

# FORENSIC EXAMINATION OF QUESTIONED DOCUMENTS

## Abstract

Forensic science integrates the fundamental principles of basic sciences and employs diverse analytical techniques to address issues related to investigation, analysis, and examination, thereby contributing to the justice system. Forensic science has formulated its own set of principles, drawing from various scientific disciplines to establish its foundation. These principles are of utmost significance. Within the legal framework, documents hold a crucial and urgent role in people's lives. Notably, instances of crime typically involve some form of document containing valuable evidence and clues. Document examination stands as one of the most challenging fields within forensic science when it comes to assessing evidence. With the emergence of technology and advanced tools, the creation of fraudulent and counterfeit documents has increased dramatically. Documents reflect individuals, their intentions, words, and actions, and they are encountered frequently in daily life. A document refers to any material carrying symbols, marks, or signs that convey meaning. While the majority of documents are handwritten or produced using printing devices, documents can take various forms, such as wills on wood or signs on various surfaces. Among these, a subset known as "Questioned Documents" is particularly interesting. These documents, while numerous, constitute a small portion of the whole. A "Questioned Document" refers to one whose source, authenticity, or genuineness is uncertain, doubted, or suspected of being fake. It's important to note that not all questioned documents are fraudulent, and not all serve as instruments of crime, but some do raise serious doubts.

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The study of questioned documents as a scientific discipline began with Albert Osborn. He established foundational principles of document examination that gained recognition as valid scientific evidence in courts of law. Questioned document examination, as a forensic discipline, deals with documents that raise doubts in legal proceedings. Handwriting analysis is a crucial component of this field, involving the comparison of handwritten samples based on the principle of recognition. Document examination holds a significant role within forensic sciences, particularly in legal proceedings involving criminal or civil matters. This field encompasses diverse activities, ranging from birth and death certificates to financial transactions and identification documents. Different materials used to create documents, including paper, ink, and writing instruments, are important considerations from a forensic perspective. The unavoidable engagement of documents in an individual's life results in the continuous influx of cases involving questioned documents into forensic science laboratories. Document analysis encompasses the scrutiny of diverse types of issues related to questioned documents across all forensic dimensions. This includes tasks such as identifying handwriting, typewriting, printed content, seals, and stamp impressions. Moreover, it involves uncovering and interpreting erasures, modifications, overwritings, additions, obliterations, establishing the sequence of strokes, determining document age, and more. The documents subject to examination come in various forms, such as bank drafts, checks, receipts, wills, affidavits, bail bonds, lottery tickets, anonymous or ransom letters, answer sheets from different exams, suicide notes, agreements, passports, currency notes, skin tattoo markings, and even unconventional surfaces like walls, doors, and cloth.

In the rapidly evolving contemporary society, wrongdoers or counterfeiters are becoming increasingly astute and sophisticated as time progresses. Offenses or falsifications that revolve around any form of documentation fall within the realm of white-collar crimes. White-collar crimes encompass various categories such as banking frauds, fraudulent activities involving credit or debit cards, the production of counterfeit currency notes, the fabrication of diverse documents like wills, checks, deeds, property documents, suicide notes, menacing letters, and more. These sorts of instances are managed by forensic experts specializing in questioned document examination. This chapter aims to build a thorough understanding of the Questioned Documents for its readers and validate the never-ending scope of one of the branches of forensic science.

**Keywords:** Questioned Documents, Handwriting, Handwriting Identification, Forgery, Ink Examination.

## I. INTRODUCTION

We all come across various forms of written records in our daily lives. The present age heavily relies on documents, which hold significant importance. Documents play a vital role in contemporary society, featuring prominently in legal, official, financial, business, and personal spheres. They are indispensable, completing the fabric of our lives. However, the widespread use of documents has also led to their misuse for illegal purposes. Instances of document forgery, including certificates, wills, financial records, and official papers, are on the rise, akin to a rapid spread of wildfire. It's surprising to note that almost 70% of court cases involve document-based evidence, underscoring their pervasive presence. This prevalence can be attributed to their use in almost every aspect of life. Nevertheless, unlike conclusive evidence like fingerprints and DNA, document evidence often requires corroboration due to its subjective nature. Document experts were asked about the need for corroborating document evidence and its unequal standing compared to more concrete evidence like fingerprints or DNA. They explained that document evidence relies on opinions, which can vary among individuals. Nonetheless, they emphasized that the court system highly regards expert testimonies, as mandated by Section 45 of the Indian Evidence Act.

The field of document examination holds immense importance within forensic sciences, regularly engaging scientific experts in legal matters involving such evidence. This expansive field encompasses various activities. From birth certificates to death certificates, documents are pivotal in daily transactions involving payments (banknotes, checks), trade (contracts, letters, invoices), identification (passports, identity cards), travel (tickets), knowledge dissemination (books, newspapers), and more. In all these scenarios, the materials used to create a document, such as paper origin, ink, and writing instruments, can hold forensic significance. The illicit manipulation of documents severely impacts national economies. For instance, in the United States, counterfeit and falsified documents are estimated to incur billions of dollars in losses annually (Brunelle, 2002). A document is any material containing visible, partially visible, or invisible marks, symbols, or signs meant to convey meaning or information to someone. According to Section 29 of the Indian Penal Code, a "document" encompasses any content expressed or described on a surface using letters, figures, marks, or a combination of these methods, intended for use as evidence or capable of being used as such. The vast majority of documents are written on paper, either through computer devices, typewriters, or manual writing with pens, pencils, inks, or similar substances serving the purpose. Additionally, common document types include wills etched on wood, signs painted on walls and windows, and carved inscriptions on tombstones and cornerstones, all of which hold historical significance, contributing to the realm of documents.

Questioned documents are those suspected of being fraudulent or whose source is unknown or background is disputed. Not all questioned documents are fraudulent. There may be a variety of reasons for questioning a document other than to invalidate it or to establish the basis for a criminal action. Many documents are examined closely only to identify their authors or to establish their source. Of those suspected of being fraudulent, probably at least half are exactly what they claim to be perfectly documents. But the remainders, which involve fraud, forgery, blackmail or a host of other lesser crimes or offenses, are instruments that may represent to the individual concerned sizable wealth, property or personal possessions or reputations and respectability.

Thus, the truth about these questioned ones assumes importance of large magnitude to all concerned. (Hilton, 1992)

- 1. History of Questioned Documents:** Jean Mabillon, a French monk in the year 1681 published a book named “De re diplomatic”, which outlined a science he established called diplomatics or the examination and check of reports. In 1795, William Henry Ireland an Englishman made a claim that he had the possession of a manuscript “King Lear” written by William Shakespeare himself. This would have been different paper watermarks among its leaves while examining the manuscript which Ireland claimed to be written by Shakespeare. The assortment of the paper in the manuscript suggested that it was the work of a forger. In 1805, Ireland confessed that the manuscript was a forgery and that indeed he had obtained the paper by paying a book-seller to tear the pages out of the old manuscript. From the turn of 18th century, the lifestyle changed from rural to urban. This change in the society allowed more and more opportunities in education. People got diverted towards education because they started understanding the need and importance of education. With the advancement of education and development of ink, our society became more of paper society. In early days, people trusted each other and believed in each other’s promises. There was no paperwork on the exchange of money or any other valuable thing. But due to development in the paper and ink composition our society became more of a paper society. Now instead of exchange of money and handshake it became an exchange of money and signatures. Therefore, the need grew for people who could distinguish the authenticity of a document. Because as signature started gaining its importance forgeries also started growing accordingly. In this context, experts started playing important roles. They testified that they could differentiate between two handwritings or signatures. These differences that they noted were accepted in the court of law because they used scientific methods i.e. side by side comparisons. Then came a great man a great pioneer in the field of questioned documents, Albert. S. Osborn, American handwriting expert. He noticed that there needed a basis of handwriting knowledge to prove or disprove the authenticity of the document in the court of law using some scientific methods. Albert Osborn published a book named ‘Questioned Documents’ which is still in use after so many revisions in it and even now document experts consider it as a bible for the examination of documents. A comprehensive text that established a greater focus on not only the examination of handwriting and signatures but also other types of evidence appearing on documents including paper, ink, typewriting, and alterations. Osborn also, during the early part of the century began to invite other document examiners to his home in Upper Montclair, New Jersey. These meetings were the beginning of American Society of Questioned Documents. In 1923, The Frey Standard came into existence. It was the standard by which expert testimony was allowed for decades. Among other things, it demanded general acceptance of expertise and methodology. With Albert S. Osborn presiding, the American Society of Questioned Document Examiners (ASQDE) was formally established in 1942. Membership in the organization was entirely by invitation. Its meetings were completely educational in scope, and annual attendance, as well as full participation in the program, was an absolute requirement for a continuing invitation.
- 2. Deciding between Questioned document and it’s Authenticity:** When a question is raised about the authenticity of a document or a part thereof, that document becomes a Questioned Document, which is sometimes also referred to as a ‘disputed’ or ‘contested’ document.

- The authenticity of a document or a portion of it can be questioned on various grounds.
- Among challenged documents, those pertaining to the authenticity of signatures, thumb impressions of the executor(s), or attesting witness(es) constitute the largest category.
- When an executor is required to confirm or deny a signature or thumb impression in a disputed document, they often deny it, fearing that admitting the signatures might validate the document's contents, potentially against their interests. In some cases, an executor might even claim ignorance of the script in which the disputed signatures are written or assert illiteracy. However, instances exist where documents are fraudulently prepared under forged signatures to deceive others for personal gain.

Numerous documents become subjects of legal disputes, where skilled forgers use obtained signatures on blank paper through deceit or exploit available space above signatures on other documents, tearing off the section containing previous writing. Cases also emerge where the original writing is erased physically or chemically, and the document is rewritten or typed on the erased surface, or where signatures from other documents are transplanted. Conversely, genuine documents are sometimes contested by executors who assert the genuineness of signatures but claim the writing was added later.

Another category of documents includes those alleged to be altered by erasing or adding strokes, words, or lines in available blank spaces. This involves substituting words over erased ones or modifying words by adding or deleting strokes or letters. Documents are also challenged based on the chronological order of entries, pen and ink identity, alterations in amounts, obliteration, and the sequence of typewriting in relation to paper folds (McAlexander and Marguire, 1991). At times, photocopies and carbon copies of documents are contested, alleging that they do not faithfully reproduce the originals or that alterations have been made during photocopying, such as adding or deleting portions of text. Cases are on record where photocopies have been manipulated by transplanting signatures or removing crucial sections by rubbing off their electrostatic image during photocopying on manual machines. However, such cases are relatively rare (Saini and Singh, 2010), who worked on evaluating handwriting features through photocopied signatures. Document examiners often deal with anonymous letters used for pranks, blackmail, or threats stemming from various emotional or psychological conditions.

Determining authorship in such cases can be complex due to disguised handwriting. Other scenarios involve love letters, suicide notes, and business letters that are later denied to avoid consequences (Anon, 1951; Ainsworth, 1922; Eelen, 2006; Kelly and Lindblom, 2006; Martin, 1988). Another category involves documents where the age or chronological order of different parts is disputed. The common query in such cases is whether the document is genuinely as old as its date suggests or if it's been backdated. Instances of backdating documents are not unusual. Documents have been shown to be unreliable when they bear dates preceding the manufacturing or marketing of the paper, instrument, or ink/typewriter used. Documents have been declared forged due to varying stroke sequences in the writing and discrepancies in revenue stamps.

In yet another category of questioned documents, examiners meticulously analyze typewritten content to determine the typewriter's make and model used for the writing.

They assess wear and tear marks and other factors to verify the alleged typing date and identify any fraudulent alterations in the original typed material. Writing is initially a conscious effort but becomes a habit through repetition, eventually becoming a subconscious act. Writing output is influenced by education, training, environment, occupation, and mental, physical, and emotional makeup. It's shaped by life changes, and no two individuals have identical life experiences, making their writings distinct (Edward, 1906).

## II. HANDWRITING

Handwriting stands as a uniquely personal skill inherent to individuals. The fundamental traits of handwriting encompass three essential aspects. It involves creating graphical symbols on a surface, aiming to convey a message. This communication is achieved through the symbols' conventional connection to language. Each writing system includes a collection of symbols, known as characters or letters, each possessing distinct basic shapes. Rules exist for combining these letters to represent higher-level linguistic structures. For instance, there are guidelines for uniting individual letters to form cursive words within the Latin alphabet (Huber, 1999; Brandford, 1992). Handwriting becomes ingrained in the subconscious mind once learned, resulting in its accuracy. As personalities evolve or respond to life's positive and negative events, handwriting naturally evolves as well (Greene, 1980).

Handwriting originates in a specific region of the brain controlling language and writing skills. In case of injury to this brain area, both writing and speaking abilities can be compromised. Consequently, an individual's handwriting is intricately connected to their nervous system, making it exceedingly challenging to forge a handwriting imitation that deceives a professional document examiner. These experts possess the microscopic knowledge required to identify the genuine author (Bidget, 2008; Adkins, 1970). Handwriting analysis entails a scientific approach to unveil personality traits by studying the strokes and patterns within handwriting. It's distinct from document examination, which involves scrutinizing handwriting samples to determine the author's identity. Document examination is frequently employed in forgery cases, without any conclusions drawn about the writer's character or personality (Buquet, 1985; Gay, 1970).

In this narrower sense, handwriting can be perceived as an individual's written expression, akin to their spoken words or actions. Over time, distinctive characteristics develop, setting the individual apart and offering a unique style of writing. This style might undergo variations due to factors like haste, carelessness, writing position, emotions, weakness, or health conditions (B.R. Sharma, 1990; Legruen, 1988). The evolution of writing is intricate since it is influenced by culture, which varies across regions and evolves continuously. The impact of cultural dependence is evident in class, system, or national traits. These specific movements give rise to the customary aspects of handwriting that are distinct to each person. As practice and skill refine the execution of writing, the process becomes more automatic, reducing conscious control over it (Huber & Headrick, 1999).

**Standard or Exemplars:** The fundamental and essential requirement for examining handwriting and determining the authenticity of questioned writing is the presence of standard writings. To effectively assess writing patterns and identify natural variations, a sufficient amount of standard writings and signatures are imperative. Standard writings and

signatures should ideally offer insights into the habitual writing tendencies of individuals (B L Saxena, 1968).

Two primary categories of standard writings exist:

- **Specimen or Request:** This category encompasses writings created solely for the purpose of comparison and legal verification. It is recommended to obtain these on 3 to 6 distinct sheets of paper. Writers should not be exposed to the questioned documents. Ideally, the content of the questioned document should be read out for dictation. Writers must not receive instructions regarding spelling, punctuation, grammar, or any other aspects related to the text. If feasible, the same writing instrument and surface used in the questioned document should be utilized.
- **Admitted or Collected:** This classification involves writings produced during an individual's routine activities, whether social, business-related, personal, or otherwise. These could encompass documents such as property or bank records. Since individuals are typically unaware of these writings' potential use for legal comparison, they tend to be natural and reflective of the writers' habitual patterns. They lack any deliberate alteration or disguise. These are also termed NCB or normal course of business exemplars. Although gathering such materials is challenging, the time and effort invested are worthwhile, as they minimize the risk of exemplars being tampered with or falsified (Conway, 1955).

An individual's writing is a blend of class and individual characteristics. The relative balance of these factors is personal and underpins the basis for identifying handwriting (Ron Morris, 2000).

1. **Handwriting Identification:** Handwriting identification operates on the principle that while handwriting within a language exhibits a degree of similarity that enables meaningful reading, there exist individual characteristics that set one person's handwriting apart from another's. Just as no two individuals are identical, the combination of traits within no two people's handwriting is exactly the same. Within an individual's handwriting, natural variations occur, and it's the examiner's duty to scrutinize these variations meticulously to differentiate between "variations" and "differences" (Ansell, 1979; Arnold, 1983; Lee, 1923).

Two fundamental fields of study encompass handwriting analysis:

- The examination of handwriting as a neuromuscular activity, its skill development, and the impact of internal and external factors.
- Handwriting identification as a process of discrimination.

The examiner must be conscious of the distinction between "class characteristics" and "individual characteristics." Class characteristics are common among specific groups like writing systems, family groups, foreign languages, or professional groups. Individual characteristics pertain to personalized letters or combinations that wouldn't occur in another person's writing (Davis, 1976). Handwriting identification requires comparing authenticated samples of known handwriting from the individual(s) involved. These are



closely matched with the characteristics exhibited by the questioned handwriting to establish authorship. Comparisons must be like-for-like: printed to printed and cursive to cursive, involving similar letters, combinations, words, and numerals (Huber & Headrick, 1999).

- **Underlying the Identification Process:** The systematic and meticulous use of evidence, common to various forensic science disciplines, is aimed at identifying an unknown. This process encompasses three steps:
  - Analysis or determination of discriminating elements: Analyzing, examining, or studying the unknown and known items to identify their distinguishing features. These are observable, measurable, or otherwise perceptible aspects that differentiate products or individuals.
  - Comparison: Comparing the unknown's discriminating elements, as determined through analysis, with those known from standard items.
  - Evaluation: Weighing the value of similarities or dissimilarities in discriminating elements, considering their cause, independence, or likelihood of occurrence. The significance of each element's similarities or differences must be assessed, and an explanation provided.

In this context, five aspects by which a signature or handwriting can be assessed for intricacy or complexity are proposed:

- Aggregate line length: Longer lines generally indicate more complex designs, although some stylistic signatures include strokes of varying lengths.
- Number of significant directional changes: Directional changes close to 180 degrees are retraces, while those below 90 degrees could be shifts in straight-line movement or curve initiation.
- Frequency of overwriting: Overwriting might obscure stroke direction, leading to confusion about allograph construction. It includes retracing (lines situated over each other in opposite directions) and superimposition (lines over each other in the same direction).
- Continuity of pen movement: Based on factors like pen pause, pen lift, and continuous movement.
- Repetition of well-segregated, complex pen motions: Fluent and intricate pen movements can be executed with ease but usually result from natural or practiced actions (Huber & Headrick, 1999; Brocklehurst, 1985; Ellen, 2006; Conway, 1955; Ellis, 1979; Hilton, 1964; Naftali, 1985; Tresselt, 1946)

**2. Natural Variations:** Natural variations in handwriting arise from the fact that our brain does not function like a computer, rendering two authentic signatures mathematically dissimilar. These variations result from the imprecision with which a writer's habits are executed on repeated occasions. This phenomenon is a characteristic of all motor tasks. These individualized modifications of copybook formations give handwriting its distinct personal touch. Such variations are influenced by external and internal factors, including:

- Fatigue
- Illness
- Age

- Writing materials
- Writing position
- Physical disturbances
- Emotional disturbances
- Lack of concentration during writing
- Influence of substances like alcohol or drugs

These variations primarily impact the visual appearance, size, and slant of the writing. They, however, do not alter the fundamental characteristics of the writing. In cases of guided handwritings, where another person supports the writer's hand, identifying distinct features becomes challenging. Guided signatures result from the collaborative influence of two individuals' minds. Establishing a common source for two handwritings requires the presence of observed similarities and the absence of fundamental disparities (Djioua and Plamondon, 2009; Evett and Totty, 1985; Franks et al., 1985; Kapoor et al., 1985).

Handwriting is recognized through a comprehensive examination of personal traits termed "handwriting characteristics," including:

**Class Characteristics (General Qualities):** These are handwriting attributes shared among a group of individuals and learned during early writing acquisition. The style of writing acquired reflects the prevailing trend at a specific time and place. Class characteristics encompass traits such as:

- Type of movement
- Line quality
- Speed
- Skill
- Rhythm
- Spacing between letters, words, and lines
- Slant
- Style
- Alignment
- Connection and strokes between letters
- Size and proportions of letters
- Pictorial effects
- Writing habits
- Tremors
- Pen pressure, hold, position, shading, and splicing
- Coordination of writing muscles

**3. Meaning of these Terminologies:** Movement: The way a pen is moved during writing can involve finger, wrist, forearm, or whole-arm movement, or a combination. Each type of movement results in distinct characteristics. Finger movement produces small, angular strokes; wrist movement creates angular and scratchy writing; forearm movement yields smooth and symmetrical writing; and whole-arm movement produces large, sometimes clumsy, writing (Gregory, 1989).

- Line quality: Experienced writers produce smooth and uniform lines, while forgeries often exhibit hesitation marks, pen pauses, and unevenness.
  - Speed: Writing speed varies from person to person and influences stroke quality. Speed is typically categorized as slow, moderate, or rapid.
  - Skill level: Skill level affects the aesthetic appeal of handwriting. High skill level results in fluid, artistic writing, while low skill level leads to hesitant and unpleasing writing.
  - Rhythm: Rhythm is evident in the writing of educated individuals with experience. It's characterized by smooth flow, proper line quality, punctuation, and proportional letter formation.
  - Spacing: The space between letters, words, and lines varies, leading to narrow, even, medium, or inconsistent spacing.
  - Slant: Slant refers to the angle of inclination of writing or individual letters. Slant can change within a word or sentence.
  - Style: Initial training shapes writing style, which may evolve based on individual preferences.
  - Alignment: Alignment pertains to the relationship between writing and a baseline. Writing can slant upward, downward, be concave, convex, or irregular.
  - Connecting Strokes: Ligatures or connecting strokes join letters in words, and they can be arches, garlands, angles, or threads.
  - Size and proportion of letters: The size and proportions of block and small letters remain fairly constant for an individual.
  - Pictorial Effect: Skill level is reflected in the visual appeal of writing, which can be clumsy, artistic, forceful, or hesitant.
  - Writing Habits: The analysis of handwriting involves a thorough assessment of various habits developed over time, including movement, pen pressure, shading, pen position, alignment, slope, spacing, arrangement, style, stroke quality, and general execution (Mehta, 1970).
  - Tremors: Tremors naturally occur in the handwriting of older, sick, or illiterate individuals, with a distinct pattern. Simulated tremors in forgeries may have different shapes and sizes.
  - Pen pressure: The force with which the pen contacts the paper influences stroke width.
  - Pen Position: The angle between the pen nibs and the line of writing and the pen point and paper surface define pen position.
  - Pen Lift: Pen lift interrupts strokes by removing the pen from the paper.
  - Pen Shading: Shading widens strokes due to extra pressure on a flexible pen or stub pen.
  - Splicing: Splicing involves slight overlap of two strokes after a writing interruption, often observed in forged signatures.
  - Coordination of Writing Muscles: The interaction between finger, wrist, and arm muscles differs among writers, impacting stroke execution (Gregory, 1989).
- 4. Individual Characteristics:** As time progresses, a writer develops distinctive characteristics in their handwriting; some consciously adopted for style, aesthetics, or convenience, while others become inherent in the writing process. Extracting individual handwriting traits involves the following principles:

- Identifying Divergent Characteristics: Focus on differentiating characteristics that deviate the most from the regular copybook standard.
- Prioritizing Inconspicuous Repeated Characteristics: Seek characteristics that are inconspicuous but are consistently repeated.
- Recognizing Modified Individualized Characteristics: Pay attention to characteristics that vary among writers in unique ways, like curious physical twists in character formations (Ellen, 2001).
- Unconventional Writing Surface: The term "unconventional" refers to something that is not customary. An unconventional writing surface is one that deviates from the norm, such as skin, walls, wood, cloth, marble, mirrors, etc. Traditionally, paper serves as the common writing surface. Various unconventional surfaces possess distinct characteristics like friction, orientation, and color, which can impact an individual's handwriting.
- Unconventional Writing Instrument: Unconventional writing instruments encompass those that are atypical or infrequently used, such as cosmetics (lipstick, kajal, vermilion, etc.), bodily fluids (blood, saliva, semen), brick, and coal. In contrast, regular writing instruments include pens and pencils. The choice of writing instrument can influence the writing quality; for instance, soft-tipped cosmetics like lipstick or kajal might cause smudging and affect line quality.
- Significance of Studying Unconventional Surfaces and Instruments: Cases involving writings on non-traditional surfaces are prevalent in scenarios like murder, suicide, threats, robbery, defamation, deception, identity concealment, and revelation (Sharma S et al., 2018). The decision to use unconventional surfaces or instruments hinges on their availability and accessibility during the crime. This choice affects writing in multiple ways, given the various factors influencing handwriting. Exploring handwriting variations on unconventional surfaces is crucial for attributing authorship.

When writing on a wall, the entire arm comes into play, altering several handwriting characteristics like size and shape. Similarly, writing on one's palm entails a different posture and movement, leading to corresponding changes in handwriting features. Skin is frequently used as an unconventional surface due to its easy availability. The selection of a specific writing instrument can also reflect the intention to make the writing more visible or to convey messages to a broader audience.

### **III.FORGERY**

Forgery entails creating, adapting, or imitating objects, statistics, or documents with the intent to deceive. Fraud, a related crime, involves deceiving others, often using objects obtained through forgery. While copies and reproductions are not forgeries initially, they can become so through deliberate misrepresentations. Counterfeiting refers to forging money or currency, and similar issues arise with counterfeit consumer goods not produced by the designated manufacturer or producer as indicated by labels or trademarks. Forgery is a security threat addressed by security engineering.

The term "forgery" originates from the verb "to forge" and its cognate verb "to fabricate," signifying the creation of false documents with intent to defraud (Hardless, 1997).

## 1. Features of Forged Handwriting Documents

- Forged signatures often exhibit an unnatural appearance.
- Lack of individuality in the forged writing.
- Appears as if written slowly and evenly.
- Carefully corrected mistakes, visible as splicing, retouching, pen pauses, and ink smudging.
- Blunt beginning and ending strokes.
- Identically written signatures suggest tracing.
- Absence of rhythm in the writing.
- Inconsistent letter formation (Koppenhaver, 2007).

## 2. Types of Forgery

In the context of handwriting identification, forgeries can be classified as follows:

- Freehand or Simulated Forgery: This type involves imitating a genuine writing or signature. The forger copies the general features of the model using their observation, ability, and skill.
- Traced Forgery: In this forgery, the exact outlines of the model are reproduced through tracing. The result closely resembles the model in letter forms.
- Forgery by Memory: Similar to freehand forgery, this type relies on the forger's memory of the intended writer's signature forms, without a model. Divergence from habitual writing habits is proof of forgery.
- Forgery by Impersonation: In this type, a person writes or signs on behalf of another person, often with the intent to gain pecuniary advantage. These are also called allograph signatures or writings.
- Forgery over a Genuine Signature: Commonly practiced in India, a genuine signature is placed on blank sheets entrusted to trusted individuals. Such papers are later dishonestly used for various agreements.
- Forgery by Transplanting a Genuine Signature: In this type, a genuine signature is transplanted onto a forged document. This technique involves exploiting unique signing habits, allowing stamps to be removed and fraudulently reused.

By understanding these types of forgery, experts can better detect and analyze fraudulent documents (M K Mehta, 1970). Forgery of rubber seals or stamps is not an uncommon occurrence. Some individuals believe that duplicating rubber stamps or seals is a successful way to deceive, assuming that the fraud won't be detected. In this process, rubber stamps are pressed onto soap or wax surfaces to create impressions, which are then cast accordingly. Detecting documents with false seals or rubber stamps involves various methods.

3. **Identification of Forged Documents:** Establishing the preparer of a forgery from the writing alone is often a challenging problem. The act of forgery itself serves as a form of disguise, making it difficult to pinpoint the forger. Identifying the forger solely from the writing is the exception, not the rule, especially with only a fair imitation of the genuine signature. Usually, there aren't enough of the forger's unique writing habits present to serve as a basis for identification. In rare cases, however, the forger may be identified by

specific individual habits present in simulated signatures. It is easier to identify the preparer of non-imitated signatures, particularly those where the writer didn't attempt to alter or disguise their natural writing.

Several instruments are useful for identifying and detecting forgeries:

- Simple Magnifying Glasses
- Stereoscopic Microscope
- VSC-1, VSC-4, VSC-5000, VSC-8000, and Projectina Universal Comparator
- The Transparency Sheet Method
  
- **Microscopic Examination:** Using a microscope to study minute physical details.
  
- **Stereomicroscope:** Provides a three-dimensional view of an image. It's beneficial for determining the sequence of strokes and studying pen movement, line quality, and pen pressure.
  
- **Projectina (Universal Comparison Projector):** A large instrument used for side-by-side comparison and superimposition. It includes an IR image converter system and a 35 mm camera adaptor. It's capable of observing minute differences on a monitor.
  
- **VSC-1 (Video Spectral Comparator-1):** Primarily used to reveal obliterated and chemically erased writings. It employs light of various wavelengths, including IR, UV, and visible blue light. The system includes instant video printing of deciphered writings and is non-destructive.
  
- **VSC-2000:** Used for revealing obliterated, erased, added, and altered writings. It features various built-in light sources, including IR, UV, transmitted, spot light, and oblique light for studying indentation marks. The system can differentiate inks by spectrometry and offers detailed image analysis tools.
  
- **VSC-5000:** A sophisticated PC-based Document Examination System with four primary functions: manipulation of visual contrast, measurement and comparison for detecting small differences, spectrometry and colorimeter for ink analysis, and image management for report preparation. The document is placed on a plate, viewed by a camera, and displayed on a monitor. By utilizing these tools and methods, experts can effectively detect forged documents and identify indications of deception (M K Mehta, 1970).
  
- **VSC-8000:** The VSC®8000/HS integrates advanced digital imaging and multi-wavelength LED technology, along with a user-friendly software interface, to offer a comprehensive solution for examining various types of questioned documents.
  - **12MP SRI Technology:** An exclusive feature of the VSC®8000/HS, Super Resolution Imaging (SRI) is an optical system that delivers exceptional clarity and image resolution for documents captured by a precise 12MP camera.
  - **Microspectrophotometer:** The non-destructive spectral analysis of documents can detect variations in ink and paper compositions. Real-time Absorption,

Reflectance, Fluorescence, and Transmitted spectra can be captured and displayed graphically on-screen.

- 250x Optical Magnification: Utilize advanced optics in the VSC8000/HS to examine documents at a microscopic level. Achieve up to 250x optical magnification (2400x digital) for scrutinizing evidence of tampering and identifying security features like microprint and taggants.
- Integrated XY Stage: The motorized XY translation stage enables swift and accurate document positioning at high magnification. Smooth sub-millimeter movements are controlled via simple on-screen commands.
- Intelligent Software: The VSC® Suite software package enhances the VSC®8000/HS's efficiency, offering users complete control through an accessible toolbar.
- 3-Dimensional Imaging: Generate a 3D model of a document's surface topography for improved analysis of security features, pen-tip strokes, and paper impressions. Manipulate images in 3D space by applying colormap, inversion, and rotation to aid examination.
- Automated Examinations: Automated examination procedures significantly enhance the speed and efficiency of examinations. Multiple images are displayed as thumbnails, saved with VSC examination settings.
- Calibration & Diagnostics: For precise and consistent results, the system can be calibrated using NIST-traceable standards. Automated diagnostics monitor motor, light source, and filter status. The VSC Calibration Tool is required for this function.
- Multi-spectral Illumination: Directional, multi-spectral light sources spanning UV to IR wavelengths reveal hidden details, such as semi-covert security features responsive to specific wavebands. Examples include watermarks, laser images, latent images, birefringent features, see-through registers, and stamps.
- Facial Recognition: The VSC Facial Recognition Kit, an optional accessory, enables the identification of individuals by comparing their appearance with photos in passports or ID documents. This is powered by the Live Face Identification System.

#### IV. DISGUISED HANDWRITING

Disguised handwriting refers to a deliberate alteration or modification of one's handwriting style without adopting the characteristics of another person's writing. In disguised writing, the writer intentionally makes changes to the way they form letters, often aiming to obscure their natural writing patterns. These alterations can encompass various aspects of handwriting, such as letter designs, spacing, and other distinctive features. While attempting to disguise their handwriting, individuals may make specific changes to certain letters, creating an artificial diversity within their writing style.

One common characteristic of disguised handwriting is the manipulation of letter designs. For instance, capital letters may adopt the style of small letters, and vice versa. The letter "e," which typically maintains a consistent form, might be altered to a Greek-like shape, deviating from the writer's usual pattern. Certain letters like "r" and "t" are easily disguised, leading to noticeable visual differences in their appearance. However, it's important to consider that writers often change their capital letter style over time, so variations in capital letter design alone may not conclusively indicate different writers.

To determine the authenticity of disguised writing, document examiners focus on internal consistency within the writing. Despite attempts to alter their writing style, individuals tend to maintain certain consistent elements:

- **Abnormally Elongated Loops:** Letters like "f," "y," and "g" may exhibit elongated loops.
- **Curved Terminal Strokes:** Letters such as "d," "e," "h," "m," and "n" might display curved terminal strokes.
- **Common Body Design:** The structure of letters "a" and "d" may share a common body design.
- **Reproduced Elements:** The terminal of letter "w" could be replicated in letters "b" and "o."
- **Heavily Shaded Down Stroke:** Letters "n," "m," and "h" might show a concave shape with a shaded downstroke.
- **Angular Trough:** Letters "u" and "y" could exhibit a similar angular trough.
- **Design Similarities:** The design of letter "c" might appear in the abbreviated vowel or letter "e."
- **Letter Design Patterns:** Specific groups of letters, like "b," "d," "h," "k," "l," and "f," might follow a consistent design pattern, while another group, like "g," "j," "q," "y," and "z," follows a distinct pattern. In disguised writing, these patterns may not be consistently maintained.

When individuals engage in disguised handwriting, they rarely introduce overly exaggerated letter designs. Instead, they might alter the fluency and grace of their outlines. Disguising handwriting does not often suppress the inherent quality of writing influenced by the individual's unconscious mental processes. Even when writing with an unaccustomed hand, similarities between disguised and natural handwriting can be observed, with differences primarily related to the flow and smoothness of lines.

- 1. Inconsistencies in Disguised Handwriting:** Complete and consistent disguise of handwriting throughout an extended passage is challenging. The writer's concentration diminishes with prolonged efforts, leading to variations in the degree of disguise across different parts of the text. Envelopes often bear less disguised handwriting compared to the content of the letter inside. Figures and numbers in addresses are usually left undisguised. Titles like "Mr.," "Mrs.," and "Dr." are less likely to be disguised. However, suspicious entries in account books or forms often involve disguised figures. In some cases, criminals might attempt to mimic figures from someone else who has access to similar types of documents.(Hardless, 1997)
- 2. Intrinsic Handwriting Features Resistant to Disguise:** Several key attributes of handwriting are inherently challenging to alter, as they are deeply ingrained in an individual's natural writing style. These features serve as intrinsic identifiers that can significantly aid in handwriting analysis and authentication:
  - **Unalterable Quality:** Handwriting that surpasses an individual's typical fluency, rhythm, and letter designs cannot be effectively disguised.
  - **Spacing Consistency:** It is virtually impossible to manipulate the spacing between words and individual letters to match that of a different writing style.



- **Distinct Marginal Traits:** Characteristics such as flourishes, underlining, and the use of erasures remain consistent and impervious to disguise.

**3. Distinguishing Disguise from Forgery:** It's important to differentiate between disguised handwriting and forgery. Disguised writing lacks originality and often exhibits excessive ornamentation, like extraneous loops, lines, twirls, and flourishes. Disguised writing's inconsistency becomes evident, especially when larger quantities are produced. This lack of consistency stems from the challenging process of maintaining disguise, involving inner conflict and tension between conscious and subconscious thoughts.

When examining writing suspected to be disguised, it's likely that the genuine, inconspicuous features of the writer's natural style are present within the disguised script. Individuals often overlook these subtle characteristics in their own writing, focusing more on prominent traits. Everyday writing is so automatic that individuals rarely consciously consider its distinctive attributes. Therefore, when attempting to write in a disguised manner, individuals may unintentionally reveal their true characteristics.

To confirm whether a writing is indeed disguised, an expert will determine whether the authentic features of the writer's style are hidden within the disguised text. In cases involving suspects, comprehensive and varied exemplars must be collected for further examination and comparison. Exemplars should encompass diverse speeds and hands, with both left and right hands used. Conditions of writing and the instrument used should also be noted. A sufficient volume of exemplars is necessary to obtain a thorough sampling of the suspect's writing attempts.

In the quest to recognize disguised handwriting, the reasoning behind collecting voluminous standard writing exemplars is essential. It's virtually impossible for a writer to reproduce the same content multiple times without referencing the previous writing, while still maintaining consistent disguise. This forms the basis for recognizing disguised writing. Notably, genuine changes in writing habits reveal the true writing pattern in the identification process. However, care must be exercised during the identification process to avoid misinterpreting minor, inconspicuous variations as disguised elements. This prevents misidentifications based on natural variations or coincidental differences.

**4. Challenges in Identifying Disguised Writing:** Identifying disguised writing poses challenges. While disguise can be penetrated and recognized, it may not always be fully solved. Handwriting can be obscured to the point of being unidentifiable, both in disputed documents and exemplars. Some cases may lack clear solutions, despite expert analysis. (Hardless, 1997)

**5. Limitations of Disguise:** Disguising handwriting has its limitations, as certain aspects remain resistant to alteration. These include:

- **Graphic Habits:** The overall layout and order of text on a page cannot be effectively disguised.
- **Punctuation and Symbols:** Ascending marks, small signs, and symbols, like punctuation marks, maintain consistency despite disguise.
- **Vowel Shapes:** The manner in which vowels are formed remains relatively consistent

even in disguised writing. (Page No. 68, H. R. Hardless's "Disputed Documents Examination & Finger-Prints Identification, thoroughly revised by Chiyod Seshagiri Rao, Fifth Edition, 1997.)

**6. General Findings in Disguised Handwriting:** When handwriting is deliberately disguised, several patterns emerge that can aid in identification:

- Disguised handwriting loses its natural rhythm and homogeneity, becoming irregular in terms of speed, pressure, slant, size, etc. This results in a slowed-down appearance.
- Dimensions are often enlarged, slant may be modified, and lines may become more erect or slanted backward.
- Changes are noticeable in letter forms, particularly in capital letters, with increased complexity at the expense of simplicity. Angles become more frequent.
- Pressure exerted while writing becomes irregular and generally more pronounced.

In contrast, genuine handwriting or signatures display smooth and consistent line quality. Even when signing multiple times, natural variations in curves, loops, and angles of letter strokes occur, indicating authenticity. These subtle variations are inherent due to the human hand's inability to replicate a perfect duplicate, akin to a rubber stamp.

- Disguising numbers, like figures in dates, months, and years, is challenging to achieve completely. Arrangement and alignment in numerical figures often retain the writer's distinct individuality.
- Interestingly, the final segment of disguised writing might resemble the writer's normal handwriting more closely than the earlier portion. Features that remain consistent throughout a piece of writing are likely to be undisguised. Even if a collection of specimens spans a significant period, some features can be assumed to be genuine.
- Consistent disguise primarily focuses on prominent handwriting features. Less conspicuous characteristics are less likely to be disguised. It's crucial to avoid assuming that certain changes are immune to being disguised.

## V. TAMPERED DOCUMENTS

Tampering is a form of forgery that individuals employ to achieve various objectives, such as financial gain, acquiring property, or out of jealousy. Documents serve as crucial sources of evidence in solving crimes, but they also pose a risk of tampering. Tampering can occur through multiple methods, including addition, deletion, secret writing, charring, erasures, and obliteration. As stipulated by the law, tampered documents involve the illegal alteration, obstruction, intrusion, or manipulation of a record or evidence. This can extend to influencing the testimony of a witness. In the realm of forensic science, tampered documents are frequently encountered. Experts commonly deal with cases involving alterations, additions, erasures, obliterations, secret writings, and burnt records. Evaluating tampered documents is a challenging and labor-intensive task due to the variety of writing inks and surfaces involved. Whenever there's suspicion of any alteration involving letters, figures, signatures, etc., it's essential to determine their authenticity and potential forgery. The primary goal of forensic document examiner is to discern the genuineness or falsification of the additions made by an individual. Traditionally, conventional techniques like hand lenses,

stereomicroscopes, and various illumination sources, such as ultraviolet, oblique light, and transmitted light, were used for the analysis of alterations. However, these methods are not always effective in complex cases, necessitating the development of advanced techniques that provide swift, precise results without damaging the questioned document. Documents are usually composed on paper using writing instruments like ballpoint pens, fountain pens, gel pens, etc. It's crucial to understand the properties of both the paper and inks used. Paper surfaces can include spread paper, bond paper, construction paper, and copier paper, while inks range from liquid or semi-liquid materials to oil-based and water-based compositions. Different inks have distinct characteristics, such as ballpoint pen ink being oil-based with synthetic dyes dissolved in glycol. Modern fountain pen inks contain pigmented dyes that render them permanent, while gel inks are water-based and contain insoluble color pigments. Hence, there's a pressing need to differentiate between inks of various colors used for alterations to restore the authenticity of disputed documents.

- 1. Alteration:** Alteration refers to any change or modification made to a document. It can involve erasing, adding, deleting, canceling, interlining, or substituting writing materials or figures that impact the identity, rights, or obligations of the parties mentioned in the document. Alterations can occur at any point in time within a document. Any direct alteration attempted on a document can be easily detected under magnification. The use of a stereoscopic binocular magnifying lens at low magnification can clearly reveal the altered area. Common alterations include overwriting or changes in numerals, such as converting 0 to 1, 0 to 9, or other similar transformations.
- 2. Charred Documents:** The handling of partially burnt records presents a complex challenge for forensic experts. Charred documents are typically encountered in arson investigations. Detecting and interpreting partly charred documents in the realm of questioned documents is particularly challenging. These documents demand extra care due to their extreme fragility.

Scientific techniques for detecting and interpreting such delicate documents are not yet fully established. When interpreting partly charred documents, investigators must consider critical factors. Recovered partly charred documents can vary significantly in physical and chemical composition based on the paper type, ink type (ballpoint, gel, fountain, invisible, etc.), and the burning conditions. Various factors, such as the type of paper or ink, affect the burning process.

The effects of outdoor burning, which involve complete oxidation, can differ between initial and subsequent burning phases. The type of paper or ink used also contributes to the variations in burning patterns. Ink types vary widely, including water-based, mineral-based, or oil-based inks. Composition inks often contain iron as a major compound, and their residues become iron oxide, faintly visible. Pencil writing, containing graphite and clay, is non-flammable and remains legible upon burning.

- 3. Erasures:** Erasures involve removing writing, typewriting, or printing from a document, achieved through chemical or abrasive methods. A common method for altering a document is through erasure. Erasures can be accomplished using mechanical or chemical means. Rubber erasers, sandpaper, razors, or blades can be employed to scrape away the writing, affecting the paper's surface. Mechanical erasures can disrupt the paper's upper fibers and leave rubber particles visible. Microscopic methods are often

used to detect such erasures. Chemical erasures are identifiable and can be restored using specific chemicals like ammonium sulfide vapor, alcohol, iodine vapor, etc.

4. **Obliteration:** Obliteration refers to covering or crossing out writing or printing to render the original text unreadable. A common technique is overwriting or crossing out with a pencil, pen, or ink. When obliteration occurs using the same pen and ink and dries shortly after, it becomes challenging to distinguish from the original text.
5. **Secret Writings:** Detainees often convey messages through secret writings to relatives, friends, etc. These detainees can be criminals, political offenders, international spies, or members of secret societies. Invisible inks, derived from natural or synthetic sources, serve the purpose of creating concealed writing. Various types of invisible inks are available, including disappearing ink, vanishing ink, and erasable ink, used in industries like textiles and paints. These inks are based on acid-base chemistry principles. Thymolphthalein, for instance, turns blue above pH 10.3 and colorless below pH 9.3, forming the basis of many invisible inks.

Forensic analysts often encounter cases involving invisible writings in fraudulent scenarios. Therefore, there's a pressing need for the advancement of scientific techniques to address these challenges.

6. **Additions:** Documents can be tampered with through additions, which involve altering the document by introducing additional words, figures, etc. Detection of additions is more likely when:
  - Another forensic expert observes it.
  - Different ink is used.
  - Clear differences in spacing or irregular division indicate it wasn't part of the original.
  - The distinguishable age difference in ink can also indicate tampering.
7. **Tampering Identification:** One of the most challenging tasks is determining the origin of a forgery. Often, this question remains unanswered due to the skillful nature of fabrication, which acts as a form of concealment. Identifying the forger solely through their handwriting is an exception rather than the norm, as very rarely do the forger's writing habits provide a basis for identification. However, in uncommon cases, the forger might exhibit small but distinct personal habits in their imitation, aiding in identifying them. With non-forged signatures, especially those where the writer didn't attempt to alter or disguise their natural writing, it is much easier to establish the writer's identity. The following tools are useful for identification and detection of forgeries:
  - Hand lens/Hand magnifier
  - Stereomicroscope
  - Illumination sources (UV, IR, Oblique, etc.)
  - Docubox HD
  - Docubox Dragon
  - Projectina NIRVIS Docucenter
  - Video Spectral comparator (VSC-1, VSC-4, and VSC-5000, and VSC-8000)

## VI. PAPER

Paper is primarily composed of cellulose extracted from wood or straw. It undergoes multiple stages before reaching its final state. After being beaten into small strips and passing through a continuous wire gauze screen, excess water is removed, and the paper gains sufficient strength. This initial form is blotting paper and must be modified for writing purposes by filling the pores with substances like kaolin, calcium, or barium sulfate. A mixture of rosin and alum is used for paper glazing. Technological advancements in the paper industry have led to improvements. Synthetic fibers are integrated to enhance paper strength. Innovations like "no carbon required" (NCR) paper involve special surface treatments and security features for applications such as currency notes.

Paper types are classified based on GSM (grams per square meter), determining thickness and quality. Higher GSM values indicate better quality. Bond, copier, tracing papers, etc., are utilized for document purposes. Paper examination involves assessing dimensions, color, fluorescence, fiber nature, opacity, and watermarks, etc.

## VII. WRITING INKS

Ink analysis is a challenging yet vital aspect within the field of questioned documents. The chemical and physical study of inks in questioned documents provides crucial information about their authenticity. Despite the limited quantity available for analysis, inks span various categories. Comparing the chemical and physical properties of two or more inks can help determine:

- Whether the inks were produced by the same manufacturer.
- Whether the inks are from the same production batch.
- The approximate production date of the specific ink formulation.
- When the writing was produced on any writing surface, by analyzing the formation of various markers or complex compounds.
- Consequently, ink analysis is essential and conducted by experienced experts.

**Types of Inks:** Understanding the composition of ink is essential for comprehending the reasons behind various methods employed for ink analysis. The following ink types are common:

- 1. Carbon Ink (Indian Ink):** Carbon ink, also known as Indian ink, consists of carbon suspended in water. In its simplest form, carbon is molded into a solid cake with adhesive. The cake is beaten, and the particles are suspended in an aqueous medium to form liquid ink. Prussian blue may be added to enhance ink color. Liquid carbon ink, containing shellacs, borax, and wetting agents, is available for commercial use. These inks are highly stable, insoluble in water, and resistant to heat, light, air, moisture, and microorganisms.
- 2. Ball Point Ink:** Ballpoint inks primarily contain synthetic dyes or sometimes graphite/carbon for permanence. Ballpoint pens were first discovered in Europe in 1939 and reached the US market by 1946. Glycols are used as a vehicle in modern ballpoint pens. These pens consist of about 50% dyes along with ingredients like fatty acids, gums,

surface-active reagents, corrosion control materials, and viscosity adjusters. The initial properties and lubrication of ballpoint pens are due to unsaturated fatty acids like oleic acid.

3. **Fountain Pen Ink:** Fountain pen inks come in two types: gallotannate and a liquid solution of synthetic dyes. Modern fountain pens primarily use synthetic dyes that provide a quick blue color transforming into black upon oxidation. Tannic and gallic acids are extracted from wood and mixed with ferrous salts to create a dry liquid that turns black after drying and aging. This ink class is stable, insoluble in water, and less stable compared to blue-black carbon ink.
4. **Gel Pen Ink:** Japanese introduced gel inks to the writing instrument market. Gel pen inks contain insoluble hidden pigments instead of traditional dyes. These water-based inks are insoluble in water and strong solvents. The preparation process is similar to ball pen manufacture.
5. **Porous Tip Inks:** Fiber or porous tip inks are water- or xylene-based and contain pigments along with additives similar in composition to fountain pen and rolling ball marker inks. Pyridine and DMSO are used to keep the pen tip wet and prevent drying. Water-based inks are water-soluble, while xylene-based ones are stable and water-resistant.
6. **Rolling Ball Marker Inks:** These inks were introduced in Japan around 1968 and quickly reached the US. They are water-based and contain organic fluids like glycol and formamide to prevent ballpoint drying. Colors are water-soluble or acidic dye salts.
7. **Iron Tannate Ink:** Dyestuff inks, made from various colors like nigrosine, are common nowadays. They come in different hues and shades, are not permanent, and can be easily washed off. Their fading period depends on the specific dye used. (B.R Sharma, 2004; Kelly and Lindblom, 2006; BS Nabar, 2017).

**Ink Comparison and their Identifications:** The primary objectives of ink analysis are as follows:

- Comparing two or more ink entries to determine similarities or differences in inks, which can provide insights into whether entries have been added or altered.
- Establishing whether two or more entries were written with the same ink composition and batch, thus suggesting whether certain entries could have been written with the same pen.
- Dating ink entries to ascertain if documents have been backdated (B.R Sharma, 2004; Kelly and Lindblom, 2006; BS Nabar, 2017).

## VIII. THE ROLE OF PHOTOGRAPHY IN DOCUMENT EXAMINATION

Evidence encompasses all the elements by which allegations can be substantiated or refuted in a judicial trial (Giftis, 1991). A meticulously prepared photograph serves as the most accurate reproduction of a document. Photography greatly aids in comprehensive technical analysis (Ordway Hilton, 1982). The significance of photography in document examination is paramount: it facilitates the creation of a permanent record of fragile

documents, reducing their physical handling. Photographs can be enlarged to accentuate writing strokes that may not be visible otherwise. They are also useful in constructing comparative charts of handwriting for easy observation and court presentation. This method is also applied for typed words (Hardless, 1997).

Well-executed photographs of documents effectively convey information, aiding preliminary examination. Skill is crucial in producing high-quality record photographs. Issues such as lack of sharpness due to incorrect focusing, inadequate contrast due to exposure errors, and improper lighting can arise. Thus, skilled photographers and professional equipment are necessary to address these challenges.

When photographing a document, it should be placed on a flat surface, illuminated from multiple sources to ensure even lighting. A scale should be included for measurement reference. While color photographs offer advantages by enabling differentiation of ink colors, they have limitations, as colors may not be accurately reproduced. Color photography is also more costly than black and white photography, which usually suffices in providing clear details (David Ellen, 2006).

In cases involving unconventional writing surfaces and instruments, such as suicide notes, murder or robbery threats, meticulous photography is essential. Such cases might involve writings on unconventional surfaces or with unique writing instruments. Unlike conventional documents, unconventional ones can't always be transported to the laboratory, requiring reliance on crime scene photographs and notes collected during the examination. Care must be taken to prevent distortion or defacement of writings, such as when dealing with writing on the deceased's skin or writings on surfaces with cosmetic or liquid substances.

The following considerations are crucial when photographing crime scenes with unconventional writing surfaces or instruments (BR Sharma, 2005):

- Photography should be conducted by a professional forensic photographer using high-quality digital cameras.
- Filters are essential for enhancing desired portions of the document and suppressing unwanted backgrounds.
- Adequate lighting is necessary during photography.
- At least four general view photographs of the crime scene should be taken.
- Close-up photographs should feature a scale to indicate dimensions.
- Multiple angles must be covered.
- Detailed records should document the number of exposures, illumination types, etc.
- All surfaces and potential writing instruments at the crime scene should be meticulously examined.

Thorough examination of the crime scene is crucial, as unconventional writing instruments might also be found there (Sharma S et al., 2019).

- Photographs of writing instruments should be taken with a scale for reference.
- Accurate documentation of various surfaces and writing instruments at the crime scene is essential.

## IX. OFFENCES

### 1. Offences Relating to Documents in the Indian Penal Code: The Indian Penal Code encompasses various sections that address forgery and related offences:

- Section 463 - Forgery: This section pertains to creating false documents or parts of documents with the intent to deceive or cause damage, injury, or fraud. The forgery aims to support a claim, title, or contract, leading to legal consequences.
- Section 464 - Making a False Document: This section defines the creation of a false document with fraudulent intent. It covers instances where a document or its execution is falsely represented, altered, or manipulated without lawful authority.
- Section 465 - Punishment for Forgery: The punishment for committing forgery includes imprisonment for up to two years, a fine, or both, depending on the severity of the offence.
- Section 466 - Forgery of Record or Public Register: Forging documents that resemble court records, public registers, certificates, or authorities can lead to imprisonment for up to seven years along with potential fines.
- Section 467 - Forgery of Valuable Security, Will, etc.: Forging documents that relate to valuable securities, wills, authorities, or receipts can result in imprisonment for life or up to ten years, accompanied by fines.
- Section 468 - Forgery for the Purpose of Cheating: Committing forgery with the intention of using the forged document to deceive or cheat others can lead to imprisonment for up to seven years and potential fines.
- Section 469 - Forgery for Purpose of Harming Reputation: Any person who commits forgery with the intent to harm the reputation of an individual or who knows that the forged document is likely to be used for such a purpose shall be liable for imprisonment for a term of up to three years and may also be subjected to fines.
- Section 470 - Forged Document: A document created wholly or partially through forgery is classified as "a forged document."
- Section 471 - Using Forged Document as Genuine: Anyone who fraudulently or dishonestly utilizes a document as genuine, knowing it to be forged, shall face the same penalties as if they had engaged in the act of forgery themselves.
- Section 489A - Counterfeiting Currency-Notes or Bank-Notes: Any individual who counterfeits currency-notes or bank-notes, or knowingly participates in the process of counterfeiting, shall be subject to imprisonment for life or imprisonment of up to ten years, along with potential fines.
- Section 489B - Using Forged or Counterfeit Currency-Notes or Bank-Notes: Anyone who knowingly sells, purchases, receives, traffics, or uses forged or counterfeit currency-notes or bank-notes, being aware of their illegitimacy, shall be liable for imprisonment for life or imprisonment of up to ten years, accompanied by potential fines.
- Section 489C - Possession of Forged or Counterfeit Currency-Notes or Bank-Notes: Individuals found in possession of forged or counterfeit currency-notes or bank-notes, knowing of their illegitimacy and intending to use them as genuine or facilitating their use as genuine, shall be liable for imprisonment for up to seven years, fines, or both.
- Section 489D - Making or Possessing Instruments or Materials for Forging or Counterfeiting Currency-Notes or Bank-Notes: Those who manufacture, operate, buy,



sell, or possess machinery, instruments, or materials intended for forging or counterfeiting currency-notes or bank-notes, or are aware of their intended use, shall be liable for imprisonment for life or imprisonment of up to ten years, coupled with potential fines.

- Section 489E - Making or Using Documents Resembling Currency-Notes or Bank-Notes:
  - Anyone who creates, causes to be created, uses, or delivers a document purportedly resembling a currency note or banknote, or closely resembling it with intent to deceive, shall face a fine not exceeding one hundred rupees.
  - If a person whose name appears on an offense-related document under subsection (1) refuses, without lawful justification, to reveal to a police officer the identity and address of the individual responsible for its creation, they may face a fine not exceeding two hundred rupees.
  - Until proven otherwise, if a person's name appears on a document related to an offense under subsection (1) or on any other document connected to it, it shall be presumed that the person caused the document's creation.

## 2. Based on the Indian Evidence Act:

- Section 45 - Expert Opinions: When the court needs to form an opinion on matters involving foreign law, science, art, or the identity of handwriting or finger impressions, the opinions of individuals with expertise in those respective fields are considered relevant facts. These individuals are referred to as experts.
- Section 46 - Facts Supporting Expert Opinions: Facts that are not otherwise relevant become relevant if they either support or contradict the opinions of experts when those opinions are relevant.
- Section 47 - Opinion on Handwriting: When the court needs to determine the authorship of a document, the opinion of someone familiar with the handwriting of the supposed author is considered relevant. This person's opinion on whether the document was written or signed by that author is treated as a relevant fact.
- Section 47A - Opinion on Digital Signature: When the court needs to form an opinion about the authenticity of a digital signature, the opinion of the Certifying Authority that issued the Digital Signature Certificate is considered a relevant fact.
- Section 59 - Oral Evidence for Proof of Facts: All facts, except the contents of documents, can be proven through oral evidence.
- Section 60 - Directness of Oral Evidence: Oral evidence must always be direct. If it relates to something that could be seen, it must come from a witness who claims to have seen it. The same applies to facts that could be heard, perceived by other senses, or based on opinions and their grounds.
- Section 61 - Proof of Document Contents: The contents of documents can be proven using either primary or secondary evidence.
- Section 62 - Primary Evidence: Primary evidence refers to the actual document presented for court inspection.
- Section 63 - Secondary Evidence: Secondary evidence includes certified copies, mechanically produced copies, copies made from the original, counterparts of documents against non-signing parties, and oral accounts of document contents by those who have seen them.

- Section 64 - Primary Evidence for Document Proof: Documents must be proven using primary evidence, except as mentioned in specific cases.
- Section 65 - Cases for Secondary Evidence of Documents: Secondary evidence can be provided for the existence, condition, or contents of a document.
- Section 73 - Comparison of Signatures, Writing, or Seals: To determine the authenticity of a signature, writing, or seal, a known example created by the same person may be compared, even if that example wasn't produced for other purposes. The court can direct individuals present to write words or figures for comparison purposes.
- Section 90 - Presumption for Documents Thirty Years Old: When a document purported to be thirty years old is produced from proper custody, the court may presume that the signature and other parts attributed to a specific person are indeed that person's handwriting. In the case of executed or attested documents, it can be presumed that they were properly executed and attested by the individuals claimed.

## X. IMPORTANCE OF QUESTIONED DOCUMENTS IN TODAY'S SOCIETY

- 1. Scope of Document Examination:** Questioned document examination is closely associated with the legal system, resembling the work of a scientific researcher. Forensic science applies scientific methods to legal matters. Document examiners analyze items (documents) relevant to cases that may appear in a courtroom setting. Commonly, forensic examination cases involve "white-collar crimes" like fraud, forgery, and counterfeiting. Questioned documents are significant because they are used in various crimes, such as a person committing murder and fabricating a suicide note. Often, questioned documents result from routine business or personal activities. (Hardless, 1997).
- 2. Nature of Questioned Documents in Legal Cases:** Questioned documents play a crucial role in both criminal and civil cases, addressing a wide range of issues from white-collar crimes like cheque fraud and forgery to more serious matters. Questioned document examiners are often called upon to verify the authenticity of various documents, such as suicide notes, forged identities, fraudulent activities, homicides, bank robberies, kidnappings, medical malpractice, and more. The realm of questioned documents spans across both civil and criminal litigation within the legal system.

Questioned documents hold significant importance in society for various reasons:

- **Legal Proceedings:** Questioned documents often play a crucial role in legal proceedings. They can provide evidence in cases of fraud, forgery, identity theft, and other crimes. Authenticating documents and identifying alterations are critical for establishing the truth in court.
- **Protection of Rights:** Document analysis helps protect individuals' rights by ensuring the authenticity of contracts, wills, and other legal documents. This safeguards people from falling victim to forged or tampered documents.
- **Forensic Investigations:** In criminal investigations, questioned documents provide valuable insights into the identity of suspects, modus operandi, and motives. Handwriting and signature analysis can link suspects to crimes, aiding law enforcement agencies in solving cases.

- **Business Transactions:** Documents are at the heart of business transactions. Authenticity and integrity are paramount in contracts, agreements, financial records, and other business-related documents to prevent disputes and legal challenges.
- **Personal Identification:** Questioned documents are used to verify personal identity, especially in cases where official identification documents are involved. This helps prevent identity fraud and misuse of personal information.
- **Historical Analysis:** Analyzing historical documents can reveal insights into the past. Experts examine old manuscripts, letters, and documents to authenticate their origins, providing valuable historical context.
- **Document Forgery Prevention:** By understanding techniques used in document forgery, experts help develop security features for official documents, currencies, and certificates, making it harder for counterfeiters to replicate them.
- **Expert Testimony:** Document examiners provide expert testimony in court, aiding judges and juries in understanding the authenticity or manipulation of questioned documents.
- **Public Confidence:** When people trust that documents are genuine and accurate, it instills confidence in institutions, governments, and businesses. Document examination contributes to maintaining this trust.
- **Deterrence:** Knowing that questioned documents can be analyzed and forgeries detected acts as a deterrent against potential fraudsters and forgers.
- **Preserving Justice:** Ensuring the accuracy of documents preserves justice by preventing innocent people from being wrongly accused or convicted based on tampered evidence.

## **XI. CONCLUSION**

In conclusion, the realm of questioned documents within the field of forensic science is an intricate and indispensable facet of the modern justice system. Through the integration of fundamental scientific principles and the application of diverse analytical techniques, forensic experts meticulously scrutinize documents to decipher truths hidden within symbols, marks, and signs. The significance of this discipline becomes pronounced as documents are an integral part of daily life, becoming invaluable sources of evidence in legal matters. The evolution of technology has both heightened the potential for deception through fraudulent documents and empowered forensic professionals to uncover such deceit. Albert Osborn's pioneering work laid the foundation for the scientific examination of questioned documents, bridging the gap between the complexities of writing patterns and their legal implications. The expertise of questioned document examiners, particularly in handwriting analysis, is pivotal for evaluating the authenticity of documents presented in courts of law. The wide-ranging applications of document examination are seen across various legal contexts, from financial transactions to identification documents and even unconventional surfaces. This practice addresses the challenges posed by white-collar crimes, where criminals exploit documents for their illicit gains, necessitating the precision and diligence of forensic experts. As society continues to evolve, so too do the methods of forgery and deception. The chapter underscores the significance of questioned document examination in maintaining the integrity of legal proceedings and upholding justice. By shedding light on the intricacies of this specialized field, the chapter aims to enhance the comprehension of its readers, illustrating the multifaceted nature of forensic science and its enduring role in safeguarding the truth.

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