An Introduction to Questioned Documents

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Samiksha Landge, Rajendraprasad Pawar, Rasika Kakad, Ashish Badiye, and Neeti Kapoor

Abstract

Documents are frequently discovered at crime scenes and serve as crucial evidence. They convey information through letters, symbols, figures, or other methods. This chapter provides an overview of various aspects related to documents, including handwriting analysis, forgery detection, identification of alterations and obliterations, and more. The chapter commences with an exploration of unique identifiers of individuals through their handwriting characteristics, such as letter formations, spacing, slant, pressure, and rhythm. Furthermore, the chapter scrutinizes the various alterations and obliterations that are frequently encountered in questioned documents. It highlights contemporary techniques utilized to remove or modify content, such as erasures, chemical treatments, and overwriting. The chapter also covers various methods for detecting these alterations, such as utilizing different light sources, electrostatic detection, infrared imaging, and more.

Keywords

Class characteristics · Questioned document · Forgery · Handwriting · Individual characteristics

S. Landge
GH Raisoni University, Saikheda, Madhya Pradesh, India

R. Pawar
Institute of Excellence in Higher Education, Bhopal, Madhya Pradesh, India

R. Kakad · A. Badiye · N. Kapoor (✉)
Department of Forensic Science, Government Institute of Forensic Science, Nagpur, Maharashtra, India
e-mail: neetikapoor@ifscnagpur.in

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12.1 Introduction

Questioned documents play a vital role in forensic investigations, legal proceedings, and historical research, as they often hold critical information that can either support or challenge the authenticity, authorship, or integrity of various types of documents. This chapter serves as a foundational guide, introducing the fundamental concepts, techniques, and methodologies used in the examination of questioned documents. From handwriting analysis and forgery detection to ink analysis and paper examination, this chapter explores the wide range of disciplines and practices involved in unraveling the secrets hidden within documents. Whether investigating fraudulent documents, deciphering mysterious writings, or determining the origin of a document, the knowledge and skills presented in this chapter are essential tools for forensic document examiners and anyone intrigued by the intricacies of uncovering the truth concealed within the written word.

The term "Document" is defined in the Indian Evidence Act, 1872 (IEA) and the Indian Penal Code, 1860 (IPC). According to **Section 3 of IEA and Section 29 of IPC** —"*Document means any matter expressed or described upon any substance by means of letters, figures or marks or by more than one of those means, indented to be used or which may be used for purpose or recording that matter*" (Indian Evidence Act 1872), (Indian Penal Code 1860).

The documents found at crime scenes or encountered in various contexts can be categorized based on their purpose and nature as historical documents, administrative documents, educational documents, financial documents, letters, legal documents, electronic documents and security documents. Historical documents provide glimpses into the past, shedding light on significant events and people. Administrative documents serve as records for organizational or governmental purposes, documenting transactions, decisions, and policies. Educational documents encompass a wide range of materials used for teaching and learning, such as textbooks, worksheets, and academic certificates. Financial documents are crucial for managing and tracking monetary transactions and assets. Letters, a form of personal correspondence, hold sentimental and informational value, capturing individual thoughts and emotions. Legal documents are legally binding papers that establish rights, obligations, and agreements. Electronic documents, in today's digital age, encompass various digital file formats and electronic records stored on computers or devices. Lastly, security documents are designed with specific security features to prevent counterfeiting or tampering.

While handwriting is commonly understood as the act of writing with one's hand, it goes beyond mere manual dexterity. Handwriting is often referred to as the mind writing or the brain writing as it reflects the subconscious mind at work. When individuals write, their subconscious thoughts, attitudes, and personality traits are manifested through their handwriting. Each letter or symbol impression made on a writing surface carries meaning in a particular language, forming what we know as handwriting (Lindblom and Jan 2006). In essence, handwriting can be considered a visible form of speech or a talking paper, as it encapsulates thousands of unique

characteristics that combine to create a highly personal and individualistic form of expression (Bunker 1979).

12.2 Principles of Handwriting and Signature

1. A person's handwriting also follows one of the principles of forensic science: the **principle of individuality**. No two people in this world can write precisely alike. This is because handwriting is a subconscious act, and every individual attains different training in learning how to write. Writing also differs with mental and emotional changes and the experiences in life, hence the writing of a person has a slight variation with time which cannot be copied because no other person can experience the same things as the original writer.
2. Handwriting and signatures show natural variations. The same word or a signature cannot be written precisely alike, even when written one after another by the same person; there will be a slight variation. These natural variations are seen

because of fatigue, age, illness, drugs or alcohol, writing position, emotional disturbances, etc. These characteristics of natural variation allow the examiner to distinguish between the forges and genuine writing.
3. A person can be identified by analysing the handwriting. Some people may show similarities in handwriting due to similar instruction or influences, closer examination reveals fundamental differences that allow for identification.
4. Handwriting changes along with time and skill because of the influences. External factors and personal development can contribute to an individual's unique writing style.
5. During the time of forgery, the forger tries to imitate those characteristics of the handwriting which are more appealing and ignores other features which are less conspicuous and difficult to copy. Successful imitation requires matching the original writer's skill and speed.
6. Every person's writing undergoes gradual life changes; however, the changes are prolonged and may not be discernible in most cases.
7. A writer cannot surpass his writing skill and ability unless he makes strenuous efforts and practice.
8. A person cannot adopt different writing styles at different times, as to change one's regular style of writing is an exceedingly difficult task (Huber and Headrick 1999; Sharma 2014; Koppenhaver 2007).

12.3 Characteristics

The handwriting of an individual possesses distinct characteristics that contribute to their uniqueness. These characteristics can be categorised as class and individual, with a primary focus on how a person writes. While characteristics may be shared by multiple individuals, over time, these learned traits become personalized and serve as distinguishing elements in one's writing style. These modifications and idiosyncrasies in the writing of the individual aid in identifying the original author of the handwritten document. Some of the class and individual characteristics are as follows:

12.3.1 Class Characteristics

Class characteristics can be particularly compelling in forensic document examination because they provide evidence of similarities within a defined group. These shared features can help establish a commonality among individuals who have received similar education or have been influenced by the same cultural or linguistic factors. When these class characteristics are identified in a questioned document, it can provide supporting evidence for attributing the document to a specific group or category. They contribute to the overall analysis and evaluation of a document's authenticity and can assist forensic document examiners in narrowing down potential sources or authors.

Style: The handwriting style primarily depends upon the training given to the individual during the learning days. The style generally depends upon the early teaching and practice, which is common in a group of people. With time and experience in writing, the individual adapts his writing style. The style may be creative or simple. The figures or symbols used by the individual can be round, angular or a mixture of both. Typical stylistic features found in handwriting are margins, date format, length of sentence, headings and subheadings, grammar, punctuations, etc. (Huber and Headrick 1999; Sharma 2014; Koppenhaver 2007; Choudhary and Vaya 2016).

Movement: To produce writing on a surface, the writer uses his fingers, arms, wrist or a combination of these to produce the necessary movements. These movements to produce writing are either the writer uses his fingers, arms, wrist or a combination of these. These movements are called writing movements or movements of writing. Different movements or combinations also show different features in writing, such as speed and pictorial effect. Speed of writing, the rhythm of writing, slant, etc., are also related to the movement of writing (Huber and Headrick 1999; Sharma 2014; Koppenhaver 2007; Ellen 2006).

Pen position: The pen position refers to the way a person holds and grips the writing instrument, which can leave distinct marks on the page. The pen position can provide valuable insights into a writer's habits, style, and overall technique. Different individuals may hold the pen in various ways, such as using a tripod grip, an overhand grip, or an underhand grip. These variations in pen position can result in observable differences in letter formations, slant, spacing, and overall writing style. The writing instrument is usually held at an angle between 15 and 90°, and commonly, people are found to hold it at 60°. Because of the angle at which the it is held, the pressure applied also differs, and the wear and tear are also different for different individuals (Sharma 2014; Koppenhaver 2007).

Line quality: Line quality determines the skill of a person when writing. A person with higher skills and who frequently writes has smooth and uniform writing. Line quality also helps in identifying the speed of writing. On the other hand, individuals with poor line quality often display slower writing speed, which can be indicative when assessing the authenticity of a document. The line quality can also help identify if the person is weak (physical condition), illiterate, writing in an unnatural position, etc., and all these things are observed in the person exhibiting poor line quality while writing (Lindblom and Jan 2006; Sharma 2014; Koppenhaver 2007; Koppenhaver 2002; Nickell 2014). These observations can be valuable in the analysis of handwriting and contribute to determining the genuineness of a document or identifying potential discrepancies. Therefore, line quality serves as an important characteristic in assessing the skill, speed, and potential authenticity of a person's writing.

Rhythm: To write rhythmically, a person should be highly skilled. The skill is acquired by writing experience and other factors like physical, emotional and intellectual personality. When observed, poor rhythm can be a potential indicator of the handwriting being copied or forged. A person with poor skill cannot copy the rhythm and skill of an experienced writer and thus may help narrow down the

suspect pool. Other factors need to be considered in conjunction with rhythm to make a conclusive determination. Furthermore, it is subjective to assume that a person with poor skill cannot copy the rhythm and skill of an experienced writer. Some individuals may be adept at mimicking or imitating handwriting styles, regardless of their own level of skill. Therefore, solely relying on rhythm as a determining factor may not be sufficient in identifying a suspect. Rhythm in writing may also provide an idea about an individual's mental and physical makeup (Lindblom and Jan 2006; Huber and Headrick 1999; Koppenhaver 2007; Ellen 2006; Morris 2020). Drawing concrete conclusions about someone's personality solely based on handwriting rhythm is not scientifically supported and can lead to unreliable assessments. It is imperative to follow a caution approach.

Tremors: Tremors in the handwriting are seen because of certain factors like sickness, illiteracy and even old age. Tremors are also seen in writing when a person is suffering from any kind of disease and does have an ability to write, like Parkinson's disease. When someone attempts forgery, they may intentionally incorporate these tremors into their writing, but they often place them incorrectly or in a manner that does not align with the natural characterictics of the original writer's tremors. This discrepancy can raise suspicions and indicate the fraudulent nature of the document (Lindblom and Jan 2006; Sharma 2014; Koppenhaver 2007; Hilton 1993). It is important to consider that tremors alone may not definitively prove forgery, as some individuals may naturally have slight tremors or variations in their handwriting that are not related to fraudulent intent. However, when combined with other handwriting inconsistencies and discrepancies, the presence of unnatural or inaccurately placed tremors can contribute to the assessment of a document's authenticity.

Speed: Speed is one of the characteristics which is examined in handwriting analysis. The speed of the writer differs because of various factors. Some writers have a fast thought process or are naturally impatient, resulting in faster writing. On the other hand, slow writers tend to write in a more systematic and legible manner. Fast writing individuals usually have smooth lines indicating a good line quality, while the slow writers may show tremors in their writing and have poor line quality, such as inconsistencies or shakiness (Huber and Headrick 1999; Koppenhaver 2007; Morris 2020).

Size: The size of the person's writing can vary significantly from one individual to another. It is seen that children usually write with larger strokes, and as they grow older and gain more control over their motor skills, the size of the writing gradually decreases, becoming smaller and more refined compared to their earlier writing. Variations in the size of writing are also observed based on different conditions (Lindblom and Jan 2006; Koppenhaver 2007; Morris 2020). Factors such as the writing instrument used, the writing surface, the individual's mood or state of mind, and even physical or environmental conditions can influence the size of handwriting. For example, someone may write larger when using a marker on a whiteboard compared to writing with a pen on paper.

12.3.2 Individual Characteristics

Individual characteristics of the handwriting are those which identify the author of the handwritten document. Some of the characteristics examined are as follows:

Pen pressure: The force the writer applies upon the pen or any other writing instrument on the writing surface (paper) is referred to as the pen pressure. The pressure applied is also different for every individual. The pressure has also been classified as heavy, medium, light and graduated. Pressure applied can also give insight into other aspects like speed, skill and sometimes even the writer's literacy (Lindblom and Jan 2006; Sharma 2014; Morris 2020).

Shading: Shading is observed in the writing of skilled writers and comes out naturally because of the practice. The shading is seen mainly on the upper and lower zone letters, i.e. there is a difference between the widths of these strokes. Shading also depends upon how the pen was held and at what angle (Lindblom and Jan 2006; Huber and Headrick 1999). Different pen grips and angles can produce varying levels of shading, further contributing to the uniqueness of the handwriting. The shading effect adds depth and dimension to the handwriting, making it visually appealing and distinctive.

Pen pause: Pen pause can be defined as the frequency at which a writer stops or pauses while writing. Experienced and skilled writers usually have a smooth and continuous flow in their writing, without noticeable pauses. However, occasional pauses may occur when they are distracted, or have a particular habit of pausing at specific places in their writing. When forgery is attempted, the forger may unknowingly replicate the pen pause patterns of the original writer. This becomes evident upon close examination, as the forgery will exhibit pauses and hesitations that are inconsistent with the genuine writing style. One common mistake made by forgers is the presence of a pen pause at the beginning stroke, which is not observed in the authentic writing of the original writer (Sharma 2014).

Pen lifts: The number of times a writer lifts the pen while writing is known as pen lifts. Pen lifts can be seen in the writing at specific locations and varied frequency. For some writers, pen lifts can be seen in a continuous rhythmic fashion or at only some specific places, such as when transitioning between letters or words. (Lindblom and Jan 2006; Sharma 2014). The specific pen lift patterns are often unique to each individual and can serve as a distinguishing characteristic in the identification of a particular writer.

Starting and ending strokes: A skilled writer's starting and ending strokes are smooth, and no hesitation marks are seen. When the original writer writes, the width of these starting and ending strokes is thin. However, when writing is forged, these initial and ending strokes show hesitation marks or tremors, and the width tends to be thicker, as the forger may exert more pressure or struggle to replicate the natural finesse of the genuine writer. In forgery, these strokes are more drawn rather than written (Lindblom and Jan 2006; Huber and Headrick 1999; Sharma 2014; Koppenhaver 2007; Morris 2020). It is important for

forensic document examiners to carefully examine the quality, smoothness, and width of the starting and ending strokes to identify potential signs of forgery.

Spacing: Spacing is considered one of the important characteristics while examining a handwriting document. Spacing refers to the gaps observed between two words, between two lines and the margins on the right and left sides of the page. Each individual has their own unique spacing pattern in their writing, making it a valuable factor for identification. This factor while writing is challenging to forge because the forger will subconsciously write with the spacing he is habitual to, which can differ from those of the original writer (Lindblom and Jan 2006; Sharma 2014; Koppenhaver 2007; Morris 2020).

Alignment: While writing on a blank sheet of paper with no ruled lines, the writer assumes an imaginary baseline and writes according to it. This is a highly characteristic feature. Alignment is most commonly observed in three main directions: ascending or upward direction, descending or downward direction or a straight line (Huber and Headrick 1999; Sharma 2014; Koppenhaver 2007). Some writers tend to have a natural inclination to write with an upward slant, while others may have a downward slant or prefer to write in a straight and level manner.

Hesitations: Hesitation marks are also examined in the handwriting. Hesitation marks are observed in various parts of the writing, including the starting and ending strokes, vertical lines, curvatures, and loops. These marks occur due to the writer's hesitation or uncertainty while replicating the original author's style as closely as possible (Sharma 2014; Koppenhaver 2007). During forgery attempts, the forger often tries to mimic the characteristics of the original writer's handwriting. However, the subconscious fear of detection or the lack of familiarity with the author's natural writing tendencies can result in hesitation marks. These marks may manifest as slight pauses, tremors, or irregularities in the strokes, indicating the forger's struggle to reproduce the writing accurately.

Retouching: Retouching in handwriting refers to the act of making corrections or alterations to letters or words while writing. Retouching while writing is done more commonly when the pen does not work correctly and a letter or word is rewritten. This retouching is a natural occurrence and is not habitual for most writers. However, when forgery is done, the forger misunderstand it as deliberate shading technique and applies retouching while writing in order to imitate the original author. Another aspect is that the forger may be in a habit of lifting the pen while writing or pausing the pen while writing; retouching is done to hide this (Huber and Headrick 1999; Koppenhaver 2007; Sharma 2014).

Placings: Every individual has a habit of placing the dot over an "i" or crossover "t" differently; even the punctuation marks used by an individual differs. The placement of the dot or cross can vary in terms of its shape, size, and position. Some may have a habit of placing a circle or dot or dash over "i" also with a different location like some may place it in the right or left or up direction, which is difficult to copy throughout the document. It is also said that the placing pattern may also change even in genuine writing (Sharma 2014; Koppenhaver 2007). These placement patterns can be difficult to replicate consistently

throughout a document, making it challenging for forgers to imitate. It's important to note that even in genuine writing, the placing pattern may change to some extent. Factors such as writing speed, context, and personal variations can influence the precise placement of these elements. This further reinforces the individuality of a person's handwriting and adds to the uniqueness of their writing style.

Embellishments: Embellishments in handwriting refer to decorative or ornamental elements that skilled writers incorporate into their writing. Embellishments are seen in the writing of skilled writers. These are mainly found in the starting and ending strokes, but skilled writers may show embellishments throughout the writing at specific locations or with specific letters (Sharma 2014; Koppenhaver 2007). These embellishments can take various forms, such as loops, curls, swirls, or other decorative additions that enhance the overall aesthetic appeal of the writing. Embellishments are considered a characteristic feature of skilled writers, as they demonstrate a level of control, creativity, and attention to detail in their handwriting. These decorative elements are typically consistent and show a certain level of artistry.

12.4 Factors Affecting the Handwriting

Educational background, language, employment, type of writing materials, writing surfaces and writing instruments used, support, posture, time, emotions, mental abnormalities, mood, intoxication, drugs and medication, intake of abusive substances like alcohol, cocaine, heroin etc., diseases and disorders, neurological abnormalities, surroundings, noise, etc., are some of the factors which directly or indirectly affects the handwriting of an individual. Apart from these factors, some mechanical factors such as intensity of light, cold, heat and accidental strokes significantly affect handwriting. The handedness of the writer, whether right handed or left handed, is also considered one of the important factors affecting the writer's handwriting (Ellen 2006; Richard 2007; Rao and Maithil 2013).

- *Educational background*: The level of education and training received can have an impact on handwriting style and legibility.
- *Language*: Different languages may have unique writing systems and letterforms that can influence handwriting characteristics.
- *Employment*: The nature of a person's occupation or profession may influence their handwriting due to specific writing demands or habits associated with their work.
- *Writing materials, surfaces, and instruments*: The type of pens, pencils, paper, or digital devices used for writing can affect the handwriting style and quality.
- *Support and posture*: The stability and support provided to the writer while writing, as well as their posture, can impact the handwriting.
- *Time*: The speed and efficiency with which a person writes may vary depending on the time available or the urgency of the task.

- *Emotions, mood, and mental abnormalities*: Psychological factors such as emotions, mood swings, and mental health conditions can influence handwriting characteristics.
- *Substance abuse and medication*: Intoxication or the use of certain medications and substances can affect motor control and coordination, thereby impacting handwriting.
- *Diseases, disorders, and neurological abnormalities*: Certain medical conditions, neurological disorders, or physical disabilities can result in changes in handwriting.
- *Surroundings and environmental factors*: External factors like noise, lighting conditions, temperature, or distractions in the surroundings can influence handwriting.
- *Handedness*: Whether an individual is right-handed or left-handed can affect the formation and execution of handwriting strokes.
- *Age*: Handwriting can change over time as individuals mature and develop their writing skills. Children's handwriting may differ from that of adults, and older individuals may experience changes in their handwriting due to natural ageing processes.
- *Fatigue*: Tiredness or physical fatigue can affect handwriting, leading to changes in letter formation, line quality, or overall legibility.
- *Writing speed*: The pace at which a person writes can impact the appearance of their handwriting. Faster writing may result in less attention to detail, while slower writing can allow for more precise and deliberate strokes.
- *Cultural and societal influences*: Cultural norms, writing conventions, and handwriting instruction can vary across different societies and cultures, leading to distinct handwriting styles and variations.
- *Personal preferences*: Each individual has their own preferences when it comes to handwriting, such as letter shapes, slants, or spacing. These personal choices can contribute to the uniqueness of their handwriting.
- *Muscle memory*: Regular practice and repetition of specific writing movements can create muscle memory, affecting the consistency and fluidity of handwriting.
- *Handwriting habits*: Personal habits or idiosyncrasies in writing, such as looping certain letters, crossing t's, or forming specific connections between letters, can become ingrained in an individual's handwriting.
- *Fine motor skills*: The development and coordination of fine motor skills, including hand and finger dexterity, can impact the precision and control of handwriting.
- *Writing style influences*: Exposure to different handwriting styles, calligraphy, or artistic influences can shape an individual's handwriting preferences and techniques.
- *Writing instrument characteristics*: The type of writing instrument used, such as a pen, pencil, or marker, can impact handwriting. Each writing instrument has its own weight, grip, and smoothness, which can affect letter formation and overall handwriting style.

- *Writing surface*: The surface on which a person writes, such as a smooth desk, textured paper, or a digital device, can influence handwriting. Different surfaces may require adjustments in pressure or grip, leading to variations in handwriting.
- *Hand injuries or conditions*: Any injuries or conditions affecting the hands, such as fractures, arthritis, or neurological disorders, can have an impact on handwriting. These factors may cause pain, limited mobility, or involuntary movements that can affect writing abilities.
- *Psychological or emotional state*: A person's emotional state, stress levels, or psychological factors can manifest in their handwriting. Intense emotions or mental health conditions may influence the pressure, size, or overall appearance of handwriting.
- *Writing purpose and context*: The purpose and context of writing, such as taking notes, writing a formal letter, or creating artwork, can influence the style and presentation of handwriting. Different writing tasks may require specific adjustments in handwriting techniques.
- *Language proficiency*: Individuals who are bilingual or multilingual may exhibit variations in their handwriting due to the influence of different language writing systems or script styles.

Additionally, mechanical factors such as intensity of light, temperature (cold or heat), and accidental strokes can also have a noticeable impact on the quality and appearance of handwriting. Handwriting analysis is a complex process that involves considering multiple factors and comparing various aspects of a person's writing to make informed assessments. These factors can collectively contribute to the uniqueness and variability of an individual's handwriting.

12.5 Examination of Handwriting

12.5.1 Specimen or Requested Writing

A specimen or requested writing is obtained from a person to compare and individualize their handwriting with the questioned handwriting. It is crucial to collect the specimen writing when the person is feeling comfortable and at ease. When collecting specimen writing samples, it is important to keep the following considerations in mind. By adhering to these guidelines, the collection of specimen writing samples can be conducted in a standardized and comprehensive manner, allowing for effective comparison and analysis in handwriting examinations.

- Create a comfortable environment for the person before collecting the specimen writing. Initially, ask them to write their name, address, hobbies, favorite film, food items, and destinations.
- Ensure that all the writings and signatures are collected using the same or similar writing instrument, material and surfaces.

- During the collection process, dictate at a slow, normal, and fast pace. Use separate sheets for each speed of dictation.
- The dictation should include a variety of words, symbols, signs and digits to cover a wide range of writing characteristics.
- The specimen writing should be obtained in the same language or medium as the questioned writing.
- Avoid providing specific instructions or guidance regarding punctuations, language, abbreviations, symbols, etc.
- These samples should also be collected at different intervals, such as on alternate days or alternate weeks, to observe any natural variations in the person's handwriting.

12.5.2 Natural Writing/Admitted Writings/Collected Writings

Natural writing is considered ideal for comparison because a person writes it for obvious purposes in normal life. It is also known as collected writing, admitted writing, or contemporaneous writing. It can be obtained from personal belongings such as diaries, notes, letters, etc., or from the school or colleges where the person has completed his/her education. It can also be obtained from the employment offices, banks, utility services, insurance agencies, hospitals, courts, etc., if the person is associated with these places. Answer sheets, agreements, contracts, cheques, financial records, drafts, orders, communication letters and bills can be considered important specimens to obtain the natural writings for comparison and identification in any handwriting related disputes. It's important to note that the freshness of the samples is also significant. Ideally, the natural writing samples used for comparison should not be too old, as handwriting can evolve and change over time. Fresh or recent samples provide a more accurate representation of an individual's current writing characteristics. The principle of comparison states that "only likes can be compared"; therefore, the comparison is made with the same or nearly the same type of samples in similar conditions and writing surfaces, instruments or material used (Ellen 2006; Richard 2007; Rao and Maithil 2013).

12.6 Collection and Packaging of the Documents

Like the other physical evidence, document as evidence must be collected, preserved and packaged with utmost care and sincerity. Samples of the documents examination and comparison can be collected from various sources, either from the house of the victim, suspect or criminal or from the locker, school, college, working place, office, etc. Dump yards, dustbins, waste paper baskets or boxes installed at the house, offices or workplace can be critical sources where a complete document or pieces of a document may be found. These suspected places or sources should be adequately searched during the investigation.

The documents found on the crime scene should be picked up carefully and placed on a clean sheet of paper. The document then should be examined for the presence of any extraneous material like pollen grains, dust, soil, hair or blood. All these extraneous materials should be collected appropriately. The document should be packed in an envelope larger than the document. Questioned documents should be handled carefully to preserve the latent fingerprints. Rubber-tipped forceps or handpicking of the document is recommended. Fingerprints should not be developed before submitting the document for examination as they may interfere with the examination of the document.

Do not write over documents or make any markings with a pen or pencil. Do not mutilate by erasing, repeated refolding, cutting or tearing. Avoid excessive handling. Keep documents in envelopes or protective folders. Do not allow anyone except a qualified expert to carry out chemical or other types of tests. Take documents to the laboratory or expert at the earliest convenience. Every document should be handled carefully, and photography should be done before and after the collection, especially for charred documents or documents found in the arson cases. In the case of charred documents, they should be stabilized before collection to prevent damage during lifting, handling, packaging and transportation.

The documents should be protected from extreme environmental conditions like heat, moisture, contaminants, etc. Documents should not be treated unnecessarily with any kind of solvents or chemicals. The documents should not be damaged, folded, torn, punched, tagged, twisted or stapled. During the evidence collection, the identification mark should be placed on the backside of the document or where no typed, printed or handwritten information is present (Hilton 1940).

12.7 Forgery: Types and Detection

According to section 464 IPC, "Whoever makes any false document or part of the document with an intent to cause damage or injury to the public or any person, property or with an intent to commit fraud or that fraud may be committed, commits forgery". There are four main types of forgery:

1. Simulated forgery
2. Traced forgery
3. Forgery by memory
4. Forgery without model

1. **Simulated forgery:** Simulated forgery is generally the imitation or copying of actual writing or signature. This is also known as "freehand forgery", "imitation forgery" or "copying forgery". In this type of forgery the forger keeps a model in front of him and tries to imitate or copy the pictorial effect of the handwriting as similar as possible with his observation and skills. While imitating the signature, the simulator tries to draw it pictorially similar to the original signature. However, even after the signature might look precisely similar, it lacks some details that can

be identified during examination (Lindblom and Jan 2006; Sharma 2014; Ellen 2006; Nickell 2014; Mohammed 2019; Harrison 2008).

2. **Traced forgery**: Traced forgery is when the forger reproduces an exact replica of the original or genuine writing using different methods. This type of forgery, when committed, has a close resemblance to the model. Some ways in which traced forgery is executed are as follows:
   (a) **Direct tracing**: The most common and straightforward method for tracing forgery is a direct forgery. More often, the paper bearing the genuine signature is held against a window, and then after proper adjustment, the signature is traced or outlined on the required paper as the outline of the signature can be seen through the window glass (Sharma 2014; Ellen 2006; Nickell 2014; Harrison 2008).
   (b) **Projection tracing**: Projection tracing is considered to be an easy method for doing forgery. In this method, the document consisting of the genuine is placed over the document where it is to be forged. The genuine signature is then traced with a pointed instrument with pressure to see indentation marks on the following paper. The document consisting of the indentations is then traced with an ink pen; thus, a forged signature is done (Sharma 2014; Ellen 2006; Nickell 2014; Harrison 2008).
   (c) **Use of Carbon paper:** This type of tracing forgery is akin to projection tracing. In this method, a carbon paper is placed over the document where forgery is to be done, and then the original document is kept over the carbon paper. With the help of any sharp writing instrument like a pen or pencil, the signature is traced and imprinted on the paper kept underneath. The signature is then inked with a pen (Sharma 2014; Ellen 2006; Nickell 2014; Harrison 2008).
   (d) **Use of tracing paper:** In this method, a model signature is kept over a tracing paper and traced with the writing instrument. The tracing paper is then kept over the document, then again traced with the writing instrument, and finally inked with a pen (Lindblom and Jan 2006; Sharma 2014; Ellen 2006; Nickell 2014; Harrison 2008).
3. **Forgery by Memory:** Forgery by memory is very similar to freehand forgery. In this method of forgery, the forger uses his memory to copy the original writer's forms, letters and style to write or for doing a signature. A model is not present in this method of forgery (Harrison 2008).
4. **Forgery without model:** Forgery without a model is also known as a forgery by impersonation. It refers to the writing or a signature made by a person representing himself to be another person to whom the writing or the signature may either be made bonafide by the person. Such types are also called allograph signatures or writings (Harrison 2008).

12.7.1 Detection of Forgery

Forgery can be detected by a minute examination of the writing on the questioned document. The first examination step includes observing and noting the class and individual characteristics. Characteristics include placing the dot over "i" or the cross over "t", spacing, style of writing, pressure applied, angle of the writing and alignment.

In case of a forged signature, a superimposition technique can be employed for comparison. If the genuine signature matches/overlaps with the forged signature, it indicates that the signature is forged. This can be said because there is a slight variation in signature even when done consecutively.

Hesitation marks in the starting and ending stroke also account for an attempt of doing forgery. Apart from this, pen stops and lifts at the unusual site also indicate forgery. Abrupt changes in the strokes and the direction of writing, and non-continuous strokes are also signs that can be seen when forgery is done. Other factors through which forgery can be detected are observing any overwriting, crowded writing, pen blobs, abrasion over the paper, misplaced shading, variation in pen pressure, change in slant, etc. Marginal spacing, defective line quality, retouching, tremors, indentations, and the presence of more than two types of pen inks indicate forgery.

Speed of writing is one of the features of handwriting, which also plays a vital role while detecting forgery. In genuine writings, the written material will have uniform writing, whereas if the speed is either fast or slow, variations in the writing are visible during an examination.

Tremors, which manifest as irregularities or shakiness in handwriting or signatures, are generally seen in forged writings or signatures. These tremors are naturally present in handwriting because of age, illness, disease, etc., but when someone tries to copy a signature, uniformity in writing is not seen, along with hesitations in the wrong place (Sharma 2014; Ellen 2006; Nickell 2014).

12.8 Alterations

The term "alteration" refers to any intentional modification, change, or manipulation made to a document with the purpose of deceiving or misleading others. In the context of document examination and forensic analysis, alterations can take various forms and may involve additions, deletions, erasures, or modifications to the content, appearance, or structure of a document. Generally, it is a modification made to a document by physical, chemical or mechanical means such as erasures, addition and obliterations of the words, or employing electronic means to digitally modify electronic documents. It can also be done by charring and indentations. The intention behind alterations is often to conceal or manipulate information, forge signatures or endorsements, create false records, or perpetrate fraud.

If the changes are made in a document without the concerned person's or other parties consent, then such changes are called "deceitful alterations". Identifying and

detecting alterations in documents is a crucial task in forensic investigations and legal proceedings. Document examiners utilize a range of specialized techniques and tools to uncover hidden alterations and restore the original content whenever possible. These methods can include visual examination under different lighting conditions, use of magnification devices, infrared imaging, chemical tests, and even the application of computer software for digital document analysis. Detection of alterations depends on good training and available equipment. By meticulously examining the physical and visual characteristics of a document, experts can detect signs of alterations such as variations in ink color or texture, inconsistencies in handwriting or printing, misalignments, or disruptions in the sequence of content. Through these analytical processes, the detection of alterations helps to ensure the integrity and accuracy of documents presented as evidence and aids in determining the truthfulness of the information contained within them. The various types of alterations are as follows:

Abrasion: Abrading the paper generally means using any destructive means to erase something. Abrasion is also known as erasure or removal of writing, typewriting, or printing from paper by means of rubber erasures or by using a sharp instrument like a knife, blade, glass piece, etc. Because of using a sharp object on the paper, the erasure area gets damaged; the fibres present get disturbed, and the area becomes thinner than the other part of the paper where erasure is not executed, leaving the paper to become more porous. When a pen is used to write over erasures, the ink is readily absorbed by the paper. If pencil is used to write, bumps are seen because of the unevenness in the paper (Lindblom and Jan 2006; Koppenhaver 2007; Richard 2007).

Detection: Physical erasures can be detected using different methods or, more commonly, different light sources. The document can be exposed to infrared or ultraviolet light to detect fluorescence or luminescence changes. The erasure area becomes thin, which can be detected by using transmitted light. Indentations left by the erasure are also detected by holding the paper at eye level and an angle so that the light can pass through. Other means of detecting erasure are oblique lighting and Electrostatic detection apparatus. Various powders are also used to detect erasures, including the mixture of methylene blue and starch; another powder that can be used is bicarbonate of soda (baking soda) and toner powder (Lindblom and Jan 2006).

Chemical Erasure: Chemical fluids or solvents are used to erase the ink from the paper. Different types of inks need different chemicals to erase them. However, a complete removal is not always possible, and these chemical eradicators leave stains on the paper and cause the paper to expand. The paper, after drying, does not go back to its original size but leaves wrinkles at the location of the fluid (Lindblom and Jan 2006; Sharma 2014; Ellen 2006; Richard 2007).

Detection: Erasure with chemical treatment can be detected with the help of UV light, IR light, oblique light or transmitted light. Indentations can be deciphered by ESDA and by the use of oblique lighting because indentations are not altered by the chemical erasures and thus can be restored. Inks with

carbon composition can be restored when erased chemically with sulphocyanic acid fumes. The fumes react with iron, and the red colour after reactions reveal the writing. Iodine fuming also accounts for one of the methods of deciphering the alteration. The iodine crystals are kept in a glass or dish, and the paper is then exposed to fumes. Sublimation takes place, which reveals the writing. The process can be fastened by warming the glass with a candle. Nowadays, iodine fuming is not recommended as the fumes are toxic, and when used, a photograph is suggested because the deciphered portion fades away quickly (Lindblom and Jan 2006; Huber and Headrick 1999; Sharma 2014; Koppenhaver 2007).

Obliteration: Overwriting a sample of handwriting or any printed matter with the help of any pen, pencil, correction fluid or opaque material is obliteration. These obliterations are made either accidentally or purposely to hide something essential or any mistake. The method used to detect the obliteration depends on the original writing and the means used (Lindblom and Jan 2006; Huber and Headrick 1999; Sharma 2014; Koppenhaver 2007; Richard 2007).

Detection: The obliterated writing can be deciphered using transmitted light and then captured by photography. In this method, the document is placed on a light box or a transmitted light machine; then, photography is done. If correction fluid is used to obliterate in some cases, it leaves the underneath shape seen on the opaque material, which can also be deciphered with the help of transmitted light. A non-destructive technique uses acetate sheets and a photocopier to decipher the opaque material. This method consists of placing the document on the photocopier where the opaque material is faced up, then it is covered with black paper and the toner level is adjusted to full dark. A transparent sheet is then inserted into the tray, and a transparent copy is produced. The copy will then contain the obscured material read through the paper.

Another method includes spraying a solvent consisting of acetone on the document. This will remove the opaque material and decipher the writing. As this is a non-destructive method, photography should be done before starting and after completing the process. When a document is obliterated using a black marker, it can be soaked in methyl alcohol or ethyl alcohol for its decipherment as it removes the marker ink without damaging the written or printed matter underneath. Infrared or ultraviolet light is also suggested to be used as it may cause the writing to fluoresce and thus decipher it (Lindblom and Jan 2006; Sharma 2014; Koppenhaver 2007).

Insertions: Insertions are generally the addition of any word, digit, symbol, sign, etc., into the original document to commit deceitful activity. It is fraudulent in most cases. The addition is commonly made in the space between the letters, words or sentences. For example—**eight thousand** can be converted into **eighty thousand** by adding the letter "**y**". In a similar case, adding the number "0" is required to convert the "8" into 80 (Lindblom and Jan 2006; Sharma 2014; Richard 2007). Additions or insertions are most of the time found in crowded

places. These additions are more challenging to be detected than the erasures. The methods to detect insertions are as follows.

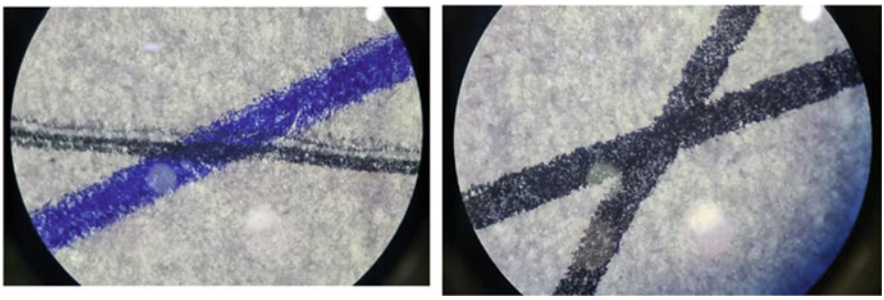
Detection: When a handwritten document is altered by addition, the most common way to decipher it is by observing the misalignment as it is probably in crowded places. The addition made in any document can be detected by examining handwriting features such as the spacing between the words and numbers, pen pause and pen lift, connecting or intersecting lines, line qualities and differences in the appearance of inks or shapes and size of the letters or numbers. The writing will usually have a different style if written by another person rather than the original writer. The size and shape of the alphabets will also differ, which helps identify the insertions committed. A typewritten document can be deciphered by observing the misalignment, as it is difficult to align the document perfectly vertically or horizontally. When a grid is placed over the document, it will eventually reveal the text that has been added to the document or not. The typeface will help identify the alteration if a different typewriter is used. Inks used to alter the document are often different; hence, the ink difference can help detect the addition. Exposing the document to different light sources like infrared light or ultraviolet light will help decipher.

The composition of ink can be determined by using Thin Layer Chromatography, High-Performance Liquid Chromatography or UV–visible spectrophotometer. Video Spectral Comparator (VSC) and stereo microscopes are also helpful in determining the differences in inks. Both the techniques are non-destructive and very sensitive by which the intersecting lines or sequence of strokes can be determined in case alteration is done in a document through addition. Sometimes an examination with UV rays, IR rays and colour filters may also be helpful for this purpose (Lindblom and Jan 2006; Koppenhaver 2007).

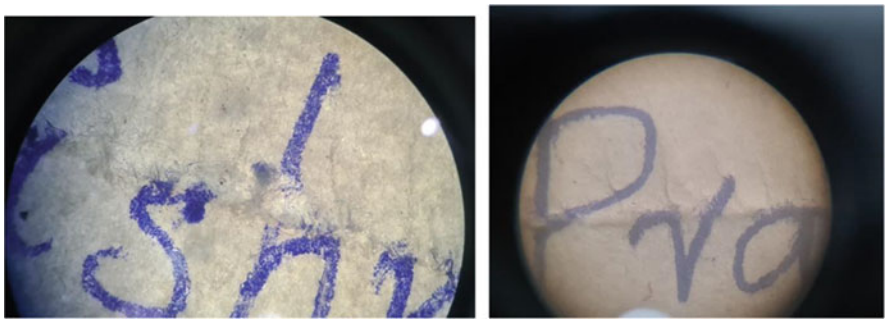
Page substitution: Adding paper to a multi-page document is page substitution. This addition to the page can be identified by observing some minute details. The first method which can be used to identify the addition of a page is to expose them to different light sources like IR light, UV light and even the transmitted light. These lights will make the paper fluoresce, and different papers will fluoresce differently, thus aiding identification. Another method of identification includes measuring the size and width of the paper, observing the colour of the paper, see any stains or marks present on the paper like the punch hole marks, staple marks or presence of any indentation marks, etc. (Lindblom and Jan 2006; Koppenhaver 2007).

Cutting: Cutting is the most frequently used type of alteration where a small portion of one document is cut and then pasted onto another, or something else is pasted onto the respective document which had been cut. These alterations are detected, but the original material present before alteration cannot be detected (Lindblom and Jan 2006; Koppenhaver 2007).

The Sequence of Writing/Intersecting Lines: One of the most practised alteration types is adding writing into the original or already written matter. The forensic expert can distinguish if the material was present before or added afterwards. These writing sequences can be detected using a stereomicroscope, handheld microscope, linen counter or microscope equipped with UV light (Shukla et al. 2022; Badiye et al. 2022; Sharma et al. 2022; Kapoor et al. 2022). This can be detected because the ink used speaks for itself. When ink is used to write over already written matter, the ink spreads at the intersection detected using the above-listed instruments (Lindblom and Jan 2006; Huber and Headrick 1999; Sharma 2014; Koppenhaver 2007). The most efficient way to assess the sequence of strokes is to use a Video Spectral Comparator with various features such as UV illumination, side lighting, high magnification, and so on.



Folds and Creases: Alteration of this type is often done without any intention and knowledge that it may act as potential altered evidence. When a paper has folded, the folding lines break the topmost layer of paper and damage it. Because of this damage, when a pen is moved over the area of those folds or creases absorbs more ink which spreads a little more than the undamaged part of the paper. This alteration is then detected using a stereomicroscope, handheld microscope, etc. (Shukla et al. 2022; Lindblom and Jan 2006; Sharma 2014; Koppenhaver 2007; Ellen 2006).



12.9 Examination of Typewritten Document

Printers have largely replaced typewriters. Typewritten documents are less often encountered nowadays because typewriters are not used by people as widely as printers nowadays. However, different make and model of typewriters are still observed, and the examination of these typewritten document is common particularly for personal use or legal purposes.

Typewritten documents are examined for their authenticity and to determine whether any alteration is present. Some of the following points considered for examining typewritten documents are discussed herein.

Typeface: The typeface is considered the style of how the alphabets should be written and even the numerals. Every machine has a particular typeface which can be different on a large or small scale from other manufacturers of the typewriter. Differences can be observed with letters and numerals like the cross bar over "t", to observe if "3" has a curve or a straight line, etc. these letters also have a difference in size which is also an essential factor during the examination.

Letter Spacing: Another characteristic is letter spacing. Every machine ensures that the letters are adequately spaced. In this, the characters are counted to an inch, i.e. the length occupied by 100 characters in inches. The two most common spacing, ten or 12, are seen in typewriting: 10 characters to the inch are known as pica and have a spacing of 254 mm per 100 characters and 12 characters to an inch are referred to as elite which has a spacing of 212 mm per 100 characters.

Comparison with the typewriter: A typewritten document is not necessarily always compared with a typewritten document only. Many times the typewriter is also examined to determine if the document is produced by the machine only or not. With time and use of the machine, wear and tear are observed, which aid in the examination.

Alignment of letters: One of the key points which can be considered during the examination is the alignment or misalignment of the letters. This is important because the letter may be either placed a little upward, downward, close or far from the residing letter during the manufacturing. This defect will be seen on the document and often helps identify the machine.

Ribbon characteristics: The examination may involve analysing the ribbon used in the typewriter. Different typewriters can have variations in ribbon characteristics such as ink colour, density, and fading patterns. These can provide valuable information for identification.

Impressions and indentations: The examination may focus on identifying impressions or indentations on the document that may have been left by the typewriter keys or other parts of the machine. These can help determine the specific typewriter used.

Line spacing and margins: The spacing between lines and margins on the document can be examined for consistency and specific measurements. Variations in line spacing or margins may indicate different typewriters or tampering.

Mechanical defects: The examination may involve assessing any mechanical defects or unique quirks associated with a particular typewriter model. This can

include irregularities in key strikes, misalignments, or other mechanical inconsistencies that may leave identifiable marks on the document.

Typewriter identification marks: Some typewriters may have identification marks or serial numbers that are unique to a specific model or manufacturer. These marks can be examined for authenticity and compared with known typewriter records.

Anachronisms: When examining a typewritten document, it is important to consider the date of the document and determine if the typewriter used to produce it was available or in use during that time period. Anachronisms may suggest forgery or tampering.

Temporary Defects: Temporary defect that can be useful in identification is the presence of dust or dirt. When dust or dirt accumulates on the typewriter's typeface, it can cause the letters to be printed with a more solid appearance than they were originally intended to be. When two keys are pressed together, it can result in an effect where both keys or either of them are affected. This impact can be visible in subsequent printing impressions, indicating the occurrence of simultaneous key depression. Sometimes, after pressing certain letters, the ink printed on the paper may appear darker or lighter. This discrepancy in ink intensity can be attributed to factors such as ink saturation, ink ribbon condition, or variations in typing pressure. Occasionally, typewritten letters may appear broken or incomplete on the paper. This defect provides a crucial clue about the condition of the typewriter, potentially indicating mechanical issues or irregularities in the typing process. Defects related to the spacebar can also be observed. For instance, the spacebar may provide excessive or insufficient space while typing letters, which can indicate abnormalities or malfunctions in the typewriter mechanism. The absence of a character from the typescript can be an important clue for identifying the make and model of the typewriter. This can occur if a letter key is not fixed correctly during manufacturing or becomes detached due to operational failure. double impression of a key can hold significance during examination. Continuous use and wear and tear can prevent a key from returning to its original position after being pressed, resulting in a double impression on the subsequent printing (Lindblom and Jan 2006; Huber and Headrick 1999; Sharma 2014; Koppenhaver 2007; Ellen 2006; James et al. 2014; Harris and Lee 2019; Houck 2018; Esther 2009). These defects and anomalies provide forensic experts with valuable information about the condition, usage, and potential characteristics of the typewriter used to create the document. By carefully examining these observations, along with other aspects of the typewritten document, analysts can make informed assessments and draw conclusions regarding the identification and potential implications of the typewriter involved.

12.10 Examination of Photocopied Documents

With the more usage of the photocopy machine, it has become essential to examine photocopied documents. This examination is commonly practised due to the involvement of crimes such as fraud, terrorism and passing on the secrets or confidential materials. Photocopies are used because the perpetrators often believe that it may not be helpful as the original documents for identification purposes.

One aspect of examination involves analyzing the toners used in the photocopier machines. Toners are used to print images onto the paper that is only partially absorbed. The chemical composition of the toner can be determined by using an instrumental technique like the scanning electron microscope. Dry toners' composition includes a higher percentage of resin which can be determined by pyrolysis mass spectroscopy and infrared spectroscopy for identification and comparison. Toners also contain a specific amount of iron which can be identified using a non-destructive technique like magnetization. Toners are also specific for the particular make and model of a machine; this information may aid in identifying the machine.

Extraneous marks made on the paper account for additional important information. The grippers, grabbers and rollers in the photocopier machine leave certain marks on the paper, which are unique for the machine. The photocopy-generated documents differ in size and dimension from the printed matter by around 1%. Most of the time, there is a slight enlargement in size, although reduction may also be seen, and this too varies for different brands and models of machines.

Marks on the photocopied document are also ubiquitous because of damage to the machine. Damage to the platens, lids, glass plates and even the scratches and dirt over it leads to printing those marks onto the paper. Trash marks are one of the significant ones produced over the document. These marks are formed by the dust and dirt present in the machine and appear on the paper in the form of small dots at random places, further identifying the machine that causes it. Some marks that may not be recognized but are important as those of others are the staple marks, holes, folds, tears, stains and any other extraneous material (Lindblom and Jan 2006; Koppenhaver 2007; Ellen 2006; Houck 2018).

12.11 Examination of Secret Writing

Examination of secret writing is done to analyse the hidden messages that have been concealed by using various types of invisible inks. The invisible inks cannot be seen until they are revealed using different unveiling methods (Andharmule et al. 2013). Initially, physical methods are applied to preserve the document. The physical method that can aid in detecting the secret writing is using different light sources such as UV light, IR radiation and different filters available to visualize the writing better. A household cloth iron that evenly distribute heat in all directions can be used to decipher secret writing. The secret ink containing any type of body or vegetable fluid will often disclose the writing when ironed. This can also be achieved by

keeping the document over a burner flame, but it is not recommended as it can destroy the evidence.

In addition, an IR lamp can also be used by exposing the document to radiations through a small opening. While doing this, any powder can also be dusted to see if it adheres to the surface of the paper where the message is secretly written. The iodine fuming method, more commonly used to develop the latent fingerprint, can also be used to decipher secret writing. This method is also non-destructive because, after some time, the colour starts to fade away (Huber and Headrick 1999; Ellen 2006).

12.12 Document Dating

Determining the age of a document is an intricate and challenging task that requires expertise in the field of questioned document examination. To date a document, there are various methods that can be employed, including examining its paper, ink, handwriting, and intersecting lines. The dating process can be achieved through static, dynamic, or supplementary approaches, or a combination of these (Kapoor et al. 2021).

Static methods employ time tags, chemical composition analysis, and elemental profiling to determine the age of the document. Dynamic methods include ink, paper, and toner ageing, which involve examining the changes in the chemical and physical properties of the materials used in the document over time. Supplementary methods include accelerated ageing techniques, chemometric approaches, analysing luminescent components, constructing a chronology of documents, radiocarbon dating, and nanotechnology-based approaches (Kapoor et al. 2021).

In static dating methods, the time tags used are usually watermarks, manufacturer logos, and other markings that indicate the date of manufacture of the paper. Chemical composition analysis involves determining the presence and concentration of specific chemical elements in the document. Elemental profiling, on the other hand, involves comparing the elemental composition of the document with that of other documents of known age (Kapoor et al. 2021).

Dynamic dating methods rely on the changes in the physical and chemical properties of the ink, paper, or toner used in the document. Ink ageing involves analysing the changes in the chemical properties of the ink, such as the loss of volatile solvents or the oxidation of the ink. Paper ageing involves analysing the changes in the physical properties of the paper, such as the loss of strength or the yellowing of the paper due to ageing. Toner ageing involves analysing the changes in the physical and chemical properties of the toner used in the document over time (Kapoor et al. 2021).

Supplementary methods, such as accelerated ageing techniques and chemometric approaches, involve subjecting the document to specific conditions to simulate the ageing process and analysing the changes that occur. Analysing luminescent components involves examining the fluorescence and phosphorescence properties of the document to determine its age. Constructing a chronology of documents involves comparing the document with other documents of known age to establish

a timeline of the document's creation. Radiocarbon dating involves analysing the carbon content of the document to determine its age.

Nanotechnology-based approaches involve using nanoparticles to analyse the document's physical and chemical properties (Kapoor et al. 2021).

12.13 Conclusion

The examination of documents is a key component in forensic investigations, as it provides valuable insights and contributes to understanding a case. Document examination involves a meticulous process of collecting and preserving physical evidence, detecting hidden messages, and analysing different types of forgery, including handwriting, typewritten documents, photocopies, and secret writing. Forensic experts employ a combination of scientific methods, specialized equipment, and expert analysis to identify unique characteristics, detect alterations, and decipher concealed messages. Their work enhances the understanding of document authenticity, aids in identifying individuals involved in fraudulent activities, and helps resolve complex cases. The field of document examination is constantly evolving with technological advancements and the development of new forgery techniques, providing invaluable support to the legal system and ensuring the integrity of documentary evidence. While this introductory chapter cannot cover all aspects of questioned documents, readers are encouraged to refer to other books for a more detailed account of the various aspects.

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