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КРИМІНАЛІСТИЧНІ ВИДИ СУДОВИХ ЕКСПЕРТИЗ

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PROBLEMS IN COMPARING VERY SIMILAR HANDWRITINGS

In forensic handwriting examination, the examiner is often confronted with extremely similar handwritings. This often results in wrong judgments. This circumstance is to be countered by means of a more specific approach than usual, and, thus, by using comparison methods based on systematic scales of quantified and therefore highly differentiated quality analysis, followed by a systematic numerical approach. Some appropriate instruments have proven to be very useful and convenient in this context so as to achieve scientifically based assessments

Key words: *forensic expert activity, forensic expert, handwriting examination, handwriting comparison.*

1. Introduction

Very similar handwritings are not supposed to occur often in daily life. Yet, they do – and they cause problems. The following samples (Fig. 1 and Fig. 2) were written by two men aged about 35 during a leadership assessment the author had to carry through; the astonishing similarity of the handwritings lead the author to the development evaluation an entirely new concept of psychodynamics shown in the handwriting [8, 9], named later *functional identification*, and newly underload by recent neurophysiological findings [10].

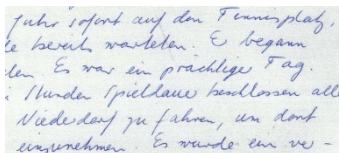


Fig. 1

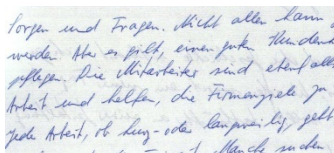


Fig. 2

When these two handwritings were presented at a congress of handwriting experts, a well-known professor berated the author severely and accused her of cheating the audience by showing the same writing twice. To no avail, the author asserted that two different people had written down these texts before her own eyes. The professor insisted that they could only be different texts and not different people.

Nevertheless, in forensic handwriting examination, the examiner is repeatedly confronted with very similar handwritings, and he has to find out if the author is the same or just seems to be the same, thus completing a task of high responsibility. At first glance, this does not seem to be an unusual observation, since – if the writing to be compared is not authentic – it is usually a matter of imitation, and such imitation is naturally executed as similarly as possible to the model.

However, there are writers who by nature have a very similar style to their “model” or can put themselves in the person’s shoes exceptionally well. Indeed, we expect the features assigned to *form* to be the most congruent ones. In consequence, we have to be aware that concentration mainly on specific shapes can be a severe source of errors. In forensics, this often results in wrong judgments. This circumstance is to be countered by means of a more specific and even more objective approach than usual.

In consequence, in all these cases where highly similar handwritings occur, we have to use comparison methods e.g. systematic scales of quantified and thus highly differentiated quality analysis, followed by a systematic numerical approach. Some appropriate instruments have proven to be very useful and convenient in this context so as to achieve scientifically-based assessments. In the following, some related methods will be presented for discussion.

2. Example of two very similar handwritings (case 1): Pablo Picasso (1881-1973) and René Magritte (1898-1967)

As an example of a natural and unintentional similarity, the writings of Picasso and Magritte are cited:

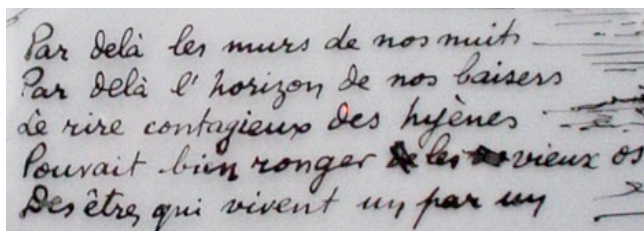


Fig. 3. Pablo Picasso: Letter excerpt in poem form (1936)

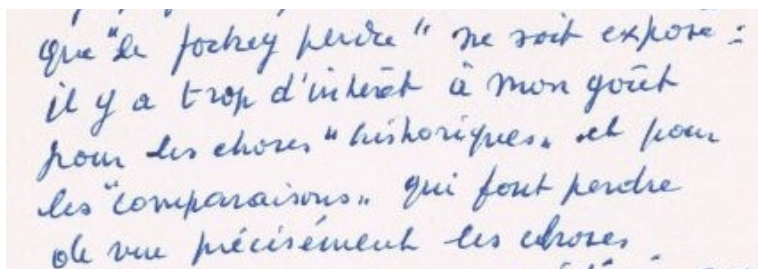


Fig. 4. René Magritte: Letter excerpt

It is indeed not easy to distinguish between two writings that have so many similar forms. In Fig. 5, for example, are highlighted

– In the word **qui**:

right-handed connection in **q** / transition to **u** in a stiffened, arcadian form / actual form of the connection as an angle / next connection as a garland/drop of **i** tends to be shorter / **i**-dot set separately

– In **mains / mais, mot**:

arcade shape of **m** / connection and shaping of the **a**, the **i** and the **s** / raising of the last strokes of the **n** (**mains**) or the **m** (**mains, mot**)

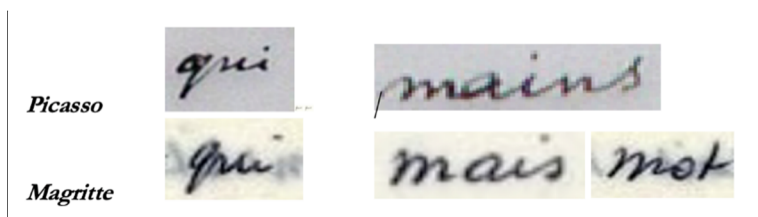


Fig. 5. Examples of similar letters

So, 8 very similar formations are found with only 8 or 10 letters. If the expert, not knowing these well-known authors, did not have further possibilities for comparison, he probably would conclude that it is the same authorship.

3. The necessity of a numerical-systematic examination method

3.1. The numerical-systematic estimation of handwriting features

The need for a systematic registration and collection of data of various kinds is indispensable for scientific methods. In the case of the recording of graphic facts, however, such a method is not yet particularly widespread. In the German-speaking and European countries, comparative handwriting examinations are usually conducted according to the Best Practice Manual ENFSI (European Network of Forensic Science Institutes [1, 2]): This gives a comprehensive description of best practices in this field. A large part of the manual is devoted to the instructions for the technical examination; however, it is often the case that these do not provide any

further insights. Then it is often almost exclusively a matter of identifying graphic facts. In addition to some investigations that can still be classified as technical, the manual also recommended identifying and comparing eleven graphic features in 2018, in 2020 fifteen. However, there is no question of systematic or even numerically scaled recording; nor is a number of eleven or fifteen features sufficient for a differentiated determination of handwriting.

For a systematic determination of graphic features, it makes sense to first classify them according to the five basic dimensions of movement, form, space, pressure, and stroke; most overarching, as well as individual features, can be prevalently assigned to one of the dimensions. This compilation is not always compulsory, as individual characteristics often contain qualities of different basic dimensions, but it allows for better overview; it is presented in Table 1. For the present differentiation chosen for practical purposes (which can of course be broken down further), there are between 6 and 21 characteristics per dimension, a total of 62.

Table 1

Classified characteristics

Picasso/Magritte: Basic Dimensions	Number of recorded characteristics
Movement	11
Shape	15
Space	21
Pressure	6
Stroke	9
Total	62

Not all of them can be recorded in every manuscript, especially in signatures or short texts the number is limited. For numerical recording, each individual feature is classified on a seven-point scale; subsequently, the congruences can be determined numerically from the assessed values. In Table 2, the first exemplary dimension of the movement is broken down into 8 sub-dimensions, all assigned to movement, and both handwritings of Picasso and Magritte are assessed on a seven-point scale from 1 to 7: 1 means a very weak appearance, 4 a medium one, and 7 a very strong one. By doing this, we get two sets of 62 values, one for each of the writings.

By assessing 8 sub-dimensions of the basic dimension of movement along a seven-point scale, table 2 shows 11 deviating points (negative congruence) against 0 congruent points. Over the whole number of the recorded 62 characteristics is found a proportion of **Congruence: Deviation = 9:47**, corresponding to a significance according to X^2 test scarcely as $p^{**} \sim 1\%$, yet per sure as $p^* \leq 5\%$ (Table 3: column 2 & 3; Fig. 6).³

³ Significance of proportion Congr: Dev $\rightarrow p^{**} \sim 1\%$ (according to X^2 test, value: 6.446; critical value: ≥ 6.63)

Table 2

Congruence of signs associated to the basic dimension: movement

Signs associated to movement	Pi-casso	Magritte	Congru-ence positive	Congruence negative / deviation
Strength of impetus	5	4		1
Homogeneity of movement	3	4		1
Tempo	4	5		1
Looseness vs. bond	3	4		1
Leftward/rightward trend: initials	5	2		3
Leftward/rightward trend: endings	3	4		1
Leftward/rightward trend: general	3	5		2
Connectedness: degree	6	5		1
Total: 8 sub-dimensions			0	11

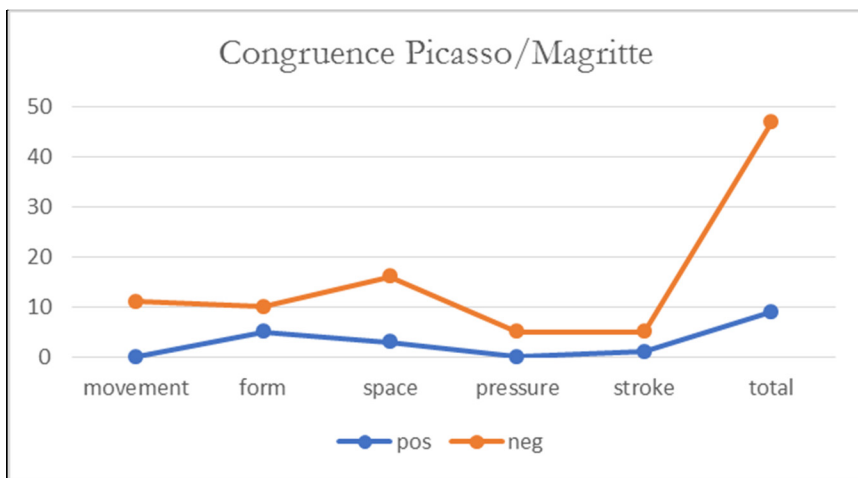


Fig. 6. Congruence between handwritings of Picasso and Magritte

Significance of proportion Congr: Dev → $p \leq 5\%$ (according to X^2 test, value: 6.446; critical value: ≥ 3.84)

3.2. The mitigation of results

Table 3

Congruence and deviation (negative congruence: a
bsolute and weighted values

Picasso/Ma-gritte: Basic Dimen-sions	Congru-ence pos	Congru-ence neg	Congruence pos (weighted)	Congruence neg (weighted)
Movement	0	11	0	5
Shape	5	10	5	4
Space	3	16	3	9.5
Pressure	0	5	0	3
Stroke	1	5	1	5
Total	9	47	9	28

Yet, to avoid too strong deviations, the congruence can also be weighted and weakened according to a certain scheme. This is particularly important in difficult cases: If even the weakened variant still shows clear deviations, the certainty is all the greater.

Deviation weighting: proposition for a mitigating processes scale:

– In order to mitigate the strong potential of a merely arithmetic deviation value, in many cases a deviation weighting is recommended.

– The definition may again be stronger or weaker, depending on the material available as well as on certain quality criteria.

– Definition: Deviation of

- 1 point from medium value → deviation value: 0
- 1 point on same polar side → deviation value: 1
- 2 points in general → deviation value: 1.5
- ≥3 points in general → deviation value: 2

If the difference between the values of congruence and deviation remains significant, the result is even stronger. If the difference between the values of congruence and deviation is no more significant as in the previous example (Table 3, column 5 & 6)⁴, the result may be attenuated; anyway, it may just point to a strong tendency. This indicates that further qualitative investigations are compulsory and shows that the expert never is allowed to rely on one only instrument.

3.3. A case with two possible authors (case 2)

In a case of a questioned testament, two persons were possible writers of the text. In order to find out the correct author, a numerical-systematic estimation of handwriting features was carried through.

⁴ Significance of proportion Congr: Dev → $p \geq 5\%$ (according to X^2 test, value: 2.439; critical value: ≥ 3.84)

Table 4

**Values of congruence (positive & negative) of three handwritings
(X: questioned text; V: author 1; W: author 2)**

Characteristics Weighted	Congr pos X/V	Congr neg X/V	Congr pos X/W	Congr neg X/W	Congr pos V/W	Congr neg V/W
Total	18	56	46	5	13	31
Significance		p*≤ 5%	p**≤ 1%			p≥5%

Table 4 shows a significant deviation between the features of the questioned handwriting and the text of author V as well as highly significant congruence between X and author W. As a kind of background test, the features of the two possible authors were assessed additionally; there is a strong tendency towards, but no significant deviation. Yet, this finding shows that between the authors V and W there is not that much deviation and the investigation the investigation has a valid reason.

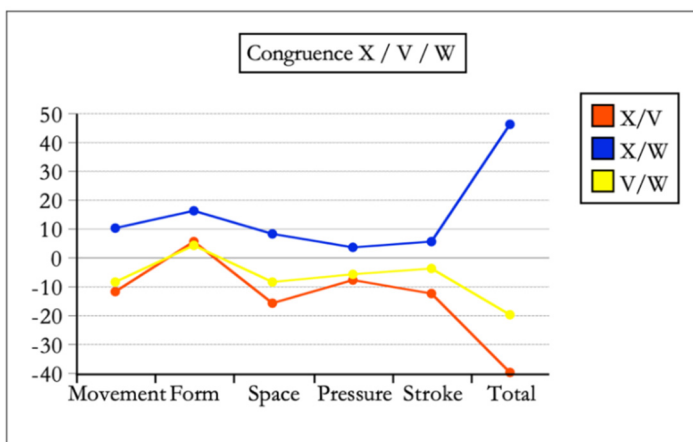


Fig. 7. Summarized positive and negative congruence for basic dimensions, and in total, of the scaled characteristics of three handwritings

In Fig. 7 the summarized positive and negative congruence shows a very clear picture and leads to a very high probability that the questioned testament X was written by author W, and not by author V.

4. Cluster analysis

4.1. The cluster analysis

In certain cases, not only several manuscripts, but several groups of manuscripts are to be compared. Estimating systematically as many handwriting characteristics as possible on a numerical scale as described above, results in a large amount of numerical data that requires special processing. Cluster

analysis allows to classify the data additionally; it is used to uncover similarity structures between graph-theoretically classified groups that have not been pre-assigned and to re-identify them. In the process, the deviations from each other group are estimated on the basis of the graphological variables, and the determined distance between the groups is given: The greater the distance, the further "away" the groups are from each other.

4.2. Exemplifying case 2

In the case of the questioned document in case 2, there were some additional documents Y that could not be, due to the relatively high similarity between the two possible authors, clearly assigned to one of them. The cluster analysis (Fig. 8) yet shows a clear distance of V to all the other writings building one big group. This result reinforces the findings of thy systematic analysis and classifies the writings Y among the group of X and W.

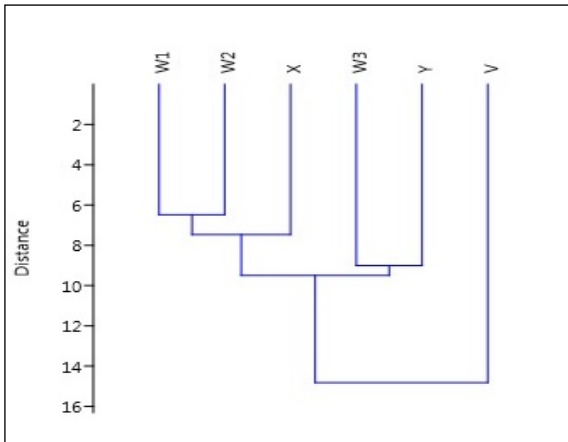


Fig. 8. Cluster analysis for the writings X, V, W1, W2, W3, Y

4.3. Example with different groups of writings (case 3)

In a handwriting comparison case of a questioned letter, there were five distinguishable groups of comparative manuscripts available: two postcards with spontaneous cursive writing (V1, V2), both dated preceding the questioned document; furthermore, the suspected person is asked by the police to produce current handwriting samples, which are written particularly carefully (V3-V5). In the further course he prepares a draft in print (Script, V6), describes the events with handwritten letters to the expert (V7-V9), and submits a note with a short spontaneous note in Script (V10).

Since all these groups of scripts, in a certain way, appeared different from each other, they were divided up as described and each group was systematically classified according to 43 characteristics to be made out on a seven-point scale.

Table 5

Case 3: classification of signs associated with the movement

Example handwriting comparison	X1	V1, V2	V3-V5	V6	V7-V9	V10
Signs associated with the movement						
Movement accentuation	5	5	4	4	4	5
Strength of impetus	5	6	4	5	5	5
Homogeneity of flow	2	6	7	6	7	5
Looseness vs. bond	2	5	6	6	6	5
Tempo: Speed of Stroke	6	5	5	5	5	5
Tempo: Speed of Success	5	6	5	6	6	6
Connectedness: degree	3	3	6	1	6	1
Leftward/rightward trend: general	5	6	5	5	5	5

Table 5 shows the exemplary classification of 8 characteristics associated with the movement as shown in the table, scaled for 6 groups of handwriting: the results leading to a table with 83 values. Accordingly, the four other dimensions were classified.

The systematic classification of all 43 characteristics leads to a table of 258 values worked out in a cluster analysis (Fig. 9). In this case, a clear picture emerges: the questioned handwriting X shows a fairly large distance to all the other writings.

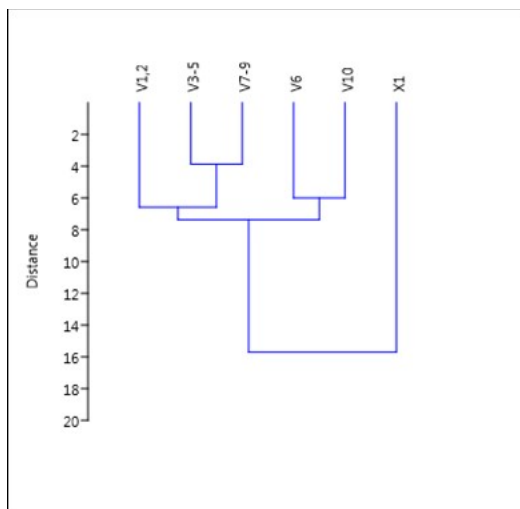


Fig. 9. Cluster analysis for the writings X, V1-2, V3-5, V6, V7-9, V10

The comparative manuscripts, however, even if by only small distance to each other, divide again into two groups: the cursive manuscripts and the "script letter" ones (V6, V10). This corresponds very well to the other findings in this case and shows a clear deviation of the characteristics of the questioned handwriting X.

5. General Discussion

In the comparison of very similar handwritings it is often difficult to obtain a clear result. Of course, a certainty of 100 % is never possible *a priori*, the method always remains in the domain of probability. Nevertheless, there are hardly found authors who suggest a systematic *qua* scientific approach for graphic features even if they do for a physical, chemical, or similar investigation. Yet, a systematic numeric registration and classification as well as its mathematic working up allow a better approach to a higher degree of probability.

The numeric tools presented and proposed should not be considered as solely conclusive evidence in a forensic handwriting analysis any more than any other method. Yet, experts do have to apply and develop as many instruments as possible. Hence, as an extension of the *repertorium* of methods, these instruments can amplify the findings and support the evidence in certain cases.

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ПРОБЛЕМИ У ПОРІВНЯННІ ДУЖЕ СХОЖИХ ПОЧЕРКІВ

Марі Енн Науер

При проведенні судової почеркознавчої експертизи експерту часто доводиться зіштовхуватися з надзвичайно схожими почерками. Це часто призводить до помилкових міркувань. Цій обставині слід протидіяти за допомогою більш конкретного підходу, ніж зазвичай, і, передусім, шляхом використання методів порівняння, що базуються на систематичних шкалах кількісного і, отже, високо-диференційованого аналізу якості з наступним систематичним числовим підходом. Деякі відповідні інструменти виявилися дуже корисними та зручними в цьому контексті для отримання науково обґрунтованих оцінок. У сенсі розширення переліку (repertorium) методів ці інструменти можуть посилити результати та підтвердити докази у певних випадках.

Ключові слова: судово-експертна діяльність, судовий експерт, почеркознавча експертиза, порівняння почерку.