

The Establishment of Document Forgery

Nicoleta-Elena Hegheș

*Researcher 2nd Degree, "Acad. Andrei Rădulescu" Institute of Legal Research of the Romanian Academy,
nicoleta.heghes@icj.ro*

*Professor, PhD, Faculty of Juridical and Administrative Sciences "Momcilo Luburici", "Dimitrie Cantemir"
Christian University of Bucharest, Romania, nicoleta.heghes@ucdc.ro*

Abstract: Detecting document forgery is a crucial component of forensic examination, aiming to identify alterations, counterfeits, and interventions in written content. This article analyzes the methods used to commit forgery, addressing techniques such as text removal, addition, and masking; chemical erasure (corrosion) and washing; the use of invisible inks; and methods for revealing the writing. A distinct section is dedicated to identifying the counterfeiting of handwriting and signatures, covering servile imitation, freehand imitation, copying, scanning-based forgery, and handwriting disguise. Forensic analysis may employ the microscopic examination of writing materials and the evaluation of graphic features to detect interventions and establish a document's authenticity. The study of these techniques demonstrates the importance of a comprehensive examination of the substrate, writing materials, and graphic characteristics in the process of identifying forgeries. Forensic analysis can employ the microscopic examination of writing materials and the evaluation of graphic peculiarities to detect alterations and establish a document's authenticity. An examination of these methods highlights the importance of a comprehensive analysis of the substrate, writing materials, and graphic characteristics in the process of identifying forgeries.

Keywords: Forgery, Handwriting, Signature, Documents, Methods

Introduction

Forgery involves the alteration, distortion, or erroneous drafting of a document for the purpose of obtaining specific privileges, establishing certain relationships, or acquiring undue assets (Gheorghîță, 2017, p. 260). Document forgery can be material and/or intellectual in nature (Suciu, 1972, p. 472). Intellectual forgery consists of attesting to facts or circumstances in a written document that do not correspond to reality. This category includes delivery notes for fictitious goods, documents regarding the alteration of merchandise, often fabricated by individuals with official duties at state-owned economic entities, and other documents attesting to untrue facts. Establishing intellectual forgery requires a complex forensic investigation, often involving the assistance of specialists from other fields (such as accounting, economics and commerce, finance and banking, industrial production technology, etc.) (Doraș, 2011, p. 236).

Material forgery consists of altering the original content of pre-existing documents. It can be committed through a physical modification of the document and may take various forms; the most common include altering the original content by removing, adding, or rewriting text, as well as counterfeiting signatures and authentication marks (stamps) and substituting photographs. A wide range of methods, materials, and technical means are employed in document forgery, making detection by law enforcement authorities difficult. In the vast majority of cases, the preliminary examination of documents serving as physical evidence merely raises suspicions of forgery, with confirmation typically achieved through forensic document analysis (Gheorghîță, 2017, p. 260).

Document Forgery

Documents may be forged either wholly or partially. They are drawn up in the name of an institution or an individual. The person in whose name the document is created may be real or fictitious (Mircea, 1998, p. 188).

Wholly forged documents possess a certain structural unity, both logical and graphic, that is usually absent in partially forged documents.

Partial forgeries may involve the removal or alteration of text, the addition of text, the counterfeiting of a signature, the application of a fake stamp, the substitution of a photograph, etc. (Suciu, 1972, p. 472). Aside from total counterfeits or forgeries, the primary methods of falsifying documents include removing or covering text, adding text, altering a graphic character (letter or digit), imitating handwriting or a signature, and disguising one's own handwriting. In addition to these, other authors cite forgery by covering text, forgery by assembling a new document from disparate parts, and forgery via chemical washing (corrosion), a process that usually precedes the addition of new text or the complete rewriting of the document. These falsification techniques are accompanied by the forging of stamp and seal impressions, as well as the substitution of photographs on identification cards or documents (Sandu, 1994, p. 11). The methods used to examine a forgery are selected and applied based on the falsification technique employed, as well as the nature of the paper and the writing medium used to create the document (Mircea, 1998, p. 188).

Forgery involving the removal of text is carried out through mechanical or chemical means. Mechanical methods for removing one or more characters include scraping and erasing (Gheorghită, 2017, p. 261). Mechanically removing writing with various implements damages the paper's surface alongside the removal of the characters themselves. The erased area becomes duller, thinner, and loses its sheen; it appears fuzzy and reduced in thickness compared to the unaltered sections. If the irradiated or abraded area features a protective grid, the protective pattern is damaged to such an extent that the alteration is visible to the naked eye. Other traces, which are more difficult to detect, consist of residual material from the erased writing. Such traces are revealed under laboratory conditions through the application of selective photography techniques (Gheorghită, 2017, p. 261; Sandu, 1977, p. 68).

Writing with a pencil or ballpoint pen also causes alterations to the paper's substance along the stroke path, particularly when the paper is of inferior quality. The indentations created by the writing instrument are not removed by erasure but remain largely intact. They are more pronounced on the reverse side of the document as a raised ridge, which often allows the erased writing to be reconstructed (Mircea, 1998, p. 189). If the writing was executed in ink, various techniques can be employed to reveal the erased text. One of the simplest methods involves treating the relevant section of the document with citric acid and subsequently examining it under ultraviolet light; this reveals a distinctive fluorescence in the area (Ciopraga & Iacobuță, 2001, p. 172).

Scraped or erased text can be revealed through various photographic techniques, such as using light filters or infrared and ultraviolet light, and by applying the diffuse-copying method (Gheorghită, 2017, p. 261). Chemical document forgery can be achieved through chemical erasure (corrosion), washing, or text masking.

Chemical erasure involves removing text using a wide variety of chemical reagents. It bleaches the writing, transforming the ink into a faintly colored or even colorless substance. Dilute acids and alkaline substances (which yield a basic reaction in solution) are typically used for this purpose (Mircea, 1998, p. 190). Forensic science identifies the following characteristic signs of chemical text erasure: matte areas on the document surface where chemicals were applied; surface fissures in the areas affected by the chemicals; yellow stains on white paper and whitish stains on colored paper; damage to security features and lithographic elements; partial discoloration of adjacent graphic marks; remnants of the removed text in cases of incomplete erasure; and pressure marks left by the writing instrument used for the original text (Doraș, 2011, p. 238).

Washing is the process by which the writing, under the action of organic solvents, discolours or dissolves the writing until its total or partial disappearance (Chiriac, 1966, pp. 161-162). The affected part usually has a different shade of color than the non-corroded or unwashed areas; it is more fragile, with significant loss of smoothness and gloss. If the removed text was replaced by another, the latter differs from the first by the thickness of the

writing, the color shade, and the diffusion of the substance in the paper (Mircea, 1998, p. 190). The removal of text via chemical erasure or washing can be detected through specialized examination methods, such as stereomicroscopic examination, examination under ultraviolet and infrared radiation, and the detection of characteristics associated with chemical erasure using color-separation photography and image contrast enhancement techniques (Gheorghiuță, 2017, p. 262).

Covering the text is the most primitive method, accessible to those lacking sophisticated forgery tools. Typically, the text is obscured by scribbling over it with ink, pencil, or India ink, or by dripping ink onto the text, often under the guise of an accident (Ciopraga & Iacobuță, 2001, p. 172). Revealing the obscured text is easier when the covering material differs in nature and color from the writing medium. Detection is also facilitated by a significant time lapse between the application of the two materials, greater writing pressure, the absence of other writing or stains on the reverse side of the document, and a substantial amount of text (Sandu, 1994, p. 101). The simplest method for attempting to read obscured writing involves examining the document on both the recto and verso sides, using unilateral lighting and transmitted light. It is recommended that examination via transmitted light be conducted in a darkroom (Sandu, 1994, p. 101). The original text can also be revealed through the use of infrared radiation, specifically by photographing the document in the infrared spectrum, examining it directly using an electro-optical image converter, or employing holographic examination (Cîrjan & Chiper, 2009, p. 250).

Writing with *invisible inks* presents an issue related to forgery via text concealment. Forensic practice frequently involves revealing invisible writing produced with various colorless substances, generally known as “sympathetic inks”. Such writing is typically executed on ordinary paper, often between the lines of visible text, to avoid arousing suspicion regarding the actual secret message (Gheorghiuță, 2017, p. 263).

A wide range of materials can be used as invisible inks. Practically any colorless liquid that does not evaporate too quickly, starting with plain or distilled water, can be employed. Commonly used substances include plant juices (lemon or onion juice), organic fluids (milk, saliva, urine), and various chemicals such as diluted sulfuric acid, cobalt salt solutions, solutions containing fluorescent substances (e.g., quinine sulfate), and a wide variety of liquids derived from pharmaceutical products. There is an extensive list of colorless chemical compounds that produce color reactions when combined with other substances. The optimal choices are determined experimentally and are usually known only to those who utilize this method of communication (Sandu, 1994, pp. 107-108).

Writing produced in this manner can be revealed through several procedures. Initially, the suspicious document is examined under varying angles of incident light; this allows for the observation of slight differences in sheen, caused by the substance used, and variations in surface relief resulting from the writing instrument (Mircea, 1998, p. 191).

Among laboratory techniques, some rely on the effects of invisible rays, while others involve the application of specific powders or the treatment of the suspect document with iodine vapors or solutions. Under ultraviolet and infrared radiation, writing is revealed either through the reflection of the radiation used or through the generation of luminescence. X-rays are used to reveal writing executed with inks containing heavy metal salts (lead, mercury, iron, tin, zinc, nickel, etc.). Treatment of the suspect document with powders and iodine employs procedures similar to those used to reveal latent papillary ridge impressions (Sandu, 1994, pp. 108-110).

Forgery involving the addition of text, like that involving its removal, is typically associated with partial forgery (Stancu, 2015, p. 329). Additions can take various forms, ranging from the insertion of a single stroke or punctuation mark, which alters the meaning of a word or sentence, to the addition of a digit, word, phrase, or text fragment; insertions made above signatures and additions to typewritten texts represent distinct manifestations of this

same method of document alteration (Sandu, 1994, p. 111). Added text is identified based on criteria regarding its logical placement within the document and the manner in which the writing is arranged and flows. Characteristics of added writing include unusual word abbreviations, the crowding of letters or figures, and differing line orientation, as well as numerous detailed differences between the two writing samples, particularly if the forgery was committed by someone other than the author of the authentic text. Differences in ink pigmentation also serve as an indication of text additions (Gheorghită, 2017, p. 263).

In addition to graphic differences, alterations may arise from changes to the surface upon which the document was written. For instance, if the paper was initially placed on a perfectly smooth surface but was subsequently, at the time of forgery, placed on a rough or uneven surface, this creates a detectable difference. Furthermore, a change in the writing instrument or the specific writing conditions, even when the writing is performed by the same person, provides clues that can lead to the discovery of the forgery (Stancu, 2015, p. 330).

To identify a forgery, microscopic examination of the writing materials and the intersecting strokes of the two texts is recommended, using a comparison microscope and a stereomicroscope. Fine particles of the original material may be detected along the added stroke, or differences between writing instruments may be established by analyzing the linear continuity of the striations left on the document (Cîrjan, 2005a, p. 427). Typically, subsequently executed strokes overlap previously executed ones, just as the strokes of lower lines intersect those of upper lines. A reversal of this sequence indicates the presence of an addition (Alecă, 2001, p. 221).

Another characteristic feature of additions is a difference in line alignment, a trait commonly found in typewritten texts. To make this difference in alignment easier to detect, the document is affixed to a large sheet of paper, and lines drawn beneath the written lines are extended onto that sheet, thereby magnifying any discrepancies (Suciu, 1972, pp. 477-478). Among the techniques for detecting forgeries involving added text, Cîrjan & Chiper (2009, p. 251) highlight the following: optical investigation, stereomicroscopic examination with color-contrast illumination, scanning electron microscopy, and the study of ultraviolet fluorescence or infrared luminescence.

Forgery of Handwriting or Signatures

Establishing the forgery of handwriting or a signature, and identifying the elements that attest to the falsification, requires an understanding of the writing process and the specific characteristics of signature execution.

Writing is one of the most complex processes; its competent study necessitates coordinating the efforts of forensic experts with those of philosophers, linguists, mathematicians, and other specialists (Sandu, 1977, p. 22). A person's handwriting is a conscious act of habit formation, possessing relative stability; while it may undergo modifications due to various conditions, it does not experience a radical change that would transform the entire system of habits (Drăghici et al., 2018, p. 456).

A *signature* is understood as the graphic representation of a name, executed personally by the individual in question, serving to attest that they are the author of the document or that they approve its content. Furthermore, a signature marks presence, indicates acknowledgment of a document or a specific notation, and so forth, in short, it generally serves to confirm something (Ionescu, 2010, p. 207). There are various methods of forging signatures, but the most frequently used are imitation and copying (Ionescu, 2010, pp. 218-228).

Handwriting imitation consists, in essence, of reproducing the specific graphic characteristics of another person's handwriting. Such a forgery may be total or partial and can involve either a text or a signature (Suciu, 1972, p. 478). In the process of imitation, the writer must alter their own established dynamic stereotype, adapting to the new prototype they wish to execute. By not being bound to a specific technical element of forgery, the forger breaks

free from their own writing or signing habits; they succeed in the imitation, yet at the cost of producing features that, despite retaining the general automatism of writing, are imperfectly rendered relative to one another and distinct from the imitated model (Radu et al., 1980, p. 292).

Imitating another person's signature can be achieved in two ways: a) by slowly visually tracing the path of the authentic signature, a process resembling drawing from a model, known as “servile imitation”; b) by executing the signature at a more or less normal pace after having previously studied the original model or even practiced the imitation, known as “free imitation” (Sandu, 1977, p. 26).

Servile imitation results from carefully observing the model at hand and reproducing the target path through relatively coordinated movements; depending on the forger's graphic aptitude and the complexity of the model, the imitator reproduces the traced path with varying degrees of accuracy or imperfection (Radu et al., 1980, pp. 292-293).

Forgery via servile imitation may be revealed by characteristics such as: a) slow, halting strokes lacking confidence and fluidity; b) unjustified pauses, tremors, or retouches; c) heavy and uniform pen pressure; d) omission of fine graphic details: stroke direction, starting and ending points, dimensions and spacing of characters, and the shape and placement of ancillary elements (cedillas, dashes, flourishes, and diacritics for the lowercase letters ă, â, î, ï); e) traces of erasures, etc. (Cîrjan, 2005a, p. 428). Sometimes, servile imitation is preceded by a pencil draft that is subsequently traced over in ink, a feature that becomes apparent upon infrared examination of the text (Drăghici et al., 2018, p. 457).

Forgery via freehand imitation is usually executed with the model in view, though it can also be done from memory. Outwardly, the forged signature or handwriting bears a general resemblance to the genuine article, particularly if the forger has practiced the execution. Imitation is somewhat easier when the target handwriting is less developed than the forger's own, or in the case of simplified signatures (Stancu, 2015, p. 331). A typical technical method of forging signatures involves copying the original text or signature (Golunski, 1961, p. 179).

Copying can be performed in several ways: *direct copying*, which consists of executing the model signature directly onto the document in dispute; and *indirect copying*, which requires reversing the position of the documents, placing the document bearing the model signature on top and the document intended to receive the forged signature underneath. Some more sophisticated offenders, aware that an identical shape between the forged and authentic signatures constitutes definitive proof of copying, resort to copying via projection; while this distorts the appearance of the signature, they still cannot avoid the other tell-tale signs of forgery (Stancu, 2015, p. 332). In such cases, the only elements identifying the forgery are graphic in nature: interruptions, restarts, retouching, hesitation, etc. (Suciu, 1972, p. 479).

Currently, *forgery via scanning* is a frequently used method for falsifying signatures, documents, and banknotes, and even for creating pirated copies of scientific or artistic works.

Handwriting disguise is frequently encountered in anonymous letters containing abusive, defamatory, threatening, or blackmailing content. Disguise may also occur during the act of signing; in such cases, the author, intending to later contest the signature, deliberately introduces elements that mimic forgery (such as retracing the stroke, making it wavy or thicker, etc.) (Stancu, 2015, p. 333). The main techniques used to disguise handwriting, which also serve as indicators of forgery, include altering the slant of the writing or the size of the letters, adopting calligraphic-style graphic elements, or using block lettering.

Left-handed writing, which, in untrained individuals, manifests as a clumsy, uncoordinated, and angular script, becomes more refined as the person grows accustomed to writing in this manner (Stancu, 2015, p. 333).

A characteristic feature of left-handed writing is the reversal of the direction in which circles and ovals are drawn, specifically moving from right to left and from top to bottom.

Furthermore, the connection between a letter's oval and its accompanying vertical stroke, as seen in the lowercase letters "a" and "d", is rarely made. If the left-handed text extends beyond just a few letters or words, the writing gradually becomes more fluid and natural. The more extensive the left-handed writing, the more the coordination of the hand's graphic movements is influenced by established right-handed writing habits; consequently, the script will reflect a specific set of graphic characteristics (Suciu, 1972, p. 480).

Altering the level of handwriting development. Forensic practice has encountered cases where individuals, in order to disguise their handwriting, altered its level of development to give it a completely different appearance. This is only possible for those whose actual handwriting is highly developed and who wish to present it, through disguise, as undeveloped. The reverse scenario is not possible (Anghelescu et al., 1978, p. 150). It should be noted that distinguishing between handwriting that is merely apparently disorganized and handwriting genuinely affected by the writer's advanced age and/or illness is a difficult task, often posing significant challenges even for subject-matter experts (Frățilă & Constantin, 2000, p. 49).

Less frequently used techniques include disguising handwriting by using a letter-tracing template or a model devised by the writer. Texts produced via these methods entail a higher degree of complexity; however, analysis can still take into account extra-graphic characteristics or general graphic elements (such as pen pressure, layout/topographical features, baseline positioning, etc.) (Cîrjan, 2005b, p. 430).

Conclusions

Establishing document forgery relies on identifying alterations made to the document and noting the differences between its original and subsequent appearance. Forgery can be achieved through various methods: removal, addition, obscuring, chemical erasure, washing, or total counterfeiting. Regarding handwriting and signatures, forensic analysis examines individual writing characteristics as well as any signs of imitation or disguise. Servile imitation involves reproducing a model as faithfully as possible, whereas free imitation attempts to capture the general appearance of the writing without strictly copying the model. Copying and scanning can reproduce the visual appearance of a signature, yet forensic examination can reveal characteristics inconsistent with an original signature. Handwriting disguise aims to conceal the author's habitual graphic traits by altering their writing style. Modern examination methods, including microscopy and the analysis of writing materials, assist in identifying interventions made to documents. In conclusion, establishing forgery is a complex process that combines the examination of the document itself, the writing materials, and the graphic characteristics.

References

- Alecu, G. (2001) *Criminalistica* [Forensics]. Exponto.
- Anghelescu, I., Asanache, G., Coman, L. (1978). *Tratat practic de criminalistică* [Practical Treatise on Forensics] (Vol. 2). Serviciul Editorial.
- Chiriac, E. (1966). Aplicarea metodei difuzo-copiative în studiul și expertizarea documentelor [Application of the diffusion-copying method in the study and forensic examination of documents]. In *Probleme de medicină legală și judiciară* (Vol. 5). Medicală.
- Ciopruga, A. & Iacobuță, I. (2001). *Criminalistică* [Forensics]. Junimea.
- Cîrjan, L. & Chiper, M. (2009). *Criminalistică. Tradiție și modernism* [Forensics: Tradition and Modernism]. Curtea Veche.
- Cîrjan, L. (2005a). *Compendiu de Criminalistică* [Compendium of Forensics]. Fundația României de Măine.
- Cîrjan, L. (2005b). *Tratat de criminalistică* [Treatise on Forensics]. Penguin Book.
- Doraș, S. (2011). *Criminalistica* [Forensics]. Cartea Juridică.
- Drăghici, C., Iacob, A., Dobreanu, R. (2018). *Tratat de tehnică criminalistică* [Treatise on Forensic Techniques] (3rd rev. and expanded ed.). SITECH.
- Frățilă, A., & Constantin, R. (2000). *Expertiza grafică și raționamentul prin analogie* [Handwriting analysis and reasoning by analogy]. Tehnică.
- Gheorghiuță, M. (2017). *Tratat de Criminalistică* [Treatise on Forensics]. F.E.P. Tipografia Centrală.

- Golunski, S.A. (1961). *Criminalistica* [Forensics]. Științifică.
- Ionescu, L. (2010). *Expertiza criminalistică a scrisului (Forensic handwriting analysis)*. CH Beck.
- Mircea, I. (1998). *Criminalistica* [Forensics]. Lumina Lex.
- Radu, A., Anghelescu, I., Dan, N., Constantin, I. R., Constantinescu, M., Pop, O., & Manea, V. (1980). *Tratat practic de Criminalistică* [Practical Treatise on Forensics]. (Vol. 3). Serviciul Editorial și Cinematografic.
- Sandu, D. (1977). *Falsul în acte* [Forgery of documents]. Dacia.
- Sandu, D. (1994). *Falsul în acte - Descoperirea și combaterea prin mijloace criminalistice* [Document Forgery – Detection and Combating through Forensic Means]. Lumina Lex.
- Stancu, E. (2015). *Tratat de criminalistică* [Treatise on Forensics] (6th rev. ed.). Universul Juridic.
- Suciu, C. (1972). *Criminalistica* [Forensics]. Didactică și Pedagogică.