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FORENSIC GRAPHOSCOPY

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Abstract: *As a field of forensic science, graphoscopy studies the legalities of writing and develops methods for examining and identifying the person who forged a document or signature. The identification is made on the basis of an expertise carried out by an expert in the field, ordered by the competent bodies*.

Keywords: *identification, forging, graphoscopy, examination, expertise*

1. Physiological mechanisms of writing

Writing, as a means of fixing and communicating ideas, is a skill, namely an intellectual skill in which various motor acts are involved. The physiological mechanism of skills in general, including the skill of writing, is given by the ensemble of temporary nerve connections (connections between the focuses of excitation) and conditioned reflexes.

According to the Pavlovian theory, at the level of the cerebral cortex, the fundamental nervous processes – excitation and inhibition – are permanently systematized. Due to the phenomenon of excitation irradiation from the weaker focus to the stronger focus and the concentration of the two types of nervous processes, as well as a result of their mutual induction, a phenomenon of stabilization, of strengthening the nerve paths of a certain action takes place. In this way, a dynamic stereotype is formed, that is, en ensemble of temporary links, which manifests itself in the form of stable reactions with a unitary character. The dynamic stereotype is not born all of a sudden, but requires numerous repetitions and exercises, so that with time a process of fixation takes place, and the performance of said action becomes automatic (Ionescu, 2010, p.27).

The principles set forth apply fully to the act of writing. The execution of writing is based on a series of temporary nerve connections produced in the cortex, determined by the perception of words through reading, listening and pronunciation; these links are associated with the movement of the hand that inscribes the graphic signs. For a fair appreciation of the way in which writing is born, the indissoluble link between the oral language and the written language must be taken into account, both of which basically represent two aspects of language. Different systems lead to the same result in the realization of language: the afferent system, composed of auditory, visual, kinaesthetic and tactile analysers, which transmits the nervous influx from the peripheral receptors to the central nervous system, and the efferent system, made up of the organs of

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speech and writing, which carries out the reverse process of transmission of the nervous influx from the centre to the effector organs (Ionescu, 2010, p.28).

The effector organ – the hand, including the arm – is therefore set in motion, led and controlled by the central nervous system, which regulates muscle tone. The main writing movements are flexion, extension, abduction and adduction. Flexion and extension are performed vertically and consist of bringing the writing instrument from top to bottom and bringing it from bottom to top, by squeezing and spreading the fingers, respectively, while abduction and adduction take place in the horizontal plane, by moving the hand from left to right and vice versa, which means a distance and approach to and towards the centre. Straight lines will correspond to these most simple movements, the more complicated rotational movements being obtained by combining the four basic movements. As Dr. H. Callewaert rightly observes, the writing movements are complemented with fluent movements, having the role of ensuring the advancement of the writing on the sheet of paper and are analysed by turning the wrist or the elbow or by small "jumps" of the hand.

In the initial phase of writing, writing is cumbersome; although the signs used as a model are perceived visually, that process of strengthening the execution nerve paths has not yet occurred, the movements have not yet become reflexes and, as such, the hand contracts and encounters great difficulties in reproducing the signs. By continuing the exercises, by learning the simplest shapes (straight and curved lines), then the letters of the alphabet and finally their union into words, we finally reach a gradual "liberation" of the hand and obtain a fluent process of writing. At the same time, the additional, non-functional features, present in the first phase, disappear, leaving only the correct movements from a calligraphic point of view. In a more advanced stage, after a long practice of writing, during which the coordination of movements and at the same time the rhythm increase, the writing shows a tendency to simplify, which represents a refinement of the action that has become automatic (Ionescu, 2010, p.29)

As far as conscious control is concerned, at the beginning the subject's attention is particularly tense, participating in the drawing of each line. During the formation of the dynamic stereotype, and when the crystallization of a balanced system of nervous processes related to the act of writing takes place, attention decreases, but without disappearing altogether. Even in the most advanced writings, where the attention is mainly focused on the content of the text, the exposition, it does not stop supervising the way of execution. A strict automation of the skill of writing cannot be conceived, for example when compared to what happens in walking, where the automation is very strong because it is part of the category of instinctive acts (Constantin Păunescu).

Due to the phenomenon called "reverse afferentation", writing is subject to permanent control by sensory, visual and muscular excitation. Thus, the eye registers the deviation of a writing from the straight line and the writer corrects himself by rectification or the eye perceives that the end of the line is approaching, which determines the change of the course of writing, either by stopping and starting from the beginning, or by cramming the last words. We add that if such a control has more of a subconscious character, in other situations the control is perfectly conscious, for

example when the writer returns to what is written, making touch-ups for a better visibility of the letters (Ionescu, 2010, p. 30).

2. The Individuality of Writing

The strength, balance and mobility of the higher processes of a certain person, to which other factors related to the actual conditions in which the writing takes place are added, give the writing of said individual a series of characteristics that in their grouping are unique, unrepeatable, ensuring the writing the property to be strictly individual. Quantitative features are limited in number. However, as in the case of the details characteristic to a papillary drawing, the quasi-infinite variety of combinations, which they can form, makes a writing with certain particularities practically unrepeatable (Constantin R., Frățilă A., 2018, p.84).

The force is given by the amount of excitable substance with which the nerve cells are endowed, under this aspect strong cells and weak cells being distinguished. The endowment of a person with one of the two types of cells also depends on their ability to respond to a certain effort, tiring to a greater or lesser extent; the phenomenon called "protective inhibition" ensures the defence of nerve cells through exhaustion. Applying it to writing, it can be concluded that precisely the functional capacity of the nerve cells will determine the ease or difficulty of forming the conditioned reflexes that are the basis of the skill of writing, to which the influence exerted on the muscle tone of the hand is added (Ionescu, 2010, p. 31).

The balance consists in the force ratio between the two fundamental processes - excitation and inhibition - a ratio that determines the precision of the temporary bonds formed, the ability to regulate and control the reactions. In the case of an imbalance translated by a lack of control, it will materialize with respect to writing through a series of disorders called „dysgraphia"; however, we note that the reasons for the alteration of the writing capacity are much more numerous and can be related to an organic change of one or many analysers or the functionality of the cerebral cortex due to lack of development (Ionescu, 2010, p.32).

3. The Relative Stability of Writing

By writing stability we mean the constant preservation, throughout life, of the general characteristics and formation of graphisms after they have been consolidated in a person's writing.

Stability must be understood in a relative sense, because it can be changed whenever there are constant changes in the determination of the excitatory system such as to form a new type of temporary nerve connections, a new dynamic stereotype, or just to perfect or weaken the old temporary nerve connections and the dynamic stereotype. This relativity must also be viewed through the lens of the elasticity and mobility of the dynamic stereotype to the actions of internal and external stimuli that are not only manifested during its formation period, but throughout its existence (Constantin R., Frățilă A., 2018, p. 84).

Likewise, these changes caused by the need to adapt the dynamic stereotype to different stimuli should not be confused with the variable writing given by the ability of some people to simultaneously use several variants of writing.

It must be understood that a complete classification of all the modifying causes of writing is practically impossible if we take into account that the external and internal influences on the cortex are among the most varied and complex.

The causes that can induce changes in writing, apart from those determined by the evolution of writing which include changes that occurred after writing was more or less formed, are (Constantin R., Frățilă A., 2018, p.84):

- unusual writing conditions for that person; an unusual posture, writing material which differs from that usually used by the writer;
- traumatizing the hand, pathological changes in the eyes, writing without glasses;
- writing with the left hand when one normally writes with the right hand;
- unusual nervous and physical states of the writer (fear, fatigue)
- nervous diseases;
- the tendency to write in a certain way:
  - carefully or quickly
  - with the distortion or disguise of the writing
  - imitating another person's writing.

4. Changes that can Occur during the Evolution of Writing

In this category we include changes that occurred after the writing was more or less formed, regardless of whether it is of higher or lower quality. Writing skills are continuously improved, but the changes experienced during this process are slower and sometimes imperceptible.

A particularly important factor is the person's concerns, which involve a writing activity. For example, there are differences between the writing of students from the upper secondary education and the writing of the same people after a year or two of higher education. The need to take notes at an accelerated pace and in large quantities determines a simplification of writing: letters often lose their individuality, combine with each other in unique graphic signs, legibility decreases, spaces increase, size decreases, all of which attract a change in the nature of the writing.

Of course, the changes that take place during the evolution of writing require, in the case of investigations for forensic purposes, the use by the expert of some comparison writings performed during the period in which the document in dispute was drawn up. Although this is the rule, we found that in most cases with an evolutionary character, even for longer time intervals, they are not fundamental, which confirms that writing is stable. As a result, in the practice of expertise, in numerous cases it was possible to identify the writer only on the basis of comparative documents much older or, on the contrary, more recent than the disputed document (Ionescu, 2010, p.38).

5. Changes caused by the Writer's Psychosomatic State

If writing is the result of complex nervous processes and of the movement of the arm and hand as an effector organ, the influence that the state of the person's body exerts on the writing performed at a given moment is obvious.

The abnormal physiological state knows an infinite number of stages, ranging from simple disorders caused by cold, fatigue, intellectual overwork, transient nervous states (violent or depressive) and up to serious chronic diseases, with serious repercussions on the whole body. Likewise, old age, frequently associated with morbid, stationary or progressive states, brings a process of disorganization of writing. The age at which this stage is reached varies from one writer to another; thus I met people over 75-80 years old whose writing, reflecting a robust constitution and a perfect preservation of the mental faculties, showed almost no change, the only noticeable sign being a slight zigzagging of the features, almost imperceptible, and sometimes, an increased number of interruptions. Less serious diseases do not lead to fundamental changes in writing; they are reflected more in the general allure of the writing than in the structure of the letters, so that the identification of the writer is perfectly possible, even on the basis of comparative documents made under normal conditions. However, it is not possible to establish a general norm, applicable to all cases, because acute diseases, although transient, present various ways of manifestation depending on the individual reactivity of each person (Ionescu, 2010, p.38).

6. Reconstruction and Reconstitution of Documents

Restoring damaged documents, such as burned or torn ones, is often absolutely necessary to solve a criminal or civil case. Such an activity carried out through procedures specific to the forensic technique is required in circumstances such as the destruction of documents as well as in the case of the reconstitution of judicial documents, according to special criminal and civil procedures, related to cases of disappearance of judicial documents.

By reconstructing the missing documents based on forensic methods, we consider degraded or partially destroyed documents, in other words only those that can be restored.

Restoring torn or cut documents is an operation that is carried out in several stages. First, the pieces of paper picked up from the site are selected according to their general characteristics, such as the nature or quality of the paper and ink, the general characteristics of the writing, by other marks, stamps affixed on the paper.

The actual restoration starts from the corners and edges of the document, continuing with the other fragments, based on the shape of their edges, the direction of the rows, the fold marks, the content or other graphic elements that allow establishing the place, the sequence of the fragments of paper. The pieces of paper are fixed between two glass plates or two transparent plastic covers that are glued on the edges with adhesive tape.

Restoring burnt documents in the sense of establishing their content is a more difficult operation, requiring more laborious procedures and special attention to prevent a final destruction, both on the part of the judicial body and on the part of the forensic expert.

Forensic graphoscopy – field of forensic science that studies the legalities of writing and elaborates the methods of its examination in order to identify the person, by way of expertise. It also deals with the research of the written language in order to use its particularities to determine the author of a text. Forensic graphoscopy should not be confused with graphology, as the latter is a field of study concerned with determining a person's character based on writing.

Documents can be forged totally or partially. They are written on behalf of a public company or institution, an organization or a private person. The person on whose behalf the document is drawn up may exist in reality or be fictitious.

Documents forged entirely by the same person have a unity, both logical and graphic, which is missing in most cases of partial forgeries.

7. The Notion of Forgery and its Forms

The notion of false documents is not specified by a legal definition. The main forms of forgery of documents provided by the criminal code in force are: material forgery of official documents (art. 320 Criminal Code), intellectual forgery (art. 321 Criminal Code) and forgery of privately signed documents (art. 322 Criminal Code).

The legal literature, the jurisprudence has revealed essential elements of the crime of forgery of documents, showing that they present three main characteristics: the alteration of the truth contained in a document, the production or the possibility of producing some legal consequences, committing the crime with intent (Sandu, 1977, p.12).

Forgery of official and unofficial documents consists in falsification by forgery of writing or signature or by altering it in any way, likely to produce legal consequences. The most frequently used are the methods of altering documents through deletions and additions: besides these, the practice of forensic expertise has highlighted a series of methods, such as: modifying some graphic signs by overlapping, hatching certain portions to cover the writing, forgery of writing, signature and stamp impression (Sandu, 1977, p.14).

The scientific foundation of this expertise is determined, first of all, by the changes in structure and composition caused by the action of falsification on the writing and on the material used for writing.

The modification of graphic signs by simple overlapping occurs not only in handwriting, but also in mechanical printing, for example in typewritten writing and automatically or semi-automatically printed numbers.

The document can therefore be modified by hatching or covering with different materials a portion of the writing or only some graphic portions. In this way, one or more words are excluded from the text, the date of the document is altered or the numbers representing sums of money, quantities of goods are modified (Sandu, 1977, p.15).

Forgery can also be committed by completely re-composing a document that does not correspond to reality, the ways of making it being different. In practice, they even occur in cases where the incriminated piece is made up of fragments of two or more real documents.

The creation of a false document can also be achieved by obtaining the authentic signature by surprise (stealing the signature with the help of copy paper) or in another way. But most often, for the creation of a new document, one resorts to forgery of the writing and especially of the signature, which has the appearance that it is the hand of the owner.

- *Forgery by text deletion*

The removal or deletion of text is a method of falsification frequently encountered in practice and it is carried out mechanically or chemically, often followed by the addition of another text, situation in which we are in the presence of a forgery by substitution. Text removal forgery is done by mechanical removal or chemical removal.

The mechanical removal is done by scraping the text with a blade, knife, tip of a needle, as well as some abrasive substances sprayed in a fine layer on the surface of the paper, after which the place to be erased is gently rubbed. In general, forgery by scraping is limited to the removal of a small number of digits, letters or other signs, usually applied to documents written with ink, paste, or typed (Stancu, 1986, p.307).

The mechanical removal is also achieved by erasing the text with an eraser, with breadcrumbs, the erased portion thus becoming more matte, without gloss, scaly and thinner as compared to the erased areas (Stancu, 1986, p.307).

Chemical removal involves corroding or washing a text with certain chemical substances, in whole or only partially, resulting in its discoloration and, sometimes, even the definitive removal of the text. Corrosion is the removal of text by using various chemical reagents, it discolours the writing, turning the ink into a weakly coloured or even colourless composition. Usually, dilute acids and alkaline substances that have a basic reaction in solution are used for this purpose (Stancu, 1986, p.308). Washing, also carried out by means of chemical reagents, especially organic solvents, discolours the writing and even dissolves it many times, disappearing completely.

The corroded and washed documents are examined under ultraviolet rays, under a microscope and by means of chemical reagents, in order to detect the forgery and especially to highlight the altered writing.

- *Forgery by covering a text*

Forgery by covering a text is done by hatching in the same substance as the writing, or stains of ink or another substance are placed over the writing. In the event that the stain cannot be removed without damaging the paper and the writing in the covered region, photographing the document on the back with transparent light or colour filters is the appropriate course of action. One can also resort to photographing the writing covered with infrared radiation.

A problem which is somewhat related to forgery by covering a text is writing with invisible inks. The expert identification of these writings by covering is carried out by laboratory, physical and chemical means. First, the methods that do not in any way affect the integrity of the document are applied, and then those that partially modify its

initial appearance, but which at the same time highlight the latent writing, invisible to the naked eye.

- *Forgery by text addition*

Forgery by text addition consists of adding some signs or words to the existing text, it is usually specific to partial forgeries. Such an addition changes the initial meaning of the content of the document, as happens in the case of changing words from masculine to feminine, from singular to plural by just one letter. Sometimes, even more simply, the meaning of a sentence is changed by a single comma. The added text is discovered using the criterion of logical inclusion in the contents of the document according to the way of ordering and development of the writing. Specific to the added writing are the unusual abbreviations of some words, the crowding of letters or numbers, the different orientation of the lines, as well as numerous detailed elements of the two writings, if the forgery was committed by someone other than the author of the authentic text.

In typed documents, the added signs have a deviated position from the original text, they are higher or lower than the horizontal writing. Also, the step between the immediately adjacent signs of the two writings differs in size, being smaller or larger both compared to the size of the distances between the signs of the original writing, and the size of the distances between the signs of the added writing.

- *Forgery by falsification of the writing*

Forgery by falsification of the writing has two forms: copying and imitation. Copying is performed by reproducing the writing or signature of another person in transparency, using tracing paper, copy paper or the usual one. The text copied in this way has the following characteristic elements: interruptions in the fluency of the writing, touch-ups, repetitions, tremors, uniform pressure and the same dimensions as the copied writing.

Imitation is done based on an original writing or from memory. In what concerns the original writing, the imitation is done with the authentic model in front, while the one from memory is based on a prior exercise.

Among the „missing" features, we can mention the connecting features of the letters, the base line of the letters and numbers, the endings, etc.

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