

“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-

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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 standardized¹ 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. Characteristics² 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 reason⁴ 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.

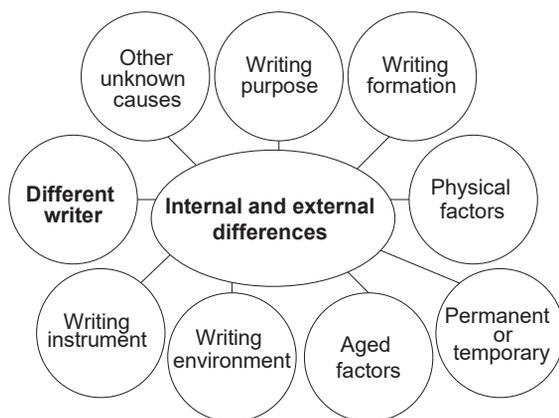


Figure 1. Factors influencing differences in writing

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 methodology⁶ 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-repetitive¹¹ peculiarity.

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.

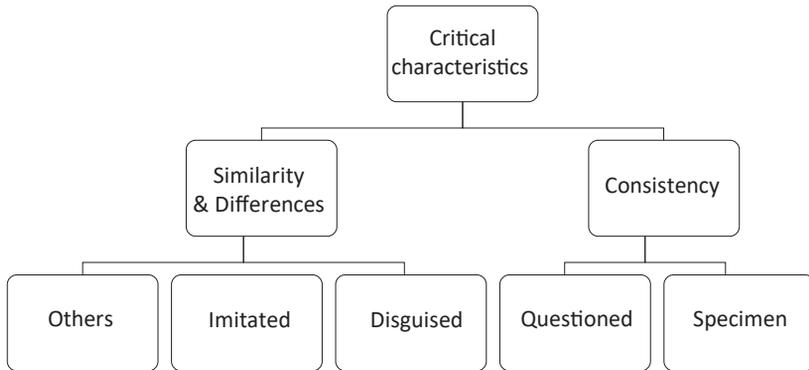


Figure 2

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).

Case description

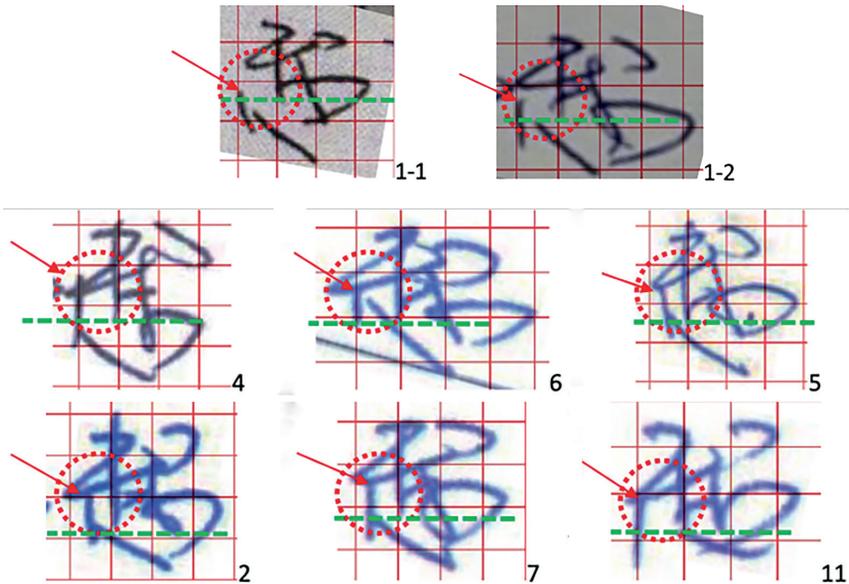


Figure 3. Q:1-1, 1-2; K: 2, 4, 5, 6, 7, 11

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.

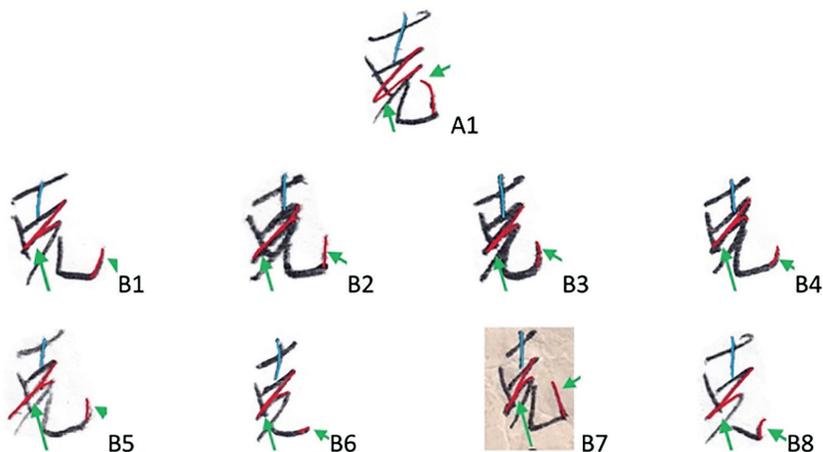


Figure 4. Q: A1; K: B1–B8

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

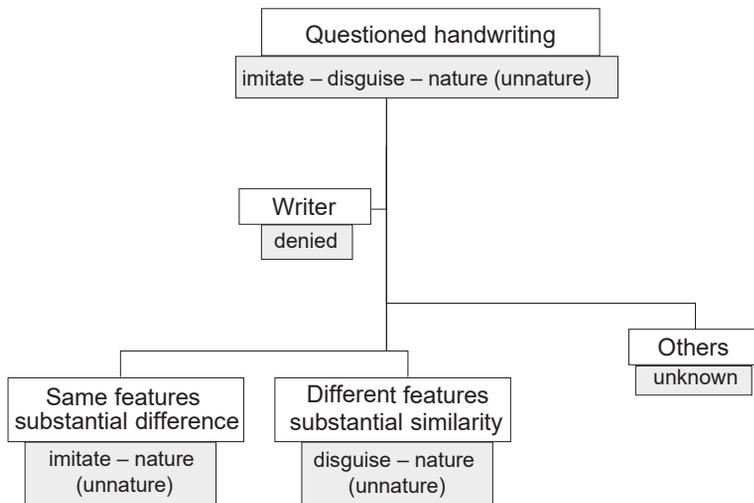


Figure 5

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.

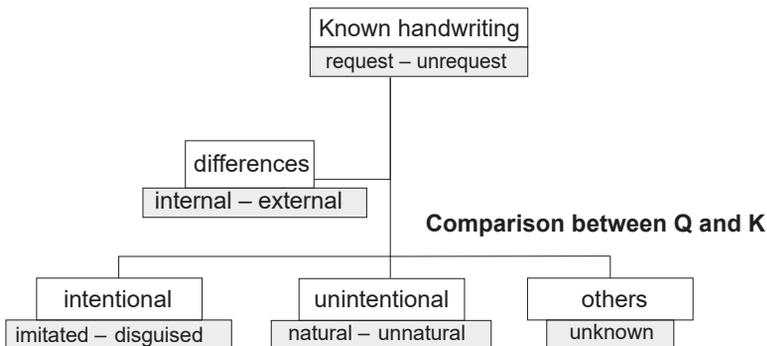


Figure 6

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 than “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).

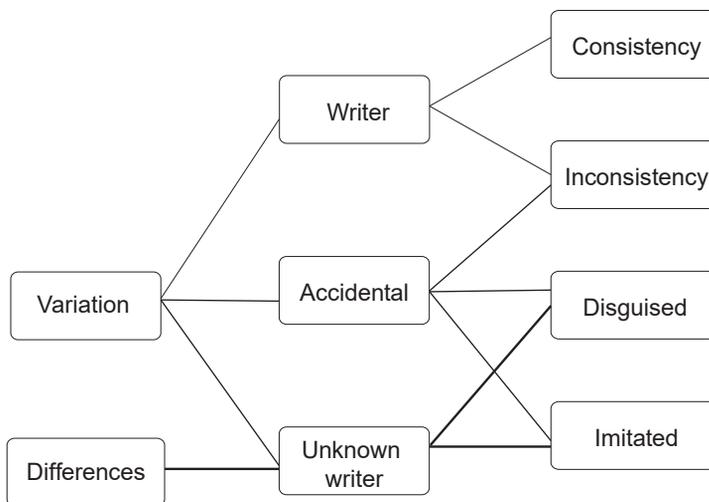


Figure 7

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	<ul style="list-style-type: none"> – 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	<ul style="list-style-type: none"> – 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.		

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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).

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