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Foreword

The present volume of the *New Criminal Law Codification* journal contains interesting articles devoted to reliable understood specific forensic handwriting examination (FHE) and questioned document examination (QDE). It includes both strictly forensic articles as well as legal evidence and articles on the borderline of other fields of forensic science. In particular, there are articles emphasizing the use of appropriate research methodology in each forensic examination of handwriting, including signatures, pointing to the key importance for the interpretation of research and the credibility of the expert's conclusions. The reader will also find articles devoted to interesting point of view supported by interesting theses on the subject "variation" vs "individuality" redefinition in handwriting examination, and forensic analysis of handwriting as well as the impact of comparative material on the quality of handwriting expertise. The issues of competence of document experts were raised. Some articles discuss the examination of questioned documents, such as the problems of research on the impact of unusual surfaces and writing instruments on the characteristics of handwriting, the study of stamps and their importance in the examination of questioned documents. The reader will also find interesting issues regarding the basic security features implemented in Indian banknotes. One of the articles discusses an unusual and interesting case of a corn stalk leaf, which in turn led to the identification of a rapist and murderer. It is worth noting that the articles have been written by international forensic document experts, not only theoreticians, but above all practitioners dealing with the issues of examining documents on a daily basis, also at the experimental level. This volume aims to further expand knowledge in this relevant and vast area of FDE and QDE. The problems discussed in the volume indicate the need to conduct

further research on documents and implement their results into practice. The articles take into account the existing possibilities and achievements in the field of broadly understood, interdisciplinary research of documents. The conclusions contained in these texts should be used in practice by document experts, courts, prosecutors, and defense attorneys, as well as other participants involved in the process of taking evidence.

Rafał Cieśla

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Case study: A few letters on a corn stalk leaf led to a rapist and murderer*

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Abstract

The article shows a case study of the rape and murder of an 18-year-old girl. The perpetrator sexually assaulted the victim in his car, which he parked in a cornfield, and then set her on fire. One of the most important pieces of evidence in that case was a reflection of damaged relief letters from the sidewall of a car tire, near the tread, pressed against a corn stalk leaf – the size of the imprint was 1 × 0.5 cm. The article describes the procedure of traceological expertise and concludes that analyzing the imprint in the discussed case was based on the same principles as the procedure of identifying a trace of an imprint made by a stamp on a piece of paper.

Keywords: traceological expertise, damaged relief letters of the car tire, reflection of letters on a corn stalk leaf.

* The case was taken from the archives of the forensic traceology expert Miroslav Busarčević.

1. Short chronology of the event

The event took place on 2 July 1996.[1] It was a warm, bright night, when an 18-year-old girl named Jelena Dordević was waiting for a bus at a bus stop. A driver stopped his car and offered her a ride home, which she accepted.

During the ride, the driver suddenly took a turn off the main road into a path leading through corn fields. He stopped at the edge of the field, running over several corn stalks, and attacked the girl in the car. The perpetrator beat the victim, forced her to strip under the threat of a gun, then raped her. After this act, he followed the dirt road further until reaching a remote location near a village cemetery, at which point he dragged the naked girl out of his car and beat her again, this time also striking her blows on the head with his gun. When the victim fell, he soaked her in petrol and set her on fire. Then he fled the scene, believing her to be dead.

Despite the severe burns and other major injuries to her body, Jelena managed to get to the main road – there, she was found and transported to hospital. The victim was conscious and able to communicate in spite of her condition – she described the details of the event to the police twice, giving them the approximate location of the crime scene between two villages (covering about 12 kilometers) as well as describing the perpetrator – as it turned out, inaccurately.

Five days later, she died due to her severe medical condition. 80% of her skin had burnt and she had visible injuries on her head caused by 22 blows inflicted by a blunt object.

Searching for a possible crime scene, the police discovered the location where the attempted murder occurred. Some material evidence was found (e.g. the victim's hair), but it was not sufficient to find the perpetrator.

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[1] "Oglasio se najbrutalniji ubica u Srbiji: Silovao je i zapalio devojku (18), a sada se paraćinski monstrum posle 22 godine robije obratio javnosti! Pogledajte njegovo pismo", *Kurir*, 6.12.2018, https://tinyurl.com/b774uy2j; Jelenu silovao, pretukao pa zapalio živu! Srbija zgrozio zločin Paraćinskog monstruma – on se obratio javnosti", *Srbija Danas*, 23.06.2022, https://www.sd.rs/vesti/hronika/jelena-djordjevic-mladja-milovanovic-silovanje-ubistvo-paracin-2022-06-05/; M.Ž. Lazić, "Stvarnost gora od horor filma: Devojka u opekotinama nađena na auto-putu 1996", Nova.rs, 7.09.2022, https://nova.rs/vesti/hronika/stvarnost-gora-od-horor-filma-devojka-u-opekotinama-nadjena-na-auto-putu-1996/.

Photo 1. The crime scene where the girl was beaten and set on fire

Photo 2. The crime scene where the driver pulled his car over and raped the girl

The following day, the police were examining the dirt path leading from the main road to the cemetery and found the place with tire marks entering the cornfield. They observed several corn stalks which had been

run over – the assumption was that the perpetrator had parked the car there and raped the girl inside. However, they did not find any traces or evidence to confirm that.

Four days after the event, the CSI team inspected the second crime scene again, refusing to accept the lack of evidence. This time, the state of the location was different – it had been raining the previous night and the corn stalks, which were previously on the ground, rose.

Photo 3. Broken stalks of corn which rose after the rain

After repeated examination, the CSI team found a trace on one of the corn leaves, which turned out to be a small imprint of Latin alphabet letters. The size of the imprint was 1 × 0.5 cm!

2. The mechanism of imprints on corn stalk leaves

The imprint was made when the relief letters on the sidewall of a tire, near the tread, pressed a leaf on one of the corn stalks. This led to the rupture of cell walls within the leaf and caused necrosis on its surface, creating an imprint of letters from the tire's sidewall. The necrosis was a slow process, so the imprint was not immediately visible, appearing days after it had been made.

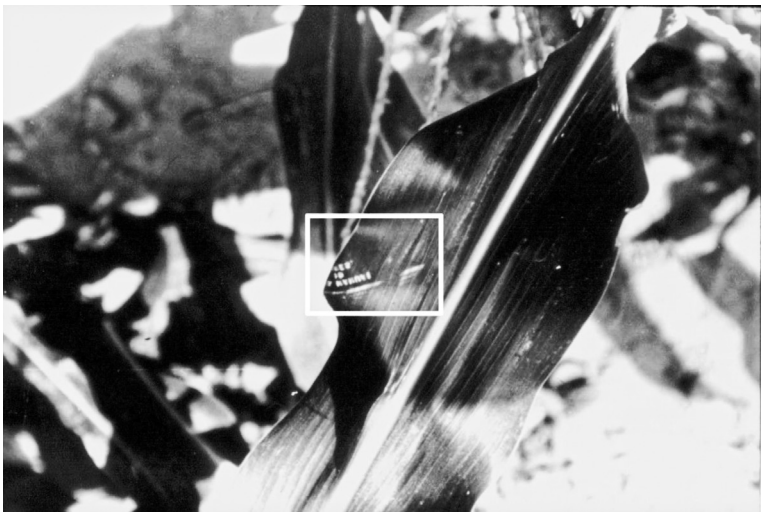

Photo 4. The text from a car tire reflected on a corn stand

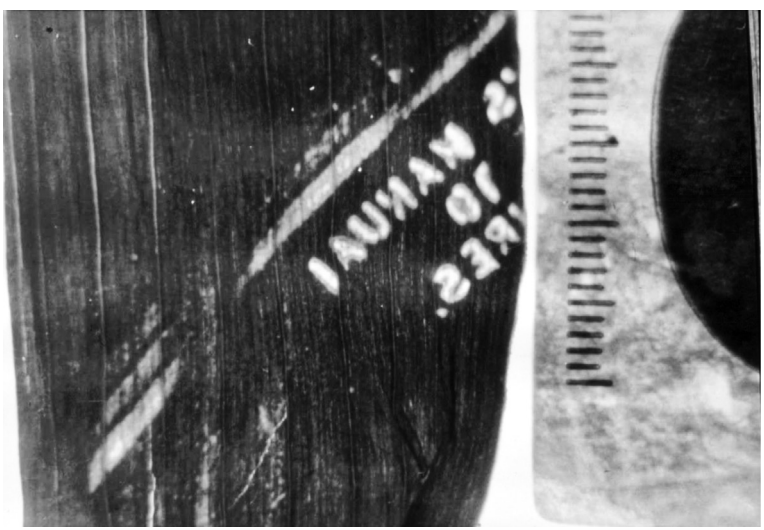

Photo 5. A closer look at the reflected letters

3. Information in the media helped find a suspect

When the news about the incident appeared in the media, a man called the police and explained that his girlfriend had been attacked the same way the year before. While she had been waiting at the same bus stop, a man in a car had stopped next to her and offered to drive her home. She had refused, after which he had gotten out of the car and tried to force her in. However, she had started screaming and calling for help, scaring away the driver who had then jumped into his car and left.

The man gave the police information about the perpetrator. He stated that the incident had not been reported, but he had found the man and physically assaulted him. Police officers took the suspect, Mlađa Milovanović (a Faculty of Law graduate), into custody and confiscated his car to conduct a forensic examination. On her deathbed, the victim recognized the suspect in a photo and identified him as the perpetrator of this cruel crime. However, he did not confess.

Photo 6. The car in which the rape was performed.
The rear right wheel left an identification mark

4. Comparative expert analysis of the text on the corn stalk leaf significantly contributed to solving the case

Miroslav Busarčević, a forensic expert and one of the authors of this paper, was summoned from the National Forensic Centre of the Ministry of Internal Affairs of the Republic of Serbia. He conducted a detailed forensic examination of the suspect's car and determined that the letter imprint on the corn stalk leaf was made by the left rear wheel of the confiscated car.

During his analysis, Busarčević made several precise imprints of both relief texts from the sidewalls of the tire, using black paint on a white sheet of paper. Some of the letters in both relief texts were damaged and that was reflected in all the imprints on the paper.

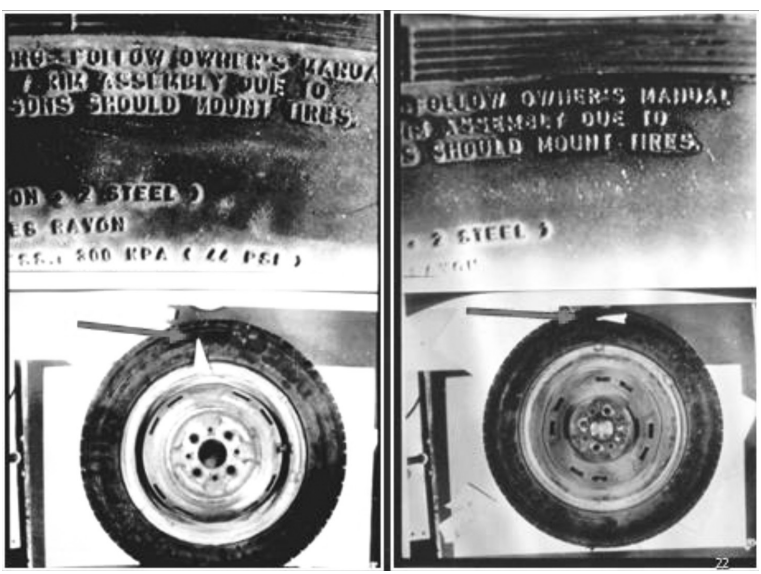

Photo 7. In the expert examination process, the print of the letters from the car tire was transferred to a paper sheet

The damage of the relief letters on both sidewalls of the car tire (seen in the imprints on the paper) is of the same identification importance as the damage of relief letters on a rubber stamp.

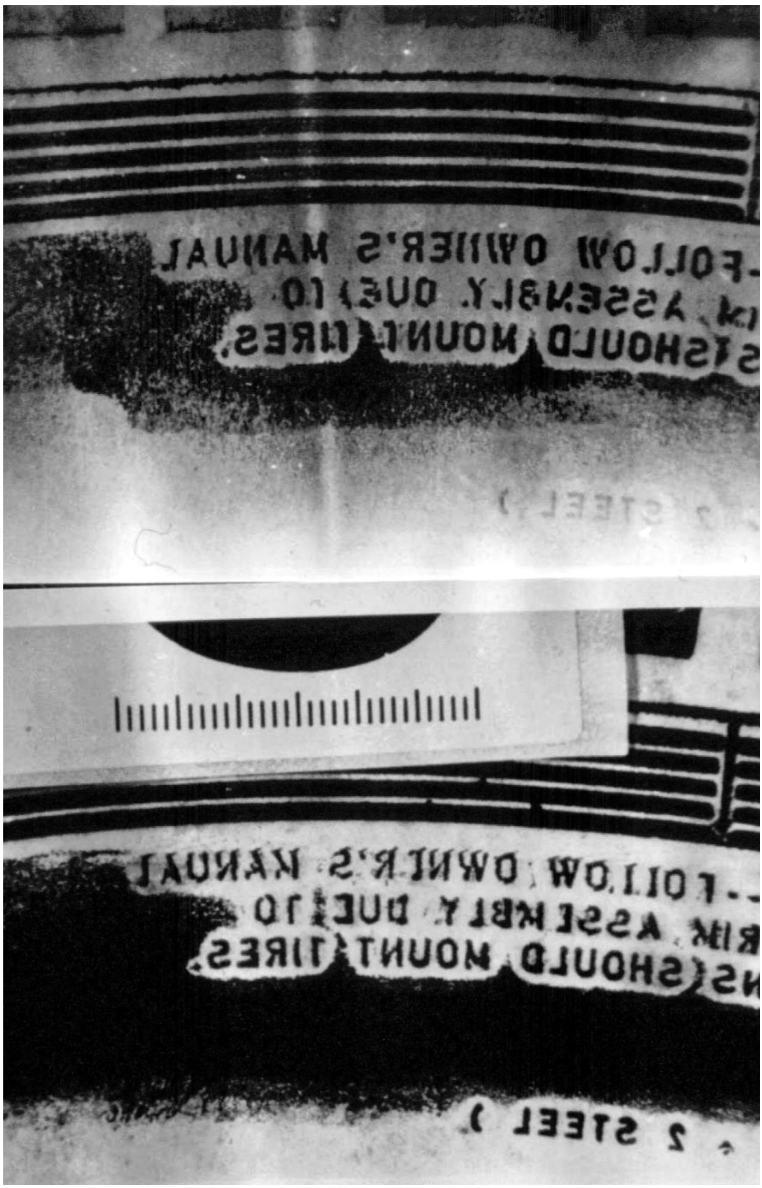

Photo 8. A closer view of the reflected letters

Photo 9. Comparison of the letters from the car tire reflected on the paper sheet and on the corn leaf

Photo 10. Individual characteristics of the rubber letters were reflected on the paper sheet and the corn leaf

Using comparative analysis, Busarčević determined that – judging by the damage – the Latin alphabet letters from the upper two rows of the relief text on the outer sidewall of the car tire are a complete match to those found on the corn stalk leaf.

Even though it was placed on a corn stalk leaf, this trace, with the size of only 1 × 0.5 cm, is analogous to imprints of relief letters of a rubber stamp on a piece of paper. For that reason, the procedure of identifying the car tire which made the imprint is based on the same principles as one regarding a trace of an imprint made by a stamp on a piece of paper.[2]

5. The court of law accepted the expert's analysis

The accused Mladja Milovanović was sentenced to death. During the second-instance proceeding, the penalty was reduced to 40 years of prison – a sentence which he is still serving.

References

Bell S., *Forensic Science: An Introduction to Scientific and Investigative Techniques*, Boca Raton, FL 2019.

Handbook of Forensic Science, eds. J. Fraser, R. Williams, London 2013.

"Jelenu silovao, pretukao pa zapalio živu! Srbija zgrozio zločin Paraćinskog monstruma – on se obratio javnosti", *Srbija Danas*, 23.06.2022, https://www.sd.rs/vesti/hronika/jelena-djordjevic-mladja-milovanovic-silovanje-ubistvo-paracin-2022-06-05/.

Lazić M.Ž., "Stvarnost gora od horor filma: Devojka u opekotinama nađena na auto-putu 1996", Nova.rs, 7.09.2022, https://nova.rs/vesti/hronika/stvarnost-gora-od-horor-filma-devojka-u-opekotinama-nadjena-na-auto-putu-1996/.

Lee H.C., Palmbach T., Miller M.T., *Henry Lee's Crime Scene Handbook*, Amsterdam 2001.

"Oglasio se najbrutalniji ubica u Srbiji: Silovao je i zapalio devojku (18), a sada se paraćinski monstrum posle 22 godine robije obratio javnosti! Pogledajte njegovo pismo", *Kurir*, 6.12.2018, https://tinyurl.com/b774uy2j.

[2] S. Bell, *Forensic Science: An Introduction to Scientific and Investigative Techniques*, Boca Raton, FL 2019; *Handbook of Forensic Science*, eds. J. Fraser, R. Williams, London 2013; H.C. Lee, T. Palmbach, M.T. Miller, *Henry Lee's Crime Scene Handbook*, Amsterdam 2001.

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Competence aspects in forensic expertise of documents

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Abstract

The technical expertise of documents, although it already seems to be a well-developed field, in the current stage faces many problems which need to be investigated. This especially concerns the limits of expert-examiners' competences. Apart from the "classic" means of falsifying and counterfeiting documents, new ones constantly appear as the offenders gain new skills and equipment, which makes expertise much more complex.[1]

In the present article, the authors attempt to discuss the limits of competences in the specialties of judicial expertise – code 6.01 (technical expertise of documents) and code

[1] S. Alămoreanu, *Falsul în acte: aspecte clasice şi moderne în cercetarea sa criminalistică* [Forgery in Documents: Classical and Modern Aspect in Its Forensic Research], Bucureşti 2021, p. 10.

10.11 (examination of materials, documents, and writings).[2] Exceeding one's competence in carrying out the expertise cancels the evidence accumulated through scientific effort as well as entails disciplinary and often criminal liability of the expert-executor. The authors also propose an exemplary curriculum for training experts in forensic expertise of materials and documents and writings.

Keywords: technical expertise of documents, limits of competences, expert examiners, training experts, examination of materials, documents, and writings, integrated conclusions.

In practice, we acknowledge that the tasks assigned to the technical expertise of documents within the judicial process are numerous and often formulated without taking into account the specialty of expertise necessary in specific cases. Therefore, the expert is the one who must know the connections between different specialties of forensic/judicial expertise very well in order to "handle the interweaving" of the objectives formulated by the judicial body. This allows them to conduct research based on scientific and objective support, in full compliance with the requirements of the procedure. However, forensic/judicial expertise, regardless of the circumstances, should be based on reliable research.

When analyzing the practice of forensic document examination in Romania and the Republic of Moldova, we see a similarity in the approach to jurisdiction issues. From the perspective of judicial expertise theory, in Romania, we observe the existence of scientific studies investigating the delimitation of the competences of forensic/judicial expertise of documents and writing,[3] as well as the physico-chemical examination of paper and scriptural materials.[4] In the Republic of Moldova, these delimitations are contained in the nomenclature of judicial expertise.[5]

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[2] Hotărâre Guvernului Nr. 195 din 24 martie 2017 privind aprobarea Nomenclatorului expertizelor judiciare [Government Decision no. 195 of 24 March 2017 regarding the approval of the Nomenclature of judicial expertise], https://www.legis.md/cautare/getResults?doc_id=119445&lang=ro (accessed: 12.01.2022).

[3] S. Alămoreanu, op. cit., p. 22.

[4] M.G. Stoian, *Contribuţia expertizei fizico-chimice a probelor materiale la probaţiunea judiciară* [The Contribution of Physico-Chemical Expertise of Material Evidence to Judicial Probation], Bucureşti 2013, p. 375.

[5] Hotărâre Guvernului Nr. 195 din 24 martie 2017.

In our paper, we will only refer to aspects of the connection between technical expertise of documents and that of document and writing materials in the context of delimiting expert skills and competences. In the Romanian literature on the topic, we find these delimitations very well explained in a study by Maria G. Stoian. According to her, forensic investigation of documents can be classified into three types (based on the purpose of the examination):

– identification of the author of a document (judicial graphoscopy);

– technical examination of documents;

– physio-chemical examination of documents (expertise of scriptural support and materials).[6]

In the nomenclature of judicial expertise in the Republic of Moldova, we find the delimitation of the purpose of the mentioned expertise specialties. For technical expertise of documents (code 6.01), the purpose is identified as technical research of documents, writing instruments, and materials for making documents in order to establish the authenticity of certain documents, the presence of complete or partial falsification based on the use of various methods, procedures, and technical-scientific means. This specialty solves the following issues:

– establishing the authenticity of the documents (standard forms, secure forms, banknotes, identity documents, ID cards, etc., taking into account protection elements specific to the original document);

– establishing the manner of making the documents and their conformity with the manner of creating the samples presented;

– establishing the existence of changes made to any type of act or document (removal or addition of text by covering, hatching, mechanical erasure, chemical erasure, etc.);

– reconstitution of the initial textual content of the document;

– identification of latent documents by physical methods;

– identification/discovery of the forgery made by different methods (photocopying, collages, etc.);

– examination of stamp and initial impressions, identification of stamps;

[6] M.G. Stoian, op. cit.

– identification of copiers and calculation techniques used to perform the act;

– establishing the types of printer or mechanical typewriter with which the documents were printed (die, inkjet, laser);

– identification of the mechanical typewriter and the typist according to the text of the printed document;

– establishing the manner of falsifying or counterfeiting identity and travel documents (passports, identity cards, etc.);

– establishing the manner of forging or counterfeiting credit cards and other means of payment (banknotes, bank cards, etc.);

– establishing the age of the document;

– establishing the type of writing materials, if all parts of the document were written with the same scriptural tool;

– establishing the consecutive execution of the parts of the document;

– technical examination of the signature / stamp impression (method of execution of the signature, if it was forged by copying, scanning, etc.);

– reconstitution of damaged documents (burned, washed, deleted, hatched, torn, etc.) and revealing/reconstructing the existing information on them;

– establishing the whole by parts of the broken, cut, etc., documents.

– identification of the scriptural instrument based on the pathological indications from the manuscripts;

– differentiation of scriptural instruments according to the pathological indications from the manuscripts;

– other similar issues.[7]

As for the technical expertise of documents (code 6.01) and writings materials (code 11.10) – forensic examination of materials, documents and writing (paper, inks, glues and other materials used in making documents), the problems solved influde:

– examination of the paper, determination of group membership, presence or absence of protection elements, etc.;

– examination of writing materials, content of scriptural instruments (dyes, inks, inks, pencil mines, etc.);

[7] Hotărâre Guvernului Nr. 195 din 24 martie 2017.

– examination of scriptural materials intended to obtain impressions (ink paints, typewriter dyes, indigo paper, printing paints, etc.);

– examination of scriptural materials intended to obtain the image by multiplication-copying methods (thermo-, electrophotographic toner, ink for jet-color printers, etc.);

– examination of glues;

– examination of cover materials;

– examination of corrosive regents;

– other similar issues.[8]

With regard to delimiting the competencies of these expertise specialties, similar guidelines is found in the scientific literature of other states. For example, in the Russian Federation, the expertise of documents materials includes:

– examination of scriptural materials;

– examination of paper and paper articles;

– examination of auxiliary materials;

– examination of engraving substances (washing).[9]

Thus, the expertise of documents, materials, and writings is conceived as a kind of "frontier" expertise, which accounts for the possibilities of technical expertise of documents and forensic/judicial expertise of materials and substances, sometimes called "technical forensic/judicial expertise of documents and materials."[10] This is confirmed by the fact that in the classification of expertise according to research objects, this specialty is found in the expertise of materials and substances category.[11]

From personal experience, the judiciary rarely distinguishes between technical expertise of documents and expertise of document (and writing) materials – therefore, the tasks of expertise are formulated by interweaving the objectives of forensic study in both specialties. Apparently, their

[8] Ibid.

[9] Russian Federal Center for Forensic Science under the Ministry of Justice of the Russian Federation, *Subject, Objects and Tasks of Technical Expertise of Documents*, http://www.sudexpert.ru/possib/techn.php (accessed: 17.01.2022)

[10] Document examination laboratory, *Issledovanie materialov documentov (sudebno-tehnicescaia expertiza documentov)* [Examination of Document Materials (Forensic Examination of Documents)], http://stolid.ru/content/view/20/36/ (accessed: 17.01.2022)

[11] M.G. Stoian, op. cit., p. 375.

objectives differ very little, as do the methods of investigation used. For example, in order to solve the problem of the documents' age, the expert can rarely limit themselves only to knowledge in the field of technical expertise of documents. Moreover, when required to identify the instrument with which the documents were made, an expert cannot possibly formulate a categorical conclusion only on the basis of route indices, without physio-chemical examinations of materials and substances.

Practice shows that in 50% of the requests for judicial expertise (analysis for 2016–2020) in the field of graphoscopy and document technique by the National Centre of Judicial Expertise of the Republic of Moldova, the tasks sent are meant to establish how old documents or other pieces of evidence are. The beneficiaries designate this type of examination as graphoscopic or technical expertise of documents. In reality, however, to answer such questions, integrated knowledge is needed, both in the field designated in the request and in the examination of document and writing materials, which sometimes requires knowledge of chemistry.

As was also reported by other researchers, we acknowledge that although the scope of our field is becoming increasingly complex, understanding the correct approach remains difficult. We believe that the process of conducting an integrated expertise requires taking into account several criteria:

– the vision about the matter of expertise (the material competence of the expert);

– its purpose (expert version);

– the type of object studied (the nature of the material evidence or actions to be investigated);

– appropriate research methods.[12]

There are opinions, which we agree with, that performing integrated and complex expertise enables the extraction of extensive evidentiary information and widens the circle of scientific research tasks, thus increasing the scientific level of forensic examinations. As for the theory of complex and integrated judicial expertise, it approaches the technology of the respective process differently, which in practice creates a situa-

[12] O. Cataraga, *Expertiza judiciară* [Judicial Expertise], doctoral dissertation, Universitatea Babeș Bolyai, Cluj-Napoca 2022.

tion of confusion. In the absence of clear provisions in this regard, either methodological or procedural, very often even if they do obtain valuable results, judicial experts cannot put them in the "format" of evidence, i.e., in a special form necessary for the judicial process, conceived and easy to understand by the judiciary. Thus, the judicial process cannot benefit from integrated conclusions, having only separate opinions regarding the objects under investigation, which the judiciary body cannot use adequately in order to solve the case.[13]

In practice, it is found that not all forensic experts understand the limits of competence in cases related to issues concerning technical expertise of documents and expertise of document materials. They therefore manifest a "professional impotence" in a sense, which has detrimental consequences to the acquisition of scientific evidence "for the judicial process." As the main problem from which the "professional impotence" stems, we consider the imperfect process of training judicial experts in the given matter.

Judicial expertise in the Republic of Moldova, as well as in other states, more and more often encounters problems related to the training of judicial experts and the establishment of training requirements for candidates. These issues are discussed on various scientific forums, exposing different opinions and experiences in the field. In recent years, the "professional background" of an expert (understood as initial training and qualification) has been often challenged – either in court, at the Ministry of Justice, or before the heads of expertise institutions. Decisions are made in various states regarding the training of judicial experts, the requirements for candidates in this profession, often without taking into account international practice and/or the opinion of the profession's representatives.[14]

The training programs for forensic examiners in the field of expertise must be well thought out, developed on a solid methodological and scientific basis, so that both the topics and the tasks of expertise within each spe-

[13] Ibid.

[14] O. Cataraga, "Erori în concepția contemporană a profesiei de expert judiciar" [Errors in the contemporary conception of the forensic expert profession], *Revista științifico-practică Info-Med* [Scientific-practical Journal Info-Med] 2016, no. 1.

cialty are structured. Table 1 presents an example of a program designed to train experts in the examination of document and writing materials.

Table 1. Model program for expert training regarding the examination of document and writing materials

	Topic	Activity
I	Fundamentals of judiciary examination of document materials	
1.	theoretical fundamentals of forensic science document materials; methods of researching document materials	lectures, test questions, checking the lab, testing
II	Forensic base study documents and materials letters	
2.	forensic paper research, coverslips materials	lectures, test questions, checking the lab, testing
3.	forensic materials research letters	
III	Forensic research of adhesives and etching substances	
4.	forensic adhesive research substances	lectures, test questions, checking the lab, testing
5.	forensic study of etching substances	lectures, test questions, checking the lab, testing
IV	Control examinations (5 units)	expertise check

Additionally, in order to obtain the right to expertise, candidates must prepare scientific papers on certain topics, such as, e.g.:

1. Modern possibilities of forensic examination of materials documents when solving KEMD tasks.
2. Tasks of identification research on document materials.
3. Materials of documents as objects of identification research.
4. Establishing changes in the materials of documents over time or under the influence of specific external factors.
5. Forensic identification of document materials as a complex, multi-stage process.
6. Methods of forensic paper research.
7. Binding materials as objects of forensic research.
8. Methods of forensic research on ink.
9. Methodology for forensic investigation of ball pastes pens.

10. The method of electrophoresis and its potential in forensic study of letter materials.

11. The method of thin layer chromatography and its possible contribution to forensic investigation of document materials.

12. The method of qualitative chemical reactions and its possibilities for forensic investigation of document materials.

13. Establishment of the mineral composition during forensic paper research.

14. Etching substances, the possibility of their detection and research in the examination of forged documents.

15. Methods of forensic investigation of letter materials in strokes.

16. Types of adhesives and methods of their research.

17. Establishing the type of glue using non-destructive methods.

At the same time, theoretical training is accompanied by laboratory work and mock expertise performed by each of the candidates. The practical tasks performed by the candidates during the exam are also very important – these include:

1. Based on the indicated signs (forms brown spots on the surface of the paper, the reaction of the medium is neutral, quenching of luminescence is observed in UV rays), determine the type of etchant.

2. Based on the indicated signs (forms brown spots on the surface of the paper, the reaction of the medium is neutral, quenching of luminescence is observed in UV rays), determine the type of etchant.

3. Based on the indicated signs (forms yellowish spots on the surface of the paper, the reaction of the medium is neutral, luminescence of light tones is observed in UV rays), determine the type of etching substance.

4. Based on the specified characteristics (discolors only strokes of ink from fountain pens, forms yellowish spots on the surface of the paper, the reaction environment is neutral, luminescence of light tones is observed in UV rays), determine the type of poison.

5. Based on the indicated signs (forms yellowish spots on the surface of the paper, the reaction of the medium is neutral, quenching of luminescence tones is observed in UV rays), determine the type of etchant.

6. Based on the presented sample of paper, determine the mass of 1 m^2.

7. Based on the presented sample of paper, determine the weediness of the paper in per 1 m^2.

8. Based on the indicated signs (forms plastic, transparent film of yellowish color on the surface of the paper, luminesces in UV rays with yellow-green color, the reaction of the medium is neutral, highly soluble in hot water, ethyl alcohol, acetone), determine the type of adhesive substances.

9. Based on the indicated signs (forms fragile, matte smooth film of light gray color of various granularity on the surface of the paper, luminesces in UV rays with milky blue, reaction medium neutral, emits the smell of burnt paper when burned, dissolves in hot water), determine the type of adhesive.

10. Based on the indicated signs (forms yellowish or brown horn-like film on the surface of the paper, luminesces in UV rays with yellow or green, the reaction of the medium is neutral, during combustion emits the smell of burnt paper, dissolves in hot water), determine the type adhesive.

11. Based on the indicated signs (damages paper, discolors ink and photographs, forms a brittle on the surface of the paper, transparent or opaque film with numerous cracks, particles of dried glue under a microscope look like shapeless shiny formations, luminesces in UV rays with gray-blue or lilac, the reaction of the medium is alkaline, it dissolves in hot water, when burned turns the flame yellow), determine the type of adhesive.

12. Based on the indicated signs (forms light yellow elastic film on the surface of the paper, sometimes with the smell of gasoline, luminesces in UV rays with yellow-green or milky blue, the reaction of the medium is neutral, will readily dissolve in gasoline and dichloroethane), determine the type of adhesive.

13. Based on the strokes presented, identify morphological signs which make it possible to determine the type of material of the letter.

14. Based on the presented chromatogram, identify the appropriate signs which make it possible to characterize the material of the letter.

15. In the presented paper sample, determine the direction of fibers.

16. In the presented sample of paper, determine the gap.

17. Conduct a paper preparation study and determine the composition fiber paper.

18. Conduct a paper preparation study and determine the quantitative composition of the fibers.

19. Conduct a paper preparation study and determine the degree of fiber grinding.

20. Determine the degree of sizing of the presented paper sample using the dry indicator method.

21. Determine the thickness of the submitted paper sample.[15]

We could continue this list of ideas, but we only aim to present a model program for the preparation of experts in the field of forensic examination of documents and writing materials, which in our opinion – provided it is followed – will solve the problem of differentiating the competencies of this expertise from that of the technical-forensic examination of documents.

From the structure of the program, it is very clear that the competences of forensic expertise of materials are oriented towards the identification of the indices and composition of the substances used in the process of making the documents. In contrast, the other discussed speciality is aimed at examining factors which indicate the methods used in that regard. The truth is that the vast majority of the methods used, especially non-destructive ones, are common to both fields of expertise, but this should not mean (as many experts emphasize) that if we use the same tools, we expose ourselves to issues which go beyond our competence. It must be understood correctly that similar methods can be used for more purposes than an expert in a particular field can know. From a professional point of view, an expert specialized in a certain field can extract results and interpret them exclusively within the limits of their specialty. Only this kind of approach is professional and scientifically correct.

Unfortunately, there are cases in which the judiciary experts exceed the limits of their competence and misinterpret the results obtained from the research carried out, wrongly believing that they can do so. Consequently, due to the fact that the judicial body is not able to guide itself in this matter, such erroneous conclusions may lead to incorrect decisions regarding the case. For these reasons, actions are required to set limits of the competences of forensic expertise specialties, starting from the establishment of a training curriculum. Given the trends of the modern world, we believe

[15] Ministerul Justiției al Republicii Moldova Centrul Naţional de Expertize Judiciare [National Center of Judicial Expertise of the Ministry of Justice of the Republic of Moldova], *Arhiva Consiliului metodico-științific din 2018–2022* [Archive of the Methodological-Scientific Council of 2018–2022], https://cnej.gov.md/ro/content/primirea-%C3%AEn-audien%C8%9B%C4%83-cet%C4%83%C8%9Benilor (accessed: 12.01.2022).

that a unique approach to these competences is important, regardless of geographical area. The first step in this direction, in our opinion, has already been taken by the European Union, which in 2015 adopted a guide to good practice in civil judicial expertise. The guide contains general principles of quality assurance of expert services – one of them being: "The appointment of a legal expert natural or legal person must be based on a legal framework that includes a quality assurance system based on common rules, and uniforms, including accreditation and certification."[16]

References

Alămoreanu S., *Falsul în acte: aspecte clasice şi moderne în cercetarea sa criminalistică* [Forgery in Documents: Classical and Modern Aspect in Its Forensic Research], Bucureşti 2021.

Cataraga O., "Erori în concepţia contemporană a profesiei de expert judiciar" [Errors in the contemporary conception of the forensic expert profession], *Revista ştiinţifico-practică Info-Med* [Scientific-practical journal Info-Med] 2016, no. 1.

Cataraga O., *Expertiza judiciară* [Judicial Expertise], doctoral dissertation, Universitatea Babeș Bolyai, Cluj-Napoca 2022.

Document Examination Laboratory, *Issledovanie materialov documentov (sudebno-tehnicescaia expertiza documentov)* [Examination of Document Materials (Forensic Examination of Documents)], http://stolid.ru/content/view/20/36/ (accessed: 17.01.2022).

Hotărâre Guvernului Nr. 195 din 24 martie 2017 privind aprobarea Nomenclatorului expertizelor judiciare [Government Decision no. 195 of 24 March 2017 regarding the approval of the Nomenclature of judicial expertise], https://www.legis.md/cautare/getResults?doc_id=119445&lang=ro (accessed: 12.01.2022).

Ministerul Justiţiei al Republicii Moldova Centrul Naţional de Expertize Judiciare [National Center of Judicial Expertise of the Ministry of Justice of the Republic of Moldova], *Arhiva Consiliului metodico-ştiinţific din 2018–2022* [Archive of the Methodological-Scientific Council of 2018–2022], https://cnej.gov.md/ro/content/primirea-%C3%AEn-audien%C8%9B%C4%83-cet%C4%83%C8%9Benilor (accessed: 12.01.2022).

Russian Federal Center for Forensic Science under the Ministry of Justice of the Russian Federation, *Subject, Objects and Tasks of Technical Expertise of Documents*, http://www.sudexpert.ru/possib/techn.php (accessed: 17.01.2022).

Stoian M.G., *Contribuţia expertizei fizico-chimice a probelor materiale la probaţiunea judiciară* [The Contribution of Physico-Chemical Expertise of Material Evidence to Judicial Probation], Bucureşti 2013.

[16] O. Cataraga, "Erori în concepţia…".

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Rubber stamp impressions: A study of defects and their significance in questioned document examination

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Abstract

The sole objective of a forensic document examiner is to assist in discovering and proving the facts in any investigation or legal inquiry involving genuineness of a document or any part thereof. A document is usually questioned because its origin, content, or the circumstances and story of its production arouse serious suspicion as to its genuineness. It may also be adversely scrutinized simply because it displeases someone with its unexpected provisions, and a careful examination may show conclusively that the document is indeed genuine.[1] The increasing use of many kinds of documents is among

[1] *Scientific Examination of Questioned Documents*, eds. J.S. Kelly, B.S. Lindblom, Boca Raton, FL 2006.

the characteristics of civilization. Taking into account the opportunities for fraud this offers and the imperfection of human nature, it is not strange that now and then a document appears which does not belong in the genuine class.

As it relates to document examination, rubber stamp identification is closely akin to handwriting and typewriting analysis.[2] Identifying a particular stamp, type-, or handwriting and determining when it was performed, its possible source, and circumstances of production – these are the chief aims of any initial examination. Rubber stamps may be individualized at any stage of the manufacturing process, even back-tracking to imperfections in the metal typefaces,[3] but more commonly, unique characteristics are the effect of use, misuse, wear, and even age of the stamp.[4] The present study discusses the steps in manufacturing a rubber stamp and the causes of defects leading to its identification, as well as attempts to examine the stamp impressions on the basis of the defects induced by these factors.

Keywords: forensic examination, rubber stamps, stamp impressions, defects, manufacturing techniques.

The present study pertains to defects in different types of rubber stamps and their significance in forensic questioned document examination.

Types of rubber stamps

Rubber stamps have been around since the mid-1800s, but various forms of stamps – ones made of clay, wood, animal hides, or metal – have been in use for much longer.[5] Modern-day rubber stamps typically are mounted onto a wooden or plastic handle and come with a separate stamp pad used to ink them before application. Rubber stamps are a very economical and simple way of copying whatever text or image one deems worth repeating.[6]

[2] E.F. Alford, G.R. Stangohr, "Synthetic signatures", *Journal of Forensic Sciences* 10, 1965, pp. 77–85.

[3] G. Herbertson, *Rubber Stamp Examination*, Colorado 1997.

[4] M.A. Casey, "The individuality of rubber stamps", *Forensic Science International* 12, 1978, no. 2, pp. 137–144; A. Herkt, "Rubber stamps, manufacture and identification", *Journal of the Forensic Science Society*, 25, 1985, no. 1, pp. 23–28.

[5] T.O. Sloane, *Rubber Hand Stamps and the Manipulation of Rubber*, New York 1891.

[6] ASTM International, *The Standard Guide for Examination of Rubber Stamps*, ASTM E 2289-03, 2003.

They can be divided into three types.

Self-inking stamps. These convenient and durable stamps have a pad built right onto the machine. They flip around and hit a pad with each stamping motion, giving thousands of good-quality impressions before having to be re-inked. They are best for extensive stamping, easy to operate, since they only require pressing down.[7]

Pre-inked stamps. More convenient than self-inking stamps due to the lack of a pad – push down the stamp mount and the impression will appear. They are the best in terms of quality and durability, and are easy to refill with oil-based inks. Recommended for logos as well as signature, notary, and professional stamps.[8]

Traditional rubber stamps. Stylish, eco-friendly, with a varnished wooden handle. These stamps can be made with custom text, logo, or image.

Defects occurring in a rubber stamp

Individual defects most commonly occur through the use or abuse of the stamp. They may be caused by many factors, including dirt, paper fiber accumulated with nicks and cuts, edge wear and breakdown, or stamp distortion.[9] The characteristics observed by the forensic document examiner in stamp impressions are influenced by the die material, whether the ink is water- or oil-based, the size of the stamp, the type of paper and its interaction with the ink, as well as the individual defects.

Method

In the present study, 50 different types of rubber stamp impressions were collected, and the following observations were made:

– There is a difference between impressions made by traditional or self-inking stamps and pre inked stamps.

[7] M.A. Casey, op. cit.; J.S. Kelly, *Forensic Examination of Rubber Stamps*, Springfield, IL 2002.

[8] *Scientific Examination*…

[9] Ministry of Human Resource Development, *P-08, Questioned Document*, module 21. *Rubber Stamp and Seals*, http://epgp.inflibnet.ac.in/epgpdata/uploads/epgp_content/S000016FS/P000695/M011505/ET/1516250384FSC_P8_M21_e-text.pdf.

– No definite judgment regarding the type of stamp can be made while examining a questioned impression.

– The die material of the stamp can be studied.

– Vulcanized rubber and the photopolymer are the most common materials used for traditional and self-inking stamp dies. However, several characteristics were observed regardless of these materials:

1. even ink coverage;

2. a ring of darker ink outlining individual letters, occurring due to the relief of the printing area squeezing the ink out of the ink line edge. This is difficult to observe if the entire surface of the letter is heavily inked.

3. no indentation in the ink line;

4. rounded beginnings and endings of letters;

5. sharp angles and intersection of two lines being filled with ink;

6. some patchy areas within the inked impression;

7. uneven outline of the letters.

Because the die of a pre-inked stamp is soft and has some flexibility, its impression slightly differs from ones made by a traditional or self-inking stamp. Its characteristics include:

1. clear and concise detail;

2. individual characters showing even ink saturation throughout;

3. the inside and outside of the letters not showing any heavier ink line;

4. edges of the letters showing feathering or bleeding of ink;

5. no indentation in the ink line;

6. blurring or distortion in small-typed text.

Microscopic examination of the stamp die and the impression was done, with the inclusion of both direct and oblique lighting. Direct lighting helped in providing even illumination of the examined area in order to determine the manufacturing process used to create the die. Oblique light narrowed the focus of the examination, making it possible to detect even the smallest of defects and determine whether they were permanent or transitory.

After a thorough stepwise examination, an impression-to-impression comparison was conducted. The researchers made numerous impressions from the submitted stamp on a substrate similar to the material

hosting the questioned impression. The stamp had to be cleaned in order to obtain impressions free from transit materials – however, it was photographed beforehand to document the condition in which it was received.

Significance of rubber stamps on questioned documents

Affixation of rubber stamps plays a vital role in proving the genuineness of a document in question – to determine the authenticity of a document in question, the expert must examine it very minutely and check for any signatures or writing on the affixed stamp. In Figures 2 and 3, it was observed that the rubber stamp was affixed prior to the writings, i.e., the rubbers stamps were affixed on the blank papers and the writings and signatures have been written subsequently.

Figures 1 and 4 show rubber stamps which, when examined under a stereo microscope, showed striations at the edges of the rubber stamp and breakages occurring at intervals, proving these to be fabricated.

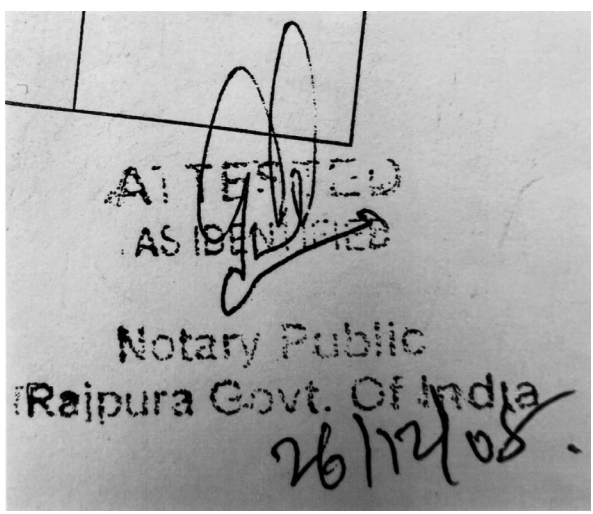

Figure 1

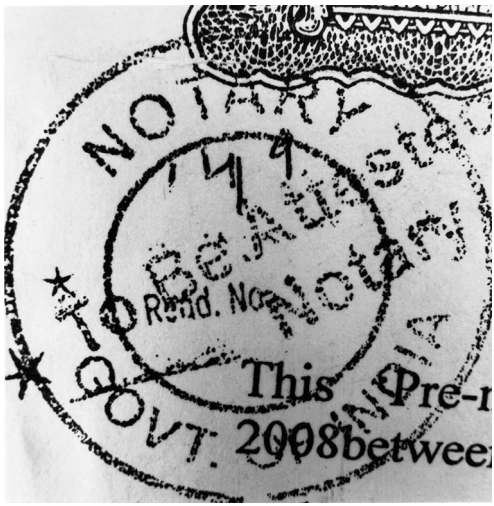

Figure 2

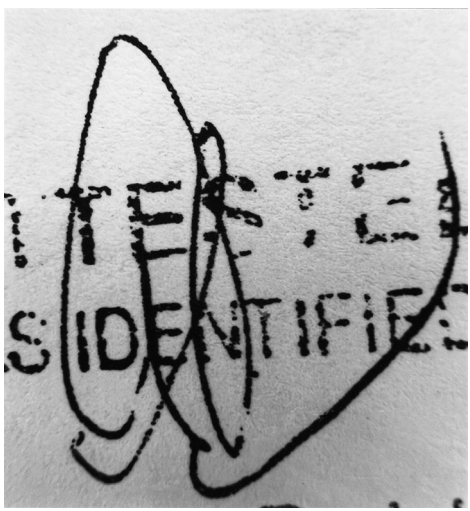

Figure 3

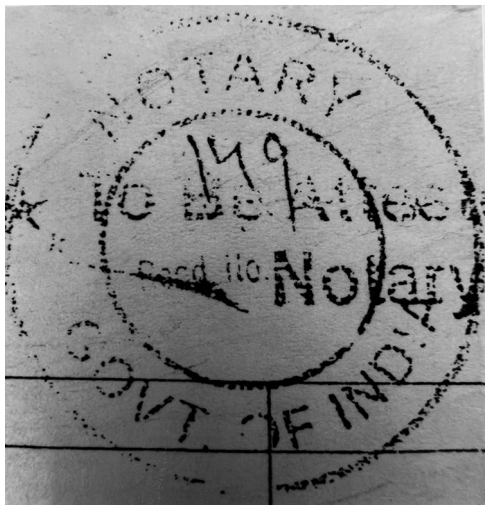

Figure 4

Conclusion

After detailed analysis of all types of stamp impressions, it was concluded that when a sharp impression on a document is ignored by a forensic expert, it leaves out a great deal of evidential information which could strengthen even a simple case. Additionally, in order to classify or determine the source of the defect, the document examiner must have the suspected stamp – they cannot make assumptions in this regard based on examining the impression. The significance of the defects can be determined by identifying the stage at which they occurred within the manufacturing process.

References

Alford E.F., Stangohr G.R., "Synthetic signatures", *Journal of Forensic Sciences* 10, 1965, 77–85.

ASTM International, *The Standard Guide for Examination of Rubber Stamps*, ASTM E 2289-03, 2003.

Casey M.A., "The individuality of rubber stamps", *Forensic Science International* 12, 1978, no. 2, 137–144.

Herbertson G., *Rubber Stamp Examination*, Colorado 1997.
Herkt A., "Rubber stamps, manufacture and identification", *Journal of the Forensic Science Society*, 25, 1985, no. 1, 23–28.
Kelly J.S., *Forensic Examination of Rubber Stamps*, Springfield, IL 2002.
Ministry of Human Resource Development, *P-08, Questioned Document*, module 21. *Rubber Stamp and Seals*, e-Pg Pathshala, http://epgp.inflibnet.ac.in/epgpdata/uploads/epgp_content/S000016FS/P000695/M011505/ET/1516250384FSC_P8_M21_e-text.pdf.
Scientific Examination of Questioned Documents, eds. J.S. Kelly, B.S. Lindblom, Boca Raton, FL 2006.
Sloane T.O., *Rubber Hand Stamps and the Manipulation of Rubber*, New York 1891.

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Selection of comparative material as objective basis of expertise in forensic document examination

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Abstract

The comparative method is universally accepted and applied in forensic document examination. Comparing the questioned handwriting or signature against the comparative material reveals graphic elements which allow the expert to arrive at a technically and methodologically structured conclusion regarding authenticity. The opposing parties in a case provide comparative material for the expert to assess. Specimens deriving from public documents are initially considered to be of safe origin – these usually consist of signatures. However, handwriting samples are mainly found in private documents. Such circumstances make it easier for each party to contest the material provided by the opposite party while asserting the authenticity of their own. This, in turn, may lead to a debate between experts regarding the selection of appropriate comparative specimens. After all, the validity of their conclusions depends on whether the choice they make in this matter is correct. The present article provides some methodological guidelines, suggestions regarding the way of expressing the final expert opinion, as well as illustrates them through a specific case study.

Keywords: comparative material, signature, forgery, authenticity, public documents, private documents, handwriting, expert's conclusion, methodological criteria.

The universally accepted and applied method in forensic document examination is the comparative method. It allows the expert to contrast

the questioned handwriting or signature against specimens provided by individuals involved in a particular case in order to answer the question regarding its authenticity.

1. Methodological criteria of estimating the comparative material

The comparative material should meet the necessary methodological requirements. The possibility of applying these criteria leads to the amplified revelation of the graphic elements in which the conclusion of the expert will be technically and scientifically structured. The quality and quantity of this material is fundamental for the expert because the conclusion depends mainly on the completeness of it.

The scientific criteria at their core refer to:

– the possibility of the expert to access and examine original documents (or documents in other forms, such as photocopies, photos, scans, etc.), so as to carry out all the necessary kinds of analysis, some of which could only be applied to the originals. Lack of this possibility could diminish the diagnostic capacity of the expert (qualitative criterion);

– the quantity of comparative material, since the analysis of a large number of specimens could reveal the range of variability[1] of the writer's graphic skill (quantitative criterion);

– the existence in the comparative material of specimens contemporaneous to the questioned document, which gives the expert the opportunity to understand and define the graphic skill of the individual in the suspected chronological period (chronological criterion[2]).

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[1] D. Ellen, S. Day, C. Davis, *Scientific Examination of Documents: Methods and Techniques*, Boca Raton, FL 2018, p. 12; K. Koppenhaver, *Forensic Document Examination: Principles and Practice*, Totowa, NJ 2007, p. 27; H. Harralson, *Developments in Handwriting in Signature Identification in the Digital Age*, Oxford 2013, pp. 4–6; N. Stergiou, L. Decker, "Human movement variability, nonlinear dynamics, and pathology: Is there a connection?", *Human Movement Science* 30, 2011, issue 5, p. 869.

[2] M. Wakshull, *Forensic Document Examination for Legal Professionals: A Science-based Approach*, Temecula, CA 2019, p. 133; L.A. Mohammed, *Forensic Examination of Signatures*, London 2019, p. 65; D. Purtel, "Dating a signature", *Forensic Science International* 15, 1980, issue 3, pp. 243–248; P. Kipouràs, "Metodologickè kritèrià

It is rather indisputable that if the comparative material is compliant with these requirements, the expert could orientate their conclusion in a safer methodological direction.

In the case of expertise in forensic document examination (FDE) – or rather forensic handwriting examination (FHE), since in the modern times there are several forms of digital documents which sometimes demand a different approach by the expert – the opposing parties provide the comparative material of the person(s) involved to the case file. Such material may include not only their own specimens, but also specimens of the opposite party, which is a very common practice. Such a situation can lead to conflicts and sometimes even severe confrontations between private examiners hired by the parties and the court-nominated expert. It is undeniable that the definiteness of the comparative material is crucial for the court expert. In many cases, the forgers even create specimens for comparison – they usually derive from private documents, since creating a comparative specimen in a public document demands the collaboration of a state official, such as a notary public or a police officer (e.g., regarding a notary proxy or the authentication of a signature by the police or public services).

Discrepancies become a fertile field for disagreement, and this is a challenge many nominated experts deal with. Independently of their final opinion, the court expert's conclusion is usually attacked by one of the private examiners, who claims an inadequate estimation of the comparative material. Admittedly, a wrong conclusion regarding the identity of the writer who created the specimens could invert the results entirely.[3] It needs to be kept in mind, however, that the questioned document and comparative material having been produced by the same graphic hand does not necessarily mean that the suspected document is authentic. It is rather a question of a 'label' in the identity of the person who has written a specimen. A testament written by the same person in a private letter,

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v grafologickej expertise" [Methodological criteria in graphological expertise], *Slovenská grafologická spoločnos'* [Slovak Graphological Society Journal], 2019, issue 56, p. 5.

[3] A. Sulner, "Critical issues affecting the reliability and admissibility of handwriting identification opinion evidence – how they have been addressed (or not) since the 2009 NAS Report, and how they should be addressed going forward: A document examiner tells all", *Seton Hall Law Review* 48, 2018, issue 3, art. 5, https://scholarship.shu.edu/shlr/vol48/iss3/5.

which is declared to the court expert as a specimen of the testator, does not necessarily prove the validity of the testament.

2. Suggestions

The correct selection of the comparative material could protect the validity of the expert's conclusion and their professional figure. At the same time, it can prevent attempts of scientific confutation by the opposing examiners. How can one protect themselves in the procedure? Some initial suggestions could be expressed:

– It would be safe to conclude on the (in)compatibility of the hands which have written the suspected document and the comparative material rather than referring to the identity of the person, e.g., "the suspected document was written by the hand which has written the material declared as comparative."

– Refer to the identity of the person only on the base of the hypothesis of authenticity – e.g. (in continuation of the aforementioned proposed expression), "if the specimen declared as comparative material of the person A really belongs to them, the suspected document is authentic. If not, the questioned document is forged."

Such a way of opining gives our scientific conclusion to the court, but at the same time protects both ourselves and judges from attempts of fraud by the parties involved regarding the writer's identity. Undeniably, the basis and ultimate aim of the law is justice. Hence, under this assumption, the estimation of evidence and correctly determining the writer's identity are of utmost importance. On the other hand, the nominated FDE is restricted to their own scientific field, having the jurisdiction to opine only in relation to the technical questions of the court. Furthermore, the judges have a complete vision of the case file as well as the wide jurisdiction to cross-examine and estimate all the different forms of evidence. An expert's conclusion, therefore, does not restrict the court's estimation of the facts – according to the jurisdictional procedure, the judges have to adopt or reject the expert's opinion. It is preferable for them to have the opportunity to interpret the expert's research data and conclusion within the full context of the case and evidence rather than make a decision as to whether they should deem the whole expertise unreliable and exclude

it from their final evaluation. The last eventuality is definitely in favor of the party whose aims are deceitful.

3. Case study

After a long-lasting collaboration, there is a dispute between two accountants (called Mr. A and Mr. B) regarding a signature on a bank cheque. Mr. A has given an oral authorization for B to sign different kinds of documents in relation to their professional activity on his behalf. This situation has led to the establishment of Mr. A's signature which was conceived and evolved entirely by Mr. B and completely different from the original. After the court nominated an expert, Mr. B has presented comparative material in several documents (in practice signed by him on behalf of Mr. A), claiming that these were the signatures of Mr. A, although there was no morphological or ideological connection to the authentic signature. He also claimed that this was a second model of Mr. A's signature. Mr. A vehemently denied this assertion.

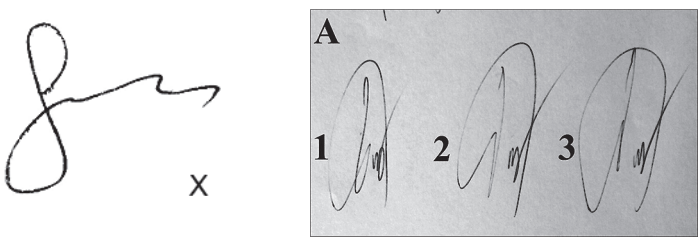

Figure 1. The suspected signature X and the comparative material of Mr. A (A)

The specimen declared by Mr. B as comparative material of Mr. A was the following:

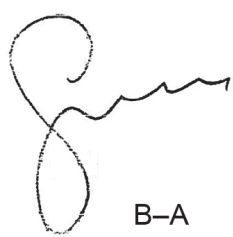

Figure 2. The signature model that Mr. B declared as Mr. A's authentic signature (B–A)

Mr. B tried to base his claim on the fact that the documents he presented which contained the alternative signature model were found in public documents.

Signatures on some documents declared or considered as public are related to the delicate issue of legal entities. If the FDE expert does not have basic legal knowledge, they can become disorientated. We have to distinguish between signatures in public documents in which their authentication and validity derives from the fact that they were traced in front of a public officer who confirms their authenticity, and documents which have legal validity as public due to the validation of their content. In the first case, we have an absolute certainty of authenticity (if the public officer did not commit fraud), in the second – we do not. The fact that a document was signed in private and then delivered to a public service in order to acquire legal validity does not necessarily mean that the signatures on it are authentic. This is the case for documents presented by Mr. B. as authentic specimens of Mr. A, followed by the claim of their public origin. We have to mention that in the majority of these documents, there was also the authentic signature of Mr. B next to the presumed signature of Mr. A.

The expert, in order to avoid being trapped by such claims, should take into consideration every aspect, including common sense. At the same time, the eventual plurality of comparative material at their disposal could give them the opportunity to exclude disputed specimens by cross-examining the other samples. Nevertheless, they should take into account the historical facts of the case, which may provide information useful for orientating the investigation. Experience indicates that the individuals favored by a forged document do not always create it themselves, but sometimes involve third persons. In the case examined, due to the nature of the collaboration of the persons involved, an eventual production of the forged signature by Mr. B should be examined. The authentic signature of Mr. B is the following:

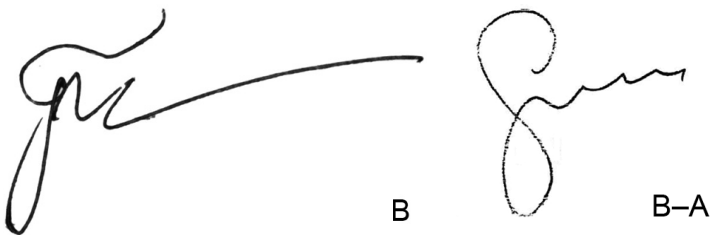

Figure 3. The authentic signature of Mr. B (B) next to the one declared by him as signature of Mr. A (B–A)

There are obvious points of compatibility between the specimens B and B–A (declared as specimens of Mr. A by Mr. B) which regard not only the morphology of the signature, but also the clockwise or anti-clockwise changes of direction[4] in the initial form which resembles the number 8.

Figure 4. The same direction of strokes on the initial form of signatures X and B in the same points

Practically, the suspected signature X is traced by unifying the two parts of the authentic signature B and simplifying the initial part of authentic specimen B, which presents an even more complicated form in other authentic specimens.

[4] A.I. Kapandji, *The Physiology of the Joints*, vol. 1. *The Upper Limb*, Edinburgh, 2010, pp. 146–197; P. Kipouràs, "Evidence for a 3-stage model for the process of free-hand forgery of signatures and/or handwriting", *IJISET – International Journal of Innovative Science, Engineering & Technology* 8, 2021, issue 1, pp. 238–249, http://ijiset.com/vol8/v8s1/IJISET_V8_I01_23.pdf.

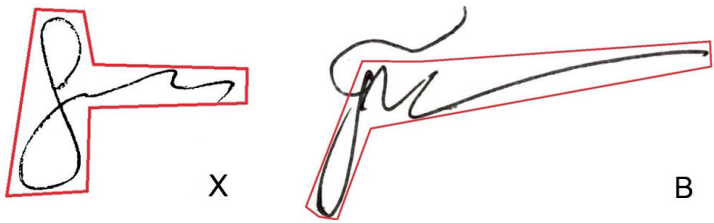

Figure 5. The morpheme of signature X is part of the authentic signature B

Conclusion

The correct identification of the comparative material is the starting point of a successful FDE. The expert should take into consideration the fact that the parties' claims could be deceitful for obvious reasons (obtaining a favorable court decision). We can draw a parallel between a mathematic equation and the expertise procedure. An accurate estimation of the comparative material and attributing the real identity to the hand which has graphically produced the specimens in certain documents are crucial for an objective application of the methodological steps. An error in the initial part of the procedure may condemn the reliability of the conclusion, regardless of whether the next stages of the expertise are methodologically correct. Experts should rather express as a point of reference their opinion regarding the compatibility of the hands rather than the identity of the persons involved. In this way, they expand the significance of the expertise and allow the court to adopt the conclusion by adjusting it to the parallel findings of other means of evidence.

References

Ellen D., Day S., Davis C., *Scientific Examination of Documents: Methods and Techniques*, Boca Raton, FL 2018.

Harralson H., *Developments in Handwriting in Signature Identification in the Digital Age*, Oxford 2013.

Kapandji A.I., *The Physiology of the Joints*, vol. 1. *The Upper Limb*, Edinburgh, 2010.

Kipouràs P., "Evidence for a 3-stage model for the process of free-hand forgery of signatures and/or handwriting", *IJISET – International Journal of Innovative Science, Engineering & Technology* 8, 2021, issue 1, http://ijiset.com/vol8/v8s1/IJISET_V8_I01_23.pdf.

Kipouràs P., "Metodologickè kritèrià v grafologickej expertise" [Methodological criteria in graphological expertise], *Slovenská grafologická spoločnos'* [Slovak Graphological Society Journal] 2019, issue 56.

Koppenhaver K., *Forensic Document Examination: Principles and Practice*, Totowa, NJ 2007.

Mohammed L., *Forensic Examination of Signatures*, London 2019.

Purtel D., "Dating a signature", *Forensic Science International* 15, 1980, issue 3.

Stergiou N., Decker L., "Human movement variability, nonlinear dynamics, and pathology: Is there a connection?", *Human Movement Science* 30, 2011, issue 5.

Sulner A., "Critical issues affecting the reliability and admissibility of handwriting identification opinion evidence – how they have been addressed (or not) since the 2009 NAS Report, and how they should be addressed going forward: A document examiner tells all", *Seton Hall Law Review* 48, 2018, issue 3, art. 5, https://scholarship.shu.edu/shlr/vol48/iss3/5.

Wakshull M., *Forensic Document Examination for Legal Professionals: A Science-based Approach*, Temecula, CA 2019.

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Evaluation of the sailent features in Indian currency notes

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Abstract

Security features are topographies invisible to the naked eye, such as micro-printing or features visible in ultraviolet, transmitted, and oblique light. The present paper focuses on the examination of Indian currency notes such as 2000, 500, 200, 100, 50, 20, and 10 in different light sources and with the help of a compound microscope. This kind of examination is very useful when it comes to distinguishing counterfeit currency from genuine one. Crime is increasing day by day, and so is the making of false currency – this study discusses the numerous security or hidden features which are invisible to the naked eye, and therefore may very well be missed by the potential perpetrator. It is the responsibility of the government along with the issuing authority to incorporate these structures

into all travel and security documents, including passports, voter-id cards, and many others. These features are implemented either during the manufacturing of the paper itself (e.g., fluorescent fibres) or at the time of printing (e.g., microprinting, watermarks, and other fluorescent features).

Keywords: currency notes, micro-printing, fluorescence, transmitted light, counterfeit currency.

Introduction

Advancements in banking facilities and automated systems are very important for various devices using automated systems to recognize banknotes, such as computerized ATMs, vending machines, or ticket dispensers. These systems usually apply rapid processing and accuracy recognition – innovations in this field serve to protect the economy from counterfeit currency and maintain social order. The need for such automatic tools encouraged many researchers to develop corresponding robust and reliable technology which facilitates the false currency identification process. Counterfeit products are often used to disguise something in order to abuse the general reputation of the original – counterfeit money looks like the genuine currency, but is issued without proper government approval, and therefore is not safe for the country.[1]

The present paper focuses on noteworthy elements of Indian currency notes, created for security reasons as well as to make it easier even for a layperson to distinguish ordinary banknotes from counterfeit ones. A big step towards verifying undeclared dark cash in India was taken on

[1] T. Pathrabe, S. Karmore, "A novel approach of embedded system for Indian paper currency recognition", *International Journal of Computer Trends and Technology* 1, 2011, no. 2; M. Tanaka et al., "Recognition of paper currencies by hybrid neural network", [in:] *IEEE International Joint Conference on Neural Networks Proceedings. IEEE World Congress on Computational Intelligence, 4–9 May 1998, Anchorage, AK*, vol. 3, Piscataway, NJ 1998; N. Jahangir, A.R. Chowdhury, "Bangladeshi banknote recognition by neural network with axis symmetrical masks", [in:] *Proceedings of the 10th International Conference on Computer and Information Technology, 27–29 December 2007, United International University, Dhaka-Bangladesh*, Dhaka 2007; R. Mirza, V. Nanda, "Paper currency verification system based on characteristic extraction using image processing", *International Journal of Engineering and Advanced Technology* 1, 2012, no. 3; R. Mirza, V. Nanda, "Characteristic extraction parameters for genuine paper currency verification based on image processing", *IFRSA International Journal of Computing* 2, 2012, no. 2.

8 November 2016 – with demonetization taking place, the government started the production of new currency notes which incorporated new security features. 2000 and 500 were the very first banknotes launched and also the most commonly used. Usually, counterfeit currencies carry the general watermark of the father of the nation and a fluorescent line of RBI – so features which can be easily incorporated.[2]

Objectives

The present study aims to examine the hidden features present in currency notes and provide tools for distinguishing genuine banknotes from counterfeit ones.

Material and methodology

The currency notes of the following denominations were collected: 2000, 500, 200, 100, 50, 20, and 10.

Instrumentation used: various light sources and a compound microscope.

Light sources used: visible, ultra-violet, and transmitted.[3]

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[2] B.K. Sharma, "Counterfeiting of Indian currency", *CBI Bulletin* 2000, no. 11; J. Oliver, J. Chen, "Use of signature analysis to discriminate digital printing technologies", [in:] *18th International Conference on Digital Printing Technologies 2002 (NIP 18), 29 September – 4 October 2002, San Diego, CA*, Springfield, VA 2002; S.C. Mittal, N. Arora, "Forgery of rupees five hundred denomination notes: Methods of detection", *CBI Bulletin* 2003, no. 2; K. Suneet et al., "Forensic analysis of security features in Indian currency denomination of ₹500 authentication and recognition through Docucenter NIRVIS instrument", *Journal of Forensic Sciences and Criminal Investigation* 13, 2020, no. 3, art. 555865.

[3] Ultraviolet light is electromagnetic radiation with a wavelength 10 nm to 400 nm smaller than that of visible light, but greater than that of X-rays. Transmitted light examination is the process in which the light is conceded through the surface and is not reflected. Micro-printing refers to the production of a recognizable pattern which is only visible under certain magnification, invisible to the naked eye – it is one of the most effective ways to hide security features. A. Pal, H.K. Pratihari, "Spectral studies on original and fake rupees 1000 denomination note", *International Journal of Chemistry and Applications* 4, 2012, no. 2.

Procedure

1. The denomination should be crease free in order to visualize the features appropriately. Place the note under a visible light source to examine the general features of the currency from both sides.

2. Once the visible light features are examined, place the note in a UV light source and note down the fluorescent features on both sides.

3. Conduct the transmitted light examination – it usually concerns watermarks present in various places.

4. Analyse the micro-printing using a compound microscope to allocate the features present in different places with variable magnification, such as 4×, 10×, 40×, etc.

5. Make sure not to mark anything on the currency because it can hinder the process of analysis.

Observations

Figure 1. General currency features in visible light examination

1. The size of the note is 63 mm × 129 mm and the overall color is green-yellow.

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Table 1. The dimensions and colors of the banknotes

Denomination	Dimensions	Color
2000	66 mm × 166 mm	magenta
500	66 mm × 150 mm	stone grey
200	66 mm × 146 mm	bright yellow
100	73 mm × 157 mm	blue green
50	66 mm × 135 mm	fluorescent blue
20	63 mm × 129 mm	green-yellow
10	63 mm × 123 mm	chocolate brown

2. Guarantee clause, promise clause along with the governer's signature and the stamp of the RBI (Reserve Bank of India).

3. Intaglio printing of the numeral 20 in green ink.

4. Intaglio printing of the protrait of Mahatma Gandhi (additionally, there are bleed lines present in the corners of the 100, 200, 500, and 2000 banknotes).

5. See-through register is the denomination of the banknote.

6. Ashoka emblem in intaglio printing.

7. Numeral 20 in Devnagiri.

8. Number panel (by size, in ascending order).

9. Year of printing.

10. Sawach Bharat Abhyan logo and slogan.

11. Language panel.

12. The motif of historical monuments – in this case, the Ellora Caves. The 2000 banknote contains the motif of Mangalyan, 500 – the Red Fort, 200 – Sanchi Stupa, 100 – Rani ki Vav, 50 – Hampi, and 10 – the Konark Sun Temple.

Different types of security features in UV, transmitted, and microscopic examination

Denomination: 2000

UV examination: various bands, fibers, and the security thread give fluorescence.

Figure 2

Figure 3

Transmitted light examination: watermark with the portrait of Mahatma Gandhi along with numeral 2000. On the extreme left, numeral 2000, RBI, various dark and light bands, symbol 2K on the bottom left.

Figure 4

Micro-printing examination: visualized at 4× magnification.

Figure 5. “RBI2000INDIA” above the see-through register

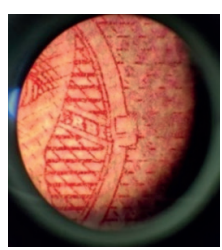

Figure 6. “RBI” on the spectacles of Mahatma Gandhi

Figure 7. “Bharat” on the security wire

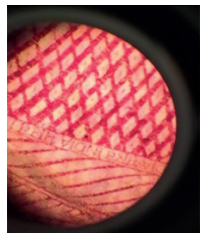

Figure 8. “Bharat, INDIA” on Mahatma Gandhi’s collar

Denomination: 500

UV examination: various bands, fibers, and the security thread give fluorescence.

Figure 9

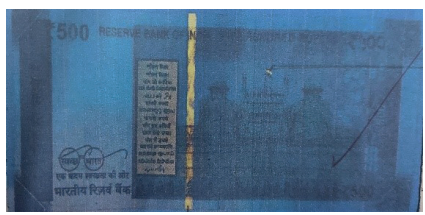

Figure 10

Transmitted light examination: watermark with the portrait of Mahatma Gandhi along with numeral 500. On the extreme left, numeral 500, RBI, various dark and light bands.

Figure 11

Micro-printing examination: visualized at 4× magnification.

Figure 12. “Bharat, INDIA” on Mahatma Gandhi’s collar

Figure 13. “RBI500INDIA” above the see-through register

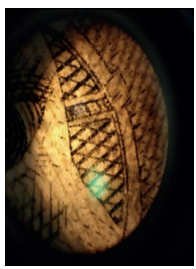

Figure 14. “RBI” on the spectacles of Mahatma Gandhi

Figure 15. “RBI” near the flag on Red Fort

Denomination: 200

UV examination: various bands, fibers, and the security thread give fluorescence.

Figure 16

Figure 17

Transmitted light examination: watermark with the portrait of Mahatma Gandhi along with numeral 200. On the extreme left, numeral 200, RBI, various dark and light bands.

Figure 18

Micro-printing examination: visualized at 4× magnification.

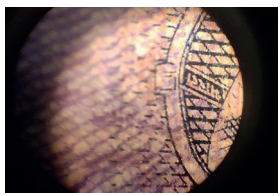

Figure 19. “Bharat” on Mahatma Gandhi’s spectacles

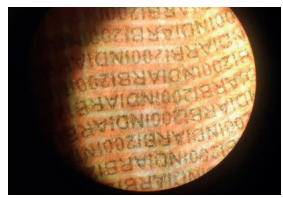

Figure 20. “RBI200INDIA” above the see-through register

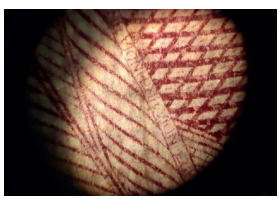

Figure 21. “Bharat, INDIA” on Mahatma Gandhi’s collar

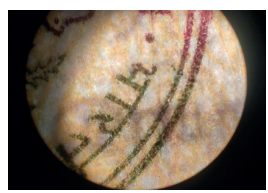

Figure 22. Color change from dark maroon to green in the Ashoka emblem

Denomination: 100

UV examination: bands do not give prominent fluorescence whereas fibers and the security thread do.

Figure 23

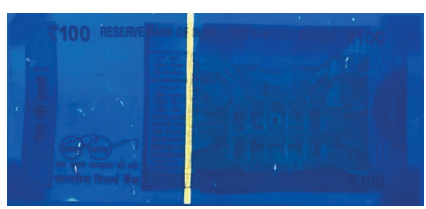

Figure 24

Transmitted light examination: watermark with the portrait of Mahatma Gandhi along with numeral 100. On extreme left, numeral 100, RBI, various dark and light bands.

Figure 25

Micro-printing examination: visualized at 4× magnification.

Figure 26. "RBI100INDIA" above the see-through register

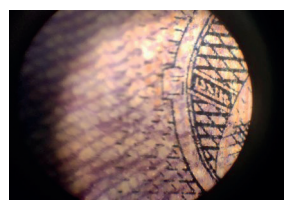

Figure 27. "Bharat" on Mahatma Gandhi's spectacles

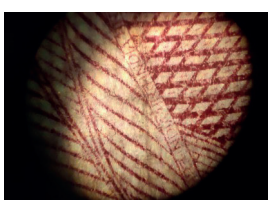

Figure 28. "Bharat, INDIA" on Mahatma Gandhi's collar

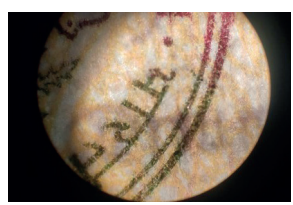

Figure 29. Color change from dark maroon to green in the Ashoka emblem

Denomination: 50

UV examination: bands do not give prominent fluorescence whereas fibers and the security thread do.

Figure 30

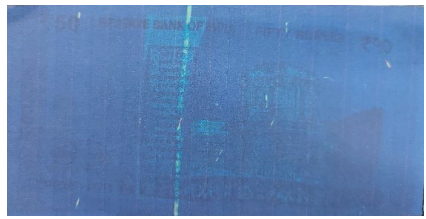

Figure 31

Transmitted light examination: watermark with the portrait of Mahatma Gandhi along with numeral 50. On the extreme left, numeral 50, RBI, various dark and light bands.

Figure 32

Micro-printing examination: visualized at 4× magnification.

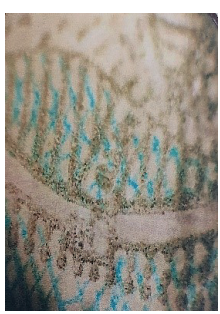

Figure 33. "B" on the spectacles of Mahatma Gandhi

Figure 34. "RBI 50" above see-through register

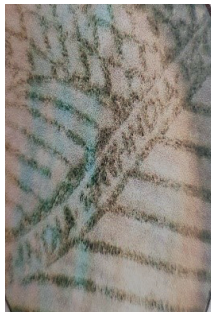

Figure 35. "Bharat, INDIA" on Mahatma Gandhi's collar

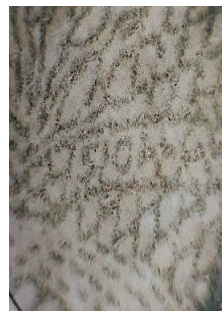

Figure 36. "50" on Mahatma Gandhi's right ear

Denomination: 20

UV examination: fibers, the security thread, and numeral 20 present on the bottom left give prominent fluorescence.

Figure 37

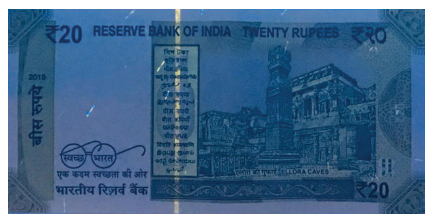

Figure 38

Transmitted light examination: watermark with the portrait of Mahatma Gandhi along with numeral 20. On the extreme left, numeral 20, RBI, various dark and light bands.

Figure 39

Micro-printing examination: visualized at 4× magnification.

Figure 40. "Bharat" on the spectacles of Mahatma Gandhi

Figure 41. "20" on the right ear of Mahatma Gandhi

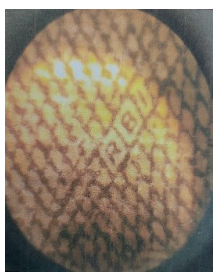

Figure 42. "RBI" on Mahatma Gandhi's collar

Figure 43. "RBI 20" above the see-through register

Denomination value: 10

UV examination: fibers, the security thread, and numeral 20 present on the bottom left give prominent fluorescence.

Figure 44

Figure 45

Transmitted light examination: watermark with the portrait of Mahatma Gandhi along with numeral 10. On the extreme left, numeral 10, RBI, various dark and light bands.

Figure 46

Micro-printing examination: visualized at 4× magnification.

Figure 47. "Bharat" on spectacles of Mahatma Gandhi

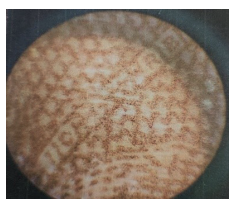

Figure 48. "RBI 10" above the see-through register

Figure 49. "Bharat, INDIA" on right side corner of the currency

Conclusion

During our research, we were able to find and present security features incorporated into Indian currency which are visible in UV and transmitted light as well as through a compound microscope. Our chief aim was to make people aware of such elements and ways in which they can distinguish genuine banknotes from fake ones. Security features include: latent images, watermarks, fluorescent dyes, and micro-printing built into the currency by the government to avoid the negative impact forged currency could have on the economy and the development of the country. These features are maintained throughout the process of printing and are changed every 10 to 20 years. However, incorporating them into the cur-

rency is a costly process, therefore their number varies depending on the specific denominations. At best, approximately 3 different microprinting elements are present in the lowest-value banknotes – 10. Watermarks are always manufactured at the same spot in all the currency, whereas the position of microprinting varies. India is a developing country, hence the focus is always on results and cost efficiency. Consequently, in the future, we will surely be dealing with some of the methods used to counterfeit currency and should have the means to detect them.

References

Jahangir N., Chowdhury A.R., "Bangladeshi banknote recognition by neural network with axis symmetrical masks", [in:] *Proceedings of the 10th International Conference on Computer and Information Technology, 27–29 December 2007, United International University, Dhaka-Bangladesh*, Dhaka 2007.

Mirza R., Nanda V., "Characteristic extraction parameters for genuine paper currency verification based on image processing", *IFRSA International Journal of Computing* 2, 2012, no. 2.

Mirza R., Nanda V., "Paper currency verification system based on characteristic extraction using image processing", *International Journal of Engineering and Advanced Technology* 1, 2012, no. 3.

Mittal S.C., Arora N., "Forgery of rupees five hundred denomination notes: Methods of detection", *CBI Bulletin* 2003, no. 2.

Oliver J., Chen J., "Use of signature analysis to discriminate digital printing technologies", [in:] *18th International Conference on Digital Printing Technologies 2002 (NIP 18) 29 September – 4 October 2002, San Diego, CA*, Springfield, VA 2002.

Pal A., Pratihari H.K., "Spectral studies on original and fake rupees 1000 denomination note", *International Journal of Chemistry and Applications* 4, 2012, no. 2.

Pathrabe T., Karmore S., "A novel approach of embedded system for Indian paper currency recognition", *International Journal of Computer Trends and Technology* 1, 2011, no. 2.

Sharma B.K., "Counterfeiting of Indian currency", *CBI Bulletin* 2000, no. 11.

Suneet K., Mahipal S.S., Rajeev K., Vaibhav S., Kapil P., Ramesh K.P., "Forensic analysis of security features in Indian currency denomination of ₹500 authentication and recognition through Docucenter NIRVIS instrument", *Journal of Forensic Sciences and Criminal Investigation* 13, 2020, no. 3, art. 555865.

Tanaka M., Takeda F., Ohkouchi K., Michiyuk Y., "Recognition of paper currencies by hybrid neural network", [in:] *IEEE International Joint Conference on Neural Networks Proceedings. IEEE World Congress on Computational Intelligence 4–9 May 1998, Anchorage, Alaska, USA*, vol. 3, Piscataway, NJ 1998.

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Is a forged signature an "apple" or a "fruit salad"?

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Abstract

This article is penned as a result of the continuous significant findings in my daily forensic handwriting examination practice and experience.

The methodology and process followed in any forensic handwriting examination are central to its interpretation and reliability – the repeatability and reproducibility of the same tests giving the same results;[1] its validity concerning the appropriateness of the chosen methodology and process;[2] and the resulting accuracy or discriminative reliability of the expert opinion in reflecting the true state of the evidence.[3]

In this regard, the present article poses the question firstly as to whether a forged signature is fundamentally a signature or handwriting? Once the implication of that question is understood and answered, the ensuing one is: in the interests of reliability, validity, accuracy, and best practice, what categories of comparison samples of the forger's writing should be used as evidence to analyse, compare, and evaluate a questioned signature, the forger's signatures, initials, or handwriting?

In short: in the pursuit of identifying authorship of any forged writing, and specifically a forged signature, whether disguised, free-hand simulated, traced, or even spuriously created, should the so-called apple be compared to apples (which would imply comparison to the signatures of the forger in the case of a forged signature), or is the

[1] G.M. Langenburg, *A Critical Analysis and Study of the ACE-V Process*, doctoral dissertation, University of Lausanne, Lausanne 2012, https://www.unil.ch/files/live/sites/esc/files/shared/Langenburg_Thesis_Critical_Analysis_of_ACE-V_2012.pdf, p. 52.

[2] Ibid.

[3] Ibid., p. 51; R.A. Huber, A.M. Headrick, *Handwriting Identification: Facts and Fundamentals*, New York 1999, pp. 363–367.

forged signature a fruit salad that should be compared to the full potentiality and repertoire of the entire writing skill range and master pattern of the suspected forger?

Keywords: forensic handwriting examination, reliability and validity, signature comparison specimens, signature and handwriting verification, signature and handwriting forgeries.

Introductory remarks

Three relevant fundamental principles of forensic handwriting examination require highlighting and reflection.

Firstly, one of the central and fundamental principles of forensic handwriting examination is comparing "like with like." This principle remains relevant and sacrosanct in the circumstances of identifying forgeries as instructed by Osborn: "It is obvious that the best standards of comparison are those of the same general class as the questioned writing and as nearly as possible of the same date."[4] However, in the case of establishing authorship of a forgery it is relevant and equally sacrosanct to establish and consider what "like with like" actually means. which categories of handwriting should be compared to the questioned signature? As was also pointed out by Osborn: "A positive conclusion that a signature is fraudulent can sometimes be reached by comparison with a small amount of genuine writing, especially, […], if the disputed signature is a bungling forgery that is suspicious in itself."[5]

The second relevant principle of forensic handwriting examination is that a successful forgery which defies detection is extremely difficult to achieve due to the inability of the forger to simultaneously suppress their own writing habits whilst taking on the habits of another writer. As was explained by Saudek: "The imitation of an unfamiliar handwriting entails, of course, not only the imitation of unfamiliar characters, but also the simultaneous suppression of one's own."[6] Osborn further confirms that "[m]any kinds of acquired skill become as automatic as walking or

[4] A.S. Osborn, *Questioned Documents: A Study of Questioned Documents with an Outline of Methods by Which the Facts May Be Discovered and Shown*, Rochester 1910, p. 18.

[5] Ibid., p. 19.

[6] R. Saudek, *Experiments with Handwriting*, London 1928, p. 148.

speech and are carried to the point where the operation not only requires no conscious direction but is actually almost beyond control of the mind and hand. Writing is a conspicuous example of such a habit and cannot be discarded or assumed at will.”[7]

In the case of identifying the authorship of forgeries, in which categories of writings of suspected forgeries are these writing habits to be found?

The third apposite principle is that determining whether two handwriting samples are authored by the same writer requires the absence of unexplained differences and a sufficient number of substantial similarities.[8] In order to determine this, the article again poses the question as to which categories of handwriting should be used in such an investigation.

This study would be incomplete without taking into consideration the psyche represented in each genuine signature and the nature of genuine signatures, initials, and indeed, of all genuine writing.

Genuine signatures or initials, in all their possible variations, identify a writer in a particular idiosyncratic reproduction of a unique, to differing extents, combination of characters. Signatures and initials are the preferred branding personally selected by a writer. That is to say, they are highly individualised “words/phrases” crafted, created, and conceptualised by their owners to their own tastes and writing abilities and skills. And, as is the case for all genuine writing, signatures and initials are practiced writing completed in automatic and unconscious movements. As stated by Howard C. Rile Jr, “[f]or the vast majority of individuals, signing one’s name is a habitual act. The act of reproducing this piece of writing called a signature requires a minimum of concentration. Individuals can usually multi-task when signing their signature.”[9]

Additional remarks

Certainly, some writers may have more than one signature and/or initial style for particular and different purposes which may or may not

[7] A.S. Osborn, op. cit., p. 240

[8] Ibid., p. 210.

[9] H.C. Rile Jr, “Identification of signatures”, [in:] *Scientific Examination of Questioned Documents*, eds. J.S. Kelly, B.S. Lindblom, Boca Raton, FL 2006, p. 76.

include various allograph styles such as cursive writing or block capital writing. Unquestionably, in such instances, it would be best practice for the forensic handwriting examiner to evaluate comparison samples that contain writing with the relevant range of allograph styles in order to assess authenticity.

When a forger simulates or traces another writer's signature, are their signature writing, initial writing, or handwriting skills being utilised? When a writer disguises their own signature, are their signature writing, initial writing, or handwriting skills being utilised?

Can a writer's established habitual complex handwriting motor programs and neural handwriting memory pathways be instructed to utilise specifically only one set of writing skills when creating any type of forgery?

Caligiuri and Mohammed refer to research indicating that:

> A motor program is a theoretical memory structure capable of transforming an abstract code into an action sequence […]. With regard to handwriting, Thomassen and van Galen (1992) noted that the high degree of consistency in the form of an individual's script when written using different limbs offers compelling evidence in support of an abstract motor program.[10]

Bird substantiates this further in her discussion regarding muscle memory:

> Both simulation and disguise behaviors require the writer to suppress his or her usual motor control system which attempting to copy other handwriting features or introduce new features different from his or her own, respectively. Writing generated "automatically," particularly signing one's name, is driven by an open loop mode of movement control, where a message is sent from the brain to execute a movement or string of movements which proceeds autonomously, largely without peripheral feedback. Compared to this usual open loop system of motor control that a reasonably skilled writer utilizes when writing normally, simulation and disguise (depending on the strategy) rely on a closed loop system. The feedback-dependent closed loop mode of movement control means the movement is interrupted or paused so the writer can monitor progress and allow adjustments to the movement as deemed necessary; visual feedback on the writing is progressing is relied upon to effect the formation of the resultant writing.[11]

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[10] M.P. Caligiuri, L. Mohammed, *The Neuroscience of Handwriting: Applications for Forensic Document Examination*, New York 2012, p. 37.

[11] C. Bird, "Evaluation of handwriting evidence", [in:] *Forensic Document Examination in the 21st Century*, eds. J.S. Kelly, M. Angel, Abingdon-Oxon 2021, pp. 83–84.

In a considerable number of different cases, I have consistently found that combinations of substantial and significant conscious (conspicuous) and unconscious (inconspicuous) similarities are seen when comparing questioned signatures, initials, and handwriting variably and unpredictably with the all sets of a the suspected forger’s writings. Morris explains inconspicuous features as follows: “By inconspicuous, the author does not mean that they are latent or otherwise invisible, he is referring to those features of the writing the average person may not notice, or even knows exist, and what significance they have for identification purposes.”[12]

Matley states:

> The more deep-rooted and unconscious a habit is, the more unaware the person is of its existence and/or extent and the harder it is to act contrary to it. Handwriting is a habitual activity which was acquired through training and practice. It is also a habit of minute movements, and minutiae in behaviour tend to be inconspicuous, unconscious and involuntary once they become inculcated. The variations from the practiced pattern tend to be from habits or inclinations beyond the person’s conscious, deliberate choice. So the inconspicuous, unconscious and involuntary nature of these are greater than that of the deliberately practiced habits.[13]

The importance of considering both conspicuous and inconspicuous features in handwriting, and especially the heft and gravitas of information contained in inconspicuous features, are also highlighted by Saudek:

> The distinction between conspicuous and inconspicuous features is of fundamental importance, both in characterological graphology and in expert forensic work. The inconspicuous features are least affected by the writer’s endeavours to alter his handwriting in an arbitrary fashion […]. The difficulty of arbitrarily producing the various features of handwriting bears an essential relation to their degree of conspicuousness.[14]

Conclusions

In my opinion, forged signatures or initials are not by definition signatures nor initials; they are, in essence, the handwriting of the forger.

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[12] R. Morris, *Forensic Handwriting Identification: Fundamental Concepts and Principles*, London 2000, p. 63.

[13] M. Matley, “The difference a difference makes: Variations in handwriting identification”, *The National Document Examiner* 2, 1992, pp. 13–14.

[14] R. Saudek, op. cit., p. 374.

Forged signatures, as well as forged initials and handwriting, are not apples or even oranges. They are fruit salads, created within the entire repertoire and arsenal of the forger's writing skills, whether free-hand simulations, tracings, or disguised writings. In as much as a genuine signature may contain similarities with that genuine writer's handwriting or initials, the forged signature may also contain similarities with the genuine writing of the forger.

When someone creates a forgery, their programmed writing habits cannot be compartmentalised and separately discarded at a whim into signature, initial, or handwriting habits. All learnt writing habits are summoned in creating a written forgery. To compare a forged signature, initial, or handwriting to only the corresponding categories of the suspected forger's writings would limit the probative value of the examination.

In my experience, all writings of the suspected forger, signatures, initials, and handwriting, require analysis, comparison, and evaluation in order to determine possible authorship of a forgery, as all may contain elements of "like" to be compared with "like." Additionally, a central parameter upon which the efficacy of an examination must be measured includes whether sufficient data were used in assessing the proof of authorship. In my opinion, this should include comparison samples of all the categories of a suspected forger's writing.

A second central question when assessing the merits of a forensic handwriting examination is whether it is the product of reliable, stable, consistent, repeatable methodologies and processes, and whether they have been applied reliably to the facts of the case. A valid examination can only be claimed if the methodologies were based on sound processes that were justified.[15] Any examination requires both internal validity, in that the observed criteria can be attributed to specific explanations, and external validity, in that the extent of the investigation results can be generalised across the same observable facts.[16]

Should a forensic handwriting examiner have made use of a "pathological methodology"[17] that did not encompass all the possible hand-

[15] G.M. Langenburg, op. cit., p. 52.

[16] R.A. Huber, A.M. Headrick, op. cit., pp. 363–367.

[17] Term proposed by Rafał Cieśla, PhD (Department of Forensic Sciences, Faculty of Law, Administration and Economics, University of Wroclaw), in an e-mail discussion occurring in April of 2022.

writing abilities and arsenal of a writer, a blinkered, limited, and, most seriously of all, a misguided opinion can be reached. In the interests of enhancing the credibility of the forensic handwriting examiner profession, it is upon us to collect as much pertinent and objective evidence as possible in order to reach an opinion that resembles the truth to the greatest achievable extent. This includes a holistic view of all the writing habits of the suspected forger.

References

Allen M., *Foundations of Forensic Document Analysis*, Chichester 2016.

Bradford R.B., Bradford R.R., *Introduction to Handwriting Examination and Identification*, Chicago 1992.

Caligiuri M.P., Mohammed L, *The Neuroscience of Handwriting: Applications for Forensic Document Examination*, New York 2012.

Ellen D., *Scientific Examination of Documents: Methods and Techniques*, Bristol 1997.

Forensic Document Examination in the 21st Century, eds. J.S. Kelly, M. Angel, Abingdon-Oxon 2021.

Harrison D., Burkes T.M., Seiger D.P., “Handwriting examination: meeting the challenges of science and the law”, *Forensic Science Communications* 11, 2009, no. 4.

Hilton O., *Scientific Examination of Questioned Documents*, Hoboken, SC 1982.

Huber R.A., Headrick A.M., *Handwriting Identification: Facts and Fundamentals*, New York 1999.

Koppenhaver K.M., *Forensic Document Examination: Principles and Practice*, Totowa, NJ 2007.

Langenburg G.M., *A Critical Analysis and Study of the ACE-V Process*, doctoral dissertation, University of Lausanne, Lausanne 2012, https://www.unil.ch/files/live/sites/esc/files/shared/Langenburg_Thesis_Critical_Analysis_of_ACE-V_2012.pdf.

Matley M., “The difference a difference makes: Variations in handwriting identification”, *The National Document Examiner* 2, 1992.

Morris R., *Forensic Handwriting Identification, Fundamental Concepts and Principles,* London 2000.

Osborn A.S., *Questioned Documents: A Study of Questioned Documents with an Outline of Methods by Which the Facts May Be Discovered and Shown*, Rochester 1910.

Robertson E.W., *Fundamentals of Document Examination*, Chicago 1991.

Saudek R., *Experiments with Handwriting*, London 1928.

Scientific Examination of Questioned Documents, eds. J.S. Kelly, B.S. Lindblom, Boca Raton, FL 2006.

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"Variation" vs "individuality": Redefinition in handwriting examination

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Abstract

The present article attempts to discuss the practical problems which have appeared in several recent cases, leading to converse conclusions and affecting the court trial as well as the rights and interests of the parties. The reinterpretation of "individuality" and "variation" can allow document examiners to use and interpret all the theoretical bases and methods of analysis, comparison, and judgment without any hesitation or uncertainty. It can also highlight the "basic theory" which must be applied differently depending on individual cases and in order to avoid analysis errors when non-professional document examiners reevaluate the same case.

Keywords: variation, individuality, handwriting examination, redefined theory, critical characteristics, results verification, reconstruction of document examination.

Background

In general practical cases, when setting out to confirm the authenticity of known documents, it is not difficult for an experienced forensic document examiner to classify the writings of the subject and find their consistent writing habits. At this point, if any differences are found, the majority of examiners would classify them as the writer's natural variation or different writing formations. However, when comparing ques-

* Yun Chih & Associates Consultancy, www.qde.com.tw.

tioned and known documents, it is not so easy to make an evaluation of any characteristics other than those found to be similar.

In order to recognize whether the differences come from inter- or intra-writer variations, the examiner cannot follow the same procedures as in the case of known handwriting. Instead, their conclusion must be based on very detailed observation and analysis. Since the examination is often done with limited data, the analysis and comparison can only be conducted after confirming the writer's consistent writing habits. Only then can it be determined whether or not the two documents (questioned and known) were authored by the same person.

Since the results are mainly based on "individuality" and "variation," it is undeniable that the conclusions regarding the identification vary greatly among experts (laboratories) – even if the laboratories around the world are standardized[1] in terms of the analysis, comparison, evaluation, and conclusion processes. These differences may include whether the case is accepted, the methodology applied, or even the final interpretation of the results. Such variety has appeared in several recent cases, sometimes leading to converse conclusions and affecting the court trial, as well as the rights and interests of the parties.

The present article attempts to discuss these problems and endeavors to redefine them.

Underlying theories

1. Characteristics[2] in the document examination can be divided into class or system characteristics and individual characteristics. It is stressed

[1] Scientific Working Group for Forensic Document Examination (hereinafter: SWGDOC), *Published Standards*, https://www.swgdoc.org/index.php/standards/published-standards (accessed: 15.01.2022).

[2] SWGDOC, *Standard for Examination of Handwritten Items*, ver. 2013-1, https://www.swgdoc.org/index.php/standards/published-standards (accessed: 15.01.2022); Federal Bureau of Investigation, "Handwriting examination: Meeting the challenges of science and the law", *Forensic Science Communications* 11, 2009, no. 4, https://archives.fbi.gov/archives/about-us/lab/forensic-science-communications/fsc/oct2009/review/2009_10_review02.htm (accessed: 15.01.2022); S.N. Srihari, S.H. Cha, H. Arora, S. Lee, *Individuality of Handwriting*, New York 2001, https://www.ojp.gov/pdffiles1/nij/grants/190133.pdf (accessed: 19.02.2022).

that the process of identifying "characteristics" needs to follow the principles of the consistency, individuality, and rarity of handwriting.[3] A document examiner needs to take into consideration the unique and steady nature of personal characteristics, on the basis of which they can then differentiate an individual's handwriting from others'. These characteristics can also be used as a reference to prove existing differences, as well as provide a valid reason[4] for identification and evaluation.

2. The interpretation of "variation" includes the distinction between the "natural variation" of one writer and the "individual characteristics" or "writing habits" of multiple writers (Figure 1). Traditional theories, such as the comprehensive SWGDOC Standard for Examination of Handwritten Items,[5] are insufficient for interpretation of "variation," "range of variation," "distorted writing," "significant differences." Thus, the document examiner must make a clear distinction between "variation" and "difference" before it can be accurately evaluated.

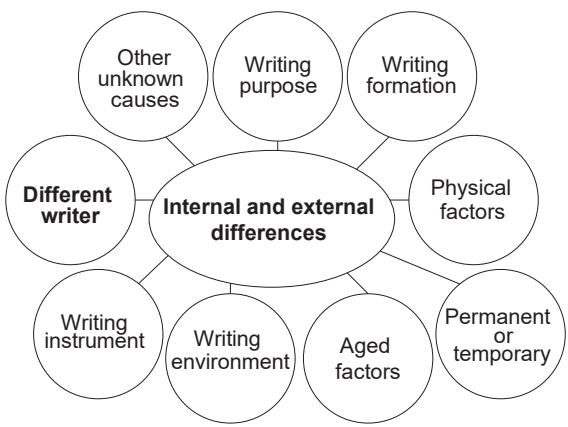

Figure 1. Factors influencing differences in writing

[3] K.M. Koppenhaver, *Attorney's Guide to Document Examination*, Westport, CT 2002, pp. 65–76; R.A Hubert, A.M. Headrick, *Handwriting Identification: Facts and Fundamentals*, Boca Raton, FL 2018, pp. 158–161; R. Morris, *Forensic Handwriting Identification: Fundamental Concepts and Principles*, London 2021, pp. 61–75, 154–155.

[4] *Forensic Document Examination in the 21st Century*, eds. J.S. Kelly, M. Angel, Abingdon-Oxon 2021, pp. 23–32.

[5] SWGDOC, *Standard for Examination*…

Redefined

As stated before, no matter how significant the "individuality" of handwriting is, the rarity cannot be analyzed merely through evaluating statistical data – such methodology[6] would be limited by the timeframe, the number of exemplars, and the undetermined internal and external influencing factors of the writer. That is why a professional, skillful, and experienced expert's evaluation still cannot be substituted by statistics and computational methods.

In terms of cases, distinguishing between questioned and known handwriting or discovering the consistency of the writing habits is still the basis for examination regarding the authenticity of writings (Figure 2). But if all the evidence cannot be illustrated by its particularity likelihood ratios, the term "individual characteristics" can be wrongly interpreted by a layperson when conducting a handwriting examination in real cases or even misunderstood by a report reader in the trial. One of the typical pieces of evidence when evaluating if documents were written by the same person is a comparison of right-hand and left-hand writing. Although these are not unique in writer identification, when compared to a right-handed writer, the questioned handwriting performed by undisguised left-handed writer will bear characteristics crucial for evaluation.[7] And if the document examiner can make a definite judgment in this regard, including an explanation of the process of excluding all other influential factors, then it is not necessary to prove rarity or error rate.

Other characteristics typically used for analysis and comparison include, i.a., describing features of writing, the relative relationship between words or strokes, pen pressure, appearances, the writing instruments, or any influences by internal and external factors. However, the importance of every feature's value will be different from writer to writer,

[6] *Handbook of Forensic Statistics*, eds. D. Banks, K. Kafadar, D.H. Kaye, M. Tackett, Boca Raton, FL 2021, pp. 349–363.

[7] S.N. Srihari, S.H. Cha, H. Arora, S. Lee, "Individuality of handwriting", *Journal of Forensic Sciences* 47, 2002, no. 4, pp. 856–872.

and the interpretation will vary throughout cases.[8] That is why document examiners seem to use the same writing features as evidence to make a distinction between writers or conclusions regarding the authenticity of the writings, but the evaluation and explanation were entirely different in various cases.

The value of such evidence is not how unique it is, but what crucial discoveries it shows. Some characteristics, while not specific (general), can therefore be critical for relative comparisons in each separate case. Even if they cannot prove uniqueness, if no reasonable explanation exists for why something was written differently or similarly, they can still be used to distinguish whether the writer is the same.

For example, when facing unnatural handwriting, the document examiner may observe difference in writing strokes in terms of "pen stops" and "pen deposits." A pen stop occurs when the writer lifts the pen and then applies it again, often in a different position from the original stop. A pen deposit, on the other hand, means simply that the writer continues to write after a temporary break due to internal and external factors. Therefore, in comparing it to pen stops, the coherence of strokes will be a critical feature regarding the authenticity of the writing. So, if the case concerned imitation, the unnatural strokes and unexplainable writing habits will become important evidence which can be applied to differentiate between writers. Such "critical characteristics" are ones showing relative,[9] exclusive,[10] and non-repetitive[11] peculiarity.

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[8] "Any character in writing or any writing habit maybe modified and individualized by different writers in different ways and varying degrees, and it is clear that the writing individuality of any particular writer is made up of all these common and uncommon characteristics and habits." A.S. Osborn, *Questioned Documents: A Study of Questioned Documents with an Outline of Methods by Which the Facts May Be Discovered and Shown*, Rochester 1910, p. 210.

[9] "Relativity" refers to the characteristics of known handwriting, which is significantly "similar and different" compared to other writers.

[10] "Exclusivity" means that all identifications are case-by-case, and the so-called characteristics are limited to individual cases.

[11] "Non-repeatability" means that questioned handwriting cannot be repeated in other cases, which is different from other datable forensic evidence.

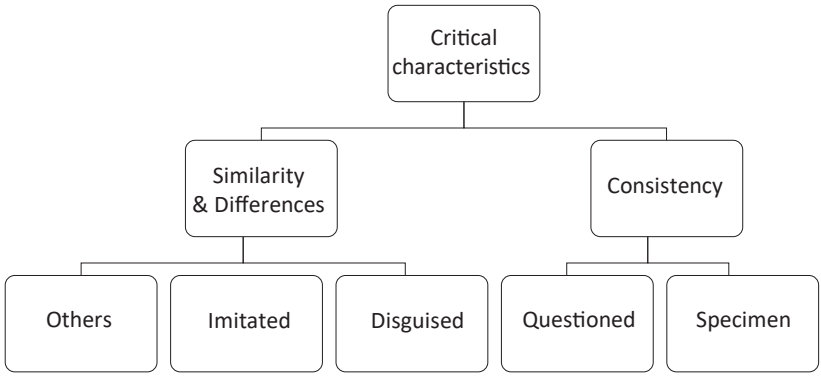

Figure 2

When it comes to the theory of "variation," we must emphasize the concept of handwriting as a skill developed through a long period of learning and repeated writing, resulting in the development of consistent personal characteristics, individual to the writer. These unique features can be used to differentiate one's handwriting from others'. Everyone has different writing habits,[12] a "master pattern,"[13] which cannot be formed in a short time nor completely changed.[14] Conducting handwriting examination should be premised on three main elements: consistency, individuality, and rarity. Consistency rules out any "uncertain features" which would cause "variety" in handwriting. "Personal differences"[15] and "individuality" exclude the possibility of one set of characteristics being the same as others.

There is much research about what causes unnaturalness or variations in handwriting, but examiners are still unable to decisively establish them. Therefore, all analyses must be based on the principle that all writers can present stable writing habits, both in questioned and known handwriting. Even if we interpreted "variation" as a lack of consistency in the appearance of the writing, it still would be debatable whether the variety

[12] R.A. Hubert, A.M. Headrick, op. cit., p. 237.

[13] K.M. Koppenhaver, Chapter 12. "Master Pattern", [in:] eadem, *Forensic Document Examination: Principles and Practice*, Totowa, NJ 2007, https://link.springer.com/chapter/10.1007/978-1-59745-301-1_12 (accessed: 19.07.2022).

[14] M.P. Caligiuri, L.A. Mohammed, *The Neuroscience of Handwriting: Applications for Forensic Document Examination*, New York 2012, pp. 131–199.

[15] R.A. Hubert, A.M. Headrick, op. cit., pp. 129–131; R. Morris, op. cit., pp. 79.

is the effect of accidental features outside the range of one writer, or of differences between multiple writers. Therefore, when comparing different writings by the same person, these characteristics can be evaluated as various inconsistent writing patterns found in consistent writing habits – differences between questioned and specimen handwriting, however, are beyond the nature of variation. Examiners cannot determine whether unstable changes belong to the range of one writer's habits or not.

It is important for document examiners to keep in mind that such uncertain features should not be applied in cases of questioned handwriting. When comparing consistent characteristics of questioned handwriting with the consistent writing habits of the known handwriting, the discrepancies found must be assumed to be caused by different authorship instead of classified as "variation" from the same writer. The philosophy here is the same as in the modular forensic handwriting method.[16] Ron N. Morris stated: "an accidental and will not be repeated exactly the same way in other writings by the writer." This means that such "differences" must be non-repetitive – otherwise the handwriting probably comes from different writers (Table 1).

Table 1. Classification of differences in the appearance of characteristic of handwriting

Substantial differences (excluding influence factors)	Unsubstantial differences (affected by internal and external factors)
writing appearances (words or strokes)	different timeframe
writing style (words or strokes)	different writing purpose
writing proportion of words (or strokes)	different writing condition (physical – instrument – environment)
critical difference	writing formation (words or strokes)
imitation	disguise
misused words (or strokes) and punctuation	accidental
consistent habit	not enough samples
exclude disguise	exclude imitation
Evaluation: different writer	Evaluation: same writer

[16] C. Bird, B. Found, "The modular forensic handwriting method", *Journal of Forensic Document Examination* 26, 2016, https://www.researchgate.net/publication/314116493_The_modular_forensic_handwritin_method (accessed: 20.07.2022).

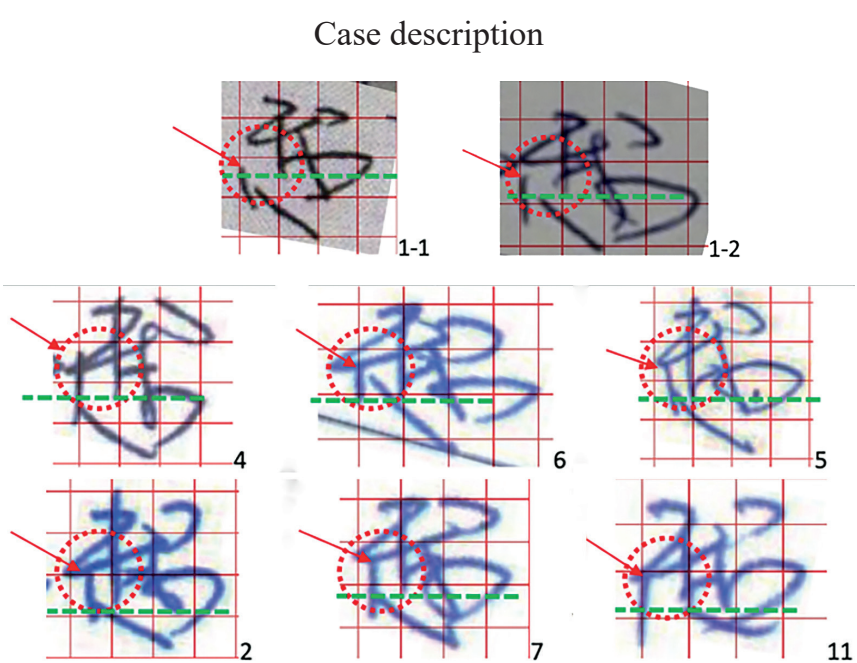

Figure 3. Q:1-1, 1-2; K: 2, 4, 5, 6, 7, 11

Q – questioned, K – known

In practical casework (Figures 3–4), there are some document examiners who compare questioned handwriting with known handwriting only according to the "randomly" matching similar characteristics and explain the difference by variation from the same writer. Such an evaluation method does not meet the principle of three aforementioned elements existing at the same time. It also ignores the most important requirement: that all compared features should be "stable and consistent," not random in appearance. In this regard, the discovery of different or similar and stable individual characteristics is the main point of analysis and comparison which can prevent errors and misinterpretation.

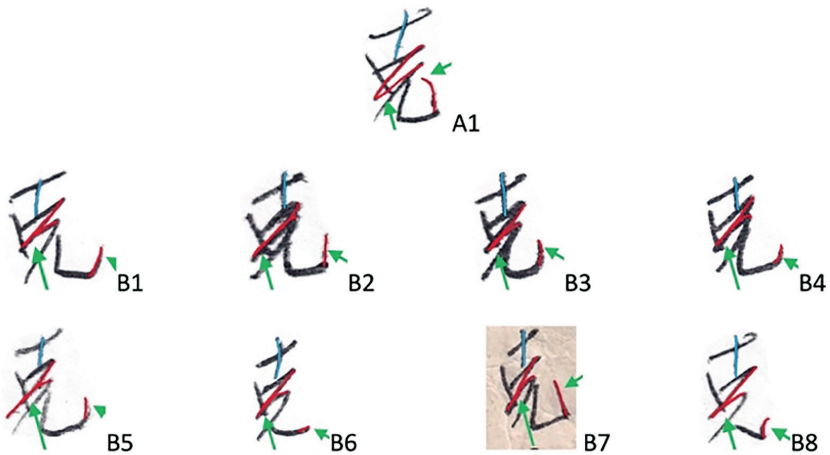

Figure 4. Q: A1; K: B1–B8

Figure 5 logically interprets the differences between variation and imitated handwriting or disguised handwriting compared to the range of the writer's natural handwriting.

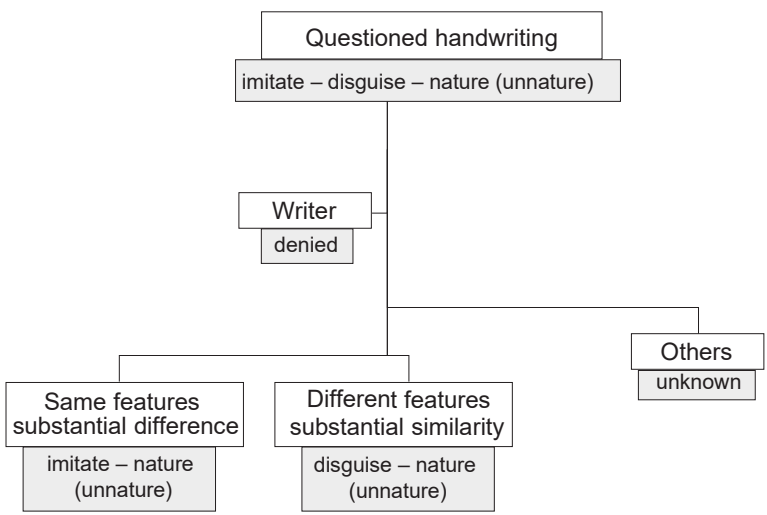

Figure 5

First, the differences or similarities within the writer's natural handwriting can be categorized by collecting samples. The more samples collected, the higher the chance of finding the writer's "consistent writing habits" and their inconsistent natural variation, which cannot be attributed to the writer's writing habits nor be applied to predict the reason for the change in writing features. Therefore, when document examiners work with imitated or disguised handwriting, the most important step is to make a logical distinction. For example, inconsistencies between the questioned handwriting, which has been analyzed and evaluated to be "imitated," and the "consistent writing habits" presented by the specimen, should be interpreted as inter-writer differences instead of "natural variation" of the same writer. Similarly, the differences between the questioned handwriting, which has been determined as "disguised," and the inconsistent differences between "consistent writing habits" presented by the comparison, can be interpreted as a "variation" caused by the writer intentionally hiding their writing habits (Figure 6). Regardless of whether the differences are caused by "imitation" or "disguise," since they do not belong to the writer's own writing habits, it is impossible to obtain verification through sample collection. That is why to finding consistent writing habits instead of random characteristics is crucial in determining whether the difference is intra- or inter-writer.

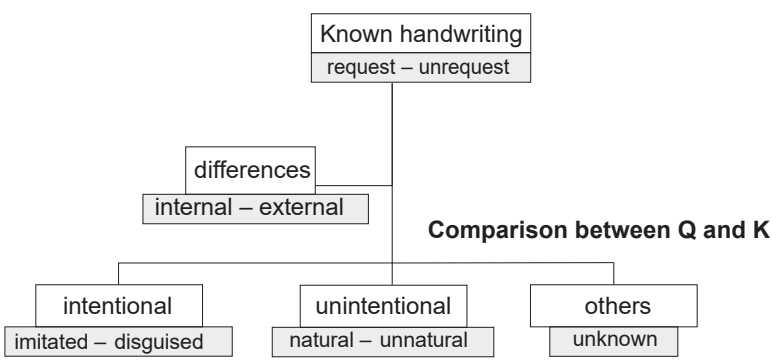

Figure 6

Secondly, regardless of whether the document examiner is faced with a questioned document or specimen document, they must determine if the handwriting on the analyzed document is natural or not. However, since the document examiner is unable to speculate on the specific reason for unnatural factors in the handwriting, the analysis must be concentrated on the principle regarding the presence or absence of the writer's consistent writing habits.[17] This is more reliable that "variation" and "individuality" which are so heavily emphasized in forensic document examination theory. For a stroke formation which has no stability but may affect the conclusion, the document examiner must collect as many exemplars as possible until the sample can be evaluated (Figure 7).

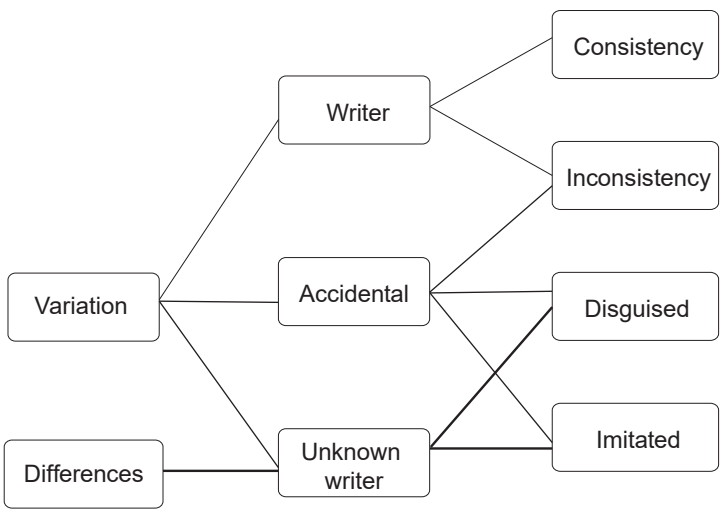

Figure 7

[17] "With invariants discretization, the accuracy of handwritten identification is improved significantly with the classification accuracy of 99.90% compared to discretized data. Invariants discretization for individuality representation in handwritten authorship." A.K. Muda, S.M. Shamsuddin, M. Darus, *Computational Forensics: Second International Workshop, IWCF 2008, Washington, DC, USA, August 7–8, 2008. Proceedings*, https://core.ac.uk/download/pdf/235628902.pdf (accessed: 20.07.2022).

Conclusion

The development of handwriting examination theory and identification methodology has been going on for hundreds of years. Even into the twenty-first century, this field is still continuously evolving, hoping to find consensus, conforming to scientific, verifiable methods for identification (see: Appendix).

We can all agree that when document examiners conduct handwriting analysis,[18] it is standard that all observations are taken into account. In practice, however, overemphasis on analysis and comparison has caused the most important procedure to be often overlooked – visual examination. Without keen observation, there can be no follow-up precise analysis, no "critical characteristics,"[19] no distinguishable evidence for evaluation. Because there is neither proper observation nor rigorous interpretation, all undiscovered evidence is attributed to experts using different research methods, the speculative results – to insufficient comparison data, and so on. Such an evaluation statement not only confuses the reader, but also hinders the progress of the entire field.

The "individuality" and "variation" emphasized in this article are extraordinarily important "identification languages" in forensic document examination. It constitutes the way experts communicate at the time of identification to ensure that the person reading the report or listening to the explanations (lawyers, judges, clients) can receive a clear and uniform understanding of the results. At the same time, it can serve as a basis for the court to clarify the issue. Additionally, because the language used domestically and abroad is different, if the report is not explained in sufficient detail, it is easy for the same text to be misunderstood. The reinterpretation of "individuality" and "variation" can allow document examiners to use and interpret all the theoretical bases and methods of

[18] Expert Working Group for Human Factors in Handwriting Examination, US National Institute of Standards and Technology, *Forensic Handwriting Examination and Human Factors: Improving the Practice Through a Systems Approach*, NIST Interagency/Internal Report no. 8282, Gaithersburg, MD 2020, https://nvlpubs.nist.gov/nistpubs/ir/2021/NIST.IR.8282r1.pdf (accessed: 20.01.2022).

[19] Y. Chang, "'Critical Characteristics' and 'Results Verification'", *Academia Letters* 2021, art. 756, https://www.academia.edu/45647871/_Critical_Characteristics_and_Results_Verification (accessed: 2.02.2022).

analysis, comparison, and judgment without any hesitation or uncertainty. It can also highlight the "basic theory" which must be applied differently depending on individual cases and in order to avoid analysis errors when non-professional document examiner re-evaluate the same case.

Appendix

Appearance of the questioned and known handwriting		
Appearance	Questioned	Known
Are there unnatural conditions?		
Originals or non-originals?		
Are documents complete?		
Are the strokes clear?		
Are the styles and formats of the documents the same?		
Is the writing formation the same?		
Are the documents produced within the same timeframe?		
Are the general features and proportion of words the same?		
Are the writing instruments the same?		
Special condition?		

Similarities and dissimilarities of questioned and known handwriting (consistent writing habits)	
Items of comparison	Results
Whether the writing formation in the feature of words are the same.	
Whether the proportion of words are the same (baseline, space between words, tilts)	
Whether the ways of writing in the feature of strokes are the same.	
Whether the relative position of the proportion of strokes are the same.	
Whether the initial or terminal strokes and feature of writing are the same.	
Whether the pen movements or direction and feature of writing are the same.	
Whether the sequences of pen movements are the same.	
Whether the connection strokes (angle) and style of writing are the same.	
Whether the pen pressure, thickness, and feature of writing are the same.	
Whether the proposition or feature of dots and writing style are the same.	
Whether the unnatural strokes increase or decrease.	

Whether there is unnatural pen stop, pen deposits or feature of tremors.	
Whether the internal/external influencing factors has been ruled out.	
Special writing features.	

Technical methodology	
Comparison of strokes sketching.	
Comparison of superimpose.	
Comparison of geometric pattern.	
Examination with microscope and enlarge system.	
Examination with special light sources.	
Examination with assistance of video software.	
Other (non-destructive, physical inspection).	

Opinion of result	
Results	Explanation
Identification	Conclusive evidence shows the handwriting was performed by the same person, excluding imitation.
Elimination	Conclusive evidence shows the handwriting was written by a different person, excluding disguise.
Inconclusion	– It is not possible to summarize the writer's consistent writing habits. – No sufficient and comparable words or strokes for analysis (either questioned or known specimen). – No sufficient specimen or recollect documents is impossible. – Questioned handwriting has been proved to be disguised plus the written formation is different from specimens. – Questioned handwriting has been proved to be imitated plus to summarize the writer's consistent writing habits are impossible. – Different writing conditions (timeframe, physical and mental situation, writing instruments, posture, and other unpredictable reason) – No obvious comparative stable individuality. – others
Sample collection	– The results can be obtained by collecting similar specimens (like with like). – The results cannot be confirmed based on the existing data (conclusive, inconclusive, no conclusion). – There is disguised writing among specimens. – Questioned and known handwriting cannot be determined. – Differences cannot be reasonably explained. – Others

Explanation of results verification		
Verification	Questioned handwriting	Known handwriting
Natural handwriting		
Unnatural handwriting		
Intentional handwriting		
Unintentional handwriting		
Imitated handwriting		
Disguised handwriting		
Other		
Reconstruction of document examination.[20] – Relationship with conclusion of identification. – Relationship between the data and the plaintiff or the defendant. (imitated disguised intentional or not) – Relationship with influencing factors.		

References

Bird C., Found B., "The modular forensic handwriting method", *Journal of Forensic Document Examination* 26, 2016, https://www.researchgate.net/publication/314116493_The_modular_forensic_handwritin_method.

Caligiuri M.P., Mohammed L, *The Neuroscience of Handwriting: Applications for Forensic Document Examination*, New York 2012.

Chang Y., "Bi ji jian ding xian chang chong jian" [Reconstruction of document examination], https://www.academia.edu/39761376/筆鑑定現場重建_reconstruction_of_document_examination.

Chang Y., "'Critical characteristics' and 'results verification'", *Academia Letters* 2021, art. 756 https://www.academia.edu/45647871/_Critical_Characteristics_and_Results_Verification.

Expert Working Group for Human Factors in Handwriting Examination, US National Institute of Standards and Technology, *Forensic Handwriting Examination and Human Factors: Improving the Practice Through a Systems Approach*, NIST Interagency/Internal Report no. 8282, Gaithersburg, MD 2020, https://nvlpubs.nist.gov/nistpubs/ir/2021/NIST.IR.8282r1.pdf.

[20] Y. Chang, "Bi ji jian ding xian chang chong jian" [Reconstruction of document examination], https://www.academia.edu/39761376/筆鑑定現場重建_reconstruction_of_document_examination (accessed: 20.07.2022).

Federal Bureau of Investigation, "Handwriting examination: Meeting the challenges of science and the law", *Forensic Science Communications* 11, 2009, no. 4, https://archives.fbi.gov/archives/about-us/lab/forensic-science-communications/fsc/oct2009/review/2009_10_review02.htm.

Forensic Document Examination in the 21st Century, eds. J.S. Kelly, M. Angel, Abingdon-Oxon 2021.

Handbook of Forensic Statistics, eds. D. Banks, K. Kafadar, D.H. Kaye, M. Tackett, Boca Raton, FL 2021.

Hubert R.A, Headrick A.M., *Handwriting Identification: Facts and Fundamentals*, Boca Raton, FL 2018.

Koppenhaver K.M., *Attorney's Guide to Document Examination*, Westport, CT 2002.

Koppenhaver K.M., Chapter 12. "Master Pattern", [in:] eadem, *Forensic Document Examination: Principles and Practice*, Totowa, NJ 2007, https://link.springer.com/chapter/10.1007/978-1-59745-301-1_12.

Morris R., *Forensic Handwriting Identification: Fundamental Concepts and Principles*, London 2021.

Muda A.K., Shamsuddin S.M., Darus M., "Invariants discretization for individuality representation in handwritten authorship", *Computational Forensics. Second International Workshop, IWCF 2008, Washington, DC, USA, August 7–8, 2008. Proceedings*, https://core.ac.uk/download/pdf/235628902.pdf.

Osborn A.S., *Questioned Documents: A Study of Questioned Documents with an Outline of Methods by Which the Facts May Be Discovered and Shown*, Rochester 1910.

Scientific Working Group for Forensic Document Examination, *Published Standards*, https://www.swgdoc.org/index.php/standards/published-standards.

Scientific Working Group for Forensic Document Examination, *Standard for Examination of Handwritten Items*, ver. 2013-1, https://www.swgdoc.org/documents/SWGDOC%20Standard%20for%20Examination%20of%20Handwritten%20Items.pdf.

Srihari S.N., Cha S.H., Arora H., Lee S., "Individuality of handwriting", *Journal of Forensic Sciences* 47, 2002, no. 4.

Srihari S.N., Cha S.H., Arora H., Lee S., *Individuality of Handwriting*, New York 2001, https://www.ojp.gov/pdffiles1/nij/grants/190133.pdf.

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Forensic study on the effect of atypical surfaces and writing instruments on handwriting characteristics

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Abstract

Handwriting examination is becoming a captivating field nowadays, as there are numerous cases where handwriting is not written on a usual surface – i.e., paper, with a conventional writing instrument – i.e., pen. However, while it is interesting to analyze these types of handwriting samples, most forensic document examiners find it difficult due to the effect atypical surface and writing instrument have on handwriting characteristics. Thus, a systematized study has been carried out on documents prepared on unconventional surfaces such as cardboard, cloth piece, and blackboard, with uncommon writing instruments such as lipstick, kajal, and chalk. Correspondingly, studies were carried out on writing samples provided by 40 individuals using the conventional pen/paper as well as unconventional cardboard/kajal, cardboard/pen, cloth/pen, cloth/lipstick, cloth/kajal, and board/chalk combinations. Various handwriting features were examined and compared among aforementioned combinations, and changes in handwriting characteristics were reported. Those could be due to the atypical writing instruments and surfaces which conjointly impact the overall identity of the handwriting and expert's conclusions thereon.

Keywords: handwriting examination, unusual surface, lipstick, handwriting features.

Introduction

So far, forensic document examiners (FDEs) have been rather accepting of the novel challenges and complications introduced by non-traditional documents which are not made with pen and paper. However, the biggest one is typically the examination of handwriting written on unusual surfaces such as cloth, cardboard, and blackboard, with non-conventional writing instruments such as lipstick, kajal, and chalk. This area of expertise is of utmost importance because such solutions are very common in cases of suicide, since the person committing suicide may want to hide the evidence from the suspect (meaning the person who abet the victim to do such an act) but at the same time share that information with a loved one or the law enforcement officials. The commonly encountered writing surfaces exhibiting the evidence in cases of suicide are skin, mirror, wall, cloth, tissue, or anything available in the vicinity.[1]

The utilization of unusual surfaces and instruments is more prominent in cases of suicide because the usual surface (paper) and common writing instrument (pen) are not usually available in the vicinity. Thus, the individuals opt for the atypical surfaces, due to their easy availability and resistance to destruction.[2] It is evident from earlier studies that the overall pictorial appearance of the handwriting on unfamiliar surfaces is influenced by the limited availability of the space and awkwardness faced by the writer while inscribing on the unique and unknown surface with the new writing instrument.[3]

The utilization of unique writing tools and surfaces tends to have an impact on writing in numerous ways. For example, a thick and broad nib and a rough surface may hide crucial handwriting features, which make it challenging for the FDE to examine the document without awareness

[1] A. Kaur, M. Threja, R.K. Garg, "Forensic examination of handwriting transcribed on an unusual surface (human skin)", *Problems of Forensic Sciences* 117, 2019, pp. 5–18.

[2] M.C. Joshi, R.K. Garg, "Examination of writing on an unusual surface in a suicide case: Dead persons do tell tales – conduct a forensic investigation for the cause of humanity and justice", *Problems of Forensic Sciences* 101, 2015, pp. 50–59.

[3] R.W. Byard, "Evidence of premeditation in skin messages in suicide", *Journal of Forensic Sciences* 61, 2016, no. 2, pp. 566–568.

of how the unknown surface and instrument are affecting the hidden features of handwriting.[4] Comparable studies have been done by several other authors.

In the present study, lipstick, kajal, chalk, and ball point pen were used by the writers to inscribe on unusual surfaces such as cloth, board, cardboard, and paper. It was evident after analyzing and comparing the handwriting that the surface and writing instrument had affected the overall pictorial appearance of the handwriting, but there are peculiar features which make the comparison of writing on different surfaces with different writing instrument possible.

Materials and methodology

Handwriting samples for the present study were obtained from 40 individuals (20 males and 20 females) between the ages 20–35 from the RIMT University Campus. The chosen subjects were skilled writers and well-versed with the handwriting process. Each one of them was asked to write "A grumpy wizard makes a toxic brew for the jovial queen" on three non-conventional substrates – i.e., cardboard, board, and cloth piece, with chalk, kajal, lipstick, and ball point pen (Figure 1). Each individual wrote on four surfaces, including paper. Thus, 240 samples were collected overall (Table 1).

Table 1. Number of samples collected on different surfaces

Writing instrument	Writing surface				Total
	A4 sheet	Cloth	Cardboard	Board	
ball point pen	40	40	40	–	120
lipstick	–	40	–	–	40
kajal	–	40	–	–	40
chalk	–		–	40	40
Total	40	120	40	40	240

[4] M. Threja, K. Saini, M. Singh, "A study of the effect of unusual writing instruments and surfaces on the handwriting characteristics", *Problems of Forensic Science* 118, 2019, pp. 123–140.

Figure 1. Writing instruments

All samples were photographed with a 24MP digital camera (Sony). The samples on the board were photographed immediately because they could be easily erased with a duster. Later on, each sample was compared with the writing of the same individual on paper using ball point pen.

Results

The handwriting samples were analyzed and compared to determine the differences and similarities in the handwriting made on unusual surfaces with unusual writing instruments. At first, features such as line quality, slant, relative height, and alignment were taken into account. Additionally, individual characteristics such as letter forms, shape and formation of diacritics, omission of letters or parts of a letter, area enclosed by loops, and capitalization of letters were considered for the purpose of examination.

Features of handwriting analyzed:

Line quality. The line quality of the handwriting is the combination of numerous handwriting features such as rhythm, retouching and overwriting, pen lifts, connections, and nature of initial and terminal strokes.[5] The variation in these factors helps the FDE to judge the line quality of the given sample.

Rhythm. It can be classified as smooth, intermittent, and jerky. It is evident from Table 2 that the rhythm is jerkier and more intermittent

[5] A.S. Osborn, *Questioned Documents*, New York 1929.

in the lipstick/cloth combination. The rhythm of handwriting is mostly smooth in pen/cardboard and chalk/board combinations (Figure 2).

Table 2. Variation in rhythm (percentage of samples)

S.NO.	Writing instrument/ surface	Characteristics		
		Rhythmic	Less rhythmic	Non-rhythmic
1.	lipstick/cloth	7.50	67.50	25.00
2.	kajal/cloth	25.00	57.50	17.50
3.	ball point pen/cloth	85.00	15.00	–
4.	pen/cardboard	82.50	17.50	–
5.	chalk/board	45.00	50.00	5.00

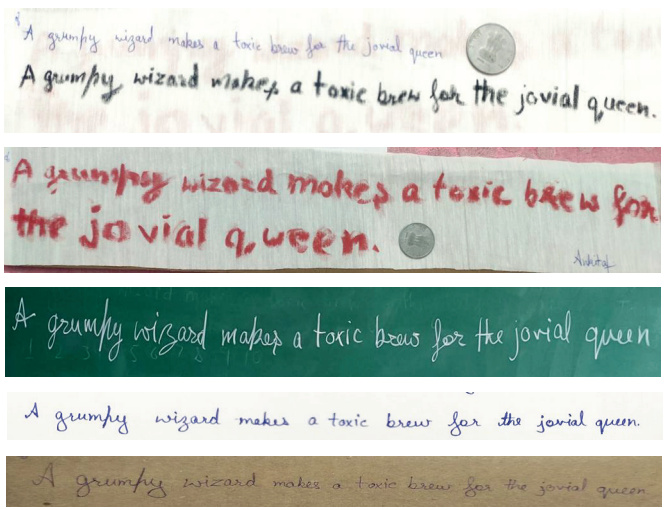

Figure 2. Variation in rhythm

Retouching and overwriting.[6] It is evident from Table 3 that retouching similar to pen/paper is present in all of the handwritings; additional retouching and overwriting also appears in 32.5% of the lipstick/cloth combination samples (Figures 3 and 4).

[6] R.A. Huber, A.M. Headrick, *Handwriting Identification: Facts and Fundamentals*, Boca Raton, FL 1999.

Table 3. Variations in retouching and overwriting (percentage of samples)

S.NO.	Writing instrument/surface	Characteristics	
		Natural	Additional
1.	lipstick/cloth	67.50	32.50
2.	kajal/cloth	72.50	27.50
3.	ball point pen/cloth	87.50	12.50
4.	pen/cardboard	82.50	17.50
5.	chalk/board	77.50	12.50

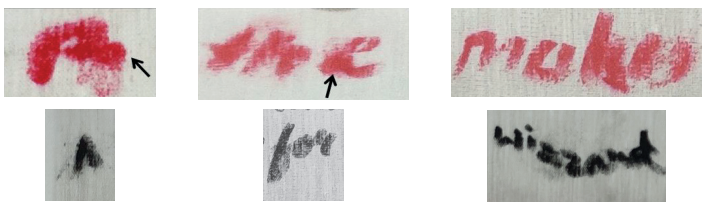

Figure 3. Presence of retouching in handwriting written on cloth piece with lipstick and kajal

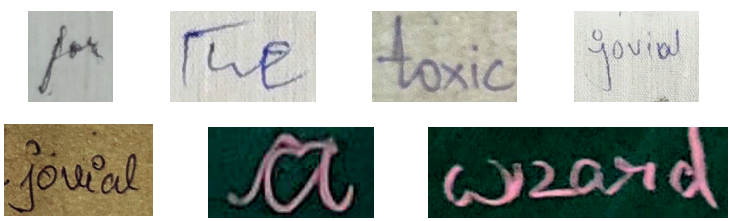

Figure 4. Presence of retouching in handwriting on a cloth piece with ball point pen, on a board with chalk, and on cardboard with ball point pen

Pen lifts.[7] Pen lifts ultimately affect the frequency of connections in the line of handwriting (Figure 5). The number of pen lifts increased in 92.5% of lipstick/cloth and 90% of kajal/cloth samples (Table 4).

Connections.[8] Connections among the various strokes of handwriting vary from acute angles to broad curves. From Table 5, it is evident that the number of connections decreased as the subject wrote with an atypical writing instrument (Figure 5). The results revealed that there are

[7] O. Hilton, *Scientific Examination of Questioned Documents*, New York 1982.
[8] R.A. Huber, A.M. Headrick, op. cit.

fewer connections in the writings with lipstick and kajal than the ball point pen (Table 5).

Commencing and terminal strokes. The nature of commencing and terminating strokes here depends upon the thickness of the writing instrument. For this reason, the maximum blunt initial and terminal strokes are present in the lipstick/cloth rather than other combinations. The surprising fact is that even in the case of chalk/board, most strokes are fine and flying (Table 6).

Table 4. Variations in pen lifts (percentage of samples)

S.NO.	Writing instrument/surface	Characteristics	
		Similar	Increased
1.	lipstick/cloth	7.50	92.50
2.	kajal/cloth	10.00	90.00
3.	ball point pen/cloth	75.00	25.00
4.	pen/cardboard	70.00	30.00
5.	chalk/board	72.50	27.50

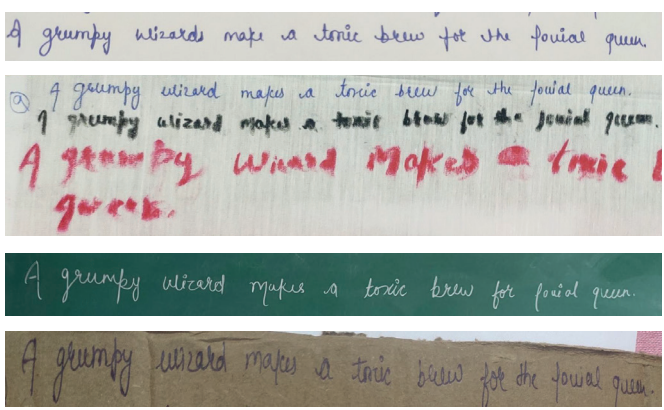

Figure 5. Variations in the number of pen lifts and connections

Slant. Variation in slant is more evident in lipstick/cloth and kajal/cloth samples (Figure 6). The variation in slant is from backward to forward especially in case of writing with lipstick. In most cases, the writing on board is vertical. There is little difference in the slant in writing inscribed on cardboard.

Table 5. Variations in connections (percentage of samples)

S.NO.	Writing instrument/surface	Characteristics	
		Similar	Decreased
1.	lipstick/cloth	5.00	95.00
2.	kajal/cloth	27.50	72.50
3.	ball point pen/cloth	82.50	17.50
4.	pen/cardboard	85.00	15.00
5.	chalk/board	62.50	37.50

Table 6. Variations in nature of commencing and terminal strokes (percentage of samples)

S.NO.	Writing instrument/surface	Characteristics	
		Fine and flying	Blunt
1.	lipstick/cloth	5.00	95.00
2.	kajal/cloth	35.00	65.00
3.	ball point pen/cloth	82.50	17.50
4.	pen/cardboard	85.00	15.00
5.	chalk/board	70.00	30.00

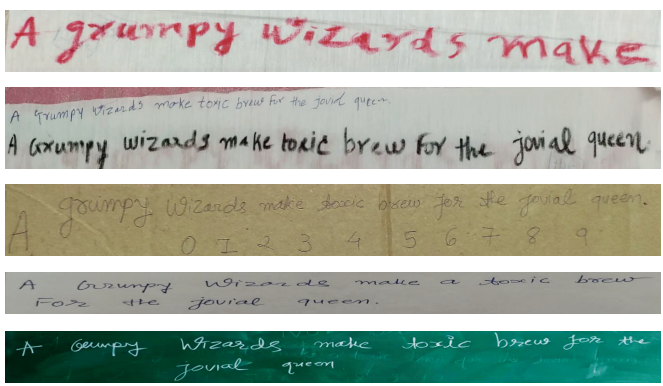

Figure 6. Variation in slant (retracted towards both sides)

Relative height.[9] Letter combinations 'ds' from the word *Wizards*, 'to' from the word *toxic*, 'fo' from the word *for*, 'al' from the word *jovial*, and 'qu' from the word *queen* were chosen for determining the variations

[9] A.S. Osborn, op. cit.

in relative height and proportion. The height was measured with a template scale with parallel lines, each 1 mm apart. The size of handwriting is larger in the case of lipstick/cloth, kajal/cloth, and chalk/board combinations, but the relative height and proportions remained similar in each case irrespective of the surface or the instrument because it is a habitual characteristic.

Alignment.[10] It can be classified as ascending, descending, horizontal, and mixed. Compared to normal handwriting, the alignment was very similar in writings with pen and kajal on cloth, but affected in writings with lipstick on cloth. No major changes in alignment were observed in writings with pen on cardboard (Figure 7); however, some appeared in the case of writing on board with chalk due to the change in writing posture and movement.

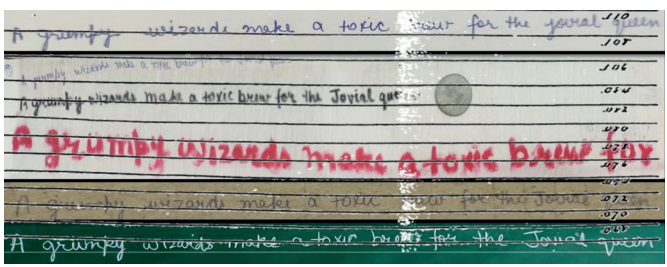

Figure 7. Variation in alignment

Letter formations.[11] For analyzing the effect of handwriting surface and handwriting instrument on letter formations, four letters were selected i.e., 'f,' 'g,' 'j,' and 'A.' The highest numbers of deviations are there in lipstick/cloth samples (Figures 8 and 9).

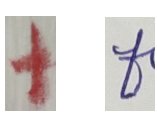

Figure 8. Change in form of the letter 'f'

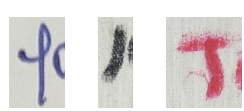

Figure 9. Variation in form of the letter 'j'

[10] W.R. Harrison, *Suspect Documents: Their Scientific Examination*, London 1996.
[11] R.A. Huber, A.M. Headrick, op. cit.

Diacritics.[12] In the present study, i-dots were considered and analyzed qualitatively, regarding their frequency, shape, and position. Shapes of the i-dot such as a circle, semicircle, or coma, used in writings performed in normal conditions, were observed to be simplified into a dot in samples written on atypical surfaces with atypical instruments (Figure 10). On a cloth surface filled circles were observed due to the thickness of the writing instrument.

Figure 10. Variation in the 'i-dot' diacritic mark

Omission of letters and parts of letters.[13] The presence of omission of letters and parts of letters is evident on unusual surfaces especially in the case of lipstick/cloth handwriting due to the simplifications made under abnormal conditions (Figure 11). The highest percentage of omissions was present in lipstick/cloth samples (67.5%), and the lowest (12.50%) – in chalk/board samples (Table 7). No omissions were observed in the case of pen/cardboard samples.

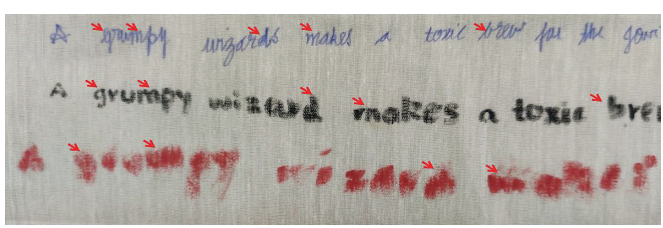

Figure 11. Omission of letters and parts of letters in lipstick and kajal handwriting

[12] Ibid.
[13] Ibid.

Table 7. Presence or absence of omission of letters and parts of letters (percentage of samples)

S.NO.	Writing instrument/surface	Characteristics	
		Present	Absent
1.	lipstick/cloth	67.50	32.50
2.	kajal/cloth	35.00	65.00
3.	ball point pen/cloth	–	100.00
4.	pen/cardboard	–	100.00
5.	chalk/board	12.50	86.50

Capitalization of letters. Capitalization was found to be present in even normal writing samples of some individuals, which indicated their individual habit. A comparison of the writings on unusual surfaces with normal writing samples revealed that capitalization was introduced in 34.21% of the samples written with lipstick on cloth and in 25% of the samples written with kajal on cloth (Figures 12, 13, and 14). No capitalization was observed in cardboard/pen handwriting. Only two samples of board/chalk handwriting showed capitalization.

Figure 12. Capitalization of letters in handwriting on cloth with lipstick

Figure 13. Capitalization of letters in handwritings on cloth with kajal

Figure 14. Capitalization of letters in handwritings on board with chalk

Area enclosed by loops and eyelets. Comparison of writings transcribed on cloth, board, and cardboard with writings on usual surfaces revealed a contraction of area bordered by loops, eyelets, and ovals in

about 82.5% of the samples written on cloth with lipstick and in 70% of the samples written on cloth with kajal (Figures 15 and 16). There is no significant change in the area enclosed by loops, ovals, and eyelets in writings on board and cardboard (Table 8).

Figure 15. Variation in the area enclosed by an oval in the letter 'a'

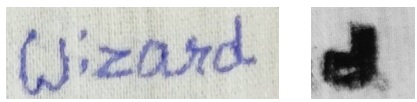

Figure 16. Variation in the area enclosed by an oval in the letter 'd'

Table 8. Variation in area enclosed by loops and eyelets (percentage of samples)

S.NO.	Writing instrument/surface	Characteristics	
		Similar	Dissimilar
1.	lipstick/cloth	12.50	82.50
2.	kajal/cloth	30.00	70.00
3.	ball point pen/cloth	100.00	–
4.	pen/cardboard	100.00	–
5.	chalk/board	90.00	10.00

Discussion

All the samples were analyzed and compared in terms of the effect unusual surfaces and atypical handwriting instruments have on handwriting characteristics such as: slant, size, proportions, line quality, connections, diacritics, etc. Due to an unusual surface or instrument, the appearance of the handwriting can differ from the typical pen/paper handwriting; still, many of the recurring identifying features of normal handwriting remain unaltered, which can help answer the question of common authorship.

A prominent cause of deviations in handwriting features is the fragility and roughness of the handwriting surface (cloth and cardboard).[14]

[14] M. Threja, K. Saini, M. Singh, op. cit.

Furthermore, the holder's grip, thickness of the nib (lipstick and kajal), the writer's position, and writing movement also affect the overall appearance of the handwriting. All these factors can contribute to changing well-arranged handwriting into a clumsy one.

While examining the collected samples, it was observed that the highest quantity of deviations in all the handwriting features was observed in the cloth/lipstick and cloth/ kajal combinations. The possible reason behind these divergences is the interaction between the two surfaces along with the thickness of the writing instrument nib as well as irregular surface. We are well-acquainted with the nature of the usual writing instrument (pen) and handwriting surface (paper), but not with many atypical ones. This is why awkwardness can be found in writings on unusual surfaces.

The size and spacing of the handwriting are influenced by the nature of the surface and the instrument used.[15] However, the present study made it clear that the relative size always remains identical, and the spacing changes depending on the available space.

Conclusion

In the course of the study, it was observed that the characteristics of writing on cloth, cardboard, and board show evident deviations, but some particular individual features still remain unaffected – particularly the relative size, letter formation, and the nature of commencing and terminal strokes. Such features can help in comparing handwriting present on atypical surfaces written with atypical instruments and normal writing. It was concluded that if writing features are original, undisguised, clear, and collected within a short period, it is possible to give a definite opinion regarding the authorship, irrespective of the complications induced by unusual surfaces or unusual writing instruments. The findings of this research reveal that numerous factors play a significant role in the analysis of writing, such as: surface features (texture, color, nature), writing instruments (width of nib, texture of the writing instrument, color of ink), writing posture, and writing movement.

[15] J. Levinson, op. cit.

References

Austin A.E., Byard R.W., "Skin messages in suicide: An unusual occurrence", *Journal of Forensic and Legal Medicine* 20, 2013.

Behera C., Rautji R., Krishna K., Kumar A., Gupta S., "Suicide note on the palm: Three case reports and discussion of medico-legal aspects", *Medicine, Science and the Law* 54, 2014, no. 2.

Behera C., Swain R., Bhardwaj D.N., Millo T., "Skin suicide note written in mehndi (henna)", *Medico-Legal Journal* 84, 2016, no. 1.

Byard R.W., "Evidence of premeditation in skin messages in suicide", *Journal of Forensic Sciences* 61, 2016, no. 2.

Demirci S., Dogan K.H., Erkol Z., Gunaydin G., "Unusual suicide notes written on the body: Two case reports", *American Journal of Forensic Medicine and Pathology* 30, 2009.

Ellen D., *Scientific Examination of Documents: Methods and Techniques*, Boca Raton, FL 2006.

Harrison W.R., *Suspect Documents: Their Scientific Examination*, London 1996.

Hilton O., *Scientific Examination of Questioned Documents*, New York 1982.

Huber R.A., Headrick A.M., *Handwriting Identification: Facts and Fundamentals*, Boca Raton, FL 1999.

Joseph J., "The unidentifiable writing: An anonymous note case", *Journal of the National Association of Document Examiners* 20, 1997.

Joshi M.C., Garg R.K., "Examination of writing on an unusual surface in a suicide case: Dead persons do tell tales – conduct a forensic investigation for the cause of humanity and justice", *Problems of Forensic Sciences* 101, 2015.

Kaur A., Threja M., Garg R.K., "Forensic examination of handwriting transcribed on an unusual surface (human skin)", *Problems of Forensic Sciences* 117, 2019.

Koppenhaver K.M., *Attorney's Guide to Document Examination*, Westport, CT 2002.

Levinson J., *Questioned Documents: A Lawyer's Handbook*, Burlington 2000.

Mathyer J., "The influence of writing instruments on writing on signatures", *Journal of Criminal Law and Criminology and Police Science* 60, 1969, no. 1.

Osborn A.S., *Questioned Documents*, New York 1929.

Scientific Examination of Questioned Documents, eds. J.S. Kelly, B.S. Lindblom, London 2006.

Sulner F.H., *Disputed Documents*, New York 1966.

Tarannum A., Mishra M.K., Prasad R., Lawrence R., Saran V., "Evaluation of similarities among conventional and unconventional writing for qualified opinion", *International Journal of Social Relevance & Concern* 3, 2015.

Taylor L., Hnilico V., "Investigation of death through body writing: A case study", *Journal of Forensic Sciences* 36, 1991.

Threja M., Saini K., Singh M., "A study of the effect of unusual writing instruments and surfaces on the handwriting characteristics", *Problems of Forensic Science* 118, 2019.

Totty R.N., "A case of writing on an unusual surface", *Journal of Forensic Science Society* 21, 1981, no. 4.
Tumram N.K., Ambade V.N., "Engraved suicide notes: The last note written on body by metallic object", *Journal of Forensic Sciences* 61, 2016.

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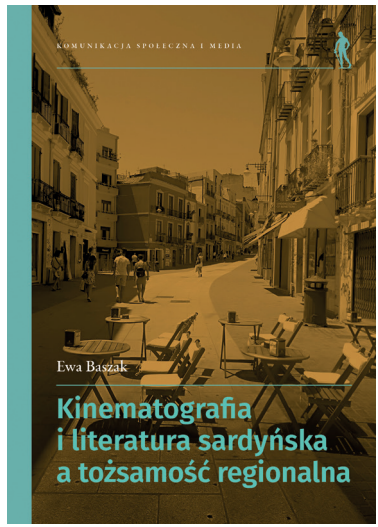

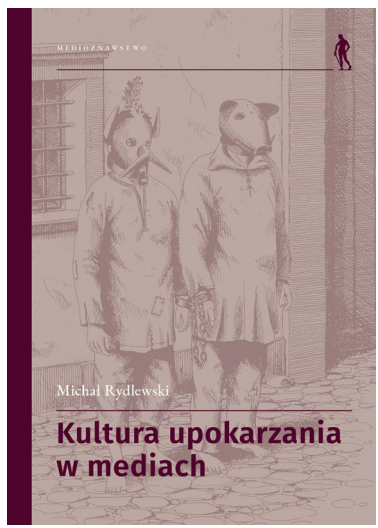

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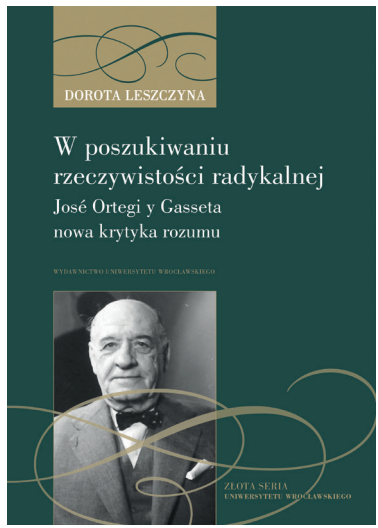

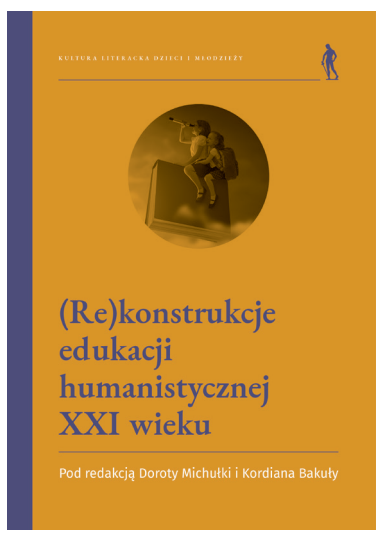

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