

Research on short manuscripts made by the elderly and old age people

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^a Methodology, Conceptualization, Writing — original draft.

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The purpose of this research paper is to generalize and systematize forensic expert experience (as theoretical knowledge as research practice) and the scientific basis for research on of short manuscripts made by elderly and old age people of obtained experimental data; to give regularities of handwriting and to explain the nature of occurrence of diagnostic signs; develop recommendations for forensic handwriting analyses and determine the procedure structure (algorithm of forensic expert actions) to solve identification and diagnostic tasks; collect information about the identification value and the possibility of differentiation of the mentioned signs. Forensic expert practice requires qualitative specific criteria that would unequivocally confirm relative stability of signs in short manuscripts made by elderly and old age people. Thereby this issue is given special attention.

Thanks to the research carried out during 2019—2021 at NSC «Hon. Prof. M. S. Bokarius FSI» experimental research and generalization of expert practice developed a technique for handwriting research of short handwritten records made by elderly and old age people that allows solving identification and diagnostic tasks to establish the performer (performers) of such records and the

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conditions for their implementation; a detailed algorithm of actions of the expert in the process of solving this issue is given.

The technique is based on a two-level principle, the essence of which is that the expert conducts the research not just in stages, but performs it cyclically, that is, with a different degree of depth and approximation to the final solution at different levels.

Keywords: *handwriting; short handwritten records; elderly and old age people; diagnostics; writing and motor skills; age-related changes in the body; morbidity; coordination of movements.*

Research Problem Formulation

Recently, short handwritten notes made by elderly and old age people have become more and more common objects of forensic handwriting analysis. The lack of uniform methodological approaches to the identification research on these handwriting implementations causes certain difficulties in the work of handwriting experts. This is due to peculiarity of separate and comparative researches including nature explanation of the occurrence of diagnostic signs in short manuscripts made by elderly and old age people and determine the frequency of their detection. The latter makes it possible to identify the most persistent traits that are rare or only in certain variants, as well as chains of sequentially dependent individual traits.

Specificity of the forensic research on short manuscripts made by elderly and old age people is that due to natural physiological aging of the body, signs of handwriting change. Over time, handwriting degradation also occurs due to little writing practice, especially when a person has stopped actively writing at the stage of handwriting automatism. Therefore, while examining short

manuscripts made by elderly and old age people, forensic experts face significant difficulties in identifying handwriting signs and assessing their significance, finding out the causes of discrepancies and determining their significance.

Analysis of Essential Researches and Publications

Psychiatric, medical and forensic literature contains a lot of data on the degree and nature of motor function disorders in the elderly and seniors due to the disease state of the body, as well as on the possibilities and limits of stabilizing this process in some chronic and non-chronic diseases. This suggests a possible persistence of changes in handwriting signs (due to impaired motor functions) for some time, which can be used to perform identification studies.

Among the scientific works devoted to the study of handwritten texts performed by elderly and seniors, it is worth mentioning the works of such scientists as: A. H. Birshenker, A. Erlenmeier, M. M. Manaseina, B. V. Pavlov, O. U. Zitser, O. R. Luriia, Ye. K. Sepp, V. V. Tomilin, T. O. Chepulchenko, V. V. Lypovskyi, M. Ye. Bondar¹.

1 Биршенкер А. Г. Расстройство сочетательных движений при письме. *Военно-медицинский журнал*. Санкт-Петербург, 1871 ; Erlenmeyer A. Die Schrift: Grundzüge ihrer Physiologie

Article Purpose

The purpose of this research paper is to generalize and systematize forensic expert experience (as theoretical knowledge as research practice) and the scientific basis for research on short manuscripts made by elderly and old age people of obtained experimental data; to give regularities of handwriting and to explain the nature of occurrence of diagnostic signs; develop recommendations for forensic handwriting analyses and determine the procedure structure (algorithm of forensic expert actions) to solve identification and diagnostic tasks; collect information about the identification value and the possibility of differentiation of the mentioned signs. Forensic expert practice requires qualitative specific criteria that would unequivocally confirm relative stability of signs in short manuscripts made by elderly and old age people. Thereby this issue is given special attention.

Main Content Presentation

Formed as a result of special training and practice of writing based on subjective adaptation to a variety of external and internal conditions, the writing and motor skill (or functional-motor skill) acquires its own features in the person who writes. In other words, the handwriting of any person, no matter at what age they write, is individual and different from the handwriting of the rest of the person. Thus, the performers of short handwritten records made by elderly and old age people can be identified.

Professionals of NSC «Hon. Prof. M. S. Bokarius FSI» during 2019-2021² experimentally studied handwriting in short manuscripts made by elderly and old age people. Obtained data allowed to draw certain conclusions about the identification value and the possibility of differentiation of features characteristic of the handwriting of elderly and senile and handwriting performed by imitation.

und Pathologie. Stuttgart : Adolf Bonz & Co., 1879. 72 с. ; Манасейна М. М. О письме вообще, о зеркальном письме в частности и о роли обоих полушарий большого мозга. Санкт-Петербург, 1883 ; Павлов Б. В. Нарушения чтения и письма при проникающих черепно-мозговых травмах военного времени и динамика их восстановления. *Рефераты работ учреждений Отделения биологических наук Академии наук СССР за 1941—1943 гг.* Москва ; Ленинград, 1945. С. 376—377 ; Зицер Е. У. Наиболее устойчивые признаки почерка. *Проблемы криминалистики.* Москва, 1947. С. 31—37 ; Лурия А. Р. Очерки психофизиологии письма. Москва, 1950. 352 с. ; Сепп Е. К. О локализации функций в коре головного мозга. *Журнал невропатологии и психиатрии имени С. С. Корсакова.* 1955. Т. 55. Вып. 12. С. 881—889 ; Томили В. В. Об естественном изменении признаков почерка на протяжении жизни человека : мат-лы 3-го Всесоюз. совещ. суд.-мед. эксперт. и 3-й Всесоюз. конф. науч. общ. судеб. мед. и криминалист. Рига, 1957 ; Чепульченко Т. А. Криминалистическое исследование рукописных текстов, выполненных лицами пожилого и старческого возраста. *Современное состояние почерковедческой экспертизы.* Москва, 1981. С. 112—114 ; Липовский В. В. Криминалистическое исследование подписей, выполненных от имени лиц пожилого и старческого возраста : метод. пособ. для экспертов. Москва, 1983. 64 с. ; Бондар М. Є. Встановлення характеру збиваючих факторів при дослідженні підписів, що виконані з порушенням координації рухів : метод. рек. Київ, 2001. 36 с.

- 2 Розробка методики почеркознавчого дослідження коротких рукописних записів, виконаних особами похилого й старечого віку : звіт НДР (заключ.) / МЮУ ; ННЦ ІСЕ ; кер. Д. І. Гайдамакіна ; викон.: О. М. Смоліна, О. С. Дробишева та ін. Харків, 2021. 164 с.

Experiment involved 35 elderly people (60-75 years old) and 35 old age people (75-90 years old), whose handwriting was characterized by high, medium and low levels of production, simple, simplified and complex structure. The research took place in three stages. The first stage was selection of free handwriting samples for the elderly and old age people. In the second stage, the same persons provided experimental handwriting samples in the form of short handwritten notes to the usual writing instruments, usual hand for writing, in usual conditions (sitting at a table, in natural light, if necessary, in glasses). In the third stage, 30 outsiders made short handwritten notes, following the handwriting of the elderly and old age people. Stability of handwriting in the conditions of natural physiological aging (in the lack or existence of certain diseases that impair motor functions) was studied by professionals on free and experimental samples of handwriting of the elderly and old age people.

In addition, the identification value of the features was studied, summarizing more than 50 expert proceedings³. The results of the experiment were processed, using knowledge about the basis of the structure of written signs, the frequency of repetition of a particular sign, variability and stability of handwriting of the elderly and elderly. The researchers aimed to develop (on the basis of the obtained experimental data and the analysis of expert practice) recommendations for conducting examinations on the study of short handwritten records made by such persons, and as a final result is a methodology for studying handwritten records made by these persons.

Generalization of expert practice and experimental array made possible to distinguish informative general and

individual signs of handwriting that help to differentiate the handwriting of elderly and old age people.

Informative general and individual signs of handwriting

1. *Coordination of movements* is a sign of handwriting reflecting consistency (accuracy) of the performer movements, depending on the formation degree of writing and motor skills, as well as conditions of handwriting objects. Each muscle participates in the overall movement with a certain force and begins to act at a certain time. The sequence (coordination) of actions in which a particular muscle is involved, due to the work of the musculoskeletal system of the cerebral cortex, subcortical nodes and brain stem. Coordination requires accurate signals from the periphery about the position of body parts every second, the speed of movements that occur, and the strength of resistance to these movements. These signals come from sensitivity receptors. Coordination of movements of the 1st group testifies to accuracy of observance of parameters of small movements (elements of letters, separate strokes executed by bending and extensor movements). Coordination of movements of the 2nd group ensures the accuracy of the parameters of large movements: inclination, size, mutual vertical and horizontal placement of written signs and their elements. In the absence or lack of accuracy of signals from the receptors *ataxia* (impaired coordination) occurs. Handwriting of the elderly and old age is characterized by decreased coordination of movements. Atactic handwriting is characterized by the lack of straight long strokes, they seem to be broken in some places, the same evils are observed in curvilinear strokes (ovals, semi-ovals).

3 Archives of KhRIFE during 2015–2019.

Atactic handwriting is characterized by the wrong shape of the letters, their erratic tilt, size and acceleration, too long strokes, which makes such handwriting indistinct and difficult to read. Decreased coordination of movements of the 1st group is manifested in tortuous shape of the strokes, repeated awkwardness, angularity and fractures of strokes, inaccurate beginnings and endings of movements. Tortuosity of the shape of movements can be large and small and is characterized by inaccuracy in execution of rectilinear, arc, oval, semi-oval and connecting elements. It characterizes the system of movements in handwriting and acquires relative constancy. (Fig. 1).

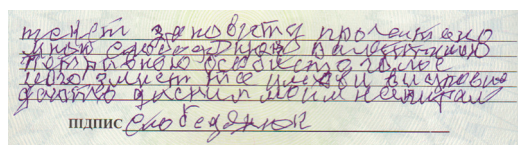


Fig. 1

Reduced coordination of movements of the 2nd group is manifested in the disproportionate parameters of large movements: uneven size, acceleration, placement and unstable inclination of written signs. In the handwriting of the elderly and senile there is often a decrease in coordination of movements of the 2nd group. Tortuosity of the strokes is due to trembling of the fingers, i.e. involuntary movements that disrupt the smoothness of the strokes by rhythmic oscillations due to the alternating contraction of a certain muscle circle. Tremor begins to manifest early in the handwriting. Due to small tremors of the hand during writing, the handwriting becomes shaky, i.e. straight strokes, especially deflection and drive, become tortuous. The handwriting in this case mostly remains clear, legible, but in some cases (due to severe shaking

of the hand) it can become difficult to read. Trembling of the hand and (as a consequence) tortuosity of the strokes during writing can sometimes also cause physiological reasons strong excitement and so on. Repeated angularity (as an integral part of the coordination of movements) is most evident in the fact that when performing elements of letters and their connections, loop and arc forms of movements give way to rectilinear-angular with a change in direction. Angularity is most often detected while performing lowercase letters (Fig. 2).

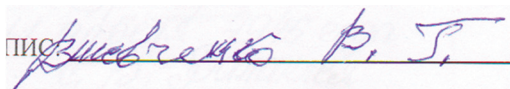


Fig. 2

2. Writing pace is a sign of handwriting reflecting the manuscript speed. Handwriting of the elderly and senile is characterized by the usual pace of writing, namely: a) slow: blunt beginning and end of strokes, often simple letter structure, low coherence or lack thereof (interval execution or execution of written signs and their elements movements that adjacent); b) medium: correct execution of arc elements, average connectivity, differentiated pressure; c) fast: significant connectivity, differentiated pressure, thinning of strokes in the initial and final parts of the elements, various simplifications. Handwriting of this category of people is also characterized by an unusually fast pace (manifested in the simplification of written signs, loss of their elements, omission of words, omission of words in words, shortening words, increasing coherence and acceleration) is often combined with decreased coordination. For imitating handwriting of old age people is characterized by an unusual slow pace, which is manifested in the fragmentary execution of written

signs and their elements, existence of blunt beginnings and endings of strokes, their thickening, unwarranted stops of the writing instrument, undifferentiated pressing; often combined with a decrease in coordination of movements of the 1st group under influence of confounding factors.

3. *Handwriting structure* reflects the degree of complexity of movements, which is associated with the tendency to form a very fast, rather fast and clear writing. The handwriting of the elderly and the elderly is characterized by a simple or simplified structure of movements while execution of letters. In general, it corresponds to worksheets. handwriting of elderly and old age people is unequal, indelible. Sometimes capital letters are executed as small letters.

4. *Pressing* displays the total intensity and distribution of effort on the writing instrument. Pressure elderly and old age people is usually standard differentiated and uneven: from weak in the initial part of the word to strong in the final part.

5. *Inclination* (position of the longitudinal axes of written signs and their elements) is divided into: right, left, no inclination (the position of the longitudinal axes is close to the vertical). Elderly and old age persons are characterized by an unstable inclination that is determined by the angle between the main strokes and writing line or the blank line, if the performer adheres to this blank line during writing. Unstable slope is detected in uneven deviation of letters and strokes from the conditional vertical straight line. With a left-hand slope, the main strokes are tilted to the left, the angle of inclination fluctuates (most often from 95° to 105°). The inclination angle of the main strokes in the right-hand handwriting is 70–80°, in the vertical one — 85–95°.

6. *Acceleration* is the length ratio of movements horizontally (the distance between the main elements of written signs and between them) and the length of movements vertically; elderly and old age people acceleration is usually unstable and characterized by a different ratio between the height and width of letters and strokes. Very often it increases at the end of the word.

7. *Connectivity of movements* is the degree of continuity of writing during the execution of letters within one word; it is determined by the number of letters executed in a solid manner, and is divided into: solid, large, medium, small, lack of connectivity (all letters are executed separately). In the handwriting of elderly and old age people, connectivity of letters and strokes is usually small or absent — there are fragmentary movements while execution of letters and their elements. Such execution of letter elements involves writing in separate movements (Fig. 3).



Fig. 3

8. *Content organization of writing* — availability of outline, new letters, omission of letters, repetition (perseveration). The outline, that is, the imposition of one stroke on another on an already executed letter or its element in order to repeat their general configuration is found in manuscripts of elderly and old age people during execution of individual elements of the letters or the letter as a whole. Execution of new letters and corrections involve making certain corrections in the record by crossing out previously executed signs and executing new ones (Fig. 4).

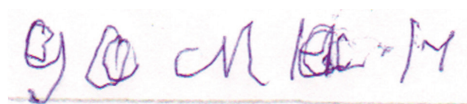


Fig. 4

9. Signs reflecting the *structural characteristics of movements*:

- predominant form of movements is determined by the degree and nature of participation of different groups of muscles involved in writing. In the elderly and the elderly, curvature or a mixed form of movements is observed in the handwriting in general. Angularity is characterized by clumsy movements devoid of smoothness, by direction of movements changes dramatically while execution of elements of letters. Handwriting becomes fuzzy;
- preferred direction of movements is raised with respect to the blank line; a rectilinear horizontal direction is encountered. It is possible to observe the bends of the lines, where the lines are most often concave with respect to the blank line (less often – convex). The bending of the lines is almost always uneven and is clearly detected at the end of the lines.

Furthermore, elderly and old age people have fragments in the text that differ among themselves in general terms that implies instability in connection, size, acceleration and other signs during part of the study record. Fragments of a word record may differ from each other or in several of the above features. For example, the presence of a small overclock at the beginning of the recording and an increased overclock at the end of a sentence or phrase. This signs does not depend on the recording rate (Fig. 5, 6).

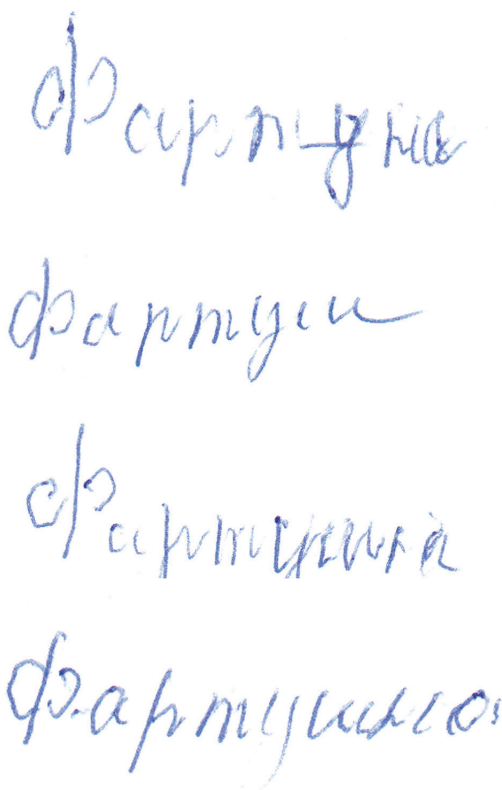


Fig. 5

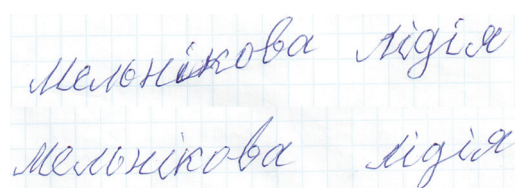


Fig. 6

These general signs can be found in the handwriting in general, in the group of letters and in individual letters and strokes. At the stage of a separate research, forensic expert studies handwriting of short handwritten records in order to identify informative signs in it that indicate the performance of short handwritten records by an elderly person.

Data generalization obtained while experiment and the analysis of expert practice indicate the following.

Firstly, in the elderly and senile signs of impaired coordination in the form of broken strokes are found at the beginning of the word more often than at the end.

This is especially noticeable in words performed with continuous movements. This is due to the fact that the elderly and old age people experience some difficulties at the beginning of the recording, but then these difficulties are reduced due to the dynamic stereotype.

Secondly, there is a lack of stability and stability in the placement of stroke breaks (as a violation of coordination). In other words, fractures are not always and not necessarily in the same place. It depends on the condition of the person who writes and the conditions of the recordings.

Thirdly, there is a dependence of the appearance of fractures in the strokes on future change of direction of movement, due to the difficulties that arise in the person writing, due to the change of direction due to loss of coordination.

Fourthly, there is a dependence of the appearance of signs of senile handwriting on the presence of a connection with the following strokes. In the absence of such connections in the final and initial strokes of the letters, these signs appear more often.

Fifth, the most common signs of incoordination are observed in those parts of the letter elements that are performed by extensor movements. The main sign of impaired coordination of movements in the handwriting of the elderly and senile, associated with age-related changes in the body; availability of fractures in handwriting elements (Fig. 7).

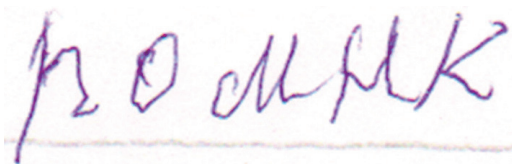


Fig. 7

Signs of decreased coordination of movements were found primarily in places of change in the direction of movement, as well as in areas of oval elements of letters or elements made by extensor or drive movements. With further intensification of beating factors caused by aging or the appearance of diseases that affect motor functions, signs of incoordination may be found in areas of letter elements or elements in general, performed by bending or deflection movements. However, in all cases, even with a significant destruction of the dynamic stereotype of handwriting, these features are mainly localized in the elements performed by extensor and drive movements. Therefore while solving identification and diagnostic tasks, forensic expert should carefully analyze studied handwriting in order to determine nature and predominant localization of signs of impaired coordination. Then it is necessary to analyze nature and predominant localization of these signs and determine whether it is characteristic of the elderly and old age people with motor impairments. In addition, it is necessary to distinguish between signs of impaired coordination of movements that occurred in the case of handwriting imitation of elderly and old age people and signs of impaired coordination, characteristic of the handwriting of these persons. In this case, in addition to data on nature and predominant localization of signs of impaired coordination, you must also take into account: 1) stability

lack in placement of such signs in the real handwriting. They can be in a particular element (area), but not necessarily in one place. Usually such signs are observed in the same place, especially while their performing with imitation; 2) lack of these short handwritten records of unreasonable stops of writing instrument in places of change of direction; 3) existence of more significant detection of signs of impaired coordination in initial part of the records. In this case, often, especially if they are performed in a state of significant physical weakness, in this part of the records there are a number of unreasonable strokes of different sizes and directions, unrelated. In addition, there is often increased detection of signs of impaired coordination in the final part of the recording that is associated with fatigue. In forged handwriting, due to availability of handwriting samples made by the person in a seriously ill condition, impaired coordination signs of movements are placed evenly throughout the record. In addition, they do not have unreasonable strokes in the initial part of recording that indicates a difficult *start reflex* of the inclusion of a dynamic stereotype of handwriting of elderly and old age people; 4) detection dependence of signs of impaired coordination of movements on the presence or absence of coherence of movements with the following strokes. In absence of such connections in the final and initial strokes of the letters, these symptoms occur more often. Elderly and old age people for some diseases (cerebrovascular disorders, tremor paralysis, myocardial infarction) can be observed diagnostic signs: *agraphia*; complete or partial loss of ability to write (*agraphia* can be expressed in different ways from inability to write only some letters and words to the complete loss of ability to perform words completely with ability preservation to perform only

individual letters and strokes, in some cases the preservation of the ability to perform letters lost the ability to connect them or preserved ability to spell correctly or replaced by a meaningless combination of letters or individual strokes), *paragraphia* of individual letters, syllables or whole words (in this case, elderly and old age people change places not only letters and syllables in one word but in different words (usually neighboring): for example, to write one word after another “e.g. written and “read ”they can write “read” and “prescribed”).

The sophistication of writing is manifested in the use of excessively refined forms of writing while writing. In ataxia, an elderly and old age person cannot accurately draw a perfectly straight line that violates the relationship between the individual strokes in the letter and between the letters in the word. Ataxic handwriting is characterized by the absence of straight long strokes, they seem to be broken in several places, the same fractures are observed in curvilinear strokes (ovals, hemispheres). The lines directed downwards are especially vigorous at ataxias. They reflect the degree of effort a person makes to avoid the wrong direction of the line and increase the pressure on the writing device to make up for the lack of sensation of movement. In general, ataxic handwriting is characterized by irregular letter shape, inconsistent tilt, size and acceleration, too long strokes that makes handwriting indistinct and difficult to read. In some cases, ataxia significantly distorts the symptoms that cannot only complicate the identification of the person, but also make it completely impossible. Tortuosity of the strokes while writing also occurs as a result of tremor, i.e. involuntary movements that disrupt the fluency of writing. While the left hemisphere of the brain is affected, various forms of aphasia

occur, i.e. ability to speak and write is impaired (at the same time there is no damage to the musculoskeletal system involved in writing).

There are three main forms of *aphasia*: sensory, amnesic and motor. *Sensory aphasia* retains only the ability to write under dictation and write without understanding what is being dictated or written down. In this case, the patient writes curls that remotely resemble letters or have no resemblance to them at all. In *amnesic* form of *aphasia*, the patient forgets the names of objects while writing. However, if the patient remembers a word, he will write it correctly. *Agraphia* and *paragraphia* can occur. Characteristic of handwriting is the frequent deletion of written words and letters due to the uncertainty of the person writing, in the correctness of their spelling. Lesions of the frontal lobe of the brain are usually accompanied by motor *aphasia*, *agraphia*, *apraxia* (loss of ability to use letters correctly), *deautomatization* of movements while writing, especially precise hand movements. There are repetitions of the same letters several times in a row (perseveration), omissions of letters, the transformation of complex words into one or two elements. Occasionally there is a lack of words. Occipital and occipital parietal areas of the brain are affected by optical *agraphia*, amnesic *aphasia*, and *apraxia*. Optical *agraphia* is characterized by distortion of the drawing of written signs with the tendency of the mirror image due to the violation of the correct perception of space, their size and shape. Characteristic in such cases is the uneven size of the letters, awkwardness, unstable direction of the line due to insufficient spatial orientation of movements. Such writing is characterized by *deautomatization* of movements, a mirror image of letters or their individual elements and gives the

impression of writing performed by an unusual (left) hand. In some cases, there is a replacement of one letter with another that was in the previous word. There is no correspondence and clarity of movements, execution of variable movements directly opposite in the direction is disturbed which is expressed in the fact that alternation of such movements is slowed down, and the volume of the movements themselves is increased.

Trembling paralysis (Parkinson's disease) is a disease of the elderly and senile. It is characterized by tremor and general stiffness. It usually begins at the age of 50-60. Trembling is most pronounced in the hands. The handwriting of patients is significantly disturbed. As the letters are written, their size decreases (*micrography*), the strokes appear tortuous, and the act of writing slows down considerably. *Micrography* is a characteristic feature of tremor paralysis. At a strong tremor patients keep a habitual hand unusual, try to find a convenient pose. In such handwriting there is a tortuosity of strokes and incoordination (*ataxia*). The writing of elderly and old age people with limited visual control has some signs, because their field of vision is narrowed. In such cases, the presence of a blind spot is of great importance. A person with limited visual control is unable to observe a line in writing in a large area and sees only a certain part of it at any given moment. Therefore, person writing cannot place the lines correctly, i.e. perpendicular to the side edges of the paper and parallel to each other: they are crooked and oblique. The handwriting of such people is usually coherent, because in the process of writing they are afraid of losing the direction of the line and try to tear the writing instrument off the paper as rarely as possible. Gaps between words are often uneven, as such individuals do not calculate their movements along the line.

Due to the lack of binocular vision in such people, it is difficult for them to calculate the distance from the eye to the object and, making corrections and additions, they make extra strokes, make strong pressure. Elderly and old age people who have lost their sight for a long time place lines and words better than people who have recently lost their sight. Obtained data while analyzing expert practice and experimental research on the handwriting of the elderly and old age people indicate that in substantiating conclusions, forensic experts often note the convergence of the same common signs: pace, size, slope, acceleration and connection elements, direction record. At the same time, there are peculiarities in the detection nature of common signs indicating the procedure of breaking the dynamic stereotype in old age, due to influence of changes in the body. In most cases, experts cite general evidence in support of their conclusions, which indicates a decrease in the degree of coordination of movements (slow pace, low coherence degree, etc.). Given the gap in time between the execution of studied manuscripts and samples, forensic experts often note discrepancy of some common signs. These include: omission of letters, tilt of the elements (detection of instability), increase in size, the degree of coordination of movements (decrease), pace of execution (deacceleration). Forensic experts assess these signs as uncharacteristic, detection is explained by unusual conditions of recording, unusual (painful) condition of the person writing, or age-related changes in the body. Categorical positive conclusion of the forensic handwriting expert is caused not by quantity and not quality of signs and set of such signs. Criteria of quantity and quality are of great importance for determining existence or lack of a set of characteristics.

The study of expert practice and experimental array shows difficulty of solving handwriting problems to identify the executor of the studied short manuscripts made by the elderly and old age people. Over the last 10 years, forensic experts have provided both categorical (positive or negative) conclusions about identity and plausible conclusions. Part of the research was completed by providing an opinion in the form of “not possible”. For some reason, it was also reported that it was impossible to draw conclusions. Due to incompleteness of conclusions of previous examinations, re-examinations were often appointed. Most often, forensic experts found primarily diagnostic signs, in addition, the degree and nature of detection of these signs testified to implementation of studied manuscripts under influence of beating factors or altered movements, simulating old age people handwriting. The form of conclusions (their categoricalness) was influenced by such factors as complexity of studied objects, availability of diagnostic signs, performance of movements of simple structure and the limited amount of graphic material. Significant were the quantity and quality of comparative material provided for research, difficulty of obtaining it by the person who appointed handwriting examination, and this made it difficult to assess the handwriting expert identified diagnostic, convergent and divergent general and individual features, prevented tracking variability and stability of handwriting.

The result of performed work is a method of handwriting research on short handwritten records made by elderly and old age people. Methods are structured according to a two-level principle which essence is that research is carried out not only in stages, but performed cyclically, that is, with varying degrees of depth and

approximation to the final solution at different levels. Each level, each stage, each research stage ends with the formation of intermediate conclusions which evaluation takes place taking into account all previously obtained research results. Intermediate solutions form a logical sequence that leads to final conclusion? namely: forensic task solution. Gaps in this sequence, internal contradictions of intermediate conclusions, if they occur, should be the subject of special forensic analysis: if the expert does not solve issues in the intermediate stages, he will not be able to reach a final conclusion. The *first level* contains preliminary research, that culminates in nomination of general and individual expert versions and planning further research. The *second level* is a detailed complete research of handwriting objects with the final issue solution. In the structure of solving a diagnostic issue, three stages are distinguished: preparatory, identification and diagnostic one, which are also combined with two levels⁴. The *first level* (preliminary research) involves an initial, approximate approach to the solution of the main task. Within its framework, forensic expert works at the following stages: familiarization with all the materials provided, review (preliminary analysis) of the object under research, review of comparative material, preliminary comparative research, evaluation of the results of preliminary comparison and nomination of expert versions, planning of future expert actions. With the help of this level, forensic expert forms an idea of the main task elements, the degree of its complexity, possibility and direction of solution. Professional solves the identification and diagnostic subtask. The first level allows forensic expert to see the main thing in a limited

time, get an idea of the expert situation, to bring the final result of the task closer, plan a methodically correct approach to its solution or to substantiate the opinion about the impossibility of such a solution. At this level, the expert decides on the transition to the second level of research or makes a request to the person (body) who has appointed an examination to provide the comparative material or additional information necessary for research. To the second level of handwriting research, the expert approaches with varying degrees of probability of solving an integration problem, with sufficient information about the executor of the studied handwritten records, with a sufficient amount of comparative material. The second level is a detailed comparative research. Preliminary integration results obtained by forensic expert at the first level are deepened, comprehensively evaluated that helps to establish objective information necessary to formulate a reasonable and reliable conclusion.

The *second level* consists of two stages: 1) identification and 2) diagnostic one. This level is the main one in the diagnostic process. At the second level, forensic expert reworks all the above subtasks. In addition, the first diagnostic subtask (if there are pronounced diagnostic signs in the study document) can be solved already at the first level at the stage of preliminary examination of the document. In this case, there is no need for a solution at the second level. However, if the preliminary analysis of the handwriting object does not give positive results in terms of identifying diagnostic signs, forensic expert transfers the decision of the first subtask to the second level, having previously noted at the first level the equilibrium of the versions of both the presence and absence of unusual

4 Куприянова А. А. Методические рекомендации решения судебно-почерковедческих диагностических задач. Минск, 1982. 61 с.

writing. At the identification stage, the professional decides identification subtask necessary for the final solution of the second diagnostic subtask. At this stage, identification and diagnostic signs, unlike preparatory are studied more carefully. A detailed and comprehensive study of the properties of writing, comparison and evaluation of these characteristics, allow to identify all available diagnostic signs, including slightly pronounced ones, to form complete reliable complexes of diagnostic signs necessary to solve the following subtasks. The content of identification stage consists of the following stages: analysis of all signs of writing (identification and diagnostic) in the object under research and comparative material, comparative study of these signs, evaluation of comparison results, formation of conclusions about identity of the performer and the commonality of the nature of the unusualness of writing. The diagnostic stage of the second level is final. Within its limits, the issue of species, a group of whipping factors, a specific whipping cause is solved. At this stage, the expert analyzes diagnostic signs, operates diagnostic complexes, conducts a comparative study of the latter with well-known diagnostic complexes, namely: standards. This stage of diagnostic research involves establishing the availability or lack of detection of any churning factors during the execution of examined handwritten records by visual observation and contains the following stages: establishing the availability or lack of informative diagnostic signs in handwritten records under research; establishing the availability or lack of informative diagnostic signs in handwriting samples of the identifiable person; comparison of informative diagnostic signs, if they are detected; evaluation of comparison results; formulation of conclusions

about availability or lack of any whipping factors. Research on writing pace at this stage are carried out to differentiate the free (natural) pace and pace containing deceleration elements. The slowdown depends on a decrease in coordination of movements. It should be noted that the nature of the detection of signs of decreased coordination of movements, as in the case of handwriting with imitation of true handwriting of elderly and old age people is almost the same - indistinguishable small and large waviness during the execution of arc and straight strokes performed by both bending and indigestion movements. Sometimes, there is also an angle of movement in places of change in the direction of movements. A thorough research on these signs will allow forensic expert to clarify or revise the separate version put forward at the first stage of the previous study. The next stage is the study of informative diagnostic signs in handwriting samples of a certain person involves the establishment of not only the presence or absence of informative diagnostic signs, but also the degree and limits of their detection and (if possible) the diagnostic cause. This approach will further help to exclude superficial comparison and possibility of an error in assessing comparison results. The purpose of assessing comparison results is to state availability or lack of whipping factors during implementation of objects of comparative research and (if possible) to diagnose them (natural or artificial). At the same time, the final decision should be made by forensic expert only after conducting a detailed identification research.

Conclusions

The method of research on handwritten records made by elderly and old age

people possible to solve identification and diagnostic tasks to establish the performer (performers) of such records and conditions of performance. Above, the theoretical prerequisites for the handwriting research on short handwritten records performed by elderly and old age people are considered; some results of the generalization of a significant amount of both experimental array and expert practice on the possibilities of studying such handwriting objects are set out; handwriting signs characteristic of elderly and old age people are grouped; the algorithm of sequential actions of while expert during the solution of this issue is disclosed in detail.

It is known that forensic examination of short handwritten records made by elderly and old age people is one of the most difficult types of research in forensic handwriting. Features of the handwriting research on short handwritten records performed by elderly and old age people considered; forensic expert should take into account both in the process of while diagnostic procedure and during identification comparative research. The use of the above information in forensic practice optimizes and streamlines the expert activities will enable to perform forensic research, observing principles of completeness and comprehensiveness in accordance with the current legislation requirements.

Thus, research on handwriting features during the performance of short handwritten notes by elderly and old age people is relevant and requires further careful study.

Особливості дослідження коротких рукописних записів, виконаних особами похилого та старечого віку

Діана Гайдамакіна, Раса Тамошюнайте

Мета цієї наукової праці — на підставі здобутих експериментальних даних уза-

гальнити й систематизувати експертний досвід (як теоретичні знання, так і дослідницьку практику) і наукове підґрунтя із дослідження коротких рукописних записів, виконаних особами похилого та старечого віку; навести закономірності почерку й пояснити природу виникнення діагностичних ознак; розробити рекомендації для проведення почеркознавчих експертиз і визначити структуру процесу (алгоритм дій експерта) для розв'язання ідентифікаційних і діагностичних завдань; дібрати відомості про ідентифікаційне значення й можливості диференціювання згаданих ознак. Експертна практика потребує якісних конкретних критеріїв, які б однозначно підтверджували відносну стійкість ознак у коротких рукописних записах, виконаних особами похилого та старечого віку. Саме тому цьому питанню приділено особливу увагу.

Завдяки проведеним упродовж 2019—2021 рр. у ННЦ «ІСЕ ім. Засл. проф. М. С. Бокаріуса» експериментальним дослідженням і узагальненню експертної практики розроблено методiku почеркознавчого дослідження коротких рукописних записів, виконаних особами похилого та старечого віку, що дає змогу вирішувати ідентифікаційні й діагностичні завдання зі встановлення виконавця (виконавців) таких записів і умов їх виконання; наведено докладний алгоритм дій експерта в процесі розв'язання зазначеного питання.

Методика ґрунтується на дворівневому принципі, сутність якого полягає в тому, що фахівець проводить дослідження не просто поетапно, а виконує його циклічно, тобто з різним ступенем глибини й наближення до остаточного вирішення на різних рівнях.

Ключові слова: почерк; короткі рукописні записи; особи похилого та старечого віку; діагностика; письмово-рухова навичка; вікові зміни організму; хворобливий стан; координація рухів.

Особенности исследования кратких рукописных записей, выполненных лицами пожилого и старческого возраста

Диана Гайдамакина, Раса Тамошюнайте

Цель этой научной работы — на основании полученных экспериментальных данных обобщить и систематизировать экспертный опыт (как теоретические знания, так и исследовательскую практику) и научные основы по исследованию кратких рукописных записей, выполненных лицами пожилого и старческого возраста; привести закономерности почерка и пояснить природу возникновения диагностических признаков; разработать рекомендации для проведения почерковедческих экспертиз и определить структуру процесса (алгоритм действий эксперта) для решения идентификационных и диагностических заданий; подобрать информацию об идентификационном значении и возможностях дифференциации упомянутых признаков. Экспертная практика нуждается в качественных конкретных критериях, которые бы однозначно подтверждали относительную устойчивость признаков в коротких рукописных записях, выполненных лицами пожилого и старческого возраста. Именно поэтому данному вопросу уделено особое внимание.

Благодаря проведённым в течение 2019—2021 гг. в ННЦ «ИСЭ им. Засл. проф. Н. С. Бокариуса» экспериментальным исследованиям и обобщению экспертной практики разработана методика почерковедческого исследования кратких рукописных записей, выполненных лицами пожилого и старческого возраста, позволяющая решать идентификационные и диагностические задания по установлению исполнителя (исполнителей) таких записей и условий их выполнения; приведён подробный алгоритм действий эксперта в процессе решения указанного вопроса.

Методика построена на двухуровневом принципе, суть которого заключается в том, что специалист проводит исследование не просто поэтапно, а выполняет его циклически, то есть с различной степенью глубины и приближения к окончательному решению на разных уровнях.

Ключевые слова: почерк; краткие рукописные записи; лица пожилого и старческого возраста; диагностика; письменно-двигательный навык; возрастные изменения организма; болезненное состояние; координация движений.

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Declaration of Competing Interest

The authors declare that they have no conflict of interest.

References

- Birshenker, A. G. (1871). Rasstroistvo sochetatelnykh dvizhenii pri pisme [Associative movement disorder while writing]. *Voenno-meditsinskii zhurnal*. Sankt-Peterburg [in Russian].
- Bondar, M. Ye. (2001). *Vstanovlennia kharakteru zbyvaiuchykh faktoriv pry doslidzhenni pidpysiv, shcho vykonani z porushenniam koordynatsii rukhiv* [Establishing nature of confounding factors while research on of signatures

- made in violation of coordination of movements] : metod. rek. Kyiv [in Ukrainian].
- Chepulchenko, T. A. (1981). *Kriminalisticheskoe issledovanie rukopisnykh tekstov, vypolnennykh litsami pozhilogo i starcheskogo vozrasta* [Forensic research on handwritten texts made by persons of elderly and old age]. *Sovremennoe sostoianie pocherkovedcheskoi ehkspertizy*. Moskva [in Russian].
- Erlenmeyer, A. (1879). *Die Schrift: Grundzüge ihrer Physiologie und Pathologie*. Stuttgart : Adolf Bonz & Co.
- Kupriianova, A. A. (1982). *Metodicheskie rekomendatsii resheniia sudebno-pocherkovedcheskikh diagnosticheskikh zadach* [Methodological recommendations for solving forensic handwriting diagnostic issues]. Minsk [in Russian].
- Lipovskii, V. V. (1983). *Kriminalisticheskoe issledovanie podpisov, vypolnennykh ot imeni lits pozhilogo i starcheskogo vozrasta* [Forensic research on signatures made on behalf of elderly and old persons] : metod. posob. dlia ehkspertov. Moskva [in Russian].
- Lurii, A. R. (1950). *Ocherki psikhofiziologii pisma* [Essays on writing psychophysiology]. Moskva [in Russian].
- Manaseina, M. M. (1883). *Opisime voobshche, o zerkalnom pisme v chastnosti i o roli oboikh polusharii bolshogo mozga* [About writing in general, about mirror writing in particular, and about the role of both cerebral hemispheres]. Sankt-Peterburg [in Russian].
- Pavlov, B. V. (1945). *Narusheniia chteniia i pisma pri pronikaiushchikh cherepno-mozgovykh travmakh voennogo vremeni i dinamika ikh vosstanovleniia* [Reading and writing disorders in wartime penetrating craniocerebral injuries and the dynamics of their recovery]. *Referaty rabot uchrezhdenii Otdeleniia biologicheskikh nauk Akademii nauk SSSR za 1941–1943 gg.* Moskva ; Leningrad [in Russian].
- Rozrobka metodyky pocherkovedchoho doslidzhennia korotkykh rukopysnykh zapysiv, vykonanykh osobamypokhyloho y starechoho viku [Development of a methodology for handwriting research of short handwritten records made by elderly and seniors] (2021) : zvit NDR (zakliuch.) / MIuU ; NNTs ISE ; ker. D. I. Haidamakina ; vykon.: O. M. Smolina, O. S. Drobysheva ta in. Kharkiv [in Ukrainian].
- Sepp, E. K. (1955). *O lokalizatsii funktsii v kore golovного mozga* [On localization of functions in the cerebral cortex]. *Zhurnal nevropatologii i psikhiatrii imeni S. S. Korsakova*. T. 55. Vyp. 12 [in Russian].
- Tomilin, V. V. (1957). *Ob estestvennom izmenenii priznakov pocherka na protiazhenii zhizni cheloveka* [On natural change in the signs of handwriting throughout a person's life] : mat-ly 3-go Vsesoiuz. soveshch. sud.-med. ehkspert. i 3-i Vsesoiuz. konf. nauch. obshch. sudeb. med. i kriminalist. Riga [in Russian].
- Zitser, E. U. (1947). *Naibolee ustoichivye priznaki pocherka* [The most stable signs of handwriting]. *Problemy kriminalistiki*. Moskva [in Russian].