal STRs can provide a higher expected likelihood ratio in kinship analyses than only autosomal STRs and still maintain a sufficient discrimination power of direct comparisons of single source profiles (Hares, 2012). An increased number of Y-STRs may improve the efficiency of familial searching. On the other hand, in missing person cases, distant male relatives can be good references with their lineage-based Y-STRs. Due to its block inheritance and haplotypes, Y-STR profiles can be used in a familial search in geographical areas with limited immigration (Ge et al., 2014).

24.1.2.3 SNPs for Missing Persons Identification

While the autosomal and lineage markers provide a high level of diversity and resolution for identity testing, compromised samples may not contain sufficiently long enough template molecules to yield results with the current format kits. Therefore, alternate genetic markers that may be more applicable to degraded DNA are being sought. SNPs variation is restricted to a small site of the genome. Thus, the amplicon generated that captures the SNP can be smaller in size than those generated for STRs. Because it is feasible to reduce the amplicon size for SNP typing to only 60–80 base pairs in length (Consortium, T.E.P., 2007), much more degraded DNA samples can be typed than with the mainstay STRs. A single SNP is not as informative as a single STR locus is; most SNPs are bi-allelic. However, technology exists to multiplex a large number of SNPs to obtain identity-testing power equivalent to that afforded by using multiplex STR kits.

The SNPs can be divided into five classes (Budowle & van, D. A., 2008) based on their application: *Identity Testing SNPs*, which are those that have the desired features of high heterozygosity and low-population heterogeneity; *Lineage Informative SNPs*, which are sets of

tightly linked SNPs that function as haplotype markers or as pseudo-STRs and are particularly useful for kinship analyses (Dario et al., 2009; Ge et al., 2010); *Ancestry Informative SNPs*, which are SNPs that differ substantially in frequency in population groups and can be used to reconstruct an individual's biogeographical ancestry (Daniel et al., 2009); *Phenotype Informative SNPs*, which are SNPs that can be used to directly reconstruct an individual's phenotypic characteristics, such as skin (Anno, Abe, & Yamamoto, 2008), hair (Fujimoto et al., 2008; Medland et al., 2009), eye pigmentation (Walsh et al., 2011), height, and facial features; and *Pharmacogenetic SNPs*, which are SNPs that can be used to determine cause and manner of death based on an individual's genetic predisposition to triggering risk events (Kashyap et al., 2014). The forensic DNA field is investigating these markers, and we fully expect SNPs to be an important part of the forensic DNA repertoire in the not too distant future.

24.1.2.4 Future Needs and Developments in Forensic DNA Analysis

Lastly, the capabilities of next generation (or actually better termed current generation) sequencing have improved, and costs have dropped dramatically. The examination of large parts of the genome will make interpretation of difficult mixtures easier and will facilitate research to identify the next generation of forensic markers. Furthermore, the simultaneous recovery of the standard autosomal DNA, mtDNA, and X and Y chromosome markers regularly assayed in forensic genetics, along with additional markers of interest, may be possible with these new technologies (Hancock-Hanser et al., 2013; Scheible et al., 2014). Already, whole genome sequencing has been shown to be effective for microbial forensic investigations (Xue & Tyler-Smith, 2010). However, with these more resolving and greater depth tools, there is a concomitant gathering of private or personal data. Serious thought should be given to the degree of information that should be typed and/or disclosed.

Next Generation Sequencing (NGS) can generate individual sequences of the alleles present

in a STR amplicon mixture (Van Neste et al., 2012). More identifiable alleles mean more statistical power of the STR investigation and essentially reduce the necessary number of loci that need to be typed to solve a case to a certain level. Recent studies have evaluated the use of next generation sequencing of STRs in forensic science (Bornman et al., 2012; Scheible et al., 2014; Van Neste et al., 2012). Sequencing of D21S11 allele in Danish population revealed different sequences of alleles of identical lengths (Rockenbauer et al., 2014). The possibility to distinguish between individuals with identical allele lengths as far as the characterization of mutation events could be essential in forensic or kinship analysis.

Historically, the so-called hypervariable segment 1 (HVS-1) of the mitochondrial control region, the only larger noncoding region in the mtGenome, was targeted providing a random match probability (RMP) of roughly 1 in 30 individuals. With the entire mtDNA control region, the RMP augmented to 1 in 120 and has provided useful evidence in many cases. The extension to analyze the entire mtGenome is a logical consequence and desirable goal to maximize the information content of mtDNA analyses (Irwin et al., 2011). With mtDNA, NGS allows the obtaining of entire mtDNA genome sequences when only a small portion of the genome is sequenced and at a fraction of the cost of traditional approaches, in addition to small amounts of samples (Miller et al., 2013). In the case of mtDNA, Sanger capillary sequencing of whole mtDNA was until recently the only method to detect variants. However, this technology employs an expensive and time-consuming technique (Parson & Bandelt, 2007). New series of next generation sequencing mitochondrial solutions are been developed by Life Technologies to analyze missing persons or human remains by getting more information from challenging samples. Ion Torrent™ next-generation sequencing and Ion AmpliSeq™ technologies are used to developed simple, scalable, and fast solutions to create forensically relevant panels and reporting tools.

In addition, SNPs multiplexes have been developed in order to predict eye color (IrisPlex)

(Walsh et al., 2011) and eye and hair simultaneously (HIrisPlex) (Walsh et al., 2014). The multiplexes plus prediction models developed from individual genotypes and phenotypes datasets can correctly predict human blue and brown eye color with >90 % precision (Walsh et al., 2011) and hair color with accuracy of 79 % (Walsh et al., 2013). Developmental validation has been performed and guidelines have been followed to assess the use of these new kits to be used in certified forensic laboratories and their implementation for missing persons identification (Walsh et al., 2014).

The use of both new alternative genetic markers and novel technology platforms will increase are abilities to type biological evidence, make stronger associations with kinship analyses, and allow for greater use of genetic databases. These are exciting times for the forensic science field. The needs to enhance typing are likely to continue to drive innovation, and the field will continue to grow and become integral to more investigations.

24.2 Genetic Databases

The use of different genetic markers and/or discrepant software can block up the scientific efforts in missing persons cases. Although legal infrastructures grow slowly, there is no reason for the lack of implementation of the analytic tools and databases to identify missing children (Crimes, 2009; UNODD, 2009). Once the political resources for a universal use of genetic data are implemented, these acts will facilitate the fight against human trafficking.

Molecular biology techniques based on the analysis of DNA are necessary for the implementation of a system based on genetic databases for missing persons and the identification of children. Using DNA to trace people who are suspected of committing a crime has been a major advance in policing. When DNA profiling is used wisely, it can help to convict people who have committed serious crimes or exonerate people who are innocent. However, concerns arise when individuals' tissue samples, computerized DNA

profiles, and personal data are stored indefinitely on a DNA database. There are concerns that this information could be used in ways that threaten people's individual privacy and rights and that of their families.

Scientific and technical advances have generated such an amount of information that has to be kept organized and rationally for its future uses. That is why databases play an important role as a place to collect all type of information that will be recovered automatically according to some parameters previously set. The access to these databases is more or less restricted, depending on the importance of the data included. The most protected ones are those containing information about the "identity" of the people (Lorente et al., 2000, 2001; Lorente, Alvarez et al., 2002; Lorente, Entrala et al., 2002).

Forensic DNA databases are indispensable tools of the law enforcement system (Ge et al., 2014). Forensic DNA databases are now well established in many countries in the world. Rules on what data can be collected and stored and how it can be used differ greatly between different countries. As DNA sequencing technology advances and becomes cheaper, there are plans to set up new databases or expand existing databases in many countries.

A DNA database is a computer database containing records of DNA profiles. Genetic databases follow a strict alphanumeric code associated to the identification code of each individual. The access to these data has to be thoroughly controlled and the conclusions derived will depend on the software accepted by the laws.

According to the content of these databases, they can be differentiated as:

Criminal forensic databases: Information about accused or condemned people is kept, as far as biological traces found in the crime scene. In some cases, known victim profiles can be incorporated to facilitate crime resolution. The crime scene profile might match with stored DNA profiles from other crime scenes, indicating a link between these crimes. Or it might match with an individual's DNA profile, suggesting that they could be a suspect for the crime. When a new DNA profile from an individual is added to the

database, it is searched against all the stored crime scene DNA profiles on the database. Again, a match may indicate that the individual may be a suspect for the crime. This process is known as "speculative searching," and it results in reports of matches that can be sent back to the police for further investigation ([Forensic Genetics Policy Initiative, n.d.](#)). The main characteristic of these databases is that some of the samples and the data are obtained without an informed consent of the individuals. Crime scene DNA profiles must be stored with information about when they were collected and where they came from or linked to databases which contain this information by a crime reference number.

Civil forensic databases: the final objective is the identification of missing persons comparing the non-identified DNA with their relatives. Due to their humanitarian characteristics, the relatives have to collaborate voluntarily after an informed consent following Helsinki's recommendations.

National and international protocols have to be created to easily identify corpses and human remains through genetic databases. Four basic requirements have to be followed:

1. The analysis must be based on standard protocols and genetic markers must be universally accepted.
2. The results have to be reliable (all laboratories and techniques have to pass exhaustive quality controls; GITAD, ISFG-GEP, etc.).
3. Technology employed has to be easily automated to facilitate huge number sample typing and intra/international comparison.
4. Data must not give any personal or confidential information about the individuals. Genetic civil databases have to be treated according to national laws; data have to be disassociated and with a restricted access, informed consent of all donors has to be obtained, and human remains have to be managed under judicial commands (Alvarez-Cubero et al., 2012).

Some countries keep databases only of crime scene DNA profiles, but others also keep databases of individuals' DNA profiles. As of May 2013, China and USA maintain the two largest

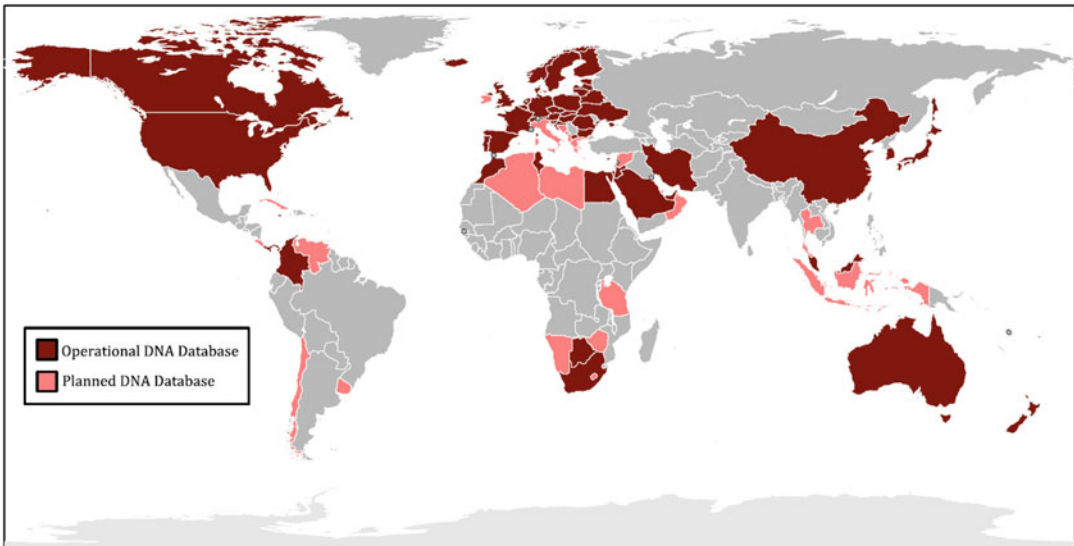


Fig. 24.1 World map of countries with DNA databases (Thibedeau, 2011)

forensic DNA databases, with more than 20 and 12 million profiles and have produced over 410,000 and 185,000 matches, respectively (Ge et al., 2014). In 2005, started the creation of a national Belarus DNA database and to date, 564 profiles have been included in the questioned database, and 4500 profiles of relatives of missing people have been incorporated in the reference database (Borovko et al., 2009, Fig. 24.1).

24.2.1 International Noncriminal DNA Databases

24.2.1.1 Phoenix Program

In November 1998, the Spanish Ministry of the Interior supported the implementation of a national program to identify cadavers and bones from missing persons by the Guardia Civil as part of an initiative from the University of Granada. The initiative was named the “Phoenix Program” (Programa Fénix, in Spanish), a name from classic Greek mythology that is consistent with the program’s objectives. This was an innovative program, no previously nongenetic database with this purpose existed (Lorente et al., 2000, 2001; Lorente, Entrala, et al., 2002).

The Phoenix Program contains two independent databases namely the Questioned Database that contains STR profiles and mtDNA sequences from bone samples that could not have been identified by classical methods, e.g., fingerprinting, anthropological parameters, odontology, X-Rays, etc. (Lorente et al., 2001; Lorente, Entrala, et al., 2002) and the Reference Database that contains STR profiles and mtDNA sequences from known relatives of missing persons. Only DNA obtained under informed consent of its donors is kept in this database. The databases store genetic data that may be automatically searched on a regular basis to associate matching or related DNA profiles, such as those from unknown remains and reference samples from relatives (Collins et al., 2004; Consortium, T.E.P., 2007).

The general procedure is shown in Fig. 24.2. Only persons who follow the valid informed consent protocol formulated for the program are allowed to participate. Participation includes the submission of two reference buccal samples. People who have reported missing relatives were requested to contact the Phoenix Program by calling a toll-free telephone number. For each missing person, a minimum of two up to four relatives are sampled. All samples are bar-coded

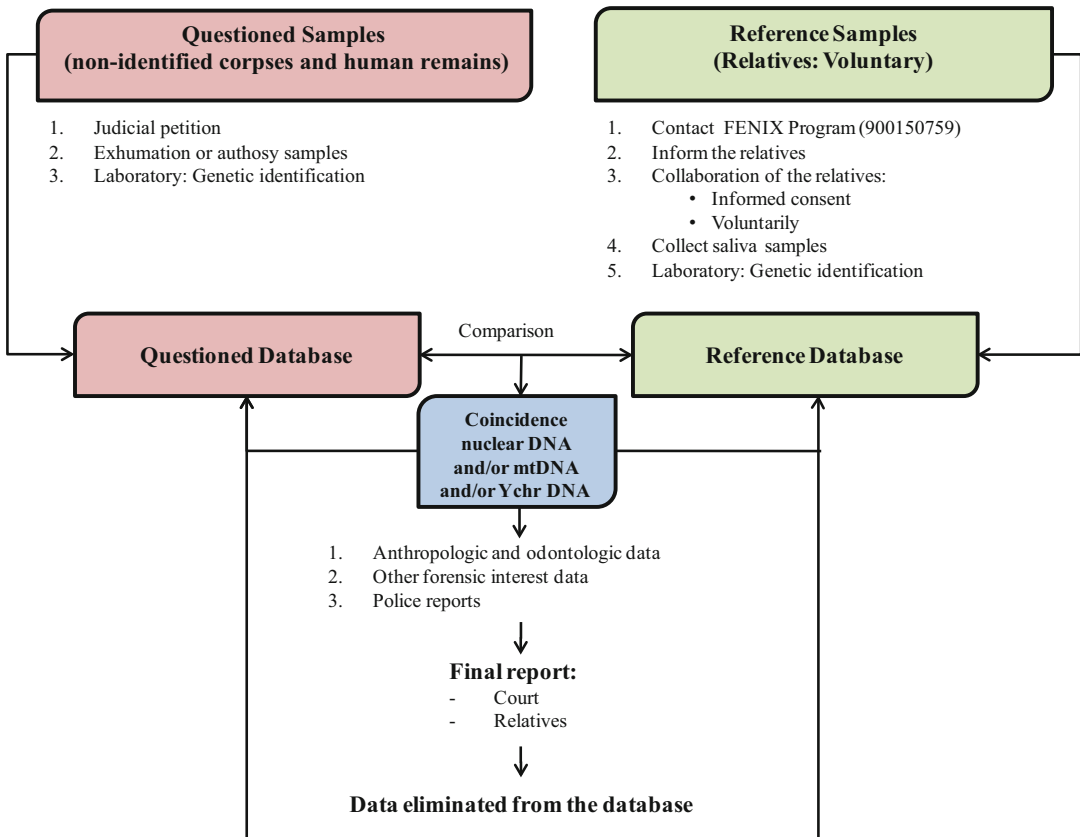


Fig. 24.2 Identification of corpses and human remains in the PHOENIX Program (Copyright: Authors' own image)

and subsequent genetic data are likewise coded to maintain confidentiality and to reduce the possibility of misusing genetic data for purposes other than identification. For inclusion in the Questioned Database, the Guardia Civil's trained personnel typically collects two to four fragments of consisting of 25 g of compact bone and/or teeth from unidentified human remains.

Autosomal STRs and mtDNA analyses are routinely performed. In cases requiring additional information, such as when a maternal reference sample is not available, Y-chromosome STRs may be included. STR typing is facilitated due to the availability of multiplex commercial kits, e.g., PowerPlex[®]16 kit (Promega Corp. Madison, WI, USA), and the AmpFIST R[®] Identifiler[®] PCR Amplification Kit (Life Technologies—Applied Biosystems, Foster City, CA, USA) that are used to generate DNA profiles

of up to 15 STRs in a single reaction, and a gender determination marker known as amelogenin. More recently, these two commercial kits were modified to include the amplification of shorter fragments of the same genetic markers that enhanced the sensitivity of detection resulting in better data recovery from degraded samples. The inclusion of genetic markers, included in the US FBI prescribed Combined DNA Identification System (CODIS) in both kits, which are now used in many countries, facilitate cooperation among different laboratories and law enforcement agencies in order to conduct investigations more effectively. This is particularly important when dealing with transnational crimes such as human trafficking that affect more than one country or locality.

For mtDNA analysis, DNA from two maternally related individuals is extracted from buccal

swab samples and sequenced for the two most polymorphic regions of the mtDNA genome. The regions are the hypervariable region 1 (HV1) and hypervariable region 2 (HV2) of the control region or D-loop of the mtDNA genome. To date, more than 3700 families have contacted Phoenix, more than 850 have enrolled in the program, and at least 319 unidentified remains have so far been identified and returned to their relatives. When mtDNA and/or STRs associations are found, a second independent analysis is performed as part of the quality assurance process.

Nationally and internationally compatible protocols leading to identification of human remains or skeletons ideally will require the use of databases that meet four basic requisites, as follows:

1. Analyses have to be based on standard operating protocols and universally accepted genetic markers.
2. Results must be reliable (laboratories and techniques are subjected to quality assurance and quality control programs).
3. The technology should be amenable to automation to facilitate the typing of the anticipated large volume of samples and to allow intra- and international searches and comparisons.
4. The data provide little or no personal or confidential information about the individual(s). Proper use of the database according to national laws, dissociation of data, restricted access, informed consent from voluntary donors, and court orders to handle human remains are among some of the requirements of Spanish database management.

The Phoenix Program is using DNA to develop associations between relatives of missing persons and unidentified cadavers or human remains of previously unsolved cases. Once an association is found, anthropologists, odontologists, specialists in forensic medicine, and law enforcement officers work together to establish a final, positive identification and prepare a report for the Court.

24.2.1.2 NamUS

In the USA, the Federal Bureau of Investigation (FBI) maintains its own missing person and unidentified human remains databases, known as the National Missing and Unidentified Persons System (NamUs). It is a national centralized repository and resource center for missing persons and unidentified decedent records. NamUs is a free online system that can be searched by medical examiners, coroners, law enforcement officials, and the general public from all over the country in hopes of resolving these cases.

The database contains three indexes in which DNA profiles may be entered: Unidentified Human Remains, Missing Persons, and Unclaimed Persons.

The Missing Persons Database contains information about missing persons that can be entered by anyone; however, before it appears as a case on NamUs, the information is verified. NamUs provides a user with a variety of resources, including the ability to print missing persons posters and receive free biometric collection and testing assistance. Other resources include links to state clearing houses, medical examiner and coroner offices, law enforcement agencies, victim assistance groups, and pertinent legislation. There are 19,171 missing persons cases reported in the USA and 42.75% have been closed (8197) but only 11.08% were NamUS aided.

The Unidentified Persons Database contains information entered by medical examiners and coroners. Unidentified persons are people who have died and whose bodies have not been identified. Anyone can search this database using characteristics such as sex, race, distinct body features, and even dental information. There are 11,767 missing persons cases reported in the USA and 13.45% have been closed (1583) but only 427 were NamUS aided.

The newly added *UnClaimed Persons database* (UCP) contains information about deceased persons who have been identified by name, but for whom no next of kin or family member has been identified or located to claim the body for burial or other disposition. Only medical examiners and coroners may enter cases in the UCP

database. However, the database is searchable by the public using a missing person's name and year of birth.

The US National Missing and Unidentified Persons System (NamUS) has successfully solved 3499 missing persons cases (Ge et al., 2014). Hence, more investigative work is needed to locate the missing persons as well as to identify these human remains in order to assist these families. When a new missing persons or unidentified decedent case is entered into NamUs, the system automatically performs cross-matching comparisons between the databases, searching for matches or similarities between cases. NamUs provides free DNA testing and other forensic services, such as anthropology and odontology assistance.

24.2.1.3 Texas Missing Persons DNA Database

There are only a handful of qualified laboratories in the USA that are able to genotype samples using the full battery of genetic markers which are autosomal STRs, Y-chromosome STRs, and mitochondrial DNA. The largest program of missing person identification in the USA is in the State of Texas. The *Texas Missing Persons DNA Database* was established in 2001 at the University of North Texas Health Science Center (UNTHSC). UNTHSC, in collaboration with law enforcement, offers families with missing loved ones the opportunity to submit reference samples for DNA testing, which undergo complete analyses of nuclear and mtDNA markers. Once DNA profiles are obtained, they are directly entered into the FBI's Combined DNA Index System plus Mito (CODIS + mito) database.

The database began accepting samples from Texas law enforcement agencies in March 2003. Texas was the first state in the country with a Missing Persons DNA Database capable of analyzing both mitochondrial and STR systems and is the first state to participate in the federal database for missing persons using the FBI prescribed CODIS genetic markers. The database provides a very powerful tool for investigators trying to locate missing persons or identify remains by allowing federal, state, and local crime laborato-

ries to electronically exchange and compare DNA profiles. The database operates at a local (LDIS), state (SDIS), and national level (NDIS).

To date, UNTCHI has completed the analysis of 7792 Family Reference Samples, 3461 Unidentified Human Remains, and 182 Direct Reference Samples. Once completed, these profiles must meet eligibility requirements in order to be uploaded to the next level of CODIS. Of the eligible completed samples, a total of 5300 Family Reference Samples, 2450 Unidentified Human Remains, and 140 Direct Reference Samples have been entered into the local CODIS database. Currently, UNTCHI has made 700 associations through the use of CODIS. The DNA analysis provided by the Texas Missing Persons DNA Database is at no charge to law enforcement agencies or families with missing members.

24.2.1.4 The Victorian Missing Persons DNA Database

The Victorian Institute of Forensic Sciences (Australia) established in 2009 the Victorian Missing Persons DNA database to serve as a repository for all DNA profile information for reference and unknown deceased samples. Since September 2010, the police have provided the database with reference samples for missing persons cases for nuclear and mtDNA analysis. Furthermore, the database keeps DNA information about unidentified deceased persons to compare with missing persons cases. As of June 2013, the database contained information for 206 family samples and 47 unidentified human remains. This database is independent from the Australian National Criminal Investigation DNA database (Hartman et al., 2014).

24.2.1.5 Banco Nacional de Datos Genéticos (BNDG) Argentina

The National DNA Data Bank is an autonomous and self-governed agency, created in 1987. It was created to help identify genetically the children of persons who had disappeared during the State Terrorism period between 1976 and 1983, and who had been deprived of their identity and appropriated by military oppressors based on a

systematic plan designed and implemented by military officers of the highest rank. The purpose of the BNDG is to search for and identify children born from missing persons, who had been kidnapped together with their parents or were born during confinement of their mothers, during the undemocratic military rule; identify genetically the human remains of victims who were forced to disappear. The database is at no charge to law enforcement agencies or families with missing members.

For 22 years, the BNDG developed a genetic database based on genetic samples provided by relatives (mainly grandparents) of disappeared children, which were received and stored at the BNDG. Thousands of genetic analyses were performed in children who were suspected to have been born from missing parents and had been appropriated by oppressors, and such analyses contributed to identify 109 children (Anon, n.d.).

24.2.1.6 Missing Person Database-gen

In 2007, a study determined that there were 7287 cadavers that had not been identified in five Brazilian states. Based on this information, there could be an estimated of 10,000–14,000 unidentified cadavers per year in the entire country. At present, Brazil does not have a national, integrated system for the registration of missing persons and the identification of corpses and human remains. That is why, da Silva et al. developed a tool named Missing Person Database-gen to register and compare the genetic and nongenetic information from missing personas, relatives of missing persons, unidentified corpses, and human remains (Da Silva et al., 2009).

The system stores information from missing persons, relatives of missing persons, unidentified corpses and human remains. The system compares the genetic profiles obtained with autosomal and Y chromosome STRs between the group of unidentified individuals and their relatives. It can compare and integrate the resulting genetic information, either online using the Internet or offline using a desktop computer. It searches for those genotypes that are most likely to indicate a familiar relationship using an algo-

rithm based on the heterozygosity of the markers to calculate the likelihood ratio and probabilities of a positive genetic relationship (Da Silva et al., 2009). Two databases are compared: the reference database containing profiles from the relatives and a questioned database containing the genetic profiles from unidentified corpses and human remains (Da Silva et al., 2009).

24.3 Conclusion

DNA typing is integral to resolving a number of serious criminal and civil concerns, such as solving missing persons cases, identifying victims of mass disasters, identifying children that may have been victims of human trafficking, and historical/anthropological studies. As the demand for genetic testing continues, novel approaches such as genetic testing by next generation sequencing (NGS), mass spectrometry, chip arrays, and pyrosequencing will be increasingly utilized. Single nucleotide polymorphisms (SNPs) offer the potential to analyze severely compromised biological samples, to determine the facial phenotype of decomposed human remains or samples whose human sources are unknown, and to predict the bioancestry of individuals.

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25.1 Introduction

DNA technologies may be used in missing persons' investigations to assess kinship by testing genetic similarity. Typically, genetic relationship testing is used to identify unidentified remains by connecting a report of a missing person to a sample from a deceased person whose identity is unknown. Recent efforts are attempting to expand missing persons investigations using genetic information to include routine searches of missing persons' DNA samples to questioned *live* individuals. Such efforts may involve, for example, testing of persons suspected of being human trafficking victims, persons migrating without identity documentation, or investigation of the identity of a person unable to establish her/his identity (e.g., comatose, in a drugged state). This new population of sample providers opens new questions around genetic privacy in addition to the ethical questions surrounding the privacy of family members' collected samples.

This chapter will examine the genetic privacy implications in missing persons cases. The collec-

tion and retention of a DNA sample, creation of a DNA profile, and repeated searches of profiles in DNA databases present a number of privacy challenges. Specific privacy concerns and legal rights to privacy differ across communities and over time. Broadly, privacy concerns regarding DNA identification can be associated with the risk of private medical, personal, or family information being revealed, the right against surveillance or intrusion by law enforcement, and control over when personal information is accessed and how it is used.

The predictive nature of genetic information, its relevance for family members, and its past use to support discrimination, at times, heightens public concerns over genetic privacy. As such, new applications of genetic information for social or human identification may result in media-led public debate (Kaufman, Murphy-Bollinger, Scott, & Hudson, 2009). For instance, the law enforcement program in Canada to collect DNA from sex workers for postmortem identification raised questions of privacy intrusion and fear (Hainsworth, 2010). Likewise, a program to identify stolen children in Argentina raised questions about genetic privacy (Pertossi, M. (November 20, 2009).

Because of the possible risks to individual privacy presented by DNA technologies, it is necessary to consider when and how to use these technologies. First, law enforcement should judge whether DNA identification should be

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used. In some cases, family members might be willing to voluntarily give a DNA sample in order to improve the chances of locating their loved one. In others, evidence of a crime or outside circumstances might compel law enforcement to require DNA testing in order to preserve public safety. Prior to collecting a DNA sample, it is important to ensure that the individual providing the sample understands and consents to how the sample will be stored, analyzed, and searched. Finally, after the profile has been created, authorities must ensure both the sample and the profile are securely held and that access to the sample and profile is limited in order to protect individuals' private information.

As DNA technologies develop and are increasingly applied in missing persons cases, public attitudes and privacy concerns toward DNA testing will likely evolve. Continued examination of these privacy concerns will help shape the role DNA technologies play in missing persons cases. The tremendous value of DNA as a biometric to locate or identify missing persons warrants examination and consideration of the privacy challenges of DNA collection.

25.2 Secrets Contained in a DNA Sample

The collection of DNA samples for identification by law enforcement raises two kinds of privacy concerns. The collection of DNA may be seen as a governmental intrusion, both physical and psychological. The intrusion takes place when a sample is collected, stored, and used to create a unique DNA profile which is stored in a database and searched repeatedly without the individual's knowledge or consent. These intrusions affect not only criminal suspects, but also those who voluntarily provide samples to law enforcement (e.g., rape victims and their intimate partners).

Because DNA contains critical information specific to an individual, DNA identification also raises concerns about the potential revelation of private medical information and/or personal family information (e.g., family secrets, non-paternity). A DNA sample can reveal non-visible

information including disease propensities, psychological predispositions, biological relationships, and ancestry or ethnic information. For example, kinship analysis may reveal a genetic relationship previously unknown to the individuals involved (Anderson, 2006). The revelation of such facts could have profound emotional impact on entire families, potentially leading to domestic violence, estrangement, or stigmatization (Suter, 2009). The DNA source may not know this information herself, she may not wish to know this information, or she may not wish others to know this information. In bioethics, respect for a research participant centers both on her right to know and right not to know information gleaned from research participation. Similarly, the DNA sample provided in a missing persons case should be protected from accidental release and incidental information must be handled with utmost respect for the sample provider. In disaster victim identification, incidental findings such as non-paternity are not revealed routinely to the family members to protect the family from unexpected distress (Parker, London, & Aronson, 2013). However, this approach may be seen as paternalistic and could have adverse implications should a biological relationship be needed for medical purposes and the investigative team is known to have withheld the pertinent information.

Historically, genetic markers for identification included ABO typing, DQ-alpha genotyping, and other genetic loci that are known to confer medical information. The development of national DNA identification databases allowed for the selection of standard short tandem repeats (STRs) specifically avoiding markers with genotypes associated with medically relevant information. The DNA profile on the other hand may or may not be neutral to sensitive information depending on the approach used.

The current STR-based identity genotypes used in DNA profiles do not have any predictive value in determining traits other than sex. Although the markers themselves may be "linked" or associated with traits or sensitive genetic information such as disease susceptibility, the genotypes of the typical forensic DNA markers are not known to be predictive of any

trait or disease (Katsanis & Wagner, 2013). In other words, the location of the marker may be next to or even within a disease gene, but the variants typed from these markers are not known to be causing or predictive of any disease state or visible characteristics. As DNA technologies continue to develop, the potential and depth of the information contained in noncoding DNA where STR loci lie is not yet fully understood and the STR genotypes could eventually implicate more than identity (Hogan, 2008).

Beyond the typical STRs used for DNA profiling for CODIS or CODIS-like databases are the potential applications of single nucleotide polymorphism (SNP) panels, genome sequencing, and next-generation technologies that may assess thousands of points in a genome (Keating et al., 2013; Kidd et al., 2014). Little is understood about the ethical implications of using these data points for identification and what the effects may be of using these data points beyond identification.

In addition to traditional identification markers, DNA profiling for missing persons may include trait-predictive markers in order to better guide investigations. In unidentified remains with trace genetic information, using markers to predict race, ethnicity, height, eye-color, or other similar metrics may be invaluable for narrowing down population origin. Similarly differentiating between related individuals may benefit from using such trait-specific markers. The ethical implications of using genetic markers for visible characteristics in this context have not been researched in any systematic way.

Most forensic laboratories retain collected biological samples in addition to the DNA profile to allow for future analysis of the sample using new technologies and for verification of a DNA profile after a database match. The concern among ethicists is whether a stored sample can be misused to obtain unauthorized information about the sampled individual (Williams & Kaye, 2014). Moreover, the longer a sample is retained, the greater the risk that the sample may be used for a purpose secondary to its original intent. Policies for retention of samples should be clear and stated as part of the informed consent process. Similarly, the retention of the genetic profile

used for identification should be well-defined, particularly how the profile is maintained in a database, the protections of that database from misuse, and who has access to the database.

While inclusion of DNA profiles in a database like CODIS is subject to strict oversight, the use of non-CODIS databases is mostly unregulated in the U.S. Local laboratories can maintain local DNA databases consisting of suspects' and victims' profiles. These so-called *rogue* databases appear to be more common in large municipalities, although the extent of their use and utility are unknown. International regulations of country-specific and intercountry databases may have very different protections. Particularly in view of the potential to share information or conduct searches across jurisdictions, concerns have been voiced about the security of DNA profile systems, the possible disclosure of personal information, and the risk for misuse and/or malfunction (Thomas, 2006).

25.3 Defining Privacy

Privacy is a dynamic concept that can differ across communities and evolve over time (Margulis, 2003). Privacy concerns may be shaped by a number of factors, including new technologies and their application by government or businesses, existing social and cultural perspectives, public debates, and changing policies and laws. As such, individual expectations of privacy and how individuals uphold social norms and community expectations regarding privacy tend to vary. Nevertheless, "privacy" often touches on a number of concepts, including the right to be let alone, protection from "unwanted access by others—either physical access, personal information, or attention" (Bok, 1983, pp. 10–11), and "the claim of individuals, groups, or institutions to determine for themselves when, how, and to what extent information about them is communicated to others" (Westin, 1967, p. 7; Solove, 2002). Psychological interpretations of privacy have defined privacy as "control over or regulation of or, more narrowly, limitations on or exemption from scrutiny, surveillance, or

unwanted access” (Allen, 1988; Margulis, 2003, p. 244).

Privacy serves a number of functions, psychologically, legally, and socially. Privacy (or lack thereof) has important implications for individuals’ emotional and psychological well-being, ability to form and maintain social relationships, and legal rights. Privacy can affect individuals’ autonomy, individualization, development of personality, and ability to relax and express themselves emotionally. Privacy relates to many social rules guiding both relationships between individuals (e.g., spouses, teacher, and student) as well as the functioning of groups, organizations, and states. Violations of privacy can cause emotional or psychological stress and stunt individualization (Margulis, 2003). From a legal standpoint, privacy rights protect individuals from unwarranted government or police surveillance or interference.

Because invasions of privacy can profoundly impact individuals and communities, legal intervention may be necessary to ensure individual privacy rights are safeguarded. Laws also exist to protect individuals from invasions of privacy committed by other citizens. Laws may address both intrusions on individual privacy as well as disclosure of private information (Margulis, 2003).

25.4 Balancing Justice and Privacy

DNA technologies have the potential to serve critical social needs, but also can pose a threat to individual rights and privacy (Parven, 2013). It is therefore important to consider how to minimize potential risks to individual privacy while maximizing the efficiency of law enforcement investigations, sometimes through the use of novel technologies. In the legal sense, “*balancing*” weighs an individual’s privacy rights against the government’s duty to preserve public safety. Missing persons cases are often led by law enforcement and subject to the legal procedures including following chain of evidence, policies for retention of evidence associated with a crime,

and other procedures that may provide law enforcement with private information about a person. Furthermore, law enforcement has a duty to pursue missing persons cases as a matter of public safety, particularly when a crime is associated with the case. In such cases, balance of the need for privacy of a family member’s biological sample, or indeed that of a deceased person, might be outweighed by the need to solve a crime. While totality-of-circumstances might justify the inclusion of family members in a broad DNA database, because these family members are included based on biological relation, kinship searching of the database could reveal private information regarding legal or social relations during the ensuing investigation (Kim, Mammo, Siegel, & Katsanis, 2011; Suter, 2009). Court decisions, such as in the 2001 *Kylo v. U.S.*, ruled that, with technological developments, physical intrusion is not the only way to violate privacy and overstate the government’s right to information. Kinship testing and searching of databases could result in revelation of private family information and, while this offense might not rise to the level of constitutional concerns, it could be a factor when balancing and determining whether and/or how a database search should be used in a criminal investigation.

In recent cases of disaster victim identification (DVI), family members of suspected deceased individuals are willing readily to supply genetic samples to compare to remains. Several surveys explored American’s attitudes on government responses to the attacks of September 11, 2001, examining the balance between civil liberties and privacy on one hand, and law enforcement and security on the other. In response to such a catastrophe, the privacy interests of a person’s own samples are diminished when weighed against the potential for identification of a loved one. However, research is lacking as to whether or in what contexts the privacy interests of an individual may be strong enough to refuse sample provision.

Balancing individual privacy rights and the utility of DNA information in law enforcement applications can shape decisions from national policies and laws to individual cases. A decision

by the International Criminal Tribunal for the former Yugoslavia (ICTY) demonstrates how courts have considered both of these interests. In 2008, former Bosnian Serb leader Radovan Karadzic was arrested and placed on trial for committing war crimes during the Bosnian War, particularly his role in the Srebrenica genocide (Haines & Toom, 2014). In 2009, Karadzic and his defense demanded access to the International Commission on Missing Persons (ICMP) DNA database, reasoning that sealed documents containing information on DNA identifications violated Karadzic's right to a public trial and prevented Karadzic from verifying DNA identifications of victims of the Srebrenica genocide (Haines & Toom, 2014). The prosecution argued that documents with information related to DNA testing were sealed to protect victims' and family members' privacy. Additionally, some family members or participants in databanks may not want their participation in DNA identification to be publicly known. In making their decision, the judges aimed to "balance the right of the accused to a fair trial, the rights of victims and witnesses to protection, and the right of the public to access information" (Haines & Toom, 2014). Ultimately, the court ruled that seven sets of files should be unsealed and made publicly available and that four sets could remain sealed, but that redacted versions of these four sealed files should be made publicly available (Haines & Toom, 2014).

25.5 Trust and Consent

Policies for informed consent for participation in DNA collection should address not only how DNA information will be used upon collection, but also how it could be used for future identification, law enforcement, or scientific purposes. Privacy concerns that could be addressed as part of informed consent include where and for how long DNA samples and information will be stored as well as who will have access to DNA information (Curtis, 2014). Often, documented consent of participants is secondary to the implied personal or collective well-being of society, whereby

individuals provide samples for the good of their loved one or their society (Parven, 2013). It is for this reason that strict rules and practices of informed consent are essential for maintaining a framework for what seems a moral duty for citizens (Parven, 2013). The informed consent process is a critical opportunity for law enforcement to lay out their obligations to protect the privacy of voluntary sample donors, educate potential donors on the risks and benefits associated with participation in DNA identification, and to make clear that individuals are not required to provide DNA samples for a missing persons case. Policies for informed consent for participation in DNA databases should address not only how DNA information will be used upon collection, but also how it could be used for future law enforcement or scientific purposes. Other privacy concerns that could be addressed as part of informed consent include where and for how long DNA samples and information will be stored as well as who will have access to DNA information (Curtis, 2014). Furthermore, in many cases, individuals may not fully understand the benefits and risks associated with the DNA collection, storage, and profiling or may believe they are required to provide samples or feel coerced by authorities to participate.

According to polls, attitudes on collection of DNA from law enforcement professionals (including victims' advocates) show fairly strong support of the use of DNA technologies of all types in criminal investigations including missing persons. Public surveys on forensic DNA applications are limited, but in the context of government-run biobanks, respondents responded strongly that privacy protections are crucial when asked how important would it be that it be illegal for law enforcement to access to genetic information (Kaufman et al., 2009). On the other hand, respondents on a similar survey when asked whether law enforcement should be allowed to search such a biobank, responded positively that the biobank should be used for law enforcement and identification purposes.

Given the utility of DNA for identification purposes, many have proposed universal or national databases, linked to newborn screening

programs, child vaccination programs, obtaining driver's licenses, or as part of national identification programs (Simoncelli, 2006). While these theoretical programs would have high utility for missing persons, most proposals have been sidelined over concerns of privacy. However, efforts to conduct whole genome sequencing at birth have been met positively in the health care context, with national programs developing in Kuwait, Qatar, Iceland, and other small nations. The implications of cross-application of using this sequencing data for identification, whether for criminal investigations or humanitarian purposes, is yet to be seen.

Informed consent is a lynchpin for building trust with DNA providers. A consent process may involve formal written consent or be a comprehensive oral exchange between a third party (with no interest in the missing persons case) and the sample donor. An informed consent process would encompass the following:

- Written documentation (in the language of the donor) of the elements described below (signature would be optional)
- An explanation of the purpose of sample collection
- Duration of sample retention
- Description of the process for sample collection
- Description of the protections from inadvertent release of collected information
- Description of who has access to the DNA sample and the DNA profile
- Description of how DNA samples and profiles are shared with other parties or jurisdictions
- Description of potential incidental findings associated with DNA testing
- An explanation of whom to contact to withdraw the provided sample and expunge the associated data

Interest in participation in DNA identification processes may be shaped by social norms and expectations, cultural traditions for families, and individuals' trust or mistrust in those performing DNA testing (such as law enforcement). Loss of a loved one, whether missing or dead, brings

grief to the mourners, and triggers sociocultural norms related to the management of the dead that may be informed by cultural beliefs including religious rites (Bennett, 2014). In some cultures, removing even a small part of the body, such as a tooth, for identification is considered a "desecration of the dead" (Bennett, 2014). For example, Islamic tradition ordains that Muslim remains be handled only by Muslim people (Bennett, 2014). In others, recovery of a body is not considered necessary for the grieving process. In Cambodia, mourners follow a regime of rituals to ensure that the spirit cannot return to the body after death, but identification of the corpse itself is irrelevant since the loved one is no longer physical (Bennett, 2014). Families are able to mourn their loved ones and achieve a sense of closure without laying to rest their loved ones' remains (Bennett, 2014). If a society holding such beliefs went through a mass disaster, law enforcement and disaster response might place low priority on identifying deceased victims.

In other cultures, burial of physical remains is very important to mourning family members. A study with survivors of the 1994 Rwandan genocide illustrated that, despite having a limited understanding of DNA, many Rwandans expressed support for the development of a DNA database for identification, particularly after mass grave exhumations. Those supporting DNA testing stipulated that investigators and others handling the deceased should consult with communities and adhere to local traditions (Jessee, 2012).

Willingness to participate in DNA collection is also shaped by trust in law enforcement and other authorities. For example, in many societies, some minority populations are overrepresented as victims and perpetrators of crime. Individuals identifying as being part of such a minority group tend to distrust law enforcement and question the use of DNA evidence. One study found that the Maori, the indigenous people of New Zealand, tend to express suspicion that DNA might be "planted" at crime scenes (Curtis, 2014). Similarly, African Americans are more likely to doubt the reliability of forensic DNA, place lower significance on the presence of DNA evidence,

and oppose a national DNA database (Brewer & Ley, 2010).

Mistrust of law enforcement officials among certain populations may be high, such as undocumented migrants or sex workers (both populations that have individuals go “missing”). The mistrust of authorities among sex workers is rooted in a history of brothel raids and sting operations targeted at arresting sex workers. Often undocumented migrants and trafficking victims are traumatized or are fearful of retaliation by

their traffickers and may accordingly be reluctant to cooperate with law enforcement investigations (Antonopoulou & Skoufalos, 2006; Clawson, Small, Go, & Myles, 2003). Existing programs using DNA are partnerships between law enforcement and academic or social services to assuage concerns of DNA misuse by authorities. However, further delineation between authorities may be necessary to assuage participation to maximum benefit of these population (Katsanis & Kim, 2014; Kim & Katsanis, 2013).

Box 25.1. Mock Example Scenarios of Ethical and Privacy Challenges with Genetic Information in Missing Persons Cases (Copyright: Authors’ Own Image)

Mock examples

- (a) **Lack of informed consent.** The sister of a sex worker reports her missing and the sister refuses to sign any forms because she does not want her name to be known to the police since she too is a sex worker. But she agrees verbally to an anonymous buccal swab of herself and provides a toothbrush believed to be the missing woman’s.
- Samples from living individuals should be accompanied by a signed consent form.
 - **Violation of a social norm.** Biological samples taken from an excavated mass grave in Iraq are sent to a European country for identification.
 - According to Islam, the body must be buried intact wherever possible because it is required for resurrection later. For this reasons many request that Muslim remains be handled only be Muslims and autopsies be avoided.
 - **Revelation of biological relationship.** During post-war investigations, samples of entire families of missing soldiers are collected in efforts to identify

the deceased. A parent–child match indicates that a now-adult woman is the daughter of a deceased soldier. This woman provided her sample because her uncle had disappeared during the war and she believed her father to be alive. This genetic match reveals that the man she considered to be her uncle was actually her biological father, the brother of the man she believed to be her father.

- Whether or not to reveal misattributed paternity or other previously unknown relationships is a contentious debate. Many academics claim that best practices are to not reveal the incorrect family assumptions. But others assert that truth should be revealed as long as there is no danger of violence within the community once the information is revealed.
- **Revelation of medical information.** Identical twins—both mothers of young children—are killed in a plane crash and biological samples are tested for identity to return the women’s remains to the proper families. To distinguish the twins, the laboratory uses deep genome sequencing that can reveal epigenetic differences between the twins. This deep sequencing successfully distinguishes the remains but

(continued)

- reveals a heritable genetic variant that may cause cancer.
- Since the twins are deceased, revelation of this finding to the person at risk of cancer is irrelevant; however, the partner of the woman with the variant may want to know so that he can inform their children of an increased risk. Any disclosed information must be accompanied by genetic counseling.
 - **Revelation of ancestral information.** Remains found near the US-Mexico border are assumed to be that of a migrant, but tested for biological ancestry markers to establish a suspected country of origin. Ancestry DNA testing reveals the deceased is mostly Native American with strong Asian ancestral ties. Once the body is identified as the remains of a tribe elder who disappeared five years prior, the tribe learns of the testing.
 - Many Native American cultures have creation beliefs that contradict the scientific theories of ancestral migration from Asia.
 - **Misuse of biological sample.** DNA samples are collected from hundreds of families in an Eastern hemisphere remote village affected by a tsunami killing thousands of residents. The samples are being retained indefinitely in a Western laboratory for ongoing efforts to identify the remains of the degraded samples. A terrorist who was killed during an attack on a Western city is known to be from one of these villages. The Western authorities request comparison of DNA from the remains of the terrorist to that of the villagers in the missing persons database in an effort to identify his relatives and other potential terrorists.
 - There are no international laws that prohibit use of genetic information collected for one purpose from being used for another purpose. However, best practices are to prohibit this cross-activity.

25.6 Summary

The development of DNA databases and improved genetic technologies has the potential to improve investigation of missing persons (Kim & Katsanis, 2013). However, the privacy and social ramifications of collecting DNA from families that may be vulnerable populations (e.g., children, undocumented migrants, vagrant youth, sex workers, and victims) are considerable. Questions remain unanswered as to how best to protect voluntarily provided DNA samples from misuse and how to handle privacy implications of incidental genetic findings in kinship analysis. Cross-jurisdictional collaborations present the nontrivial challenge of sharing sensitive identification information, DNA

profiles, and genetic information in a secure manner and with cultural sensitivities distinct to each population. Respect for persons that are considered vulnerable populations is paramount, and in missing persons cases, their ability to make an autonomous and informed decision (i.e., provide voluntary consent) may be limited compared to the general population. Cultural and political differences around the world mean that different communities may hold varying attitudes toward DNA collection and profiling. Some populations may differ in concerns regarding DNA submission and fear of retribution for reporting suspicions or evidence of ongoing crimes. Understanding the views and experiences of the public is key to further missing persons genetic identification strategies.

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Sarah Fieldhouse and Karen Stow

26.1 Introduction

Friction ridge skin covers the entire palmar surface of the hands and the plantar surfaces of the feet. It is arranged into a series of ridges and furrows running alongside one another, forming characteristic patterns and recognisable features that are common to all areas of friction ridge skin. In evolutionary terms, friction ridge skin has developed to provide humans with a firm grasp and a resistance to slippage.

The use of friction ridge skin for the purpose of human identification is a widely researched and established technique. A brief history of the use of friction ridge skin as forensic evidence can be found in Sect. 26.2 of this chapter. Impressions that are knowingly made by the friction ridge skin of the fingers are commonly referred to as ‘fingerprints’, whereas unknown marks made inadvertently by the friction ridge skin of the finger are commonly referred to as ‘fingermarks’.

Not all evidence has the same value for identification. Whether a victim of mass disaster,

abduction or amnesia, the ability of the investigator to be able to identify a missing person is vital. If the missing person has been found, it may be possible for them to be identified by relatives or friends. This may depend on whether the person is alive, because changes that occur post-mortem can make it difficult to identify the person visually. If the missing person is alive, then the ability for an investigator to make a visual identification may depend on the length of time that the person has been missing, given that a person’s appearance will change over time. Personal belongings found with the missing person can aid identification. For example, the clothing which the person or body is wearing may match the initial description on disappearance. Care must be taken, however, as such evidence will only provide a presumptive identification, due to the fact that a number of individuals may have the same or similar clothing.

In instances where visual identification is not possible, then alternative means of identification must be used. This is why the detail contained within friction ridge skin can significantly contribute to missing person investigations. Fingerprints are considered to provide confirmatory evidence of identification. This is because no two areas of friction ridge skin have yet been found to be so similar that differentiation is not possible. During the identification of an individual INTERPOL generally require at least two methods of identification to be confirm identity.

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Fingerprints represent one of these accepted methods. The process of fingerprint identification is quicker than DNA profiling and is generally more cost effective.

26.2 Fingerprints: A Brief History

Historically, there is evidence to suggest an appreciation of the uniqueness of friction ridge skin a long time before its use in criminal investigations. During the construction of the king's storehouse in 3000 BC, Mesopotamia craftsmen would impress an area of their friction ridge skin into each of the bricks. Archaeologists believe that this was to provide recognition of the craftsman's work (Berry & Stoney, 1976). In terms of its use for criminal identification, handprints were reportedly used to identify the perpetrator of a crime between 221 and 206 BC (Xiang-Xin & Chun-Ge, 1988). Around this time, friction ridges were also impressed into the clay used to seal documents alongside the author's name, which was believed to support the identification of the author. This practice continued for centuries, with friction ridges impressions marking important documents, such as wills and other legal documents (Xiang-Xin & Chun-Ge, 1988).

In the UK, it was in 1880 that the first publication describing the use of friction ridge skin for human identification was presented by Henry Fauld (1880). In Faulds' publication in *Nature* (1880), he suggested how friction ridge skin might be used to catch perpetrators of crime. During the same year, Sir William Herschel also wrote a letter to *Nature*, describing how he had been using friction ridge skin impressions for identification (Herschel, 1880). Sir William Herschel is also credited for his research pertaining to friction ridge skin persistence (Herschel, 1916). In 1886, Henry Faulds tried to convince Scotland Yard to adopt the method for identification purposes, although they did not adopt his advice at the time. Around this time, another method of identification was being trialled, known as the Bertillon system, named after its inventor, Alphonse Bertillon (Bertillon, 1896). The Bertillon system used aspects of anthropometry, where specific measurements of the body

were taken, for example, the length of the middle finger. These measurements in total were considered to be unique to the individual. Other information, such as eye colour and hair colour were also recorded. Given the lack of discrimination offered by single measurements, combined with the unlikely event of such information being left at scenes of crime, the Bertillon system was not used to identify perpetrators of crime based on evidence analysis.

Sir Francis Galton (1892) was the person who fuelled the police interest in friction ridge skin in the UK with the publication of his book 'Fingerprints'. Galton is acknowledged for his role in the assignment of pattern types, and his appreciation of friction ridge detail, the terminology of which is still in use today. By 1894 a combination of anthropometric and friction ridge skin methods were used in Britain for human identification purposes. As the use of friction ridge skin for human identification purposes developed, the need to store the impressions also increased, and therefore classification systems began to appear. Juan Vuchetich, an Argentinian statistician, is credited with the development of the first classification system, which was used to identify prisoners (Lambourne, 1984). In 1897 the first major classification system was introduced to Scotland Yard, designed to deal with the growing database of fingerprint records. The classification system was developed by Sir Edward Henry, and his two assistants, Azizul Haque and Hemchandra Bose (Henry, 1934). The 'Henry System' allowed for the filing of inked fingerprint sets and allowed unknown fingermarks from crime scenes to be searched against those fingerprint sets already in the manual filing system in order to provide suitable comparisons for the fingerprint expert tasked with identifying the unknown mark. The system was capable of holding 100,000 sets of fingerprints, which was sufficient for the requirements of the system at the time of publication. By 2014, the National Fingerprint Database in the UK held in excess of eight million marks, which demonstrates how the manual Henry System would be unworkable for today's requirements. In 1914, it was recommended that friction ridge skin analysis should be the main method of human identification in the UK.

26.3 Friction Ridge Skin: The Principles of Identification

There are two fundamental principles that allow friction ridge skin to be used for identification: the first is that it is considered to be unique to an individual, and the second is that it is a permanent characteristic of that individual.

26.3.1 Principle 1: Friction Ridge Skin Is Unique

To date, no two areas of friction ridge skin have been found to be similar to the extent that differentiation is not possible. It is the friction ridge detail contained within an area of friction ridge skin that imparts individuality. Like other types of forensic evidence there are class characteristics and individual characteristics associated with friction ridge skin. A fingerprint examiner will look for similarities and differences in the class, and individual characteristics between an unknown mark and known prints.

26.3.2 Class Characteristics

Within friction ridge skin class characteristics are found in the form of pattern types. Pattern types are generally present on the distal tips of the fingers and toes, but can also be found on the plantar areas and palm areas of friction ridge skin. There are three main types of friction ridge skin pattern common to humankind: loops, whorls, and arches. Before each pattern type is discussed, it is important to recognise key features and terms that are common to areas of friction ridge skin that contain patterns, and which help define the pattern type that is present. The first key feature is the core, or the approximate centre of the pattern, which varies between pattern types. Second there is the delta, which has a characteristic tri-radiate appearance. An example of a delta and a core can be viewed in Fig. 26.1.



Fig. 26.1 Friction ridge skin impression demonstrating the appearance of a core (green) and a delta (blue) (Copyright: S. Fieldhouse)

26.3.2.1 Loops

A pattern is defined as a loop when one or more friction ridges enter the friction ridge area from one side towards the centre, curve back on itself and exit the friction ridge area on the same side it originated from, with a ridge count of at least one.¹ Loop patterns contain one delta. There are different types of loop, and different countries may recognise and use different types in their classification approach. Different types of loop include Plain, Nutant, and Converging.

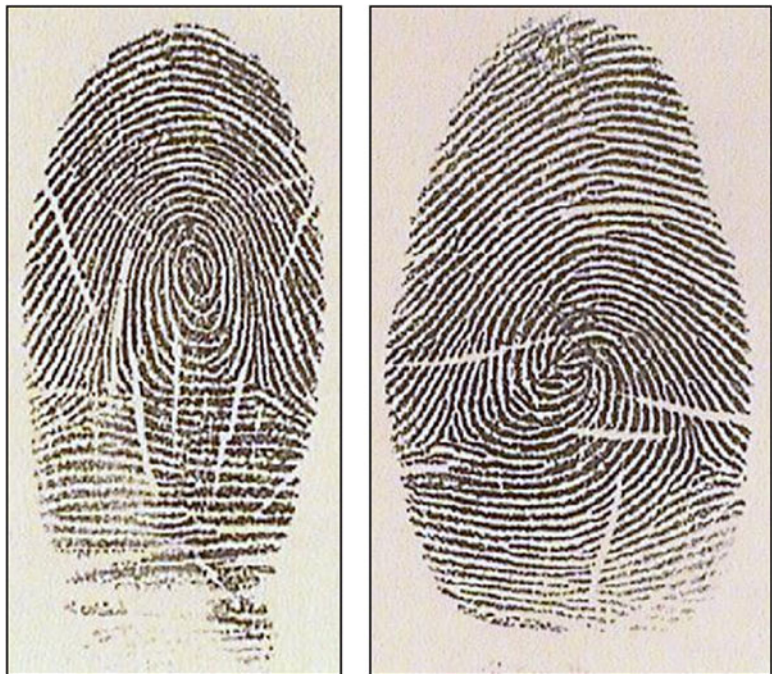
Loops can be further differentiated according to the direction of the ridges. Loops that slope to the left on the left hand or right on the right hand are defined as ulnar loops. Conversely, loops that slope to the right on the left hand, or left on the right hand are defined as radial loops. Examples of plain loops with different directional slopes can be seen in Fig. 26.2.

¹ the number of ridges encountered between the outer terminus (the delta) to the inner terminus (the core).

Fig. 26.2 Example of plain loops with different directional slopes (Copyright: S. Fieldhouse)



Fig. 26.3 Examples of a plain whorl and a twinned loop whorl (Copyright: S. Fieldhouse)



26.3.2.2 Whorls

Whorl patterns have a minimum of two deltas, and have a ridge formation where a ridge or ridges form at least one complete circuit of 360°. Like loops, there are many different types, all of which must at least conform to that basic defini-

tion. Examples of different types of whorls include Plain, Central Pocket Loop, Twinned Loop, Elongated, Lateral Pocket, Composite, and Accidental Whorls. Although they all conform to the basic definition, they appear quite different, as shown in Fig. 26.3.

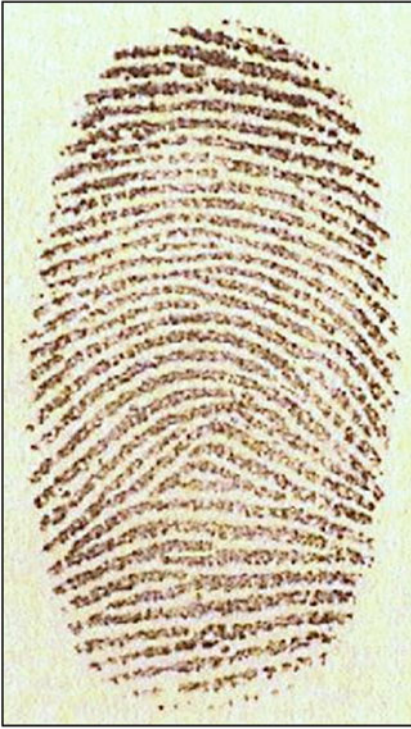


Fig. 26.4 Example of a plain arch (Copyright: S. Fieldhouse)

26.3.2.3 Arches

Friction ridges which enter one side of the friction ridge area, curve slightly towards the centre, and exit the opposite side of the friction ridge skin area are known as Arches. They have no deltas and no identifiable cores. Different types of arch may include Plain, Tented, and Approximating. An example of a plain arch can be seen in Fig. 26.4.

26.3.2.4 Individual Characteristics

In addition to class characteristics, friction ridges possess recognisable features known as ridge characteristics or ‘minutiae’, which are randomly arranged throughout the region of friction ridge skin. It is the type, number, orientation, and relative locations of these ridge characteristics in relation to each other that impart individuality to that area of friction ridge skin. Examples of ridge characteristics can be seen in Fig. 26.5.

Warts, scars, wrinkles, flexion creases, and incipient ridges can represent individual charac-

teristics. The fingerprint examiner must take care with such features, and ensure that they represent permanent features, and not temporary damage, such as a paper cut. Permanent scars can be relied upon as they will have resulted from damage affecting the basal or regenerative layer of skin at the base of the epidermis. Similarly, incipient ridges may or may not appear from one impression to the next dependent on the amount of pressure applied to a surface deposition.

The individual ridge structures possess individual characteristics that are considered to be unique. Their study is known as Edgescopy and Poroscopy. The edges of friction ridges are not smooth in appearance; they are uneven with distinctive contours. This contour is derived from the ridge unit at the stage of fusion when ridges are forming on the foetus in the womb. Given this attribute the ridge profiles can and have been used as evidence in making identifications. Poroscopy relates to the analysis of the number, size, shape, and location of the eccrine sweat pores, which are aligned throughout the lengths of friction ridge and are also considered unique to that ridge area.

26.3.3 Principle 2: Friction Ridge Skin Is Persistent

The fact that friction ridge skin is a feature that persists throughout life is essential for using fingerprints in human identification because it facilitates the identification of fingerprints deposited at different points in time. Friction ridge skin is formed during foetal development. The arrangement of the friction ridges is directly related to the size and shape of the foetal hand when the friction ridges start to develop, together with other aspects of differential growth such as pressure and movement over time (Ashbaugh, 1999; Wertheim, 2011; Wertheim & Maceo, 2002). The unique arrangement of the friction ridge skin remains permanent throughout a person’s lifetime, with the exception of damage to the basal layer of the skin’s surface.



Fig. 26.5 Ridge characteristics (Copyright: S. Fieldhouse)

26.4 The Use of Fingerprints in Missing Persons Investigations

The process that is followed when a person is missing will depend upon the circumstances of the case. A summary of a typical protocol which may be followed to identify a missing person using fingerprints can be seen in Fig. 26.6. Essentially, the reason that a person is missing may relate to criminal or non-criminal activity. This will determine how the case is investigated. Due to the nature of missing persons enquiries, there may be significant time between a person going missing and being found. It is therefore vitally important to secure useful forensic samples, such as fingerprints and other information, e.g. position and type of tattoos, dental records, and other identifying features of the person that

can assist identification when the missing person is found. The samples and information obtained for this purpose is termed ante-mortem information. Fingerprints represent a type of ante-mortem sample. It is essential that *known* samples are retrieved, so that they can correctly confirm identification. If the person has been arrested on suspicion of having carried out a criminal offence, her or his fingerprints are likely to be stored on the national database, and would therefore represent known *fingerprints*. The laws pertaining to the storage of fingerprints vary between countries, for example, the Protection of Freedoms Act, 2012 (Fig. 26.7). In this instance, no further fingerprint ante-mortem samples would be required. In instances where the missing person's fingerprints are not on file, ante-mortem known *fingerprint* samples are required.

If there is a large time lapse between a person being reported missing and being found, for

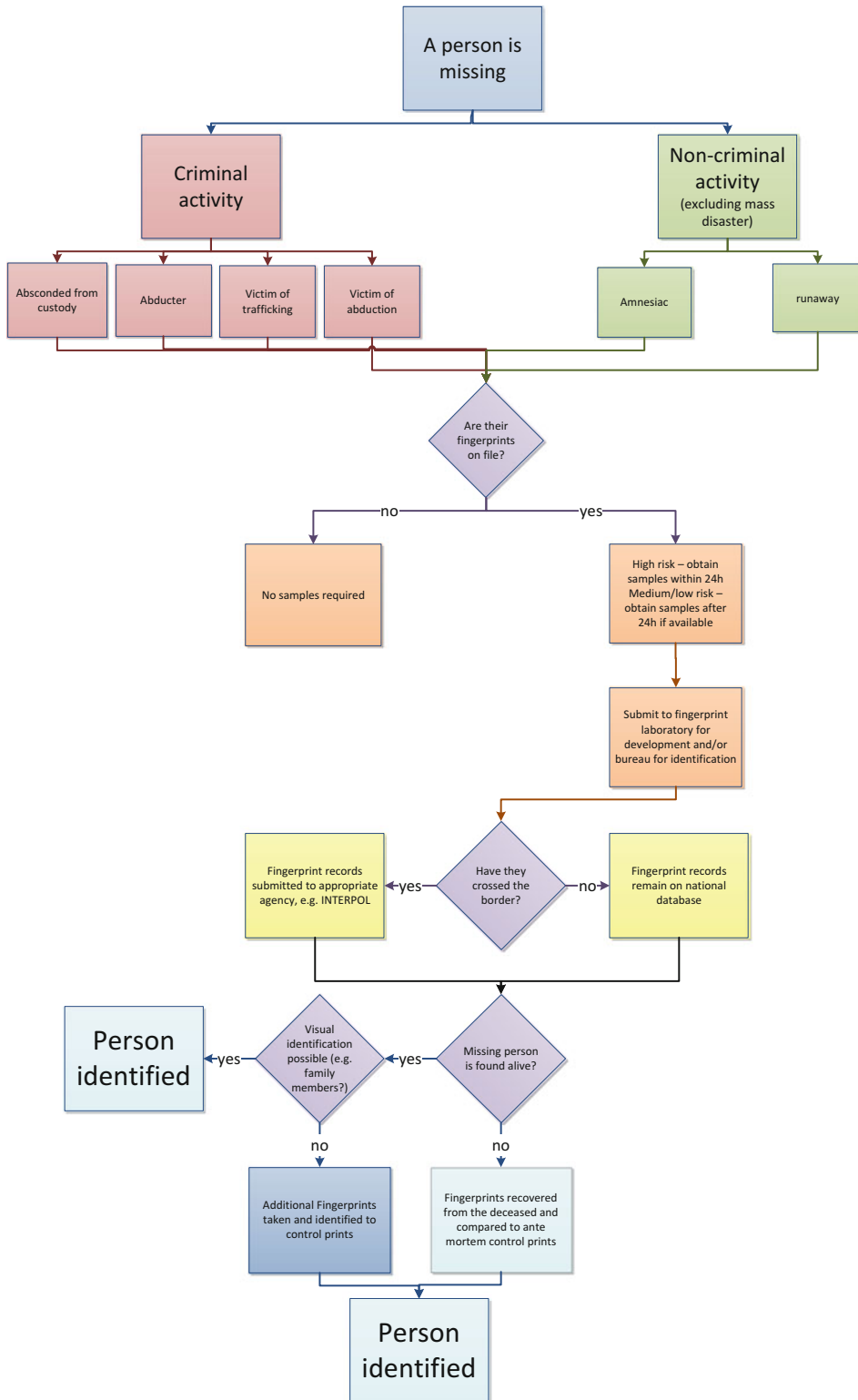


Fig. 26.6 The identification of missing persons using fingerprints; a typical protocol (Copyright: S. Fieldhouse and K. Stow)

Protection of Freedoms Act 2012

Part 1 : Regulation of Biometric Data

- Chapter 1 covers the destruction, retention, and use of fingerprints, footwear impressions and DNA samples. It also covers profiles taken in the course of a criminal investigation. Fingerprints and DNA profiles taken from persons arrested for or charged with minor offences will be destroyed following a decision not to charge or following acquittal.
- This supersedes Sections of the Police and Criminal Evidence Act 1984, and Crime and Security Act 2010, relating to the retention of fingerprints.
- In Section 20 of Chapter 1 the Secretary of State is instructed to appoint a Commissioner for the Retention and Use of Biometric Material to review the use and retention of biometrics by the government.

Fig. 26.7 Protection of Freedoms Act (2012)

example, in the case of child abductions, the physical appearance of the person may have changed significantly. In these cases, due to their persistent nature, fingerprints are especially useful for confirming identity.

26.4.1 Obtaining Known Fingerprint Samples

There are two main types of friction ridge skin marks: patent and latent. Patent (visible) marks are formed by the transfer of a coloured substance, such as ink or blood from the friction ridges onto a contacting surface. Another subcategory of patent marks are plastic marks or impressions, formed when the friction ridges are impressed into a soft substance, such as putty or soap. Latent (invisible) marks consist of a colourless material (usually including sweat), which is transferred from the friction ridges to any surface which comes into contact with them. As part of our daily lives, we routinely touch surfaces around us, particularly our belongings, and therefore deposit fingerprints, especially latent marks because they are invisible on most surfaces. It is therefore perhaps unsurprising that latent finger-

marks are often used as part of missing person investigations to provide known friction ridge skin marks for the missing person. Known fingerprints are typically obtained from personal items recovered from the individual's dwelling.

Latent fingerprints change over time, depending on the surface they are deposited on and the environmental storage conditions (Barnett & Berger, 1977; Bobev, 1995; Thomas & Reynoldson, 1975; Wertheim, 2003). On some surfaces where they are exposed, they are easily destroyed, for example, when they are touched or during cleaning. This is particularly true when the marks are latent because of their invisible nature. To maximise the recovery of fingerprints both for evidential purposes (in criminal cases of abduction, human trafficking, etc.) and confirmation of identification of the missing person, those reporting a person missing should be informed of the following:

- Restrict access to the person's dwelling and in particular rooms within the house specific to the individual, e.g. bedroom.
- Leave the house as it has been found.
- Do not handle items within the house.
- Do not attempt to tidy up, clean, dust, or polish.

After the police have assessed the level of risk associated with the missing person and have determined whether a crime has been committed, a decision will be made as to the approach taken. If a person is missing from home and there is no evidence of criminal activity, a Crime Scene Investigator (CSI) will be dispatched to the missing person's dwelling to recover appropriate DNA and fingerprint samples. In the UK, this recovery and the subsequent handling and processing of the samples and associated data will be conducted in accordance with the ACPO (2009) Code of Practice on the Collection of Missing Persons Data. According to ACPO (2009), if the risk associated with the missing individual has been assessed as high, then the CSI should be dispatched and the fingerprint samples acquired within 24 h. If the risk is medium to low, then the CSI should be dispatched and the fingerprint marks acquired within 7 days. Items targeted will be those which are personal to the missing person, such as her or his hair brush and tooth brush in the case of DNA, and her or his diary, driving licence, passport, and personal note books in the case of fingerprints.

26.4.1.1 Latent Fingerprint Development and Recovery

Latent fingerprints often require visualisation before they can be used for identification purposes. The Centre for Applied Science and Technology (CAST) has devised a comprehensive guide to fingerprint visualisation, which provides recommendations for relevant personnel to follow when treating exhibits for fingerprint evidence (Home Office, 2014). Some of these techniques are briefly described in Boxes 26.1 and 26.2.

It may be possible to develop latent fingerprints 'in situ', at the victim's dwelling. This would depend on the type of surface that the known *fingerprints* were being recovered from, as some techniques are generally more effective on some surfaces rather than others. They can be categorised according to their porosity. Surfaces that do not absorb any part of the latent fingerprint are referred to as *non-porous surfaces* and

are treated with techniques that can target the marks appropriately. Examples of non-porous surfaces would be glass and plastic, therefore a plastic driving licence would be treated as a non-porous surface. Non-porous surfaces are commonly treated 'in situ' at the crime scene using powder (see Box 26.1). Alternatively, they may be submitted to a laboratory, where more sensitive, alternative treatments are available, such as Cyanoacrylate fuming (see Box 26.2). Many laboratory-based techniques are not routinely deployed outside of a laboratory due to health and safety considerations and due to the laboratory-based equipment that is required, which is not generally portable.

Surfaces that absorb part of or all of the fingerprint are described as *porous surfaces*. Examples of porous surfaces would be paper and cardboard; therefore, a paper diary, a passport (excluding any laminated pages), or a notebook would be treated as a porous surface. Non-porous treatments, such as powder and Cyanoacrylate fuming, are less effective at treating porous surfaces because the fingerprint has been absorbed into the surface, and therefore the powder or Cyanoacrylate fumes cannot target the mark. Instead, liquid reagents are applied to the porous surface, such as Ninhydrin or Diazafluoren-9-one. They are also absorbed by the surface and can therefore target and react with constituents of the mark, making them visible.

The CSI attending will recover these samples as she or he would pieces of evidence from a crime scene. The items will be appropriately packaged to ensure integrity and preservation. In addition, continuity will be initiated by the CSI who will record what she or he has recovered, where she or he have recovered it from, together with the date and time of recovery. Full contemporaneous notes will also be completed with any relevant observations, opinions, sketches, and other information recorded.

Once the fingerprints have been developed, they will be photographed or scanned (lifted powder marks) to a standard which facilitates identification of the mark. INTERPOL (2012) requires images that are taken of fingerprints to:

Box 26.1 The Development of Latent Fingermarks Using Powder

The most commonly used method of latent fingerprint development at scenes of crime is powder dusting. Powder dusting is suitable for use on *non-porous surfaces*. Its extensive usage is attributed to its cheap and time efficient approach. There is no significant health and safety risk associated powder dusting if the procedure is carried out appropriately (Bandey, 2004). Powders are available in several different colours and their particle size and shape varies between manufacturers, as different powders can suit different surface types, and the powder needs to contrast with the background surface. They can be broadly divided into magnetic powder and non-magnetic powders. Non-magnetic powders (such as Aluminium powder and Carbon Black powder) are generally applied with brushes, which range from synthetic fibre types to animal hair brushes and feather applicators (Bandey &

Gibson, 2006). The brush is loaded with a very small quantity of powder. The powder is then applied to the surface in a light sweeping motion, and adheres to the latent fingerprint, thus making it visible, as shown in Fig. 26.9. Magnetic powders contain magnetic elements, such as Iron. Unlike non-magnetic powders, they are not applied with a brush, but rather magnetic applicators, which contain a magnet at one end to attract the powder and form a brush head, which can then be applied to the surface. Many magnetic powders are fluorescent, which makes them suitable for use on patterned surfaces. Once developed the mark can be photographed 'in situ' and then lifted from the surface using clear sticky tape, or gel lifters. The tape or gel would then be fixed onto an acetate sheet. This lift would be made tamper proof, by scoring the edges of the tape, and/or the CSI would sign across the seal of the tape, before it was packaged appropriately into a tamper evident bag.

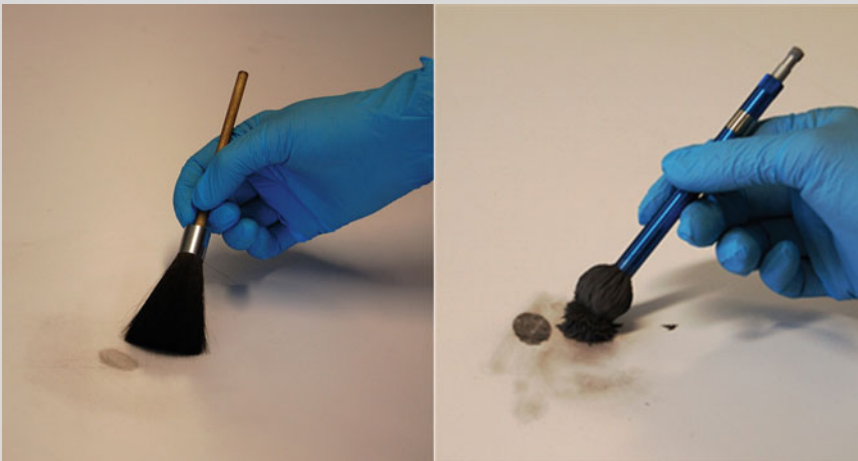


Fig. 26.9 Developing latent fingerprints on a non-porous surface using powder. *Black powder* applied with a squirrel hair brush (*left*), and *grey magnetic*

powder applied with a magnetic applicator (*right*). (Copyright: S. Fieldhouse)

- Have a unique identifier; Be photographed as 1 to 1 images with the resultant photograph a minimum of 500 DPI (1000 DPI if possible);
- Be in WSQ, JPEG 2000 format, or raw format; Have no pixilation of the image when it is viewed under a magnifier; Have scale (inch or centimetre) visible in the image which is on the same plane of focus as the finger mark being photographed; Be grayscale at 8 bits minimum (coloured images at a minimum of 24 bits are acceptable).

26.4.1.2 Elimination Fingerprints

When recovering known fingermarks it is important to ensure that the marks taken from personal items are actually those of the missing person. In order to check that any fingermarks recovered are not those of other people who also live in the missing person’s home a collection of known fingerprints are taken. These are referred to as ten-prints and contain a comprehensive record of the friction ridge detail from the palmar surfaces of

the fingers and palms. When an inked ten-print set is produced, the distal phalanx of each finger is rolled in ink to provide ridge detail from the entire friction ridged area. The ridge detail from the remains of the fingers is then taken, as shown in Fig. 26.8. Palm prints are recorded on the reverse of the ten-print form. Ten-print sets should be taken from everyone residing in the home and/or those who have potentially handled the missing person’s property. These fingerprints are recorded as *elimination prints*, and can either be taken using ink or a portable scanning device. Elimination ten-prints should not be confused with those taken from those arrested on suspicion of carrying out a recordable offence. They are destroyed as soon as they are no longer required in that case.

If the initial police assessment has shown that a crime has been committed which has resulted in the person being ‘Missing’, then the person’s house or the place from which she or he have gone missing would be treated as a crime scene and would be dealt with accordingly.

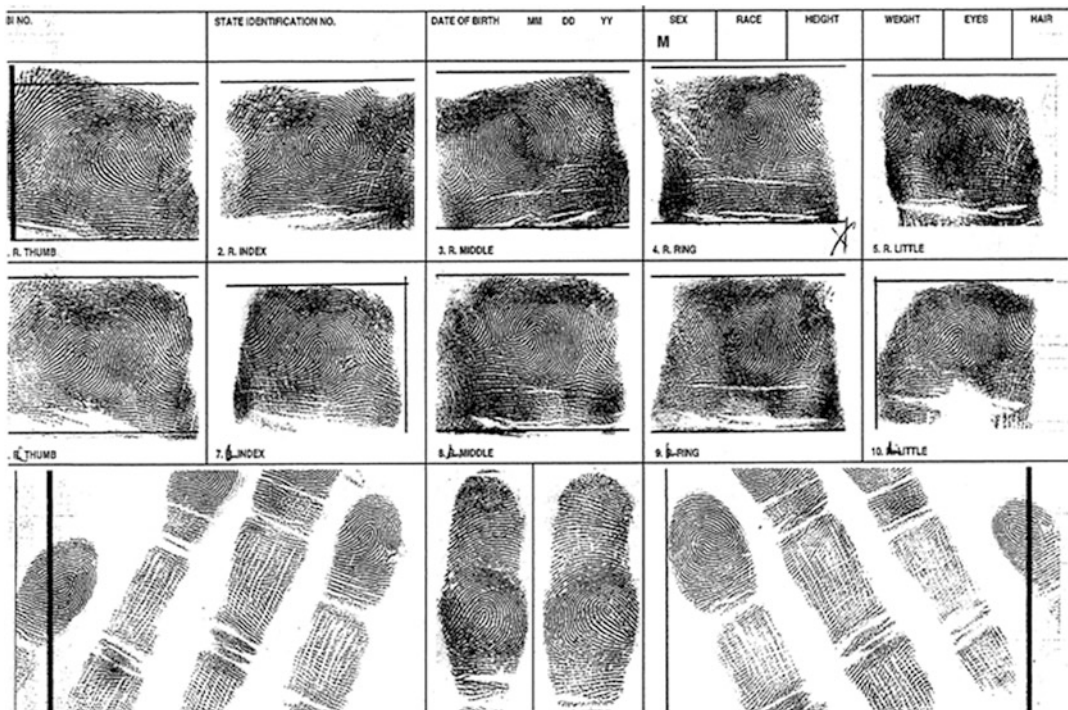


Fig. 26.8 An example of a ten-print form (Copyright: S. Fieldhouse)

Box 26.2 Laboratory Development of Latent Fingermarks

There are a wide variety of laboratory-based techniques which might be used to develop latent fingermarks. Three further techniques will be briefly introduced here on the basis of their extensive laboratory use.

Cyanoacrylate fuming

Cyanoacrylate (superglue) fuming is used to develop latent friction ridge detail on non-porous surfaces such as glass, metal, and plastic. Cyanoacrylate contains alkyl 2-cyanoacrylate monomers, which polymerise readily in the presence of suitable nucleophilic initiators (A^-), such as the hydroxide ions, alcohols, amines, and carboxyl ions (Edwards & Day, 2004). Suitable initiators are found within latent fingermarks, and therefore when they encounter Cyanoacrylate fumes the polymerisation reaction occurs and this makes the fingermark visible (Wargacki, Lewis, & Dadmun, 2007). Optimum conditions are reported to be 80% relative humidity with a glue temperature of 120 °C (Home Office, 2012). The developed marks appear white and rigid.

Ninhydrin

Ninhydrin is typically applied to *porous surfaces*, such as paper. Primary and secondary amines (found in amino acids, proteins, and peptides) react with Ninhydrin to produce a purple stain, known as Ruhemann's purple (Champod, Lennard, Margot, & Stoilovic, 2004). The Ninhydrin is dissolved into a suitable solvent and surface is saturated with the solution. It is then dried and any suitable fingermarks develop. The process may be accelerated in a hot and humid laboratory oven (typically 80 °C and 65% relative humidity, (Home Office, 2014).

Diazafluoren-9-one (DFO)

DFO is typically applied to *porous surfaces*, and like Ninhydrin, reacts with amino acids found in latent fingermarks. A light pink/purple mark results from the reaction (Wilkinson, 2000). The item to be treated is saturated with a solution containing DFO (applied by brushing, dipping, or spraying) and is heated at 100 °C for 20 min (Home Office, 2014). Fluorescence examination is then generally applied to enhance the marks.

26.4.2 Obtaining Unknown Fingerprints from the Missing Person

As detailed in Fig. 26.6, the course of action that is taken to identify a missing person using their fingerprints depends upon the circumstances with which a missing person is found. This includes whether or not the missing person is found alive.

26.4.2.1 When the Missing Person Is Found Alive

If the person has absconded from custody or failed to answer bail, there will already be a set of fingerprints 'on file' either as a hard copy ten-print form or held digitally on an *Automated Fingerprint Identification System*, e.g. IDENT 1 (UK) as detailed in Box 26.3. In these cases there will be no requirement to recover any additional fingerprint samples from the person's home. On rearrest, the abscondee will have their fingerprints taken again and these will be compared with those already held on file in order to confirm identity. They may be taken using ink and paper or using scanners, which digitally record friction ridge detail. Smaller portable hand-held fingerprint scanners may be used to scan prints from persons recovered alive but several years after they originally went missing. The resultant prints can then be compared with

Box 26.3 Automated Fingerprint Identification Systems

Any person who is arrested on suspicion of carrying out a recordable offence will have their friction ridge detail recorded as *ten-prints* and filed by the Police Service of the relevant country in which they committed a crime. The ten-prints may be taken using ink, or using scanning devices, which require the person having their friction ridge detail recorded to place their hand against a glass platen, which scans their finger and palmar surface following the traditional rolling of the fingers and records the detail contained therein.

Once the inked fingerprints have been taken they may be stored in hard copy and then possibly transferred to an Automated Fingerprint Identification System (AFIS). An Automated Fingerprint Identification System is essentially a large database used to store known and unknown friction ridge skin marks. The system stores digital representations of the friction ridge skin marks, and information about the marks, such as the presence and location of class and individual characteristics or more commonly known as minutiae. Scanned friction ridge skin images can be directly loaded onto an AFIS. Ten-prints recorded via scanning devices are automatically entered to the database, but may require processing by a ten-print officer first, who will process the mark and ensure that it is stored appropriately.

Police forces are likely to have their own AFIS systems, e.g. IDENT 1 is the national database in the UK. International fingerprint collections can be searched by requesting a search through INTERPOL, or the British Office international databases, therefore the searching capability is vast.

Not all countries that file ten-prints keep the records indefinitely, and those involved

in a missing persons enquiry must check that such fingerprint records are still available and have not been destroyed if they plan to rely on these records to confirm identification. For example, in 2012 the UK adopted as law The Freedoms Act 2012. This act prevents the UK Police Service from retaining DNA and Fingerprint Records of those persons arrested for a recordable offence indefinitely, except for certain categories of crime. The Act sets time limits on retention, and ensures that records are deleted appropriately after certain time limits which it sets for different crimes, or if a person is released without charge.

marks already on the AFIS database or to previously recovered from personal items of property. In the same way, prints can be recovered from cadavers and compared with ante-mortem marks recovered.

In the UK, hand-held devices that can scan individual fingers of, for example, stop and search detainees, or amnesiacs have been used for several years now since their rollout to UK police forces began in 2010. Previously known as the Lantern project, UK forces were to be supplied with hundreds of devices to aid identification out on the street. Latterly, these devices have been used in mortuaries to record and search cadaver prints to try and establish early identification. There is a cautionary note here, however, in that the devices linking to central AFIS databases do not claim to be 100% accurate. Even with living impressions taken on the devices, high confidence respondents are only 95% accurate, so cadaver prints may be considerably less accurate. Despite the quick nature of this mortuary use, it is advisable that full sets of prints from the deceased are taken and re-searched at the Fingerprint Bureau.

In all of these cases, the electronic nature of the scanned prints allows more efficient comparison and identification of the individual as the

prints can be transmitted to the Fingerprint Bureau or INTERPOL in a matter of seconds.

26.4.2.2 Person Found Deceased

Sometimes missing persons are found deceased, and in some cases identification cannot be made by family members or people known to the person. This may be because a body has been found in circumstances where the potential family members and friends are unknown. In these instances identification may rely on pre-existing record data, such as the case if a person has a criminal record, as illustrated with case 26.1. It may also be due to damage to the body by the manner in which death was caused, for example, mutilation, fire, drowning, animal scavengers, or the onset of decomposition. In such cases, and as long as the friction ridge skin is intact identification may be confirmed using fingerprints. Fingerprints should also be taken even if identification can be achieved by other means, as fingerprints can be used as part of the wider investigation to link the deceased with the potential murder scene or to deduce the circumstances of the death, accident or suicide. Therefore, in all instances of sudden or suspicious death, fingerprints should be taken. In addition, fingerprint identification is accepted by the various judicial authorities as confirmation of identity of a deceased person.

Fingerprints are taken following the completion of a *post-mortem examination* in order to ensure there is no contamination of, or damage to, any other forensic evidence that may be present. Permission must be granted by the Pathologist prior to fingerprints being taken. Fingerprints are usually recovered by CSIs or dedicated Fingerprint Officers. In the majority of cases, there is no reason to remove the fingers or hands from the body, and this practice should only be used as a last resort. In the UK, such practice would be covered by the Human Tissue Act (2004).

In the UK, the central repository and database of information in relation to unidentified bodies and body parts is the Home Office Missing Persons Bureau. The former National Police Improvement Agency (NPIA) published guidance in (2010) for the Police Service in relation to the investigation of missing persons in

Case 26.1

In 2011, the UK Missing Persons Bureau was notified of a man who had died of natural causes in a resort in Darwin, Australia. The man had arrived at the resort in 2003 seeking employment and had been living and working at the resort ever since. He was described as somewhat reclusive and had not disclosed any personal details to his employer beyond a name and date of birth. Leading up to his death, he had complained of ill health but had refused to see a doctor; he was later discovered dead in his bed. A marriage certificate was located among his personal belongings so the Australian Federal Police contacted his ex-wife who confirmed that they were married in 1986 and separated 13 year later. She indicated that the individual had a criminal history in the UK, and she suspected he had provided false personal details.

The man's fingerprints were taken and sent to the UK Missing Persons Bureau for forwarding to the National Fingerprint Office. The Bureau found a man on the Police National Computer with the details provided by the ex-wife and requested that the National Fingerprint Office run a direct comparison; this returned a positive match. It would appear that he fled to Australia in the 1980s with false documentation for fear that he was wanted for criminal offences in the UK.

Source: McAra, S., Apps, J., Missing Persons Bureau, National Crime Agency, UK.

which they refer to the Association of Chief Police Officers ACPO (2009) *Code of Practice on the Collection of Missing Persons Data*, which states that all unidentified bodies and body parts must be notified to the Missing Persons Bureau within 48 h. This process enables matching of these submitted records with those of outstanding missing persons thus assisting major enquiries that cross force borders. Such cross matching is a routine function of the Bureau providing cases

remain unresolved and the record is outstanding. The Missing Persons Bureau routinely use fingerprints for the identification of missing people.

There are several methods which may be used to recover fingerprints from cadavers. The method that is used to recover the fingerprints depends upon the condition of the friction ridge skin at the time of fingerprint recovery. Should *rigor mortis* have set in, the fingers may be difficult to straighten in order to record the friction ridge detail, and recommendations exist in the literature to overcome this issue, which suggest hyperflexion of the palm and fingers, and/or to sever the tendons in the wrist to relax the hand prior to fingerprinting (Kahana, Grande, Tancredi, Penalver, & Hiss, 2001). Possible methods include:

Inked Fingerprint Recovery: If there is no, or very little, sign of decomposition, then the most commonly used fingerprint recovery technique is ink and print. This involves ink being applied to each finger in turn and placing the inked finger on the relevant section of a pre-prepared set of fingerprint cards. This process is also repeated for the palm marks. Alternatively, pre-inked fingerprint pads can be used, which are easy to use and require very little if any clean up afterwards. The inked fingers may be rolled in situ using a post-mortem spoon or shoe horn, which is essentially a curved device which cups the finger, thus allowing contact across the finger pad (Moenssens, 1971). Some believe that this technique is not as effective as the black powder recovery method used by some police forces as the oil-based ink relies on the skin being as dry as possible. As cadavers tend to continually leak fluid through the pores as decomposition progresses, it is often quite difficult to keep the hands completely dry when fingerprinting. The ink will not absorb the moisture; therefore, the quality of the fingerprint produced is adversely affected.

Black Powder Recovery: Again, if there are no or very little signs of decomposition, then the black powder recovery technique may be used to recover the fingerprints from cadavers (Principe & Verbeke, 1973). This process uses black pow-

der applied with a brush to each of the fingers and the palms. This technique is preferred by some over the ink and print technique as it is easier to control the amount of powder applied by brushing off any excess, which enables the acquisition of clearer prints. The technique is also quick, easy to use, and easier than ink to clean (Uhle & Leas, 2007). Also, the powder absorbs small amounts of moisture which may be present on the skin, and, therefore, the adverse effects on the quality of the fingerprints is minimised.

The 'Double Glove' Method: Where the skin is pliable enough, then it is possible to record the friction ridge detail by a process referred to as 'double gloving'. A second pair of nitrile gloves is placed over the first pair on the fingerprint examiner's hand. Once the thumb or finger of the deceased is inked, then the deceased's finger/thumb is rolled over the palmar surface of the examiner's glove to give a clear inked impression. This is due to the pliable nature of the palm area. The print is then cut out of the glove, annotated, and retained. Photography is not required for this method.

Casting Method: Where deceased hands are in a desiccated form, the skin can go through a process of rehydration to make it more pliable for fingerprinting, but this can be in some ways destructive. A less destructive method is known as 'casting'. A silicon-based product known as Mikrosil may be used for this purpose (Tombs & Schrader, 2005). Following the cleaning and drying, if appropriate, of the deceased hands and separation of the fingers (so the cast does not attach to another finger), a light coating of black fingerprint powder is applied to the friction ridges to aid visualisation. The silicon is then applied after being mixed to each finger in turn, or palmar surface. The solution is left to set for approximately 10–15 min and then peeled off. The resultant impressions can then be photographed and the casts suitably annotated and retained should the case then be heard at coroners court. The impressions on the cast will be correctly orientated as though recorded on a fingerprint form.

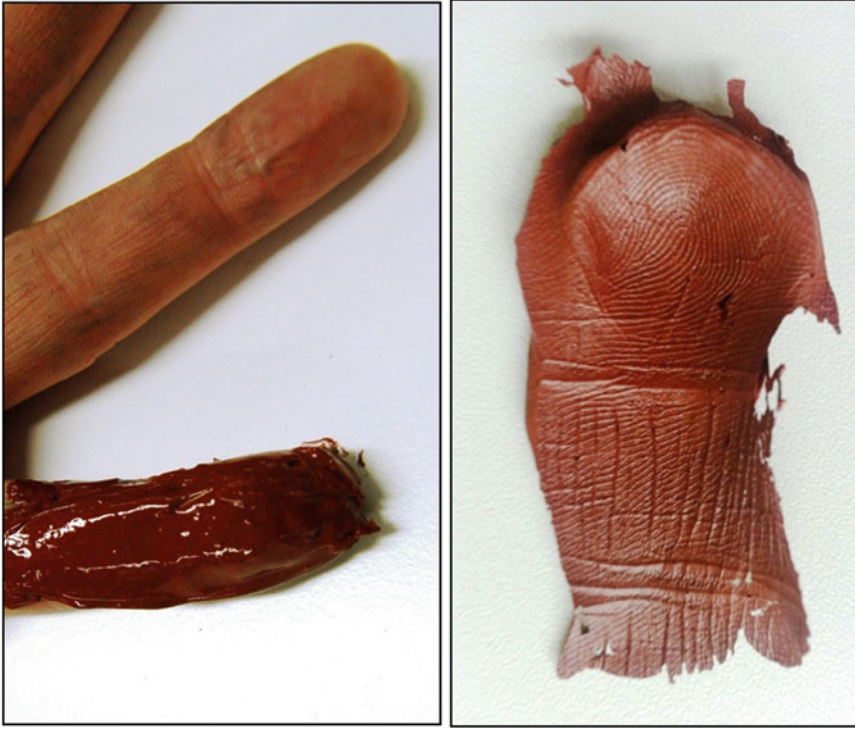


Fig. 26.10 A finger coated in black powder and Mikrosil (*left*) and its resultant cast demonstrating ridge detail (*right*) (Copyright: S. Fieldhouse)

A photograph of a finger coated in black powder and Mikrosil and its resultant cast can be seen in Fig. 26.10.

Photography: If the skin on the hands is fragile and unsuitable for powdering, inking, or casting, then photography of the ridges of the fingers and palms may be utilised in conjunction with oblique lighting. In this process, white light is shone at a very acute angle across the fingers and the palms in turn. In order to facilitate fingerprint identification, the images of the finger and palm prints taken must be of a 1:1 ratio; therefore, a scale should appear on any images produced. In some cases where the ridge detail on the skin of the fingers and palms is unclear, techniques can be used to enable clearer visualisation of the ridges prior to photography. One technique is the use of Magnesium strip, which is held with tweezers close under the area of skin of interest. The strip is set alight and the vapour produced containing white Magnesium Oxide powder adheres to the ridges, forming a greater contrast of the ridges

against their background, thus aiding photography (Kahana et al., 2001). Another similar technique uses Ammonium Chloride, which is also heated in a glass with air pumped through an insufflator, which causes a white deposit to adhere to the ridges of the skin to enable a better quality image to be produced.

If a body has been immersed in water for a lengthy period of time, then the skin becomes deeply wrinkled, and in some cases the epidermis can become detached. The change made to the skin due to water immersion is called maceration. If the skin is not too damaged, then it may still be possible to use ink, powder, or casting to recover the fingerprints. If the whole of the epidermis has separated from the dermis, then it may be possible to perform a 'double glove' technique to record the friction ridge detail. This is achieved by an examiner having a nitrile glove on her or his hand and then feeding the epidermal cadaver skin over her or his hand. The skin can then be inked or powdered to record the full hand print.

If the fingerprint ridge containing epidermis of the skin is badly damaged and fingerprint recovery is not possible, it may be possible to use the dermis to recover fingerprints using ink, powder, or casting. Images recovered from the dermis will show friction ridge detail in a ‘tramline’ effect, but this does not affect the individualisation process. The dermis, however, may often be swollen due to the effects of water immersion. In these cases, the dermis can be shrunk in order to restore the fingerprint ridges by heating the tissue in Neatsfoot oil at 100 °C, and then conventional methods may be applied to obtain useable fingerprints. Care must be taken at this stage if the cadaver prints are to be searched on AFIS systems because they only have small tolerances against the actual size of impressions searched (McGarr, 2015).

In certain cases, alternative methods will need to be used because of the condition of the friction ridge detail:

Macerated Skin: In some cases, the skin is too decomposed or soft for fingerprints to be taken effectively. In these circumstances the injection of a tissue building solution or glycerin into the fingertips can make the skin firm enough for useful prints to be taken (Kahana et al., 2001). It may be necessary to tie below the entry point of the tissue builder to maintain the ‘filled’ finger condition. In some cases, it may be useful to soak the fingers in a solution of glycol, lactic acid, and distilled water to soften the tissue. Sometimes, the damage to the fingertips is so great that it is better to remove the skin and mount it on the finger of the fingerprint taker in order to take an inked impression similar to the double gloving technique mentioned above but with each finger dealt with individually.

Fire Damaged Skin: The skin of bodies recovered from fires can be burnt, charred, or dehydrated. However, it can still be possible to recover fingerprints. During exposure to fire, the hands of a body react by clenching to form a fist, thus protecting the skin of the fingers. This is known as the pugilist position. Despite this protection, the skin can still become fragile, and ink, powder,

and casting recovery are not possible. In these circumstances, the Aluminium strip or Ammonium Chloride methods can be used. If the skin has become dehydrated, brittle, and hard, then it will require rehydration for the fingerprint to be effectively recovered. In these cases, the softness and pliability of the fingers and hand can be restored by immersion in 2% Sodium Hydroxide Solution or Potassium Hydroxide solution (Kahana et al., 2001). Application of these solutions, however, is destructive and can lead to shedding of the epidermal layers.

Mummified or Desiccated Skin: If bodies are exposed to long periods of dry air, the skin becomes desiccated or mummified. As with the dehydrated skin experienced by bodies exposed to fire, immersion in 2% Sodium Hydroxide Solution can restore softness enabling casting or use of the magnesium strip method (Kahana et al., 2001).

26.4.3 Ethics and the Identification Process

Everyone has the right to be treated with respect, including post-mortem. Sometimes, as we have already discussed, people may become ‘missing’ due to abduction, dementia, and other events that make them vulnerable and traumatised. Professionals involved in the recovery of fingerprints and other identification samples and data must therefore be mindful of this and treat individuals with care and understanding.

In addition, some medico-legal practices used to identify an individual may conflict with the values and beliefs of their families, e.g. specific religious requirements for the handling of a body after death. Some religions teach that a body must be buried soon after death and do not allow voluntary post-mortems as they are considered a desecration of the person. That said, there are permitted exceptions, e.g. if the post-mortem is required to assist in the solving of a crime or the information derived may save a life. Some religions prohibit the burial of an incomplete body, believing that if the whole body is not buried, then no burial took place. This can present chal-

allenges for investigators as samples may need to be retained for future tests. In the UK, this is covered by the Human Tissue Act (2004), which places strict responsibilities on all those involved in post-mortem and subsequent analysis with respect to the recovery, analysis, retention, and disposal/repatriation of samples taken from a body. It also covers activities in relation to fingerprints, such as the recommendations and subsequent review of coroners' responsibilities which came out of the Marchioness Disaster Public Inquiry in 2000 (Case 26.2).

Case 26.2 The Marchioness Disaster (1989)

In the UK, the practice of removing hands from cadavers to facilitate identification came under fire following the Marchioness Disaster in 1989. On the 20th August 1989, over 130 passengers in their twenties were attending the 26th Birthday party organised for banker Antonio de Vasconcellos on board the pleasure boat The Marchioness. No more than 40 min into the party the river dredger, Bowbelle collided with and sank The Marchioness, with 51 of the 131 partygoers aboard perishing. Twenty-four bodies were found in the boat and a further 27 found in different locations along the River Thames. Following the disaster, the hands of 25 of the 51 victims were severed to ensure identification prior to the quick onset of decomposition (caused by immersion in water). This caused a public outcry and disquiet amongst the families of the victims. In 2000, a public inquiry was set up led by Lord Justice Clarke. His resulting non-statutory report expressed concern regarding the practice of removing the hands and the fact that no one person or group had been established to oversee what identification evidence was available for each body; the latter would have prevented hand removal as in 21 of these instances, identification had already been established by other means.

Since the disaster, identification commissions have been established consisting of the Coroner, the pathologist, and senior police representatives and there was a full review of the centuries-old Coroner's system to establish a legal basis for Coroners' powers, duties, and responsibilities. Coroners also received formal training for the first time. This now means that there is no longer an automatic removal of hands unless the Coroner and identification commissions agree that it is totally necessary. The removal of hands from cadavers now rarely happens in the UK, as police identification of the deceased is derived by utilising images or prints of the deceased hands which are recovered in the mortuary or temporary mortuary. Furthermore, the adoption of the Human Tissue Act, 2004 also ensures that strict rules regarding the removal of body parts and their subsequent repatriation are adhered to.

26.5 Processing Fingerprints in Missing Persons Investigations

26.5.1 Processing Fingerprints in the Country of Origin

The level of risk associated with a missing person enquiry will dictate the time within which a set of fingerprints should be submitted to the enquiry. In general cases where there is medium to low risk, then the fingerprints can be retained until required. However, where there is high risk or the case is the subject of a criminal investigation, then the fingerprints must be submitted immediately.

In the UK, the police force responsible for policing the geographical area from which the person has been reported missing will maintain responsibility for the investigation. However, if there is suspicion that the missing person has gone to or been taken to another country, then the

UK police force will enlist the assistance of INTERPOL, the Federal Bureau of Investigation (FBI), or the police force in the relevant country. This approach is replicated in a number of other countries.

INTERPOL now has 190 member countries that use their facilities and services. All these members are encouraged to submit fingerprints they have taken of arrested non-nationals in order for them to be included in the INTERPOL AFIS database. In addition, if the missing person has not been involved in any criminal activity and does not have a set of fingerprints on file, then INTERPOL will accept a composite set of fingerprints compiled by the relevant member country from those marks recovered from personal possessions recovered from the home address of the missing person. If a person is reported missing in a member country, then a request can be sent to INTERPOL for a 'yellow notice' to be issued which requests the fingerprints of the missing person. On receiving the fingerprints, INTERPOL will open a case in their criminal history database and the fingerprints will be added to the database. This then allows the fingerprints to be compared with every set of fingerprints and crime scene marks that are searched against the database. It is possible that a person who may not have been reported as missing is subsequently identified, and is then linked to crimes where no suspect had previously been identified. This is highlighted in Case 26.3.

As well as the INTERPOL Fingerprint Unit processing the fingerprints on the AFIS, the fingerprints can also be searched against the INTERPOL database by the National Central Bureau in the member countries. By doing this, the member country carrying out the search will receive an automatic response to their search. If an identification or 'hit' is made, then the country owning the fingerprints is also informed of the result. All members are recommended that fingerprints included in notices be searched against the member countries databases.

If there is no criminal history, identification of the person or body is made by comparing the fingerprints taken post-mortem as detailed above

Case 26.3

A Vietnamese national was arrested in 2013 at a cannabis house in Northern Ireland for illegal entry to the UK. He claimed to be aged 17 years old and as a result was placed into foster care. He was reported missing from his foster placement a week later and has not been located since. Initial enquiries were conducted by the Police Service of Northern Ireland (PSNI) with support from the UK Missing Persons Bureau, however no trace has been found.

As part of an annual review by the Missing Persons Bureau, the fingerprints from the time of his arrest were requested from PSNI. These were sent to the National Fingerprint Office for comparison against the Ident1 unidentified crime scene marks database. His ten-print set were matched against an outstanding crime scene mark of evidential significance from a Metropolitan Police drugs case. The missing person had not previously been known to have been involved. As a result, the individual has now been classified as 'wanted'.

Source: McAra, S., Apps, J., Missing Persons Bureau, National Crime Agency, UK.

with those recovered ante-mortem from personal effects fingerprinted at the time of the person being reported missing.

26.5.2 Processing Fingerprints Internationally

According to INTERPOL (2015), the INTERPOL Fingerprint Database contains over 189,000 fingerprint records (as of December 2013). Each member country has nominated authorised users who are able to submit, access, and cross-check fingerprints on the INTERPOL AFIS through a secure global police communications network

called the AFIS Gateway. This service is available 24/7 using the I-24/7 Network and is used by 190 countries. From 2010, this system has also been able to search palm prints and palm marks. 1200 fingerprint identifications were made by INTERPOL in 2013. This was because of an increase in use and data sharing by the member countries. An example of how INTERPOL aided the identification of a UK national is shown in Case 26.4.

Case 26.4

A 37-year-old man was last seen by his family at his home address in Wales in 1992. He lived quite an itinerant lifestyle and was known to often travel abroad. They believed that he planned to hitchhike across to Europe and, indeed, he telephoned from Spain a month after he had left home. After no further contact with his family, he was reported missing to police in 1994.

In 2010, the UK Missing Persons Bureau was notified of an unidentified man who had been found deceased in Paris. He was known to have lived on the streets in the area for many years. He had previously been stop checked by the Police Nationale and provided a name and date of birth that indicated he had links to the UK. As a result, they obtained a copy of his fingerprints and sent them via Interpol for comparison against the UK National Fingerprint Database. The fingerprints were searched and a match was returned against the man missing from Wales in 1992, as his prints were held against a custody record from 1988. The name he had provided to the Police Nationale was false and given the length of time since he was last seen, his appearance had changed significantly; without the fingerprint comparison, this individual may never have been identified.

Source: McAra, S., Apps, J., Missing Persons Bureau, National Crime Agency, UK.

In 2012, INTERPOL published *Guidance Concerning Fingerprint Transmission* with respect to submitting fingerprints to them for identification purposes. Fingerprints are submitted to the INTERPOL General Secretariat who up-loads them to the database. The storage, retention, and exchange of the fingerprint records is as per the format set by the National Institute of Standards and Technology (NIST) and INTERPOL's rules on the Processing of Data. If NIST format is not possible, the fingerprints and/or finger marks taken from a crime scene or as ante-mortem data for identification confirmation should be submitted in JPEG 2000 format particularly in the case of marks as this is a lossless compression (all of the original data can be reconstructed from the compressed data). In these cases, the fingerprints/finger marks should be original documents at a ratio of 1 to 1 at 500 DPI using JPEG 2000 compression 8 Bits per pixel (grayscale) with a visible scale attached or be part of fingerprint form. There should be no pixilation when viewed under a fingerprint glass. In the case of photographs, information regarding image improvements, e.g. reversals, must accompany the image. If image improvements have been carried out, information regarding this must be retained and accompany the image when it is sent for comparison to inform the fingerprint officer if the mark had been reversed, etc. The transmission of fingerprints in JPEG format is not as effective as the NIST format as:

- Automated comparisons are not possible via the AFIS Gateway.
- More manual work is needed to process the fingerprints.
- It is more time consuming.
- The image quality is not as good.
- High quality JPEG images of the correct size and resolution are large files.

The submitted fingerprints will be searched against all data stored in the INTERPOL AFIS. If a match cannot be made (NO-HIT), the result will be returned to the searcher in 10 min. If there is a match or HIT, it will be validated by two fingerprint examiners at INTERPOL.

In the USA, missing persons cases are solved by the National Missing and Unidentified Persons System using the NamUs Database. This system was born out of a need based on an approximate 4400 unidentified human remains cases every year and nearly 100,000 active missing persons cases on any given day in the USA. A repository for missing persons data the NamUs database was created by the National Institute of Justice. Like the INTERPOL database, NamUc makes missing persons records accessible by investigation agencies and medical examiners to assist them in the identification process (Pearsall, n.d.).

26.6 The Identification Process Using Fingerprints

When a fingerprint examiner is asked to identify an unknown friction ridge skin surface or a friction ridge skin mark, she or he will look for similarities and differences between the class and individual characteristics (Sect. 26.3) contained within the unknown mark compared to a known *fingermark* or *fingerprint* taken from an individual. Any inconsistency between the class characteristics would exclude the known fingerprint as originating from the same source. Should the class characteristics not be available, clear, or consistent between the unknown and known marks, then the examiner would proceed to comparing the individual characteristics on the unknown fingermark compared to the known mark or print.

There are four possible outcomes that a fingerprint examiner may make:

- Identification—there is sufficient, legible friction ridge detail in agreement between the unknown mark and the known print, with no unexplainable differences to conclude that (in the opinion of the practitioner) the mark and print originated from the same individual.
- Exclusion—there is sufficient disagreement between the unknown mark and the known print to conclude that they did not originate from the same individual.
- Inconclusive—there are insufficient similarities or dissimilarities between the unknown

mark and known print therefore it is not possible to neither identify nor exclude a particular individual.

- Insufficient—there is not enough detail, or the detail contained within the unknown mark is of such a poor quality that a reliable comparison cannot be made.

Fingerprint comparison and subsequent identification must be carried out by qualified and highly experienced fingerprint experts/Officers. Fingerprint experts are predominantly employed by police forces, but can also be employed by other agencies that may be involved in missing person enquiries such as INTERPOL or borders agencies in different countries. The organisations involved in a missing person's enquiry will depend on the nature of the enquiry.

There are two main approaches which accurately describe friction ridge skin identification methods: numeric and non-numeric approaches.

Numeric approaches to identification: As the name suggests, numeric approaches rely upon a minimum number of characteristics (from the friction ridges) to be present for confirmation of identification. This number has and currently varies throughout the world.

Non-numeric approaches to identification: Non-numeric approaches do not require a minimum number of characteristics to exist in order for an identification to be made. Instead, it is based on the opinion of a fingerprint expert² based on their training and experience. The non-numeric approach has been more recently associated with the protocol known as ACE-V.

26.6.1 The ACE-V Process

The ACE-V (Analysis, Comparison, Evaluation, and Verification) process is used in many parts of the world as a methodological framework for fin-

²A fingerprint expert is required to have extensive training, beyond basic fingerprint examination, which qualifies them to give evidence in court

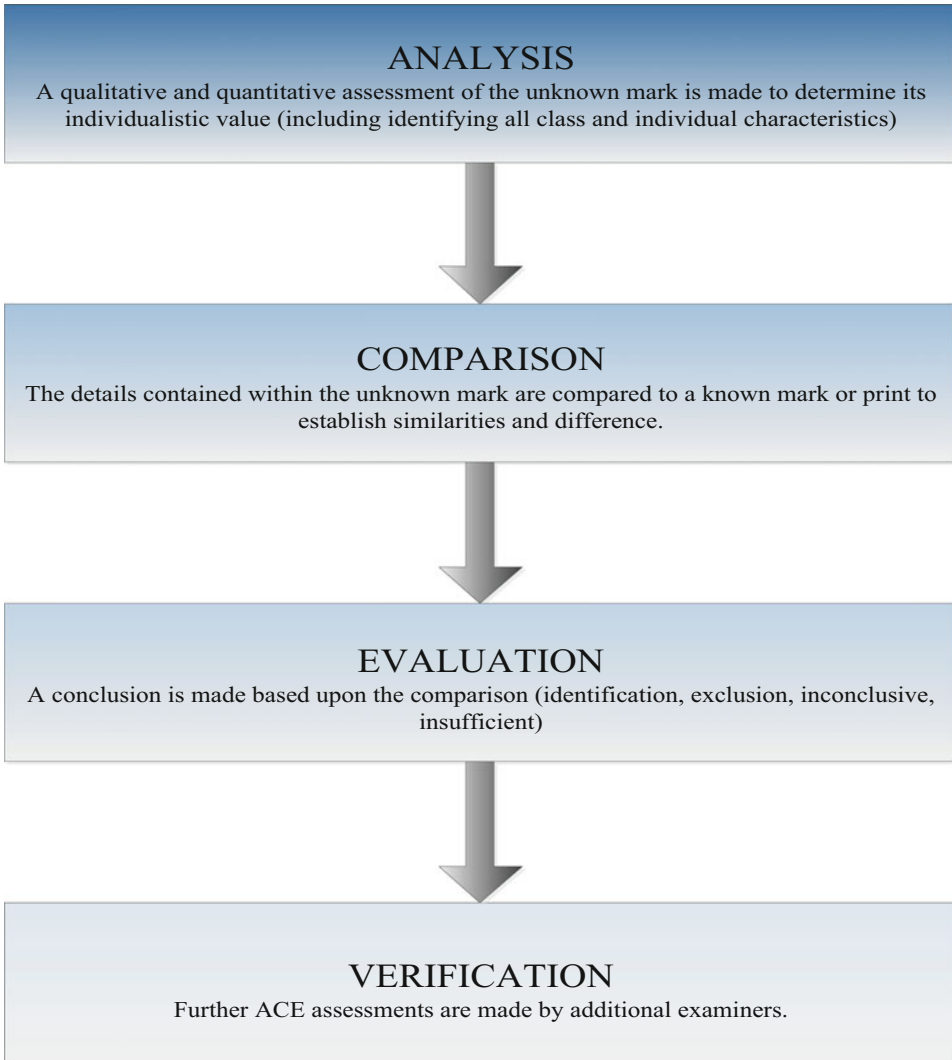


Fig. 26.11 The ACE-V method of fingerprint identification (Copyright: S. Fieldhouse)

gerprint examiners to follow when examining unknown friction ridge skin marks, and outlines various thought processes and stages a fingerprint examiner goes through to try and reach an identification. It is summarised in Fig. 26.11.

Analysis: During the analysis stage, the unknown mark is independently assessed to identify any class or ridge flow and individual characteristics. It will then be annotated accordingly, demonstrating the direction of the ridge flow, and the positions of any identifying detail. The examiner

will make an assessment to determine the actual value of the mark; that is, whether or not it contains enough detail for identification. They are likely to take into account factors which may affect the mark's appearance, such as substrate effects, the physical manner of deposition, such as excessive force or distortion, and the methods used to enhance the marks. The analysis may be carried out on an AFIS, particularly if the marks have been remotely submitted directly to this system. The unknown mark would then be searched against all friction ridge skin prints and

marks present in the database, subject to digit determination or palm mark area/orientation determination. This search would aim to produce a list of potential matches, which would then be compared to the unknown mark in the next stage by the examiner.

Comparison: At this stage, the unknown mark is compared to the known mark/print(s) to look for similarities and dissimilarities in the ridge detail identified in the analysis stage. An annotated comparison chart may be produced to demonstrate the results of the comparison. In such charts, corresponding areas of ridge detail are identified to demonstrate the similarities and/or differences in the detail that has been identified.

Evaluation: The evaluation may have one of four outcomes, as previously described in Sect. 26.6.

Verification: The final stage in the identification process is verification. Generally, at least two further experts are requested to examine the evidence, using the ACE-V method, as described, one being usually a senior officer. The verification stage is used to mitigate against error, given the subjective nature of the process. Blind verification means that the verifying examiner conducts an independent analysis, comparison, and evaluation of the unknown mark, with no prior knowledge of previous examinations or contextual information. With an open verification, the verifying examiner will have some knowledge of previous examinations of the unknown mark, such as the decisions that were reached by other examiners.

Following identification, the case will progress according to the nature of the investigation (for example, if it is part of a criminal investigation).

26.7 Latest Developments

According to INTERPOL (2015), a project is currently under way to create the first ever Police database to identify and link missing persons and unidentified bodies on an international level. At a

cost of almost three million Euros, INTERPOL launched the Fast & Efficient International Disaster Victim Identification System (FASTID) Project in 2010. The project is led by INTERPOL and is partly funded by the European Commission. The aim is to provide a system used internationally to manage enquiries concerning missing persons and unidentified bodies in the event of disasters. It will also be used in day-to-day policing of missing persons enquiries and will result in the creation of a global Missing Persons and Unidentified Bodies (MPUB) database.

26.8 Conclusion

Fingerprints represent a widely used and established technique of human identification. They are routinely used for the identification of missing persons, owing to the discriminative power of the technique, combined with its cost effective, and portable approach. The processes followed for the use of fingerprints for identification purposes depend on the circumstances surrounding the case. This may include whether the absence of the missing person is related to criminal activity, and whether the person has been found alive or dead. Frequently, the ability to identify people using fingerprints is related to the quality and quantity of the unknown fingermarks or friction ridge skin samples, and having access to known fingerprint impressions for comparison. This chapter has outlined typical protocols which may be followed by law enforcement agencies to use fingerprints as part of an investigation, from the recovery of fingermarks and friction ridge detail, to the information provided by friction ridge skin that is used by fingerprint examiners during identification.

Glossary

AFIS Automatic Fingerprint Identification System—a database containing ten-print sets and unknown fingermarks which helps an examiner to identify unknown marks by providing examiners with potential comparator marks.

Ante-mortem Data, information or documentation collected for a person during their life that could assist in identifying them after their death or if found alive

ACE-V Analysis, Comparison, Evaluation, Verification—a process used by fingerprint examiners to identify unknown friction ridge skin marks.

CSI Crime Scene Investigator

DNA Deoxyribonucleic acid

Elimination prints Ten-prints taken from an individual who has not been arrested on suspicion of carrying out a recordable offence.

Fingerprint A known impression made by the friction ridge skin of a finger.

Palm Print A record made of the pattern of friction ridge skin on the palms of the hands

Fingermark An unknown mark made by the friction ridge skin of a finger.

Non-porous surface A surface which does not absorb the latent fingermark

Palm Mark The mark made by the palm print on a substrate (surface) when a palm touches that substrate

Ten Print Known fingerprints taken from the palmar surfaces of individuals for identification purposes

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27.1 Introduction

In North America, the discipline of anthropology has traditionally encompassed the sub-disciplines of archaeology, biological (or physical) anthropology, sociocultural anthropology and linguistic anthropology. Within this particular schema, forensic anthropology lies within the sub-discipline of biological (or physical) anthropology. The cross-training of anthropologists in these four sub-disciplines has meant that forensic anthropologists in North America may also be field archaeologists experienced in the search, location and recovery of human remains (Steadman, 2013).

In the United Kingdom, forensic anthropologists have originated from a variety of different backgrounds and disciplines, but have primarily derived from the fields of anatomy, biological anthropology, osteoarchaeology and skeletal biology.

Within the last decade, dedicated forensic anthropology and archaeology single and combined degrees have been offered by UK universities, and it is now the case that the vast majority of post-graduate students and early career

practitioners are entering the work place with degrees in one or both of these disciplines. Given the diversity of terminology that is currently used in the literature to describe the role of the forensic anthropologist and archaeologist (which appears to depend to some extent upon the country and educational system), the term ‘forensic anthropologist’ will be used to describe a practitioner who is skilled in the analysis of human remains as well as having a thorough understanding of search, taphonomic change and recovery techniques (Blau & Briggs, 2011; Cattaneo, 2007).

This chapter will discuss the role of the forensic anthropologist in the search, recovery and identification of human remains as it is conducted in missing person cases. The recovery of the body and the post-recovery process will also be discussed and this chapter will include a brief consideration of the parameters of the biological profile, including the variety of new techniques currently being utilised which allow the maximum amount of information to be gained from unidentified human remains.

The involvement of the forensic anthropologist in cases of missing persons can be extensive. Individuals who go missing will often turn up unharmed after a short period of time, but in situations where this is not the case, there is a vital role for the forensic anthropologist to play. This role may variously span the initial search phase, the recovery phase and the subsequent

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anthropological analysis within the mortuary. The participation of the forensic anthropologist in one or all of these processes can ultimately assist in the identification of the missing person.

The first and most important role of the anthropologist at the scene is to identify potential bone material for recovery. The ability to recognise and identify human bone at the scene is of utmost importance. Bone can be damaged and changed by the environment, especially after exposure to heat such as fires or after decomposition and/or animal scavenging has occurred (Blau & Briggs, 2011; Haglund & Sorg, 1996; Pokines & Symes, 2013). Taphonomic factors can result in fragmentation, colour change and loss of bone matrix and structure which can make human bone difficult to locate, identify and recover. Therefore, an ability to detect and recognise both adult and juvenile human bone in these states is a vital skill for the forensic anthropologist (Blau & Briggs, 2011; Cattaneo, 2007; Haglund & Sorg, 1996, 2001). Once remains have been recovered, the role of the forensic anthropologist can continue in the mortuary, where an analysis of the remains will allow the creation of a biological profile which can assist the police in making an identification (Blau & Briggs, 2011; Cattaneo, 2007).

27.2 Search

Whilst on many occasions the involvement of the forensic anthropologist will only begin once remains are discovered, a forensic anthropologist can also advise the police in the forensic search phase of a missing persons investigation and work in tandem with other search assets such as victim recovery dogs, geophysicists, forensic archaeologists and forensic ecologists (Hunter, Simpson, & Sturdy Colls, 2013). A forensic anthropologist will generally have an in-depth knowledge of taphonomic processes that can contribute to an understanding of which search assets would be most useful to bring to any given situation (Beary & Lyman, 2012; Dirkmaat, Cabo, Ousley, & Symes, 2008). Each search situation is different, with different weather,

landscapes and scenarios, so an understanding of the strengths and weaknesses of each search method and their use means that the involvement of a forensic anthropologist during the planning stages supports the establishment of a fit-for-purpose forensic search strategy that is most appropriate to the unique circumstances of each individual missing persons case (Hunter et al., 2013; Hunter & Cox, 2005).

Having the forensic anthropologist on scene during a search should be a consideration as it is not unusual for animal bones to be found in both rural and urban environments (Haglund & Sorg, 1996; Schultz, 2012). If the forensic anthropologist works within, and alongside the search team, this allows both bones and any other artefacts which might resemble bone to be identified as non-human material quickly and efficiently, enabling the search to continue with limited interruption and therefore helping to minimise both costs and the resource requirements for the search.

After decomposition, human remains may become disarticulated and scattered, especially if remains are on the surface or in a shallow burial. In this case, a careful and systematic search of the immediate and surrounding area has to be implemented to ensure that maximum recovery of the remains is achieved. Again, the forensic anthropologist has the skills to advise and support these searches, firstly by identifying bones of the skeleton that are present/missing and secondly to advise on potential scenarios such as indications of animal scavenging which may provide intelligence for the possible location of the scattered remains (Blau & Briggs, 2011; Cattaneo, 2007; Hunter et al., 2013; Moraitis & Spiliopoulou, 2010).

The presence of the forensic anthropologist at the scene is vital to a full and accurate recovery, especially where the body has undergone any degree of fragmentation, commingling, decomposition, skeletonisation or thermal damage (Blau & Briggs, 2011; Dirkmaat, 2001; Hunter et al., 2013; Moraitis & Spiliopoulou, 2010; Mundorff, 2008, 2012; Park et al., 2009; Pinheiro, 2006).

27.3 Scene Recording

When human remains are found, the length of time that the individual has been deceased will be crucial component to the overall condition of the remains (Bell, Skinner, & Jones, 1996; Duday & Guillon, 2006; Haglund & Sorg, 1996, 2001; Pinheiro, 2006). Individuals who have gone missing and died very recently prior to discovery, especially during colder weather, will tend to retain most of their soft tissue and any clothing that they were wearing may still be in situ. It should however be noted that clothing can be removed by a perpetrator or by the victim themselves during a period of confusion such as can occur with hypothermia or substance abuse (Rothschild & Schneider, 1995; Wedin, Vanggaard, & Hirvonen, 1979). A body found with clothing in situ and which still retains all of the soft tissue does not pose any issues in recovery due to the lack of fragmentation and the limited taphonomic damage caused by biotic and abiotic environmental factors encountered in cases where human remains have been found upon the ground surface. The areas that are often found to sustain taphonomic damage in the immediate post-death period are generally the hands and the head as these are the most exposed to the environment and therefore tend to be most at risk of damage by animal scavenging (Duday & Guillon, 2006; Haglund, 1996). The remainder, including the torso and the feet, may also be vulnerable if they are exposed, but clothing and footwear both tend to act to protect the body, at least initially, from animal scavenging, slowing down access. The forensic anthropologist will be able to identify the marks left by animal scavenging and in some cases can help to narrow down the species of animal involved. This information may assist with any further search which might be implemented for missing skeletal remains since the search can then identify and follow animal runs and even track back to hides (Hunter et al., 2013).

If a longer period of time has passed since the missing person has died, and especially if the weather has been warm or the body has been damaged or suffered from prolonged animal

scavenging and insect activity, then there is more likely to be a greater degree of decomposition (Duday & Guillon, 2006; Haglund & Sorg, 1996; Mann, Bass, & Meadows, 1990). The subsequent loss of soft tissue can mean that the body becomes skeletonised and the bones disarticulated, and it may become spread over a large area. Fragmentation can also occur through exposure to thermal damage (Dirkmaat, 2001; Pokines & Symes, 2013).

Each scene is unique in the issues that are encountered including the degree of decomposition of the remains, the degree of damage and the amount of disturbance, disarticulation, and subsequent dispersal of the body caused by taphonomic factors such as scavenging, water flow, exposure to heat or other influences, the combination of which will vary from scene to scene (Haglund & Sorg, 1996). One of the most important factors in any successful recovery is the ability to recognise bone from other possible artefacts such as wood or other non-osseous materials (Christensen & Crowder, 2009; Klepinger, 2006). This can be especially challenging when materials have been exposed to heat (Dirkmaat, 2001; Park et al., 2009). Once bone has been discovered, the forensic anthropologist will be able to ensure that it is correctly identified as human in origin and recovered in an appropriate manner. It is important to ensure that animal and human remains are appropriately recorded and if necessary separated during recovery and that any recovery is complete and properly recorded (Dupras, Schultz, Wheeler, & Williams, 2011; Park et al., 2009). The forensic anthropologist is in the unique position to be able to undertake all of these tasks and their presence results in an efficient and timely recovery whilst also producing recording documentation to court appropriate standards.

Differentiation of fragmented or burnt bone into species of origin can be especially difficult but the importance of successful identification cannot be emphasised (Blau & Briggs, 2011; Fairgrieve, 2007; Park et al., 2009). To confuse the two can result in a number of issues; to identify animal as human bone can firstly mean an initiation of an expensive series of tests such as

DNA tests, further searches by the police and the involvement of other investigating agencies. Furthermore it may also result in family members being given incorrect information at a time when they are most vulnerable. To identify human as animal bone at best results in incomplete recovery and at worst can mean that the deceased may be missed completely whilst also causing unnecessary trauma to the family of the missing person.

Once bone has been identified as human bone, the recording and recovery methodology is important. Whilst many missing people disappear in non-suspicious circumstances, this is not true in every case and therefore accurate records in the form of documentation and photography must be maintained at each stage of the process, even if circumstances would initially suggest that the death is non-suspicious. All body recovery that is undertaken results in disruption to the scene that in turn causes changes that cannot be reversed (Hunter, 2009; Hunter et al., 2013). Accurate recording and mapping of the scene at all stages ensures that it can be recreated for the purposes of the investigation and for later presentation in court if required. All stages of the recovery of the body and associated personal effects should be recorded both through accurate documentation and through photography (Christensen & Crowder, 2009; Galloway, Birkby, Kahana, & Fulginiti, 1990; Snow, 1982). The relationship of personal effects to the body itself can also be of importance and must therefore be mapped and recorded in order to provide an understanding of the scene and of the individual and their personal effects within that scene. The forensic anthropologist will work in association with the crime scene investigators to ensure that this is carried out, creating an accurate record of events and locations.

27.4 Packaging

Once human remains have been identified, recorded and recovered they have to be appropriately packaged for successful transportation to the mortuary. Remains that have become fragile

as a result of taphonomic processes or exposure to heat can be damaged further as a result of poor packaging and rough handling (Correia & Beattie, 2002; Dirkmaat, 2001; Fairgrieve, 2007). In addition, bones that still have vestiges of soft tissue adherent or which are damp are liable to continue to deteriorate if packaged in plastic and if left for an extended period of time. Mold can grow on the bone surface which not only obscures vital information such as the presence of cut marks and other trauma, but it can also cause damage to the surface of the bone and affect the chances of DNA recovery (Buzon, Eng, Lambert, & Walker, 2005; Grupe, 2007; Startari, Benoit, Quatrehomme, Carle, & Pognonec, 2013). The forensic anthropologist can therefore advise on appropriate packaging that minimises damage and maximises preservation. In relation to very fragile remains, such as those exposed to thermal damage, the stabilisation of bone may be necessary prior to packaging, although the use of chemicals such as cyanoacrylate glue should be carefully considered and only used with the agreement of other forensic scientists who may have cause to also examine the remains, such as fire investigators and forensic biologists (Griffiths & Bellamy, 1993). Photographic imaging of vulnerable areas of the bone, such as those that are used in creating a biological profile, i.e. the pubic symphysis, should also be considered prior to packaging as this will assist in ensuring that information is not lost due to the damage that might occur during transportation.

27.5 Commingled Remains

Commingled human remains may result from diverse range of incidents such as natural disasters, transportation accidents, terrorist attacks and human rights violations including war crimes, crimes against humanity and genocide (Adams & Byrd, 2008; Mundorff, 2008, 2012; Park et al., 2009). Recording and recovery protocols at the scene and the mortuary will therefore necessarily differ depending upon: the type of incident, the degree of fragmentation, disruption and commingling, the number of victims, the location and

logistics of the recovery operation, and importantly whether it is an ‘open’ or ‘closed’ population. An ‘open’ population is one in which the numbers of victims missing may not be known for an extended period of time or, indeed, may never be known to the investigating authorities. Whilst a ‘closed’ population is one in which the number and the identity of the victims are known from the outset, such as would be the case with an aircraft accident where a flight manifest would indicate the names of the individuals who had boarded the aircraft (Black & Hackman, 2009).

Commingled human remains present a particular challenge in missing persons cases and must be carefully recorded, mapped and recovered to preserve—as much as possible—the integrity of individual bodies and body parts (Tuller, Hofmeister, & Daley, 2008). In human rights investigations, the removal of commingled human remains from mass graves presents its own unique challenges. The combined effects of the decomposition of bodies buried *en masse*, the taphonomic conditions that may have influenced the decomposition (oxygen availability, soil type and pH, access by insects and carnivores, water ingress and egress, etc.) and the circumstances surrounding the original deposition or in some cases redeposition of the bodies can dramatically affect the integrity of the bodies. These can all also affect the relationship between a body and its individual body parts (Haglund, 2002; Schmitt, 2001; Skinner, 1987; Tuller et al., 2008). The excavation and recovery process must therefore be undertaken using rigorous and methodical processes in order to ensure that the human remains are carefully recorded in situ and reassociation of body parts and their relationships to one another are considered before final removal from the grave; to do otherwise may ultimately hinder the identification process in the mortuary as each individual body part would otherwise need to be separately sampled (Adams & Byrd, 2008; Prinz et al., 2007; Tuller et al., 2008).

The role of the forensic anthropologist is also integral to the identification process of commingled remains as fragmented and commingled remains need to be correctly identified to species and skeletal element. In order to maximise the potential of identification of all persons missing

from the incident, if no soft or hard tissue attachment or association of commingled remains can be made at the triage station by the forensic anthropologist, each bone or body part must be broken down into individual cases and separately processed in order to maximise the potential to identify all victims from the incident (Mundorff, 2008; Mundorff, Bartelink, & Mar-Cash, 2009; Park et al., 2009).

The degree of fragmentation and commingling of human remains and the number of victims will dictate the size and number of samples that will ultimately be tested (Mundorff et al., 2009; Prinz et al., 2007). Best practice dictates that a practical threshold of minimum fragment size and/or condition for DNA analysis be established for the processing of remains. Therefore, depending on the type of incident that has generated the commingled human remains and the jurisdiction and country in which the incident has taken place, the criteria on how the commingled remains are separated and processed will necessarily be dictated by the medical examiner, the coroner or the investigating judicial authority (Mundorff, 2008).

27.6 Mortuary

If a forensic anthropologist has been involved in the recovery of the remains everything that has been recovered will have been mapped, recorded and labelled at the scene. Accurately identifying all of the remains recovered, especially if they are fragmented or damaged, is a vital role of the forensic anthropologist. Whilst a detailed knowledge of skeletal remains ensures that an accurate inventory can be made, including identification of the number of individuals that have been recovered, the separation of commingled remains and the detailed analysis of the skeletal remains must be undertaken within the mortuary.

27.7 Maceration of Remains

Whilst the forensic anthropologist has traditionally been involved in cases where loss of soft tissue is extensive because there has been either

complete loss of soft tissue or decomposition has progressed to the stage where soft tissue and organs are not discernable, the use of imaging modalities such as radiography and computed tomography (CT) has meant that anthropological analysis can be undertaken upon unidentified human remains without the necessity to undertake removal of adherent soft tissue (Thali et al., 2003). The use of imaging methods such as CT also means that even bodies that still have full soft tissue in situ can be examined and a full analysis undertaken of the underlying skeleton, allowing the forensic anthropologist to play an important role in the identification of unidentified missing persons.

Despite the use of imaging techniques, the removal of soft tissue, especially where there is only a limited amount still in situ, can still be useful. This is known as maceration and there are a number of methods available to undertake this procedure (King & Birch, 2015; Lee et al., 2010; Offele, Harbeck, Dobberstein, von Wurmb-Schwark, & Ritz-Timme, 2007; Steadman, DiAntonio, Wilson, Sheridan, & Tammariello, 2006). The forensic anthropologist will be able to advise on the most appropriate method to use, taking into account the reason for the soft tissue removal, the amount of soft tissue to be removed and the speed with which results are required. A number of maceration techniques, whilst relatively quick, can be harmful to the underlying bone rendering any subsequent analysis of cut marks or other trauma impossible because of the damage to the surface of the bone and so care must be taken with the method choice (Steadman et al., 2006).

27.8 Biological Parameters

Once the skeletal remains have been X-rayed or CT imaged and cleaned (if required), the role of the forensic anthropologist within the mortuary is to assist with the creation of a biological profile that will include an estimation of ancestry, sex, age at death, and stature, together with the identification of any individuating traits that may be present and a description of any ante- and peri-

mortem trauma which may ultimately assist in the identification of the individual and the investigation into their death (Christensen, Passalacqua, & Bartelink, 2013; Klepinger, 2006; Snow, 1982). Each of these analyses can be done either directly from the skeleton or through the analysis of CT scans (Grabherr et al., 2008).

The creation of a biological profile can be used to guide the identification process, either through the publication of accurate information for press release and appeal, or to assist the investigative authorities to narrow down the possibilities in relation to any searches of possible missing persons.

Whilst DNA can ultimately assist with the identification of the individual, this depends on the ability to produce a full DNA profile from the remains, which is not always possible due to decomposition (Bender, Farfán, & Schneider, 2004). Partial DNA profiles can be of assistance however their usefulness may vary from case to case. Additionally, identification by unique identifiers such as DNA or dental records relies on finding a match between both post-mortem data and ante-mortem data (Petju, Suteerayongprasert, Thongpud, & Hassiri, 2007; Szibor, Huckenbeck, Thiel, Krause, & Lessig, 2008). Even when a DNA profile or dental chart has been created, unless the individual has been reported missing or already has their DNA on a DNA database, a DNA profile will not be available for matching and it becomes incredibly difficult to identify the dentist who holds their records, if indeed there are any dental records. The ability to appeal to the public for information can be vital for the identification process in such situations as the information gained from the public can narrow the field of inquiry.

The assessment of ancestry is purely an assessment of characteristics on the skeleton, allowing a broad brush approach to the ancestry group of an individual. This analysis does not assist with identifying the sociocultural group to which a person may belong or to which they may self-identify or have defined themselves whilst still alive (Cattaneo, 2007). For this reason, it is less useful in some situations, such as in mass disaster incidents, where the analysis of ancestry

does not contribute to information of an individual's citizenship and so is a limited method for sorting individuals. Both cranial and postcranial regions have been studied morphologically and metrically to identify the best indicators of ancestry (Hefner, 2009; Konigsberg, Algee-Hewitt, & Steadman, 2009; Wright, 1992). There is a close link between skull morphology and ancestry and as a result this is the skeletal area most commonly used in the estimation and assessment of ancestry. Both morphological and metric methods exist and there are computer programmes which have been developed to analyse ancestry groups from metric measurements of the skull (Jantz & Ousley, 1993; Wright, 1992). Testing has shown however, that these should be used with care and the results may fall far short of admissibility criteria which would be acceptable in court if the incorrect population sample is used (Elliott & Collard, 2009; Kallenberger & Pilbrow, 2012).

In relation to identification criteria, the assessment of sex and age at death are arguably the two most important of the biological parameters which the forensic anthropologist is able to identify. Research has demonstrated that it is possible to suggest the sex of an individual from a number of bones of the body, but that the most accurate analysis of sex is made from interpretation of the morphology of the pelvis and skull as these are most sexually dimorphic. Inaccurately assigning a sex to an individual set of remains can be costly in both time and money as any investigation will proceed on the information which it has been given. Biological sex separates the population into roughly two halves and any investigating team, once informed of the sex of the individual, will concentrate all their efforts on individuals of that sex, e.g. if told that the remains are female, all subsequent appeals will be for missing females and therefore the records requested and examined will also be for females. It should be noted that the analysis of biological sex is an assessment of the sex indicated by the skeletal morphology of the individual and as such is an analysis of the effects of sex hormones on the morphology of the bones and gives no indication of how an individual may have chosen to live their life (Konigsberg et al., 2009; Spradley &

Jantz, 2011). There are examples of people choosing to live, dress and be known as male when they are female, or conversely be known as female when they are born male and they may choose to keep this a secret from friends and family. This scenario is not common, but it is one which does have to be considered when any analysis of sex is undertaken. Therefore, the term biological sex is used throughout this chapter to differentiate the fact that any assessment undertaken by the forensic anthropologist will be an analysis of the effect of sex hormones on the skeleton (Marshall, 1974).

This of course raises the issue of what happens in relation to juvenile remains. Prior to puberty, it is not possible to assign a biological sex to skeletal remains without the use of DNA analysis, since the morphological changes that are assessed in sex estimation occur as a result of exposure to the hormonal changes that occur at puberty (Wells, 2007). There are a number of methods which have been developed and tested for the assessment of sex from the bone tissue in juvenile remains, but none of these has the high degree of reliability which is required for any method used in a forensic case (Cunha et al., 2009; Franklin, Oxnard, O'Higgins, & Dadour, 2007). As previously stated, an error in this assessment can cause enormous issues for the investigation team, so any method which is unreliable should be avoided.

The development of an accurate age at death relies on the correct analysis of the sex of the individual. Males and females mature and age at different rates and therefore, wherever possible, age estimation has to be sex specific (Ritz-Timme et al., 2000). The forensic anthropologist can give an age at death for the individual, this will, by necessity, cover an age range since every method has to take into account individual differences caused by differences in genetics, lifestyle and socio-economic background (Ritz-Timme et al., 2000). Age is assessed by observation of changes that occur within the skeleton, in adults these changes can be observed on the bones of the pelvis, especially the pubic symphysis and the auricular surfaces and at the sternal end of the ribs. For non-adult remains the changes include

the appearance, development and fusion of ossification centres seen in juvenile skeletal development (Franklin, 2010). As these changes progress through childhood, they can be compared to reference data taken from children of known age and sex to provide an age range. These changes cease once full adult morphology is achieved and age estimation will then rely on degenerative changes in specified areas of the skeleton including the pubic symphysis, auricular surface and the sternal end of the fourth rib (Buckberry & Chamberlain, 2002; Franklin, 2010; Iscan, Loth, & Wright, 1984, 1985; Kimmerle, 2008).

The forensic anthropologist will be able to estimate the stature of the human remains if the requisite bones that are required for this analysis are present, and therefore give the investigation team a stature range which will indicate the height of the individual in life. Measuring the long bones of the limbs and inserting the measurements into sex and population specific equations allows stature estimation (Duyar, Pelin, & Zagyapan, 2006; Radoinova, Tenekedjiev, & Yordanov, 2002; Raxter, Auerbach, & Ruff, 2006). It is vital for the anthropologist to have ascertained the ancestry of the individual since the accuracy of the results is dependent on the use of the correct population specific equations. This is straightforward but can be of limited use in the identification process. It does add to the information profile that can be created and can help relatives and loved ones to recognise the description of the missing person when added to other biological parameters.

All of the methods involved in creating a biological profile are dependent upon the skeletal elements which have been recovered and how intact or damaged they have become during the post-mortem period. A complete profile may be hindered by fragmentation and damage such as can occur after a fire, however even in these cases it is unusual for an experienced forensic anthropologist not to be able to undertake an analysis, even if it might be restricted.

None of the biological profiles can themselves act as unique identifiers, however they come together to create a profile which can be

used to narrow down the search for appropriate ante-mortem data which can be harvested and compared to post-mortem data to confirm the identity of an individual. In addition to age at death, sex, ancestry and stature, there are other markers on the skeleton that the forensic anthropologist will identify and which may assist in creating a biological profile, it has been suggested that some of these such as frontal sinuses may be of assistance in confirming an identification, but only if ante-mortem radiographs exist which can be compared to the post-mortem images (da Silva et al., 2009; Tatlisumak et al., 2007).

Once a biological profile has been created, the forensic anthropologist will examine the remains to check for any trauma that might be visible on the bones. Perimortem trauma, if it is present, will be of the most important for the investigation team, since this will assist with the investigation of what happened around the time of death (Galloway, Symes, Haglund, & France, 1999; Kimmerle & Baraybar, 2008; Symes et al., 2001). Any unwitnessed death that results in the recovery of a missing person has to be considered suspicious until proven otherwise and trauma analysis can support the final conclusion in relation to this. Additionally, the identification of healed trauma on the skeleton or indications of pathology can also be used to compile information to assist with any appeal that might be used to help to identify an individual (Angyal & Derczy, 1998). There are a limited number of pathologies which leave markers on bone, those that do are often long-standing disorders which result in boney changes which means that are often medical records associated with them which can be of assistance in the identification process.

Damage can be caused during the post-mortem period by factors within the environment such as plant roots or scavenging by animals such as foxes, dogs and rats (Hunter et al., 2013). All of these can leave markers on the bone and it is vital to have a trained anthropologist who is able to differentiate between this damage and perimortem trauma.

27.9 Conclusion

The presence of the forensic anthropologist at all stages of a missing person search, location, recovery and examination can be of use to the investigative team. Forensic anthropologists have an understanding of taphonomy and search techniques which allows them to support any team who are in the process of looking for a missing person. In the event of the discovery of an unidentified individual or individuals, the forensic anthropologist also has a role to play, both in the recovery and in the examination of the remains, providing the investigative team with information on the biological profile of the individual, even in cases of complete skeletonisation.

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Forensic Facial Reconstruction and Its Contribution to Identification in Missing Person Cases

28

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28.1 Introduction

The earliest attempts to reconstitute the face from the skull so far recognised appear to arise from the Pre-Pottery Neolithic B (PPNB) culture of circa 11,000–8000 BP (Settegast, 1990) centred on Jericho and adjacent regions of Jordan and the West Bank (Fig. 28.1). Archaeologists interpret these objects as having played a role in funerary, ancestor-worship, or similar such rites. These reconstructions were completed by modelling a facial surface in plaster. The eyes and eyelids

were often replaced with cowry shells, and the skin complexion and facial features—including moustaches—were painted onto the plaster surface. The reconstructions are described as ‘typized and conventional’ and are not believed to represent reconstructions of ante-mortem appearance, beyond ‘some features determined by the bony framework’ (Strouhal, 1973, p. 231). Nine millennia were to pass before the first scientific attempts to reconstruct ante-mortem appearance were to arise.

As empirical science grew in significance during the eighteenth and nineteenth centuries, efforts were made to collect measurements that could be applied to the hard-tissue surface of the skull in order to project the location of the soft-tissue surface. These tissue depth measurements were collected from cadavers at specific locations on the face surface, referred to as landmarks. These measurements were then applied to roughly corresponding landmarks on the skull which is the subject of a facial reconstruction (Kollman & Buchly, 1898). Early attempts at facial reconstruction were applied to sculptural portraits of Johann Sebastian Bach (His, 1895) and Friedrich Schiller (Welcker, 1883).

In the early part of the twentieth century, facial reconstruction was adopted for use in investigations into the identification of human remains. One of the most celebrated—but not necessarily the earliest—practitioners of the era was Mikhail Gerasimov of Leningrad (now St Petersburg) and

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Fig. 28.1 Faces constructed on skulls using plaster from Tell Aswad, Syria, 7000–6000 BC (Copyright: www.diplomatie.gouv.fr)

Moscow. In *The Face Finder*, Gerasimov (1971) acknowledges earlier attempts to reconstruct the face from prehistoric archaeological finds—such as those of Hermann Schaafhausen who, with Carl Fuhlrott, is credited with the discovery of Neanderthal Man—and the scientific efforts of Kohlmann and Buchly (see above). Gerasimov then recounts the development of his own approach and its application in a variety of forensic and archaeological contexts—among which the reconstructions of Valentina Kosova (Fig. 28.2) and Ivan IV Vasilyevich (Ivan the Terrible—Fig. 28.3) are prominent.

The latter part of the twentieth century saw a consolidation of methods into ones predominantly based on the reconstitution of the features of soft tissue anatomy (Tyrrell, Evison, Chamberlain, & Green, 1997)—frequently supported by some use of measurements—and ones solely based on the use of measurements, where the face surface is extrapolated from that of the skull (Prag & Neave,

1997; Wilkinson, 2008). It also saw the adoption of computerisation, which permitted 3D digitization of the skull and reconstruction in virtual reality (VR) (Vanezis et al., 1989).

In this chapter, the term reconstruction is used to refer to both the process of restitution of a facial surface from that of the skull, as well as to the finished article. Reconstruction, however, is an ambiguous term. It should not be taken to imply that the result is an exact likeness of the ante-mortem face. This outcome is probably impossible to achieve. Reconstructions are in reality approximations—an alternative term frequently used in the literature—that offer widely ranging degrees of resemblance to the individual during life. In this chapter, the principle methods of facial reconstruction will be reviewed, including computerisation, and the value of facial reconstruction in missing person cases will be considered with reference to current controversies in the field.

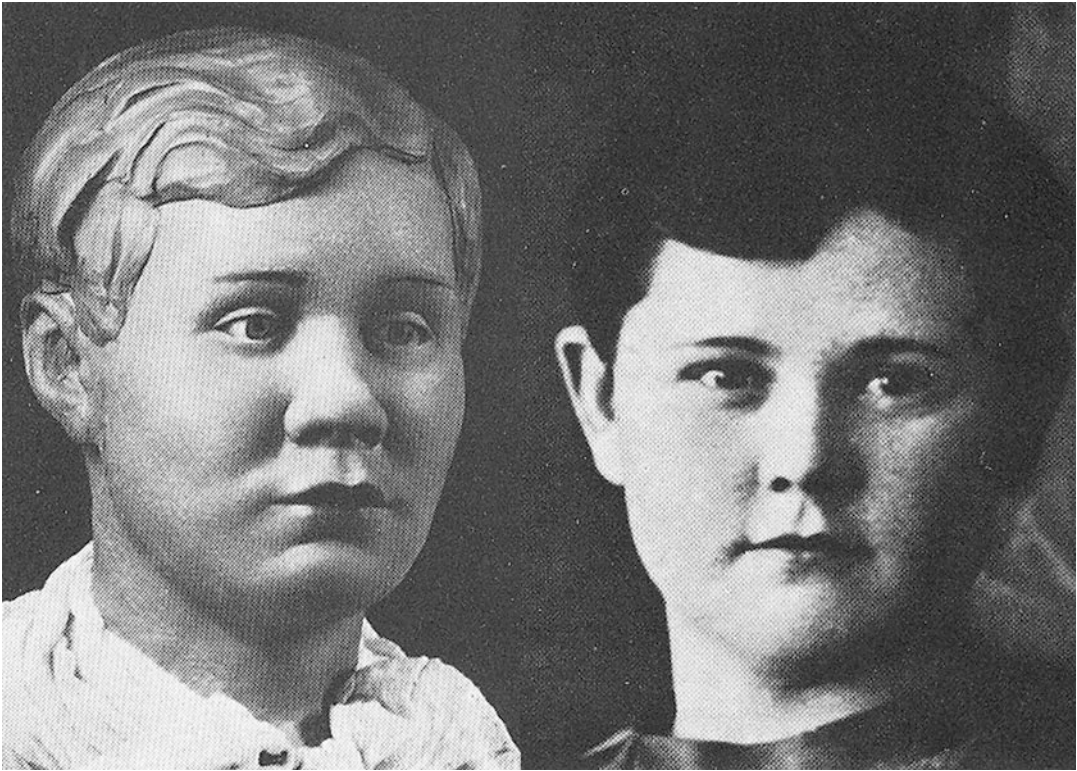


Fig. 28.2 Gerasimov's reconstruction of Valentina Kosova (Gerasimov, 1971)

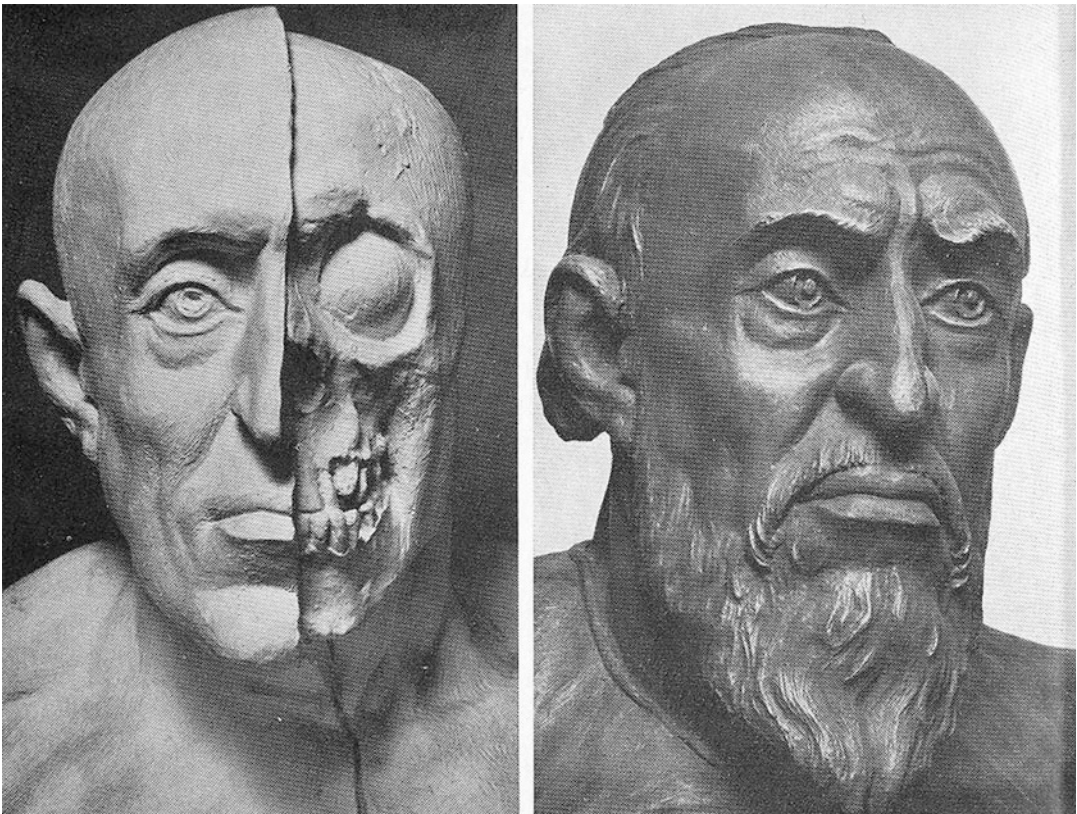


Fig. 28.3 Gerasimov's reconstruction of Ivan IV Vasilyevich—The Terrible (Gerasimov, 1971)

28.2 Technical Approaches to Facial Reconstruction

The anatomy-based method of facial reconstruction—sometimes called the Russian method in deference to Gerasimov—relies on the reconstitution of the soft tissue anatomy (Fig. 28.4 ; Hayes 2012). Measurement-based methods—coined, in contrast, the American method (see below)—rely on the hard tissue surface as a template for the soft tissue surface. In the case of both the Russian and American methods, geometric methods derived from research studies and from the canons of sculpture are used to estimate the basic dimensions of the eyelids, nose and lips. In the case of both the Russian and American methods, however, it is important to note substantial regions of the face are not simply a projection of the underlying bone structure. Much of the soft part of the nose, eyes and eyelids correspond to voids in the skull. The lips overlay the dentition, but the underlying hard tissue does not precisely determine the shape of the lips. In the case of the eyeballs and eyelids, the nose, and the lips, the general dimensions can be estimated from the hard tissues but cannot be precisely determined (George, 1993; Reichs & Craig, 1997).

28.2.1 The American Method

Figure 28.5 illustrates a reconstruction performed directly on to the surface of a skull using the American method. This reconstruction was undertaken in the 1990s: current practice would be to perform the reconstruction on a cast taken from the skull. This introduces a source of potential error, but is seen to be more sensitive to current expectations regarding the ethical treatment of human remains.

The reconstruction was performed following the removal of the soft tissues. This was achieved by treatment of the remains in hot water (~90 °C) in the presence of the papain facilitating the digestion of proteins and of detergent facilitating the dispersion of fats. This treatment may last several days, depending on the rapidity with which the defleshing process takes place. Following removal of the soft tissues the clean skeletal material is washed with methylated spirit to remove residual fats and odour. In this case, defleshing was performed following autopsy and odontological examination, during which the calvarium and maxilla had been separated (Fig. 28.5a). The skull was carefully reassembled from the parts, taking care to adjust for skeletal material lost during the post-mortem separation (Fig. 28.5b).

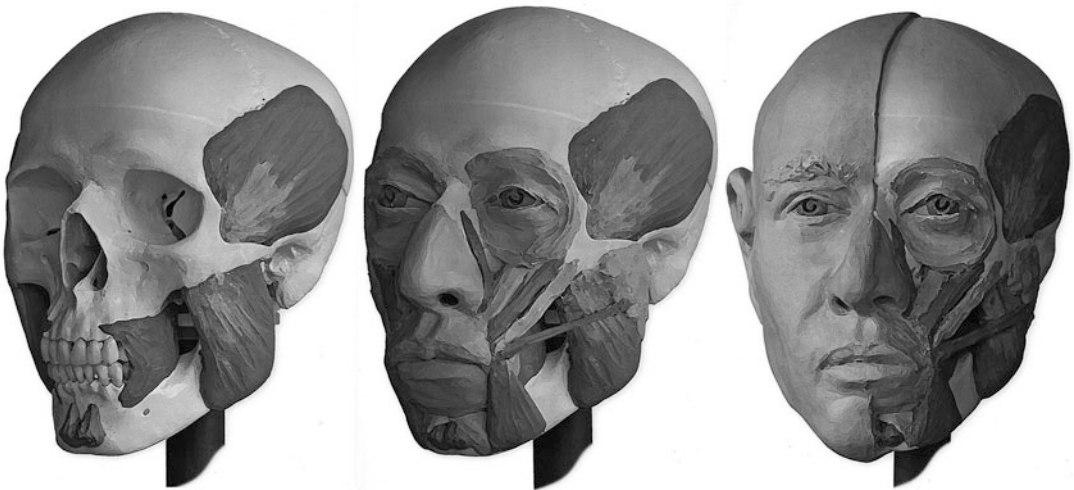


Fig. 28.4 Russian Method (Copyright: Susan Hayes, University of Wollongong, with kind permission of the author)

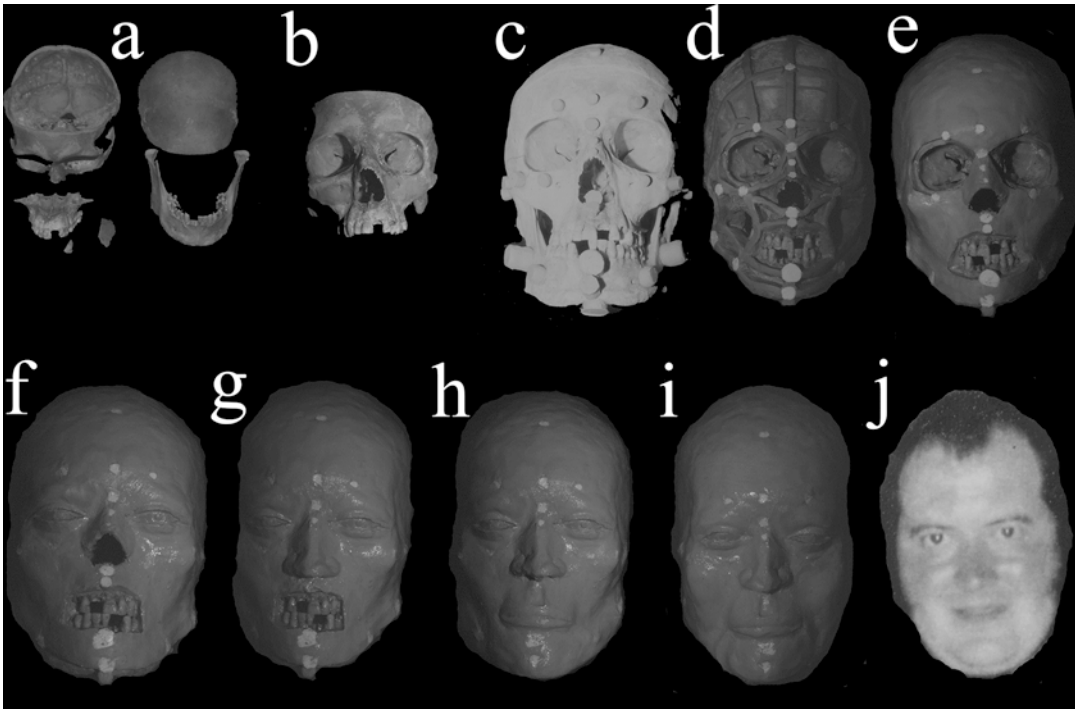


Fig. 28.5 Reconstruction onto the skull using the American method with accompanying ante-mortem photograph of the ‘missing person’ following identification (Reconstruction by Martin Evison); (a) disassembled skull following autopsy, (b) reassembled maxilla, (c) soft tissue

depth markers in situ, (d) tissue depth interpolated between markers, (e) soft tissue depth interpolated into interstices, (f) eyeball and eyelids modelled, (g) nasal tip modelled, (h) lips modelled, (i) fullness of face increased, (j) ante-mortem photograph of subject (Copyright: Martin Evison)

The American method relies on average measurements collected in research at about thirty landmark sites on the skull used as guides to soft tissue depth. Figure 28.5c illustrates the placement of average soft tissue depth markers at landmark sites on the skull. The significance of these markers and variation in their measurement values are considered in further detail below. As Fig. 28.5c illustrates, however, these are distributed widely over the skull surface, but certain areas of the face—most notably the orbits, nasal cavity and dentition—are not represented. In this example, clay was used to model the soft tissue depths. Wooden or plastic pegs may be used as an alternative, which requires holes to be drilled into the surface—a practice therefore likely to be restricted to a cast facsimile and not to the skull surface itself for ethical reasons.

Figure 28.5d illustrates the modelling of a lattice by interpolation between tissue depth

markers using a ‘plastic’ or clay-based approach. Figure 28.5e illustrates the modelling in clay of the interstitial spaces in the lattice. The voids associated with the orbits, nasal cavity and dentition are particularly clear at this stage. The eyeballs and eyelids, nasal wings and tip, and the lips are reconstructed following established guidelines in the literature (Fedosyutkin & Nainys, 1993; George, 1993; Prag & Neave, 1997).

Figure 28.5f illustrates the reconstructed eyeball and eyelids. The conventional approach is to model the eyeballs in clay, ensuring a tight fit into the eye socket. The eyelids are then modelled over the eyeball surface using guidelines associating the commissures of the inner and outer canthi with bony features on the margins of the orbits. The nasal tip (Fig. 28.5g) is modelled by projecting the tip as a point triangulated by imaginary lines from the base of the nasal cavity and the nasal bridge, and by modelling the width of

the alar wings beyond the actual margin of the bony nasal cavity. Similar contentions are also followed for modelling the width and height of the lips (Fig. 28.5h).

Whilst the gross dimensions rely on conventions in the literature, there is a good deal of latitude available in the modelling of the facial features in particular. This is important in taking account of the age, sex and ancestry estimated from the skeletal remains—in this case a White male of greater than 45 years of age (Fig. 28.5j). Similarly, while average soft tissue depths are typically used, the reconstructed model may take into account a degree of obesity associated with middle age—as attempted in this example (Fig. 28.5i).

28.2.2 The Russian Method

The Russian method relies on the reconstitution of the soft tissue anatomy. It is possible to locate the origin and insertion sites of a number of craniofacial muscles, which offer some guidance to the location, and general size and shape of the muscles concerned—the temporalis, masseter and buccinators, for example (Fig. 28.4). Placement of the muscles is inevitably subjective, as their precise depth along any point in their cross section is unknown.

Figure 28.6 illustrates the Russian method as applied in the reconstruction of a White male youth. In this instance, tissue depth markers are also followed as a guide. This is a widely used method of facial reconstruction, popularised by Wilkinson (2008) and co-workers. In Fig. 28.6a the tissue depth markers are inserted into a plaster cast of the skull. Figure 28.6b illustrates modelling of the temporalis, buccinators, masseter and levator anguli oris muscles, Fig. 28.6c modelling of the orbicularis oris and placement of the eyeball and Fig. 28.6d the frontalis, levator labii superioris, depressor anguli oris and mentalis muscles, and modelling of the height and width of the lips. In Fig. 28.6e the orbicularis oculis is modelled, taking into account the position of the commissures of the inner and outer canthi of the eye, and the position of the nasal tip is projected.

Figure 28.6f illustrates the completed model of the face surface reconstructed to reveal underlying anatomy.

28.3 Computerised Approaches

Computerised approaches to facial reconstruction from the skull tend to be analogous to the plastic methods, undertaken in ‘virtual reality’ (VR). Following pioneering forensic work by Vanezis et al. (1989), Tyrell et al. (1997) reviewed research in the field and described the process of 3D data capture and post-capture processing—which permits reconstruction of the skull from bone fragments, for example (Fig. 28.7).

A 3D VR facsimile of the skull is amenable to facial reconstruction using a variety of approaches. One common approach is based upon collection of a ‘volume’ tissue depth dataset from a living individual using computed tomography (CT) of the head and neck. CT is based on X-ray radiology, which yields a strong signal from the underlying hard tissue of the subject’s face. Attardi et al. (1991), for example, used a volume tissue depth dataset derived from CT which they deformed over the surface of a skull of an Egyptian mummy obtained by X-ray radiography. The reconstruction is finished by rendering or ‘texture mapping’ the photographic image of the face of a living Egyptian individual over the surface of the reconstruction, yielding a life-like appearance.

VR modelling can be used to generate a facial surface using approaches analogous to the American and Russian plastic methods. In Figs. 28.8 and 28.9, the reconstruction of the faces of Egyptian mummies is again shown, this time employing methods that simulate the traditional techniques. Figure 28.8 shows reconstruction of the face surface using tissue depths—similar to the American method. Figure 28.8a shows the ‘lofting’ or projection of a primitive 3D surface of the skull from 2D X-ray radiographs of the mummy. Figure 28.8b shows an intermediate stage where the mandible was rearticulated in VR as it appeared to have been dislocated in the ancient remains. Figures 28.8c shows the

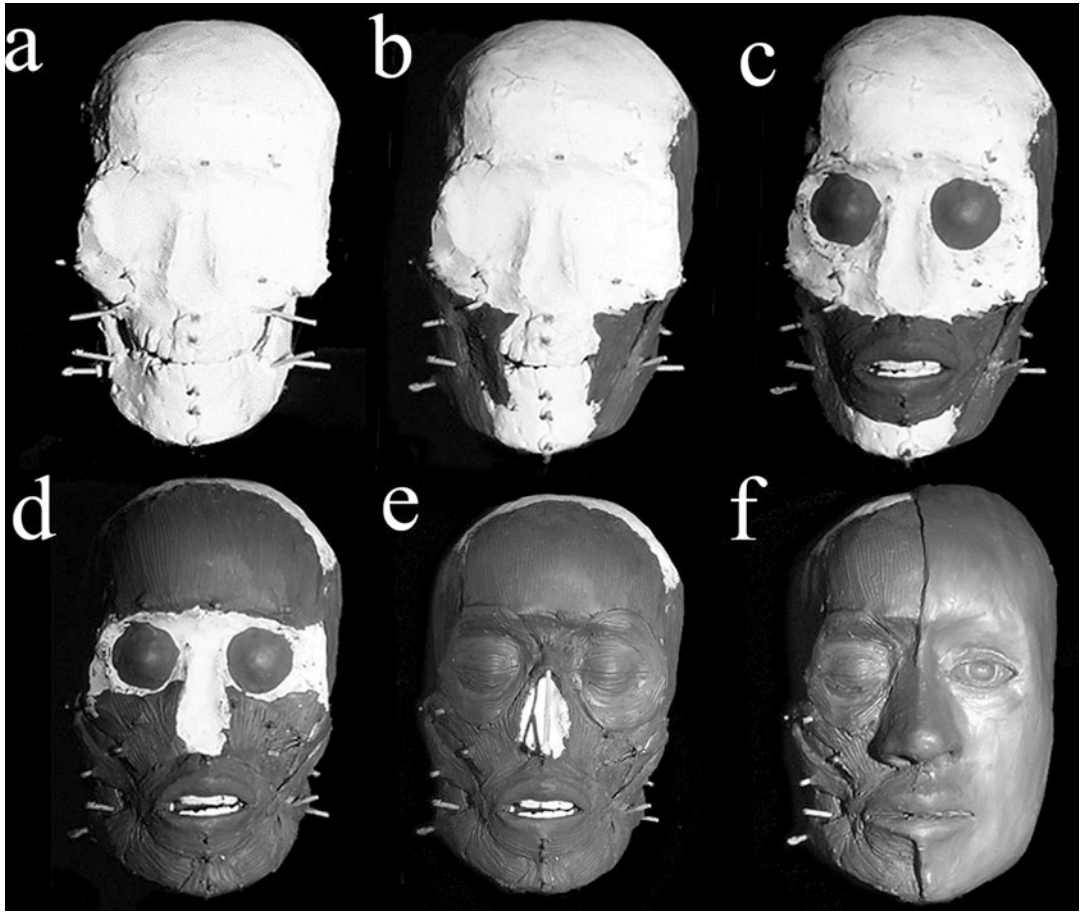


Fig. 28.6 Reconstruction onto a plaster cast of the skull using the Russian method with accompanying use of tissue depth markers (Reconstruction by Nikki Taylor); (a) soft tissue depth markers in situ, (b) modelling of the temporalis, buccinator, masseter and levator anguli oris muscles, (c) modelling of the orbicularis oris and placement of the eyeball, (d) modelling of the frontalis, levator labii

superioris, depressor anguli oris and mentalis muscles, and modelling of the height and width of the lips, (e) modelling of the orbicularis oculi muscles, taking into account the position of the commissures of the inner and outer canthi of the eye—the position of the nasal tip is also projected, (f) completed face surface revealing underlying anatomy (Copyright: Martin Evison)

completed superimposition of markers representing the soft tissue depths at traditional landmark sites, as well as a series of mathematically interpolated pseudo-landmarks spaced at regular intervals between them. Figure 28.8d shows a simple face texture modelled on the face surface without texture mapping the photograph of a living individual.

Figure 28.9 shows the facial reconstruction in VR of a mummy believed by some experts to be that of Queen Nefertiti (ca. 1370–ca. 1330 BC; Fletcher, 2005). Whilst Fig. 28.9a shows the 2D digital X-ray radiographs collected in situ marked

up for lofting, Fig. 28.9b shows the 3D surface projected from the 2D radiographs and the facial musculature modelled in VR following the Russian method. Figure 28.9c shows a simple face texture modelled on the face surface, again without texture mapping the photograph of a living individual. Figure 28.9d shows an alternative version of the finished reconstruction with the face surface texture mapped using the photograph of a living individual.

The advent of computerisation has opened up possibilities for facial reconstructions that are rapid, automated, easily disseminated, and

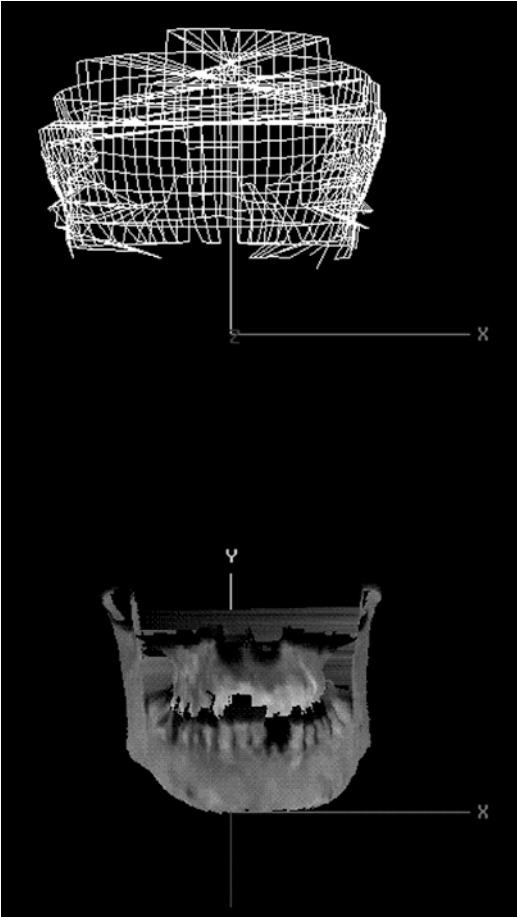


Fig. 28.7 Reconstruction of skull in virtual reality from separately scanned components. The mandible, maxilla and part of cranium shown are the 3D digitally captured skull elements shown in Fig. 28.5a. (Copyright: Martin Evison)

flexible or adjustable according to a range of parameters that can be selected to reflect uncertainties arising from osteological or investigative evidence. Figure 28.10 illustrates, for example, VR modelling of a range of variation in age, obesity and biogeographic ancestry that can be presented on the Internet (Evison & Green, 1999; Green & Evison, 1999). These early models allow the shape and colour of finished VR models to vary within the range of uncertainty implied from forensic osteological and odontological analysis, or from other investigative findings. Figure 28.7 shows the reassembly in VR of the components of the skull that had to be reassem-

bled manually in the plastic reconstruction demonstrated in Fig. 28.5.

Computational models continue to suffer from a paradox in that purely virtual reconstructions tend to have an artificial and sometimes ‘mannequin-like’ appearance, whereas those finished by texture mapping a photograph tend to resemble the individual depicted in the photograph. Interpolating between facial surface textures may offer one solution to this problem (Green & Evison, 1999). Alternatively, using averaged photographs overcomes the resemblance of the reconstruction to a particular individual, and it is axiomatic that an average face surface texture is likely to be closer in appearance to the real individual than a distinctive face surface texture—unless there is a good reason for including it. Distinctive features—such as in the dentition or other empirically determined features—are factors that should be emphasised. As caricature frequently demonstrates, these can aid recognition (McIntyre, Hancock, Kittler, & Langton, 2013). Furthermore, research in face perception suggests that rendering an average face surface texture where the real face surface texture is unknown may increase the prospects of identification as it may enhance the distinctiveness of other—and known—aspects of facial appearance, such as those determined by the shape of the underlying hard tissues (Little, Hancock, DeBruine, & Jones, 2012). Computerisation offers considerable potential in facial reconstruction. However, the long-standing promise of an affordable, powerful and easy-to-use online application remains unfulfilled.

28.3.1 The Value of Forensic Facial Reconstruction in Missing Persons Cases

The precise role of facial reconstruction in investigation is contentious. It might be assumed that a reconstruction of high artistic quality, with a life-like facial appearance, of the correct age, sex and ethnic group, and bearing a strong resemblance to the individual during life is essential to secure identification. In reality, case examples testify to

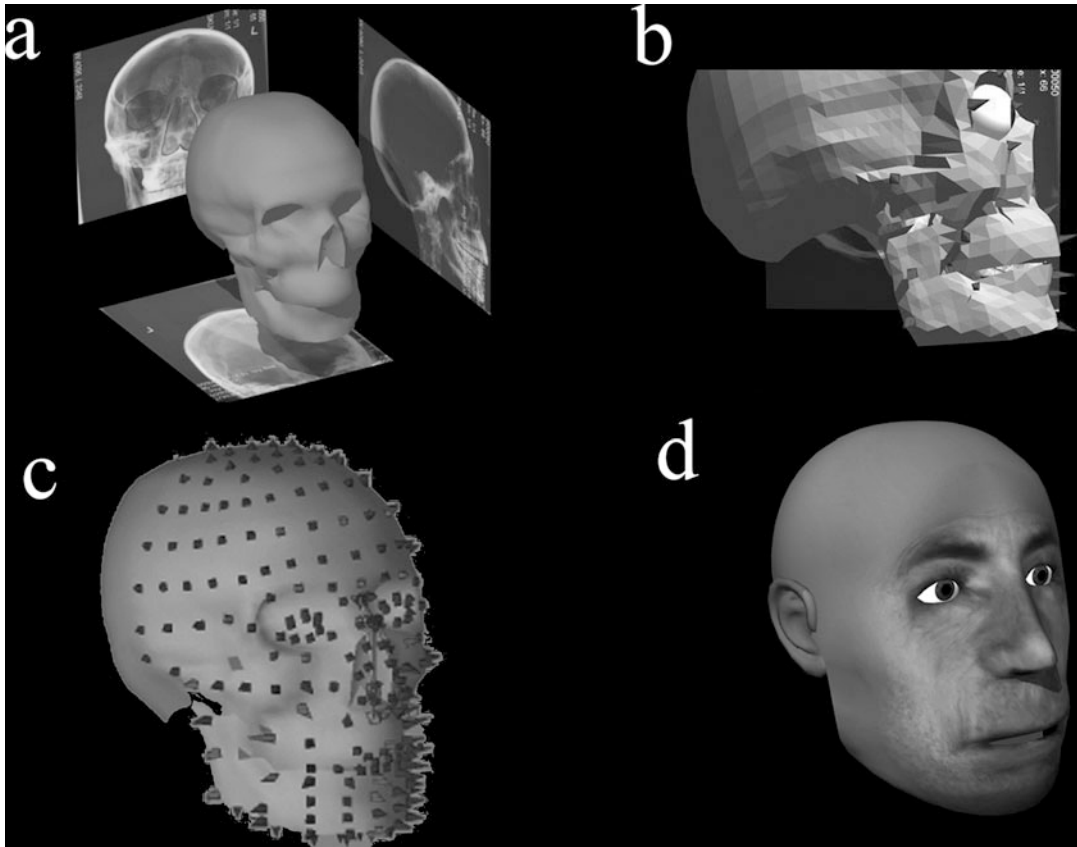


Fig. 28.8 Stages in the reconstruction in virtual reality of an Egyptian mummy using the American method (reconstruction by Martin Evison and Damian Schofield, State University of New York Oswego); (a) lofting of primitive 3D surface from 2D digital X-ray radiographs, (b) adjust-

ment in VR of displaced mandible, (c) placement of soft tissue depth landmarks (*dark grey*) and interpolated pseudo-landmarks (*light grey*), (d) face surface texture modelled in VR (Copyright: Damian Schofield and Martin Evison)

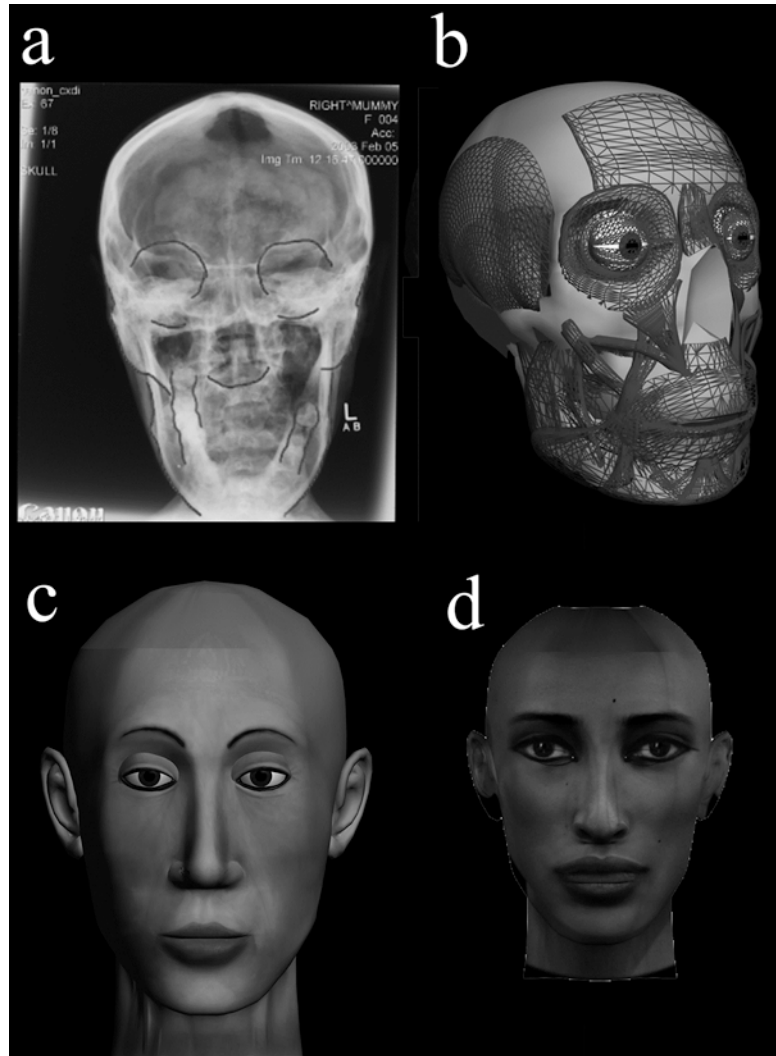
the observation that identifications can be obtained from reconstructions that are of poor—or mannequin-like—sculptural quality, of limited resemblance and of the wrong race (Prag & Neave, 1997).

Figure 28.11 shows a set of reconstructions produced during the long investigation of human remains found dumped in a suburban hedgerow. Not unusually, there was some uncertainty regarding the biogeographic ancestry of this individual: the remains were found in a region of England with a high level of immigration from South Asia, and both White and South Asian reconstructions were produced. There was also some initial uncertainty regarding the age and sex of the individual, and at least one androgynous

reconstruction was produced. Slightly different age estimations were offered by the forensic anthropologists and odontologists consulted, placing the individual in their teens or twenties. Ultimately, the individual was identified as a known missing person by DNA analysis—a White female of 18 years of age—allowing the reconstructions to be compared with ante-mortem photographs.

Figure 28.12 shows an unsolved case where a similar miscommunication led to the modelling of male and female reconstructions based on the same remains, believed to be those of a South East Asian. The case illustrated in Fig. 28.5 concerned a middle-aged White male whose remains were initially unidentified because investigative

Fig. 28.9 Stages in the reconstruction in virtual reality of an Egyptian mummy using the American method (reconstruction by Martin Evison and Damian Schofield, State University of New York Oswego); (a) 2D digital X-ray radiograph marked for lofting (see Fig. 28.8a), (b) craniofacial musculature reconstructed in VR, (c) face surface texture modelled in VR (© Damian Schofield and Martin Evison), (d) face surface rendered using the photograph of a living individual (Copyright: Atlantic Productions)



information from the subject's mother had led the police to believe he was 6" shorter than he really was. A key found in the subject's clothing allowed the misunderstanding to be resolved and the missing person enquiry to proceed.

These cases illustrate the somewhat subjective nature of assessing resemblance in facial reconstruction cases and of the uncertain role of precision in investigation and artistic quality in yielding recognition. In order to investigate some these issues, Stephan and Henneberg (2001) measured recognition rates using 16 facial reconstructions accompanied by photographs of the living individual and found that 403 incorrect identifications were made from 592 comparisons.

Using a similar approach in a further study, Stephan (2002a) found that the accuracy of a facial reconstruction is not related to subjectively-assessed resemblance. This observation tends to complement a commonly held belief amongst some practitioners that successful recognition in facial reconstruction cases is not related to artistic quality or even to resemblance itself (Stephan and Henneberg 2006). In fact—as the case of a reconstruction completed following a misunderstanding of the deceased's race illustrates (Prag & Neave, 1997)—resemblance may be entirely secondary to the publicity surrounding the publication of a reconstruction in the print and broadcast media.

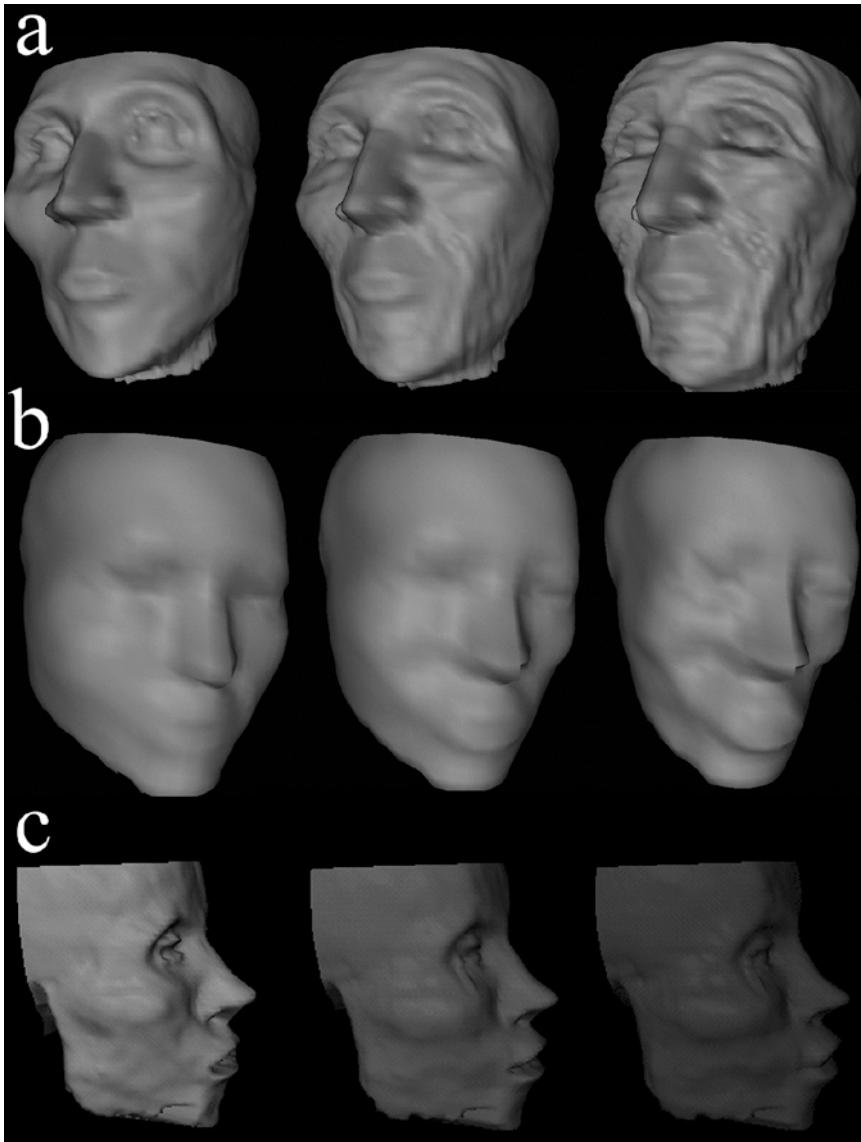


Fig. 28.10 Models demonstrating 3D animated VR on the Internet (Evison & Green, 1999) and the modelling of (a) ageing, (b) obesity and (c) ancestry (Green & Evison, 1999)

Assessment of biogeographic ancestry is not precise, particularly beyond the major continental groups—African, Indo-European, Oriental—and presents problems in cases where group differences are subtle, but individual differences may be wide. In another case (Fig. 28.13), investigators suspected the deceased may have been Arab, although the demography of the locality where the remains were found was predominantly White. Age estimation again varied

according to the osteological or odontological method used, giving a range of 45–60 years. As no distinction could be made on the basis of empirical evidence, two reconstructions were produced intended to have Arab and White appearance. Subtle differences in the generosity of the nasal tip and lips were modelled to make the distinction, within the usual published conventions for White subjects. In this instance, sufficient soft tissue survived post-mortem to assist



Fig. 28.11 Facial reconstructions generated by a variety of practitioners using different techniques during a lengthy missing person investigation solved by DNA

analysis—two ante-mortem photographs of the subject are also shown (Copyright: Martin Evison)



Fig. 28.12 Facial reconstructions from the same skull of a South East Asian individual varied to appear male and female, respectively (Copyright: Martin Evison)



Fig. 28.13 Reconstructions produced to accommodate Arab (*centre*) and White (*right*) appearance, compared with ante-mortem photographs of the subject. The left-hand image is of the reconstruction intended to appear

White. The complications of accommodating subtle variation between groups which vary widely within themselves are discussed in the text (Copyright: Martin Evison)

in the estimation of the shape of the facial features, including the ears—which otherwise can be placed following sculptural canons—and the hair, including a moustache—which otherwise are guesswork. The dentition was also distinctive and helpful in soliciting identification, suggesting that modelling a subtly open mouth is desirable. Following publicity centred on the reconstruction on national television, the remains were identified by DNA analysis as those of a known missing Arab male of 73 years of age and ante-mortem photographs could again be compared with the two reconstructions (Fig. 28.13).

Forensic anthropologists often rely on published guidelines based on reference samples in their analyses. The representativeness of these reference samples to the particular case under investigation is a key controversy in the field. This is particularly relevant to those regions where reference samples are not available and even more so to those regions where historic admixture has complicated the simple assignment of skeletal remains to relatively well-characterised groups. This scenario applies noticeably in Brazilian forensic anthropology (Francisco, 2015), where historic immigration and intermarriage has led to admixture between groups of Native South American, African, European and—more recently—Arab and Japanese ancestry. Figure 28.14 illustrates a reconstruction of a Brazilian individual of mixed ancestry, successfully leading to identification of a missing person.

The scientific precision of facial reconstruction remains questionable, however. As well as summarising a range of pertinent issues, Stephan (2003a) has reevaluated existing conventions regarding the estimation of the mouth width (Stephan, 2003b), and projection of the eyeball (Stephan, 2002b) and nose (Stephan, Henneberg, & Sampson, 2003). They also questioned the value of using tissue depth data derived from different ancestry groups and even different sexes. Stephan and Simpson (2008) offer a generic set of tissue depth averages for use in reconstructions.

The question might reasonably be asked ‘why not just use DNA?’ The value of forensic facial reconstruction in missing person cases is highlighted by this very question. It is of fundamental value where no candidate identifications are available with which post-mortem–ante-mortem comparisons can be made. In these instances, publicising a forensic facial reconstruction and any accompanying physical or other circumstantial information may be critical to a putative identification being put forward, which can subsequently be corroborated by more reliable scientific means. In contemporary forensic science, corroboration will be achieved by DNA analysis in comparison with a reference sample from family or an intimate sample from personal possessions or clothing (Chaps. 22–24). Forensic odontological comparison with ante-mortem dental records is also commonly used to confirm identity. An

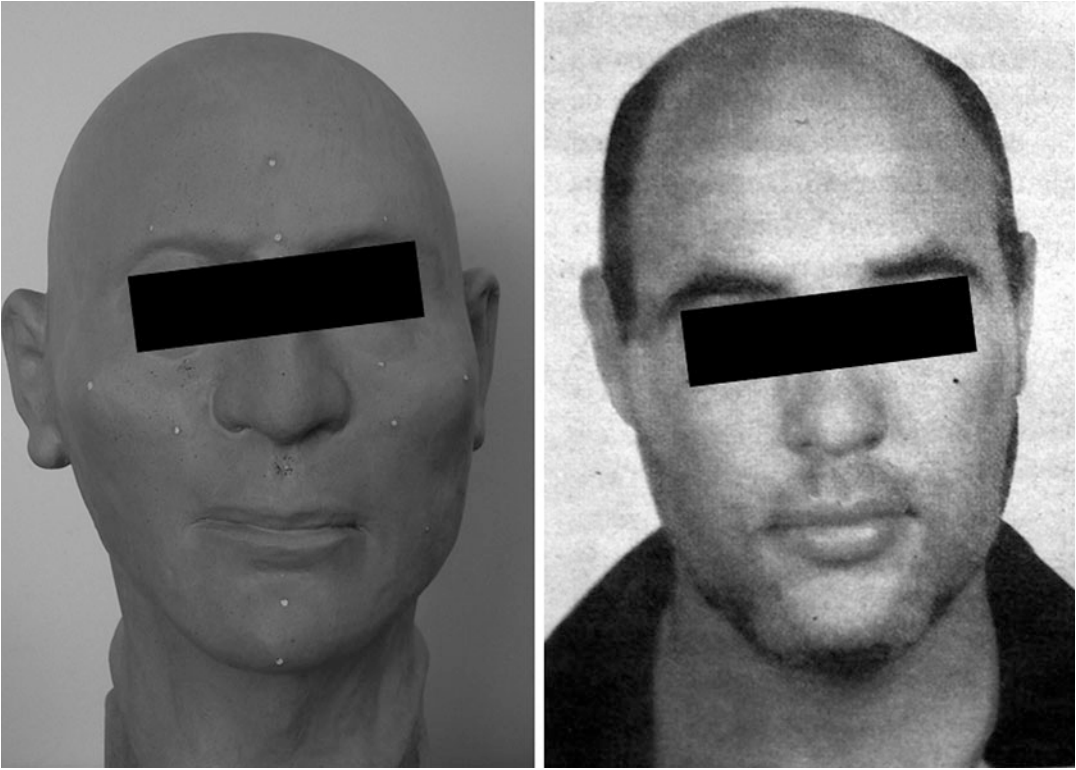


Fig. 28.14 Further case illustration undertaken using the American method with ante-mortem photograph (Copyright: Harold Capitanini, University of São Paulo Ribeirão Preto Medical School)

unusual medical history involving trauma or surgery affecting the skeleton may offer a potential alternative if neither DNA profiling nor dental comparison can be undertaken (Chap. 27). It is important to note that identification of the victim is a signal attrition point during homicide investigations. Identification of the victim is a key contribution that forensic anthropology and facial reconstruction can make to case conversion and progress (Evison, Francisco, & Guimarães, 2012).

28.4 Conclusions

Given the overall subjectivity involved in forensic facial reconstruction, a resemblance to the individual during life is the best that can usually be expected. In the absence of strong evidence for reliable recognition of a facial reconstruction, in many instances it is arguable that it is the interest arising from the publicity surrounding the case upon which the reconstruction centres,

rather than the reconstruction itself, which leads to identification. Furthermore, public interest generally leads to a number of potential paths of inquiry where individual names are sequentially excluded by a process of elimination. Should one individual remain who cannot be excluded, further investigation is essential to confirm or exclude them as the ‘missing person’.

Osteological, odontological or wider investigative information that can be used to improve the accuracy of the reconstruction may prove invaluable. Experience suggests such information should nevertheless be regarded with some circumspection. In those cases where no candidate identification is available that may offer a route to comparison of DNA or odontological evidence from the remains with those of ante-mortem reference samples, the technique is—in the absence of other means—invaluable in generating media attention that may ultimately lead to an identification, whether or not that is achieved by actual recognition of the facial image itself.

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Stable Isotope Forensics as an Investigative Tool in Missing Persons Investigations

29

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29.1 Introduction

In October 2000, two hunters scouting for ducks along an Interstate-80 frontage road in Utah found human remains, including some scattered bones, a few personal effects, and a mass of long, matted hair. The unidentified woman was dubbed “Saltair Sally” for the location of discovery near a resort-turned-concert-pavilion on the shores of the Great Salt Lake. No local missing person reports fit the biological profile of the remains and neither the facial reconstruction nor a description of the personal effects yielded any clues as to her identity. Who was Saltair Sally?

The detectives involved with the case of Saltair Sally faced a significant challenge that is, unfortunately, often encountered during investigations of missing and unidentified persons. How do we name a decedent—and match unknown remains to a missing person—when there is no information available about the deceased individual’s life history? Methods for identifying remains include

examination of the biological profile, inspection of personal effects and artifacts from medical or surgical procedures (scars, implants, etc.), fingerprint analysis, dental records, and DNA analysis. In cases where only partial remains are found, like those of Saltair Sally, not all profiling methods are applicable; for example, it was impossible to use fingerprint analysis to identify Sally because soft tissues were not preserved. With other methods, like examination of personal effects and forensic odontology, results do not always provide enough characteristic information for identification. For Saltair Sally, investigators needed an additional technique for profiling the decedent and collecting characteristic information about her life history before death.

The measurement of stable isotope abundances contained within an evidentiary material—like human remains—can provide clues about the history and source of the material. This is because stable isotope abundances record information about material creation. Stable isotope compositions are used to discriminate between two materials that are chemically identical by measuring the distinctive “isotopic signature” of samples. As such, stable isotope analysis has begun to play an increasingly important role in resolving medicolegal issues over the past decade (Ehleringer et al., 2010; Ehleringer, Cerling, & West, 2007; Meier-Augenstein, 2007, 2010).

Forensic experts can apply stable isotope analysis methods in a number of contexts, including

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assessing whether two sets of explosives share a common origin, determining the geographic source of anthrax, identifying synthetic testosterone in urine samples, and predicting the region of origin, or *provenance*, of various materials (Ehleringer & Matheson, 2010). Concentrating on origin investigations in particular, provenancing studies have included forensic comparisons of the isotopic signatures of wooden safety matches (Farmer, Curran, Lucy, Daeid, & Meier-Augenstein, 2009), paint (Reidy, Meier-Augenstein, & Kalin, 2005), packaging tape (Carter et al., 2004; Horacek, Min, Heo, Park, & Papesch, 2008), drugs (Ehleringer, Cooper, Lott, & Cook, 1999; Hurley, West, & Ehleringer, 2010; West, Bowen, Dawson, & Tu, 2010), adulterated foods and beverages (Padovan, De Jong, Rodrigues, & Marchini, 2003), and human remains (Ehleringer et al., 2007, 2010; Meier-Augenstein, 2007, 2010). This chapter focuses specifically on the emerging role of stable isotope forensics in missing persons investigations. We review recent advances in stable isotope analysis (SIA) techniques for predicting region of origin and residence patterns of unidentified human remains and discuss case studies where SIA has aided in missing persons investigations. Here we provide an overview of the basic principles of SIA and refer the interested reader to recent comprehensive reviews of the literature (see Bartelink, Berry, & Chesson, 2014; Benson, Lennard, Maynard, & Roux, 2006; Ehleringer et al., 2007, 2008, 2010; Meier-Augenstein, 2007, 2010).

29.2 Forensic Applications

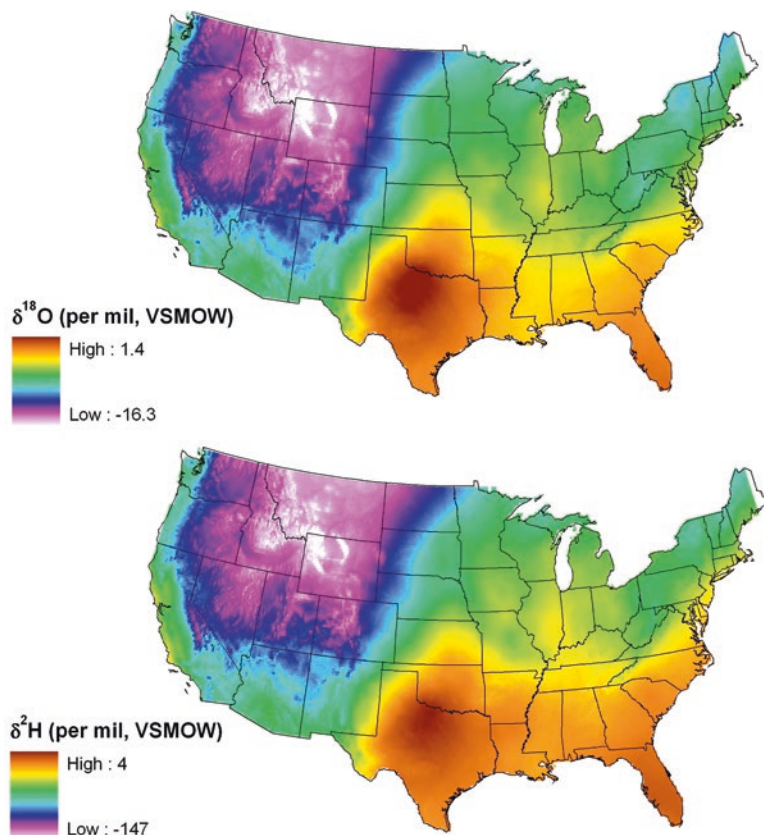
While applications of stable isotope forensics are relatively new to the medicolegal community, SIA and the examination of isotope signatures has been used extensively in physical anthropology, archaeology, biology, chemistry, ecology, geology, hydrology, and oceanography for decades (Ehleringer et al., 2010). The use of SIA for predicting the life history of unidentified human remains has generally proceeded on two fronts. Researchers have evaluated the natural abundances of stable isotopes in various ecological and geological systems, and have used isotope

data to understand biological and geological processes, and to generate predictive models. Some predictive isotope models incorporate spatially variable parameters to construct isotope landscapes, or “isoscares,” that can be helpful for provenancing unknown samples, including plants, animals, soil, and water (Beard & Johnson, 2000; Ehleringer et al., 2008, 2010) (Fig. 29.1). This isoscape approach has provided an empirical framework from which to predict probable region of origin of unknown samples based on their isotopic signatures (Ehleringer et al., 2010). Most of this work has focused on non-forensic research questions, such as tracing water sources, reconstructing animal migration patterns, and studying climatic patterns (Bowen, 2010; Bowen, Ehleringer, Chesson, Stange, & Cerling, 2007; Hobson & Wassenaar, 2008). Fortuitously, the isoscape models provide a framework from which to predict the region of origin and residence patterns of unidentified human remains from medicolegal contexts (see Fig. 29.2 for an overview of the theoretical framework; Chesson et al., 2014).

Physical anthropologists and archaeologists have used SIA since the late 1970s to reconstruct the diets (Bocherens, Polet, & Toussaint, 2007; Schoeninger, DeNiro, & Tauber, 1983; Tauber, 1981; Vogel & van der Merwe, 1977) and migration patterns of ancient humans (Bentley et al. 2003; Ezzo, Johnson, & Douglas Price, 1997; Price, Burton, & Alexander Bentley, 2002, 2011; Price, Frei, Dobat, Lynnerup, & Bennike, 2011). More recently, SIA and the isoscape approach has gained popularity among forensic anthropologists as a tool for predicting region of origin and residence patterns of unidentified human remains based on analyses of bone, teeth, hair, and nails (e.g., Bartelink, Berg, Beasley, & Chesson, 2014; Juarez, 2008; Kimmerle & Kamenov, 2014; Regan, 2006). As many forensic anthropologists have extensive backgrounds in both bioarchaeology and archaeology, SIA is often a component of their academic training and research. Thus SIA data, in conjunction with the biological profile information from the skeleton, can provide new investigative leads that may aid in a missing persons case by narrowing down the geographic region from which a person traveled or previously lived.

Fig. 29.1 The predicted average oxygen and hydrogen isotope ratios of human body water across the continental United States.

(Reprinted with permission from Springer Science + Business Media: Isoscapes: Understanding Movement, Pattern, and Process on Earth through Isotope Mapping, A framework for the incorporation of isotopes and isoscapes in geospatial forensic investigations, 2010, Ehleringer, J. R., Thompson, A. H., Podlesak, D., Bowen, G. J., Chesson, L. A., Cerling, T. E., Park, T., Dostie, P., and Schwarcz, H., West, J. B., Bowen, G. J., Dawson, T. E., and Tu, K. P. eds.)



29.3 Stable Isotope Natural Abundance

29.3.1 Basic Principles: Natural Abundance and Standards

Isotopes are nuclides of an element that have the same number of protons but a different number of neutrons in the nucleus (Fry, 2006). This difference in atomic mass makes some isotopes of an element “light” (fewer neutrons) and others “heavy” (more neutrons). Seventy-one of the ninety-two naturally occurring chemical elements exist in more than one isotope form, most often as stable isotopes, and less commonly as radioactive or radiogenic isotopes (Meier-Augenstein, 2010). The natural abundance of an isotope refers to the amount of the element found naturally in the environment. Generally, isotopes

of an element with fewer neutrons occur in greater abundance in nature than isotopes with additional neutrons. For example, approximately 99% of naturally occurring carbon isotopes in the environment are ^{12}C , while only 1% is the heavier ^{13}C (Smith, 1972). When reporting stable isotope abundances, the ratio of less abundant to the more abundant isotopes in a sample is typically compared to the ratio of less abundant to the more abundant isotopes in an international standard (Table 29.1). Measured stable isotope data are usually reported as values using the “delta” notation (δ), which is expressed in parts per thousand, or “per mil” (‰) difference compared to the appropriate international standard. For example, this difference is calculated for oxygen isotopes as follows:

$$\delta^{18}\text{O} = \frac{{}^{18}\text{O}/{}^{18}\text{O}_{\text{sample}} - {}^{18}\text{O}/{}^{18}\text{O}_{\text{standard}}}{{}^{18}\text{O}/{}^{18}\text{O}_{\text{standard}}} \times 1000(\text{‰})$$

A framework for applying stable isotope ratio analysis in forensic investigations

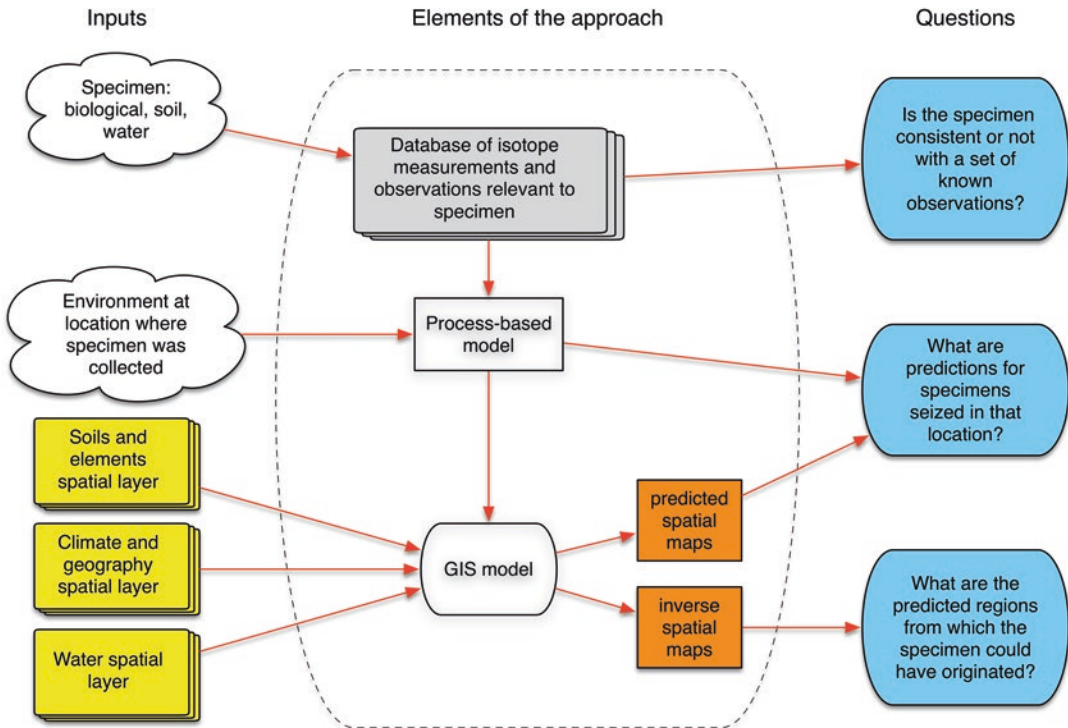


Fig. 29.2 A suggested framework for the application of stable isotope ratio analysis in a forensic investigation. Using this framework, three classes of questions can be answered, as presented on the right: (1) How does the isotope fingerprint of the specimen compare to other seized or authentic materials? (2) Is the isotopic composition of the specimen consistent with the prediction for a material

originating in a given location? and (3) Based on the measured isotopic signature, from where could the specimen have come? Note that the last two questions require the development of modeling capabilities; see textboxes within the figure for a complete description. Framework adapted after Ehleringer et al. (2010) and Chesson et al. (2014) with permission

As seen in the above equation, a δ -value of zero would indicate an isotope ratio in the sample equivalent to the standard. However, ratios in a sample are often greater than (positive δ -values) or less than (negative δ -values) than in the standard.

29.3.2 Isotope Fractionation

Abundances of stable isotopes within a select pool (e.g., a strand of hair, tooth enamel) demonstrate variability due to partitioning. Differing numbers of neutrons contained within stable isotopes of the same element do not change the

chemical properties of the isotopes, but do affect the mass. The chemical bonds between light isotopes generally take less energy to break than the bonds between heavy isotopes (Mook & de Vries, 2000). Because of their stronger bonds and greater mass, heavier isotopes typically react more slowly than lighter isotopes in chemical reactions (Hoefs, 2009). The partitioning of isotopes due to differences in reaction rates is known as fractionation (Fry, 2006; Hoefs, 2009). Fractionation occurs in many natural processes including the hydrological cycle, photosynthesis, and metabolic processes within organisms. If a reaction goes to completion, the product will have the same isotopic composition as the starting

Table 29.1 Natural global abundances of the stable isotopes for the elements of hydrogen, carbon, nitrogen, oxygen, and sulfur, as well as their corresponding international standards (Copyright: Authors' own image)

Element	Isotope	Abundance (%)	International Standards
H	¹ H	99.98	Standard Mean Ocean Water (SMOW), Vienna-SMOW (VSMOW)
	² H	0.02	
C	¹² C	99.89	PeeDee Belemnite (PDB), Vienna-PDB (VPDB)
	¹³ C	1.11	
N	¹⁴ N	99.63	Ambient Inhalable Reservoir (AIR)
	¹⁵ N	0.37	
O	¹⁶ O	99.76	Standard Mean Ocean Water (SMOW), Vienna-Standard Mean Ocean Water (VSMOW) PeeDee Belemnite (PDB), Vienna-PDB (VPDB)
	¹⁷ O	0.04	
	¹⁸ O	0.20	
S	³² S	95.02	Canyon Diablo Troilite (CDT), Vienna-(VCDT)
	³³ S	0.75	
	³⁴ S	4.21	
	³⁶ S	0.02	

material; however, if the reaction does not go to completion—as is often the case in most natural processes—the product will be depleted in the heavy isotope (Fry, 2006).

The hydrological cycle illustrates the principles of isotope fractionation. The relationship between hydrogen and oxygen isotopes in meteoric waters has been well established (Craig, 1961). Fractionation occurs as water moves between liquid, gas, and solid states (Dansgaard, 1964). Within a body of water, isotopes fractionate when molecules containing lighter isotopes of hydrogen (¹H) and oxygen (¹⁶O) evaporate first, while water molecules containing heavier isotopes evaporate more slowly. This results in clouds that are isotopically lighter than the original body of water. As clouds move across the landscape and condense into precipitation, heavier hydrogen (²H, also called deuterium) and oxygen (¹⁸O) isotopes are rained out first, resulting in a cloud that is isotopically lighter than the precipitation. This

“continentality effect” results in higher δ -values of precipitation near the coast and lower δ -values further inland.

29.4 Variation in Stable Isotope Natural Abundances

29.4.1 Stable Isotopes of Bio-Elements

Bio-elements are those elements that have low atomic mass and are very common in air and organic tissues. They are easily turned into gases, unlike heavier elements. The most commonly used bio-elements in human identification are discussed below, and include hydrogen, carbon, nitrogen, oxygen, and sulfur (H, C, N, O, and S, respectively).

Carbon isotopes (¹³C/¹²C, or δ^{13} C) reflect three different photosynthetic pathways used by plants, known as C₃, C₄, and CAM photosynthesis. Plants take in carbon dioxide (CO₂) during photosynthesis, which can contain carbon as ¹²C or ¹³C. Plants using C₃ photosynthesis discriminate more against ¹³C than do C₄ plants during photosynthesis, and have δ^{13} C values that average $-26.7 \pm 2.7\%$ (Cerling et al., 1997). The majority of the earth's vegetation comprises C₃ plants, including trees, shrubs, legumes, and most grasses and tubers found in temperate regions (O'Leary, 1981; O'Leary, 1988). C₄ plants discriminate less against ¹³C during photosynthesis compared to C₃ plants, and have δ^{13} C values that average $-12.5 \pm 1.1\%$ (Cerling et al., 1997). There is no overlap in the carbon isotope values for C₃ versus C₄ plants. CAM plants, in contrast, can use both C₃ and C₄ photosynthetic pathways, and therefore their δ^{13} C values can overlap with either plant type. CAM plants include cacti and succulents found in desert environments (O'Leary, 1988; Schwarcz & Schoeninger, 1991). However, these plants are rarely significant sources of food for modern populations and are unlikely to be considered in forensic contexts when investigating unidentified decedents.

Due to the differences in δ^{13} C values between plants that use C₃ and C₄ photosynthesis, it is

possible to estimate the contribution of different plant types to the diet, especially with knowledge of the specific plant resources available to a local population. This knowledge makes it possible to interpret the contribution of different types of animal protein to the diet, as animals that eat these plants will look to be isotopically similar (DeNiro & Epstein, 1978). Carbon isotopes can also be used to examine the contribution of terrestrial versus marine foods to the diet. Carbon signatures in marine food webs overlap with C_4 terrestrial plants (Schoeninger et al., 1983; Schwarcz & Schoeninger, 1991); thus, it may be difficult to identify which source is contributing to the carbon isotope values (Schoeninger & DeNiro, 1984). In these cases, $\delta^{15}N$ values can provide additional information regarding the importance of marine versus terrestrial food sources to the diet, as described in more detail below. Studies on various human tissues (e.g., nails, hair, bone, and teeth) have demonstrated significant dietary variation based on carbon isotopes, suggesting that the analysis of biological tissues may aid in predicting region of origin or residence patterns in certain contexts where cultural dietary patterns characterize a particular region (Bartelink, Berg, et al., 2014; Lehn, Rossmann, & Graw, 2015; Nardoto et al., 2006; Thompson et al., 2010).

Stable nitrogen isotopes ($^{15}N/^{14}N$, or $\delta^{15}N$) are correlated with the trophic level of an organism. The $\delta^{15}N$ values in a consumer's tissues are elevated approximately 2–4 ‰ over the primary food sources consumed due to fractionation between each step in a food chain (DeNiro & Epstein, 1981). Marine resources tend to have higher $\delta^{15}N$ values than those observed in terrestrial species because marine food chains tend to be much longer (Schoeninger, 1995; Schoeninger & DeNiro, 1984). In studies on humans, measured $\delta^{15}N$ values can be used to broadly estimate the trophic level of an individual relative to the food web and can determine if an individual primarily consumed a vegan or vegetarian diet (ate mainly primary producers), or if they consumed large quantities of meat (ate mainly consumers) (Nakamura, Schoeller, Winkler, & Schmidt,

1982; O'Connell & Hedges, 1999; O'Connell, Hedges, Healey, & Simpson, 2001; Petzke, Boeing, Klaus, & Metges, 2005; Sponheimer et al., 2003). For example, a person who regularly consumed seafood would have a much higher $\delta^{15}N$ value recorded in his/her tissues than someone who primarily consumed beef, or who consumed a primarily vegetarian or vegan diet (Meier-Augenstein, 2010). Elevated $\delta^{15}N$ values may also occur due to changes in health status, including pregnancy and nutritional stress (Fuller et al., 2004, 2005; Hatch et al., 2006; Mekota, Grupe, Ufer, & Cuntz, 2006; Petzke, Fuller, & Metges, 2010).

Stable sulfur isotopes ($^{34}S/^{32}S$, or $\delta^{34}S$) in the environment can vary spatially, similar to isotopes of the geo-elements strontium and lead (see below). Processes that impact sulfur isotope abundances include deposition from the ocean (the "sea spray effect") and anthropogenic inputs (Krouse & Grinenko, 1991; Richards, Fuller, & Hedges, 2001), such as deposition from coal burning power plants. In general, $\delta^{34}S$ values typically increase with ocean deposition and decrease with anthropogenic deposition. The $\delta^{34}S$ values in local soils are correlated with the values in organisms that consume resources from that landscape, providing a possible tool for predicting region of origin (Hobson, 1999; Valenzuela, Chesson, O'Grady, Cerling, & Ehleringer, 2011; Vika, 2009). Sulfur isotopes appear to correlate with the location where dietary protein sources are derived (Valenzuela et al., 2011). Organic sulfur in bone collagen and keratin from hair and nails derives from the dietary amino acid methionine, which is passed into consumer tissues with minimal fractionation. Although sulfur shows promise as a tool for provisioning humans, more research is needed to better understand the source of its variation.

Stable hydrogen ($^2H/^1H$, or δ^2H) and oxygen ($^{18}O/^{16}O$, or $\delta^{18}O$) isotopes reflect the isotopic composition of drinking water and water in food. Water isotope values vary geographically based on precipitation patterns and are influenced by temperature, continentality, altitude, and aridity (Ehleringer et al., 2010). The δ^2H and $\delta^{18}O$ val-

ues of water vary predictably across the globe and are highly correlated with one another, forming what is known as the “meteoric water line” (Bowen et al., 2007; Bowen & Revenaugh, 2003; Craig, 1961; Dansgaard, 1964). The variation in the hydrogen and oxygen isotope abundances of drinking water, which is primarily derived from precipitation, can be mapped with Geographic Information Systems (GIS) software to create an isoscape (West et al., 2010). As $\delta^2\text{H}$ and $\delta^{18}\text{O}$ values in human tissues reflect the patterns of $\delta^2\text{H}$ and $\delta^{18}\text{O}$ values of local precipitation and drinking water, they can be used to predict possible geographic locations where a person traveled (Bowen et al., 2007; Meier-Augenstein, 2010). Despite the growing popularity of bottled water, much of it is actually locally filtered tap water; thus, the consumption of bottled water is unlikely to have a significant effect on an individual’s isotope values in most contexts (Bowen, Chesson, Nielson, Cerling, & Ehleringer, 2005; Chesson et al., 2014; Ehleringer et al., 2010). When the stable isotope values of human tissues—like hair or tooth enamel—are mapped to water isoscapes, predictions of geographic region of origin and residence patterns can be made (Ehleringer et al., 2008). This model of provenancing is well developed, especially for the continental United States (Bowen et al., 2007, 2009; Ehleringer et al., 2008, 2010). We do note, however, that hydrogen can also be influenced by the amount and type of meat consumed, which should be taken into consideration for groups that consume large amounts of marine protein (Bowen et al., 2007, 2009).

29.4.2 Geo-Elements and Stable Isotopes

Geo-elements have a much greater atomic mass than the bio-elements discussed above. They are generally trace elements that originate from rocks and minerals in the underlying geology of a region. The isotope ratios of geo-elements, such as strontium (Sr) and lead (Pb), reflect local geology and are not typically affected by fractionation processes as they are passed from the

environment into a consumer’s tissues. Reference standards are not required for reporting strontium and lead abundances in materials since the absolute abundance ratios are usually meaningful up to five decimal places (Bentley, 2006).

Variation in ^{87}Sr is a result of radioactive decay of rubidium into strontium. Although the product of radioactive decay (i.e., radiogenic), ^{87}Sr is considered a stable isotope since it does not change further. Strontium isotope ratios ($^{87}\text{Sr}/^{86}\text{Sr}$) are used to trace the geographic location of materials. Higher $^{87}\text{Sr}/^{86}\text{Sr}$ ratios found in the underlying geology and plants from a region are consistent with older bedrock (i.e., greater rubidium decay), whereas lower $^{87}\text{Sr}/^{86}\text{Sr}$ ratios are consistent with younger bedrock (Bentley, 2006). Strontium originates from the local bedrock and is leached out by water; it is then passed on to animals that imbibe water and consume plants or other animals from the local region. Bioavailable strontium substitutes for calcium in tooth and bone hydroxyapatite, and shows negligible isotopic fractionation as it moves up the food chain (Beard & Johnson, 2000). Strontium isotopes in teeth record the local geological signature at the time of tooth formation, and remain unaltered if a person migrates to a new location; however, in bone, remodeling will cause the $^{87}\text{Sr}/^{86}\text{Sr}$ ratio to shift over time to reflect the new location (Beard & Johnson, 2000).

Lead isotopes ($^{207}\text{Pb}/^{206}\text{Pb}/^{204}\text{Pb}$) are similar to strontium isotopes in that they can substitute for calcium in hydroxyapatite. Variation in lead isotope ratios also reflects the age of the underlying geology as well as the local region’s U/Th/Pb ratios (Burton, 2008; Katzenberg, 2008). However, lead isotope ratios in human tissues can also reflect inputs from soil and transported dust, as well as anthropogenic contamination from the local environment, including gasoline exhaust fumes from automobiles (Kamenov, 2008; Rauch, Rummel, Lehn, & Büttner, 2007). Anthropogenic contamination of lead may limit its use for forensic provenancing studies in some contexts, although it has provided useful evidence in certain cases (see Kimmerle & Kamenov, 2014; Rauch et al., 2007).

29.5 Instrumentation and Standards

29.5.1 Bulk Stable Isotope Analysis

Bulk stable isotope analysis measures the isotope abundance of an entire sample. As an analogy, think of a football stadium with fans wearing red. When viewed from afar, a picture of the stadium would appear to be a uniform sea of red color; however, a close-up of one section would reveal some fans wearing red shirts and others with chests painted red. Similarly, the carbon isotope values obtained from a bulk analysis of bone collagen represent an aggregate value of all of the individual amino acids contained within the sample, like the stadium seen from afar. In contrast, compound specific analysis produces separate isotope values for each amino acid contained within the sample (Katzenberg, 2008). In this way it is possible to compare the isotopic signatures of essential and nonessential amino acids to investigate dietary effects. Bulk stable isotope analysis is generally sufficient for forensic analyses of human tissues as it corresponds to available comparative datasets. However, in other materials, such as illicit drugs (e.g., heroin), bulk analysis can skew results because the drug can represent a combination of both the original plant and impurities introduced during manufacture (Idoine, Carter, & Sleeman, 2005). These impurities can sometimes provide even more characteristic and discriminatory information than stable isotope analysis of the drug alone.

29.5.2 Isotope Ratio Analysis of Bio-Elements

To measure stable isotope ratios of the bio-elements within a sample, the material must be prepared and then analyzed via gas source isotope ratio mass spectrometry (IRMS). The mass spectrometer analyzes pure gases (e.g., H as H₂, C as CO₂, N as N₂, O as CO, and S as SO₂), which are ionized at the mass spectrometer's source. The ionized gas beam is focused and then accelerated for travel through a flight tube where a

mass analyzer (magnet) separates the ion species by deflection based on their atomic mass (Hoefs, 2009; Katzenberg, 2008; Meier-Augenstein, 2007). In traditional mass spectrometry, the strength of the magnetic field is typically varied and all ionic species are measured via a single detector. In contrast, isotope ratio mass spectrometry uses a fixed magnetic field that deflects different isotopes (masses) into a series of detector cups placed at the end of the flight tube; the number of heavy versus light isotopes of the element of interest is counted to calculate raw stable isotope ratios. The advantage of this approach is greater sensitivity in measuring extremely small mass differences between ionic species.

To collect data for more than one element from a single sample material, multiple separate gases may need to be analyzed. These gases can be prepared and purified offline, then introduced to the isotope ratio mass spectrometer one at a time. However, it is also possible to obtain simultaneous results for two or more elements in one sample without any offline preparation, such as C, N, and S or H and O, due to modern continuous flow instrumental set-ups (CF-IRMS) and the use of elemental analyzers (Meier-Augenstein, 2007). Here, samples are combusted or pyrolyzed using an elemental analyzer and the resultant gases separated via gas chromatography. The separated gases are then transferred to the mass spectrometer for analysis using helium as a carrier gas. Technological improvements in IRMS have recently led to machines with greater portability, smaller sample requirements, less sensitivity to the external environment, and a higher degree of automation (Hoefs, 2009; Katzenberg, 2008; Lis, Wassenaar, & Jim Hendry, 2008).

29.5.3 Isotope Ratio Analysis of Geo-Elements

Isotope measurements of geo-elements (e.g., Sr, Pb) are made using either a thermal-ionization mass spectrometer (TIMS) or a multi-collector inductively coupled plasma mass spectrometer (MC-ICP-MS). Similar to the IRMS systems discussed above, TIMS and MC-ICP-MS also

employ a group of lenses to focus an ion stream, a magnet to separate the different masses, and a series of detectors to measure the ion currents. The main difference between these three mass spectrometer systems is each system employs a unique sample introduction mechanism and ionization strategy. With TIMS, solid samples are loaded directly on a nonreactive metal filament as a salt. After the sample is loaded, the filament is heated until the mineral salt evaporates and the analyte is ionized (Woodhouse & Abrams, 2001). In contrast, MC-ICP-MS systems most commonly aspirate liquid samples or digests. Here, the samples are nebulized into an aerosol and introduced into an argon plasma and ionized (Albarède & Beard, 2004). Also, a laser ablation system can be coupled to a MC-ICP-MS, allowing for analytes from solid materials to be introduced into the plasma. Another major difference between TIMS and MC-ICP-MS is sample throughput; about 10–15 samples per day can be analyzed via TIMS, while MC-ICP-MS requires 5–15 min per sample (Woodhouse & Abrams, 2001). Also, MC-ICP-MS systems can be highly automated, while TIMS systems require a human operator.

29.5.4 Reference Materials and Data Quality Assurance

To ensure that measured stable isotope data are accurate and comparable between analytical facilities, the International Atomic Energy Agency (IAEA), and in the USA the National Institute of Standards and Technology (NIST), have identified the international reference materials against which stable isotope abundances should be expressed. Two calibration reference materials are used to define each isotope scale (e.g., VSMOW-SLAP scale for H and O isotope analysis). The first calibration material has a defined δ -value of 0‰ and no associated uncertainty of measurement. Also available are reference materials that ensure the measurements made on samples at a laboratory are properly anchored to the appropriate isotope scale (i.e., Greenland Ice Sheet Precipitation, or GISP, for H

and O isotope analysis); these international reference materials do have associated uncertainty (Hoefs, 2009). In addition, almost all laboratories use in-house standards that have been calibrated against the international reference materials and cross-checked with other laboratories to verify the accuracy, precision, and reliability of measured results (Coplen, 2011; Ehleringer & Matheson, 2010). The use of in-house standards allows analytical facilities to monitor the tuning, stability, and linearity of instrumentation in order to control and assess data quality. More details on ensuring data reliability are provided in the Forensic Isotope Mass Spectrometry Network's (FIRMS) *Good Practice Guide for Isotope Ratio Mass Spectrometry* (Carter & Barwick, 2011).

29.6 Sample Selection and Quality Measures

Stable isotope ratios can be measured in all human tissues and bodily fluids. The most commonly used organic tissues for forensic isotope analyses in unidentified decedent cases are bone collagen, hair keratin, and nail keratin. Inorganic tissues used for analysis include carbonate and phosphate from bone and tooth enamel hydroxyapatite (bioapatite).

29.6.1 Bone Collagen

Bone is constantly being resorbed and regenerated over an individual's lifetime, a process known as bone remodeling. Bones in the human body remodel at different rates, such that a rib bone reflects the last 5–10 years of an individual's life, while a femur, which remodels more slowly, records isotopic information from the last 20–25 years of life (Hedges, Clement, David, Thomas, & O'Connell, 2007; Meier-Augenstein, 2010). Bone is an organic matrix of collagenous protein interlaced with inorganic calcium phosphate crystals. It is approximately 30% organic and 70% inorganic by weight (Katzenberg, 2008). Collagen, the main organic component of bone,

is composed of both essential and nonessential amino acids. The essential amino acids primarily come from ingested protein; therefore, carbon isotopes from collagen reveal protein sources in the diet (Ambrose & Norr, 1993; Tieszen & Fagre, 1993).

29.6.2 Hair and Nail Keratin

Both hair and nail growth depend on multiple factors including overall health, diet, genetics, age, and even season, as these tissues grow faster in the spring and summer than in the winter and fall (Wilson & Gilbert, 2007). However, once stable isotopes are incorporated into keratin from diet and drinking water inputs, they are no longer subject to the metabolic cycling of the body and their values remain fixed (Ehleringer et al., 2008). Isotopic differences in keratin can facilitate prediction of an individual's lifestyle, diet choices, or residence patterns.

Although hair and nails are not often recovered with skeletal remains, in instances when they are well preserved, they can be used to reconstruct diet and possible residence patterns of an individual in the months prior to death. Hair is composed of keratin protein and grows at an average rate of 0.4 mm per day (Saitoh, Uzuka, Sakamoto, & Kobaro, 1967). At this rate of growth, a 1 cm segment of hair would represent approximately 25 days. When taking serial samples, the directionality of hair must be known prior to analysis as the root end reflects a more recent period of time in comparison to the distal end of the hair.

Similarly, fingernails and toenails are also composed of keratin and can provide an incremental record of diet and residence patterns. Like hair, nails grow continuously during life. Fingernails grow at a rate of 2–3 mm per month and take approximately 6 months to fully regrow, whereas toenails grow slightly slower at 1 mm per month and take 12–18 months to regrow (Elewski, 1998). The directionality of the nail is also important for analysis as the portion of the nail closest to the nail bed is more recently formed than the distal edge. Studies have shown

that isotope values in nails differ from those of hair in the same individual, suggesting that nail keratin forms more slowly than hair keratin (Fraser, Meier-Augenstein, & Kalin, 2006; Fraser et al., 2006; Lehn, Mutzel, & Rossmann, 2011; O'Connell et al., 2001). Due to the slower formation time and greater complexity of nail keratin, some researchers have recommended using hair when possible rather than nails for provenancing studies (Fraser et al., 2006; Lehn et al., 2011).

Regional differences in diet can aid in narrowing down possible geographic regions of origin of unidentified remains. For example, significant differences have been observed in carbon, nitrogen, and sulfur isotopes of hair keratin from individuals who lived in different regions of the United States, and between individuals living in the United States versus Europe (Valenzuela et al., 2011; Valenzuela, Chesson, Bowen, Cerling, & Ehleringer, 2012). Despite worldwide trade in food products, termed the "global supermarket," the diet of most individuals consists of significant amounts of locally sourced food items (Nardoto et al., 2006). As discussed earlier, a benefit of analyzing keratin is the option of serial sampling hair and nails to obtain a travel-movement history. Hydrogen and oxygen isotopes are especially useful when analyzing hair and nail keratin because $\delta^2\text{H}$ and $\delta^{18}\text{O}$ values of precipitation vary across geographic regions (Ehleringer et al., 2008). Serial sampling of hair can provide isoscapes of an individual's travel history through isotopically different regions (Ehleringer et al., 2010).

29.6.3 Bioapatite: Bones and Teeth

Hydroxyapatite, often referred to simply as apatite or bioapatite, is the inorganic component of bone and tooth enamel. Carbonate (CO_3) is a component of bone and tooth apatite that is formed from dissolved bicarbonate in the blood and reflects the contribution of all dietary macronutrients, including carbohydrates, lipids, and proteins (Ambrose & Norr, 1993; Krueger & Sullivan, 1984; Tieszen & Fagre, 1993). Carbon and oxygen isotopes of the carbonate in apatite

can be used to explore diet and residence patterns, respectively. Bone, with its slow remodeling time, may record diet and residence pattern information accrued over a long period of time prior to death, and may provide misleading results due to mixed dietary or residence pattern signals. For example, an individual who moved several years prior to death may retain some of the signature of their old place of residence as well as the signature of their most recent place of residence. Therefore, bone apatite will be most useful for contexts where the person recently traveled to a region, and thus still retains a nonlocal signature. Tooth enamel, in contrast, can provide more specific information regarding birthplace or childhood diet and residence patterns since it represents “snapshots” of different periods of childhood when the enamel formed. Sampling several teeth with different formation times can provide information regarding diet and residence patterns from birth into adolescence.

29.7 Diagenesis

Although most modern forensic cases have relatively short intervals between the time of death and analysis of remains, sample integrity should be critically evaluated. Diagenesis, the chemical alteration of remains due to chemical exchange with soils and groundwater, can be assessed through several sample quality measures. Bone collagen yields above 1% are considered acceptable (van Klinken, 1999). Comparing the atomic carbon to nitrogen (C/N) ratio for bone collagen is a standard method to address possible sample contamination. Suitable collagen should have C/N ratios that fall between 2.9 and 3.6 (DeNiro, 1985). Although sample quality indicators for keratin continue to be studied, a C/N ratio between 3.0 and 3.8 is considered acceptable (O’Connell et al., 2001; O’Connell & Hedges, 1999).

Bone apatite is highly susceptible to diagenesis due to its structure and chemical similarity with calcium carbonate in the buried environment (Ambrose, 1993). In contrast, tooth enamel is less susceptible to diagenesis due to the

smaller pore size of its matrix. Apatite sample quality can involve measuring the percentage of sample lost due to the removal of organics with sodium hypochlorite or hydrogen peroxide, and assessing the carbonate content (C/P; i.e., CO_3/PO_4) and the infrared splitting factor (IR-SF) from the spectra produced with Fourier transform infrared spectroscopy (FT-IR) (Garvie-Lok, Varney, & Katzenberg, 2004; Shemesh, 1990; Surovell & Stiner, 2001; Termine & Posner, 1966; Wright & Schwarcz, 1996). Samples of poor quality often have an inverse relationship between the IR-SF and C/P ratio (Nielsen-Marsh & Hedges, 2000; Yoder & Bartelink, 2010).

29.8 SIA as an Investigative Tool in Missing Persons Investigations

29.8.1 Applications for Provenancing Humans

We next discuss the use of SIA as an investigative tool for missing persons cases, and more specifically how the use of a multi-isotope approach on human tissues that form at different points in time can provide a wide range of information regarding a decedent’s diet and residence patterns. For investigators, identification of human remains is a main priority as it can resolve missing persons cases and provide information regarding the circumstances surrounding the death event. Our examples include hair from the Saltair Sally case as well as bone and tooth samples extracted from a mandible found in northern California in 2012.

29.8.2 Identifying Travelers

Returning to the case of Saltair Sally, we can ask a series of questions that may help to identify her. Was she a resident of the metropolitan area of Salt Lake City, Utah, where she was discovered? Had she traveled to or from the area before her death? If yes, from where had Sally traveled?

The stable isotope analysis of hair is especially useful in answering those questions. As mentioned previously, the $\delta^2\text{H}$ and $\delta^{18}\text{O}$ values in hair keratin reflect the $\delta^2\text{H}$ and $\delta^{18}\text{O}$ values of drinking water, which vary spatially in a predictable way. Similarly, the $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ values in keratin reflect the $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ values of diet, which can vary globally based on food availability and preferences. The isotopic composition of hair from an individual traveling through a region would therefore not necessarily match those of local inhabitants. A study of migrants to an English town demonstrated this application by comparing carbon, nitrogen, oxygen, and sulfur isotope ratios in the hair of new arrivals to residents in order to distinguish the two populations (Bol, Marsh, & Heaton, 2007).

A sequential analysis of Saltair Sally's hair at weekly intervals (approximately 2.5 mm of hair) revealed that she had traveled extensively in the 2 years before her death, spending part of her time in a region that was consistent with Salt Lake City, Utah, as well as other portions of the Intermountain West in the continental United States (Fig. 29.3; Ehleringer et al., 2010; Remien et al., 2014). Origin predictions based on the oxygen isotope ratios measured in her hair included no regions of the continental United States east of the Mississippi River. In addition to her time in the Intermountain West, Sally had consumed water with lower isotope ratios (that is, likely traveled to regions more inland or at higher elevation) twice in the 24 months preceding her death. During this time, she also consumed water that had higher isotope ratios.

The regions consistent with the higher δ -values measured in Saltair Sally's hair included portions of the Pacific Northwest and provided investigators with concentrated search areas for reviewing missing persons reports. One report from the metropolitan area of Seattle, Washington, that was filed in 2003 matched the physical description of Saltair Sally. In 2012, DNA analysis confirmed that Saltair Sally was in fact Nikole ("Niki") Bakoles and the case's lead investigator, Detective Todd Park, was able to finally return Niki's remains to her family living in Seattle.

29.8.3 Provenancing the Unidentified

The case of Saltair Sally demonstrates the utility of stable isotope analysis to reconstruct the history of an individual just prior to death by examining the "snapshot" of time recorded by hair keratin. We next consider two additional time points recorded by bone (years before death) and tooth enamel (adolescence). This multi-snapshot approach can be extremely useful when only limited remains are available for analysis and virtually no biological profile examinations are possible. This was just the case for an isolated mandible found in northern California's Siskiyou County.

The Siskiyou mandible was recovered from the North Coast Range in 2012. Morphological and metric assessments of the bone and teeth suggested the decedent was an adult male, although classification of ancestry was indeterminate. With no other identifying information or evidence available (including no evidence of dental restorations), we applied stable isotope analyses to investigate potential origins of the individual in the years before his death and his adolescence. We analyzed bone bioapatite for oxygen isotope ratios and enamel collected from a third molar for both oxygen and strontium isotope ratios.

To predict potential origins from the $\delta^{18}\text{O}$ value determined for the bone bioapatite and tooth enamel, we first converted carbonate measurements to equivalent phosphate data (Iacumin, Bocherens, Mariotti, & Longinelli, 1996) and then predicted drinking water (Daux et al., 2008) from the phosphate data. Those regions of the continental United States with tap water consistent with predicted drinking water (plus an estimation of uncertainty in analytical results) are shown in Fig. 29.4. Predictions for both points in time represented by the analyzed remains are generally consistent and located in the Intermountain West. The unidentified decedent may have spent the years prior to death in a region of slightly higher latitude and higher elevation than his adolescence, as seen in a comparison of the bone versus tooth enamel predictions. However, these regions

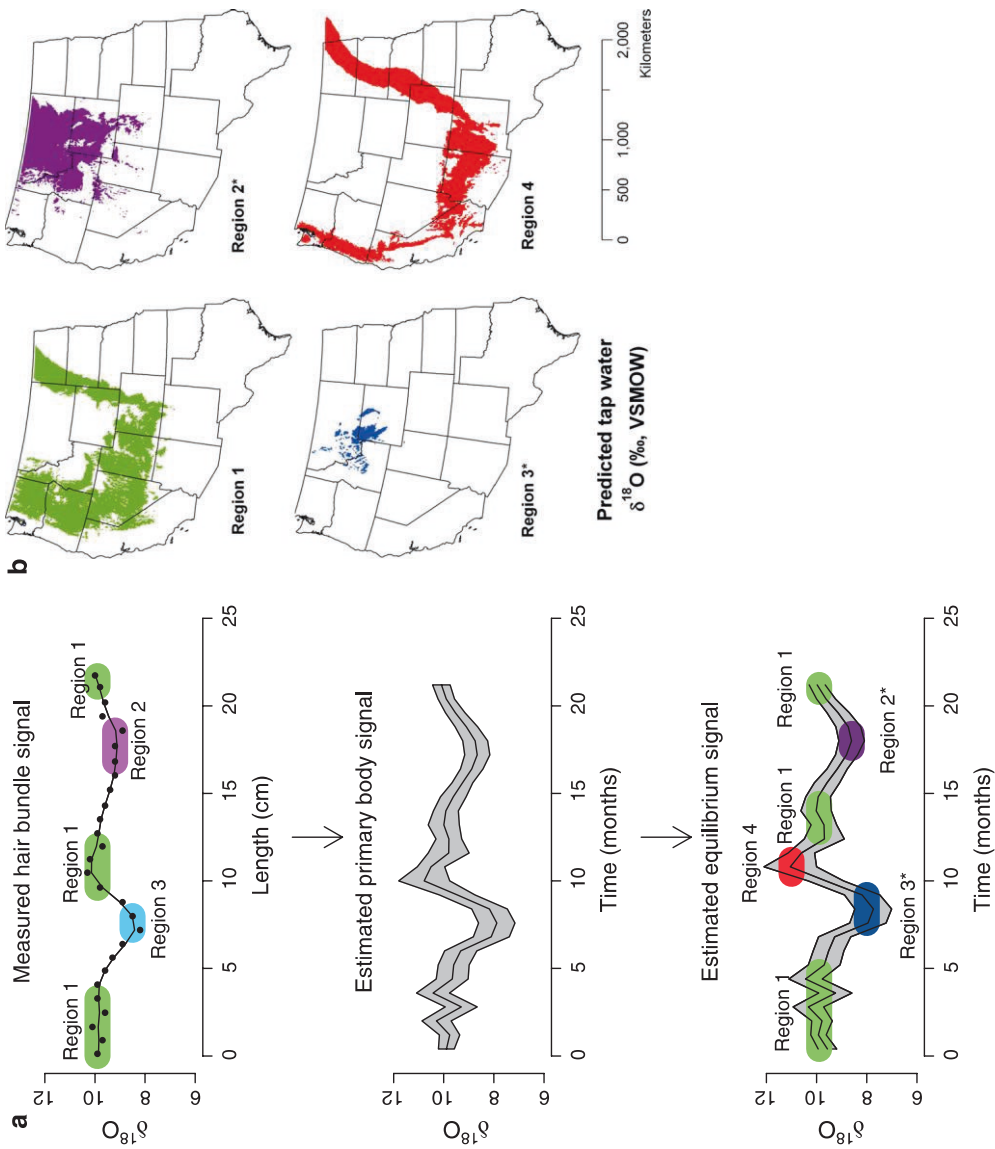


Fig. 29.3 (a) Estimated primary body signal and equilibrium signal from hair $\delta^{18}\text{O}$ measurements of a previously described hair bundle of a murder victim [Saltair Sally] (Ehleringer et al., 2010; Kennedy, Bowen, & Ehleringer, 2011). (b) Isoscape maps based on tap water for geographic regions predicted by the estimated equilibrium signal from hair $\delta^{18}\text{O}$ measurements. Time was calculated based on an average hair growth rate of 0.4 mm/day. (Reproduced from Remien et al., 2014)

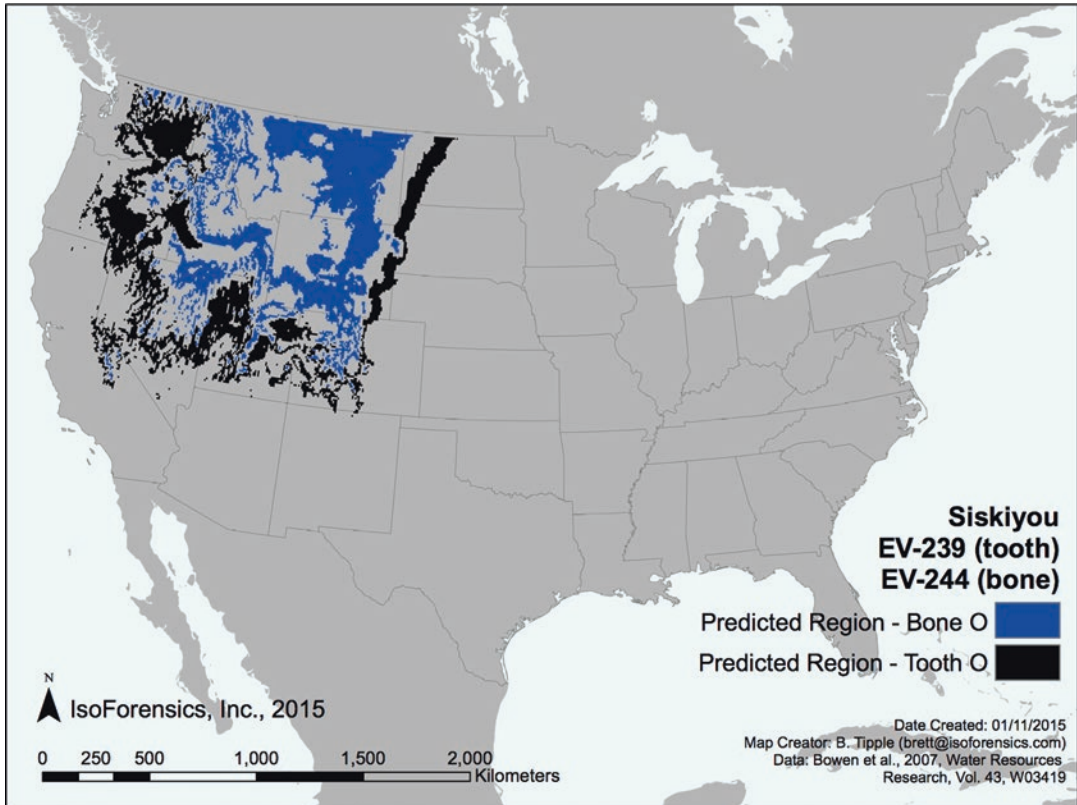


Fig. 29.4 Predicted regions from the oxygen isotope ratios measured in bone bioapatite (*blue*) and tooth enamel (*black*), plus some estimation of analytical uncertainty. The two “snapshots” in time provided by the bone and

tooth can be compared to determine if the decedent spent his adulthood before death and childhood in similar locations (Copyright: IsoForensics, Inc.)

are in proximity to the location of discovery in northern California.

The addition of another measurement—in this case, strontium isotope analysis of the third molar—helped to further constrain prediction regions to those areas consistent with both measured $\delta^{18}\text{O}$ values and $^{87}\text{Sr}/^{86}\text{Sr}$ ratios. This was possible because oxygen and strontium isotopes provide separate origin information. To predict potential origins using the strontium isotope ratio data, we assumed no isotopic fractionation between the environment and the tissue (tooth). Environmental $^{87}\text{Sr}/^{86}\text{Sr}$ ratios were estimated using a water isoscape published by Bataille and Bowen (2012) that considers the age of local bedrock and the susceptibility of different rock types to leaching. The prediction based on the strontium measurement was then layered with that

from the oxygen measurement (Fig. 29.5). Although this individual has not yet been identified, the results further constrained probable origin assignment to select areas of the Intermountain West. The investigation is ongoing and DNA results are pending; however, the isotope results were able to eliminate at least one missing person who spent their entire life in Siskiyou County.

29.8.4 Estimating Birth Year

Although this chapter has focused almost exclusively on the application of stable isotope analyses in investigations of unknown decedents, we mention one useful radioactive isotope measurement here: bomb curve radiocarbon (^{14}C) dating. For remains younger than approximately 1955,

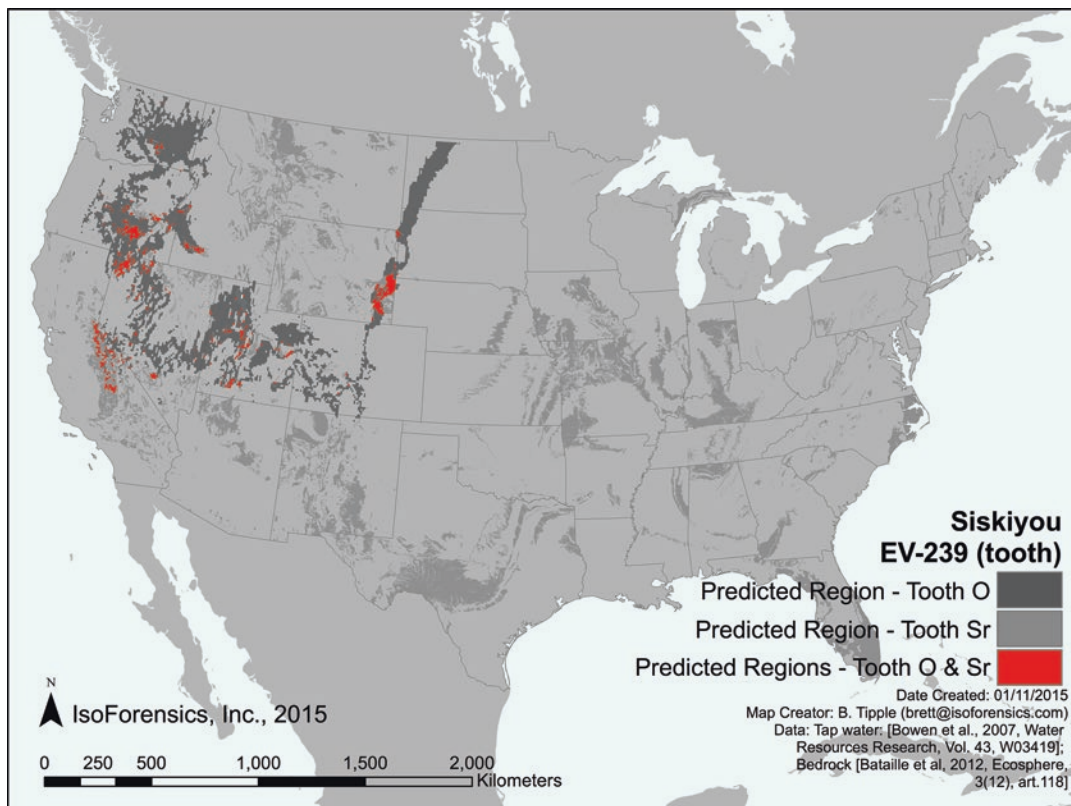


Fig. 29.5 Predicted regions from the oxygen isotope ratios (*light gray*) and strontium isotope ratios (*dark gray*) measured in tooth enamel, plus some estimation of analytical uncertainty. Regions of overlap between the pre-

dictions are shown in *red* and helped to constrain probable origin assignment of the unidentified decedent (Copyright: IsoForensics, Inc.)

this measurement technique can provide an independent assessment of age and/or date of death through measurement of ^{14}C in tissues like hair or tooth enamel.

Age dating is possible because of the Partial Nuclear Test Ban Treaty signed in 1963. Prior to 1963 there was extensive above ground testing of nuclear weapons leading up the Treaty, which increased atmospheric radiocarbon (^{14}C) content dramatically between 1955 and 1963 (Ubelaker, Buchholz, & Stewart, 2006). Since the Treaty's signing, the increase of atmospheric radiocarbon presented as "fraction modern" ($F^{14}\text{C}$) values and known as the "bomb curve" or "bomb spike" has subsequently decreased as carbon has been removed from the atmosphere by oceans and plants (Buchholz & Spalding, 2010). Radiocarbon produced by nuclear blasts quickly oxidizes to

carbon dioxide, which is then taken up by plants during photosynthesis and, in turn, is recorded in the tissues of animals that eat the plants. Recent studies demonstrated that animal tissues such as hair and teeth record the radiocarbon concentration that was in the atmosphere when the tissue formed (Ubelaker et al., 2006; Uno et al., 2013). This method provides several avenues of research for unidentified remains, including the estimation of year of birth (sampled from permanent molar teeth), estimation of year of death (sampled from incremental tissues such as hair), and in determining whether remains predate or postdate atomic bomb testing, which may help in establishing whether remains are of medicolegal significance.

This age dating technique was utilized in the investigation of Saltair Sally to estimate date of

death. The scattered skeletal remains, personal effects, and hair were found in 2000 on the ground (i.e., not partially buried), suggesting Sally had potentially died a few months before her discovery. However, analysis of the proximal (youngest) portion of some hair strands for $F^{14}C$ suggested a date of death a few years earlier, in 1996 (Ehleringer et al., 2010).

29.9 Conclusions

Applications of SIA are still relatively new within the forensic sciences and the medicolegal community in particular. At present, SIA is not yet a routine method for the examination of unidentified remains, and there are few published case studies that have demonstrated its utility to law enforcement (e.g., Fraser & Meier-Augenstein, 2007; Katzenberg & Roy Krouse, 1989; Rauch et al., 2007). However, the growing body of literature on the technique indicates that applications will continue to develop, and will likely refine our ability to predict migration history and region of origin of unidentified human remains. We have described applications of the technique in two case study examples here.

We note that, in general, SIA is best applied as a means of eliminating investigative possibilities, such as whether a person is likely native to a particular area versus a traveler or foreign-born individual. While we are optimistic that SIA will continue to provide a robust tool for provenancing human remains, we realize it is unlikely that it will ever approach the level of precision to identify a person's origin to a specific area, such as a city. When used in conjunction with other forensic methods, it will serve as an important tool for narrowing down search parameters for missing persons investigations. Finally, there is a need to generate additional reference datasets, including data on hydrogen, oxygen, and strontium isotopes in all parts of the world. Provenancing unidentified remains within places such as the United States or United Kingdom is facilitated by the availability of large reference datasets used to generate isoscape maps. In many other regions of the world, reference datasets are

limited and therefore hinder the use of SIA for predicting migration history or region of origin of unidentified human remains.

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Claire Gwinnett

30.1 Introduction to Trace Evidence

Trace evidence can be taken to mean any physical or biological evidence left at a crime scene that is not visible to the naked eye. This definition may also include both latent fingerprints and DNA, although these two types of evidence have their own classification and are not normally investigated by trace evidence analysts (Caddy, 2001). Typical classes of trace evidence that are commonly encountered at crime scenes include fibres, glass, paint, soils, shoe polishes, and cosmetics. The term trace evidence is also part of a broad category of physical evidence. Physical evidence can be any material but, in a legal context, it refers to materials that may be brought into court and are formally entered as exhibits. The term 'trace' refers to two concepts. The first concept is the size of the material, which can undoubtedly be small, but there are circumstances in which a large amount of substance can be found, for example, a large smear of cosmetic foundation (Gordon & Coulson, 2004). The second concept is that trace refers to something that has been left behind after something else has

been removed (Caddy, 2001). This concept represents an interaction that leads to an exchange or transfer in material and, in terms of an investigation, this is a more useful concept to appreciate.

Trace evidence is commonly seen as the traditional evidence type. Made famous by the fictional Sherlock Holmes, its value was expressed by Edmund Locard in his Exchange Principle in the 1930s. The Exchange Principle suggests that whenever two objects come into contact, a transfer of material will occur (Locard, 1930). The type of contact that occurs and the material transferred are dependent upon the circumstances of the case; for example, fibres may be transferred from a suspect's jumper to a car seat whilst driving. It has been conversed among trace evidence analysts whether Locard's ideas are still valid in today's world of forensic science. Willis (2014) stated that today's shortened version of Locard's principle, 'every contact leaves a trace', is an oversimplification of the true understanding of Locard's work. This potentially can lead to an oversimplified interpretation of the evidence that does not take into account the many other aspects underpinning this principle. Certainly the basic principle is still true, but to utilise this principle effectively, a trace evidence analyst must be aware of the many factors affecting transfer of different evidence types in different cases, which is eluded to in the unabridged version of Locard's work but not explicitly stated in his principle. Knowledge of the wide range of factors affecting

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transfer of trace evidence is particularly important in missing persons investigations where the circumstances of each case may be extremely varied. This increased knowledge about the different transfer mechanisms of trace evidence and the factors affecting such, based upon modern empirical experiments and case studies, may be where we have built upon Locard's work and made it fit-for-purpose for today's casework.

One benefit of trace evidence is its ubiquity at crime scenes; where it is possible for the informed perpetrator to avoid leaving DNA and fingerprints, it is almost impossible to avoid leaving trace evidence behind. Demonstrating this, a review conducted by Petraco (1985) of 506 cases between 1977 and 1983, showed that 402 cases had one or more categories of trace evidence (categories included fibres, human hair, animal hair, and particulate matter) that proved valuable in the case. Although this is powerful support to the value of such evidence, it is not always utilised or even collected at scenes, due to the expense of analysis and its worth not being recognised in today's DNA-driven investigations.

If trace evidence is being sought, any which is found at a crime scene is initially treated as relevant as it may have come from the offender and therefore link that person with the crime (Evet, 1993). Further analysis and comparison of trace evidence to suspect samples can help to provide information about events before the crime, at the crime scene itself, and events after the crime took place. In the case of a missing person incident, this may help identify the movements of an individual(s) related to the case. This is known as reconstruction of the crime scene. One such example of this is the ability of glass fracture analysis to determine the potential cause of the fracture, whether a window has been broken from the inside or the outside and the sequence of impacts (McJunkins & Thornton, 1973). In missing person investigations, this information may be used to indicate whether an individual has broken into a building (during a kidnapping case) or whether a person has broken the window from the inside (during escape or when running away). Reconstruction of events can also be attempted by identifying how trace evidence may have transferred, and observing the location and

pattern of the transferred evidence at the scene, on the object or person. Valuable information can be gathered even by knowing whether samples from a person's shoes were found on the top or the bottom. Trace evidence found on the top could have been present for a long time, whereas evidence found on the sole is likely to be much more recent (Sandiford, 2012). In missing persons investigations, knowledge of when trace evidence was transferred can provide timeframes for certain events, for example, soil found on the sole of shoes may be from the environment of a body disposal site. Access to this form of trace evidence before it is lost is extremely valuable in locating such sites.

Trace evidence has also proven in the past to be very useful for two other reasons: because of its value as an investigative aid (by providing intelligence to police investigations) and its use as associative evidence. Hairs and fibres, among other trace evidence types, can provide very good investigative leads as their characterisation may provide information about any suspects involved in a missing person case; for example, the type and colour of a garment they wore, the colour of their hair and their possible occupation and recently and/or frequently visited environments. This is particularly useful when utilising Closed Circuit Television (CCTV) to try and identify potential suspects and their movements. Paint evidence is particularly useful when attempting to identify suspect vehicles potentially involved in a missing person case. Paint chips and smears are readily transferred to surfaces during scrapes and impacts, and if the vehicle leaving these paint particulates is believed to be involved in the case, such chips can be analysed in order to indicate the manufacturer and model of the vehicle (Gothard, 1976; Wheals & Noble, 1974).

As associative evidence, trace evidence can provide links or relationships between individuals; between individuals and objects; and between objects/individuals and locations, after suspects have been identified. For example, pollen and other plant material found in the tire tread of a suspect's vehicle may be linked back to the plants present at an abduction site (Petraco, Kubic, & Petraco, 2008). In missing person cases, such evidence can be invaluable in identifying poten-

tial suspects involved in the case. Likewise, the associative evidence can aid investigators in understanding where and who the missing person has previously been in contact with. The evidential value of a range of trace evidence is discussed further in Sect. 30.5.

30.2 Types of Trace Evidence

Trace evidence comes in many forms, leading to a diverse portfolio of particulates that can be analysed in a missing person case. The breadth of evidence retrieved for analysis is primarily down to the ability of the Scenes of Crime Officer (SOCO) and investigators to conduct adequate searches for trace evidence (Gruza & Tomaszewski, 1990) and to identify its potential value in a case. For example, some investigators may overlook dust as a form of trace evidence, but this form of evidence has proven to be very useful in providing investigative leads and as associative evidence. The list of trace evidence is almost endless, but Fig. 30.1 provides some examples of this category of evidence.

Although some evidence is commonly found at crime scenes, such as fibres and hairs (Petraco, 1985), other trace evidence may only occur in particular case scenarios. For example, shoe polish has been used to investigate police assault of

suspects in custody by examining smears present on the suspects' clothing (Cole & Thorpe, 1992) and metal particles have been used to link tools (e.g. pliers) to scenes and suspects (McDermott, 1994). In many cases, it is the presence of multiple trace evidence types that has high evidential value as, if more than one type of evidence can link a suspect to a scene or victim, this makes it much more difficult for the defense of such a case to state this is coincidental.

Selected trace evidence types are defined and described in Sects. 30.2.1–30.2.5, some of which are commonly analysed in casework and do not appear elsewhere in this book (fibres, hairs, and soil) and other less commonly analysed types (dust and cosmetic evidence).

30.2.1 Textile Fibres Evidence

A fibre has been generally defined as a substance that has a high length-to-diameter ratio and is flexible in nature (Robertson & Grieve, 1999; Taylor, 1990). Depending on the type of fibre, characteristics can differ. However, generally fibres have the following qualities:

- They have a structure that is much stronger longitudinally than laterally.
- They are flexible and extensible.

Types of Trace Evidence		
Textile fibres	Hair	Glass
Soil	Paint and other coatings	Pollen
Cleaning products	Greases	Oils
Diatoms	Waxes	Lubricants
Cosmetics	Nail varnish	Minerals
Gun shot residue (GSR)	Plastics	Pesticides
Acids/Alkalis	Dyes	Tapes
Light filaments	Plant material	Solvents
Wood	Foil	Pesticides
Feathers	Glitter	Dust (normally a mixture of
Metal	Building materials	other trace evidence)

Fig. 30.1 Types of trace evidence (Copyright: Claire Gwinnett)

- Natural fibres develop naturally in a fibrous form and will differ according to the variety of plant or breed of animal and external conditions.
- Fibre-forming polymers have streamlined molecular chains and a high molecular weight (Robertson & Grieve, 1999; Taylor, 1990).

There are a multitude of textile fibre types used today. These fibres can be classified as either man-made or natural fibres. Natural fibres are those which are obtained from natural sources such as plants and animals; for example, cotton and wool, respectively. Man-made fibres are fibres that have been manufactured by humans from either naturally occurring fibre-forming polymers (such as cellulose) or from synthetic fibre-forming polymers (Roux & Robertson, 2000).

Fibres can be classified into further subsections. Natural fibres are subdivided into animal, vegetable, and mineral (asbestos fibres). Animal fibres, or protein fibres, can be divided into three further groups: silk, wool, and other hair fibres. These three categories are based upon the protein composition or their utilisation. For example, the protein composition of silk is fibroin and the protein composition of wool and other hair fibres is keratin (Roux & Robertson, 2000). Vegetable fibres can also be subdivided into three categories: seed fibres, bast fibres, and leaf fibres. Man-made fibres, or artificial fibres, are divided into three subsections: synthetic-polymer fibres, natural polymer fibres, and other fibres (including carbon and glass fibres) (Robertson & Grieve, 1999).

Textile fibres are ubiquitous in modern society. The use of fibres can be broken down into four main areas:

1. Apparel, for example, trousers, shirts, dresses
2. Household textiles, for example, carpets, curtains, bedding
3. Industrial applications, for example, tenting, insulation, filter systems
4. Other applications, for example, brushes, ropes, twines, tires, fishing lines (Grayson, 1984)

Some fibres lend themselves more readily to a certain application more than others. One example of this is nylon fibres which are the predominant type of fibre used in carpets; this is due to

their excellent wear resistance, low cost, and their ability to be modified in terms of lustre and colour (Grayson, 1984). Specialist fibres are created with specific characteristics for a particular purpose, for example, Kevlar fibres have high strength and cutting resistance (DuPont, 1974). Some applications use multiple types of fibres due to the need for variation in the textile market. The best example of this is in the clothing industry where there is a constant need for new finishes and effects, such as new dyeing methods anti-static finishes. This leads to a huge variety of fibres that can be transferred from person to scene or person to person, which increases the evidential value of such evidence.

Natural and synthetic fibres display different characteristics, some typical to a fibre's type or manufacturer. Synthetic fibres tend to be long chain polymers that initially start in a molten, concentrated form that is forced through small holes, called spinnerets. The filament produced is immediately precipitated or cooled to form the final solid fibre (Hall, 1975). Due to this manufacturing process and different raw starting materials, synthetic fibres display particular optical and morphological properties that the trace evidence analyst can observe including birefringence (the difference between the two refractive indices of a sample), sign of elongation, dichroism, width, inclusions (such as delusterants and finishes), and transverse cross-sectional shape. Natural fibres do not show the same optical properties as synthetic fibres and the majority of observations that are made are morphological in nature, such as length of ultimates, presence of nodes, thickness of lumen, and twist direction (Valaskovic, 1991). For commercial purposes, the textile industry adds dyes and pigments into both natural and synthetic fibres covering the whole spectrum of colours. This huge variation in colour and fibre type combination is a valuable observation for the trace evidence analyst to make.

30.2.2 Hair Evidence

Hair evidence can be defined as 'any of the fine thread-like strands growing from the skin of humans, mammals, and some other animals'

(‘Hair’, Oxford Dictionary 2014). Technically, hair evidence can also be categorised as a fibre due to its properties and the fact that some textile fibres are of hair origin. Composed of the protein keratin, hairs are generally stable and do not suffer from biological or chemical degradation due to the di-sulphide bonds between the adjacent keratin chains. This allows forensic scientists to be able to use this type of evidence more readily in environments that have degraded other biological matter (Taupin, 2004).

Hairs can be subdivided into three key regions along the length of the hair, these are: the root, which contains a root bulb and may allow DNA profiling of any nuclear material present; the shaft, which is the main bulk of the hair and is primarily used for morphological observations; and the tip (aka shield in animal hair), which lies at the distal end and may provide information regarding cutting method used. In addition to this, hairs are composed of three main different cells: cuticle, cortical, and medulla. If a hair is envisaged as a pencil, the central lead of the pencil is the medulla, the wood surrounding the lead is the cortex, and the paint on the outside is the cuticle. Each area provides information about the hair and can contain distinguishing features. The cuticle is made up of overlapping scales that may show damage, or in the case of animal hairs, help identify species. The cortex consisting of spindle-shaped cells makes up the main component of the hair, contains pigment granules, and may also include small irregular-shaped air spaces called cortical fusi and larger solid oval structures called ovoid bodies. Observations of the cortex may include pigment density and distribution; and aggregate shape and size of pigment. The medulla is a central core of shrunken cells with the spaces between the cells filled with air and whose structure may be observed in terms of distribution and whether pigment is present.

Hairs from across the human body will differ in macroscopic and microscopic characteristics mainly due to their purpose, but also due to environmental factors, styling and modifications; head hairs typically show the most variation due to this. This classification of hairs is somewhat similar in animal hairs, which can be classified as vibrissae

(whiskers), under-hairs (fine hairs used as insulation), guard hairs (coarse hairs making up the bulk of the pelage), and over-hairs (longer hairs sparsely but evenly distributed across the pelage). Observations of hair evidence include macroscopic and microscopic morphological characteristics, the identification and quantifications of compounds present within and on the hair, and DNA analysis (both mtDNA and nuclear DNA). This chapter does not discuss the DNA analysis of hair evidence, but it is worth noting that hairs can sometimes provide this individualising information if cellular material is present on the root bulb.

30.2.3 Soil Evidence

There are many different opinions as to what defines soil but generally it can be said that it is a mix of organic and inorganic components, including mineral particulates and vegetable matter, found above the bedrock in a particular geographical location (Petraco et al., 2008). The inorganic materials are mostly produced from the weathering of bedrock. Soil can be thought of three-dimensionally with a composition that will change both vertically and horizontally. Vertically, soil may be arranged by mineral and/or organic components which make up the surface soil, subsoil, and deeper layers. Horizontally, soil differs due to variations in vegetation, climate, relief, and parent materials (Gerrard, 2000). Soils can be classified by their physical, chemical, or biological characteristics. A common classification is by soil texture, these categories are in terms of particle size distribution and include clay, loam, sand, silt, and variations of such, for example, clay loam, silty clay, and silty loam (Rowell, 1994). Further classifications may be as ‘soil orders’ as seen in the U.S. Department of Agriculture’s dichotomous Soil Taxonomy system (Lindbo, 2015). This complex mixture of substrates lends itself to a broad range of observations including: colour (Antoci & Petraco, 1993); pH; particle size, shape, and density gradient (Petraco & Kubic, 2000); pollen profiles; organic-matter percentage; trace-elemental composition; and the presence of other particulates (Petraco et al., 2008).

30.2.4 Dust and Mixed Particulate Evidence

Dust is a mixture of fine environmental residue that may comprise of any material in the form of tiny particles. This modified definition from the Oxford English Dictionary (2014) exemplifies the broad nature of dust and its potential contents, which could be anything. The contents of a dust sample will differ depending upon geographical region and if found on a suspect, the movements and behaviour of the individual. With that in mind, dust may contain fibres, pollen, minerals, metals, soil, paint, glass, hairs, and any other combination of trace evidence. The type and proportions of these samples will differ whether they are of indoor or outdoor origin (Palenik, 2000). The diverse nature of the contents of dust means that the observations will be dependent upon the specific particulates present and will require a multiskilled trace evidence analyst to realise the full potential of the evidence.

30.2.5 Cosmetic-Type Evidence

Cosmetic-based evidence is a broad category of trace evidence which can include any substance used for aesthetic or decorative purposes. This category commonly includes foundation, lipstick, mascara, eye-shadow, nail varnish, and particulates such as glitter. Different cosmetics will have different compositions due to their use and manufacturer, but the nature of such products means that the majority of cosmetics contain pigments of some sorts. Lipsticks generally consist of a solid fatty base that may contain waxes, oils (such as castor oil), hydrocarbons, and other ingredients such as oleyl alcohol and polyethylene glycols. Colour is diverse in such samples and is imparted through dissolved dyes and suspended pigments (Andrasko, 1981). Major inorganic and organic constituents are observed rather than trace constituents as this is difficult with the amount of substrate seen in cosmetic smears (Keagy, 1983). Cosmetic foundation has

been found to be the more common cosmetic type encountered in forensic casework; it is easily detectable and demonstrates high discrimination between samples (Gordon & Coulson, 2004).

30.3 Recovery of Trace Evidence from Scenes, Victims, and Suspects

For any evidence, it is important to retrieve transient samples reliably and efficiently before they are lost. This is arguably more important to ensure with trace evidence because it is sometimes difficult to see with the naked eye. The acronym, GIFT (Get It First Time), is a principal anyone attempting to retrieve evidence should abide by and therefore should choose the most appropriate method for the recovery of trace evidence (Robertson & Roux, 2010).

Before describing the range of techniques available to investigators of missing person cases for the retrieval of trace evidence, it is important to define the two broad categories of samples. Commonly, trace evidence used in the analysis of a criminal investigation are defined as either questioned (aka target) or control samples. Using fibres evidence as an example, target fibres are the extraneous fibres that have been transferred during contact and are the evidential fibres that will provide information about the case. In contrast, control samples are retrieved from evidence which the investigator wishes to compare target samples to and are used to ascertain whether there is a link, e.g. fibres taken from the clothing of a missing person.

The retrieval of target samples requires a method that allows the efficient, fast, and reliable removal of all possible transferred trace evidence from a surface, which will be dependent upon surface type, surface area, whether the evidence is loosely or firmly adhered, and whether the exact location of evidence from the surface is required to be known. There is a range of methods available for the retrieval of questioned trace evidence, some particularly useful for certain trace evidence types and situations. Table 30.1 outlines some of the common retrieval method types.

Table 30.1 Retrieval methods for trace evidence (Copyright: Claire Gwinnett)

Retrieval method	Description of use	Evidence types	Advantages	Disadvantages
Tape lifting	Use of a tape, similar to sellotape. The tape is gently placed on the surface removing any surface fibres. Tape is then placed upon an acetate sheet to preserve the evidence and allow for searching. (Choudhry, 1988). Glass microscope slides are commonly used instead of acetate sheets for dust evidence (Millette & Few, 2001)	Good for all particulate trace evidence on any dry porous or non-porous surface, especially useful for smaller surface areas. One-to-one taping can be used to completely cover a victim's body in order to aid interpretation	Able to capture multiple types of trace evidence at a time and makes it possible to know the location from which the evidence has been retrieved	Trace evidence must be dissected from the tape to allow for further examination. This is time consuming and therefore increases cost of analysis. A new tape, called EasyLift has been introduced that removes the need for dissection. (Jackson & Gwinnett, 2013). Care should also be taken as to avoid tape damaging the sampling surface (Millette & Few, 2001)
Hand Picking	Use of clean tweezers or a needle to remove obvious trace evidence from surfaces, e.g. a tuft of fibres	Good for larger particulates, such as hairs, fibres, glass, and paint on all surfaces but usually only when trace evidence is found in prominent positions. Could be easily lost and/or when the exact location of the item of evidence is required to be known	Good for when trace evidence is embedded within a substance or object, e.g. tread of victim's shoes	Time consuming for large areas
Vacuuming	Use of vacuum filters which attach to either a full size or hand-held modified vacuum system which uses air sampling pumps, usually with a flow rate between 1 and 5 L/min (Millette & Few, 2001) to remove trace evidence	Very good for all trace evidence and small particulates greater than 5 µm (Millette & Few, 2001). Particularly useful for dust evidence from large surface areas, e.g. suspect's garments	Quick for retrieving large amounts of different trace evidence. Vacuum filters can be individually sealed	A non-targeted approach that collects lots of 'background' information in the form of debris and material deposited long ago or from the surface itself, which may not be useful to the case (Petrao, 1985). This can lead to a more time consuming search process. A simple differential trace evidence trap (DTET) device has been designed to preliminarily sort trace evidence upon vacuum collection (Petrao, 1987)
Shaking	The object is shook over a large collection funnel and any evidence collected in a Petri dish	Good for loosely bound larger trace evidence types that will fall off fabric type objects when shook, e.g. glass particulates from suspect garments	Very quick method for retrieving loose evidence	May miss evidence that is stuck in the weave of the fabric or is smeared on the surface, such as cosmetics. Does not allow the exact location of the evidence to be identified
Scraping	Use of a scalpel or razor blade to remove trace evidence strongly adhered to a surface	A smear of trace evidence on a surface, e.g. lipstick evidence on a suspect's garment. Also used for evidence that is embedded within a surface, for example, hairs embedded in paint	Gathers a large quantity of evidence from difficult surfaces	May damage surface during removal

(continued)

Table 30.1 (continued)

Retrieval method	Description of use	Evidence types	Advantages	Disadvantages
Combing	Use of a seeded comb (a comb in which cotton wool has been pressed into the base of the teeth which removes and retains extraneous trace evidence (McKenna & Sherwin, 1975))	Useful for obtaining all particulate evidence transferred to the victim and suspect's hair. This may include head and pubic region	Gently removes surface evidence without pulling out hairs from the person being sampled	Not as useful for residues present on hair, whole hairs should be sampled and residues extracted to obtain this type of evidence
Filtering	Technique involving the use of different solvents and other chemicals to remove debris and extract trace evidence from contaminated samples	Particularly useful for pollen when being extracted from soil. Also used for other evidence, such as hair which is heavily contaminated with soil and other debris, e.g. buried samples	Allows the 'clean-up' of heavily contaminated samples and allows relatively easily extracted of microscopic samples from large amounts of inorganic and organic matter	Some extraction chemicals are harmful and need robust risk assessments
Brushing	Use of synthetic bristle brushes (animal hair brushes retain evidence and make it difficult to remove) to gently remove surface evidence	For lightly attached particulate evidence such as dust evidence	Quick method for removing multiple trace evidence types from larger surface areas	Non-specific approach to gathering evidence, care needed not to lose evidence during brushing motion
Wiping	Use of a variety of materials including cloths (non-shedding), swabs and filter papers to sample surfaces. This may also include solvent impregnated gauze pads but generally dry wipes are preferred	Particularly used for particulate evidence such as dust	Depending on the substrate used, this is a quick technique for sampling surfaces	Not particularly useful for larger surface areas

Further sampling procedures are used for liquid-based evidence or residues, including swabbing and pipetting. For example, in cases where water samples must be taken in order to identify if a missing person had been in contact with a particular waterway, surface samples would be retrieved in small sampling pots for analysis. In some instances, particularly pollen, grass stains on fabric may be cut from the textile object in order to start the pollen extraction process; the order of the analysis of such samples should be well thought out so as not to compromise any other evidence (Sandiford, 2012).

In some instances, it may be preferable for the investigator to use multiple techniques to ensure

all trace evidence has been retrieved; for example, tweezers may be initially used to remove obvious, larger trace evidence from the surface of a suspect's garment, followed by tape lifting of the whole garment and then scraping to remove any particularly adhered stains.

Control sample retrieval is somewhat different to collecting target samples. Control samples should be uncontaminated and representative of the object, person, or animal that they originate from. In order to achieve this, generous samples are obtained from locations that are deemed less likely to be contaminated. Table 30.2 provides a general overview of where and how control samples can be retrieved for key types of trace evidence.

Table 30.2 Control sample retrieval for types of trace evidence (Copyright: Claire Gwinnett)

Evidence type	Retrieval details
Textile fibres	At least 20–30 fibres to be retrieved, usually with tweezers, from uncontaminated areas of garments or textile items; this is usually an inner seam. In addition to this, a further control should be taken from an area that has been exposed to external conditions such as sunlight; this ensures that any changes to the textile fibres due to this exposure will be represented in the control sample. All fibre types, colours, and other morphological characteristics should be represented in the controls
Hair	Multiple hairs should be taken from each required body region; the greater the variation in length and colour, the more control hairs that should be taken. For head hair, different areas of the head should be sampled. These samples should either be gently combed from the region or cut close to the skin so as to ensure the full length of the hair is obtained. If hairs are to be taken for examination of external residues, ideally 5–10 cm in length is required (Andrasko & Stocklassa, 1990)
Soil	Samples should be both taken horizontally and vertically at each exact location of believed to be the origin of the questioned sample (Munroe, 1995). The number of control samples will increase depending on the area being sampled—enough should be gathered so as demonstrate any local variation. There are also standard sampling points on vehicles that should be focussed upon for soil, these include wheel wells and tires, external and internal areas of the front bumper and grill
Glass	In instances where controls are needed from a broken window or door, glass fragments should be retrieved from the frame with tweezers and its exact location, including which side is inside and outside facing, noted. Samples can also be retrieved from the surrounding area and any other possible sources of broken glass, e.g. drinking vessels. At least six fragments should be retrieved from each site and if physical fit (piecing an item back together like a jigsaw) is to be attempted, then all potential glass from that object should be retrieved
Paint	Control paint samples from surfaces such as window frames or vehicles should be gently cut/scraped away from the surface using a scalpel or tweezers (if loosely adhered). The full thickness of the paint, including all layers, is required. In some instances, a sample of the surface is also necessary
Liquid and semi-solid based samples, such as cosmetic foundation, nail varnish and waxes	If possible, the whole container, e.g. bottle of nail varnish/cosmetic, should be retrieved. If this is not possible, a generous sample should be obtained, using a spatula, into an airtight plastic tub

30.3.1 Packaging of Trace Evidence

The potential for contamination of trace evidence samples is considerable, especially as many of these samples cannot be seen with the naked eye. Using disposable retrieval equipment or thorough cleaning of such equipment between different samples will reduce the potential for contamination but suitable packaging must also be utilised in order to maintain the integrity of the sample, not only from contamination but also tampering. Any dust present on or in packaging will cause issues as such contamination can contain all types of trace evidence. If dust has been sampled as evidence, this possible contamination causes even greater concerns. All trace evidence should be ultimately packaged in tamper-evident bags, but due to the small nature of these samples and the static that can occur in plastic evidence bags, they need prior packaging in either paper wraps (particularly useful for loose hairs and fibres), plastic tubs (e.g. for glass and soil), or clean envelopes. Tape lifts should be sealed (to prevent contamination on the edges) by placing additional clean tape over each of the edges of the evidential tape. Packaging must be chosen so as to also prevent any changes, degradation or damage to the sample; for example, glass samples should be protected so as not rub against each other and causes scratched upon the surfaces as these could be mistaken as characteristic to the sample. In order to protect samples from the same area, they may need to be packaged separately either in paper wraps or plastic tubs. Although trace evidence is normally highly stable and resistant to the majority of degradation, it is good practice to store samples out of direct sunlight in a cool, dry place. Samples suspected of containing pollen are generally kept in a refrigerator to control moisture content and temperature (Sandiford, 2012).

30.4 Analysis Methods of Trace Evidence

The analysis of trace evidence is varied and techniques available for a trace evidence analyst are vast due to the diverse nature of the evidence the

investigator may analyse. This chapter does not aim to provide an in-depth description of all of the techniques used in trace evidence analysis but to appreciate the vast range of techniques available, describe why multiple methods are used and outline their evidential value in casework, and provide an overview of the different analysis stages using relevant examples. There is a stage of analysis that is fundamental to trace evidence examination, is iconic in the world of forensic analysis, and undoubtedly an essential tool for the trace evidence analyst. That stage of analysis is microscopy and, due to its importance, it will be covered in greater detail. The range of microscopy techniques used in casework is described in Sect. 30.4.4.

Currently, forensic examination of trace evidence is predominantly a comparative analysis; a sample of unknown origin is examined to determine whether it is similar to a sample from a known source. Alternatively, a trace evidence analyst may be requested to identify the source or possible end use of the sample that has been collected as evidence. For example, in the Atlanta Child Murders, it was helpful to establish which manufacturer produced a green trilobal carpet fibre found on many of the bodies (Deadman, 1984). This was important in this case, due to the lack of suspects and the need to use trace evidence for the generation of leads, which may be gained by identifying where certain carpets have been distributed and sold. In order to possibly ascertain the source of the trace evidence, as much information as possible is required about the sample, including morphological and optical features; composition; and details of any colourants and additives present. Where trace evidence is required for intelligence purposes, certain characteristics may be more beneficial than others to quickly screen for and then pass these details onto investigative officers; for example, fibres can be quickly screened for colour and this information used in conjunction with CCTV footage to identify potential individuals involved in a missing person case.

In order to enhance the evidential value of trace evidence, multiple techniques should be used where possible. An analyst should think of gathering 'layers of information' about each form of trace evidence, each adding value and

allowing further discrimination. To achieve this, there is a general logical approach that analysts can take for all different trace evidence that involves three main stages, albeit different techniques may be used at each stage depending upon the evidence type. These three main stages are:

1. Initial characterisation for screening purposes
2. Semi-detailed characterisation
3. Detailed characterisation using instrumental/further analytical techniques

30.4.1 Initial Characterisation for Screening Purposes

The initial stages of analysis are primarily used to screen for evidential samples, to observe the overall morphological characteristics of trace evidence, and to gain initial intelligence information. This stage should allow the quick morphological analysis of bulk samples and generally should involve very little sample pretreatment. If tape-lifts have been taken from a suspect, this stage may involve the use of low powered microscopy to search each tape for relevant trace evidence. For fibres analysis, this would be searching for evidential samples based upon colour, morphology, and sometimes fluorescence of fibres (Coyle et al., 2004). For glass evidence, this may include searches based upon colour, size, and shape of fragments. For hair evidence, this would include screening for length, colour, and shaft profile (whether the hair is curly/straight). In loose, mixed particulate trace evidence (such as soil) the initial observations may involve sieving using different sized meshes to identify particle size, observations of colour using Munsell (R) colour values (Munsell Colour Company, 1954), identifying the level of vegetable/plant debris, and the presence of any other artefacts such as glass, rust, or coal/cinders (Petraço et al., 2008). Information at this stage may help to indicate whether a suspect has come in contact with a missing person. If information about the clothing the person was wearing when he/she went missing is known, these sources of fibres can be searched for in the suspect samples. Additionally, hair potentially from a missing person may be searched for. If a

large amount of samples have been retrieved, for example, from multiple suspects or from several locations, this screening stage may be time consuming. This is currently one of the biggest issues surrounding trace evidence analysis. Attempts have been made to reduce this screening time by the generation of automated fibre finders (Sermier et al., 2005; Wiggins, Turner, & Miles, 1999) but these are no longer in use due to mechanical issues and high false positive rates. Trace evidence analysts across the world have stated the need for an improved replacement of such a system (Nehse, 2014).

30.4.2 Semi-Detailed Characterisation

After identifying potential evidential samples during the screening stage, identification, semi-detailed characterisation, and semi-quantification of certain features should be carried out. This further discrimination generally involves microscopy techniques, which are further discussed in Sect. 30.4.4. At this stage, optical properties would be observed such as refractive index in glass samples (SWGMAT, 2004). In soil analysis, this stage may involve observing the colour of soil samples that have been air-dried or pretreated (such as moistened soil, soil treated with hydrogen peroxide to decompose organic constituents and soil ignited to 850° in a furnace) (Marumo & Sugita, 1996).

30.4.3 Detailed Characterisation Using Instrumental/Further Analytical Techniques

The detailed characterisation stage also known as ‘instrumental stage’ enables the trace evidence analyst to accurately determine composition (including trace elemental composition) and to quantify colour in some manner. In order to do this, there is a wealth of techniques available to the analyst, including spectroscopy and chromatography techniques such as Infrared (IR) and Raman spectroscopy; Thin Layer Chromatography (TLC); Gas Chromatography

(GC); Gas Chromatography-Mass Spectrometry (GC-MS); and Pyrolysis-Gas Chromatography (Pyr-GC). IR has been shown to successfully identify polymer type in fibres and glitter (Grieve, 1987). High Performance Liquid Chromatography (HPLC) is commonly used for the analysis of dyes in textile fibres (Speers, Little, & Roy, 1994), lipstick (Andrasko, 1981), and residues from shampoos and balsams on hair (Andrasko & Stocklassa, 1990). Pyrolysis-Gas Chromatography has been used in the analysis of wood (Challinor, 1995). Microspectrophotometry (MSP) is a popular technique to quantify the colour of a sample and is commonly used in paint (Stoecklein & Fujiwara, 1999), dyed hairs (Barrett, Siegel, & Goodpaster, 2010), and fibres analysis (Morgan et al., 2010). X-ray techniques are also used for trace elemental composition analysis (Keagy, 1983; Shun Kai Bong et al., 2012).

The use of spectroscopic and further techniques is particularly useful when trace evidence is notable to be identified or discriminated using only microscopic techniques. For example, poly(trimethylene) terephthalate (PTT) is a type of polyester fibre that is now being mass produced and applied to a number of textiles, especially carpeting. Its optical characteristics are similar to the traditional PET, but unlike PET, it is spectroscopically distinct to other types of polyester allowing ease of identification (Chablis, 2001). For certain forms of evidence, analysis schemes have been suggested by investigators in order to maximise the evidential value of the evidence and to take into account any destructive tests or tests that require greater sample sizes. For an example of a glitter evidence analysis scheme see Gross, Igowsky, and Pangerl (2010).

30.4.4 The Importance of Microscopy in Trace Evidence Analysis

Microscopy within forensic science has almost limitless applications. This is due to the microscope's ability to detect, resolve, and image very small items of evidence. This ability is very important when analysing trace evidence (Palenik, 2004).

It has been noted on numerous occasions that microscopy is the essential core for trace evidence identification and comparisons. Microscopy is dominant in this field primarily because it:

1. Is non-destructive (ENFSI, 2001)
2. Allows easy visualisation of trace samples due to small size
3. Is a relatively quick means of sample analysis (important for timeliness of analysis, sample screening, case throughput and if repeat measurements are needed) (Faber, Sjerps, Leijenhorst, & Malijaars, 1999)
4. Is inexpensive after the initial outlay (very few consumables)
5. Has the ability to identify multiple morphological and optical characteristics
6. Has the ability to distinguish between trace samples of the same type but from different sources, for example, different manufacturers.

The popularity of microscopy techniques in fibre analysis was highlighted in Wiggins' review of fibre examination (2001) and this popularity is also seen in other trace evidence analyses due to the reasons stated previously.

There are a number of types of microscope that are available to help characterise and compare suspect trace evidence samples more thoroughly. Table 30.3 outlines the key features of microscopes commonly used by trace evidence analysts.

30.5 The Significance of Trace Evidence in Missing Persons Cases

With the advent of DNA analysis in criminal casework, the popularity of retrieving and analysing trace evidence decreased. This was mainly because trace evidence has not been regarded as highly as fingerprint and DNA evidence due to its limited ability to individualise. Yet, trace evidence makes an effective partner to DNA and fingerprints in its ability to provide answers to other questions. Where DNA evidence can state

Table 30.3 Overview of microscopy techniques available for trace evidence analysis (Copyright: Claire Gwinnett)

Microscope type	Uses	Comments
Polarised light microscope (PLM)	Multipurpose; can analyse organic, inorganic, biological, crystalline, and noncrystalline unknowns (McCrone, 1994). Can provide initial identifications of certain trace evidence types, e.g. fibres	Debatably one of the most useful forms of microscope for the trace evidence analyst as it allows for additional observations under plane-polarised light of orientated samples such as fibres and minerals (Wiggins & Drummond, 2007)
Stereomicroscope	Primarily used to search, recover, and manipulate individual trace samples from tapings and vacuum filters. It is not suitable for accurate identification of sample types (Palenik, 2004)	Usually low power, for example, a typical range of magnification is between $\times 0.5$ and $\times 10$. Stereomicroscopes should be equipped for observation with both transmitted and reflected light (Palenik, 2004)
Comparison microscope	Provides a side-by-side microscopic comparison between two samples in a single field of view	A discriminating method for determining if two or more samples are consistent with originating from the same source
Fluorescence microscope	Used to search for and observe fluorescence in samples, for example, fluorescence originating from some dyes, optical brighteners, contaminants, e.g. from washing powders	The microscope is set up in incident light with a selection of filters that cover the excitation range of ultraviolet through violet, blue, and green (Janes, McCann, & Robinson, 1999)
Hot-stage microscope	Melting point determination of fibres and Refractive Index (R.I.) determination of glass (Ojena & De Forest, 1972). An automated system entitled Glass Refractive Index Measurement (GRIM) is available, which removes subjectivity of analysis; this is currently in its third version (GRIM 3)	Technically, a hot-stage is an accessory that fits upon the stage of a polarising light microscope (with Phase Contrast capability if being used for glass analysis). The hot stage should reach to above 300 °C and should allow the user to increase the temperature by 4 °C min ⁻¹ or less
Scanning electron microscope (SEM)	As an imaging tool, it provides high resolution, three-dimensional images at very high magnifications. SEM can also yield additional physical and analytical information. Examples of use include the observation of cross-sectional shapes of textile fibres and scale patterns of hair	SEM utilises high-energy electrons to scan the surface of the fibre. Images of surface topography are either derived from backscattered electrons or secondary electrons
Interference microscopy	To determine the refractive indices of fibres and combined with a Standort diagram can determine sign of elongation (used to help identify certain fibre types). Also used to quantify curvature in fragments of glass	This utilises an interferometer to split polarised light. For fibre analysis, an interferogram is produced of the recombined light beams to enable the refractive indices of the fibre to be determined. By plotting the refractive indices on a Standort diagram, the sign of elongation can be determined (Heuse & Adolf, 1982)

‘who?’, trace evidence can provide the ‘what?’, ‘where?’, ‘when?’, and ‘how?’ (Houck, 2001). Some of the misconceptions surrounding trace evidence are now being challenged, such as its lack of use for identifying a suspect and the ‘commonality’ of certain evidence types. Palmer (2014) has stated that trace evidence provides greater probative information than DNA and fingerprints and also trace evidence, such as fibres, may be more discriminating than originally thought. In addition to this, in cases where DNA and fingerprint evidence are not present, trace

evidence is paramount, for example, in the Wayne Williams trial (Deadman, 1984). The conviction of Wayne Williams, a serial killer responsible for the Atlanta Child Murders in the USA, was primarily based upon fibres evidence retrieved from 12 bodies that could be linked to Williams’ everyday environment.

The relevance of trace evidence in casework is demonstrated in missing person investigations such as the murders of Sarah Payne, Milly Dowler, and Soham schoolgirls, Holly Wells and Jessica Chapman in the UK. These cases showed

the potential of trace evidence in providing links to suspects and reconstructing events. In the case of the murder of Sarah Payne, an 8-year-old child who was abducted near to her grandparents' home, a combination of fibres, including a particularly rare dyed cotton fibre, helped enable the conviction of Roy Whiting, her abductor and murderer, when DNA and fingerprint evidence were limited. In the case of the murders of Holly Wells and Jessica Chapman, who were missing for 13 days prior to their bodies being discovered, soil, pollen, and fibres evidence were key in the conviction of Ian Huntley. Soil and pollen evidence helped link the Huntley's car to the ditch and surrounding area where the bodies were disposed and fibres evidence was used to link the victims' football t-shirts, that they were wearing when they were abducted, to Huntley's clothing and textile items from his home.

Sections 30.5.1–30.5.5 outline some of the specific information that different trace evidence may provide, beyond the recognised use as associative evidence.

30.5.1 Textile Fibres Evidence

Fibres are a very useful type of trace evidence as they are abundant in indoor and outdoor scenes, and they can be readily transferred from surface to surface. Therefore, it is common to find a large amount of fibre evidence at a crime scene. Because of this, it can be very useful in providing: intelligence information about who was present at an abduction or murder scene, associative evidence, and crime scene reconstruction information (Roux & Robertson, 2004). One of the benefits of fibres evidence is that large bodies of research have been carried out in terms of its transfer and persistence in different scenarios. Although these studies are not exhaustive, they do provide information regarding timeframes for fibre evidence deposition enabling an investigator of a missing person case to estimate when a suspect may have been in contact with an individual who has gone missing or when the missing person was last present at a scene. Further discussion of the transfer and persistence of

trace evidence, such as fibres, can be found in Sect. 30.6.1.

Analysis of fibres to aid reconstruction of crime scenes and events has been developed further by the use of fibre mapping; a one-to-one tape lifting approach developed in Germany where each area of tape defines a particular area of interest. This approach allows the exact locations of fibres on a surface to be determined and helps to understand what has happened in a case (Coyle et al., 2004). Documenting the numbers and distribution of fibres on a victim's body may allow details such as how and where a person was moved after death (dragged by arms or legs/supine or prone) and where the perpetrator came in contact with the victim. Fibre mapping in a case documented by Coyle et al. (2004) enabled investigators to state that the perpetrator had sat astride the victim and applied pressure to the right arm and shoulder. Although very valuable, this approach is very time consuming due to the large numbers of tapes generated; this has led to many laboratories not attempting this method.

Case Study 30.1

The majority of fibres found at scenes, and upon suspects and victims, are from apparel and household textiles, but that does not mean that other sources have not demonstrated their value in missing person cases. Wig fibres, which are generally uncommon at crime scenes, were found to be very significant in the investigation of a missing person case in the USA in 1992. A college graduate was reported missing in October 1992 after failing to attend work. Investigation of her house and a nearby wooded area led to the discovery of a bloody pillow and pillowcase, small bloodstains on her mattress, and her mattress pad and fitted sheet were missing. With the uncovering of this suspicious evidence, intelligence information identified a possible suspect; a gardener employed by the missing woman's

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mother and who was known to the police. Analysis of the pillow and pillowcase identified the blood as the missing persons and led to the recovery of a few head hairs. In order to identify the hairs' origin, controls were retrieved from three of the missing woman's hairbrushes that were in her bedroom and the glove compartment of her car. When analysing these controls, a single synthetic wig fibre was found that came from one of the hairbrushes in her bedroom. There was no evidence that the missing woman owned or had owned a wig. Additional searches of the suspect's local storage facility uncovered 24 wigs and wiglets, all of which were taken as control samples and compared to the wig fibre found at the scene. This wig fibre was identified as a modacrylic fibre and displayed the same optical properties and dye composition as one of the wigs seized from the suspect. In addition to this wig hair, one head hair fragment (found on a sheet in the suspect's truck) was linked to the missing woman and one head hair (from the suspect) was deemed consistent with a hair retrieved from the victim's bedroom. This two-way transfer of head hairs and the unusual source of fibre evidence led to the suspect directing investigators to the location of the missing woman's body (Houck, 2001).

30.5.2 Hair Evidence

Hairs have some key attractive features for the investigation of missing person cases. Firstly, they do not degrade easily meaning that evidence is still viable even when a case may have turned cold. Secondly, hairs shed readily from the human body once they have reached the telogen growth stage (when the hair has ceased growing and is naturally shed from the body) and thus are abundant at scenes. Thirdly, they provide information about the source including body location, species (if not human), whether they have been forcibly removed (hairs forcibly removed still

have cellular material attached to the root bulb), and ethnic origin of the person (Vernall, 1964). It has also been shown that hairs from children can tentatively be differentiated from adult hair (Trotter & Duggins, 1948, 1950) and the gender of a person may be quickly identified from hair using fluorescence in situ hybridisation (Prahlow, Lantz, Cox-Jones, Rao, & Pettenati, 1996). Missing person investigators may be asked to identify if any hairs found on objects, such as garments that have been disposed of, could have come from the missing individual. Additionally, it is common to identify hairs retrieved from the body of a victim to ascertain who and when the victim has come in contact with. Finally, hairs may reconstruct events; in the same manner as fibres evidence. Knowledge of how hairs transfer and persist, for example, on the clothes of a missing person, can indicate how long ago a potential suspect came in contact with that individual. The location of hairs found on a victim's body may be useful in reconstructing events; for example, the presence of pubic hairs found on the pubic region of a missing person can indicate intimate contact that is difficult to refute (Lamb & Tucker, 1994).

Although hair evidence is dominated by morphological methods, it has the capacity to provide excellent intelligence information. A person's hair is a product of his/her lifestyle and as such provides information about its upkeep, styling methods, hair products used, and also any intake of legal/illegal substances. This information is very useful when trying to identify potential suspects or to confirm that the hair has come from the missing person in question. Further attempts to distinguish hairs by the modifications made to the hair have been investigated, such as bleaching and dyeing (Roe, 1980). Other external changes to the hair may provide valuable intelligence information, for example, hair that has been exposed to heat will display particular features, such as bubbling depending upon the temperature and how the heat is applied, e.g. open flame or hot surface such as heated styling tools (Pangerl & Igowsky, 2007). Hair that may be from a buried missing person or decomposing individual will also show some distinct changes, such as fungal tunnelling and decomposition bands (Tafaro, 2000), respectively.

It has been widely stated that the interpretation of hair comparisons that does not involve DNA analysis is highly subjective (Lamb & Tucker, 1994). This is partly the reason for the reduction in the use of this form of evidence over the years and hair analysis has been seen as a ‘dying art’ (Taupin, 2004). The value of hair has been questioned repeatedly over the years but trace evidence analysts are constantly seeking to make hair analysis more objective and to test its discriminating ability. These advancements have been seen in work conducted in: transfer and persistence, DNA and mtDNA analysis of hairs, the use of numerical features in hair (Robertson, Brooks, Boehme, Robertson, & McNevin, 2007), and isotope analysis. The latter has great potential in tracking the movements of individuals by observing isotope ratios of strontium (Sr) and lead (Pb) in hair samples which have showed to alter when environments have been changed (Vantour, Poirier, & Widory, 2015). This approach is still in its infancy and requires further work to understand how external factors (e.g. dust) impact results. Work by Jackson, An, Konstantynova, and Rashaid (2015) into compound-specific isotope analysis of hair has demonstrated that this approach may go beyond identifying geographical locations of individuals and also providing information regarding an individual’s Body Mass Index (BMI) and age. This work, along with other physical characteristics and attributes that can be ascertained from hair, provides a powerful profile for investigators to use. The use of stable isotope analysis of hair was used by the National Forensic Service in South Korea in the investigation of the final movements of Yoo Byung Eun, the owner of the Sewol ferry that sank in April 2014 (Min, Kim, Heo, & Jang, 2014).

30.5.3 Soil Evidence

Soil has been used for over a hundred years in criminal investigations and due to its complex composition of organic matter, minerals, microorganisms, can vary dramatically. Soil evidence has wrongly been thought of as an unimportant form of associative evidence. Yet it has

proved evidentially useful in a large number of cases including the reconstruction of events in missing persons investigations. It is particularly useful when asking the question, ‘what is the most likely place of origin of this soil material’, where the possible sources expand over a large area (Lark & Rawlins, 2008). In some cases, the vehicles of missing persons are later recovered with soil found on items inside which has led to the remains of the individuals being found. This was seen in an Australian missing persons case in 2000 (Lark & Rawlins, 2008). Soil can differ significantly between locations that are very close together, for example, it has been noted that soil colour can be very different just 30 cm apart (Petraco et al., 2008). This variation makes it possible for investigators to find specific locations where missing persons or original burial sites may have been.

Case Study 30.2

Petraco et al. (2008) describe the use of soil in a case of a missing female officer, in which her body was later found in the East River near midtown Manhattan with evidence that she had been shot with a handgun. The victim’s estranged husband became a primary suspect and during search of his house, a water-stained shoe was found that had sand adhered to the heel. These questioned grains, although not in enough abundance to allow for sieving, were still analysed using microscopy, chemically tested for sodium and chloride ions and X-ray diffraction analysis (XRD). The questioned sample was compared using the same techniques to residues obtained from the river water after it was allowed to evaporate; three samples were shown to have the same trace elemental composition and led the investigators to believe that the suspect had taken the victim down to the local beach and shot her with her own weapon. To verify this, control sand samples were also taken from the local beach and compared to the questioned sample and were found to be

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consistent in composition in terms of colour; minerals present and their percentage content, ions present, and morphology. In order to show that this composition was specific to this location, further control samples were retrieved from various locations along the East River and were found to be dissimilar. This characterisation of particular locations, although time consuming, is very useful in determining where the victim was killed and in helping investigators to focus on particular areas for further scene processing to identify the presence of any other evidence. This is especially important when large areas need to be covered.

In some cases, the outcomes are not as clear due to the dynamic nature of events that can happen in a crime. In cases where a victim's body has been dragged or they have crawled, these aggregate soil samples retrieved from the victim's clothes that can then transfer to a suspect, may show differences to the control samples. This was seen in a case reported by Petraco et al. (2008) where differences in colour and vegetation content were seen in the questioned sample from a victim who had been dragged over several hundred feet.

Soil evidence has the added benefit of having substantial databases and soil data to help provide intelligence information to investigators of missing person cases. Many of these databases have been generated by non-forensic scientists for other purposes, such as soil quality assessment but can be invaluable to a forensic scientist when trying to narrow down a search or exclude certain areas from the investigation (Lark & Rawlins, 2008). Specific soil databases for forensic purposes have also been generated, for example, the data collection of 1896 soil samples collected from forensic investigations across England and Wales (Pye & Blott, 2009). These types of database tend to be much smaller in scope than soil databases created for non-forensic purposes.

30.5.4 Dust Evidence

Discussed at length by Locard (1930), dust evidence, although rarely used, might actually be the most powerful of all evidence as it has the potential to contain a mixture of all the other trace evidence, with all the information they can potentially generate. As a mixture, dust found on an individual provides a historical profile of their lifestyle, locations visited, occupation, and activities. A sample of dust from an environment may be incredibly complex. For example, dust was analysed from the aftermath of the 9/11 World Trade Centre terrorist incident and it was shown to be composed of a myriad of materials from the buildings and their contents, including fibre glass, foam, plastics, mica flakes, and metal fragments (Petraco, Kubic, & Faber, 2007). A dust sample will differ depending upon whether it is from an indoor or outdoor scene. Indoor scenes typically contain fibres; if this is a dwelling, then the sources of these will be from garments, curtains, and other upholsteries, but in an office building, the main source of fibres may be paper. Indoor dust will also represent the people and animals that visit/live there; for example, human and animal hairs. Palenik (2000) also states that dust will differ from room to room depending upon use, for example, kitchens will contain food particles, whereas bathrooms will contain cosmetics, pubic hair, and skin cells. Outdoor dust will contain plant material, pollen, soil, and animal products and represent the industries and uses of that area. This composition might change over time and season to season but provides the investigator multiple characteristics to identify the provenance of a dust sample.

Case Study 30.3

Palenik (2011) has described the use of such evidence in the Maryland Rapist case in which dust provided detailed information about the suspect's occupation and environment. Two t-shirts were left behind by the assailant at two of the crime scenes

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and although DNA analysis identified that they were worn by the same person, no information to the identity of the perpetrator was gathered. Dust evidence was retrieved using vacuum filters and identified the occupation of the suspect as being a dry wall installer and finisher who worked on large-scale projects, most likely in a large scale company that had oak trees in its vicinity. This was deduced from the mineral (gypsum which is found in dry-walls), paint (spheres of paint, indicating the use of spray cans, which are mostly used on large scale projects rather than paint brushes), and pollen evidence found in the dust sample (Palenik, 2011). This information, once released by the media led to a member of the public identifying a suspicious vehicle in the neighbourhood, with the van markings indicating a dry wall installer and finisher company, to the police. This led to the apprehension of the perpetrator of these assaults.

30.5.5 More Unusual Trace Evidence: Glitter Evidence

Certain evidence types are only seen in a small number of cases due to either their rareness in the general population or their inability to transfer in normal situations. Their infrequent use in casework does not necessarily mean that this type of evidence was not present but that it was not identified as significant and therefore not retrieved by the investigator. This highlights the importance for scenes of crime officers and police officers to keep an open mind to the breadth of evidence types that can be usefully employed in a missing person investigation.

One such evidence type, that can be useful to determine links between missing persons with suspects and locations that the missing person may have been in contact with, is glitter. Glitter is frequently used in cosmetics, art and crafts paint, clothing, and hair and skin products (Grieve,

1987; Gross et al., 2010). During an abduction or assault, glitter can transfer from the victim to the suspect or to the environment in which the person is being held. These small particulates are usually metal-coated polymers machine cut into particular shapes (Gross et al., 2010) which can be easily scattered in an environment and subsequently transferred to an individual helping linking a missing person to a location.

A number of trace evidence analysts have researched glitter as evidence (Grieve, 1987; Gross et al., 2010) and its use in casework. Grieve (1987) was one of the earliest to identify its potential in linking a suspect to a rape victim and ascertained that glitter is produced in sufficient variety to be distinguished using a range of analytical techniques. Gross et al. (2010) investigated the characteristics that can be observed in glitter using transmitted and reflected light microscopy and how well these observations are able to differentiate between different glitter samples. Colour, shape, size, and layer structure can be observed, with colour and size normally showing the greatest variation. In Gross's analysis of 89 samples of glitter, 13 different colours and four different shapes (in order of most common to least; hexagon, square, rectangle, and diamond/rhombus) were observed. Glitter samples also varied in size from 99 μm to 1.1 mm and exhibited between 1 and 5 layers which differed between clear, silver, and/or colour. The combination of these characteristics meant that 80% of the 89 samples could be differentiated. In addition to this, when observing variability in 37 red glitter samples, 35 samples could be distinguished using physical observations, FTIR, SEM, MSP, and solubility testing with the final two samples being from the same manufacturer (Gross et al., 2010), demonstrating that this form of evidence could be highly evidentially valuable. This corresponds to Grieve's (1987) findings that allowed 11 of the 13 glitter samples analysed to be distinguished using morphological characteristics, infrared spectroscopy, and MSP. Grieve pointed out that some glitter manufacturers may have a common supplier of raw materials which may mean colourants and polymer types may be seen in multiple glitter samples.

One issue surrounding more unusual trace evidence is that it has not come under scrutiny as much as other evidence in court and has less peer-reviewed research surrounding its analysis and interpretation; therefore investigators will have less understanding of the mechanisms surrounding its transfer and persistence and its commonality in different populations than other trace evidence.

30.6 Interpretation of Trace Evidence in Missing Persons Cases

Interpretation of the analytical findings of trace evidence in missing person cases can be very difficult and can take on a number of forms. Once trace evidence has been analysed and compared to control samples, the question remains what does this information tell the trace analyst and how significant are the findings? (Roux & Robertson, 2004).

The interpretation and assessment of the significance of trace evidence depends on the questions needing to be answered and the factors influencing the significance of the evidence. Two broad questions that investigators of missing person cases would like to know are:

1. Does the trace evidence provide information regarding the whereabouts of the missing person?
2. Does the trace evidence indicate whether another person(s) are involved in this case?

3. If the missing person has been found, who person is (if not known already) and any information about that individual.
4. What crimes has the missing person been subjected to and when?

In order to attempt to answer these questions, other considerations need to be investigated. Figure 30.2 outlines some of the questions that may be asked by investigators in order to obtain intelligence information and understand the evidential value of trace evidence in a missing person case.

The questions stated in Fig. 30.2 are not easy to answer and require research studies to help answer them, these studies are invaluable to a trace evidence analyst and without them the true potential of trace evidence in providing intelligence information and corroborative evidence in a missing person case is lost. Research studies used to help interpret trace evidence in missing person cases can be categorised as follows:

- Population studies
- Target studies
- Transfer and persistence studies
- Reconstruction experiments
- Industrial enquiries
- Generation of trace evidence collections/databases

Examples of some of these studies will be provided in Sects. 30.6.1 and 30.6.2.

There are two key methods that can be used to assess the significance of trace evidence: Statistical

Questions to be Asked of Trace Evidence

1. How was the trace evidence transferred, e.g. primary, secondary etc?
2. What is the persistence of the questioned trace evidence?
3. Where does the trace evidence come from?
4. How rare/common are the control and target trace evidence?
5. Can the trace evidence be linked to the missing person or suspect(s)?
6. Could the trace evidence be from an innocent source?

Fig. 30.2 Questions that may be asked in a missing person investigation (Copyright: Claire Gwinnett)

probabilities based on fibre frequencies, expressed as statistical odds, or the Bayesian approach which considers the ratio of the likelihood of the results being caused by two different hypotheses. For example, a particular item of trace evidence being present if the suspect did or did not break a window and enter a building. The answers to the questions posed in Fig. 30.3 can be used to help more accurately calculate these probabilities.

The Bayesian approach is a powerful tool in the interpretation of trace evidence in casework but only valid if appropriate data is utilised. Using statistical probabilities to interpret trace evidence can be problematic. Although there are by far a greater number of transfer and persistence studies pertaining to trace evidence than DNA evidence, there are still a limited number of frequency studies and population data actually available for many trace evidence types.

There are many factors that affect the value of trace evidence; these can either be known or unknown. Some of the known factors, or factors which can be determined, include:

- The time elapsed between the crime and the collection of the evidence. For example, the greater the time elapsed, the weaker the evidence due to the potential loss or secondary transfer of the trace evidence to other objects or people
- The number of types of trace evidence found in combination, for example, the greater the number of types, the greater the significance
- The overall number of each matching trace evidence type, for example, the greater the number of fibres, the more likely they have not been found by chance; the greater the evidential value (Jackson & Cook, 1986). This is especially true if the fibres have been recovered from a surface that also has a low retention of fibres (Robertson & Grieve, 1999)
- Whether cross transfer of trace evidence has occurred or not, for example, between victim's clothing and suspect's clothing and vice versa (Roux & Robertson, 2004)
- The location of the trace evidence, for example, some locations are more prone to secondary transfer than others (Lowrie & Jackson, 1994)
- The methods used to analyse the trace evidence, for example, the more discriminating the techniques used, the more significant the comparisons can be between questioned evidence and control samples. The use of suitable and up-to-date equipment for fibre analysis to increase fibre evidence significance is discussed by Stoney and Aitken (1991)

The above list of known factors is not exhaustive; the factors involved in determining the significance of trace evidence are complex and can be different for each case.

Factors that may be unknown or difficult to determine also play an extremely important role in establishing or limiting the significance of trace evidence. Some of these factors include:

- The details of transfer, for example, the force of contact, the duration of contact, and the area of contact. These factors affect the amount and type of trace evidence to be transferred
- The degree of certainty that specific items or garments were actually in contact. For example, if there is an eyewitness to verify that a suspect was definitely wearing the garment being analysed
- The activity of an individual or the external factors that might affect persistence between the time of the transfer of evidence and the retrieval
- The frequency of occurrence of the trace evidence types in the population. For example, if a suspect paint sample, that has been found to match a source at a crime scene, is commonly found in the environment where it was retrieved, it can be deemed to be very low in significance. Whereas paint that is more rare due to morphological characteristics, specific end uses, and/or limited production, are high in evidential value

In order to fully appreciate why understanding these factors is important in missing person cases, imagine the following mock case.

A woman is reported missing on the 2nd of November, and police are seeking information regarding who had contact with her running up to

this date, locations she had visited, and time-frames of such activities. CCTV near the woman's home showed her leaving her house at 9.30 pm on the 1st of November wearing a red coat, yellow hat and scarf, and black trousers. Police suspect that this may be an abduction case, and intelligence information identifies a potential suspect, who lives in the same apartment building as the missing woman and who was seen with her on the afternoon of the 1st of November. The suspect is brought in for questioning on the 4th of November and his clothing (woollen jumper and jeans) and car taken for analysis. The suspect confirms that he did see the missing woman on the 1st of November but only in passing on the street. Upon analysis of the suspect's jumper, seven hairs that could not be distinguished from control samples taken from the missing woman's hair brush were found on the outer front torso. In addition to this, a large number of red fibres and a few yellow fibres were found on the outer surface of the suspect's jeans and jumper. At this point, investigators would want to know the following:

1. When were the hairs and fibres transferred? How could this number of hairs and fibres be transferred? How long would these hairs and fibres be retained on the suspect's clothes?

These questions are related to transfer and persistence and will help identify whether this evidence could have transferred in an innocent manner and if that occurred during the time that he stated he was with the woman, or has the transfer happened more recently, indicating potential involvement in the woman going missing. A common defense given by a suspect in such a case is that they had 'innocent' contact with the victim, such as a hug, or that they shared the same space, e.g., car. The mechanisms of transfer for these particular evidence types in these different situations would then need to be investigated so as to corroborate or refute such a statement. In addition to this, the suspect may also state that they transferred during their meeting on the 1st of November. Persistence information regarding whether this number of hairs and fibres would retain for that period of time on his particular garment types would have to be sought, ideally via reconstruction

experiments. In an investigation such as this, the suspect's dwelling and car would also be searched for the presence of these fibres and hairs so as to identify if there was any primary transfer from the woman's clothes to these locations or secondary transfer via the suspect. Please see Sect. 30.6.1 for further discussion of how such questions may be answered.

Could the hairs belong to someone else? Are the fibres from the missing woman's clothes? Are these fibres commonly found in the environment, i.e. could be explained away innocently?

These questions are related to prevalence of the characteristics seen in the evidence and the confidence that can be given to any associations that are made with them. If the characteristics seen in the hair are common, then evidential value is low, and confidence as to their association with the missing woman is also low. Yellow is a less common colour in fibre populations and therefore these fibres may hold high evidential value, as the likelihood they have come from the missing person's clothing and not elsewhere is higher than if the fibres were of a common colour, e.g. black. Knowledge of their prevalence on garments in the general population would be needed in order to provide evidence to this statement. Please see Sect. 30.6.2 for further discussion of the studies carried out to provide this type of information.

Some of these factors have been individually addressed in the following sections.

30.6.1 Transfer and Persistence of Trace Evidence

Transfer of trace evidence can be defined as the movement of evidence from one place to another, either by direct contact or via another mechanism. This transfer may occur before, during, or after the crime and will be dependent on a large range of factors, which may be known or unknown. Transfer may be primary, secondary, tertiary, or quaternary. Primary transfer is caused by direct contact with an object, whereas secondary transfer is indirect, in which an intermediary surface is involved; tertiary transfer involves two intermediary surfaces and so on.

The persistence of trace evidence can be defined as the length of time that an item of trace evidence is retained upon the surface in which it was transferred. The persistence is also affected by a number of factors.

In order for investigators to understand how likely a certain type of trace evidence is to transfer to a particular surface and the scenarios in which this transfer might occur, studies are carried out to either investigate the factors that affect transfer or to mimic real-life case scenarios. These studies can give general guidance to analysts regarding the number of trace evidence samples expected to be found under given situations; for example, generally natural fibres shed more readily than synthetic (Parybyk & Lokan, 1985). Factors that may affect transfer include type of evidence, particle size, time of contact, force of contact, number of contacts, and recipient surface composition. These factors must be considered when assessing the significance of the overall number of items of trace evidence found. Generally, certain statements may be made in terms of transfer of evidence, such as the greater the force and the number of contacts, the greater the transfer rate, but to be able to fully interpret trace evidence in this manner, an attempt to quantify should be made. An example of this is research conducted by Grieve, Dunlop, and Haddock (1989) that looked at the transfer and persistence of acrylic fibres under simulated real life conditions. This research was based upon a homicide case, utilising the actual garment involved in the incident. This reconstruction study allowed the transfer (including secondary transfer) and persistence of the fibres involved to be assessed under a series of conditions, including different contact types, time of contact, and the effect of washing. Knowledge of the persistence of different trace evidence provides the investigator of a missing person case time frames in which a suspect may have been in contact with the missing individual, or the time period since an individual has been in a particular location. As with transfer, many of the same factors affect persistence of trace evidence, including evidence type, particle size, and recipient surface composition, but in addition to these, external

factors will play a role in evidence persistence. Generally, the majority of evidence will be lost in the first few hours displaying an inverse exponential decay curve if number of items remaining (y axis) is plotted against time (x axis) but this is not always the case. For example, Dachs, McNaught, and Robertson (2003) found that a linear decay pattern is seen with human hair on wool items.

The majority of transfer and persistence studies conducted are for fibres, glass, and hair evidence. Fibre studies have investigated a range of different factors that may affect transfer and persistence, including the effect of pressure, type of recipient garment, number of repeated contact passes, and fibre length on the transference of wool fibres (Pounds & Smalldon, 1975), and the effect of laundering using two different types of washing machine upon the persistence and secondary transfer of acrylic, wool, and viscose fibres on cotton t-shirts (Szewcow, Robertson, & Roux, 2011). Glass studies include the analysis of secondary transfer of glass (using a hand as the intermediary object) and its subsequent persistence to a nylon jacket to help reconstruct a case scenario (Cooper, 2013). The transfer mechanisms of human hair to individuals during general day-to-day activities have also been investigated by Gaudette and Tessarolo (1987). The transfer of other trace evidence has also been investigated, albeit to a much lesser extent. This includes the transfer of diatoms to clothing (Scott, Morgan, Jones, & Cameron, 2014), pollen, powder, and metal particulates on different clothing materials (Bull, Morgan, Sagovsky, & Hughes, 2006) and the transfer of microscopic fragments of polyurethane foam from foam mattresses and vehicle seats onto cotton clothing (Wiggins, Emes, & Brackley, 2002).

30.6.2 Prevalence of Trace Evidence and Its Link to Evidential Value

Information about the frequency of trace evidence enables the rarity of given evidence types to be determined and can help answer the

question ‘what is the chance of finding a particular trace evidence type with certain characteristics in a given environment?’. This knowledge not only helps to identify the relevance of an item of evidence found in a missing person case but can also focus the investigation if this information is known early enough. In court, when interpreting trace evidence, it is preferable to give a statistical evaluation of the prevalence of a particular trace evidence type. A statistical evaluation can reduce the subjectivity of an expert’s opinion. For example, it has been thought that cotton fibres have little evidential value because they are very common in the environment and they have proved more difficult to discriminate from each other in the past (Grieve, Dunlop, & Haddock, 1988). But these ideas have more recently been found to be misleading as a recent study has shown that cotton has greater discrimination than originally thought (Palmer, 2014). This assessment of cotton fibres is a subjective opinion, although backed up by experience, it does not give a statistical probability of how common the fibre is, i.e. the probability of finding it at a particular crime scene.

In order to identify the frequency of different trace evidence types, population studies, target studies, databases, and industry enquiries are utilised.

Industrial enquiries may be used for two purposes: to seek sources of samples found at a scene in order to gather intelligence information or to obtain manufacturing data and statistics to gather population information. The first of these, might involve obtaining samples from manufacturers and their subsequent comparison to crime scene samples. The latter purpose includes using figures from manufacturers regarding production amounts and uses of given trace evidence types. Industry enquiries such as these have been conducted by Wiggins and Allard in 1987 in the use of fabrics in car seat covers. Enquiries made on unusual fibres evidence also occurred in the Wayne Williams trial (Deadman, 1984) as discussed in Sect. 30.5. Some industrial enquiries reveal evidence that is particularly rare and evidentially valuable.

Population studies may take on one of two approaches that are subtly different:

1. Observations of the occurrence/prevalence of evidence types and features in different environments/locations by taking samples from such areas and counting/observing the range of characteristics and evidence types, for example, observing upper garments worn in the general population for glass fragments. This method not only provides information about the rarity of a different evidence types but will also give information about the transferability and persistence of that evidence type on recipient surfaces (Roux & Robertson, 2004).
2. These surveys may observe ‘innocent’ surfaces in the general environment, i.e. environments or individuals that have not been suspected as being involved in a crime. Examples of these studies include the analysis of public-house seats (Kelly & Griffin, 1998) and outdoor surfaces for fibres (Grieve & Biermann, 1997), analysis of stationary objects, such as car park pillars and walls for paint smears (Jackson, Bunford, Roux, & Maynard, 2014), and head hair and headwear for glass (Jackson, Maynard, Cavanagh-Steer, Dusting, & Roux, 2013). The latter looked at two populations of people; the general population and individuals that worked with glass (glaziers). Alternatively, a population study may survey ‘suspicious’ surfaces or individuals, i.e. objects that have been seized from a crime scene, individuals that have been involved in a crime or potentially involved in a crime. Examples of these studies include analysis of the Refractive Index of glass recovered from the clothing submitted to forensic laboratories in connection with crimes involving the breaking of glass (Harrison, Lambert, & Zoro, 1985) and paint evidence on crowbars recovered during burglary cases (Buzzini et al., 2005).
3. Surveys of certain trace evidence characteristics in use in the general environment, for example, a survey of car topcoat colours. These studies normally involve the observation

of the everyday frequency of certain objects, whether that is choice of clothing in a certain country or choice of car colour. Examples of research carried out in this manner includes work by Biermann and Grieve (1998) into the frequency of fibre types displayed in a European (German) clothing catalogue and the counting of 16,074 car colours (topcoat car paint colours) in three regions of Canada by Buckle, Fung, and Ohashi (1987).

Target studies work differently to population studies as instead of quantifying all of the evidence that is found in a particular environment, an environment is searched for a particular evidence type. For example, Palmer and Chinherende (1996) sampled high contact areas such as cinema seats and car seats for fibres from two garments (red acrylic jumper and green cotton leggings) that were being sold in UK chain stores. A similar study was conducted by Aardahl, Kirkowski, and Blackledge (2005), observing the prevalence of four different commercially available glitter types in different environments around San Diego. This type of study does not ‘profile’ trace evidence populations but provides an idea of the probability of finding a particular evidence type from a known source.

30.7 Conclusion

Trace evidence, although commonly not viewed as highly as DNA and fingerprint evidence, has the ability to provide important information in missing person cases. The breadth of information that can be gathered from trace evidence is large and combined together has the potential for providing not only fast intelligence to police officers searching for individuals but strong associative evidence in the conviction of suspects. With the increase in technology, equipment sensitivity, and forensic science knowledge, comes the realisation of how much we still do not know in forensic science; this can be seen in DNA evidence, where its ability to identify an individual from only a few cells is increasingly being used, yet issues remain in using DNA evidence at the activity

level due to the still limited understanding of DNA transfer and persistence mechanisms. Combining this, with ever more ‘evidence-aware’ criminals, means that trace evidence is more important than ever.

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Mass Grave Investigation and Identifying Missing Persons: Challenges and Innovations in Archaeology and Anthropology in the Context of Mass Death Environments

Ian Hanson

31.1 Global Approaches

How many people in the world are missing? There are limited accurate figures and statistics that can provide an answer to this question. The most intensive attempts to count missing persons are related to those missing as result of armed conflict and human rights abuses that have often been legally investigated by tribunals, prosecutors, and NGOs, though verification of numbers is often not possible. People commonly go missing due to throughout the world as a result of ethnic conflict, war, migration, slavery and trafficking, disaster and organized crime.

In the last 30 years, developments in accounting for those missing have seen formal investigations and procedures emerge to determine who is missing, and attempt to locate and identify them (see chronologies in Rosenblatt, 2015). The nature of events leading to disappearance and the national and international responses (or lack of response) to events including conflicts over the last 100 years are well documented (see, for example, Charny, 2000).

There is unfortunately a consistent pattern of victims killed, buried, or otherwise disposed of

as a result of conflict, which unfortunately is anything but a new phenomenon (see Neolithic examples in Meyer, Lohr, Gronenborn, & Alt, 2015; Stadler et al., 2004). Scientific and criminal investigation disciplines have been increasingly applied in an attempt to best determine how to find the dead and gather evidence to aid in identification and criminal investigation. In many cases, the dead have been buried and are often found after many years or decades. There has been a successful use of archaeological and anthropological methods to enable the location, excavation, recovery, and examination of remains, and a considerable body of literature has been written on this subject (for examples, see Adams & Byrd, 2014; Blau & Ubelaker, 2015; Brickley & Ferllini, 2007; Cox, Flavel, Hanson, Laver, & Wessling, 2008; Dirkmaat, 2012; Ferllini, 2007; Groen, Márquez-Grant, & Janaway, 2015; Haglund & Sorg, 2002; Hunter, Simpson, & Sturdy Colls, 2013).

Forensic archaeology can be defined as the application of archaeological methods to legal matters. This often takes the form of landscape assessment to determine where remains are concealed, and controlled excavation to maximize the recognition and recovery of relevant evidence. Forensic anthropology can be defined as the application of physical anthropology methods to legal matters. This often takes the form of assessment and analysis of decomposed and skeletal remains to assist in determining cause

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and manner of death and the biological profile of remains. Archaeologists and anthropologists aid in the technical investigation of crime scenes where there are scattered surface remains and buried bodies. In many cases their work rules out scenes and remains as being of criminal and investigative interest. Both disciplines apply existing scientific techniques to assist investigations and are used to working as a part of interdisciplinary endeavors. They are used to assessing what range of specialist multidisciplinary expertise is required to fully investigate the archaeological landscape and skeletonized human remains. In the international setting their work often involves investigating mass graves, which are complex in terms of scale of evidence, number of bodies, and number of connected crime scenes. Analysis involves assessment of archaeological landscapes and assemblages of remains, rather than the investigation of single homicide crime scenes which is often the application in domestic investigations. Archaeologists and anthropologists have been drawn to forensic work for the most part from a varied background of professional academic, research, and commercial archaeological and osteological work. Specialist academic courses in applying these sciences to legal investigations have developed in many countries in the last 20 years. What is clear from a review of the literature and the investigations undertaken is that the approaches to dealing with the missing began in many cases with a focus on humanitarian response, with impetus from the Geneva conventions to document the burial location and identification of the deceased (ICRC, 2012). With the growth of war crimes tribunals, an evidential approach then developed and this is now increasingly focusing on the joint requirement to achieve identification and gather evidence for prosecutions. This has become recognized as a complex undertaking as the number of interventions has grown (see, for example, Bernardi & Fondebrider, 2007; Blau, 2008; Crossland, 2011; Ferllini, 2003; Hanson, 2015; Moon, 2013). This has also been mirrored in Disaster Victim Identification (DVI) response. Increasingly, international and humanitarian investigations to locate and identify the missing

have developed their technical approaches to crime scene and mass grave investigation to reflect best practice in domestic homicide investigations; thus there is a focus upon chain of custody, standards of evidence collection, standards of examinations, as well as standards of identification. This has been necessary as wider discussion about forensic science methods and standards has grown (see, for example, National Academy of Sciences, 2009), and there has been wider recognition that multidisciplinary approaches (to what are complex investigations) are required to meet objectives.

However, it is fair to say that, for many investigations and disciplines, there have not been agreed standards or approaches, and application of technical methods has varied greatly. This is certainly the case for archaeology, as exemplified by the varied approaches to forensic use of archaeological methods described in Groen et al. (2015) and to a lesser extent for anthropology, exemplified by varied approaches in investigations described in Blau and Ubelaker (2015). This is to be expected as the application of, and coordination between, disciplines develops. The experience often reflects a background in different national legal codes, legal and investigative requirements, variation in national authority and academic organization and cultural differences to approaching criminal investigation, forensic science, and science. There has also been great variation in resources, funds, and capacity available to undertake investigations. The archaeological approaches have been discussed in Cheetham and Hanson (2015) with reflection on the use of archaeological evidence in the Criminal Tribunal for the Former Yugoslavia (ICTY) since 1996 discussed in Klinkner (2009). An integrated approach that describes steps using archaeology and anthropology in the process of gathering evidence and identifying the missing in mass grave investigations is highlighted in Hanson (2015).

This chapter, based on the author's 20 years of experience as an archaeologist, outlines approaches to undertaking and managing mass grave investigations. It addresses several problems faced when undertaking such work and suggests processes to successfully find and recover missing persons in these challenging contexts.

31.2 Global Problems

31.2.1 The Number of Missing

The sheer number of the Missing globally provides a seemingly insurmountable problem if the aim is to account for those missing and investigate events related to their disappearance. Estimates have been made on a country-by-country basis, but there are no accurate global figures,¹ but the number of missing and unidentified runs into millions.

With interventions by the United Nations or others to limit or prevent civil war and conflict, there have been subsequent investigations of war crimes and prosecutions. The scale has varied, and has often defined by political will, resources, and legal mandate. For example, the formal investigation of war crimes in Bosnia by The International Tribunal for the Former Yugoslavia (ICTY) was extensive, and included the search for and excavation of mass graves from 1996 to 2001 to gather evidence for trials. The task of recovering and identifying the Missing from those events continues to this day, with over 27,000 sets of remains recovered and 22,000 of the Missing accounted for (Hanson, Parsons, & Bomberger, 2015; Hanson, Rizviç, & Parsons, 2015). In comparison, in Rwanda, some initial forensic investigation authorized by the International Criminal Tribunal for Rwanda (ICTR) were not followed up, with various implications (discussed further in Jessee, 2012). The legal trials and investigations there had to be adapted to deal with the great numbers of accused in custody awaiting trial (Ingelaere, 2008). With so many missing in countries like Rwanda and Iraq, recommendations to undertake a process that leads to identification and gathering of evidence need to be evaluated and balanced against scales of time, cost, resources, and pressing national judicial, social, economic, and political needs.

¹For a summary of missing estimates by country see <http://www.icmp.int/the-missing/where-are-the-missing/>

31.2.2 Who Is Missing

Determining who is missing from particular conflicts and events is far from easy and it becomes more difficult as time passes. The counting of the Missing varies by criteria and over time, exemplified by the ongoing process of determining the number of missing in the Western Balkans (Sarkin, Nettelfield, Matthews, & Kosalka, 2014, pp. 22–23). For many investigations the total number of missing and who they are is never determined, though processes and steps for doing so have been documented (see, for example, ICRC, 2009). Often, it is problematical to account for the dead due to political impasses, variation in assessments, or a lack of national or international organization and capacity to do so (see, for example, Pérouse de Montclos, Minor, & Samrat, 2015).

31.2.3 Impact of Time Delays

There is often a delay between the location and recovery of the missing from the time they disappeared or died. This may be, as in the examples of Argentina and Guatemala, one to two decades, or 30 years in the case of Cyprus. In Spain, the dead from the 1930s civil war are being found (Renshaw, 2011), and missing war dead from WWI are being located and identified, with great public interest (Loe, Barker, Brady, Cox, & Webb, 2014). In many cases, the time delay and conditions of burial are enough for much evidence that can assist with identification to be lost. Likewise, delays result in a loss of the memory within a society, thus limiting witness information, records of the Missing, and records of the events (see, for example, Renshaw, 2010, pp. 451–452).

The effects of time and decomposition also impact the ability to recognize and recover evidence relevant to criminal investigations that may aid in identifying groups and individuals, or may provide dating evidence of events. Much has been written about taphonomic effects and the potential to identify individuals after the loss of soft tissue and the standard indicators of identification

often used in autopsy (for example, see Haglund & Sorg, 1997). With the passage of time, the recovery of skeletal remains is therefore normal in many investigations, and specialist analysis of osteological material and skeletal trauma has become common-place. However, expertise in and access to technical methods and processes (which include specialisms such as anthropology) varies, and this impacts the ability to recognize evidence and identify individuals. Lack of comparative antemortem records in many countries or the loss of records due to conflict may prevent the use of certain methods for positive identification such as fingerprints or odontological comparison. When there is mass recovery of remains, they are often male and of common age, and methods such as anthropological assessment fail to individuate cases. The overwhelming majority of persons missing from armed conflict are male civilians, and men similarly tend to be the principal victims in regard to organized crime. Presumptive identification methods such as clothing, personal effects, and documents are used; they are likely to lead to a considerable misidentification rate if relied upon in mass death scenarios (see Huffine, Crews, Kennedy, Bomberger, & Zinbo, 2001 for examples).

Many of those Missing who are victims of murder are found to be buried, placed in water, or left in surface locations, undergoing change in environments that themselves change over time. These circumstances shift the ability to locate, recognize, and accurately recover evidence into the areas of expertise that comprise of landscape assessment, and this includes use of archaeologists (discussed in Cheetham & Hanson, 2015; Wright, 2010). The technical ability to effectively locate, recover, document, conserve, and interpret buried evidence is not always present in investigations, and the range of potential surviving evidence may not always be appreciated. However, there is often scope (depending on environments) to recover detailed evidence even after decades, similar to the evidence routinely found in shorter time frames during domestic crime scene and forensic examinations (see Cheetham et al., 2008; Hanson et al., 2009; Hochrein, 2002). This includes evidence and

connections between crime scenes, victims, and perpetrators.

All of these challenges make the mass identification of the Missing, and the recognition and gathering of evidence from large-scale crime scenes and mass graves complex, difficult to achieve.

31.3 Global Challenges

31.3.1 Finding the Missing

The problems described have generated a series of challenges concerning how those problems may be solved, the first and most pressing is that of finding the Missing. In many investigations, the work of many years often only recovers a percentage of those reported as disappeared. Statistics for the Committee on Missing Persons in Cyprus (CMP) indicate that since search and excavation began in 2005 in Cyprus, 935 sets of remains have been exhumed, which represents 48% of 2001 people listed as missing from the 1960s to 1974 (CMP, 2015). An estimated 600 of 20,000 missing have been found and identified in Argentina (BBC, 2013) by the Argentinean Forensic Foundation (EEAF) since 1986. Since 1991, The Fundacion de Antropologia Forense de Guatemala (FAFG) have recovered over 7000 missing of an estimated 45,000 that disappeared during the long civil conflict (Amnesty International, 2012). The Prosecutor General's Office in Colombia has been reported to be investigating the disappearance of 45,154 people, buried in mass graves, with a reported 4100 graves containing the remains of 5390 people excavated since 2006 (Colombia Reports, 2013; The Guardian, 2016). Some 5000 missing from the Saddam Hussein era have been recovered in Iraq since 2008, from an estimated minimum 300,000 (Hanson, 2015). However, since 1996 in the Balkans, approximately 70% of the missing have been accounted for (Sarkin et al., 2014). Some 25% of those found in Bosnia were as a result of aerial imagery used to pinpoint graves related to Srebrenica; approximately 87% of those missing as a result of the Srebrenica massacres of 1995

have been found. These higher percentages appear to be an exception, and considerable resources have been ploughed into the investigation and identification efforts.

In all of these examples there is great variation in political will to engage in finding the missing; there are ongoing conflicts, opposition to investigations, great variation in resources for search, varying investigative approaches, differences in time since investigations began to the present day, and a range of other limitations that impact the location of the missing. Work is, in many cases, ongoing. However, investigations often face a common problem: when grave search and exhumations are agreed upon and begin, over time the annual recovery rate drops, in terms of missing persons located per year. A slow beginning as investigations organize to gather resources and information leads to initial success, which then often gives way to an inability to locate and recover further missing persons as time passes. Why is this?

31.3.2 Witness-Led Approaches

A common feature of all of the investigations exemplified is the common use of the witness-led approach used to find the Missing. The approach is a core, basic starting block for most investigative work (see, for example, ACPO, 2009). Witnesses who saw events firsthand, were survivors or members of affected communities, were from the media or intervention forces or from perpetrator groups may provide the essential eye-witness evidence that describe events and pinpoint locations and allow investigations to develop. There are consistently strong preliminary results in which information is provided regarding where people are missing, who is missing and where graves are located. These known graves are quickly located, and recovery of the missing persons is undertaken, often with accompanying political, social, and media pressures to identify them. However, this initial impact wears off, and after the most promising information is utilized, assessment and use of further witness information often fails to locate graves.

There are several reasons for this. Notorious events often have several sources of corroborating information that provide accuracy in locating graves. However, for many events there may be one witness, information received may be second or third hand, or there are no witnesses at all. For example, many primary execution or burial events related to Srebrenica had survivors who provided statements to investigators or prosecutors (see, for example, ICTY, 2010, pp. 173–174). However, when bodies are moved and hidden by perpetrators there are often no witnesses that come forward. Over time memories also fade or change, and this phenomenon is well documented (for example, Davis et al., 2007), with a variety of factors affecting witness recollections. Individuals and communities develop narratives of events that lose accuracy in terms of knowing exactly where graves are, or are thought to be. If there is no political or organizational will or capacity, then witnesses are not found and interviewed. Sources of information may be spread across different agencies or held in archives or databases that authorities cannot access or are not aware of. Witnesses themselves are often reticent to provide information if they see themselves at risk of prosecution or retribution from perpetrators or communities.

In many cases, there is not enough accurate witness or other corroborating information collated to definitively pinpoint grave sites, though many sites are targeted, or graves found may not be relevant to investigations. In Bosnia some 43% of sites probed or excavated between 1996 and 2014 have not yielded remains (Hanson, Parsons, et al., 2015; Hanson, Rizviç, et al., 2015), or yield remains not related to the conflict (an average of 14% of sites where remains have been found in recent years). A review of figures presented concerning exhumations in Cyprus indicates 61% of sites excavated yield no remains. In sites where remains were recovered, 11.5% yielded remains not related to the CMP's work.² The limitation of witness information is also exemplified when what is found is matched

²See data in charts at <http://www.cmp-cyprus.org/facts-and-figures/>

against what was described by witnesses. From the author's experience working in Guatemala, Iraq, and Bosnia, the predicted number of missing in graves determined from witness information often exceeds the actual number of cases found. For a sample of sites in Bosnia, the reported number of missing persons supposedly buried in graves was on average 30% higher than the actual number recovered. The nature of the graves found and remains recovered often differs from reports, remains may be incomplete or there may be multiple graves found in one location, rather than one. For example, in Guatemala, a witness accurately identified a grave location in which he claimed to have buried ten bodies. Five bodies were found with two additional body parts. At other locations, landscape markers were claimed to indicate grave locations, but the markers were younger in date than the disappearance events. Suspected perpetrators may try to mislead the investigation by providing false information including indicating the wrong locations for investigation. Where financial rewards or other incentives are offered, the accuracy or importance of information may be exaggerated. These observations have implications for how witness information is evaluated and how effective interview techniques can be applied. Witness recall and the potential for memories to be partial, or to have merged or changed, (especially when they relate to traumatic events) is well known (see discussions in Bornstein et al., 1997).

Witness information in some circumstances may not be checked, verified, or corroborated, either because there are no other sources of information useful for comparison or because there are no formal investigative processes in place to undertake analysis or review. It may also be the case that investigators and others gathering information from witnesses or from families do not have access to or utilize interview techniques that limit bias or that qualify and quantify information received. There may be an absence of formal proformas for interviews that standardize and prompt questioning so it is uniform and can be used for comparative purposes, and that can place missing persons into specific events and timelines of disappearance.

One of the greatest issues with witness-led approaches is the difficulty of drawing existing information together for assessment. When witness information is available, it is often gathered by a range of agencies—from prosecutors, police, missing person's agencies, families, international organizations, governments, NGOs, and journalists. A consistent problem is the cooperation of organizations, and the access, sharing, and collation of data from witnesses and other sources between organizations. Issues around mandates, jurisdictions, confidentiality, and protection of informants impact the capacity to share data. There may be no coordinating authority or protocol to gather contributors and their information. Without coordination, documented sources of information gathered during or after events may lie in storage without review. Coordination of data gathering and access is essential to ensure the most complete data and intelligence picture of events is assessed and presented. Useful information often exists but does get collated and synthesized to reach a combined threshold that allows for the successful location of graves.

31.3.3 Criminalistics Approaches

The integration of criminalistics approaches to investigations of mass graves and mass fatalities has been limited in many circumstances. The level of crime scene evaluation and examination potential varies by jurisdiction. Dedicated planning, search, and recovery resources for recognition and retrieval of evidence are not standardized globally, regionally, or within countries, nor are procedures for processing and analyzing evidence. In post-conflict scenarios (which often impact developing countries) there may be only the remnants of a previously existing criminal investigation system in place after conflict ends. Criminalistics or forensics organization may have been limited in scope even before conflict, in terms of being able to deal with mass casualties, the associated crime scenes, and volume of information available to be gathered. Building such capacity is a central need when reestablishing rule-of-law structures, and there are international programs to support this (see, for example,

ICITAP, 2014). The systematic and dedicated crime scene and forensic support of a standard which is commonly publicized in western nations is not a universal luxury.

In many jurisdictions, the main investigative evidence is witness testimony and statements, confessions and other related documents, such as records of organizations and authorities. Reliance on physical crime scene evidence, which has become a focus in the last 40 years in North America and Europe, can be the exception, not the rule. In these circumstances, if there is no reliance on physical evidence there may be no process and organization in place for its systematic recognition, detailed collection, use, and management. This is especially the case for use of techniques and methods outside the normal domestic scope of authorities—for example, archaeology—where the necessity for its use is due to out-of-the-ordinary mass fatality and burial events that inevitably come with conflict and disaster (see discussions in Cheetham & Hanson, 2015). The evidential requirements listed under criminal codes may also vary and may be limited in terms of describing the specifics of what physical evidence may be significant, and what should be investigated and retrieved. Often this means the resources and technical support for certain analysis of evidence has not been planned for and provided, or are not functional for the scale of investigation that organizations find themselves facing in mass fatality situations. As a result of these issues there is often a lack of recognition of the presence or importance of classes of evidence; classes that are increasingly being shown to be of importance when investigating large-scale crime scenes and mass graves (see Cheetham et al., 2008; Wright, Hanson, & Sterenberg, 2005; Table 31.1).

31.3.4 Variation in Understanding and Application of Discipline Methods

When graves and crime scenes are located, there is considerable variation in what methods are determined as suitable to recover and document remains and evidence. There is also considerable

variation in how those methods are practically applied. This is especially true for disciplines such as archaeology and anthropology, which are often new to jurisdictions facing investigation of mass fatalities. This variation has been exemplified and discussed (see examples in Blau & Ubelaker, 2015; Groen et al., 2015). Default technical approaches to search, excavation, and examination are often utilized without full consideration of what the outcomes will be from using particular methods.

Technical approaches and methods are often found in guidelines and manuals and are used by default as the sole methods presented for undertaking a particular approach to, say, excavation. This is often an attempt, based on experience, to be systematic and gain consistency in work by using a standard approach, but often the same method is recommended or employed for every circumstance. For scientific investigation of sites that are unique (as all mass graves are), how standard methods are applied is increasingly being shown to be problematic. Each site needs unique evaluation and assessment to determine what search and excavation criteria and methods will best achieve the maximum recognition of the archaeological record and recovery of evidence (see discussions in Carver, 2011; Cheetham & Hanson, 2015). However, the result of applying the same standard method is often that graves are not found and excavation methods do not reveal and define the archaeological record. The limitations of using particular approaches at individual crime scenes and the effects of those limitations are often not formerly assessed as part of planning and review.

For example, a mass grave where intertwined skeletons are revealed may have the remains recovered as exhibits or cases (the individually numbered pieces of evidence) by formal spatial units (perhaps 1 m by 1 m grid squares) or by recovering convenient groups of remains. This often results in cases being recovered that include remains from multiple individuals, rather than discreet skeletons. Subsequent anthropological examination may often not be able to accurately separate all these remains into individuals. There may be errors in re-association, and extensive DNA sampling and matching may be relied upon

Table 31.1 Examples of the comparison of the uses of classes of evidence (Copyright: Ian Hanson)

Evidence type	Uses as evidence	Uses for identification	Dating
<i>Soil and geological samples</i>	Soil profile links between crime scenes, suspects, victims. Evidence of decomposition if no bodies are present	Soil profile from samples from victims may provide geographical origin of persons	Inclusions may indicate recent source of material, ruling out graves and remains as historic, and vice versa
<i>Botanical evidence</i>	Trace evidence links between crime scenes, suspects, victims. Growth patterns at crime scenes may indicate grave locations	Samples from victims may provide geographical origin of persons	Trees and shrubs growing over graves may provide minimum number of years since grave was created through analysis of tree rings
<i>Entomological evidence</i>	Information on time since death or time of death. Evidence of decomposition if no bodies are present	Evidence on whether victims were held over time before death, moved from different locations, exposed before burial	Time of year of events
<i>Trace evidence</i>	link between crime scenes, suspects, victims	Specific trace evidence may provide geographical origin and movement of persons	Modern materials may rule out historic age for grave and victims
<i>Ballistics-bullets</i>	Identifies type of weapon, specific weapon	Number of weapons used indicates potential number of perpetrators, identity of suspect perpetrator groups	Type of ammunition provides date range of use- rules out historic sites
<i>Ballistics- shell cases</i>	Identifies type of weapon, specific weapon	Number of weapons used indicates potential number of perpetrators, identity of suspect perpetrator groups	Head stamp provides date of manufacture— <i>terminus post quem</i> for grave creation, from secure contexts
<i>Tool marks—tire tracks</i>	Type of vehicle used to construct graves or transport victims	Matching witness statements that victims were transported in specific vehicle types, aids in identity of suspect perpetrator groups	Tire impressions in secure contexts datable to grave creation/ disturbance events. Modern materials may rule out historic age for grave and victims
<i>Tool marks-machine bucket impressions</i>	Type of vehicle used to construct, disturb or rob graves	Aids in identity of suspect perpetrator groups	Impressions in secure contexts datable to grave creation/ disturbance events. Modern materials may rule out historic age for grave and victims
<i>Footprints</i>	Type of foot ware worn by perpetrator groups	Type of foot ware worn by victims.	Impressions in secure contexts datable to grave creation/ disturbance events. Modern materials may rule out historic age for grave and victims
<i>Blood stains</i>	Blood patterns indicate nature and sequence of events	Blood matched to victims	Stratigraphy of overlying stains provides time sequence for events. Estimate of blood stain age through fluorescence testing

<i>Archaeological stratigraphy</i>	Relative sequence of events at crime scenes	Associates remains and evidence to contexts of investigative relevance	Relative dating of all events reflected in the archaeological records. Precise dating through comparison of artifacts, remains and evidence from sequences of secure archaeological contexts
<i>Human remains-anthropology: trauma</i>	Nature of cause and manner of death sequence of events. Indication of weapons used	Matching witness statements that victims were killed in specific ways. Aids in identity of suspect victim or perpetrator groups	Modern materials and patterns may rule out historic age for grave and victims. Patterns of trauma and weapon type indicate remains are historic
<i>Human remains-anthropology: pathology</i>	Nature of cause and manner of death	Specific indicators that assist with identifying individuals through comparison of known antemortem information	Modern materials and medical interventions see on remains rule out historic age for grave and victims. Historic wear and disease patterns indicators remains are historic
<i>Human remains—DNA samples</i>	Matches between body parts found in different graves DNA profiles of perpetrators.	Positive identification when matched to family reference samples	Remains matched to individuals can be compared to date of disappearance data—provide “not before” date for grave creation
<i>Human remains—Stable isotopes</i>	Indicates geographical origins of remains	Indicates narrow geographic area to compare with those listed as disappeared from that area. Provides estimate of postmortem interval (PMI)	Origin of remains from specific geographical areas relate remains to historic rather than recent events
<i>Human remains—Carbon dating</i>	Indicates remains are within a time frame of forensic interest. Determination of year of death	Potential determination of year of birth, year of death and the time period of life	Can determine remains are of historic date and not of forensic interest
<i>Clothing recovered with remains</i>	Indicates remains are within a time frame of forensic interest	Specific indicators that assist with presumptive identification of individuals through comparison of known antemortem information	Can determine remains are of historic date and not of forensic interest
<i>Personal effects recovered with remains</i>	Indicates remains are within a time frame of forensic interest	Specific indicators that assist with presumptive identification of individuals through comparison of known antemortem information	Can determine remains are of historic date and not of forensic interest, and vice versa
<i>Bindings and restraints</i>	Nature of cause and manner of death sequence of events. Material analysis evidence links crime scenes, suspects, victims	Matching witness statements that victims were held, transported. Aids in identity of suspect perpetrator groups	Modern materials may rule out historic age for grave and victims
<i>Household waste and rubbish</i>	Common discarded items that find their way into graves such as bottles and cans provide dating evidence and sources of origin	Victim, perpetrator DNA and finger prints may survive providing individual identification. Culturally specific items may items groups	Production and best before dates on items can determine remains are of historic date and not of forensic interest, and vice versa

(if available) to re-associate the main skeletal elements to each body. The time and expense of examination and additional sampling could be avoided in this example if the intertwined bodies were excavated by determining the anatomical skeletal associations within an individual, and undertaking an inventory and survey to assess the veracity of anatomical connection before lifting the remains. The removal of each overlying case is then undertaken in a systematic and documented way. The case recovered in this way is formed of one individual, examination is straightforward and usually only one DNA sample is needed for identification. The excavation method is more deliberate, leads to slower daily recovery rates, and requires expertise in stratigraphic excavation, anatomy, survey, and mapping, but produces better evidence and it is (in the overall process) more time and cost effective. The excavation by the spatial unit method would not be appropriate for this scenario. It may have been suitable for another scenario, for example, collecting scattered surface remains or cremated remains (cremains) where anatomical association of the remains has already been lost. However, where spatial control and recording of remains is essential to be able to understand context and undertake nearest neighbor analysis (to try and determine spatial connections between body parts of the same disparate individual), it is problematical.

It is often therefore at the exhumation or excavation stage where unsuitable recovery and survey methods lead to a costly impact upon the examination and identification process. The understanding of, and decisions on, what excavation techniques are used can determine whether investigation objectives can be successfully met. In general, a simple site—one where bodies can be easily excavated as discreet individuals—leads to recovery of simple cases: ones that are straightforward to examine and require minimum DNA sampling. A complex site—one where bodies are already commingled and are difficult to excavate as discreet individuals—leads to recovery of complex cases: ones that are more technically challenging to examine and require multiple sampling as cases require re-association. Too often, the excavation method leads to cases that

were simple being recovered as complex cases, as the recovery effort itself causes and increases commingling effects. This simple and complex relationship can often be seen in identification error rates. A process of case review of unidentified remains in mortuaries in Bosnia is currently providing insight into error rates, building upon data from previous analysis (see Hanson, Parsons, et al., 2015; Huffine et al., 2001; Yazedjian & Kesetovic, 2008).

Determining what methods are appropriate is not straightforward. On a multidisciplinary scene like a mass grave, experts from different disciplines can differ in their conviction of what technical approaches and procedures should be applied. This is discussed in more detail in Skinner and Sterenberg (2005). How the managers of investigations and organizations make decisions when there is conflicting advice, or make decisions on practical investigation outside their range of experience, is a compounding problem. Agencies historically in charge of crime scene and forensic cases have not always realized the full extent of the complexities of resolving mass graves, buried environments, and surface sites. The skills of archaeologists or other specialists in recognizing evidence, maximizing accurate recovery, and undertaking competent interpretation are not necessarily known or appreciated (see Cheatham & Hanson, 2015). Inflexible management approaches, a lack of innovation and pursuit of objectives that become obsolete as soon as the actual nature of the crime scene, mass grave, or evidence is encountered, are not unusual. Limited technical understanding of unfamiliar disciplines and procedures, and limited competency to make managerial decisions concerning their practical implementation, including how to support operational work and trouble-shoot problems, are common (see Wright & Hanson, 2015). These are leading reasons for difficulties and failures in finding missing persons, producing suitable evidence for courts or achieving identifications and resolution of cases. These are not isolated problems affecting only mass grave and complex crime scene investigations, but are common place in practical and operational management (see, for example, Janis, 2007; Pinto & Mantel, 1990; Rossmo, 2009).

Similar issues with method choice and variation in application exist when using physical anthropological approaches to examine remains. It is universally true that anthropologists do not have legal authority to determine cause and manner of death, but usually support pathologists and medical examiners in doing so. In many investigations and medicolegal national structures however, there have been no qualified anthropologists, as there is no archaeological or medical tradition of osteology or retention of skeletal remains for examination, identification, or research. There may be no legal or institutional precedent for storing and retaining skeletal remains above ground, or no cultural norms for doing so. This is often the case across much of the Middle-East, for example. Pathologists often do not have formal or extensive skeletal anatomical training or expertise. For example, in Iraq from 2009 ICMP supported investigations into the Missing in mass graves left as a legacy of the Saddam Hussein era. Doctors, dentists, and biologists were trained to develop specific osteology and anthropology examination skills in a training program to provide Ministries with mass grave investigations teams (Hanson, 2015). Variance in practical expertise to examine and interpret remains may also be compounded by a lack of examination facilities, appropriate storage, and technical equipment, for the reasons already described.

Anthropological methods for the assessment of biological profile and determination of contributors to identity are however more uniformly applied globally, in comparison with archaeological methods (Wright & Hanson, 2015) and are easier to apply to each examined case, even though each set of remains are unique. Examinations can often be repeated over time. The process of examination is more straightforward to implement in a formal workflow in a fixed facility. This should provide the basis for standardized processes. However anthropological analysis used in conjunction with antemortem data often fails to produce an accurate identification, but acts an exclusionary and comparative tool to assist accurate matching methods like DNA analysis (Barker, Cox, Flavel, Laver, & Loe, 2008). Detailed approaches to dealing with commingled

remains—as complex cases—have been developed (for examples, see Adams & Byrd, 2014), but these are not uniformly applied in investigations. Assessment of assemblages and assessment of demographic data analysis is not always undertaken. Such assessment can assist in determining whether there had been organized, planned, and controlled crimes that involve groups, organizations, governments, or nations. Collection and assessment of the demographic and cause of death data for assemblages of remains is necessary for investigations to determine what charges might be considered by a prosecution, and to assist in group association and identification of missing persons.

31.3.5 Demand for Identification and the Need for Accuracy

The various problems discussed and their consistent issues can impact the ability to positively identify missing persons and lead to limitations in what investigations are able to achieve. There is often great pressure for immediate recovery and identification of the missing in post-conflict situations. For example, in May 2003 communities in Iraq immediately began to dig up bodies from known mass graves once the regime had fallen. They had been waiting decades in some cases for the chance to recover the missing (see Steele, 2008 for examples). There can be enormous pressure from families, communities, and the media for authorities to act. The act of digging up bodies is not only a process that recovers remains, but it is also one which exposes alleged crimes to immediate and wider public view. For communities and families who have suffered great loss, it is not just about accurately identifying the Missing and gathering evidence, it is part of their demonstration of grief and need to explain and come to terms with traumatic events. Mass graves provide powerful media and social impact. Exhuming remains is always technically the easiest and most expedient way to demonstrate official action is being taken, but it is often done without appropriate planning and an appreciation for the consequences. Authorities and

organizations often react without the investigative, technical, and medicolegal structures in place to accurately and systematically identify the missing once remains are recovered from graves.

In Iraq in 2003 and in Libya in 2012, families identified remains at graves or after limited examinations, and before formal structures were in place for official investigations to take place. Family identifications were based on visual recognition of remains, clothing, and personal effects on the bodies. The problems in determining identifications through use of presumptive means are well documented (see Simmons & Skinner, 2006), though under-researched in terms of the breadth of impact in investigations globally. The standards for positive identification are generally known and have been described (see, for example, Edson, Ross, Coble, Parsons, & Barritt, 2004, in relation to identifying skeletal remains). Invariably there are misidentifications when presumptive methods are used, and the result is many families may be left with no body to claim, and authorities are left with no clear way to resolve the cases left in mortuaries. In many cases they are buried in marked graves as unidentified “no-name” (NN) bodies. The numbers of these cases in mortuaries around the world accumulates with various levels of attempted identification, and limited application of formal processes that are able to resolve cases in a timely way. The problem of finding any more of the missing is compounded by the limitations in accurately identifying those recovered. With limited identification, new leads for investigations of those still missing may not be forthcoming. For example, if a grave is excavated containing 40 bodies missing from an event where 80 people disappeared, identification of the 40 sets of remains will provide important feedback to an investigation as to who exactly is still missing. Further analysis to determine any differentiation or pattern in the 40 identified individuals may provide leads on where the outstanding missing might be found. Resolution of many cases is dependent on investigative research and collection of a range of antemortem, postmortem,

excavation, and other information that develops scope for, and information contributing to, identification, including targeting of specific family members for DNA reference samples to complete matches. For examples, see Rios et al. (2010, 2012), undertaking identifications of remains recovered related to the Spanish Civil War.

When the missing are not found or are found but not identified, there are ensuing issues. Expectations of families and communities are raised when bodies are recovered or when investigations implement a search and do not find graves. Expectations are exacerbated when remains sit in mortuaries or marked plots, often for many years, without resolution. For example, 3000 bodies have been exhumed from unmarked graves related to the Spanish Civil War since 2007, but only 8% have been identified (Congram & Steadman, 2008, p. 162) because of limitations in the ability to positively identify, with few surviving documents such as dental and medical records, and limited access to DNA technology (Renshaw, 2010, p. 453). Equally if authorities and organizations do nothing to find the Missing, then no family expectations may be met at all.

There are the issues of related costs to investigations and wasted expense. There are political implications in failing to react or effectively deal with family and community expectations, with not meeting international pressures to undertake criminal investigations and with not demonstrating rule of law is being established and working. There can be a loss of faith in investigations, so that the work that has been done may not be completed by authorities, or is delayed. Establishing effective programs that can achieve widespread identification of missing persons and that can provide evidence for investigations is not easy. It requires extensive funding, resources, and expertise as well as political, community, and societal consensus. This is made considerably harder by the common circumstance that the most need for the work is in post-conflict countries affected by the impact of the wide range of issues already described. However, the technical

approaches and innovations of the last decades mean that it is possible for problems to be overcome, identifications made and evidence gathered through an integrated approach.

31.4 Approaches to Consider

31.4.1 Evidence-Based Approaches

There are increasingly useful approaches to criminal investigation that are not only reliant on witness information but utilize a range of data, evidence, and analysis sources, that is corroborated, tested, and quantified. There is no simple way to locate thousands of missing persons across landscapes where they disappeared in varied events and over a number of years. However, approaches in use by domestic police forces investigating murders, serial crimes, and patterns of crime can be applied. Innovation is required to adapt available approaches to unique circumstances. Evidence-based investigation approaches can assess what will be effective in terms of answering investigative questions and fulfilling objectives. It uses research and available data and comparative experience to formerly determine, evaluate, plan, and organize what can and will work in practical terms. It assesses what can be achieved or is possible with given resources, what the impacts of the investigations will be if successful (or not), and what the outcomes will be if investigations are not implemented. Though information sources are never complete, and complex investigations are multi-faceted, some level of policy, strategic, and organizational insight is needed to effectively plan and decide on what objectives can be achieved or should be attempted. For an overview of standard police approaches to aid policy and crime detection, determination, and prevention, see, for example, Sherman (2013) and Nutley, Powell, and Davies (2013) for evidence-based approaches. Consideration of these approaches is needed to determine how they can

be applied for post-mass fatality event scenarios and objectives. Placing the Missing into specific events and locating those events in a timeline and in a landscape are the basic starting principles.

31.4.2 Intelligence-Based Approaches

Similarly, intelligence-based approaches to investigations focus on employing analysis of all available information, and are not only reliant on witnesses. Analysis is undertaken in order to map, measure, and locate criminal activity, determine patterns in behavior, apply profiling methods, apply landscape analysis, and assess interactions between perpetrators, victims, and scenes. Assessment results guide investigative and operational planning. Geographical Information Systems (GIS) are used to aid in determining significant signatures in the landscape such as locations of crime scenes, graves, or other areas relevant to investigations. Assessment includes determining what further investigation can be undertaken to gather more data. Main sources of useful data for analysis include:

- Behavioral evidence analysis (criminal profiling)
- Archaeological landscape analysis (built around GIS approaches)
- Geographical profiling and remote sensing (including use of satellite and aerial imagery)

A wide range of examples of behavioral evidence analysis can be found in Turvey (2011); for the use of GIS for crime scene analysis in Elmes, Roedl, and Conley (2014) and Leipnik and Albert (2003); and for archaeology in Conolly and Lake (2006) and Wescott and Brandon (2005). These techniques have the potential to take investigations past impasses caused by witness-led approaches, and in using combined data analysis provide greater power to target additional witnesses, and predict and find potential crime scenes and grave locations.

31.4.3 Site Investigation and Excavation Design

When sites are pinpointed, archaeological investigation can maximize the potential to recognize and recover available evidence. The planning for practical work should include the assessment of what scientific, forensic, and discipline contributions will be required. This should include what investigative questions need to be answered, and how technical methods can provide the solution to those questions through archaeological investigation. The design of any intervention will be, in many cases, unique to the site (see discussions in Cheetham & Hanson, 2015) and needs to be understood and agreed by investigators and authorities. Search, testing, excavation, and survey methods used must be suitable for the specific site and designed to allow evidence recognition and recovery. Universal principles concerning application of archaeological methods are discussed in Hanson (2015).

31.4.4 Integrated Examinations

The examination of remains should be undertaken in formal, quality-controlled facilities, with a workflow designed to maximize effective and efficient examinations. It is recommended as a standard approach that anthropologists and osteologists are present during all examinations of skeletal tissues to support and augment the findings of pathologists and medical examiners. Extensive and specific data useful in determining personal identification information, pathology and trauma can be documented from skeletal remains. The considerations for examination and the standards for anthropologists to undertake this analysis are available for application and use, and are published (for example, see Adams & Byrd, 2014; Cox et al., 2008; Kimmerle & Baraybar, 2008; Komar & Buikstra, 2008). When examination approaches are undertaken to include efforts to identify individuals, then anthropological standards should be integrated with methods for achieving positive identification (see Yazedjian & Kesetovic, 2008), including the

use of standard procedures for DNA sampling (see Hines et al., 2014), and the use of all available information to corroborate and confirm identification.

31.4.5 Impact Assessment of Identification

If investigations intend to implement processes to undertake identification, then the implications of applying the agreed approach must be assessed. The requirements to successfully achieve mass positive identifications should be determined. This should include the impact of failing to achieve identifications as well as assessing the impact of not intervening to identify. The expectations of governments and their responsible departments as well as organizations, communities, families, and media need to be consulted and managed as a result of undertaking such impact assessments. The issues around misidentification and the rates of error involving presumptive identification methods (when subsequently tested against positive methods) are now understood and should be taken into account when assessing impact and proposing designs for identification processes (see Huffine et al., 2001 and Sarkin et al., 2014). Given the problems, undertaking presumptive identifications “en masse” raises ethical questions if remains are knowingly repatriating to families and communities when they do not have a certainty of identity. This is dependent on the justifications for doing so, and if a basis for identification has been defined, agreed, and met by relevant authorities, which should be made with full understanding of the implications of potential errors (for examples, see Komar & Buikstra, 2008, p. 211; Komar, 2003). This must also be balanced against the consequences of decisions to not attempt identifications if no positive identification methods are available.

31.4.6 Review of Legislation

Whatever identification approach is designed, a review of the criminal evidence codes and other

legislation that covers the investigative process is required to provide a standard legal framework for investigation to develop in. Are existing laws and procedures adequate for what is proposed, or does a design need to augment and be conformed to existing legal frameworks? Considerations for recovery of non-forensic remains need to be included, and in the legislation of many countries there are gaps between time frames of responsibility for historic remains and those of interest to forensic investigations (for examples, see Marquez-Grant & Fibiger, 2011). Data protection, permission, and consent issues need to be addressed, where personal data needs to be collected, and there may be no suitable legislation in place. Recommendations for legislative change may need to be acted upon in a short time frame. For example, in Iraq in 2006, the Law on Protection of Mass Graves (Ministry of Human Rights, 2006) was enacted as a first step to providing a legal framework for dealing with the control, location, excavation, and evidence gathering from mass graves and crime scenes related to the Saddam Hussein era.

31.4.7 Scrutiny of All Investigations

The standard approaches discussed exemplify the considerations that should be a part of planning for mass grave and missing person's investigations. One further consideration is that it should be presumed that any investigation and work undertaken may at some point in the future be required to part of evidence for prosecutions or other formal judicial reviews. It should be presumed that investigations will be legally scrutinized, even if initial deployment to investigate is for humanitarian purposes, or there are no current prosecutions or legal investigations in place. Scrutiny will also inevitably take place from the media, families, and communities as well as the international community. Investigations should be designed and planned to expect and withstand such scrutiny. International law has a long reach and a long memory: suspected Nazi war criminals are still being arrested for crimes that took place in 1939–1945 (for example, see

The Independent, 2014). To this end, procedures should be to discipline and forensic best practice standards (for example, see Christensen & Crowder, 2009 for discussions on anthropology evidential standards). Evidence collected should be presumed to have the potential to be used for identifications as well as evidence, and should always be evaluated to see if it is relevant to both (Hanson, 2015). The standards of evidence collection, documentation, storage, and management should always therefore meet best practice criminal evidence procedures, and that can maximize the potential to recognize and gather evidence. The potential breadth of use of data gathered from physical evidence found in mass graves and mass death scenarios is not always appreciated. There are often multiple applications of use for physical evidence. Some examples of potential uses are listed above (Table 31.1).

31.5 Developing Investigative Support and Technical Innovations

Integrated support systems are needed in the complex processes described if they are to result in finding and identify the Missing, gather evidence, and provide advice and expertise to authorities. The development of rule of law structures and family support frameworks are required to support scientific and investigative work. Some examples are provided below.

31.5.1 Integrated Processes and Support

To provide guidance and to prompt assessment that can develop investigations, standard operating procedures that describe the field and mortuary process of the scientific investigation of mass graves are recommended (see Hanson, 2015). The aim is to support investigations and encourage all the elements to be considered as part of planning and design of an investigative process. All investigations are unique to some extent, and

an “ideal” process will be adapted to fit the investigative and operational requirements.

The specific mass grave investigation field and mortuary process should integrate with ante-mortem data collection, DNA analysis and matching processes, and database management systems, so that effective scientific identification can be supported. Wider coordination to support identification efforts include advising and liaising with authorities; advising on legislation development, data protection, and rule of law issues; and supporting families and communities to gain rights and empowerment. This ensures the understanding and cooperation of governments and others in addressing the issue of missing persons, including provisions to build institutional capacity, encourage public involvement, and address the needs of justice, as well as to provide technical assistance to governments in locating, recovering, and identifying missing persons (Hanson, Parsons et al., 2015).

Process planning, management, and technical advice to authorities are required so that integrated investigations can be effectively implemented. Various discipline practices need to be drawn into an integrated analysis and search approach, where search becomes ever more finite, to pinpoint micro-locations for assessment, to recognize individual archaeological features and strata within the locations (Cheetham & Hanson, 2015), potentially down to the trace evidence and chemical molecular level what Carver (2011) describes as “nano-archaeology.” The aim is to demonstrate a secure and known context for all recognized evidence.

31.5.2 Desk-Based Assessment and Analysis

The use of desk-based assessment and analysis is necessary to understand what potential there is for evaluating a defined area, for example, to pinpoint mass grave locations. This requires determining the connections between events, the landscape, and timelines relevant to investigations using, for example, maps, historical documents, utilities reports, geotechnical records, historic environment records, and the like (see

Chap. 18 in this volume for further discussion). This determination then maps onto the research or investigative questions that need to be answered to produce a design for investigative work, with objectives that can be effectively implemented. Such assessment is a normal part of archaeological planning, and often focuses on landscape analysis. Much of the forensic application of archaeological techniques requires assessment of landscapes and their history by using a much wider range of data and sources of information than is typically available for standard archaeological assessments. The aim of such planning is to improve the rate of success in finding the Missing and their burial locations in the landscape. As well as analysis of data, this approach requires significant understanding of the landscapes in question, which requires extensive time in the field by experienced landscape archaeologists, working with those individuals or organizations that have an intimate investigative, local environmental, topographical, and land use knowledge. It takes time to assess and develop understanding of a forensic landscape, with reconnaissance to gather data and the evaluation of potential locations of interest.

Fundamental to being able to undertake analysis are comprehensive databases. These may reflect standard proformas and logs that document the investigation process and gather information on search, excavation, and examination. The data collected when added to database modules allows data mining to take place to support analysis to find further grave sites. For example, accumulative data on the properties of excavated graves may, when analyzed, demonstrate there are clusters of graves that form patterns that are distinctive and predictable and thus allow the pinpointing of further areas of the landscape in which to focus search.

31.5.3 Search

The main principle of search practice is to define and identify surviving signatures in the forensic landscape that are indicative of graves and related features. The disturbance of the ground and creation of earthworks such as mass graves are

potentially detectable by many remote sensing techniques (Chap. 18, this volume). The most effective way to pinpoint large multiple locations or targets across a wide area has been increasingly through use of aerial imagery. If preparatory assessment can reduce the potential search area, determine the dates when events occurred and identify the signatures that represent the target in the landscape, then analysis of imagery can confirm specific sites of interest for subsequent testing. If there are patterns to features and graves, aerial imagery can be the most effective way of finding multiple sites. High resolution imagery from sequential time periods can provide a great deal of information on how landscapes have changed, and many archaeologists are skilled at assessing this. Assessment can evaluate potential locations without necessarily having deployed to the field. For investigations where there are security, financial, or operational reasons why site reconnaissance on the ground cannot take place, these approaches can still provide remote evidence and investigative intelligence of crime scenes, graves, dates of events, and the events themselves. Imagery is increasingly being used in this way as exemplified by the American Academy for the Advancement of Science's (AAAS) Geospatial Technologies Project within their wider Scientific Responsibility, Human Rights and Law Program.³ Recent high resolution imagery is available that can be purchased if budgets permit, and this material is helping to identify grave locations from current conflicts. For older conflicts, the access to suitable imagery is more problematic. Publicly available imagery is generally of low resolution which cannot often differentiate graves from other signatures in the images. High resolution imagery from previous decades is normally classified for access as it was taken by military assets, and so is not readily available, and may be in formats that do not readily transfer to digital formats and GIS and other software. Exceptions to this include imagery used to investigate war crimes in the Western Balkans, made available under special agreement with investigating tribunals and authorities (see Cox et al., 2008 for examples).

Physical reconnaissance and search of sites focuses on assessment and appreciation of the forensic landscape, with the principle of determining how landscape use has changed and what signatures of that change might be present. It also determines whether there is potential for a location to hold a grave or crime scene. Many locations when assessed on imagery can be ruled out of forensic interest when ground reconnaissance takes place, as the ground is too steep, or signatures are determined to be caused by non-forensic activities such as agriculture. These provide the criteria upon which remote sensing and imagery can analyze landscapes, and upon which anomalies can be identified and tested. Practical search and excavation techniques have been widely discussed (see examples in Cox et al., 2008; Dirkmaat, 2012; Hanson et al., 2009; Hanson, Parsons, et al., 2015; Hanson, Rizviç, et al., 2015; Hunter et al., 2013), and include geophysical techniques (Chap. 18, this volume) and dogs trained to detect remains or disturbance (Chap. 19, this volume). The desk-based assessment and reconnaissance evaluation should lead to a design for site search that can practically test a designated area utilizing the appropriate techniques, and in such a way that it will successfully find graves and other crime scenes in the area tested. Techniques should be systematic; that is once completed the area has either yielded a positive or negative result and can be ruled out of further investigation. Both are important for taking investigations forward, allowing review of the initial assessment and dealing with expectations of authorities, families and media. Those expectations often see technical approaches such as aerial survey, geophysical survey (such as ground penetrating radar), or search dogs as methods that are certain to find graves. However, techniques are often deployed without full consideration or planning, and do not succeed. This often has the impact of creating a lack of trust or confidence in a technique that remains for many years, which can be difficult to overcome. Graves can be found when the right technique (or combination of techniques) is deployed in the right context with design and planning. There is however no certainty, which is often what is desired or expected.

³See <http://www.aaas.org/case-studies>

31.5.4 Initial Scene Reporting

Often the sources of initial information on site locations are journalists, peace-keepers, other members of the armed forces, NGOs undertaking humanitarian tasks, and community representatives. As the initial witnesses during conflict, post-conflict, and disaster scenarios, they encounter potential crime scenes and mass graves, yet (in many cases) they have little formal training on what to do when come across them. In Iraq in 2003, British Army personnel being directed to possible mass grave sites by local communities had no frame of reference for what might be done. The location was reported up the chain of command. Subsequent discussion with military personnel on what to do when crime scenes were encountered indicated following procedures for the nearest comparable activity for which they had training was the best option: the standard response to securing and documenting a road traffic accident.

What can effectively be done when initial witnesses and first responders find mass graves and crime scenes? It is presumed such witnesses and first responders will not have specialist knowledge or equipment. There are several simple steps that can be followed to initiate documentation and start a response to these scenes:

- Determine or estimate the extent of the potential scene, where possible, and any potential risks such as UXO
- Record GPS or map coordinates for location and its extent
- Photograph and note any potential evidence such as remains, shell cases, ground disturbance
- Notes times, dates of observations and describe what has been visually observed, and who was present at observation
- Note facts as described by informants or witnesses
- Ascertain from informants and witnesses when events occurred, and record any obvious dating evidence to support this (such as fresh vehicle tracks, shell case date stamps)
- Ascertain from informants and who victims and those responsible might have been
- Ask local communities not to disturb scenes and control access if possible
- Provide a visual cordon with notices if assessed this may prevent further disturbance to the scene
- Have a procedure in place within organizations/agencies for reporting and providing documentation to managers for collation, and a procedure for informing relevant agencies such as the United Nations and investigating authorities, with mechanisms to pass documentation to those agencies.

Standard proformas for recording data on potential sites, and recording information from informants or family members are recommended.

31.5.5 Excavation

The process of undertaking an effective excavation is the cornerstone upon which the ability to undertake subsequent efficient examinations and identifications relies. Ultimately excavations that do not address or recognize complexity in the archaeological record will have detrimental knock of effects to the investigation process.

The assessment and evaluation of each site as a unique spatial and temporal location in a forensic landscape is needed, in the framework of events relevant to an investigation. What investigative questions need answering also frames the design for each excavation. The design should utilize all available excavation techniques while adhering to the overarching principle of accurately revealing the archaeological record. Variations of method use should be explained and justified. The impacts of excavation methods used or not used should be described. The excavation should be systematic so that it can be demonstrated the location can be ruled out from further investigations.

Reviews should be undertaken to reevaluate search and excavations where assessment shows results did not match expectations (based on

investigative information), or where investigative questions were not answered. While many archaeologists may subscribe to the statement that excavation is an “unrepeatable experiment,” re-excavation of sites is both proven to provide answers to open questions and provide additional interpretation and evidence (for discussion see Cheetham & Hanson, 2015, for examples see Hanson, Parsons, et al., 2015; Hanson, Rizvić, et al., 2015). In Bosnia, re-excavation of several mass graves has provided fresh investigative leads, revealed new evidence, recovered many cases of remains, tested witness information, and resolved unanswered questions. Formal review of excavations undertaken should form part of the investigative process.

31.5.6 Examination

Effective examination relies on effective excavation, but also on the same principles of assessment and evaluation to ensure a well-designed examination process. Each assemblage of remains recovered from a mass grave is related by a burial event, space, and time. Graves may be of a connected series, forming an assemblage that relates to one set of events. Examination should therefore be planned and organized using the excavation data, as well as to maximize the recovery and documentation of data relevant for identification and determining cause and manner of death, and also to provide answers to the pertinent investigative questions. The integration of excavation and examination processes is also beneficial, with the transfer of information from field to mortuary to ensure continuity of contextual understanding of each case (see Hanson, 2015 for additional approaches). One aim is to ensure only remains relevant to investigations are examined, and another that rates of case closure and identification are improved. Reflective analysis of DNA sampling approaches and results has led to improvements in bone sampling procedures at examination, the effect of which has been to reduce unnecessary sampling, waste, expenditure, failure rates, and turnaround times for results (see, for example, Hines et al., 2014).

The number of “NN” cases and assemblages as discussed previously makes their review within a defined process a priority, where, for example, assessment shows cases have not been able to be closed, identifications have not been made, results have not matched expectations, and investigative questions were not answered. Unlike excavation it is relatively straightforward to undertake a reexamination (if cases are available). The review of “NN” cases in mortuaries in Bosnia has proven to be very successful, demonstrated by the fact that many cases can be shown to be resolvable (with application of the integrated scientific process already described). Recommendations for further required work to close cases, including development of organization and management of processes and data to develop standards have also been made (see Hanson, Parsons, et al., 2015; Sarkin et al., 2014). Formal review of the results from examinations and “NN” cases should form part of the investigative process and be integrated with search and excavation review as a wider review to progress investigations and break the impasses in progress already discussed.

31.6 Conclusions

31.6.1 Impact of Effective Implementation

This chapter has raised considerations from the archaeological and anthropological perspective that all managers, investigators, and participants in the investigation of missing persons can reflect upon. Undertaking the complex coordination of investigations that successfully finds missing persons and identifies them is difficult and throws up many problems. Recognizing those problems is the first step to determining ways to address them.

There is often a great deal of information and evidence that can be accumulated and compared to narrow down the focus of search, and that provides evidence for courts and for identifications. Recognizing that evidence and having the means to exploit it to extract the maximum amount of useful information is another matter.

The use of formal and flexible processes that allow consistent evidence recognition and recovery, that can provide that evidence for rule-of-law-based prosecutions and integrated identification systems are now known and in use. Reliance on default practice and the standardization of practice over flexible standards should be discouraged. Concentration on the potential for a wider application of evidence gathering and use of analytical methods, rather than reliance on a narrower range of “traditional” approaches such as unverified witness information, should be encouraged.

We can, after some decades of the widespread application of archaeological and anthropological methods to finding the Missing, ask what we have achieved, what more can be done, and what we have missed. How can we improve our rates of finding the Missing? How can we improve rates of formally identifying the dead that are found? It is legitimate to ask these questions; families waiting for answers do so every day.

Our ability to find and identify missing persons has knock-on effects for post-conflict countries and those suffering the aftereffects of war, organized crime, and the routine disappearance of persons. Physical evidence has the potential to help limit the impact of denial and narratives that question whether persons disappeared. Physical evidence demands attention as do the artifacts that demonstrate death and that the events surrounding death occurred. The accurate determination of circumstances and events surrounding deaths and the identification of the Missing also provides a foil to revisionism. Scrutiny of investigations should be welcomed and transparency of the work process should be a standard consideration when planning and designing investigations. The ability to recognize the characteristics of perpetrator behavior, and record the evidence it leaves behind, also have the potential to be used for as a tool for vigilance. Identifying the active steps that build up to crimes of genocide, extermination and war crimes rely on an understanding of how the acts leading to crimes manifest themselves and can be observed in behavior and the landscape. There is an evidence

cycle that we can learn from as each investigation takes place, and then use those lessons to better implement future investigations.

31.6.2 The Future of Archaeology and Anthropology in Investigations

The definition of technical processes employing archaeological methods to find and excavate mass graves and other crime scenes, and the ever important contribution of anthropology to examination and identification of remains, is constantly being refined. What works? As we undertake more investigations and apply scientific methods to practical search and formal data analysis, we can determine how best to design and undertake interventions using the most appropriate applied methods.

If the objectives of investigations into the mass disappearance and disposal of missing persons are to be achieved, then complex, integrated, and coordinated planning is required: There is no cheap, fast, or easy way to counteract the massive efforts undertaken by perpetrators to make people disappear. Sharing approaches, lessons learned, and the understanding needed for technical success in finding the Missing is required. Archaeologists and anthropologists as practitioners in disciplines developing in the forensic arena do not always sell themselves and the potential of their work well. It is perhaps difficult to shake off the legacy of the impression they are scientists and artists pursuing benign historical interests in museums and labs. It is also true that many approaches have become dated as the understanding of what is needed to fulfil forensic standards becomes better understood, and requirements of criminal codes, investigative objectives, and scientific standards are developed.

Investigations have developed greatly because of what has been available in terms of scientific support. Demonstrating what new potential is available for future investigations, as well as how, when, and why it can be applied is a challenge for archaeology and anthropology. Justifying the

resources and funding required to effectively assist investigations is another challenge, but the processes, methods, and organizational tools are defined and becoming available to provide that support.

Beginning investigations with the implementation of integrated identification systems is now possible; resolving identification issues in investigations where presumptive identification has already been applied is more difficult to achieve, but can be resolved.

What future evidential data potential is there? Developments of social media and sharing of ante-mortem information, availability of high resolution imagery and topographical data are examples of the wealth of potential information that can be utilized to undertake analysis to find and identify missing persons. How such data can effectively be harnessed and used, and how databases can be developed to achieve that, requires careful design. How such data (including personal data) is managed, organized, and accessed, requires careful consideration of data protection and consent issues.

It is clear the demand for the Missing to be found is constant from families and communities, as well as from the investigations carried out under national and under international law. It is also clear that families wish the results of the work to come with more speed. While innovations develop and the ability to pinpoint and target mass graves improves, the work of the archaeologist to locate and excavate mass graves and recover the missing remains a practical process, as does the anthropologist's work in undertaking examinations and confirming identifications. Both archaeology and anthropology draw on a range of expertise to form the core of multidisciplinary processes, and will continue to expand their assistance to investigations, but both need to improve their capacity to effectively find and identify the missing. That is the major challenge; the innovations are available and are being developed to meet that challenge.

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Evolution of Disaster Victim Identification (DVI/DVM): An Overview of Management and Pitfalls

32

Calle Winskog and Roger W. Byard

32.1 Introduction

The formal and organised process of identifying multiple bodies after a mass fatality is referred to as Disaster Victim Identification (DVI). More recently it has evolved into a more comprehensive process of Disaster Victim Management (DVM) (Winskog, 2012a, 2012b, 2012c). Depending on local jurisdiction and legal requirements the number of dead required before DVI processes are initiated varies. The definition of a disaster can vary from a tsunami, with potentially thousands of deaths, to a vehicle accident with a significantly smaller number of bodies. The number of bodies involved to meet the requirements needed to launch a DVI operation can depend on various factors and are set by local authorities.

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This might depend on circumstances, such as the normal capacity of the local morgue, the number of permanent staff, or other factors. International DVI procedures are coordinated through the international police agency Interpol and their purpose is to assist local authorities that control the site(s) of the disaster. Guidelines and internationally accepted forms are provided by Interpol for collating both ante-mortem (AM) and post-mortem (PM) data and Interpol often assists practically by sending personnel to augment local agencies. DVI resources may be used in a number of different situations and may involve natural disasters, terrorist actions, human trafficking accidents (Rutty, Byard, & Tsokos, 2005) or exhumations of mass graves from previous armed conflict (Byard, Cooke, & Leditsche, 2006) (Fig. 32.1).

Bodies may be intact or fragmented, fresh or putrefied, and there are a number of issues that arise in terms of jurisdiction, recording of data, and security. Disasters can also be classified as open or closed. A closed disaster is when a number of victims belonging to a fixed identifiable group such as an aircraft crash. An open disaster involves a number of unknown individuals (DVI Guide, 2013).

The recovery and identification of deceased individuals ‘...represents the fulfilment of the right of human beings not to lose their identities after death...’ (INTERPOL, www.icrc.org) and has to be conducted in close collaboration with local authorities, taking into consideration the reg-



Fig. 32.1 Victims of human trafficking investigated by Interpol and a Nordic DVI Team in 2006 (Copyright: Authors' own image)

ulations of that jurisdiction together with the wishes and cultural practices of the local community and country. The fundamental requirement in a disaster situation with multiple fatalities is the correct identification of victims (Winskog, Tsokos, & Byard, 2012). The collection of ante-mortem data for comparison can be a challenge, as different countries and states have differing approaches to the collection of material from their citizens. Dental records have been the major means of identification in numerous DVI exercises but not all countries have these records saved. The collection of ante-mortem data is also very labour intensive and this is something that has to be taken into consideration well before a disaster happens.

When multiple agencies are involved in a DVI exercise the potential for misidentification is obvious. Failure to establish clear practice guidelines and lines of authority at the earliest possible opportunity, inadequate or idiosyncratic initial examinations, failure to follow protocols, and failure to ensure adequate quality assurance reviews are the most common reasons for misidentifications (Byard & Winskog, 2010a, 2010b). Each step of the identification process requires an internal audit (Leditsche, Collett, & Ellen, 2011). It has been recognised that the assignment of a unique identifier for each body (or body part) is vital to the final outcome. The unique numerical identifier needs to be assigned at the beginning of the identification process and should not be



Fig. 32.2 Interpol and a Nordic DVI Team assisting Barbados government 2006 (Copyright: Authors' own image)

replaced with or complemented by additional identifiers. The number assigned should be able to be tracked through the entire identification process, including fingerprinting, pathology, dental, and DNA examinations.

A great deal of time may be spent during DVI exercises re-examining and sampling bodies and parts that may have been examined multiple times before (Byard & Winskog, 2010a, 2010b). An objective measurement of the effectiveness of the process has been proposed and this could assess the work model of a DVI exercise. This 'Correction of Failures (CF) Index' could be measured simply as the total number of cases/specimens that had to undergo reexamination as a percentage of the total number of cases/specimens (Byard & Winskog, 2010a, 2010b).

Interpol is the international organisation consisting of police agencies from all parts of the world and is currently the global coordinator of major disasters. Within Interpol there is a standing committee that meets annually. Not only does Interpol coordinate continuous improvements of the DVI guide but they also coordinate, and in some cases assist in, DVI exercises (Fig. 32.2).

The need for maintaining protocols and standards at all stages of the identification process is an important part of Interpol's role in the DVI community (Lessig & Rothschild, 2012).

The roles of experts such as anthropologists (Mundorff, 2012), biologists (Montelius & Lindblom, 2012), dentists (Berketa, James, & Lake, 2012) and pathologists (Schuliar & Knudsen, 2012) in a DVI setting has been reviewed previously. This chapter will not discuss the role of these professionals in depth. Training and education in disaster victim identification/management (DVI/M) is something that is often mentioned. Winskog et al. (2012) discuss an educational approach to DVI/M and Rutty and Rutty (2012) provide suggestions on how to increase training value. A number of problems can occur after a mass disaster and when large operations are undertaken on foreign soil. Therefore, some of the issues associated with the initial management of setting up a DVI operation will be addressed in this chapter together with descriptions of the practical approach to disaster victim identification.

32.2 Management and Setting Up a Mortuary in an Emergency Situation

32.2.1 Choice of Mortuary Location

Before work can begin a location for the site has to be identified. Choosing the right location for the temporary emergency mortuary can be vital

for the successful outcome of the operation. Not only does the site have to be spacious enough to allow storage for potentially large numbers of bodies, but it will also have to allow movement of bodies within the site. Already existing mortuary facilities should always be explored before other options are initiated. Existing infrastructure and local knowledge should not be underestimated and using already established facilities can save time, work and money (Fig. 32.3).

The type of disaster and the number of decedents has to be taken into consideration when assessing the existing facilities or a location for a new temporary emergency mortuary. Will the storage capacity be sufficient and can it be expanded if needed?

The construction of a temporary emergency mortuary may vary from tents (Byard et al., 2006) to adaptations of an already existing permanent mortuary structure (Leditsche et al., 2011). Inflatable tents, mobile defence force hospitals, modified systems of containers (James, 2005) and aircraft storage buildings (Eitzen & Zimmermann, 2012) have been used and suggested (Figs. 32.4 and 32.5).

Management on site will involve logistical issues and the challenges of a multicultural working environment. The establishment of the emergency mortuary can be divided up in to three sections:

Fig. 32.3 Dry ice used for cooling in Thailand 2004/2005 (Copyright: Authors' own image)





Fig. 32.4 Existing facilities used in Thailand after the tsunami 2004 (Copyright: Authors' own image)

Fig. 32.5 System of adapted containers used as temporary mortuary in Thailand 2005 (Copyright: Authors' own image)



1. Establishment of the site and mortuary facilities.
2. Running of identification work.
3. Closing down the site.

The use of mobile cooling units (often purpose-built containers) (Byard et al., 2006)

increases the demand for electricity and this can be further exacerbated by offices, air-conditioning units, cooking facilities and equipment used in the identification work (Fig. 32.6).

Identification work is often associated with unclean conditions, and a functional sewage system and access to large amounts of water will be

Fig. 32.6 Cooling units in a hot climate can cause major issues as a continuous power supply is needed (Copyright: Authors' own image)



required. An emergency mortuary can also place a considerable strain on a community already affected by the disaster and it is important that the disaster victim identification manager (DVIM) and the mortuary manager work together with local authorities when assessing a potential site or existing facilities.

32.2.2 Mortuary Set-Up and Workflow

32.2.2.1 Set-Up of Mortuary

Once the site is established the actual set-up/layout depends not only on the type of disaster but also on the physical layout of the site. Movement of bodies within the site will have to be planned and the established procedure of how remains are examined should be incorporated into the following workflow (Figs. 32.7 and 32.8).

1. Reception of human remains.
2. Radiography (including whole body scan if possible).
3. Fingerprinting, friction ridge examination.
4. Forensic examination of human remains—(autopsy).
5. DNA collection.
6. Dental examination.
7. Evidence processing.
8. Quality control.
9. Release of examined human remains.



Fig. 32.7 Adequate space for movement of bodies and personnel is an important aspect of the site layout (Copyright: Authors' own image)

Fig. 32.8 Access to workspaces without blocking entrances will ensure a smooth handling of large number of deceased (Copyright: Authors' own image)



Fig. 32.9 Unloading bodies at a temporary mortuary in Thailand 2004/2005 (Copyright: Authors' own image)



One of the major responses to a disaster is the first phase of the DVI/DVM operation—removal of the bodies from the scene and transportation to secure and adequate storage (Sweet, 2010). This occurs almost immediately and the setting up of an emergency temporary mortuary will have to begin with the establishment of an appropriate storage area. The need for immediate initiation of identification work will be in conflict with the first organisation effort but it is important for the

DVIM to understand that proper planning of the entire operation will affect the overall outcome of the operation (Byard & Winskog, 2010a, 2010b) (Fig. 32.9).

As mentioned, the location of the temporary emergency mortuary has to be carefully chosen. Once the location is finalised it may be very difficult to relocate as a large number of resources may be required. Careful consideration should be given to the fit out of the site when the location is

Fig. 32.10 Relaxation and meals area in Site 2, Thailand 2005 (Copyright: Authors' own image)



chosen. Staff facilities for personal hygiene and changing rooms are vital, together with storage space. To maintain the safety and ensure the health of the personnel it is important to separate clean areas and dirty areas. Personal hygiene with clean and dirty areas has to be enforced and separate eating facilities established. Storage for mortuary supplies such as suits, gowns, masks, head and eye covers, boots, scrubs, body bags and other disposable items should be in close proximity to the area where examinations are being conducted. The continuous supply of equipment used in examinations has to be maintained by the mortuary manager. If this is not maintained, all work on the site can come to a halt whilst supplies are sourced.

Eating and relaxation areas for personnel should also be established. If the operation is expected to run over a long period of time, food preparation on site could be considered, depending on the size of the work force (Fig. 32.10).

The length of the operation has to be estimated and the longer the operation is expected to run, the more permanent the facilities should be. The practicalities of having accommodation close to the site cannot be underestimated and

transportation of personnel also has to be taken into consideration. Transportation and accommodation should be arranged by the DVIM team to again ensure the safety of the staff. Depending on the nature of, and media interest in, the disaster, security might be required, which can also influence the choice of location for the mortuary.

The central office will be a hub on the site. It should be easily accessible and have room for several staff. Internet access and a line of communication with the DVIM and the reconciliation centre should be available. Digital image material acquired during examinations should be stored in a secure manner for future use, as it could play a vital role in a possible future criminal investigation (Winskog, 2012a, 2012b, 2012c; Ruttu, Robinson, BouHaidar, & Morgan, 2007).

Depending on the type of disaster, hazardous material can be brought in with the bodies from the disaster site and an area for decontamination might be needed (Leditsche et al., 2011). If decontamination of personnel is required, the location of this area within the site has to be taken into consideration for the well-being of personnel. If it is expected that there will be a decontamination process included in the general work

routine, a suitable area for this should be established before any work begins on site. The process of decontamination can be complicated, and depending on the type of contamination, water and sewage facilities must be considered. Special considerations also have to be made in response to a disaster involving possible nuclear/radiation exposure (Maiello & Groves, 2006).

Large amounts of disposable products are used during DVI work and this can potentially produce substantial amounts of waste. Garbage has to be removed securely from the site. Special considerations need to be made regarding human waste in the form of items soaked in body fluids and unidentified human remains. It is important to discuss the handling of human waste with local authorities as legislation for human tissue varies between countries and states (Byard & Winskog, 2010a, 2010b). The site will also produce regular garbage, such as land fill items, together with food waste, paper products and other recyclable items.

Modern DVI involves imaging of the deceased and all material brought from the disaster site (O'Donnell, Lino, Mansharan, Leditsche, & Woodford, 2011). The positive aspects of using computer-assisted tomography (CAT scan) during DVI has been described (Blau, Robertson,

& Johnstone, 2008; O'Donnell et al., 2011) and inclusion of radiological equipment on site should be carefully planned. It is optimal to conduct CAT scans on all material collected during the recovery operation to identify skeletal elements in heavily disrupted body masses (Cordner, Woodford, & Bassed, 2011). Personal effects, together with other identifiers such as teeth and surgical implants, can then be easily recognised and recovered (Cordner, Woodford, & Bassed, 2007; Blau et al., 2008). If possible, the use of a mobile unit is preferential (Rutty et al., 2007). The presence of radiology resources should influence the choice of location for the temporary emergency mortuary (Leditsche et al., 2011).

The mortuary area should be secured before work can begin on the site (Byard et al., 2006). Entrance points should be manned 24 h a day and access should be strictly supervised (Fig. 32.11).

Covering of the area to prevent external viewing, include viewing from the air by helicopters, should be considered (Leditsche et al., 2011). Bodies need to be protected and entrance into the facility should not be permitted unless a personal identification badge can be presented. An area for relatives, media and other interested parties should be established outside the mortuary compound (Fig. 32.12).



Fig. 32.11 Entrance to temporary mortuary in Thailand 2004/2005 (Copyright: Authors Own)



Fig. 32.12 Photos and images posted for families to view (Copyright: Authors' own image)

32.2.2.2 Mortuary Organisation

A mortuary manager should be appointed early in the process to oversee and manage the work on site as well as being responsible for coordinating the set-up of the temporary emergency mortuary (Byard et al., 2006). Depending on the type of disaster there might be a need to run daily routine forensic examinations in the mortuary together with DVI on the same premises. The staff might have to be divided into two groups with an associated restructure of normal routines (Leditsche et al., 2011). The mortuary manager will have to liaise between professional teams working in the mortuary and DVI management to ensure effective coordination between disciplines, as teams will have different needs related to their work (Winskog et al., 2012). Mortuary manager duties include a range of tasks and are not restricted to the initial set-up of the emergency mortuary (Byard et al., 2006).

32.2.2.3 Site Management

Management should aim to allow the process to run smoothly with a minimal amount of errors (Byard & Winskog, 2010a, 2010b). Logistics within the site are vital to the final outcome. Close cooperation with local authorities and maintenance staff is essential to ensure that the site can maintain its operational status. Planning the workflow and controlling the different sections of

the process are important as the identification process relies upon sequential steps providing accurate information. Poor planning can prolong and complicate the identification process (Byard & Winskog, 2010a, 2010b; Huckenbeck, Thiel, Krause, Lessig, & Szibor, 2008; McCarty, Sohn, Ritzlin, & Gauthier, 1987). The uninterrupted delivery of supplies to assist in the identification process is also important for the smooth running of the daily work on site.

32.2.2.4 Overall Management

The Disaster Victim Management Team (DVMT) needs to obtain information about the possibility of a criminal investigation early in the DVI process. As legislation varies between countries and states, the appropriate local agency, and early discussion and cooperation with local authorities, is vital to the overall positive outcome of the operation (Byard & Winskog, 2010a, 2010b). Interpol can often assist with information, and for major disasters they often deploy a liaison officer to assist on site (Winskog, 2012a, 2012b, 2012c).

On-site quality management is discussed in the Interpol guidelines. Processes and outcomes must be inspected to ensure that identifications have been correctly performed. Lake, James, and Berketa (2012) have extrapolated their experience with quality management in an odontology setting to encompass all other areas of DVM. They emphasise the presence of a stable chain of command to ensure that scientific protocols and techniques are followed (Fig. 32.13).

32.3 Different Professionals and Their Role

Separate from the administrative part of the everyday running of the mortuary, together with ante-mortem data collection, there will be a considerable number of professionals working on site. The practical work will be discussed later in this chapter but a short description of the various professions involved with the practical work is outlined. The overall operation is governed by the police in most jurisdictions, as they are responsible for the identification of deceased individuals. In order to achieve this, they will be

Fig. 32.13 Final quality control after examinations before body is returned to storage (Copyright: Authors' own image)



Fig. 32.14 Friction Ridge Specialists securing fingerprints on deceased victim (Copyright: Authors' own image)

assisted by several agencies and specialists. The police provide specialists in fingerprinting in order to secure adequate samples for comparison in national and international databases (Chap. 26, this volume) (Fig. 32.14).

Photographers are usually provided by the police but this also depends on the organisational structure present on site. For the physical exami-

nation of the bodies, a forensic pathologist is required. He/she will examine the body, conduct an autopsy, and collect samples for further testing. Odontologists have, in recent years, played a significant role in DVI resulting in a larger percentage of victims being identified by dental examination and comparison. In some DVI situations, anthropologists have been of great value (Mundorff, 2012; Chap. 33, this volume) through interpretation and separation of remains. Biologists/geneticists and DNA experts also play a vital part in a modern DVI organisation (Montelius & Lindblom, 2012).

32.3.1 Post-mortem (PM) Coordinator

The PM coordinator supervises PM activities and ensures compliance with occupational health and safety requirements.

32.3.2 Human PM Remains Registrar

The human remains registrar assigns incoming remains their unique PM number.

32.3.3 Friction Ridge Specialist

The friction ridge specialist will determine the best method of collection to be used based on the condition of the bodies. If possible all victims should have their fingerprints, palm prints and footprints taken (Chap. 26, this volume).

32.3.4 Photographer

All remains should be photographed. For storage and archiving purposes digital photographing is preferred.

- Photographs should be made of all remains.
- All photographs should clearly show the PM number and, if possible, a reference scale (e.g. for tattoos, scars) (Fig. 32.15).

A specific set of photographs are recommended and these recommendations can be found in the Interpol DVI Guide (2013).

32.3.5 Radiologists

Radiographs (X-rays) and computer assisted tomography scans (CAT) are important tools in providing clues for the cause of death and in screening for foreign bodies such as pacemakers and implants to assist the identification process. A systematic radiological examination of the human remains (especially using CAT scanning technology) is conducted to:

- Record potential identifying features, including internal observations.



Fig. 32.15 PM number clearly visible on each photograph (Copyright: Authors Own)

- Find specific injuries, diseases or abnormalities.
- Search for teeth and bones or bone fragments.
- Search for foreign objects (metallic items, explosive devices, firearms, projectiles and jewellery).
- Estimate age at the time of death.
- Depict and record treatments in teeth (and bones) useful for identification.
- Enable AM/PM radiological comparisons.
- Conform with established search guidelines for the bodies of flight crews (examination of head and feet).
- Enable collaboration with forensic anthropologist to provide a biological profile.

32.3.6 Forensic Pathologist

The forensic pathologist performs an external and, where necessary, an internal examination of the body. The forensic pathologist takes samples for DNA analysis, identifies scars, tattoos and other features important for the identification process.

32.3.7 Pathology Assistant

The pathology assistant assists the forensic pathologist in the external and internal examination of bodies and will also reconstruct the body after the autopsy to a condition acceptable for viewing if required/requested.

32.3.8 Autopsy Recorder

The autopsy recorder guides and assists the forensic pathologist through the PM recording process and enters all data into the field on the appropriate form.

32.3.9 Property/Evidence Processor

The evidence or property processor documents articles of clothing, jewellery and other effects. Items should be placed in appropriate evidence bags and labelled with the unique PM number.

32.3.10 Forensic Odontology Examiner

The odontologist should be free to suggest the best methods for optimising the examination but local legislation and customs must always be considered. As a general principle, the jaw should not be removed from the body. Recommended working procedures including the odontology team structure (consisting of three dentists) can be found in the Interpol DVI Guide (2013).

32.3.11 Quality Control Officer

Documentation should always be closely examined and assessed before a new step in the investigation is initiated to ensure that the data have been accurately recorded. A structured approach to quality assurance will limit the number of mistakes that are made and improve the quality of the final outcome.

32.4 Interpol's Four Phases and the Additional Fifth Phase

32.4.1 Phase 1: At the Scene

The DVI process begins with police officers searching for, retrieving and documenting the remains of people who have died. They will search for evidence that may help in the identification process and forensic pathologists and other specialists may also attend.

However, the search for the human remains cannot begin until all survivors have been rescued. The emergency rescue units should try to ensure that human remains (including evidence) are left untouched. This is often difficult to achieve because of the large number of different organisational units involved in the early rescue phase. A structured search and discovery plan should be launched in collaboration among all agencies involved. In a disaster with a large number of victims an Operational Section for recovery and evidence collection should be

established. This Operational Section should be responsible for:

- Recovery of all bodies and body parts.
- Collection and preservation of property and personal effects.

32.4.2 Phase 2: Examination of Bodies at Mortuary

Bodies are admitted to the mortuary and kept separately and securely throughout the process. A security service should be established to ensure limited access and or disturbance by unauthorised persons. The examination will include photography, radiography (if possible), fingerprinting (if possible), autopsy (if applicable), and skeletal and dental assessments. Samples taken at this stage are used to obtain DNA, if possible.

The mortuary set-up should allow for the following functions:

- Reception of human remains
- Storage and proper cooling of human remains
- Organisation and transport of human remains for forensic examination
- Registration of human remains
- Organisation of the return transport for human remains
- Quality assurance check of identified human remains prior to release
- Workflow documentation (Fig. 32.16)

32.4.3 Phase 3: Gathering Information About Decedents from Family and Friends

The key to final identification is investigators receiving detailed information about the people who have died. Therefore, it is important to collect, record and process information regarding injured, missing or deceased persons as quickly as possible. This includes physical characteristics such as build, hair and eye colour, scars, tattoos, clothes and jewellery. Investigators will also want to know details of about medical and dental histories, including pre-

Fig. 32.16 Bodies being admitted in the temporary mortuary (Copyright: Authors' own image)



vious surgical and dental procedures. If possible, a DNA sample will also be collected from a parent or child of the person who has died. This process is referred to as the 'ante-mortem information collection process' (DVI Guide, 2013; Chap. 22, this volume). Experience has shown that the number of reported 'presumed' victims varies and often substantially exceeds the number of 'actual' victims involved in the disaster. Continuous screening of information on injured and non-injured survivors can result in a reduction of the presumed number of victims, which can decrease the workload on the ante-mortem collection teams.

32.4.4 Phase 4: Comparing Scientific Information with Personal Details

During this stage, the Reconciliation Team compares the AM and PM findings that have been submitted to make positive identifications. The presented information is used to determine identification where possible. This process is known as 'reconciliation'. The Identification Board consists of experts that verify proposals of identification submitted by the Reconciliation Team. The Board makes the final decision regarding the identification. The decision is then provided to the appropriate judicial body for consideration

and the repatriation of remains is usually performed (Fig. 32.17).

Phase 4 is usually a time-consuming and complex process with multiple variables affecting the final result. A structured, systematic approach must be undertaken to avoid misidentification. This involves:

- Review and evaluation of the evidence provided
- Decisions as to whether the evidence is sufficient to identify the victim
- Localisation and reassessment of any non-matches

The Identification Board is responsible for the final identification and should consist of experienced identification experts involved in the operation. The composition of the Identification Board can be influenced by local agencies and they can expect to report to a coroner, judge, medical examiner, the military or police authority, depending on the local legislation.

32.4.5 Phase 5: Debriefing of Investigators and DVI Staff

The final phase of the DVI protocol is debriefing. The last step of the emergency mortuary management protocol serves as a learning tool for the



Fig. 32.17 Repatriation of identified Swedish citizens from Thailand in Easter 2005 (Copyright: Authors' own image)

next operation and should include all involved agencies and personnel (Bassed & Leditschke, 2011). The temporary mortuary should be dismantled before the debriefing. Rehabilitation of the site could take a long time and include considerable efforts such as removal and disposal of contaminated soil (Byard et al., 2006). Close cooperation between all agencies is vital for the final outcome.

32.5 The Post-mortem Form

The Post-mortem Form (PM) found in the Interpol DVI guide is designed to collate information on human remains and property items to be used for comparing information on missing persons. This comparison is used to establish the identity of a victim. The AM collection process is very unpredictable and for that reason all fields on all pages must be completed during the examination. This could eliminate the need for any reexamination of bodies (Byard & Winskog, 2010a, 2010b).

The forms are designed to be used in areas where no electricity is available. The AM and PM information from the form can be transferred

to the database PLASS Data[®] for processing and this software is used and supported by Interpol. A paper form is used rather than directly entering the information into a database as the DVI staff might encounter many different types of working environments. There are many examples of DVI operations where electricity failures and extreme weather conditions have prevented and complicated the collection and saving of data during the mission. For example, cold weather prevented the use of ballpoint pens in one operation that the author (CW) was involved in and only pencils could be used (Fig. 32.18).

32.6 The Line of Work

During the tsunami DVI operation in Thailand 2004–2005 a functional working model was established. This model is now considered as a gold standard for the practical approach to data collection (Winskog, 2012a, 2012b, 2012c). The work is divided into stations where experts work on remains separately to collect as much data as possible. All information is gathered in the PM form. A simplified version of how the line works is shown below. An in depth description can be found in the Interpol DVI Guide (2013) but the process is summarised below:

The remains are placed on an autopsy table and the following examination procedures undertaken.

- The body registrar issues a PM number (if one has not already been issued) and records it on a blank PM form.
- The body registrar directs the photographer to document the body/human remains and what has been received.
- Fingerprints, palm prints and footprints are collected.
- Clothing is removed from the body/human remains. Cleaning of the clothing should not occur until all specialists have completed their evidence collection procedure.
- The photographer photographs the unclothed body/human remains plus the items of clothing and other evidence.

PostMortem (pink) **VICTIM IDENTIFICATION FORM** **B0**

DEAD BODY No: _____
Barcode

Nature of disaster : _____

Place of disaster : _____

Date of disaster : Day Month Year Male Female Sex unknown

CHECKLIST OF OPERATIONS IN THE MORTUARY			Date	Remarks
Photographs	Full size - front, back	<input type="checkbox"/> With clothes <input type="checkbox"/> Without clothes		
	Head	<input type="checkbox"/> Front <input type="checkbox"/> From left <input type="checkbox"/> From right		
Fingerprints	Finger	<input type="checkbox"/> No <input type="checkbox"/> Not Possible <input type="checkbox"/> Yes		
	Palm of the hand	<input type="checkbox"/> No <input type="checkbox"/> Not Possible <input type="checkbox"/> Yes		
Autopsy	Medicolegal examin.	<input type="checkbox"/> No <input type="checkbox"/> Yes		
	Full autopsy	<input type="checkbox"/> No <input type="checkbox"/> Yes <input type="checkbox"/> X-rays <input type="checkbox"/> Photo		
	Pathologist name Address/Phone			
Dental examination	Completed examination	<input type="checkbox"/> No <input type="checkbox"/> Yes <input type="checkbox"/> X-rays <input type="checkbox"/> Photo		
	Jaws removed	<input type="checkbox"/> No <input type="checkbox"/> Yes <input type="checkbox"/> X-rays <input type="checkbox"/> Photo		
	Odontologist name Address/Phone			
Samples <small>(cf. E2 item 73)</small>	<input type="checkbox"/> Taken <input type="checkbox"/> Sent for analysis <input type="checkbox"/> Result enclosed			
	<input type="checkbox"/> DNA profiles ordered			

CHECK LIST OF CONTENTS		Enclosed complete	Enclosed in part	Issued to Name	Date	Returned Date	Remarks
B	Recovery from scene						
C1	Clothing and Foot wear						
C2	Personal Effects						
C3	Jewellery						
D1	Physical description						
D2	Physical desc. cont.						
D3	Physical desc. cont.						
D4	Body sketch						
D5	Fingerprint information						
E1	Internal examination						
E2	Medical conclusions						
E3	Skeleton sketch						
E4	DNA						
F1	Dental findings						
F2	Dental findings cont.						
G	Further information						

[[GB] Version 2008]

Fig. 32.18 Section of the Interpol DVI paper form (DVI Guide, 2013)

- An external and internal examination of the body is performed and DNA samples are collected. Additional photos of important features are taken.
- Dental status is assessed by the forensic odontology team. The forensic odontologist directs the photographer to photograph identifying features.

- Documentation of clothing, jewellery and other effects is completed by the evidence processor and photographer. All evidence is placed in separate evidence bags.
- Clothing is placed in a clear bag and inserted into the body bag after examination is completed. Items of identification, objects of value and jewellery are taken to an evidence storage room to be released with the body after a positive identification has been made.
- Quality control measures are conducted to ensure that all necessary information has been entered on the form.

32.7 Practical Teaching

The senior staff in any knowledge-based organisation is usually expected to participate in the training of younger colleagues and students. When conducted in the field, a more hands-on approach can be recommended and practical work should be encouraged to stimulate tactile memory. The practical approach could also be recommended to help overcome any language barrier that might exist (Winskog et al., 2012). The key principles of adult learning include the following assumptions (Knowles, 1985):

1. Adults need to know why they are learning.
2. Adults are motivated to learn by a need to solve problems.
3. An adults' previous experience must be respected and built upon.
4. Learning approaches should match an adult's background and diversity.
5. Adults need to be actively involved in the learning process.

To ensure that the ideology of teaching is transferred to younger and less experienced colleagues, the approach of 'see one, do one, teach one' can be used. Adequate staff training in areas of hygiene, security, and cultural and religious awareness is also emphasised in the context of DVI/M scenarios.

32.8 Working Conditions

Many issues involving occupational health and safety have been neglected in DVI/M situations. This has been clearly shown in the early stages of the process when infrastructure may be almost absent and the effort is highly disorganised. There have been reports of possible health issues following the south-east Asian tsunami, including asbestos exposure at the Khao Lak site in Thailand. Recommendations for pre- and post-deployment medical evaluations are provided by Huusom, Agner, Backer, Ebbehøj, and Jacobsen (2012) and these should be followed.

As mentioned earlier in this chapter, the area used for post-mortem examination has to be adapted to the nature of the disaster. The space has to be sufficient to allow continuous work by all disciplines at the same time (Byard et al., 2006). Separation of the work space into clean and dirty areas for hygiene purposes is of vital importance. Hygiene items needed in the examination area are soap and hand sterilising gels. Handling of deceased bodies also includes heavy lifting and body lifts should be made available in all areas of work if possible. The area also needs sufficient lighting, heating and air conditioning units if required.

Working conditions can include physical as well as psychological strain. The possibility of a DVI team doctor (Byard et al., 2006) has been suggested. The confrontational nature of identification work has the potential to affect staff at the work site and a DVI team doctor could, in cooperation with the mortuary manager, play an important role in taking care of these individuals. Cultural and religious differences between team members working on site should also be considered to ensure a unified approach within the team and to eliminate conflicts within the team (Byard & Winskog, 2010a, 2010b).

32.9 Challenges

Disaster management and DVI operations are expensive events to operate and manage. The cost of engaging highly trained personnel is added to

by the costs involved in the set-up of new infrastructure including telecommunications, sewage systems and also more costly structures like temporary buildings and cooling facilities. Funding for DVI operations is often taken from the government budget but is very rarely planned for. This will often have a negative effect on departmental operations as no extra money is allocated to the departments involved in the management of the DVI operation. However, the costs do not only originate from actual events and operations. Maintaining a deployable operational unit between events with personnel and equipment that is up to date is not only a financial challenge to every organisation but also a demanding operational task. To achieve this, an active DVM group is required to ensure continuous funding and interest, in order to maintain a deployable unit. For certain areas and countries, this could mean that training of personnel, maintaining, and funding of the unit, could continue for several years without them experiencing an actual event.

Succession planning is also of vital importance and DVM should take every opportunity to introduce new personnel into the organisation. Transferal of knowledge has been shown to be beneficial in the development of younger or untrained individuals (Winskog et al., 2012). Older experienced staff should be encouraged to hand over the practical work to their younger colleagues. This can be achieved by hands-on training and practical exercises. DVM should, on a regular basis, run simulated scenarios to train personnel, and during these sessions the succession and introduction of new specialists should take place.

The phenomenon of uncontrolled access to DVI situations is one that is a recurring challenge. On several occasions in recent major disasters teams from various countries and forensic centres have appeared at the scene of a DVI within very short periods of time without having received a formal (or informal) request for assistance. Although these teams may be experienced in the field of identification and have previously been part of DVI events, they may have no experience in local conditions and may not even speak the

local language. It is also not unknown for such teams to have senior but inexperienced members who have initiated idiosyncratic practices that have resulted in quite significant problems. An example from the tsunami DVI in Thailand involved the unauthorised removal of mandibles and fingers from victims by one external team. An additional problem with these uninvited and rapidly deployed teams is that their presence may not be required as there are already sufficient personnel deployed. These teams all require food and lodging which may add considerably to the burden on already severely strained local resources. Introducing newly trained personnel into the system on a regular basis with strict deployment guidelines for each country and centre could reduce this type of recurrent unnecessary and counterproductive DVI 'tourism'.

It could also be a challenge for the DVM to ensure that forensic laboratories selected for identification work are appropriate, and that their standards and protocols are up to date. The scientific area of DNA examination is evolving at a rapid rate and new methods are developed continuously. On the local level, this is most likely easier to ensure as laboratories are often part of the forensic organisation of that area or state. However, when national laboratories that are located a considerable distance from where the DVM is located are utilised then problems might arise. This is definitely applicable to situations where laboratories are located in another country. Again, local legislation and other factors can influence the final result and a reporting structure from that laboratory, and constant communication, is a must to ensure that similar protocols are used when a DVI operation is initiated.

The safety and well-being of the staff involved in a DVI operation is of the highest importance. The DVM has to ensure that working conditions are safe and that personal protective equipment is available and used. The disaster zone can be located in various geographical locations including on land or under water (Winskog, 2012a, 2012b, 2012c), as well as in other hazardous surroundings such as a sinkhole, cave-in or landslide area. Dealing with disasters and large numbers of



Fig. 32.19 Sinkhole in Barbados 2007 killing a family of five presenting a hazardous working environment (Copyright: Authors' own image)

deceased individuals for identification purposes could involve work in a warfare region or in an area with an epidemic disease. The DVM group would have to plan for unforeseen events such as a typhoon striking an Ebola plagued village, or a civil aircraft being shot down in a warzone (Fig. 32.19).

32.10 Conclusion

Setting up a temporary emergency mortuary involves planning and future thinking. Already existing services like sewage and electricity has to be considered and local facilities should be explored. Location should be chosen so that security and logistics are not compromised as the final outcome of the entire operation can depend of the location of the mortuary. The practical part of the identification work is well described in the Interpol guide and this document should be used for all work involved in the operation. Using this guide can ensure that all personnel involved in the operation work according to the same routine. Challenges during a DVI operation can vary from logistical issues to staffing problems. It is of vital

importance to approach every mission with previous experiences in mind and to remember that the health and well-being of the staff is of top priority. In order to keep an organisation up to date and knowledgeable, simulated training sessions and specialised training should be conducted on a regular basis.

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Evaluating the Role of Forensic Anthropologists in Human Rights Investigations of Missing Persons

Roxana Ferllini

33.1 Introduction

The violation of human rights perpetrated by the State against their respective civilian populations occurred principally at the turn of the twentieth century, commencing with the Armenian genocide in 1915, which claimed over a million victims at the hands of the Ottoman Empire. This display of violence towards non-armed civilians was followed by the Holocaust during which the Third Reich directed mass killings against the Jews and other targeted groups within Europe in the 1930s and 1940s, claiming millions of lives. Subsequent to these two dominant events in the history of humanity, the violence did not subside, and for the next five decades, genocides¹, war

crimes² and crimes against humanity³ accompanied by acts such as torture, rape, forced disappearances through illegal detention and extrajudicial killings have taken place against religious, racial, ethnic or national groups. Most often these have been associated with civil wars and international conflicts.

Such brutal actions have elevated the death toll to unprecedented levels, making the twentieth century the most violent period in recent human history. Furthermore, towards the closure of the twentieth century, other factors were brought into play that affected the human rights of civilians. The steady process of globalisation has brought with it radical changes with respect to governmental policies, a shift which has affected in particular disadvantaged socio-economic sectors among nations across the board. Consequentially, circumstances concerning modern human slavery, human trafficking, the drug trade and femicide have been more predominant in certain parts of the world; these circumstances are often interrelated and occur

¹Genocide means the destruction in whole or in part of a national, ethnic, racial or religious group through a series of actions that do not necessarily include death, such as the transfer of children from their original group to another, or causing serious mental harm to the targeted group, and which does not necessarily have to take place in times of armed conflict.

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²War crimes are those that go against international law and can include unarmed civilians.

³Crimes against humanity are those committed as part of a widespread or systematic attack directed against unarmed civilians, with clear knowledge of the attack. Like genocide it does not need to occur in times of armed conflict.

simultaneously within a given national territory, or across international borders.

This current state of affairs has left in its wake mass graves and other contexts whereby bodies have been disposed of without any identity assigned. Under such circumstances, a multidisciplinary forensic intervention is ideal, not only to identify the bodies when possible, but also to process the scenes in an appropriate manner in order to reconstruct the respective scenarios. This provides the opportunity to more accurately comprehend the events that took place and obtain evidence that might ensure justice with respect to the abuse sustained by the victims. Yet, not all circumstances permit such results to be achieved successfully, as will be discussed further in this chapter.

Of particular interest here are the victims whose bodies require identification due to the condition in which they are discovered: decomposed, mutilated, burnt, skeletonised or, in certain circumstances, a combination of these. Under such conditions, special steps are required in order to achieve positive identifications through the efforts of a multidisciplinary team. In this regard, forensic anthropology plays a vital role, as the discipline deals specifically with the identification of human remains based on bone analysis, enabling identifications being made based upon the sex, age, stature, biological affinity (ancestry), and individualising traits of the victims found on key bone structures (Buikstra & Ubelaker, 1994; Byers, 2008). This permits a presumptive identification to be made, which may later become positively confirmed through various methods.

In the field, the forensic anthropologist is often required to assist when human remains are discovered commingled (Fig. 33.1) or dismembered, and where sorting out each individual body for the purposes of proper lifting and bagging presents a notable degree of difficulty. How many bodies are present? What is the proper mode of lifting and bagging for transport according to the condition of each body? In addition, there are circumstances in which the identification of human versus animal bones is required (Ferllini & Croft, 2009) before any proceeding can be made with respect to the rescue process.



Fig. 33.1 Commingled and incomplete human remains within a mass grave; a product of the Armenian genocide, Ras Al-Ain, Syria (Copyright: authors own image)

During the last 30 years, forensic anthropology has consolidated itself as an indispensable discipline in the investigation of human rights abuses and the identification of victims in order that they might be repatriated in many instances, and returned to their respective families.

In this chapter, the importance of a proper rescue of the victims, the use of population-specific standards and the crossmatching of information obtained via ante-mortem records and databases (in relation to the work conducted in mortuary), in order to arrive at a proper identification, is highlighted. Furthermore, emphasis is given to the adult body, as subadults require a more detailed process in order to accurately identify the individuals, a process which cannot be covered in the content of this chapter. Additionally, the geographical areas addressed specifically here do reflect the author's experience in Rwanda, Syria, Spain, Kosovo and Central America.

33.2 Background

Forensic anthropology as a discipline has been aiding law enforcement agencies since the 1940s, and gained a progressively stronger foothold through the years, especially after its intervention

in identifying the dead from the Korean War (1950–1953) and the Vietnam War (1965–1975), where the discipline fine-tuned many techniques, thereby developing new standards for human identification (Ferllini, 2014a; Stewart, 1979). By the 1990s, in the United States, forensic anthropology had become recognised within medico-legal investigations as a discipline that could offer indispensable value at crime scenes and at the mortuary.

The number of cases in which forensic anthropologists were involved increased through the years, embracing a wide variety of circumstances where identifications were required within ever more complex situations (Reichs, 1992). Although in the 1990s the application of DNA fingerprinting for positive identification was already in practice, its application was not as prevalent as a matter of course as it is today (Alexander, 2014).

In particular, the incursion of forensic anthropology into human rights investigations came about formally during the mid-1980s, after nearly 30,000 politically persecuted Argentines had succumbed to forced disappearances, were tortured in the hundreds of detention centres that were set up by the military junta, and suffered extrajudicial executions during a period known as the *Dirty War*, after a military coup in 1976, and which lasted until 1983. The body disposal varied, including clandestine burials in town and city cemeteries (Joyce & Stover, 1991). When democracy was established once again, an investigation into the disappearances ensued; yet the process was not conducted within a proper scientific context. Resultantly, the National Commission on the Disappearance of Persons (CONADEP) was created, and assistance from the American Association for the Advancement of Science (AAAS) was requested. The task required the search and location of the disappeared, also referred to as NN (no name). In 1984, American forensic scientists, including renowned forensic anthropologist Clyde Snow (1928–2014), became involved; in due course, Argentinean archaeologists, anthropologists and medical students were trained in the search, rescue and identification process, resulting in the

creation of the Argentine Forensic Anthropology Team (EAAF) (Booth Walling & Waltz, 2010; Joyce & Stover, 1991; Stover & Ryan, 2001). A contributing factor which supported the successful results during the work in Argentina was the utilisation of mitochondrial DNA (mtDNA) in order to identify the victims, since it has a better chance of being recovered from small or degraded bone, dental or other tissue samples than from nuclear DNA; furthermore, mtDNA is inherited only from the mother, meaning that any maternal relative can be used as potential reference to verify or reject a positive identification.

After the successful intervention in Argentina, the discipline took a strong hold in human rights investigations, through interventions into the disappearances from civil wars, dictatorships and genocides, as in Guatemala, El Salvador, Honduras, Colombia, Peru, the Former Yugoslavia, Spain, Cyprus, Sudan, Rwanda, Sierra Leone, East Timor, Iraq and Afghanistan, among many other countries (Ferllini, 2007; Juhl & Olsen, 2006; Mikellide, 2014). The results obtained, in most instances, helped to heal societies, and more specifically, family members, by enabling the receipt of the bodies of their loved ones for proper burial, a process which can permit a degree of empowerment. Furthermore, truth commissions benefit from such investigations, and tribunals can access the evidence gathered for the prosecution of the alleged perpetrators, and with certain circumstances, the affected survivors can enjoy transitional justice.

33.3 Contexts, Interventions and Challenges

There are various situations in which the investigation of deaths caused as a result of human rights violations is required and in which forensic anthropologists can play a key role within multi-disciplinary teams. Within the scope of this chapter, a series of chosen contexts are presented along with the challenges faced.

Although the incursion of the discipline in this area of investigation has existed for 30 years, as Rosenblatt (2010) points out, there remains the

argument of whether the dead have human rights, what these rights might be, and how the concept operates within the context of forensic investigations. The nature of this publication does not permit the rationalisation of different postures taken with respect to this subject; however, the focus here (as addressed in part by Rosenblatt's article, and the author's personal experience and position) is towards the dignity of the bodies to be rescued, for them to be afforded a dignified burial, and through these steps, the families' rights are met by knowing where their loved ones are.

In many circumstances, particularly within the context of violations brought about by governmental forces, including branches of the military, families can gain retribution via the process of transitional justice (Parent, 2010). However, this is not always possible due to barriers being raised by governments that do not wish to dig into the past. One such example is the case of Spain and the violations that occurred there during the 40 years of the Franco regime (1936–1939), which claimed hundreds of thousands of victims through torture and extrajudicial executions (Association for the Recuperation of Historical Memory, 2014; Ferllini, 2014b).

33.3.1 Genocides, War Crimes and Crimes Against Humanity

The identification process in human rights investigations—where the number of victims can run into the thousands, not to mention potential millions as a consequence of genocides, war crimes and crimes against humanity—must be specifically designed to manage the magnitude of the events' consequences in the way of human lives.

Within these contexts, the required investigations can be conducted by multinational teams put together by the United Nations (UN), through international non-governmental organizations (NGOs), or conducted by national organised forensic teams such as the Argentine Forensic Anthropology Team (EAAF), the Guatemalan Forensic Anthropology Foundation (FAFG) or the Peruvian Forensic Anthropology Team

(Equipo Argentino de Antropología Forense, 2014; Equipo Peruano de Antropología Forense, 2014; Fundación de Antropología Forense de Guatemala, 2014).

Independent of who conducts the investigations, the magnitude of the work required will dictate the number of personnel needed on the ground, although in some instances, due to a variety of circumstances, such as poor organisation or the lack of an adequate budget, the number might be reduced. This can result in the quality and speediness of the work being negatively affected. The work itself normally revolves around the location and retrieval of the victims, followed by post-mortem examinations and identification of each individual, through the involvement of social anthropologists, and forensic archaeologists, anthropologists, pathologists, radiologists, odontologists and DNA specialists, among others.

The initial steps, when possible, should include an investigation based on archival records, or oral accounts coming from survivors and other witnesses, the latter often obtained by social anthropologists. These can provide pertinent information as to who was detained or executed, where the mass killings took place, and where the bodies were disposed of, for example (Sandford, 2003). In circumstances where a considerable amount of time has passed, many of those who provide information do so based on oral accounts that have been transmitted from generation to generation (Ferllini, 2014b). Based on the author's experience, these type of testimonies can still be of enormous help.

Because the disposal of the bodies is accomplished through a variety of different means such as within mass graves, wells, caves, other structures, or simply dumped on the surface where the victims perished (Juhl & Olsen, 2006; Pečina, 2006; Simmons, 2002, 2007; Skinner, 2007), as stated earlier, it is ideal to have the forensic anthropologist in the field. This will aid in discerning individual bodies under difficult circumstances, especially when they are skeletonised and commingled. Additionally, it may be required, as a matter of control, to conduct a brief description of each skeletonised body by

determining sex, age and any observable individualising traits that might be present, based on the bones available for each individual, which can be cross-checked later at mortuary against the case number and mortuary results (Ferllini, 1999). In some instances, when the perpetrators actually bury their victims in public cemeteries, they sometimes retain records of the burials, as was the case in Argentina (Snow & Bihurriet, 1992), an example of the arrogance held by those who think of their actions as their prerogative. Nonetheless this record keeping aids in the identification process.

Within the context of genocide, the identification of each and every individual, although ideal, is not always possible⁴. In the case of the Armenian genocide, a forensic intervention was conducted in 2007 at a mass grave in what is now Syrian soil, 92 years after the events in question. This considerable time span, along with the mass deportation of the Ottoman Armenians into the desert areas by order of the Ottoman Empire, made it impossible to determine who the victims could be or their community of origin, in order to begin a research and identification process (Ferllini & Croft, 2009). On the other hand, when the attacks against the Rwandan Tutsis ensued in 1994 there was total mayhem, which caused family members to become separated; many attempted to cross the borders in order to save their lives, whilst others hid in forested areas, and within structures trying to escape the attacks, which placed the victims within contexts that hindered the identification process. When the genocide ended after 100 days of killing, approximately 800,000 victims had perished (Ferllini, 1999), and many communities throughout the country, as a whole, were totally destroyed and entire families killed. Although the forensic intervention was implemented nearly a year and a half afterwards through the UN and NGO Physicians for Human Rights (PHR), not all areas of the country could be examined, and as

such, a mass grave and areas surrounding Kibuye Prefecture were chosen as representative of the events, since it had been an area heavily populated by Tutsis, and the scenes had not been heavily disturbed. Even though the recovered bodies were profiled, it was nearly impossible to locate family members for purposes of identification, whether via DNA analysis or through the identification of personal items found in context with the victim.

The Rwandan exercise meant that the work on the ground was directed at gathering information at the scenes and information obtained through oral accounts, in addition to providing statistical data on the victims for the International Criminal Tribunal for Rwanda (ICTR). Under these circumstances, the analysis of the remains turned into a demographic exercise via identifying the number of victims recovered by sex and age, and the detection of the cause of death (Fig. 33.2) (Ferllini, 1999; Ferllini & Croft, 2009).

In the Rwandan case, the victims were reburied in one single site; in the case of the Armenian genocide, the victims were stored collectively. With reference to the victims of the Spanish Civil War, when discovered within a severely comingled context, whereby individual bodies cannot feasibly be separated, these are buried collectively, with the families' consent as is the present practice (Fig. 33.3).



Fig. 33.2 Three patellae identified from comingled human remains within an Armenian genocide mass grave at Ras Al-Ain, Syria, to serve as a demographic example but not for identification purposes (Copyright: authors own image)

⁴In forensic settings there are two types of scenes referred to as open and closed. Open scenes are those where there is no record of who the victims might be, as in genocides and the 9/11 attacks; while close scenes are those where there are records that attest who the victims are, as in the case of airline rosters when there is an air disaster.



Fig. 33.3 Collective inhumation of 10 victims killed by Franco's followers, Spain (Copyright: photograph courtesy of the Association for the Recuperation of Historical Memory, Spain)

Depending on the context and needs of each case, the post-mortem work is done under a variety of settings. The area of work can be a make-shift mortuary near the site where the bodies are found, as was accomplished at the Kibuye mass grave in Rwanda (Fig. 33.4) (Ferllini, 1999); in addition, these provisional mortuaries are sometimes mobile units which can be transported from one area to another as required, with basic but adequate equipment (Sprogøe-Jakobsen et al., 2001). On the other hand, local mortuaries can be utilised when present, and made available by local authorities; these would be fitted with extra infrastructure if need (author's experience in Kosovo).

33.3.2 Migration, Drug Trafficking and Femicide

Forensic anthropologists are typically associated with enquiries relating to human rights abuses within the context of the aftermath of genocides, war crimes and crimes against humanity; however, at present, such professionals are becoming more frequently associated with investigations relating to the deaths of civilians within the

context of migration, drug and human trafficking, and femicide; the latter contexts may, in some instances, be interrelated within a regional context.

Human migration across the world occurs for a wide variety of reasons, including such factors as severe socio-economic and political situations, where populations often live under serious deprivation, normally accompanied with brutal violations of human rights (Globalization 101, 2014; International Organization for Migration, 2014). In the current century, this problem has continued worldwide with serious consequences, as seen in migrating populations from Latin American, Africa, Middle East and Asia.

Within Latin America, population sectors from Central American countries are prime examples, as they are influenced by pull factors that drive them to the United States, in the belief of attaining a better quality of life. In order to reach the aimed destination, the main ways to cross the borders include on foot, or crossing difficult waters in crowded and unsafe vessels; other options are crowded trucks, vans or trains (Anderson, 2008; COFAMIDE, 2014a; Hinkes, 2008). As such, foreign nationals are willing to take serious risks that can cost them their lives; in particular, due to major moves taken at border controls, other routes must be chosen, which are not safe due to difficult terrain exposed to environmental hazards or which are rife with encounters with criminal elements and drug-trafficking activity. Such scenarios exist, for example, between the Mexican and United States border (among the 13 most dangerous border crossings in the world), and in the jungles along the Guatemalan and Mexican border (González, 2012; Hinkes, 2008).

According to The Economist (2014), organised crime groups dedicated to drug trafficking abound in Mexico and are extending their influence to other regions of Latin America. The impact that these groups have over the missing in Mexico cannot be underestimated; the number of individual victims of forced abduction and who are believed to have been killed has been reported at 21,000 as of 2012–2014; however the exact sources, how the figure has been tallied and who

Fig. 33.4 The temporary mortuary set up by Physicians for Human Rights in Kibuye, Rwanda (Copyright: photograph courtesy of Physicians for Human Rights, USA)



are exactly responsible for these crimes remain open to speculation, as Mexican authorities have not been transparent on this matter. Such criminal groups also extend their impact to migrants, many of whom are killed en route, or abducted.

Femicide is a crime defined as gender-based violence and it is a form of human rights abuse that retains a worldwide occurrence; yet, patterns are emerging in this century which relate this type of crime to drug and organised crime activities. A study conducted by Small Arms Survey (2012) indicated that the Americas have the highest incident of femicide per capita, putting Central America in third place within the region, with El Salvador and Guatemala in the lead; such areas are often plagued with drug trafficking under the hands of organised crime, and the involvement of international criminal gangs.

However, when statistical data is taken from regional areas within a given country, the number per capita can increase dramatically. A prime example is the hundreds of women that have been found murdered within and on the outskirts of the city of Juarez in Mexico, where the rate was 19.1 per 100,000 women during 2009; the women's bodies have presented evidence of rape, torture and dismemberment (Meyer, 2009; Prieto-Carrón, Thomson, & Macdonald, 2007). The investigation of these cases has required the assistance of forensic anthropology, including the participation of the EAAF, with the aim of

identifying the victims; however, less than half were identified. The process has been and continues to be rather difficult, as the State and local agencies do not cooperate in the investigations. Instead, the cases are muddled, in some instances producing misidentifications, and many of those involved in such enquiries are killed (Koutsoyannis, 2011).

If the region of northern Central America and Mexico is considered from the taphonomic point of view, the number of environmental factors can be problematic, especially when many of the victims are not buried but left resting on the ground surface. Examples include migrants who are abandoned, as a result of not being able to continue with the group.

In the case of foreign nationals found on the surface along the Mexican-United States border, in desert regions where the temperatures can soar up to 43 °C (Anderson, 2008; Fenton, Heard, & Sauer, 2008; Galloway, 1996), it can speed up the decomposition process, and the solar radiation can affect the bones once the body is skeletonised, making them brittle (Damman & Carter, 2014; Fenton et al., 2008). It can also alter the scene context and degrade personal items that the individuals might have been carrying, evidence which could potentially aid in the identification process. Depending on the post-mortem interval (PMI), if the body was skeletonised, the recovery of 100% of the body would not be possible

(Hinkes, 2008; Pokines, Symes, & Ropper, 2014) as there would have been an element of exposure to both scavengers and flash floods. In cases when the victims have been mutilated, burnt and then buried in mass graves, as has been witnessed in Mexico, the bodies may be discovered with little soft tissue present, comingled and incomplete (Animal Politico.com, 2012; Vulliamy, 2010).

Within such scenarios, the participation of forensic anthropologists would not only be necessary in order to determine the number of individuals present *in situ*, but also, when feasible, to aid in the bagging and transport of the remains as discrete bodies; once at the mortuary, a proper post-mortem examinations can ensue (Ferllini, 2007).

In these circumstances, the discipline of forensic anthropology is a valuable aid in the process of identification and eventual repatriation. Depending upon the regional legislation, the forensic anthropologist might work within the medico-legal office, as an academic offering consultations, or possibly an independent consultant.

In spite of the efforts applied by forensic personnel, and the help that relatives of missing individuals provide when possible, investigating the deaths and providing an identification for an eventual repatriation can be quite challenging. This is because forensic staff often have to deal with the lack of interest and the level of impunity which exists among police forces, and many governmental agencies in investigating such crimes; in many instances individuals have been bought and infiltrated by organised crime. As such, both the public and family members alike frequently chose not to come forth due to fear of reprisals from local authorities, or being uncertain as to who they can trust.

33.4 Forensic Anthropology and Identification

The identification process has many functions; principally, the deceased gains their identity back, thus permitting the repatriation/returning

process. Finally, the authorities are able to proceed with a judicial procedure when applicable, and/or bring in more evidence on an ongoing investigation. For these purposes, the intervention of the forensic anthropologist during the identification process is conducted within a forensic multidisciplinary scientific intervention including radiology, pathology, DNA specialists and odontology (Rosenblatt, 2010), along with information gathered from various sources concerning the missing, with the expectation of accomplishing a successful cross-check.

When the identification process commences, various steps are taken simultaneously: clothing and personal effects are noted, with the expectation that relatives and those who knew the victim might positively identify them. If there is soft tissue, the recognition of scars, moles and tattoos are assessed normally by a forensic pathologist. In the case of tattoos, if decomposition or mummification has set in where the details are barely seen, the use of hydrogen peroxide in a 3% concentration can make them visible (Haglund & Sperry, 1993). By analysing skeletal and dental remains through morphological methods (based on characteristics), metric or both, the aim of the forensic anthropologist is to arrive at a biological profile which comprises the determination of sex, age, ancestry (when needed), stature, and identifying individual traits (see Chap. 27 within this volume for an in-depth approach to the subject) (White & Folkens, 2005); such findings lead to a presumptive identification.

The standards to be chosen should, when possible, be compatible with the population to which the victim belongs, or better still, a standard that is population specific. However, on the whole, this is not the case with most instances, as victims who are usually in need of biological profiling belong to a population which has not been formally studied in such a context. This situation can cause skewed results (Djurić, Djonić, Nikolić, Popović, & Marinković, 2007; Ross & Manneschi, 2011; Ubelaker, 2008), frequently experienced by forensic anthropologists.

It should be highlighted that when the deaths are associated with State-sponsored killings

directed against a known group, the determination of ancestry is not normally required as the population is documented. However, in certain instances, situations may arise where a distinction must be made between individuals belonging to closely related genetic populations, and based upon bone structure a division between ancestries would not be feasible (Spradley, 2014); it is here where material culture (typical ethnic wear, religious artefacts, items in certain language, and currency) associated with each of the bodies can be of aid in making a separation between ethnic groups (Ellis, 2007; Komar & Lathrop, 2008). This is of help when human remains are discovered along international borders, or within a country where a large geographical region encompasses a variety of ethnic groups; furthermore, it can also aid in distinguishing migrants from remains found in similar areas, but who are nationals who happen to be victims of foul play.

33.4.1 Sex

Determining the sex of an individual is accomplished via the sexual dimorphism⁵ present upon the bones relating to both size and morphology; yet because forensic anthropologists working in human rights investigations face working with remains belonging to a variety of populations, it is of the utmost importance to keep in mind that the differences between the sexes varies from one population to another, in order to avoid serious mistakes (Ferllini, 1999).

33.4.2 Age

The estimation of age with respect to foetuses and juveniles is rather precise, as the develop-

mental stages present in bone and teeth occur at specific times associated with age (Baker, Dupras, & Tocheri, 2005; Fazekas & Kósa, 1978), whilst in adults, the developmental process has ceased, creating difficulties with respect to pinpointing an age within a narrow range; furthermore, the older the individual is, the age estimation falls within a wider range, hence the process becomes progressively more challenging. Because of such difficulties, it is advised to retain an overall approach which examines the entire body, and applies all the indicators feasible as a matter of standard practice (Baccino, Ubelaker, Hayek, & Zerilli, 1999; Gupta, Rai, Kalsey, & Gargi, 2007; Merritt, 2013). Once the results are at hand, an age range can be obtained. If there is a wide age discrepancy between the result obtained from one technique or another, a closer look must be taken to see if human error was at issue, or if there was another reason, including the involvement of a pathology (Faria, Andrade, & Cardoso, 2010).

However, there are some areas in the skeleton that continue to modify as the body ages, which can be described as a metamorphosis, where the changes are divided into age phases for an easier way to determine the age at the time of death. Amongst such bones is the pelvic girdle with the pubic symphysis, auricular surface and sacrum; the sternal end of the clavicle; and the sternal end of the fourth right rib (İşcan, Loth, & Wright, 1984a, 1984b; Katz & Suchey, 1986; Lovejoy, Meindl, Pryzbeck, & Mensforth, 1985; Passalacqua, 2009; Webb & Suchey, 1985).

The use of dental remains can be used to age adults when applying the Lamendin's dental ageing technique, which has been reported to be useful on different populations (Ubelaker & Parra, 2008). This method consists of assessing the translucency of tooth root, root height and the degree of periodontosis (recession of the gum line) in single rooted teeth (incisors, canines and premolars) to obtain an age estimation; however, poor oral hygiene, dental decay and odontological intervention can affect the analysis (Lamendin et al., 1992).

⁵Sexual dimorphism is caused by the hormonal differences between males and females. This causes males to be bigger and more robust, although there are always exceptions to the rule (Mays, 2010).

33.4.3 Stature

On stature estimation, here too it is important to discern which formula is to be used, as such formulae have been created based on population-specific samples, and are sex and ancestry based. Furthermore, it must be kept in mind that populations can go through a series of changes in maturation rate and height due to the effects brought on by secular, environmental and genetic factors (Jordan, Lim, Seubsman, Bain, & Sleigh, 2010; Klepinger, 2001); therefore, formulae that are based on contemporary samples are desired. On the other hand, not all populations have been studied, and therefore, when choosing a formula, one needs to know what has and has not worked in the past. Yet, there are circumstances, such as the case of the Rwandan genocide, where the population had never been subjected to an anthropological analysis, and as such, the decision as to which formulae were selected had to be taken with care (Ferllini, 1999), with experience in such circumstances being of utmost importance. Moreover, a multitude of Middle Eastern and African populations have not been adequately studied to date from the view point of developing specific databases; this constitutes a concern based upon the degree of violence present within these geographical regions, where future interventions on the part of forensic anthropologists are to be expected.

33.4.4 Individualising Traits

Within situations in which the bodies are similar with respect to profiling characteristics, the identification process has to rely on more detailed characteristics, in order to distinguish each individual (Fenton et al., 2008; Macaluso & Lucena, 2014). Not all individuals present distinctive characteristics, but when present, individualising traits can be a positive aid. These are expressed within the skeleton and so the forensic anthropologists can add such data to the biological profile, thereby augmenting the identification process, as these are unique to a particular individual.

Among such traits is evidence of ante-mortem fractures, and dental and bone variations which can be quite minute and subtle, as well as congenital or pathological markers (Stephan, Winburn, Christensen, & Tyrrell, 2011; Watamaniuk & Rogers, 2010). Of specific interest is the frontal sinus, which in some cases has been used for the purpose of positive identification, as it is unique in each individual, including among monozygotic twins. With experience and access to ante-mortem medical images, whether from traditional X-rays or more modern technologies such as computer tomography (CT scan), a comparison can be made and a match made possible, even on fragmentary remains (Deog-Im, U-Young, Sang-Ouk, Dae-Soon, & Seung-Ho, 2013; Owsley, 1993).

Another technique utilised is photo-skull superimposition, a technique created in 1937 in Scotland, with the aim of tracing the contours and particular bone and frontal dental characteristics through a 2D image, in order to arrive at an identification (Taylor, 2001). Today, with the aid of sophisticated camera and computer technology, the use of photographic superimposition with craniofacial remains is possible by mixing both images in a 3D format; furthermore, computer technology allows the addition of flesh to the craniofacial image, in order to accurately recreate the dead person's face (Fenton et al., 2008; Guyomarc et al., 2014; Ubelaker & Scammell, 1992); such techniques can be conducted by forensic anthropologists who have specialised in these fields. Further information about facial reconstruction can be found in Chap. 28 in this volume.

At times, the process gets caught in a situation where a crossmatch between the biological profiling and the list of the missing is needed, in order to attempt to locate ante-mortem data, and to verify readily visible characteristics (see Chap. 27, this volume). Nonetheless, it should be stated here that within the human rights contexts herein addressed, there is a drawback with utilising ante-mortem information, as many do not possess ante-mortem medical or dental records. In the experience of the author, in developing countries, the process of obtaining ante-mortem

medical and dental records can be most problematic, either because such records were never produced, or because they may have been retained for a minimal period of time, and then discarded. Yet, when ante-mortem records are available, matches or exclusion processes can be achieved. Equally if dental work is found in a victim, odontologists⁶ can make comparisons with ante-mortem records, which, if a match is made, is considered a positive identification (Senn & Weems, 2013).

One technique that can help investigate the area of origin of a given individual and locate possible relatives is the analysis of strontium, which contains a stable isotope that is geographically associated, and is absorbed in the body via the small intestine when consuming food and water; strontium is stored within the body's hard tissues, such as bone and tooth enamel. Because bone remodels itself every 10–15 years, strontium recovered from this tissue is viable for determining the individual's place of origin and mobility for periods of up to 15 years, albeit with a somewhat limiting time span. On the other hand, because dental enamel, once it is deposited during childhood, is retained permanently throughout the individual's life, determining a person's residence and geographical displacement can be achieved in the time which has elapsed since the individual's developmental years (Beard & Johnson, 2000; Juarez, 2008; O'Reilly, 2006).

An example of its application in a human rights context is found in the Balkans after the war in the 1990s. During the armed conflict, a great portion of the population in the region became displaced and later on killed; as part of the identification process, the use of stable isotopes have been used by the International Commission on Missing Persons (ICMP) on bodies recovered from various sites, in order to ascertain the geographical area from where each

of the victims came from (National Policing Improvement Agency, 2011; Swift, 2004; Chap. 29, this volume).

33.5 Positive Identification

In today's climate, rarely an identification is accepted if it is not a positive identification through adequate testing, yet there are instances where a presumptive identification is accepted to determine the identity of an individual (Ferllini, 2014c) (Fig. 33.5); this type of decision depends on what is acceptable and customary within the legal parameters of the country where the post-mortem analysis is carried out, and the context of the particular case.

The cost of DNA analysis has made this technique more accessible through the years, yet, traditional techniques are normally sought before a test of DNA is conducted with the aim of obtaining a positive identification (Baraybar, 2008). Part of this decision is due to the fact that a biological profile compiled by a forensic anthropologist signifies less cost for law enforcement agencies, and aids in guiding the investigation, as it provides a description of the victim to be matched with descriptions of known missing persons; this obviously is rather important when DNA databases are non-existent.



Fig. 33.5 Personal items found within a closed scene and associated with a body, which can be used for a presumptive identification, Spain (Copyright: photograph courtesy of the Association for the Recuperation of Historical Memory, Spain)

⁶Forensic odontologists in many instances can be absent during the post-mortem examination. Those who are not professionals in this field should not attempt to do the cross check between ante and post-mortem evidence (Skinner, Alempijevic, & Stanojevic, 2010).

Within the framework of those who fall victim to organised crime, including the drug trade and gang activity, a platform that can aid the identification process of the missing is the creation of organisations which help relatives in the search for their loved ones, and those that set up databases to gather the required information describing the characteristics of the missing (Spradley, 2014), including the relative's DNA. Among the groups that have been created are the Committee of Relatives of Dead and Missing Migrants of El Salvador (COFAMIDE, 2014b) which gives moral and legal support to those who are searching for the missing, the "Freeing up Hope" Caravans organised by Jesuit Service for Migrants, and the Meso-American Migrant Movement by members of the Franciscan order, among others. Aided by such organisations, Central American women travel north in search of their children who have not been heard from for considerable periods of time, and when foul play is suspected or confirmed (González, 2012). Those individuals that are located alive are of immense aid in giving information relating to the events that lead to the death of those they knew along the way, where the bodies are located, and in recognising facial reconstructions.

DNA banks created to facilitate positive identification of the bodies, as the EAAF's Border Project was established to create a regional platform between missing migrants and unidentified remains from Central America, Mexico, and the United States; additionally, in partnership with governments and NGOs, DNA banks have been created for this goal (Godoy, 2011; Reineke, 2013), and many positive identifications have been achieved. In Mexico, since 2002, a national genetic bank was established to aid with the increasing number of migrants, kidnappings and drug-related crimes that have taken over the country, and which continue to worsen. However, the project has not been as successful as was expected; according to Rea and Martínez (2014) a total of 25,885 samples of DNA have been stored from Mexican families, in addition to those of other nations, yet only 542 hits have been made in the 12 years that it has been in operation, with some bodies having been returned to

the wrong families. Such deficiencies are attributed to the lack of an efficient forensic service, including cases in which the chain of custody has been effectively overseen.

33.6 Discussion

As can be appreciated from the contexts highlighted within previous sections, investigations relating to human rights violations normally work within a context normally which is referred to as an open scene, that is, a number of victims who lack confirmed identity. Furthermore, some scenes may contain bodies which may have been deposited at different times, hence resulting from different events. Such situations potentially compound the difficulty of affecting accurate identification, even where a multidisciplinary approach has been applied.

Because of such circumstances, the input of social anthropologists constitutes a vital element of the investigative and identification process (see Sect. 33.3.1). They are able to gather data concerning the victims, e.g. events prior to them going missing, physical characteristics, clothing that they were wearing, contextual details relating to their disappearance, if others were accompanying the victim at the time of their vanishing, and if there are any ante-mortem medical and/or dental records available. Yet, it must be kept firmly in mind to carefully weigh the informant(s) point of view if no formal records are available; what is the age of the missing person perceived as being? How closely is the stature estimated? When differences in language arise, the communication process must be done carefully in order to avoid difficulties in interpretation due to the relative nuances of cultural linguistics (author's experience). Realistically, situations will always be encountered in which the information sought is not available, or not enough to aid in a lead of who the victim or victims might be. DNA databases can be of help, but as illustrated in Sect. 33.5 it may not always constitute a successful approach, but in reality, might appear as a limited exercise.

Profiling human remains during human rights investigations can be a challenge to the forensic

anthropologist, as the victims which are typically associated with such situations normally hail from populations covering wide geographical areas which are typically not comprehensively studied; therefore, properly developed standards do not typically exist which could be effectively utilised in order to determine biological parameters as relates to sex, age and stature (Kimmerle, Jantz, Konigsberg, & Baraybar, 2008). In other words, the reference sample in the standards available for use during a post-mortem analysis might not accurately reflect the population to which the victims belong. Within the context of such situations, the results obtained may be skewed; as a consequence, when attempting to eventually cross reference the accumulated traits obtained with the list of missing individuals, negative results are frequently encountered.

Because best practice must be exercised by forensic anthropologists when choosing the biological standards which most accurately represent the population from which the unidentified individual might belong, the positive side to this quandary is that a growing number of professionals in the field are conducting research in countries where local standards were not previously available. This promotes new standards in morphological and metric analysis as seen in Bosnia, Spain, India and Guatemala (Gupta et al., 2007; Ríos, 2005; Sarajlić & Cihlarž, 2007), among others. Part of this progress is due to advances in modern technology, such as CT scans, where contemporary populations can be analysed (Bulut, Sipahioglu, & Hekimoglu, 2014; Ferrant et al., 2014) without having to rely on human remains, access to which may be highly restricted in some countries. The extent by which research is relatively conducted depends upon the individual country's legal premises. Within the context of the United States, research is widely used in the field of forensic anthropology, as legislation permits the use of human remains for the purpose of such work; conversely, in the legal framework of the United Kingdom, legislation is far more restrictive relating to such matters, and resultantly, research in these areas is not on par.

33.7 Conclusion

Human rights abuses continue to occur openly in various regions of the world; within the region of Central America and Mexico, increasing numbers of individuals are going missing due to the escalation of a variety of criminal activities (Godoy, 2011). As such, the need for forensic interventions will be felt with even more urgency as such situations inevitably worsen, due to the massive levels of criminal and State impunity to be openly witnessed in countries such as Mexico, elements which continue to hinder the identification process (Trejos, 2014).

Due to the osteological knowledge that forensic anthropologists possess, in addition to training and experience in relation to taphonomic factors that can affect a scene and bodies alike, these individuals comprise an important element of field investigations, particularly when remains are discovered skeletonised and commingled. Furthermore, the retrieval of human remains from difficult settings can also be aided by such professionals.

Every effort must be made to improve the standards applied in forensic anthropology, and to assist organisational groups and genetic databanks in improving their results in a positive and timely manner. In the 30 years since the first human rights interventions in Argentina, forensic anthropology has solidified its position and broadened its participation as exercised by organised investigative teams, aiding not only in the identification process, but also in the field, during the exhumation and lifting of human remains.

Furthermore, forensic anthropological work can be key in facilitating transitional justice to members of societies which are moving toward stability, democracy and a fair justice system. During investigations in which the victims' bodies have been recovered, but the exiting judicial system has not dispensed transitional justice in the process, one of the positive ending elements which is provided is the simple result of having their loved ones returned, and permitted the dignity afforded by a proper burial.

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The Investigation of Historic Missing Persons Cases: Genocide and 'Conflict Time' Human Rights Abuses

Caroline Sturdy Colls

34.1 Introduction

The twentieth century has been described as the 'age of extremes' (Hobsbawm, 1994) due to the large number of cases of genocide and human rights abuses during 'conflict time' (Baillie, 2012). All around the world, acts of mass violence on the grounds of racial, ethnic, political and cultural differences were perpetrated, resulting in the forced disappearance of tens of millions of people. This followed the turbulent nineteenth century, during which colonialism and prejudice led to mass violence. In the twenty-first century, human rights abuses have taken new forms as a result of terrorist activity and radicalism. Genocide and human rights abuses are defined by their focus on mass destruction, injury, the removal or limitation of basic human needs (e.g. food, water, hygiene facilities, adequate living and working conditions, access to medical equipment), forced labour, forced transfers and measures to prevent births (United Nations, 1948). Genocide and human rights abuses will often also include the destruction of cultural property and limitations

on cultural and religious life, although this has not yet been ratified by law (Lemkin, 1944; Sturdy Colls, 2016a, forthcoming).

In some countries, systematic methodologies have been developed in order to locate the bodies of missing persons, resulting in the successful identification and reinterment of these remains. Additionally, there are now a broad range of techniques available to forensic archaeologists, anthropologists, pathologists and other scientists that can aid in the search, recovery and identification of other types of buried or concealed evidence. The successful application of these approaches has been demonstrated in domestic missing persons cases in many countries—in particular, the UK, the USA and The Netherlands (for examples, see Chaps. 18 and 27; Groen et al., 2015; Hunter, Simpson, & Sturdy Colls, 2013). Since the late 1990s, they have also been widely applied to the investigation of genocide, e.g. in Bosnia-Herzegovina, Croatia and Kosovo (as part of searches for victims of the Yugoslav War), and in the aftermath of terrorist attacks, e.g. following the World Trade Center 9/11 attacks in the USA (for examples, see Chaps. 31–33; Budimlija et al., 2003; Hanson, 2015; Hanson, Rizvić, & Parsons, 2015).

However, there are many cases in which the victims of genocide and human rights abuses are still missing decades and even centuries after the crimes were perpetrated. Although, in some cases, this is due to successful attempts by perpetrators to hide their crimes, the main reason why

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missing persons remain missing is because no or little attempt has been made to find them. There are a number of complex reasons why this might be the case, many of which will be discussed in this chapter. There has been little discussion in published literature about the lack of parity between investigations of historic genocide and human rights abuses worldwide. Previous studies have tended to focus on one particular crime, rather than considering the broader temporal and spatial connotations of missing persons investigations in these contexts.

This chapter will consider the various reasons why search and recovery programmes might not be undertaken, with a particular focus on twentieth century mass violence, on the basis that it is important to understand these issues if we are to move forward with missing persons investigations relating to historic crimes in the future.¹ Prior to this, the first part of the chapter will consider the impact of long-term missing persons cases relating to historic acts of mass violence on the families and communities of the missing. It will also review the widespread political, social, ethical, cultural and religious issues that practitioners attempting to engage in such investigations should consider prior to formal initiation of an enquiry. In the author's experience, being aware of these issues prior to initiating investigations has facilitated search and recovery programmes in areas previously averse to such work. It has permitted the development of more suitable field methodologies and allowed work to be carried out ethically and sensitively; an approach that is absolutely necessary in environments that are still often divided and fragile. The chapter will conclude with a series of recommendations for the future, centred around a number of case studies. It is the intention of this contribution to demonstrate that there are now a wide range of interdisciplinary techniques that can be drawn upon to locate body deposition sites in such a way that the sensitivities surrounding mass violence can be accounted for.

¹Of course, this discussion cannot possibly capture all of the nuances involved in the study of socio-historic conflict and it is recommended that practitioners who intend to initiate investigations examine the case-specific issues that surround the event with which they are concerned.

34.2 Missing 'The Missing'

Because of the toll on people and their environment, genocide and human rights abuses fracture societies. Many societies that have experienced these crimes will never truly recover. However, finding out what happened to the missing is usually regarded as an essential step in post-genocide rebuilding. When a missing person is known to be deceased, the importance placed upon finding their body is likely to be considerable. This issue was extensively discussed by Williams and Crews (2003) and in the context of domestic cases in Chap. 9 in this volume, but it will be briefly readdressed here in light of recent advances in developing ethical approaches to the investigation of mass violence. In short, finding the body of a loved one will usually be seen as an essential part of the grieving process, religious life, social justice, remembrance and ensuring the crimes are not forgotten.

34.2.1 Cycles of Grief and Hope

When missing persons are known or suspected to be deceased, even after a long time has passed since a person disappeared, the importance of locating a body will not diminish. In many cases, the sense of urgency will actually increase on the basis that those who knew the deceased wish to find out what happened and provide an adequate burial place for the missing in their own lifetime. As observed by Holmes (2008) in domestic missing persons cases, family members' lives will likely become consumed by the uncertainty surrounding what happened to their loved ones and they may become trapped in a cycle of grief and hope (see also Chap. 9, this volume). The same patterns can be observed with disappearances in the course of mass violence and they may be exacerbated in the absence of multiple family members and friends. As Kumar (2001, p. 70) notes 'in psychological terms, the mourning for a person who has "disappeared" is more attenuated than for a person who is known to be dead, even where that person died a violent death'. The failure of governments and other agencies to undertake searches for missing persons will often

exacerbate the anguish felt by relatives; anguish that the fate of their relatives is being forgotten or deliberately ignored, that the evidence of the crimes have not been laid bare and that their community remains marginalised. For example, the wives of the men who went missing during the war in Lebanon from 1975 to 1990 describe the additional distress caused by the government's failure to initiate searches:

'I never imagined that we'd hear nothing about him. I was hoping that he'd come back, despite fearing that they might tell me he was dead or in Israel...Why won't they tell us whether they are dead or alive? This was always on my mind...and I still wonder if they're dead? Where are they buried?' (Yakinthou, 2015, p. 4).

Family members of people taken during the Spanish Civil War described the ongoing pain felt by many members of their family, 90 years after the conflict began:

'To her last, my mother bore the anguish of not knowing what had happened to Jesús. She yearned to meet the child that they had stolen' (Burnett, 2009).

As Renshaw (2010, p. 50) reports:

'The Argentinean writer Ernesto Sabato said "the dead die once, the disappeared die every day". It [the failure to find missing persons] is an ongoing crime and this maintains a state of active tension between a population and its government'.

When relatives decide to give up their search, or where descendants for whom the crimes perpetrated are in living memory pass away, the effects of genocide and the uncertainty surrounding missing persons may still remain for generations thereafter. The child of a young woman who went missing during the conflict in Nagorny Karabakh in 1993 echoes the sentiments of many child survivors:

'the worst thing about this pain is that the more you grow up, the stronger it gets. The fact that you have no mother and there is no idea of what has happened to her really kills' (ICRC, 2015e).

Others may be in denial or feel that they are in a 'painful limbo' because the fate of their relatives remains unknown. This is particularly prevalent in cases where murders, people trafficking, forced labour and child kidnappings occur simultaneously. In these cases, the possibility that

individuals may in fact still be alive cannot be ruled out until evidence, e.g. a body, is found to the contrary. A recent case in Argentina—where Ignacio Montoya Carlotto was found alive, 36 years after his pregnant mother was taken by a State death squad—aptly demonstrates that some long-term missing persons cases can sometimes result in families being reunited (Güni, 2015). In other cases, relatives may assume that their loved ones are deceased given the amount of time that has passed without their safe return:

'My grandmother lost her partner in World War II in a concentration camp... the way that she came to the knowledge that he was killed was quite simply that he did not return after the war...So from a very early age I was conscious of this issue, of missing people who disappear and are never seen again' (Courtney Angela Brkic, 1997).

In the absence of calls by family members to initiate searches, it becomes easier for governments to avoid identifying the fate of missing persons.

34.2.2 Individual and Community Activism

If survivors, family members and communities feel that there is a lack of interest in pursuing searches for missing persons, they may become activists or initiate their own investigations (Chap. 9, this volume). This is particularly prevalent in relation to historic cases of genocide and conflict, since they may feel that these are the only potential options which may lead to the successful identification of graves.

Advocacy of Truth and Reconciliation Commissions, within whose purview searches for graves would be undertaken, has been particularly common. Following the creation of such a committee in South Africa, many African countries have stressed the need for a similar approach in relation to genocide and conflict in their own territories. For example, in Namibia, the 'Breaking the Wall of Silence' committee has suggested a similar approach and, in the absence of a government-led commission, has sought to raise awareness of the crimes perpetrated by the Swapo leadership, most notably the torture and

killing of 700 detainees in Angola in the 1970s and 1980s (Melber, 2003; Saul & Leys, 2003). However, they have faced resistance in the form of a lack of cooperation from the Swapo government, who have repeatedly failed to open their archives concerning these events. In the decades after the Second World War, several searches for mass graves of victims of Nazi and Soviet terror were initiated across Europe because of repeated calls by relatives to find the graves of their loved ones (Mant, 1950; Rosensaft, 1979; Sturdy Colls, 2015a, 2015b). Likewise, in Bosnia-Herzegovina, families continue to be activists in order to ensure an ongoing commitment to searches and exhumations, although many argue that:

‘we don’t need any more commissions or any other new institutions in addition to the ones we have. We only need those which already exist to carry out their work properly’ (Adisa Tihic in Djokic & Ker-Lindsay, 2010).

Organisations such as the International Committee of the Red Cross (ICRC) and Human Rights Watch have worked with relatives across the world to document genocide and mass violence, and advocate the need for scientific investigations into the atrocities.

Ongoing pressure by family members may eventually result in commissions being created and, ultimately, searches being carried out. The recent examples of exhumations of mass graves from the 1965 to 1966 conflict in Indonesia (McGregor, 2010), the 1982–2000 episodes of mass violence in Peru (Latrobe, 2008), the 1936–1939 Spanish Civil War (Renshaw, 2011) and Communist-era mass graves in Eastern Europe (Jankauskas, Barkus, Urbanavičius, & Garmus, 2005; Ossowski et al., 2013; The New Observer, 2013), provide just a few examples.

If relatives feel that the authorities are not doing enough to initiate investigations, it is not uncommon that they will carry out their own searches. Countless examples of this can be cited here from the Holocaust (Sturdy Colls, 2015a, 2015b), Rwanda (Totten & Ubaldo, 2011), Bosnia-Herzegovina (BBC, 1999) and Iraq (Steele, 2008) to name but a few. In 2009 in Timor Leste, veterans instructed the army to begin exhumations of the bodies of those who

died during the Indonesian military occupation from 1974 to 1999 in the continued absence of a cross-government initiative to undertake searches (Kinsella & Blau, 2013).

Whilst exhumations like this may result in discoveries and reburial, in the absence of qualified forensic or archaeological practitioners, evidence will be lost, remains may be damaged, identities will unlikely be confirmed, misidentifications may be made and people unaccustomed to handling corpses will be confronted with the remains of the dead. All of these instances could be avoided if methodical, scientific investigations were initiated.

In a more ‘forensically aware’ era, family members may resort to alternative methods in an attempt to initiate searches for the missing. The author regularly has letters and emails from family members of Holocaust victims who send photos, maps and documents in the hope that additional information about burial locations can be provided and that archaeological work will be undertaken. In relation to historic genocides and conflict where prosecutions of offenders are unlikely to be undertaken, archaeologists may find themselves subcontracted to undertake search and recovery efforts by families (Case Study 34.1).

34.2.3 Impact on Communities

Because of the nature of mass violence, cycles of hope and anguish are also often experienced on a larger scale by the wider communities from which the victims came. This can result in short- and long-term epochs of demographic, social and economic stagnation followed by equally varied periods of unrest and renewed attempts to encourage search efforts. For example, in Srebrenica in Bosnia-Herzegovina, the wives and mothers of men thought killed by the Serb forces in 1995 (but whose bodies have never been found) continue to be affected by the absence of several generations; children are without their fathers, families are without their chief earners, women are without children and the community is defined by ambiguous loss. Likewise, the community in mourning continues to be placed on a world stage during the

annual burial services that are held in Potačari cemetery for the victims that have been identified in the course of the year. Kumar (2001, p. 71) provides a detailed overview of the economic, social and psychological impact of mass violence during civil wars on women in Bosnia-Herzegovina, Cambodia, Georgia, Rwanda and Guatemala, noting of the latter country:

'in traditional Mayan society, widows normally have a sanctioned status within the community, where they enjoy respect and support. However, the complex and seemingly arbitrary nature of the violence stigmatized many war widows who, as a result, did not receive the economic and emotional help they needed from their villages and extended communities'.

This problem was compounded when the bodies of the missing men had not been found. This is reflective of many societies throughout the world where the failure to locate the body of a missing person will prevent a legal declaration of death and the associated support that should follow this. The presence of suspected, but unconfirmed, clandestine burial sites and the fear of disturbing human remains may also present economic inhibitors, as areas of land may be designated as unavailable for development or agricultural activities. For example, in Zimbabwe, a large number of burnt houses and mass graves exist as a result of mass violence since the 1960s (Silika, 2015). Access to these areas in general (as well as for development purposes) has been restricted due in part to a fear that the spirits of the dead haunt them (Fontein 2010). This situation is certainly not aiding the country, which is already suffering extreme poverty, famine and drought. In Guatemala, many women 'report ongoing and imperative dreams' in which 'the spirits [of the deceased] cannot be disposed of—they form a new sort of patrol, becoming another terrifying presence, persecuting the living' because exhumations and reburials according to religious rituals have not taken place (Kumar, 2001, p. 70). Many families want graves to be found and are haunted by the fact that the remains of their loved ones are within collective graves dug by the perpetrators. Following the recent exhumation of her father's remains, Ascension Mendieta stated:

'it has always troubled me how he may have fallen into the grave—face up, face down...Now we can give him a decent burial like everyone deserves. Not just dumped in there like a dog' (Reuters, 2016).

The fear of hauntings by the deceased, the creation of liminal spaces where people dare not go, and inhibitors to economic and social life are common bi-products of mass violence across the world when graves have not been officially located, exhumed or marked (for further examples, see: Ukraine in Desbois, 2008; Poland in Sturdy Colls, 2014, Chaps. 4–5; for Romani fears relating to ghosts and burial sites, see Kigar, 2012).

34.2.4 Religious and Cultural Considerations

The right to have a marked burial site, in accordance with one's religious customs, has been recognised as a primary human right (ICRC, 2015a; Roagna, 2012). Yet, this right has not been afforded to millions of people that have died in the course of historic acts of mass violence. This can have a considerable negative impact upon individuals and communities. For example, in Guatemala, the failure to locate the graves of the missing has means that 'survivors are unable to establish the post-life relations with loved ones that are essential to the maintenance of family and community coherence' (Kumar, 2001, p. 70). If a formal burial service has not been carried out to mark the passing and internment of the deceased, this can cause significant distress to family members and lead to long-term fears about the fate of the deceased in the afterlife (when the latter is believed in) (Green & Green, 2006).

Forensic archaeological and anthropological methods can facilitate the location of burial sites so that victims of human rights abuses can be afforded a funeral or commemoration service in accordance with their religious beliefs. However, in order to do so, renewed search and exhumation efforts must be handled in such a way that the religious and cultural beliefs of the people with a connection to the atrocities are considered. For example, in Jewish culture, the desire for a 'perpetual burial place' means that disturbance of

bodies buried within graves is strongly discouraged by Halachic Law, regardless of whether they were interned there legally or illegally (Christians, 2008, p. 8). Less Orthodox Rabbis have permitted exhumations, allowing remains to be moved if they are being reburied in Israel or if they are under threat from disturbance (Sturdy Colls, 2015a, 2015b, Chap. 3); thus demonstrating that, even within the same religious group, opinions concerning death and burial may be markedly different. There is also likely to be variation amongst different sects of the Christian faith. Although, as a general rule, Christians believe bodies should be buried in sacred ground, exceptions may be made if it is felt that the excavation of human remains is disrespectful or when sites of mass violence, because of their nature, are co-opted as sacred spaces (Sturdy Colls, 2015a, 2015b). Cultural approaches to death and burial must also be considered and, with many tribal cultures in particular, it should not always be assumed that these beliefs will be written down. In many religions, there are strict laws about having contact with the deceased and so practitioners must consider where bodies will be stored if exhumations are to be carried out (Green & Green, 2006; Perera & Briggs, 2008). The latter is particularly important in Hindu and Islamic culture. It is also important to have plans in place which make it clear what scientific investigations will be undertaken post-exhumation and at what point remains will be released to families for religious ceremonies to begin. Certain religions may object to scientific testing of human remains, e.g. Jehovah's Witnesses, Judaism and Islam, although positions on this may vary in cases involving unlawful killings and so these issues should be discussed with local leaders before investigations are carried out. This approach is necessary in relation to all stages of the search and recovery process.

Good communication with communities and families is vital. It should not simply be assumed that families will want exhumations, nor that particular religious customs should be followed. For example, for some people, the prospect of disturbance of the grave through excavations and exhumations further adds to the trauma they have experienced. Rose Marie Mukamwiza and

Emmanuel Murangira described how they have witnessed survivors becoming hysterical at reburial services in Rwanda because they believed that what they were witnessing was the massacre of the victims themselves (Totten & Ubaldo, 2011, pp. 33 and 93). For others, it disturbs or violates the deceased. Methodologies should be developed with local religious and cultural beliefs in mind, accounting also for the fact that the law may override religious objections or wishes. Long-term plans must be put in place before investigations begin in order to ensure the appropriate treatment and commemoration of victims. If bodies are to be exhumed, how will they be handled? How will scientific process account for religious and cultural beliefs? How will remains be analysed? What are the implications of the investigation for religious and cultural beliefs? How and where will they be reburied? What access will family members have during this process? How can science and religion work together to competently and ethically resolve the fate of missing persons? Who will care for the burial site in the future? How will the process of identification be handled? How will any ethical issues that arise in the course of genetic testing be approached? These are just a few of the vital questions that must be posed before, during and after search and recovery efforts take place. Further suggestions for adapting methodologies to account for religious and cultural beliefs are included in Case Study 34.1 and Sturdy Colls (2015a, 2015b).

34.3 Why Do Genocide and Human Rights Cases 'Go Cold'?

Depending upon the circumstances of the mass violence, witnesses may provide evidence concerning the murder and forced disappearance of individuals and groups straight away. Other physical evidence may also be instantly available. Therefore, the need to initiate a search and recovery programme may also be immediately apparent. There are a number of reasons, however, that searches may not be initiated or that cases may go 'cold' which will be discussed below.

Likewise, there are a number of factors connected to the passage of time which continue to limit the ability to search for the missing, even decades after, which are also discussed.

34.3.1 Law and Guidance

34.3.1.1 International Law

International law now asserts that family members of people missing as a result of conflict have 'the right to know' whether or not their loved ones are alive or dead. The International Committee of the Red Cross provides a comprehensive overview of the various legislation which confirms this (ICRC, 2015a, 2015b, 2015c, 2015d) and so only a summary will be included here. Essentially, international law stipulates that 'each party to the conflict must take all feasible measures to account for persons reported missing as a result of armed conflict and must provide their family members with any information it has on their fate' (ICRC, 2015d).

After the war crimes and genocide perpetrated during World War II, the *Geneva Convention* (1949) was ratified, confirming that States must address the enquiries of family members searching for missing persons and put adequate plans in place to search for the missing (ICRC, 1949). In 1974, the United Nations General Assembly reaffirmed that 'the desire to know the fate of loved ones lost in armed conflicts is a basic human need which should be satisfied to the greatest extent possible'. The International Committee of the Red Cross (2015d), the Council of Europe (2014), the European Parliament (1995, 2007), the European Court of Human Rights (2015) and various other agencies have developed legislation that stresses the necessity to locate missing persons following armed conflicts and genocide, and/or initiated prosecutions against States that have failed to do so. The identification of missing persons has been defined as a 'basic dignity' for all people, regardless of their origins, circumstances or religious beliefs (Haglund, 2002, p. 245). As the International Commission on Missing Persons (ICMP) (2014) have argued, 'the problem of missing persons does not respect borders, whether persons are missing as a result

of conflict, human rights violations, disasters, organised violence, or refugee flows and migration. For this reason, the issue of the missing is increasingly being understood as a global challenge that demands a structured and sustainable international response as opposed to uncoordinated, ad hoc, situation specific approaches'. The *International Convention for the Protection of all Persons from Enforced Disappearance* (2006) clearly indicates that 'concealment of the fate or whereabouts of the disappeared person' is illegal and all States that have signed this convention have a duty to locate missing persons (United Nations, 2006). Therefore, international law, guidance and provision have been developed, particularly over the course of the last two decades, in order to ensure that search and recovery efforts are initiated in the immediate aftermath of mass violence.

However, whilst international law acknowledges the importance of missing persons investigations, millions of people remain missing worldwide as a result of historic cases of mass violence. As noted above, much of this legislation has only been developed in the last 20 years; thus it post-dates many of the war crimes and genocides of the twentieth century. In some cases, such as the crimes perpetrated in Cyprus as part of the Turko-Cypriot War and in the Balkans during the Yugoslav Wars, this legislation has been applied retrospectively and missing persons enquiries have been initiated (see Chap. 31 for examples). However, investigations have not been initiated under the auspice of this legislation with regard to earlier examples of human rights abuses, such as the Holocaust and the crimes perpetrated by the Soviet regime in Eastern Europe. The more time that passes since genocide and war crimes were carried out, the less likely it becomes that these laws will be enforced. In cases of civil unrest that results in genocide or war crimes, the international community may be particularly reluctant to intervene, especially years after the violence has concluded, for fear of political unrest.

The international laws regarding persons missing as a result of armed conflict also only apply to the nations and States that have both signed and ratified them. There are many nations

throughout the world that have failed to do so whilst others have signed these declarations, but have failed to comply with them. For a variety of reasons discussed throughout this chapter, the international community may also fail to force them to do so. For example, Zimbabwe has signed and ratified the Geneva Convention yet there has never been a large-scale investigation into the disappearances of more than 50,000 people from four periods of violence between 1966 and 2016 (Sachikonye, 2011). In fact, an examination of the list of countries that are signatories to the *Geneva Convention* reveals the worrying reality that the majority have both seen episodes of mass violence during armed conflict and genocide immediately before and/or since the law was ratified, and the majority have failed to locate the graves of missing persons resulting from these occurrences (Wikipedia. List of parties to the Geneva Conventions, 2015). In the case of some countries, the failure to initiate investigations, or for the international community to enforce the law, also applies to episodes of recent mass violence. In light of this, it is perhaps unsurprising that more historic cases have not been (re) examined.

Therefore, despite the fact that knowing the fate of loved ones is seen as a ‘basic dignity’, there is no universal law that states that it must be afforded to *all* victims of genocide and human rights abuses resulting from conflict (Haglund, 2002, p. 245). The laws that are in place do not necessarily get applied retrospectively, nor are they always enforced in cases of more recent violence. This is one of the reasons why we find ourselves in a position in the twenty-first century whereby we have the adequate methods to locate missing persons on the one hand, and a failure to do so in many cases on the other.

34.3.1.2 National Laws

In the absence of enforced international law, the fate of persons missing as a result of genocide and conflict is often governed by the national laws. Legal statutes relating to searches for persons missing as a result of genocide and conflict vary considerably between different countries. Many States have their own legislation govern-

ing the need to resolve the fate of missing persons who have been the subjects of genocide and human rights abuses (for examples, see Organisation of American States, 1969; African Commission on Human & Peoples’ Rights, 2015; ICMP, 2014) although (as with international law) they may not be applied to historic cases of genocide and conflict.

When no specific legislation exists, some countries will approach the cases of persons missing as a result of these scenarios in the same way as domestic missing persons enquiries. Others will have specific references within legislation that indicates how searches for war crimes victims should be approached. There is considerable variation between countries in terms of the number of years missing persons cases are considered to be of ‘forensic significance’. Many countries, such as the UK, stipulate a potential seventy- to hundred-year investigation window since this puts crimes within ‘living memory’. Others place a much shorter time window on investigations; for example, in Portugal, 15 years after death, bodies become ‘archaeological’ by law and so missing persons enquiries will not be initiated. An examination of the legal approaches to missing persons in a given country may offer some clues as to why investigations into genocide and war crimes have not been initiated if such statutes exist. That said, even when specific references to war crimes exist, countries may:

1. Still choose not to readdress historic cases of genocide and conflict—particularly when a general knowledge of the crimes exists, or when investigations (no matter how limited) were carried out in their immediate aftermath, historic genocide and war crimes may not be considered a police or legal matter. However, since they will undoubtedly remain sensitive, they are often not classed as ‘archaeological’ either; thus, they fall into the grey area between history and memory in legal and societal terms. A recent investigation by the author in Alderney in the British Channel Islands highlights this situation. Despite the fact that considerable new evidence has been presented that suggests that mass graves are

present on this island as a result of Nazi persecution, further archaeological investigations have faced opposition and the police have declined to investigate the matter further (Carr & Sturdy Colls, 2016).

2. Grant exceptions to war crimes cases and so investigations may still be initiated decades after persons went missing—Croatia's approach to crimes perpetrated by the Nazis and Ustaša during World War II (Šlaus et al., 2012), and Poland's approach to Holocaust-era crimes, provide just two examples (Ossowski et al., 2013).

A comprehensive review of the legal positions of a wide range of countries throughout the world, in relation to the treatment of human remains, is provided in Márquez-Grant and Fibiger (2011) and further discussion on the issue of the legal parameters of war crimes investigations is included in Sturdy Colls (2015a, 2015b, Chap. 3).

34.3.2 Politics

Many of the key reasons why searches may not be initiated relate to politics, both within the countries concerned and internationally. Many instances of genocide and human rights abuses occur within 'conflict time' or in the immediate aftermath of war when the political situation remains uncertain (Baillie, 2012). As such, access to the country concerned may be impossible or severely restricted. It may not be safe for investigative teams to enter and governments may be swift to prevent this if they were party to the violence. If the conflict continues for years after particular instances of genocide and human rights abuses occur, search and recovery efforts may be prohibited (Hunter & Simpson, 2007). By the time investigative teams are allowed to enter, knowledge concerning burial locations may have been lost, witnesses may have passed away or may not be willing/able to speak, landscape change may have masked burial sites, and emphasis may have shifted towards prosecution of offenders or reconciliation and rebuilding. In

the aftermath of war and conflict, access to countries may continue to be restricted. Travel restrictions, lack of infrastructure, pressing humanitarian concerns for the living, e.g. medical care and housing, an absence of trained personnel, military activities, a lack of legislation and a range of other reasons may result in the dead being forgotten, or at least not prioritised.

When searches do take place, emphasis may be placed on finding military personnel over civilians (Hunter & Simpson, 2007; Rosensaft, 1979; Mant, 1950), on providing proof that a crime took place (as opposed to the thorough investigation of a grave site) or on commemorating (rather than individually locating) the dead. It may take time for facts to emerge and pressure may not immediately be placed upon governments by the international community to provide access to both sites and documentary evidence. Archives may remain sealed and the media or other activists may not become aware of missing persons until sometime after the conflict has ended. Smaller-scale acts of violence may also be overshadowed by larger-scale atrocities, either within the same country or elsewhere in the world. The shootings carried out by both the Nazis and the Soviets during World War II provide one such example as these killings continue to be forgotten and investigated to a lesser extent because of the emphasis on the death and concentration camps (Sturdy Colls, 2012, 2015a, 2015b).

Over time, priorities will likely shift, resulting in increased and decreased levels of interest in finding the missing. Regime changes may sometimes lead to new calls to undertake investigations, as perpetrator regimes fall or are forcibly removed, and as officials open to the idea of searches come to power. Following the collapse of Communism across much of Eastern Europe in the early 1990s, many of the new governments in countries in Eastern Europe called for investigations into the atrocities perpetrated in their territories by the Nazi and Soviet regimes. In Vilnius, this approach resulted in the excavation and analysis of the former Gestapo and KGB Headquarters, where the remains of 706 individuals were found in 1994–1995, and a further 18

individuals were found in 2003 (Jankauskas, Urbanavičius, & Garmus, 2010). More recently, in Papua New Guinea an official policy, regarding the need for searches for the 20,000 persons missing as a result of the 1989–1997 war, has been issued. However, although a regime change resulted in this policy finally being adopted, it is likely to still be a long time before searches are actually undertaken (ICRC, 2015f). Political leaders may also undergo shifts in policy during their time in government. Ferrándiz (2013, p. 39) has argued that:

‘societies eventually need to confront head-on the most disquieting elements of the past and...political strategies that privilege sweeping such history ‘under the rug’, while potentially effective for discrete periods of time, may be altogether more destabilizing in the long term’.

Recent exhumations of civil war victims in Spain are said to be the result of this recognition and a desire to come to terms with the past. A similar trend existed in Germany in the 1960s when rebuilding and recognition of the past were recognised as contingent on each other (Bernbeck & Pollack, 2009). International pressure may also lead to searches for graves, as with recent cases in Columbia and Sri Lanka (ICMP, 2015; McGillem, 2014). Just as quickly as changes to political regimes can permit access to killing sites, they can also restrict access. Sites connected to the Armenian genocide which are now in Syria, a country which has been plagued by civil war in recent years, serves as just one example (Case Study 34.3). Ongoing, or a resurgence in, prejudice towards the group(s) affected by the genocide or conflict may also explain a lack of investigation. This is particularly true when the prejudice is state led, supported or tolerated. The current political status of nation states can also impact upon whether or not they are forced to undertake enquiries into historic acts of genocide and mass violence. For example, some have argued that Britain’s lack of investigation of deaths that occurred under their colonial rule reflects the fact that Britain has been successful in ‘airbrush(ing) and disregard(ing) our past’ (Monbiot, 2012) by instead presenting itself as ‘a beacon of toler-

ance, decency and the rule of law’ (Sandbrook, 2010; see also Lawson, 2014).

Additionally or alternatively, governments may claim that they are committed to investigating mass violence, even setting up commissions for the purpose, when in fact these claims are simply a tactic to delay searches. This is particularly common when those who perpetrated the violence remain in positions of power (Case Study 34.2).

34.3.3 Issues of Time

The old adage that ‘time heals old wounds’ will not always be true in the context of mass violence, as many of the examples provided throughout this chapter demonstrate. Even when crimes pass from living memory, it may not be deemed desirable to readdress historic crimes (Sime, 2013). However, in other cases, time may be exactly what is needed before investigations of genocide and conflict can be undertaken. Archaeologists and anthropologists may, therefore, become involved in historic genocide investigations for a variety of reasons connected to the passage of time.

Many episodes of violence that sit ‘between history and memory’ may be too painful for governments and communities to address (Harrison & Schofield, 2010; Sturdy Colls, 2015a, 2015b). When they cross the threshold, so to speak, into being part of the distant past there may be increased interest in examining them. This may take the form of a legal investigation—when a desire to prosecute offenders still exists—or a humanitarian investigation, where the focus remains on finding the missing. An upsurge in interest in historic acts of violence by second, third, fourth or even later generations of victims’ or survivors’ family members may finally result in searches being initiated. The ageing and passing of survivors is also often cited as another reason why investigations begin decades after crimes were perpetrated. The more widespread and recent interest in locating Holocaust sites using forensic and archaeological methods provides a good example (Sturdy Colls, 2015a, 2015b).

Decisions to erect memorials, build museums or undertake other forms of development may warrant archaeological intervention, either as part of a desire to locate the remains that will be commemorated or via necessity, due to the legal obligations during the planning process (see Sturdy Colls, 2015a, 2015b, Chap. 3 for examples). Research projects are more likely to be initiated after some time has passed, especially when the legal statutes for the prosecution of offenders are no longer in existence. Communities may be quick to embrace this research when they feel the plight of missing persons has been ignored for decades; for example, women in Ukraine speak of their wait for someone to come along and take an interest in finding World War II mass shooting sites (Desbois, 2008). Media and public pressure may emerge as a response to a sense of injustice that so much time has passed and crimes have still not been examined. New witnesses may come forward, no longer fearful of the repercussions of speaking about their experiences, and archives may be opened. Alternatively, governments may be forced to confront missing persons cases because of the serendipitous discovery of remains because of natural or man-made landscape change (for an example, see Susa, 2007).

34.3.4 Issues of Scale, Infrastructure and Technological Capability

The large-scale nature of genocide and human rights abuses resulting in death offers another explanation as to why searches for body deposition sites and individual identifications may not have been carried out. Crimes of this nature, committed before the 1980s, pre-date many of the advances in forensic investigation, forensic archaeology and forensic anthropology. DNA testing, the use of non-invasive archaeological recording and detection methods, and many methods used to analyse of human remains that are widely used today simply did not exist or were not commonly used. Hence, it was simply not possible to investigate crimes like the Armenian genocide, the Holocaust and the crimes perpetrated under the Soviet Communist regime in the

same way as the crimes in Bosnia-Herzegovina, Kosovo, Iraq and the like were examined in the 1990s. Many countries that experienced violence throughout the twentieth century did not have the infrastructure to investigate mass violence fully and emphasis was instead placed upon proving that a crime took place, rather than on the location and identification of individual missing persons. This was certainly the case in the aftermath of the Holocaust in light of the unprecedented large-scale killings that occurred and the attempts by the perpetrators to hide their crimes (Sturdy Colls, 2012, 2015a, 2015b).

Genocides like this, that took place across borders, also presented the additional challenge of locating and identifying individuals from a range of different countries and, in the absence of adequate communication systems and an overarching organisation like the International Commission on Missing Persons, this would have been impossible. In many countries, this lack of infrastructure remains and may in part at least explain why further investigations have not been carried out. A recent example from Namibia highlights how a lack of knowledge concerning new technologies may be provided as a reason for a lack of investigations: when skulls of victims of the Namibian Herero and Nama genocide of 1904 were discovered in the archives of a German university in 2008, the secretary of the Ovaherero Ovambanderu Council for Dialogue on 1904 Genocide (OCD-1904), when asked about the possibility of DNA testing, stated: 'we are unaware of that method, but might consider it once we find out more about it' (Wiedlich, n.d.). The perception that perpetrators destroyed the evidence of crimes or the perception that any evidence that could be found has already been found, coupled with a lack of knowledge concerning modern advances in forensic archaeology, anthropology and technology, may also account for the lack of interest in investigating historic crimes.

For some genocides and conflict situations, the exact death toll was not known at the time and, in the absence of large-scale searches or ongoing difficulties in the location concerned, is still not known. For example, Reeves (2009, p. 173) conducted a comprehensive survey of the number of

deaths in Darfur between 2003 and 2006 but observed that ‘we may never know just how “staggering” genocidal mortality has been in Darfur, or will be’ because of the nature of the genocide there. With regard to many of the genocides and conflicts already mentioned in this chapter, the exact number of missing and deceased persons is not known. This uncertainty makes planning a strategy for future investigations extremely difficult, particularly in terms of determining how far-reaching these should be and for how long they should continue. In these circumstances, decisions should be made based on a thorough analysis of archive materials, witness testimonies and other source material (e.g. photographs, aerial imagery, audio-visual materials), drawing upon search design protocols developed by forensic archaeologists in a domestic context. These approaches are outlined in Chap. 18 of this volume and in Hunter et al., 2013. It may be necessary to accept that establishing numbers may be an impossible, or at the very least a long-term goal, and it is certainly important to remember that as much value should be placed on locating one individual as on thousands of missing persons whose locations were not known.

34.3.5 Financial Pressures

The financial pressures that the investigation of genocide and conflict exerts on governments and communities may also explain why search and recovery efforts for missing persons are not always conducted. For example, the recovery of the victims of the 9/11 terrorist attacks cost 970 million US dollars. The number of victims killed within a single Holocaust concentration or death camp, or at an individual massacre site during this period, usually exceed this number. Historians currently estimate that more than 20,000 camps existed during the Holocaust alongside tens of thousands of individual massacre sites. When we consider that other genocides and mass killings were happening simultaneously to the Holocaust across Eastern Europe, and the fact that these represent just some of the episodes of mass violence undertaken across the

world during the twentieth century, the impact of the scale and financial burden of investigations becomes apparent. Put like this, it is perhaps easier to comprehend why large-scale searches have not been carried out for victims of historic genocides and conflict. For countries suffering poverty, famine, economic downturns and other forms of hardship in the present, allocating funds to the investigation of past violence is unlikely to be a priority.

34.4 Future Considerations

The investigation of body deposition sites arising from conflict, particularly mass graves, is an extremely complex undertaking due to the various political, social, religious, ethical and logistical challenges they present. These challenges have been extensively reviewed in other chapters in this volume (Chaps. 30–33) and by other authors (e.g. Hanson et al., 2015; Hunter et al., 2013, Chap. 8; Cox, Flavel, Hanson, Laver, & Wessling, 2008), so they will not be repeated at length here. However, historic cases of genocide and conflict present a number of additional challenges to practitioners in addition to these when investigations aimed at locating the missing take place decades later. As noted above, many of these challenges relate to the reasons why investigations have not been undertaken earlier. Further challenges and potential solutions will be presented below in order to demonstrate how advances in forensic archaeology and anthropology can be successful in resolving historic missing persons cases when these challenges are taken into account.

34.4.1 Non- and Minimally-Invasive Approaches

Forensic archaeologists and anthropologists now have a wide range of non- and minimally-invasive methods at their disposal when searching for the graves of missing persons. These methods can assist in searching for graves and, if required, they can limit the amount of ground disturbance

(e.g. traditional archaeological excavation) or remove the need for it altogether. Methods include archival research; the analysis of aerial imagery, satellite imagery and photographs; complex mapping using Geographic Information Systems (GIS); reviewing and collecting witness testimony; walkover survey and the observation of taphonomic indicators; remote sensing using advanced GPS, LiDAR (laser scanning) or Total Station technology; photogrammetry; micro-robots; and documenting below-ground remains using geophysical survey techniques. For technical information about each of these methods, the reader is referred to Chap. 18 of this volume and Sturdy Colls (2015a, 2015b). These methods may prove invaluable in investigations of historic genocide and human rights abuses in particular because of their ability to: offer new ways to locate sites (which were likely unavailable when the crimes were perpetrated), compensate for some of the challenges these investigations involve, e.g. politics, religion and lack of access (see examples below), survey and document large areas, and provide digital data that can be used to raise awareness of the crimes perpetrated and/or as part of judicial or reconciliation proceedings. The following examples illustrate some potential approaches and applications of these techniques, and their benefits:

Case Study 34.1: Adampol, Poland

In 2015, an investigation was undertaken by the author at the site of a former Nazi labour camp in Adampol, Poland, where an unknown number of people were believed to have been used as forced labour. Many of these people were systematically executed or died as a result of the harsh working and living conditions they endured. The investigation was undertaken by the author at the request of the family of a survivor. The family wished to determine the location of mass graves in the vicinity of the camp and,

having become familiar with the author's forensic archaeological investigations at the death and labour camps in Treblinka (also in Poland; Sturdy Colls, 2014, 2015a, 2015b), they requested that a similar methodology be employed in Adampol. This methodology was specifically tailored to account for the fact that excavation of the mass graves was not permitted by the rabbinical authorities in Poland on account of the fact that the missing persons thought to have been killed in Adampol were Jewish. Jewish Halacha Law forbids the disturbance of human remains buried in a grave, except under exceptional circumstances (see Sect. 34.2.4).

A combination of non-invasive methods was used including archival research, the analysis of maps, plans and aerial photographs, interviews with witnesses, the inspection and collection of airborne remote sensing data, walkover survey, forensic search methods, field survey using a Total Station, geophysical survey (using a Ground Penetrating Radar; Fig. 34.1) and data analysis in a Geographic Information System (GIS). This resulted in the successful identification of the locations of probable mass graves from four periods of violence, a new account of the camp's history and greater understanding of the experiences of the people who lived and died there (The New York Times, 2016; Sturdy Colls, 2016b, forthcoming) (Fig. 34.2). This was the first detailed investigation of the area ever to take place and it was facilitated by a methodology that accounted for the religious and scientific importance of the site. The author, the religious authorities, the families of the victims and the local community are now engaged in discussions regarding the long-term protection of the mass graves and whether any further in-field investigation is required.

Fig. 34.1 Ground Penetrating Radar (GPR) survey (Copyright: Caroline Sturdy Colls)

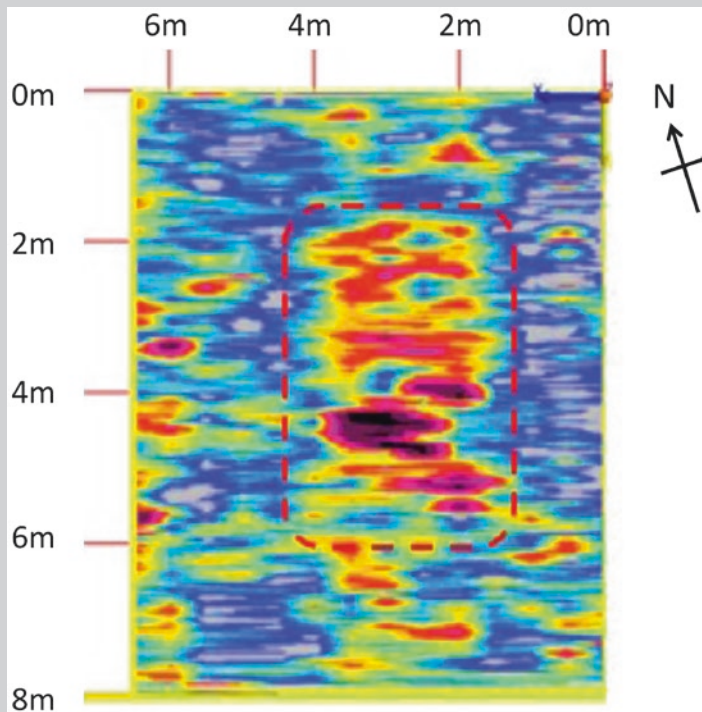


Fig. 34.2 Ground Penetrating Radar (GPR) results showing one of the probable mass graves identified in Adampol, Poland (Copyright: Caroline Sturdy Colls)

Case Study 34.2: Zimbabwe

Zimbabwe, located in southern Africa, witnessed several episodes of mass violence during the twentieth and twenty-first centuries. Resistance to British colonial rule led to conflict throughout the 1960s and 1970s, during which it is estimated that 30,000 people were killed (Sachikonye, 2011). From its independence in 1980 until 1987, genocidal acts (sanctioned by the ruling ZANU-PF party) by the Fifth Brigade throughout the Matabeleland provinces resulted in the deaths of a further 20,000 people (Phimister, 2008). Since 2000, mass violence and violent acts against individuals have occurred, particularly in the run up to, and post-, elections (Ndlovu, 2008). Most recently, Human Rights Watch (2009, 2010) have highlighted that killings are occurring in the diamond-mining areas following their militarisation by the ZANU-PF government in 2008 (Fig. 34.3). The exact number of people who have gone missing or are known to have been killed since 2000 is unknown. Mass graves, mine shafts, burnt houses and other clandestine sites have been used to dispose of the bodies of the victims (Silika, 2015).

The ZANU-PF government has reportedly undertaken several enquiries over the past thirty years, although they have refused to release the results of most of these claiming 'the publication of the report could spark violence over past wrongs' (United States Institute of Peace, n.d.). Some exhumations were undertaken by the government but a High Court Ruling claimed that they were undertaken illegally and without adequate forensic provision (The Herald, 2011). In 2013, the government created legislation that would allow for a National Peace and Reconciliation Commission (NPRC), claiming transparency on the issue of mass killings and clandestine burials (Mwonzora, 2013). However, the enquiries have not resulted in the identification of burial sites and, although it was legally created, the NPRC has yet to actually come into existence and begin its investigation (The Zimbabwean, 2015). Whilst the government has claimed that these committees were created to conduct missing persons enquiries, the reality is that they have prevented other parties from investigating the atrocities and they have stalled enquiries.



Fig. 34.3 A body is brought to the surface at Monkey William Mine about 200 km from Harare in 2011 (Copyright: P Photo/Tsvangirayi Mukwazhi)

They have also diverted attention away from the crimes perpetrated by satisfying international calls for such committees to be created. In the absence of state-led enquiries, activists and international organisations have attempted to locate some of the burial sites but their work has been hindered by opposition and the lack of infrastructure for such investigations (Argentine Forensic Anthropology Team, 1999, 2000; Eppel, 2006).

In 2015, a non-invasive investigation, which aims to locate the body deposition sites relating to the various periods of violence in Zimbabwe, was initiated at Staffordshire University (Silika, 2018 forthcoming; Silika, 2015). This project aims to address the need to locate the remains of the missing, taking into consideration the religious and cultural needs to the victims, the communities from which they came and the communities who live in the vicinity of their burials (see Sect. 34.2.2 for a discussion concerning the approaches to death and burial in Zimbabwe). The methodology selected—which involves the use of aerial and satellite imagery analysis, the collection of witness testimony, archival research and the use of Geographic Information Systems (GIS) to locate and map body deposition sites—also accounts for the ongoing opposition to in-field research in Zimbabwe and security concerns. At the time of writing, the project has only recently been initiated, but it is hoped that, by taking an approach which accounts for the sensitivities surrounding the political and social situation in Zimbabwe, a case can be made for more detailed investigations in the immediate future and guidance can be provided to the government concerning how to do this according to internationally recognised forensic standards.

34.4.2 Landscape Change

After a long time has passed since crimes were perpetrated, landscape change will undoubtedly have occurred in some form and this has the potential to impact upon the ability to locate body deposition sites. The extent of this landscape change will vary depending upon the location, e.g. whether or not sites have been redeveloped or whether they have been protected, whether they are located within an urban or rural environment. The following case study demonstrates some of the challenges that may be posed by landscape change but also the successful application of forensic archaeological and anthropological methods, ninety years after the individuals buried with a grave went missing:

Case Study 34.3: Body Deposition Sites in Syria (Ferlini & Croft, 2009)

Using a combination of walkover survey (during which scattered human remains were observed), archival research and the collection of witness testimonies, archaeologists identified the possibility that a mass grave existed in Tell Fakhriya, Ras al-Ain in north-east Syria, dating to the Armenian genocide. When forensic archaeologists and anthropologists undertook an investigation in 2007, they discovered that the site had been heavily disturbed by ploughing and other agricultural activity in the 90 years between deposition and investigation. This meant that the remains were heavily fragmented, scattered and commingled, and the team suspected that many of the bodies that were originally present within the grave had likely been removed in the decades since the war. Eighty skeletons were found within the grave and important observations were made concerning the circumstances surrounding the burials of the victims, who were believed to have been housed in a nearby internment

camp. Forensic anthropologists had difficulty in estimating cause of death because only one skeleton displayed signs of perimortem trauma. Whilst this may have been because they died of starvation and other causes which do not exhibit themselves on bone, evidence of further trauma may have been masked by the post-mortem damage caused by the aforementioned landscape change.

As many other body deposition sites connected to the Armenian Genocide are now located within war-torn Syria, the landscape change affecting these areas is now even more extreme and the lack of access to the country as a result of the conflict makes locating them almost impossible at the time of writing. Because of the present situation in Syria and accompanying limitations on access, safety concerns and other international priorities, locating the graves of those killed in the more recent conflict is also impossible or extremely difficult. As it is not currently known how long this conflict and genocide will last, it is not impossible to imagine a situation where, in several decades time, far-reaching forensic investigations aimed at locating graves will be undertaken for the first time; by which time, further considerable landscape change will have undoubtedly occurred.

In some instances, it should be borne in mind when designing investigative methodologies that remains of victims who have been missing for some time may no longer be present in primary graves. Rather they may exist in secondary or tertiary graves as a result of attempts by offenders to further hide their crimes, because of post-war exhumations (done by professionals or by local communities) or due to post-war disturbance of primary graves which led to the exhumation and inhumation of remains.

34.4.3 Proactive Approaches to the Investigation of Genocide and Human Rights Abuses

Research has shown that taking a proactive approach to the investigation of sites of mass violence yields considerably better results than reactive investigations. Reactive investigations often do not have the same freedom as proactive ones; time, access to resources, the availability and willingness of witnesses to provide evidence, and the scope of the permitted research may all be restricted in reactive investigations. During the author's own research into archaeological investigations of Holocaust sites, it was apparent that the projects that came about as a result of planned construction works at sites of mass violence had many more restrictions imposed upon them (Sturdy Colls, 2015a). This resulted in an inability to fully examine sites and the individual structures, graves and other features they contained. Certainly independent researchers undertaking searches for humanitarian reasons or for general research purposes will have more freedom to investigate compared to practitioners who are bound by limitations imposed by the public or private institutions for which they are working.

If archaeologists and other forensic specialists are the ones undertaking and advocating the research, we may find ourselves in a position where we are also activists, acting (consciously or unconsciously) on behalf of—or in the absence of—victims, survivors and their relatives. Whilst this approach has its benefits, it is also not without its challenges. Carr and Sturdy Colls (2016) argue the importance of taking a cautious and considered approach to 'taboo heritage', which includes the issue of mass graves. They stress that, under the right circumstances 'alternative approaches by activists...may force discussions concerning those aspects of the past that have previously been ignored' but under the wrong circumstances, they can incite further conflict. Our work may also become politicised and difficult due to the involvement and competing wishes of different parties, including the family members

that we initially tried to represent. The findings of investigations may fall under the scrutiny of witnesses and historians (particularly if well-established narratives are questioned), as well as those who deny that the crimes took place (Sturdy Colls, 2015a, 2015b, Chap. 12). Steele (2008, p. 425) has also issued a word of caution on this topic:

‘forensic archaeologists should see themselves as activist archaeologists—“using the past as a political means to change present social conditions” (Bernbeck & Pollack, 2009, p. 219). However, there are inherent tensions between a belief in forensic investigation as the objective pursuit of physical facts, the pursuit of justice as a force to advance social goals, and the complexity of human emotions’.

Therefore, practitioners must carefully consider how to strike a balance between all of the above elements when advocating investigations of historic genocide or conflict.

34.4.4 Identification and Commemoration

When exhumations are undertaken, the identification of individuals may represent a considerable challenge in relation to historic genocide and war crimes. For bodies buried in mass graves, this will be particularly complex given the commingling of the remains that will often have occurred (Fowler & Thompson, 2015). Bodies may be poorly preserved, it may be difficult and costly to extract DNA samples, and other traditional markers that assist with establishing identity, such as soft tissue, hair, clothing and other trace evidence, may long since have decomposed or degraded. The essential ante-mortem data needed for comparison will rarely have been collected in the aftermath of the conflicts and genocides that occurred in the first two-thirds of the twentieth century because of the absence of forensic protocols. Due to the passage of time, this data will also be difficult if not impossible to acquire decades after the event. Information such as dental records, radiographs and medical histories, alongside hair samples or other materials bearing trace DNA—that are so important in

modern missing persons enquiries (see Chaps. 20–24, 26 and 27, this volume)—will rarely be available and will likely be long-since destroyed. In some countries, these records may never have existed in the first place. Investigation of historic human rights abuses will be dependent upon samples provided by relatives and, because of the often-skeletalised nature of remains in longer-term cases, on forensic anthropologists (Chaps. 27 and 33, this volume). Again, this can be logistically complex because of the changes in geography that may have occurred since the crimes were perpetrated, because relatives may not wish to make themselves known or because they too may have passed away. If identification of individuals is not going to be possible, it is important that practitioners are clear about what else they are hoping to achieve by exhuming remains.

Investigations—like the 2008 exhumation at the Santa Cruz Cemetery in Timor Leste, which resulted in the positive identification of eleven victims of a massacre carried out there in 1991—demonstrate that identification can still be possible after a considerable amount of time has passed when modern techniques in genetics and forensic anthropology are drawn upon (Blau & Fondebrider, 2011). The ongoing work in Bosnia-Herzegovina, almost three decades after the genocide, also demonstrates how identifications may be possible even after a large amount of time has passed. On the basis that geneticists are now able to extract DNA from ancient remains, providing remains are well preserved in historic genocide and war crimes cases, the extraction of DNA should also be possible. There now exists a wide range of other methods that can provide information to help establish identity, such as forensic anthropology (Chap. 27), facial reconstruction (Chap. 28), forensic odontology (Chap. 27) and the analysis of stable isotopes (Chap. 29). Even if individual bodies cannot be identified, it may still be possible to establish the fate of a missing person or learn more about those who were caught up in the genocide and conflict. In Sturdy Colls (2015a, , Chap. 10), the author outlined how individuals might be identified via the presence of their name, e.g. on objects and in graffiti, by items or other evidence that they left

behind, or through making connections between archival materials and findings during archaeological surveys. The marking of previously unmarked burial sites, the creation of educational tools, and other forms of dissemination of the results of archaeological and anthropological investigations, e.g. public lectures, publications, exhibitions and the like, can all help highlight the stories of missing persons if they too are approached ethically and sensitively (Sturdy Colls, 2015b).

34.5 Success Factors and Conclusions

The issues involved in missing persons enquiries in the context of historic cases of genocide and human rights abuses are far more complex than just those outlined in this chapter. In every case where painful events that have resulted in mass atrocity are revisited—or in some cases examining for the first time—many years after they occurred, will undoubtedly present a broad range of political, social, religious, cultural and ethical challenges for forensic archaeologists and anthropologists. However, this chapter has sought to discuss the most common issues in the hope that practitioners considering involvement in these types of cases will use this as a guide when undertaking their own research in advance of operating in the field.

In general terms, the following factors will impact upon the ability to revisit historic cases of mass violence:

- International and national law regarding missing persons
- The political, social and financial situation in the country concerned
- The willingness of various 'communities' with a connection to the site to support and allow planned work and the nature of community engagement on behalf of the practitioner
- The ability of practitioners to account for the religious and cultural issues relevant to the victims of the specific genocide or conflict scenario

- The availability of written, photographic and other evidence

- The availability of witness testimony—in particular the ability to interview witnesses that are still alive in order to ask different questions directly relevant to potential searches and exhumations of graves

- The availability of ante-mortem information about the deceased

- The extent of landscape change

- The extent to which perpetrators attempted to hide their crimes (at the time and since)

- The size of grave and indicators present in the landscape

- The condition of the remains

Under the right circumstances and with a carefully planned methodology, even after a considerable amount of time has passed, it may be possible to:

- Locate human remains and other evidence associated with them

- Excavate graves and exhume remains (if this is permitted)

- Identify how graves were constructed and the configuration of human remains within them

- Determine whether or not a crime was pre-planned through an examination of the grave(s) and other contextual evidence

- Analyse whether any chemical agents or other materials were placed within the grave in order to accelerate decomposition in an attempt to hide the crime

- Examine the grave(s) for any further evidence that the perpetrators tried to hide or mark it/them

- Recover evidence that may assist in identifying victims and an understanding of how individuals died

- Recover evidence that may assist in identifying perpetrators/regimes responsible for the killings

- Examine patterns of behaviour and similarities/differences in disposal patterns between graves pertaining to the same conflict/genocide/act of violence.

More broadly, it may be possible to:

- Corroborate, challenge or fill in the gaps in witness testimonies—this in itself can be an important element in providing answers for witnesses who may have sought physical proof that what they witnessed was true for many years
- Provide (accurate) information concerning the crimes perpetrated, for the first time
- Re-inter remains in individual or collective graves with markers bearing names/details of the crimes perpetrated (if exhumation has taken place)
- Mark graves for the first time/more accurately if the bodies are to be left in situ in the grave in which they were found
- Develop education and genocide prevention programmes which outline the crimes perpetrated and their effects.

Many of these will be possible to achieve even when excavation is not permitted or where individual identities cannot be established from human remains.

By taking a proactive approach to the investigation of historic genocide and human rights abuses, and by developing methodologies which account for the various sensitivities that surround these investigations, forensic archaeologists and anthropologists should be able to make a significant contribution to resolving the fate of missing persons. By working with communities and drawing upon new technologies, we have the opportunity to approach missing persons enquiries in new and revelatory ways, to find new ways to commemorate the deceased and to develop alternative approaches to educating future generations about racial hatred and prejudice. In spite of its past failings (described in Sect. 34.3.1), international law does provide a framework in which investigations aimed at locating people missing in the course of historic human rights abuses could be initiated in the future. Archaeologists and anthropologists should do more to levy this legislation in the future, should survivors and family members wish for searches to be undertaken, and if negotiations fail at local level.

This chapter was deliberately chosen as the concluding chapter of this volume, in order to highlight how much more work is needed to ensure that the fate of missing persons can be resolved ethically and in a timely fashion. It also serves to reiterate the fact that the success of missing persons investigations will often depend more on political will, societal conditions, religious freedom/control and other issues specific to the context of the disappearance than the technological or methodological capability to undertake them. However, it is also positioned here to demonstrate how, if we take all of the issues posed by historic missing persons enquiries into account, it is possible to locate missing persons even after a long time has passed since their disappearance. If this can be done, against all odds, then this should provide hope for more recent missing persons enquiries in the future.

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