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Abstract

The chapter “Introduction to Forensic Psychology” provides an overview of various techniques and methods utilized in forensic psychology, specifically focusing on interview techniques and analysis tools. The chapter begins by exploring the fundamentals of forensic psychology and its application within legal and criminal justice systems. It then delves into the examination of key interview techniques, including the Morgan Interview Technique, FAIMT Interview, and Statement Analysis. Additionally, it highlights the significance of systematic content analysis techniques in assessing written or verbal statements for potential deception indicators. The chapter further discusses the use of specialized tools such as the Polygraph, Narco analysis, Brain Electrical Oscillation Signature Profiling (BEOSP) test, Suspect Detection System, and Layered Voice Analysis in forensic investigations. Finally, it emphasizes the importance of integrating these techniques within forensic psychology practice to enhance the accuracy and reliability of investigative procedures.

Keywords

Interview techniques · Detection of deception · Polygraph · Narco-analysis · BEOSP test · Suspect Detection System · Layered Voice Analysis

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13.1 Introduction

Psychology is an enthralling realm that captivates us all. It beckons us to delve into the depths of our unconscious and subconscious thoughts, unraveling the enigma behind our preferences and aversions. Furthermore, it awakens our curiosity to discern the inner workings of others' minds and unravel the intricacies of their very being. This is the essence of psychology—an awe-inspiring subject that never fails to mesmerize. Its roots span from the earliest moments of gestation to the twilight years of old age, permeating every stage of human existence. The vast tapestry of the psychology fraternity encompasses child and adolescent, adult, educational, clinical, and geriatric psychology, each branch shedding light on a unique facet of our complex nature. Through interviews, psychological tests, and the application of therapeutic techniques, psychology seeks to unravel the mysteries of human behavior. And in the realm of forensic psychology, it delves even deeper, scrutinizing the motives, psychopathology, and unfulfilled desires that lead to criminal acts, shedding light on the darkest corners of the human psyche.

Historically speaking, the word 'forensic' has come from '*forensis*'. In ancient Rome, the forum was a central public space where legal proceedings, discussions, and debates took place. Based on debate, the jury used to make decision.

Informal use of psychology was done by the well-known character Sherlock Holmes, who, with his acumen in the human psyche, understood the motive, modus operandi and act of the accused.

13.2 Brief Contributions in the Field

The origins of forensic psychology can be attributed to figures like Wilhelm Wundt, often referred to as the father of experimental psychology. Wundt's emphasis on understanding human behavior through scientific observation laid a foundation for the application of psychological concepts in legal contexts. However, it was not until the early 20th century that the field truly took shape. In 1895, J. McKeen Cattell conducted research on the accuracy and confidence of individuals' responses to a series of questions. He developed a method of rating the degree of confidence in participants' answers. Alfred Binet was a French psychologist and is known as a pioneer in intelligence testing. In the early 20th century, Binet, along with his collaborator Théodore Simon, developed the Binet-Simon Scale, which was one of the earliest intelligence tests. The test aimed to assess cognitive abilities and identify children who might need additional educational support. Lewis Terman adapted and standardized Binet's intelligence test for use in the United States. Terman developed the Stanford-Binet Intelligence Scale in 1916. This test has been widely used in assessing intellectual abilities, including in forensic settings.

After World War II, the scope of forensic psychology expanded from witness testimony to cross-examining the accused and the defendant.

William Stern was a German psychologist, and is known for his work in the field of intelligence testing and the development of the concept of the Intelligence

Quotient (IQ). Albert von Schrenck-Notzing, a German psychiatrist and para psychologist, is known for his research on suggestibility and the effects of suggestion on witness testimony. However, his work primarily focused on the study of hypnosis and its potential influence on memory. Schrenck-Notzing conducted research on the phenomenon of “posthypnotic suggestion” and explored the impact of suggestion on memory recall. He believed that hypnosis could enhance recall abilities and aid in the retrieval of repressed or forgotten memories. While Schrenck-Notzing’s work on suggestibility and memory has implications for forensic psychology, his contributions to the field were primarily theoretical and related to the study of hypnosis rather than directly applied to forensic contexts.

In 1895, Cesare Lombroso invented an instrument to measure changes in volumetric displacement to measure emotional changes and detect deception. He is considered to be the father of Modern Criminology. Lombroso’s instrument, often referred to as the “plethysmograph,” aimed to capture physiological responses associated with emotional states and potential deception. By measuring changes in volumetric displacement, the device provided a means to assess variations in blood flow, which Lombroso believed could shed light on an individual’s emotional reactions. In 1908, Hugo Münsterberg wrote a book titled ‘On the witness stand’ which gave a forensic perspective to psychology. It marked a significant milestone in the development of forensic psychology. Münsterberg explored topics such as eyewitness testimony, suggestibility, and the reliability of memory, highlighting the potential for psychological insights in legal proceedings.

In 1917, the psychologist William Marston found that systolic blood pressure strongly correlated to lying. This led him to the design of the modern polygraph detector. Earlier, polygraph detection was considered the only scientific tool for detecting deception. Though controversial, the polygraph opened doors to using physiological responses as indicators of deception, influencing the practice of forensic psychology in areas such as criminal investigations and interrogation techniques. Solomon Asch conducted research on social conformity, shedding light on how individuals can be influenced by others’ opinions and behaviors. His work has relevance to understanding witness testimony and the dynamics of group influence in forensic contexts. Elizabeth Loftus is renowned for her research on eyewitness testimony and the malleability of memory. Her work has challenged assumptions about the reliability of eyewitness accounts and has influenced the field of forensic psychology by emphasizing the importance of accurate and unbiased witness testimony. Robert Hare developed the Psychopathy Checklist, a widely used tool for assessing psychopathic traits. His work has been instrumental in understanding and identifying psychopathy in forensic contexts. In 2001, the American Psychological Association recognized Forensic Psychology as an independent field of Psychology. This recognition was a significant milestone in establishing forensic psychology as an independent and distinct discipline.

13.3 Role of Forensic Psychologist

The forensic psychologist studies the psyche of offenders and examines various factors to provide insights for investigations. They gather the facts, the police records, post-mortem reports, forensic reports, legal aspects and the history of the victim/survivor and the accused. The interview conducted is non-clinical in nature, involving legal and investigative questions. It requires a deep understanding of the criminal psychology and behaviour. During the interview, the forensic psychologist may employ psychological tests and techniques to gather additional information and then present their findings in a language that can be understood by the court and investigators.

In western countries, forensic psychologists are employed by a range of entities including private detective agencies, self-employment, and government sectors. The court also appoints the forensic psychologist. Meanwhile, in India, generally speaking, the facility of a forensic psychologist is used in the government sector like forensic laboratories. However, it can be used in other government sectors like correctional homes, juvenile homes and remand homes where the expertise of forensic psychologists can be utilized. Generally, graduates in Sociology or Psychology are recruited in India for these positions. They may undergo additional training to handle the issues related to antisocial behaviour and psychopathology. They are trained to identify signs of manipulation or exaggerated fake non-clinical symptoms during the interview session. It involves particular skills to handle criminals, witnesses and complainants. Additionally, forensic psychologist may also be involved in training and evaluating police or other law enforcement personnel, providing them with the personality profile of the accused.

The court often engages the services of a forensic psychologist to assess the accused's competency to stand trial. If the individual is incompetent, the psychologist's report will include recommendations for the interim period during which efforts are made to restore the person's competency to understand the court proceedings and participate appropriately in their defence. Additionally, the court may appoint a forensic psychologist to evaluate the accused's state of mind at the time, the crime was committed. It is to ascertain if the accused has a history of mental illness, has experienced any traumatic illness in the early days resulting in psychopathology, or has been a victim of physical/sexual abuse or has a criminal history in the family, personality disorder etc. Based on the collected information, the psychologist provides an expert opinion about the possible cause or motive of the crime and may make recommendations for rehabilitation if necessary. The court takes their services for future risk assessment and evaluation of witness credibility.

Forensic psychologists can also be used in civil cases like insurance claims related to accidents, or determining the responsibilities of child custody and visitation. The court may appoint the forensic psychologist to evaluate the child's allegation of physical and sexual abuse and to evaluate the parenting capabilities of each part, and make recommendations regarding custody arrangements. In cases where serious crimes has been committed by a juvenile, the court request an assessment of the juvenile's mental age and maturity level before taking up the case for trial. The

forensic psychologist will also evaluate the potential for appropriate interventions and rehabilitation of such juveniles. Furthermore, Forensic psychologists can contribute to enhance the capabilities of the state and national law enforcement agencies and the criminal justice system, by training them and imparting their knowledge and expertise.

13.4 Interview Techniques

An interview is a technique in which two people i.e., the interviewer and interviewee (subject), preferably engage in face-to-face conversation to gather detailed information about the crime. The primary goal of the interview is to get factual information by establishing rapport with the interviewee. Alongside the interview, the observation of the subject is equally important as it helps assess their current thought process, emotions and interpersonal qualities. It is an important aspect that will give clues to the areas that need further evaluation and assessment. The subject should feel comfortable with the interview and the testing process. The interviewer allows the subject to narrate their story, which forms the basis of a structured interview. The interviewer should have a good insight into the psyche of human behaviour and logical thinking, enabling them to differentiate between nervousness resulting from the forensic investigation and attempts to hide the truth. They should be able to identify signs of being caught, emotional dilemma and evasiveness. Preliminary information about the subject, his hobbies, habits and family life, may often prove successful in breaking the ice. In the forensic setup, it is advisable to establish the rapport in first few hours of the subject's presence. The interview should be conducted without bias against any religion, caste, occupation or habit. The interviewer should be accepting and mature to understand the reason and motive behind the subject's statements.

The interview should progress by asking the open-ended questions and encouraging the subject to give detailed answers in an unrestricted manner. If required, silent pauses should also be utilized. The interviewer poses the questions, and the interviewee/subject provides the answers. The information given by the subject may not always be accurate; therefore, the interviewer needs to verify the veracity of the available police documents like the subject's statement, FIR and other medical and forensic reports. During the interview, the interviewer must consider both the legal and psychological aspects of the case. The interviewer will evaluate the subject's mental processes like attention/concentration, memory, orientation, mood, intellectual functioning, thought and perceptual processes and decide the probable psychological tests to be administered. The purpose of the interview is not to get the confession but to gather relevant details about the crime.

13.4.1 Interview Room

The interview room should be well ventilated and well illuminated so that the subject's expression and postures can be easily observed. It should be free of visual distractions and noise free. The room should provide a minimum of one table and two chairs. Giving a revolving chair to the subject should be avoided so that the observation of their posture and action can be appropriately noted. The interviewer's chair should be positioned higher than the subject's chair, giving the subject a psychological sense of the interviewer's authority. A spatial distance of approximately 4 ft away between the interviewers' chair and the subject's chair should be maintained.

The room should have a one-way mirror facility or video camera to monitor and record the interview and the subject's emotions and behaviour. It is important to refrain from displaying any religious or saint pictures in the room to allow the subject to speak freely and avoid potential biases. It will also help the examiner safeguard themselves against any accusation, whether verbal or non-verbal, made by the subject. The subject should be instructed to keep their mobile outside the interview room, and the interviewer should keep their mobile on silent mode to avoid disruptions.

Ideally, the duration of the interview should range from 30 to 45 minutes, depending on the nature and severity of the crime and the subject's attention span. Moreover, a notepad with a pen, pencil and eraser should be made available to take notes and for the subject to explain the location of the offence. The interviewer can take notes during an interview as long as their writing skills are consistent. It is important for the interviewer to empathize with the subject's feelings, motivations and fears, as this will help foster a sense of comfort and a supportive environment. The interviewer should speak in a language that is simple and easily understandable. His voice should be audible and clear. A translator is mandatory, if the subject speaks a different language. The translator should be a government gazetted officer or an equivalent person from the academic field, capable of maintaining the confidentiality of the case and the subject being interviewed.

13.4.1.1 Characteristics of Interviewer

- Should possess at least a post-graduate degree in Psychology, especially Clinical Psychology, Criminology, Forensic Psychology, Forensic Science or as prescribed by the relevant authority.
- Should be observant.
- Should be able to use non-accusatory questions.
- Should be able to establish rapport with the subject easily.
- Should be objective and non-judgemental interview.
- Should not be biased or prejudiced towards any cultural or societal norm.
- Should have active listening skills and the ability to raise effective questions.
- Should probe and ensure the information.
- Should use the language which the subject understands.
- Should adhere to ethical guidelines and professional standards.
- Should use mild, audible and clear tone (and avoid a loud and blaming tone).

- Should have the maturity to understand the subject's lifestyle, criminal history and/or psychopathology.
- Should maximum the use of open-ended questions and encourage the subject to give more information.
- Should avoid moralizing, preaching and patronizing the subject.
- Should avoid unwarranted assurance to the subject.

13.4.1.2 Non-Verbal Characteristics

- Should maintain suitable conversational distance.
- Should maintain the eye contact.
- Should have calm and attentive body posture.
- Should show empathy.
- Should use 'silence' appropriately.

13.4.2 Morgan Interview Theme Technique (MITT)

The Thematic Apperception Test (TAT) was developed by Henry A. Murray and Christiana D. Morgan at Harvard University in the late 1930s. This projective test was initially developed for clinical patients to explore unresolved conflicts, motivations and attitudes. The TAT consists of 20 drawing cards, each containing an ambiguous stimulus that prompts the subject to create a story encompassing their past, present and future. These stories reveals the hidden emotions and internal conflicts. While working with law enforcement agencies, Raymond Morgan applied the TAT to the criminals and found that the TAT test was very effective in detecting deception. On getting success on the TAT, Morgan developed his own set of sketches that resembled various types of crime scenes. He called this technique the Morgan Interview Theme Technique (MITT) (Gordon & Fleisher, 2010, 2019). The test has 42 sketches comprising 5 irrelevant, 18 relevant non-violent, 8 relevant violent, 6 relevant sexual, 3 apprehension and 2 guilt and remorse sketches. The ambiguous nature of the sketches allows the subject to project their anxiety, worry, fear and security. This test can also reduce the subject's anxiety and creates a comfortable environment for a forensic interview. It was observed that MITT techniques helped the interviewer gain insight and determined his truth or deception. Morgan made few observations for the truthful and deceptive subjects:

1. Truthful subjects were able to relate the sketch to the crime scene and were able to create a story related to it. Deceptive subjects, on the other hand, tend to avoid any association between the sketches and the crime scene. When pressed, the deceptive individuals would give a story that lacked any reference to the crime.
2. Truthful subjects gave more positive and upbeat stories, while deceptive subjects often conveyed more negative and downbeat stories.
3. There is logic in the story of truthful subjects, while the deceptive subjects displayed inconsistencies and illogical elements. Deceptive individuals would try to find relevance in sketches that were actually irrelevant to the crime.

4. Truthful subjects were adept at providing a satisfactory conclusion to their stories, while deceptive subjects struggled to bring their narratives to a satisfactory ending. They often appeared perplexed and unsure about how to conclude the story.

13.4.3 FAINT

The Forensic Assessment Interview (FAINT) is an interview technique used to quantify the qualitative response of the subject. It attempts to interpret non-verbal behaviour into non-verbal cues. The FAINT interview is scored on following:

1. Posture

Paul Ekman is a well-known psychologist who has extensively studied facial expressions and non-verbal behavior. According to Ekman, a truthful subject will show the signs of good eye contact, appear composed, relaxed and talkative. They will maintain face-to-face body alignment and use more illustrative language. Their answers tend to be direct and in alignment with the asked questions. On the other hand, a deceptive person will show nervousness and will try to evade the answers. They will appear tense for no apparent reason and will be defensive in his answers. Non-verbal clues like restlessness and increased body movements will be seen.

2. MITT

Raymond Morgan has developed 42 sketches with ambiguous stimuli in which the subject is asked to respond to the pictures by telling the picture's past, present and future. The purpose of using these ambiguous stimuli is to elicit the subject's interpretations, thoughts, and emotions, which can provide insights into their psychological state, motivations, and conflicts. The stories they create in response to the sketches can reveal hidden emotions and internal conflicts. It's important to note that the MITT technique is a projective test and should be administered and interpreted by trained professionals in the field of forensic psychology.

3. Projective/Relevant/Comparison questions

During the interview, different types of structured questions should be asked to the subject to get full information from them. The irrelevant questions are informal questions that help establish rapport with the subject. These questions will establish a neutral atmosphere. It will minimize resistance by structuring a strategy used by tricky subjects to avoid answering sensitive questions by answering the interviewer's questions with a question. The relevant questions are closed-ended questions that directly inquire about the subject's involvement or knowledge regarding the crime. Relevant questions are formulated so that the truthful will have no resistance to answering, and the deceptive person will be forced to lie to them. The comparison questions are relative, creating the mental environment for correctly identifying truthful subjects. These questions are often broad in scope, and are devised in a way that truthful subjects are expected to answer affirmatively. These questions are designed to create a contrast between

the relevant and irrelevant questions. The interviewer can observe patterns or inconsistencies that may indicate deception.

4. The suspect's written statement

The suspect/subject's written statement refers to a document in which an individual who is suspected or accused of a crime provides a written account of their involvement or knowledge of the incident in question. The purpose is to obtain the individual's perspective on the events under investigation and allows the suspect/subject to present their side of the story and provide details that may be relevant to the case.

After the completion of the interview with the subject, it is common practice to provide them with paper and a pen to write their own version of the crime incident. This allows the subject to provide a written account of their perspective, including details about their relationship with the deceased (if applicable) and their presence at the time of the incident.

The subject should be instructed to include preliminary details, such as their personal information and any relevant background information that may help in understanding their involvement or knowledge of the crime. They should be given sufficient time and space to write their version of the incident in their own words. This written statement serves as an additional source of information and can provide insights into the subject's understanding of the events, their level of detail, and any inconsistencies with their previous statements or the evidence collected during the investigation.

13.4.4 Content-Based Statement Analysis (CBSA)

Content-Based Statement Analysis (CBSA): In 1902, William Stern defined statement analysis as a technique in which a person's statement depends on their cognitive ability as well as on the interviewing process used to obtain the statement. The content of a statement can provide insights into the individual's cognitive processes, personality characteristics, and potential deception. Stern conducted experiments involving children who had made statements alleging sexual abuse. He told the children to write down about the incidents. He observed that children's statements could be influenced by external factors, such as the presence of other people during the writing process.

When analyzing a statement, cognitive ability, creativity and self-control play significant roles. A truthful statement based on genuine recollection of events tends to be less elaborate compared to a fabricated statement. In order to maintain the illusion of truth, deceptive statements often require a greater degree of creativity to ensure coherence and avoid contradictions.

CBSA has 19 criteria to analyse the following:

1. Logical structure: The statement will be relevant to the incident, though not necessarily chronological. The content will be concrete, original, precise and evident.

2. Unstructured production: The content will be unstructured and not chronological.
3. Quantity of details: The information given by the subject is more creditable since it is difficult for a person with no experience to describe the incident in detail.
4. Contextual Embedding: The time and space during the narration will be more specific than the fabricated one. The explanation regarding the incident in context to time and space will be relevant to what the subject speaks in the interview.
5. Description of interactions: The subject will give sequential details of the actions and interactions with other people before and after the incident. He will be sequential and be able to give the details of the interactions when the crime happened.
6. Reproduction of the conversation: The subject will be able to give the complexity of conversation sequences referring to the relevant act.
7. Unexpected complications during the incident.
8. Unusual details: The subject will give unusual details instead of the stereotyped statement. It depends on how the interview extracts the minute information from the subject.
9. Superfluous details: The subject will give the details outlining the incident, which would help relate to the major incident. This information is mainly given by the subject who has witnessed the criminal act. A person who has not experienced any act will be unable to give the peripheral details.
10. Accurately reported details misunderstood: The subject gives meaning or interpretation to the details.
11. Related external exposure: When the accused is making the statement referring to the conversations or incidents in comparison with the criminal act.
12. Accounts of subjective mental state: When the subject adds the emotional content or expresses his psychological state about the criminal act.
13. Attribution to perpetrator's mental state: The subject describes the accused's mental state. This has to be more free will than the response to the question.
14. Motivation related contents: The subject will try to convince the interviewer by making automatic corrections. This will indicate the subject's attempt to convince the examiner.
15. Admitting lack of memory: The subject will readily accept the forgetfulness in retrieving a specific memory, though it has to be checked whether the subject is saying in response to the question or otherwise
16. Raising doubts about his own testimony: This will be a subtle sign of the subject telling the truth to the examiner. He will often show mistrust in his narration. This will also show that the person unconsciously does not accept his narration.
17. Self-deprecation 'Self Accusation': When the subject accepts his fault or mistake in the statement, it reinforces that the information given by the subject is accurate to their knowledge.

18. Pardoning the perpetrator—‘discharging the accused person’: When the subject considers or wants to give another chance to the perpetrator. This statement will be incompatible in case of motivation for a false allegation.
19. Offence Specific elements: The subject will include detailed elementary information about the crime. This could be the detail regarding the grooming behaviour of the accused.

The examiner considers the 19 criteria mentioned above, which determine the statement’s credibility, though not all the criteria need to be met to establish the subject’s credibility. There is no numerical or cut-off scoring method in this technique. The opinion derived from this interview will be an element of the whole process. The interview analysis will indicate the subject’s genuineness, which correlates with further interview sessions and evidence.

13.4.5 Systematic Content Analysis (SCAN) Technique

Avinoam Sapir is a well-known Israeli expert in the field of statement analysis, linguistic profiling, and forensic psycholinguistics. Avinoam Sapir developed the SCAN technique, which analyses verbal and written statements to detect deception and infer psychological traits. Sapir has divided a statement into three parts: *Pre-incident*, *Incidence* and *Post-incident*. He has observed that the truthful subject will give 20% of pre-incident information, 50% of information will depict the incidence that took place and the rest 30% of information will be comprised of post-incident. Especially in the case of rape and molestation, the truthful subject will elaborate on what happened after the incident and how they had to face the shame and humiliation. The subject who writes the statement will be rich in information and would be able to relate to the incident, e.g. My husband, My daughter, etc. There will be more use of singular tense instead of the third person. If the person does not use ‘I’ in his statement, it calls for further inquiry. The subject may start his statement in singular tense; ‘I had gone to the office in my car, I was getting late, punched in at 9.30 and worked till noon’. It is seen that where the subject does the actual act, he uses singular tense, and when he enters the office, the singular tense is missed, giving a sign of deceptive narration. Although the subject might not present the events in chronological order, the relevance to the sequence will be maintained. The statement given will be spontaneous and lengthy without many interruptions. There will be creditability and flow in the statement.

13.5 Polygraph

In 1895, Cesare Lombroso experimented with the medical instrument, hydrosphygmograph, which the doctors medically used to check the patient’s blood pressure. Lombroso used this instrument to detect the deception or truthfulness of the accused by measuring the changes in the blood pressure—the pulse of the

accused. In 1897, Georg Sticker became the first person to use the galvanometer application to detect deception (Widacki 2015). He further suggested that using GSR together without asking questions would stimulate the emotional response that could be reliably measured physiologically (Gordon 2016). Although different experiments were done, the polygraph was not officially implemented in a criminal investigation. William Marston, known for his work on the polygraph, expanded upon these early efforts by adding the periodic discontinuous measurements of blood pressure and respiration as additional parameters to determine the subject's truthfulness. He used the word association test, which showed promising results. Vittorio Benussi, an Italian psychologist, contributed to the understanding of respiration patterns in relation to truthfulness. He explained that 'if the length of inhalation were divided by the length of expiration, the ratio was greater before telling the truth than afterwards and greater after lying than before lying' (Benussi & Antonelli 2002). Benussi's work highlighted the potential physiological indicators of deception. However, the scoring method for measuring respiration was inaccurate compared to blood pressure.

In 1921, John A Larson combined the Mackenzie ink polygraph instrument, which had three parameters; blood pressure, pulse and respiration which continuously recorded complex physiological changes such as arterial and venous pulses during the entire test period. Larson combined the Mackenzie ink polygraph to record and monitor changes based on the research of Benussi and Marston. The polygraph first came into significant contact with the legal system in 1923, when Marston attempted to have the results of a polygraph test admitted as evidence (Fyre v/s United states, 1923). In 1926, Leonarde Keeler, known as the 'father of modern polygraph', improved the polygraph instrument of Larson by introducing metal tambours and a synchronized chart drive mechanism that used roller paper, enhancing the functionality and reliability of the instrument. In 1938, Keeler collaborated with Charles Wilson to add Galvanic Skin Response (GSR) as the third component of the polygraph instrument. In 1942, Keeler and Larson developed relevant/irrelevant testing techniques, that require responses in Yes/No format, aimed at distinguishing truthful and deceptive responses (Matte 1996). In 1945, John E. Reid observed that the changes in the muscular activity of the subject are controlled by the parasympathetic system and are not readily observable. Consequently, in 1947, Reid added the measurement of muscular activity to polygraph instruments. The "control question technique" developed by Reid involves the use of specific types of questions to establish a baseline for comparison and to gauge the subject's physiological responses. This technique typically includes relevant questions related to the specific incident being investigated and control questions that are designed to elicit a stronger physiological response from deceptive individuals. He also developed a combination of the card test and the confirmatory 'yes' test to check the subject's cooperation. He also gave a 'silent answer test' in which the subject does not have to give any verbal answers to the questions, and the veracity is concluded based on the recordings of the non-verbal physiological responses.

A polygraph examination includes a series of yes/no questions to which the examinee responds while being connected to sensors that transmit data on these physiological phenomena such as blood pressure, pulse rate, respiration, and GSR. The instrument uses analog or digital technology to record the data. Because the original analog instruments recorded the data with several pens writing lines on a moving sheet of paper/chart, the record of the physiological responses during the polygraph test is known as a 'polygraph chart'.

13.5.1 The Polygraph Instrument

The conventional polygraph instrument is modified with the advancement of technology and now is known as a computerized polygraph instrument. The computerized polygraph no longer rely on pens attached to tambours to write in ink onto a roll of paper-driven clockwise (Mackenzie 1908) in the way original Keeler polygraph modes used to work. The computerized polygraph produces digital outputs directly from the measuring instruments into a computer with the appropriate polygraph software (Hirota et al. 2005). There are three primary purposes of polygraphs, i.e. event-specific investigation, employee screening and pre-employment screening.

There are two broad categories of sensors used in polygraphs, i.e. *Pneumatic* and *Electrical*



1. Pneumatic sensors

(a) Pneumograph (Chest assembly)

This sensor measures changes in respiration. It consists of a convoluted tube, anti-roll bars, beaded chain or Velcro strips and rubber tubing to connect to the computer sensor box. One pneumography chest assembly will be placed around the examinee's upper body area to record the thoracic breathing pattern. A second pneumography chest assembly will be placed around the lower abdomen area to record the abdominal breathing pattern. When the muscle expands, the air inside the tube gets displaced. It is the expansion and contraction of the muscles that form a wave. The transducer converts this wave into an electrical pattern on the computer.

(b) Sphygmograph (blood pressure cuff assembly)

This sensor measures blood pressure. The polygraph system records the systolic stroke, diastolic stroke and a dicrotic notch. This sensor consists of a rubber bladder covered with a cloth sleeve and Velcro wrap, pump bulb assembly, which includes a sphygmomanometer and associated rubber tubing for connecting the sensor to the computer sensor box. It is placed over the brachial artery.

2. Electrical sensors

(a) Plethysmograph

This sensor measures blood pulse volume. It uses a light source and a photosensitive cell to measure light changes that pass through the tissues. The amount of light reaching the photosensitive cell is related to the amount of blood it passes before reaching the sensor. The amount of blood absorbed is proportionate to the amount of haemoglobin (Hb) in the blood vessel. The change in Hb is due to sympathetic nervous system fluctuation.

(b) Electro Dermal Activity (EDA) Galvanograph

This sensor measures sweat conductivity. It consists of two stainless steel plates with Velcro straps and a shielded cable for connection to the computer sensor box. The finger plates are to be attached to the index and ring fingertips of the non-dominant hand of the examinee. The fingertips are generally porous and have lots of sweat. Hence, hydrated fingertips have maximum signal strength as it conducts electrical activity. Skin conductance is generally considered more efficient and reliable (Wynn et al. 2000). This sensor has been long regarded as the most sensitive and reliable of all the channels of the polygraph (Kircher and Raskin 2002).

Another sensor called the Piezoelectric Sensor pad or the 'P gauze'—also known as 'activity sensor' is a countermeasure. It detects any form of physical movement. It is placed on the seat, arms and feet of the examinee.

13.5.2 Procedure

There are five significant steps in administering the polygraph to an examinee.

1. Pre-test interview

The pre-test interview is detailed. It is done with the subject/examinee/witness and the investigating officer (I.O.). After taking the detailed information regarding the examinee, his role and relation with the case, the examinee will be briefed about the instrument and is shown the instrument and how it works. The examinee is allowed to ask the questions, and the examiner will also give an explanation. The pre-test interview shapes the expectations and emotional state of the examinee during the test. During the interview, the examiner will provide the examinee with an atmosphere that makes him mentally accessible and less anxious about the whole ordeal. The examiner will likely form impressions of the examinee's truthfulness based on the examinee's demeanor and response in the pre-test interview. These impressions can inform the examiner's approach during the examination and guide the interpretation of the results.

2. Court Order and Informed consent

This is the most vital part of the test as the polygraph cannot be administered on an individual without a prior court order and the examinee's informed consent. The Investigating Officer should produce the subject in front of the court and take permission of the subject to be taken for a polygraph test (Selvi Ors V/s State of Karnataka). The examinee must provide written consent for the test and be informed of their right to refuse. The test cannot proceed without the examinee's consent (as per NHRC guidelines 2000).

3. Question Formulation

Based on all the information gathered during the pre-test interview, a series of Yes/No questions are developed, which are short, simple and easy to understand. Each question should be close-ended and based on a single/specific issue. The questions should not consist of any legal jargon. The questionnaire should consist of relevant, irrelevant and control questions.

4. Test administration

Before administering the polygraph test, the examinee should be familiarized with the examination room, instrument and the questions that he/she will be asked. The examiner provides proper instructions to the examinee on how to sit and respond to the questions and may give a demonstration to make things more transparent. A baseline recording of the examinee's physiological responses is obtained for comparison purposes. Initial buffer items are also intended to reduce the situational effects on the examinee's physiological responses. Hence, a card or coin sorting test creates a baseline.

Each question of the questionnaire should be administered three times. This ensures that the examinee produces the same or similar physiological responses to the same questions all three times. A 15–20 seconds pause should follow each question allowing the time for the previous response to fade and the physiological measure to return to their baseline. This procedure is followed throughout the test,

with the examiner noting when the test began when the questions were asked and when it ended. The examiner should also make notes of any extraneous behaviour, such as coughing and sneezing, and their timings. After the initial completion of the questionnaire, the examiner may ask for any clarifications on specific questions or make other refinements before repeating the test twice for comparison. After the test is completed, a post-test interview will be done.

5. Post-test interview

As the name suggests, the post-test interview is conducted after the test is administered to the examinee. This is an interview that the examiner conducts with the examinee based on the test results. New information can also be gathered from the examinee during this phase and should be cross-checked before being included in the report or reaching a conclusion.

13.6 Brain Electrical Oscillation Signature (BEOS) Profiling Test

The application of neurophysiology is applied in the Brain Electrical Oscillation signature profiling (BEOSP) test (Zachariah et al. 2017). This test detects the subject's involvement in the crime by bringing out evidence of his intention and participation. The crime investigation has two dimensions: one to identify the criminal and the second to identify and direct the other probable criminal in the crime. This test can indicate the potential source of crime. The criminal cannot deny his involvement as this test has intuitive awareness, which is result oriented and beyond the scope of intentional masking. The electrical phenomena of the brain reveal highly sensitive and specific indicators of the various cognitive states. Psychoneurological studies have proved that when a person has experience with specific events, definite changes are observed in functional neuroimaging and cognitive electrophysiology. The two such electrical activities are those related to recognition by knowing and remembering the experience. For extracting the electrical activation associated with the awareness of recalled experience or remembrance, the multichannel electrical activity of the brain is recorded, while 'knowing' is the cognitive process of recognition with or without familiarity.

In contrast, remembrance is the recall of episodic and autobiographical details from a person's life. Awareness of the transcoded detail and the remembrance of the mental imageries of the different experience components constitutes Experiential knowledge in the individual (Mukundan 2007). George Mandler has introduced the dual theory of memory, which differentiated recognition between knowing and remembrance (Mandler 1980). All life experiences have their own context; remembering that context is equally important while remembering an experience. A context may refer to aspects more than what is referred to by time and place, while the source is found to have independent localization, as recall of an episode does not necessarily result in the recall of the source information. What makes an event in life an autobiographical episode is the experiential aspect of the event.

Experiential knowledge is acquired through participation in an activity and stored with its temporal and spatial (time and space) reference in the brain. Conceptual knowledge is based on awareness and devoid of any self-experience and projects only 'knowing' in the brain.



The Brain Electrical Oscillation Signature Profiling test, widely known as the BEOS test, projects the signature of remembrance of experience using a frequency-time domain analysis program.

For the administration of the BEOS test on the examinee, the pre-test interview, court order and examinee's informed consent are taken similarly during the administration of the polygraph test.

13.6.1 Formulation of Scenario and Probes

After taking detailed information about the crime and the subject under investigation, the forensic expert prepares the scenario and probes. As a procedure, the scenario is prepared on specific sequential detail given by the I.O. The more minute details are given from the I.O., the better the formulation of probes will be. Based on the details given by I.O and the interview with the subject, the scenario is formulated comprising intention, motive, conspiracy, act and disposal of evidence. The probes in the scenario are formulated sequentially and are interlinked with the events and characters. The probe is given an I.D. mark based on the type of awareness/memory of the subject and the hypothesis of the police.

The probe is very crucial as it should be formulated in such a way that it triggers the neurocognitive process of the subject. The probe's words and phrases should be formulated so that the subject understands its semantic process and, thereby, its interpretation. Similarly, when probes are recorded on the BEOS test, the speaker should not use any emotions or add expression to the probe. The subject should be able to understand the recorder's voice and dialect.

The probes are categorized into four groups:

1. Neutral probes: They are formed for semantic processing. The EEG pattern and fluctuation in the baseline can influence the detection of the time domain and frequency domain.
2. Control probes: There are two control probes: positive control probes (PCP) and Negative control probes (NCP). The PCP are not controversial and depict the confirmed facts, while NCP do not relate to the subject. They are related to the experimenter's hypotheses and do not necessarily relate to the subject.
3. Target A probe: The target A probe is formulated based on the information given by the I.O. If the subject's test results show Experiential knowledge of the Target A probe, there is a strong possibility that the subject is suspected of the crime.
4. Target B probe: This probe is formulated based on the subject's narration. It reflects the subject's version of the incident and his alleged role. If the system indicates Experiential knowledge, it means there is a probability that whatever the subject is saying can be accepted.



5. The procedure for the BEOS test: The BEOS instrument should be kept in a soundproof room with a one-way mirror facility. The chair should be placed in the middle of the examination room with a computer monitor a meter away from the chair to present visual probes. The speakers are placed in the room to hear the auditory probes and instruct the subject at every stage of a new session of BEOS recording. The recording and proceeding of the BEOS test are monitored from the examiner's room. The subject sits with his legs resting on a leg rest on the floor of the examination room, while the examiner sits on the other side of the one-way mirror room. The examiner maintains the subject's privacy and confidentiality. The first requirement before BEOS administration is to record the auditory probes and store the visual probes for a display to the subject. The visual and auditory stimulation presentation (VASP) is used for recording auditory probes. Each probe is read out in a uniform and steady tone when recorded digitally on the computer—a list of probes assembled in the VASP system and event markers attached to each probe. The main data acquisition system controls the probe presentation, which monitors the incoming EEG signals online and sends the probe presentation signal to the VASP system if the incoming EEG is in predefined conditions. The probe presentation is delayed until such a predefined condition is restored.

The electrical activity from the scalp is recorded on a multichannel amplifier using 30-channel electro-cap and two channels for eye movements. The electrodes positions used are FP1, Fp2, AF4, F7, F3, Fz, F4, F8, FT7, FC3, FCz, FC4, FT8, T3, C3, Cz, C4, TP7, CPz, CP4, TP8, T5, P3, P4, T6, O1 and O2 along with the electrodes attached below and above right eye and above left eye for calibration. The subject's scalp has to be clean and non-oily so that the electro-cap can be easily attached to the cap with the help of gel. The chest strap is attached to the subject's chest so that the electro-cap does not move and the easy recording. The subject is allowed to read the probes before the examination to avoid a startle reaction during the test. If the subject is sleeping or distracting his mind, the probes are not further presented, which makes the examiner alert and guides the subject to retake the test. After set I is completed, the subject is given a break and after that, set II is retaken, and the same procedure applies.

The BEOS is started by asking the subject to sit relaxedly. As a part of calibration, the subject's eyes close and eyes open recording is taken. After that, the Target B probes are presented to the subject. The subject is instructed not to give verbal answers or non-verbal reactions to the probes heard. In between break is given to the subject which requires. After Target B probes (Set I) is over, the subject takes Set II, and the procedure is repeated. After the test is completed, the BEOS system generates the result. The result will indicate the subject's 'Experiential Knowledge' regarding the crime and his involvement in the crime.

13.7 Narco Analysis

The application of **Clinical hypnosis** was started to treat psychosomatic and mental disorders. Progressively the use of clinical hypnosis is done by other medical fraternities also for various purposes. The subjects having earlier traumatic experiences which are suppressed and later manifested in the form of psychological illness/problems are treated by clinical hypnosis. It removes the psychological blockage, inhibitions and fixations which disrupt the subject's daily life. Depending upon the severity, duration and individuals' personality make up the sessions of the hypnosis are scheduled. The hypnotherapy sessions are undertaken at intervals stretching from 30 to 45 min. Considering the subject's mental state, the therapist decides the interval and duration of the session. The hypnotherapy technique helps the therapist reach out to the root cause of the problem and thereby achieves catharsis. A sense of self-worth and well-being is generated in the subject through this technique. If the subject is overstressed or reluctant to take a suggestion or is non-cooperative, the therapist resorts to a technique in which the subject is taken to a trance with the help of the sodium pentothal drug. This method is commonly known as drug-induced hypnosis or Narco analysis. The first case of drug hypnosis was done in 1845. It is used in the high-profile Boston Strangler, Ted Bundy and Sam Shepherd cases. It is a valuable investigation tool with other evidence and aids the investigating agency in their quest to find the guilty.

The phrase 'truth serum' was given by Robert House in 1922, also known as the Father of Truth Serum. He experimented with Scopolamine on two criminals who were suspected of doing a crime. Under the influence of Scopolamine, the criminals denied the charges levied upon them; later, during the case trial, these suspects were released, which made House believe that Scopolamine cannot create a lie. After that, Blackwena, 1929, used sodium amytal to produce a hypnotic effect on patients. It was observed by Lindemann 1932, that sodium amytal injected slowly and intravenously produced a marked effect in psychiatric patients. After that, sodium pentothal (thiopental), was used widely by the soldiers of World War II to overcome their traumatic experiences. The drugs commonly used in the context of narcoanalysis or truth serum tests are sodium amytal (amobarbital), pentothal sodium (thiopental) and seconal (seconbarbital).

The use of narcoanalysis as a technique gained attention in 1987 when it was first used in Gujarat, India, specifically in the Sabarmati jail for accused individuals. It received further attention after the Godhra carnage. The Narco analysis after that was used in cases where the suspects/criminals are suspected of withholding the information, misleading the investigation or falsely confessing the crime. The lack of scientific interrogation methods and alternatives to coercive tactics led the investigating agencies to use Narco analysis as a tool. Drug-induced hypnosis, or Narco analysis is used for investigative purposes, when agencies reach a dead end and are clueless. This technique aims to provide the missing gaps in the investigation and provide leads for further investigation. It can help the reveal the plans of the accused and eliminate the innocent from the case. In the past, Scopolamine was used on prisoners who denied the charges of murder and eventually were found not guilty.

Subsequently, the drugs, viz., sodium pentothal and ketamine, are used for invasive procedures. Sodium pentothal, commonly used by anesthetists for surgical procedures and is considered safe to administer to subjects in forensic work.



13.7.1 Procedure for Narco Analysis Test

As a procedure for the Narco test, the subject's pre-test interview and court permission for the Narco analysis should be taken. Before conducting the test, the subject is explained the procedure and the possible outcome of the test and the right to refuse the test (Indian Constitution Article, 20 (3)). The government doctor checks the subject's physical and mental fitness. Once the subject is certified physical and mentally fit by the medical authority, the post-test Narco analysis test is done to assess the physical and mental state of the subject.

The Narco analysis requires an environment with medical equipment and tools. Because it is an invasive technique, emergency medical kits and backup are a must to deal with medical emergencies. The test is conducted by a team comprising forensic experts and includes the anesthetist responsible for giving the drug to the subject, psychiatrist and nursing staff. The role of a psychiatrist is to monitor the mental abrasion or trauma during the narco interview. The nursing staff must take care of the subject during and after the test. The whole Narco interview should be videographed. If the lawyer is required to witness the test, they are given the option to watch their client through a one-way mirror. No one except the team members is allowed during

the Narco interview to maintain the suspect's privacy and confidentiality. During the Narco interview, free association techniques are used to make the subject stress free and comfortable. The subject is not pursued but is encouraged to unload their negative feelings, anxiety and fear. As the drug proceeds, the subject's body will be loose, and their speech will be slurred. In this process, the subject is asked about the incident, and the missing relevant information regarding the incident is revealed. The information given by the subject during the Narco interview should be carefully analysed, as the subject has said things in between his state of wakefulness and trance.

After the Narco interview, the post-test interview is conducted to assess the physical condition and based on clues gathered during the Narco interview; the subject is interviewed. Often the subject reveals the truth during the post-test interview, which the expert records. The subject is also asked to write further information during the post-test interview.

13.8 Suspect Detection System



The suspect detection system, also known as the 'SDS' test, is a technology applied to interrogation and screening systems for identifying potential criminals at much earlier stages of the investigation. It is a technology capable of collecting and analyzing psycho-physiological indications and cross-referencing these indications with additional objective information. It is effective in counter-terrorism and crime prevention behaviour pattern recognition. SDS develops an intent detection system using behavioural pattern recognition algorithms and business intelligence. The software uses the 'Guilty knowledge' and 'Stimulated Reaction' methods with

advanced sensors like P300, GSR, BVP and Thermal Imaging analysis. The system is portable and easy to administer at any given place. The test administration is less time consuming, and results are auto-generated, making the system objective and reliable. The system performs the test with a high level of accuracy and reliability. The SDS system enjoys the status of the only established technology which has proved to be able to differentiate between 'guilty' and 'innocent' within 5 min with a low rate of false alarm.

This system works on a Stimulated Psycho Physical Reaction (SPPR) where the postulate is that a criminal and a non-criminal will show different levels of arousal and psycho-physical reactions to the same set of words or questions. Such reactions are uncontrollable since the words or questions can only evoke reactions in people with the necessary knowledge and intent to harm. The SDS uses the guilty knowledge test to identify an individual's guilt.

The theoretical basis of this instrument is that visual and audio stimuli will increase the subject's physiological arousal. The psycho-physiological uncontrolled responses (parasympathetic system) of the criminal intent or guilty knowledge-related questions or statements.

The significant advantages of the SDS system are as follows:

1. Automated Decision-making tool: It enables screening and investigation to isolate terrorists, criminals and hostile employees at checkpoints, border crossings, interrogation facilities, crime scenes, combat zone and field operations.
2. Self-learning system: Analyse the historical data and study behavioural patterns
3. One-stop intelligence collection: Document authentication, biometric I.D. (fingerprint, voice, video) data collection for future tracking
4. Easy to operate: It is a fully automated system that does not require an expert human operation.

13.8.1 The Procedure for the SDS Test

The SDS system consists of hardware; a laptop attached to the case, the sensors are alongside the laptop, which is responsible for electrodermal tracing, as well as some supporting devices like a scanner (to scan the subject's I.D.), camera (to record and save the facial movements of the subject) and biometric (for data collection) are also available in this system. The software includes essential system management, signal processing and decision algorithm, which are inbuilt to provide the algorithms for detecting physiological responses. This system, with the help of these parameters, detects the person who has the knowledge or gives the response related to malicious intent.

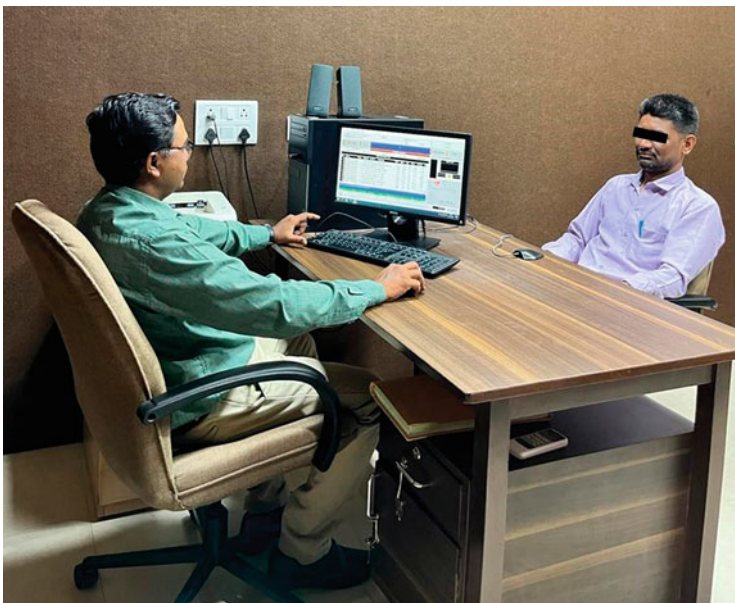


The examinee is seated comfortably in front of the instrument. The examinee's biometric and digital photo is taken with the camera attached to the system. The examiner first logs into the system and fills in the details of the examinee in the 'enter examinee' section, like filling up the name of the examinee, date of birth, gender, photo and fingerprint. After that, the questions are prepared, typed and recorded in the system based on the investigating officer's and subject's interview. The examinee's left hand on the palm sensor is placed on the system. The questionnaire comprises multiple-choice type questions about the crime. One of these questions contains information only the examiner and the suspect/criminal would know about. The examinee's reaction to a specific event-related stimulation will differ from that of an uninvolved individual. Using the Guilty knowledge method enables the SDS to build and use an algorithm that can significantly reduce the levels of false alarms. The GSR in the system checks the examinee's blood volume pressure. This is used as it has higher accuracy in detecting blood pressure.

A total of 4 +2 sets of questions are presented to the examinee. After four sets of questions, another two sets from the earlier four sets are repeated, which are most relevant to the situation. The benefit of the system is that only if the system suspects the examinee will the fifth and sixth sets of questions be repeated. The questions will be presented on the screen of the examinee. The questions are recorded and can be simultaneously heard through headphones by the examinee. The questions are usually in the language the examinee understands and can comprehend. The examinee's GSR is simultaneously measured through a sensor case while he/she answers the questions. The whole procedure takes about 5–7 min. The test results are automatically generated by the system and given to the examiner. The results is a

statistically calculated algorithm based on the SDS database. It conducts analysis and weighs the strongest reaction to the relevant stimulus. Validity of each reaction is done by comparing all the reactions, and the results are given as to whether the examinee is a 'Suspect' or 'Non-Suspect'.

13.9 Layered Voice Analysis (LVA)



This technique focuses on the emotions conveyed through the speech. It recognizes and identifies emotions based on the analysis of vocal characteristics and patterns. It analyses the conversation of the subject in real time, which will help the examiner to probe further into the doubtful conversation and may help the examiner to understand the direction of the criminal. The technique leads to hidden and concealed information just by conversation. The subject is required to speak into the microphone during the LVA test. The interview with the subject should be conducted in a noise-free environment so that the voice of the subject is audible and clear. LVA provides quick analysis in real time, which helps the examiner to answer specific questions related to the subject's role in the offence. In case involving multiple suspects, this test may help in narrowing down the suspect pool within a short period. LVA generates automated result that summarizes the overall emotional behaviour of the subject. The interview taken can also be used as offline analysis and further investigation. The result is displayed in the form of a graph, segment and bar display, making it user-friendly and easy to understand.

The screenshot displays the nemesysco LVA 6.50 software interface. At the top left, a status bar shows 'HIGH RISK' and the time '12:28:299'. Below this, a control panel includes 'Mark relevant', 'Mute', and 'Lock Mixer' buttons. The main header area features the 'nemesysco' logo and 'Investigation Focus Tool' text. The central part of the interface is dominated by a 'High Risk Statement' in a large blue font, with a red bar below it indicating 'EXTREME CONFLICT'. To the left of the statement, a 'Start Test' button and a 'Stop Calibration' button are visible. The top right of the interface contains a 'Wave Form' display, a 'Quit' button, and a timer showing '0:00:00:000'. The bottom section of the screen is divided into several tabs: 'Show Issues', 'Notepad', 'Bars Display', and 'Segment Map'. The 'Show Issues' tab is active, displaying a series of graphs for 'LIE Stress', 'Global Reaction', 'Global Stress', 'COG. Stress', 'EMO. Stress', 'Thinking Level', and 'S.O.S. Value'. A vertical red line in the graphs indicates a specific point in time, labeled 'Caption 1 Sample 337 Value 299'. The bottom right corner of the interface shows a 'Quit' button and a timer.

Online analysis of LVA test

13.10 Conclusion

In conclusion, the chapter sheds light on the essential elements of forensic psychology in relation to investigative techniques and tools. Forensic psychologists can gather valuable information and assess the veracity of statements by employing a range of interview techniques, including the Morgan Interview Technique, FAINT Interview, and Statement Analysis. Moreover, specialized tools like the polygraph, narco analysis, BEOSP test, Suspect Detection System, and layered voice analysis provide additional means for extracting crucial insights and detecting potential deception cues. By leveraging these techniques and incorporating them into forensic investigations, practitioners can contribute to more accurate and reliable outcomes, ensuring the criminal justice system's integrity. Understanding forensic psychology's diverse methodologies and tools equips professionals with valuable resources to enhance their ability to investigate, analyze, and understand complex criminal cases.

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