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SIGNATURE FORMATIVE MECHANISM: FAMILY FACTOR

Summary

The article provides a brief overview of the literature reports on forensic analysis of signatures, whilst taking into the account the papers of Lithuanian handwriting examiners. The importance of the signature in the 21st century society continues to be quite high. In the process of socialization, a young person takes responsibility for certain decisions, accompanied by signing of documents. The process of signature maturity and the factors that influence this process belong to one of the less recognized issues in handwriting analysis. The authors of this article have undertaken the investigation in that matter and, in the first step, after the experiment, they conducted preliminary evaluation of the influence of family members and their signatures on the process of elaboration of writing skill in the signature of a young person.

During the experiment, the attention was paid to the structure (transcription, overall picture) and common characteristics of the signatures. Those signatures whose structure (letter, non-letter, mixed) and most general characteristics (size, line direction, slope, etc.) were similar were considered alike. The results of the experiment demonstrated the similarity typically in such features as signature starting line, length, structure (letter or non-letter elements, line direction), as well as the order of letters in the names. The results of this study are of preliminary character, although it can already be stated that the signatures of family members in many cases influence the formative process of a young person's signature. The obtained findings encourage to conducting a more extensive study, also at the international level.

Keywords: handwriting, signatures, forensic examination, experimental, scientific project

Introduction

The authors of this paper, while lecturing forensic science and expertology, analyzing the contemporary literature of the science, evaluating the research guidelines and methodologies and having expert experience, also in the field of handwriting analysis, come to the conclusion that the examination methods applied in Lithuania and internationally are not standardized and additionally the stage of development along with the factors contributing to theoretical foundations and concepts of these sciences are different. It can be stated that the study of certain topics or issues does not rely solely on their scientific rank, practical dimensions and the needs of law enforcement and justice system, but also on the forensic and scientific policy of the state, the appeal of a particular topic or even a current trend, which is naturally related to the possibility of obtaining grants (funding) or publishing in reputable scientific journals.

Such areas include handwriting analysis, which, as one of the oldest branches of forensic examinations, has experienced its ups and downs¹. According to the authors, it is the time – after some stagnation – to look at the development of forensic handwriting examination from scientific perspective, which strongly relies on contemporary technology. Furthermore, other areas to explore involve new forms of discourse, decreasing need of writing in everyday life, changes in law (emerging form of signature such as “digital electronic signature”, biometric signature on tablets), the vision to create a common European forensic science area, globalization process, international cooperation, the activities of European Network of Forensic Science Institutes, particularly focused on accreditation, as well as other factors.

The authors are convinced that the scientific problems of handwriting examinations in Lithuania need to be investigated comprehensively, and the hereby study may serve as the starting point for discussion, as in some areas some signs of stagnation could be observed, despite periods of time when a greater attention was paid to handwriting analysis². Recently, the scientific problems related to handwriting

¹ According to the thesis by Manfred Hecker, the attempts to identify a person basing on handwriting analysis have been made since a man started to write. Forgery of documents has been a known phenomenon about since the Roman Empire. In contrast, a real breakthrough in this field started in the 16th century, when the first society of handwriting experts was founded in France. Subsequently, the works of François Demelle (1609), Camille Baldi (1622) and Jacques Ravenau (1665), referred to by M. Hecker, were of great importance in this area. Hecker devotes a chapter of his monograph to the historical aspects of handwriting analysis, where the contributions of other scholars of a later period, such as Jean-Hippolyte Michon, Jules Crépieux-Jamin, Georg Meyer, Hans Schneickert, Anton Karl Mally, Wilhelm Langenbruch, Edmond Locard and others are highlighted as well. See: M.R. Hecker, *Traktat über den Wissenschaftlichkeitsanspruch der Forensischen Schriftvergleichung*, Kolonia Limited, Wrocław 2000, s. 58–77.

² H. Malewski, A. Žalkauskienė, *Tyčia iškraipytų asmeninių parašų tyrimas*, “Jurisprudencija” 2000, vol. 18(10), pp. 94–103; J. Ignatjeva, J. Masiulienė, *Kriminalistinės rašysenos ekspertizės istorinė raida Lietuvoje 1918–2000 m.*, “Jurisprudencija” 2001, vol. 23(15), pp. 209–231; R. Tamošiūnaitė, *Eksperimentinių pavyzdžių ruošimas rašysenos objektų tyrimui*, “Jurisprudencija” 2005, vol. 66(58), pp. 77–83..

examination in Lithuania have been studied and evaluated from the perspective of international cooperation³.

The contemporary problems of handwriting expertise also include the areas of conventional examination of signatures. In fact, the determination of authenticity or forgery of signatures has remained in focus for some time and the importance of such analysis has been unquestioned since ancient times. Although the signature analysis (determination of authenticity and identification of a person on the basis of a signature) exerted influence as early as the Middle Ages⁴, the science based or forensic examinations started to be devoted a due attention only a few hundred years ago. The signature as a subject of study evoked the interest amongst lawyers, psychologists and forensic examiners, but also doctors, graphologists and the community representing other areas of scientific disciplines. The analysis of signatures is relevant in criminal as well as administrative or civil procedure. In addition to judicial trial, the questions of the authenticity of signatures, paraphrases⁵ or signatures are important in the research of historical sources, literary or artistic works⁶, or even in the analysis and verification of ballot papers, etc.

The authors believe that the topic of elaboration of individual signature style in the 21st century as well as the important role of family in this process may constitute the interesting element of the comprehensive study of handwriting. To this end, the authors have conducted a pilot study, however it is planned to carry out a more extensive investigation on the variable relationship between the signature and letter transcription of an individual's name and the less practice (need) of writing⁷. The authors are convinced that this is the right time to start working on draft "Law

³ R. Tamošiūnaitė, *Rašyenos ekspertizė Lietuvos teismo ekspertizės centre: dabartis ir ateities tendencijos*, in: H. Malevski, V. Shepitko, V. Tishchenko, *Криміналістика та судова експертологія: наука, навчання, практика*, 14 Міжнародний Конгрес, 13–15 вересня, Т. 2, Гельветика, Одеса 2018, с. 436–442; N.V. Syrotenko, R. Tamošiūnaitė, V.G. Abrosymova, *Forensic research on short signatures*, "Theory and Practice of Forensic Science and Criminalistics" 2020, vol. 22, no. 2, pp. 293–303; N. Syrotenko, R. Tamoshiunaitė, V. Abrosymova, *Solving certain integration tasks in forensic handwriting analysis*, "Theory and Practice of Forensic Science and Criminalistics" 2021, vol. 25, no. 3, pp. 135–152.

⁴ For example, the Lithuanian statute of 1522 provided for the punishment of document forgery (misappropriation of the rights of the Lithuanian nobility). At that time, all documents were written down, so the facts of forgery were determined through the analysis of handwriting, signatures, print and parchment.

⁵ Short form of signatures and their non-letter representations in particular, often referred to as initials, are always challenging for handwriting experts, as they contain little graphic material. This issue has been widely discussed by scientists and expert practitioners. See, for instance, T. Tomaszewski, *Dylematy bieglego pismoznawcy w badaniu paraf*, „Człowiek i Dokumenty” 2021, no. 63, pp. 42–50.

⁶ See, for instance, T. Widła, *Ekspertyza sygnatury malarzkiej*, Wydawnictwo Uniwersytetu Śląskiego, Katowice 2016.

⁷ R. Tamošiūnaitė, *Parašo ir vardinio įrašo tyrimo problemas rašyenos ekspertizėje identifikuojant asmenį*, "Jurisprudencija" 2004, no. 53(45), pp. 65–70.

on Signature". At the first stage, a scientific project should be elaborated and implemented, involving the participation of forensic experts of the Lithuanian Centre of Forensic Expertise and the representatives of universities and academia, which aims at a comprehensive analysis of handwriting and related areas and, consequently leads to the information on the possible ways of implementing scientific achievements and advanced practices of other countries⁸ in the activities of Lithuanian law enforcement agencies and expert institutions. With this in mind, it is advisable to involve the students in this project, who could actively participate in the scientific research of practical dimension, for instance, at the stage of elaboration of their master's or bachelor's theses. Should such a project be successful, the international project of similar scope could follow as soon as meaningful and important results have been obtained. Potential partners include academic research centres, Polish scientists and experts, as well as the Polish Forensic Association⁹, the authors have been collaborating with quite extensively.

Aim of the study: a pilot study to determine whether the signatures of family members in the 21st century influence the process of signature formation amongst young people. First-year students of the Academy of Public Security at Mykolas Romeris University and their family members were approached to participate in the study.

Research hypothesis: the hypothesis has been set that the handwriting of young people (aged 18–19) is not well formed in absence of extensive practice of signing the documents, however the need of using an individual and unique signature is observed. Also the process of signature formation is influenced by the signatures of older family members in terms of transcription, graphics, structure, etc.

Research methods: analysis of documents and scientific sources, comparative method, experimental method, generalist method.

The research sample, which fulfilled the experimental requirements, consisted of the signatures collected from members of 26 families (in total, the signatures of 147 family members were collected). This amount was sufficient to obtain the results, which preliminary confirmed the hypothesis made and opened up the possibility of a more extensive research in this area in the future (involving a larger number of sample signatures) as well as a more detailed scientific publication. During the experiment, the participants were required to strictly adhere to pre-defined conditions and method of putting their signatures, however some signatures were eliminated due to improper handling manner.

During the experiment, the attention was paid to the structure (transcription, general image) and general characteristics of the signatures. The signatures whose structure (letter, non-letter, mixed) and most general features (size, impulse, slope,

⁸ Wrocław Handwriting Examination Symposia should be noted here, which are of exceptional scientific value and have been organized on continuous basis from nearly 40 years. The University of Wrocław was the organizer of the 20th Wrocław Handwriting (Document) Examination Symposium (9–10 June 2022).

⁹ All co-authors of this paper are active members of the Lithuanian Forensic Society.

etc.) corresponded to one another were considered similar. In the course of further research, the experiment will be extended to include not only quantitative but also qualitative parameters. The analysis of the influence of name inscription features on individual signature characteristics is envisaged. The findings of the experiment constitute the basis for undertaking similar studies together with researchers from several countries in the future, according to a coordinated programme, which shall serve to establish whether the hypotheses and observations made can be confirmed internationally.

The concept and status of signature in social life

In the 21st century, one comes across multiple ties and relationships which bring people, institutions and organizations together. The members of society are constantly involved in various social, economic, cultural, political and other processes that give rise to certain rights and obligations, which often involve signing relevant documents. Therefore, the signature constitutes an integral part of our lives.

When investigating the main hypothesis of this paper, the links between the processes of formation of a person's signature and handwriting need to be mentioned. In the beginning, this is only handwriting which is usually formed, which gradually acquires some specific features during the learning process, starts to deviate from the standard requirements and rules of writing, and after some practice becomes individual by acquiring a unique character based on an individual set of general and specific features that allow identification of a person through the handwriting characteristics. This process continues virtually throughout educational period, which takes about twenty years. Typically, a 25-year-old school graduate has already developed and established his or her handwriting, whereas these are handwriting skills, which are quite important for elaboration of a signature. This is due to the fact the characteristics of handwriting are usually reflected in a person's signature, especially as the process of signature formation starts much later. In our region, one acquires certain rights of a subject guaranteed by the state while being teenager (usually aged 16). It can be said that the individual, who has not more than a mediocre handwriting skill is able to elaborate a permanent and unique signature over a sufficiently short period of time, in particular if enough attention and practical efforts are used. This does not mean that a teenager's signature will not undergo some changes at a later stage, become characterized by variability or a completely changed transcription (e.g. signatures of married women). This factor requires special attention when examining the signatures of young people.

In evaluating the process of formation a young person's signature, various factors that influence this process must be taken into the account, the most important being the name and surname of the person as their characteristics (transcription, etc.) are usually reflected in the signature. However, in order to determine the way these features develop and become incorporated in the overall signature style, it is necessary to examine the handwriting and signatures of close family members and try to establish the relationship between the already formed and learnt signatures of family members.

In the determination process, expert handwriting methods constitute an important tool to identify, systemize and analyze the characteristics of a person's handwriting and his or her signature.

Handwriting examination is based on the general principles of forensic expertise, and corresponds to other tasks of forensic examination which include identification, classification and diagnosis. The objects of handwriting examination are quite specific, by representing, for instance, lengthy handwritten texts (contracts, protocols, wills, anonyms, suicide notes, etc.) or their fragments, as well as short texts (single words or digits, short notes, signatures made in letter or non-letter transcription)¹⁰.

It should be emphasized that handwriting examinations are carried out in line with the general requirements of expert methodology, nevertheless their subject matter (long or short texts, notes consisting of several or one word, etc.) compared to other traditional forensic disciplines (fingerprint or toolmark examination, examination of firearms or questioned documents) is different, while the handwriting style itself often significantly varies, even within the handwriting of the same person; it also depends on many objective and subjective, internal and external factors. Increasingly, when analyzing handwriting and signatures, the experts need to rely on knowledge from different scientific fields such as medicine, neurophysiology, psychology, psychiatry, etc., which, on one hand, opens up new research possibilities but also, on the other hand, requires higher level of expert's competence. More and more frequently, when examining handwriting and signatures, various deviations from the so-called standard handwriting and signatures are encountered, which are mainly associated with various diseases (Parkinson's disease, dyslexia, Alzheimer's disease, etc.), trauma, specific conditions of writing or signing (intoxication with drugs, psychotropic drugs or alcohol, etc.), the mental state of the writer (stress, fatigue, etc.). In the 21st century, a greater number of people write with their left hands. The peculiarities of left-handed writing and signing have therefore attracted more attention, which is undoubtedly stimulating research in this area¹¹.

In expert handwriting analysis, it is necessary to take note of a subjective factor in handwriting or signing process, since an individual may significantly alter the characteristics of his or her handwriting (e.g. in the case of self-falsification) to such an extent that the expert will not be able to formulate conclusive opinion and may even be compelled to reject issuing an opinion. This is particularly important when analyzing short texts and signatures, and hence the analysis of signatures occupies a particular place amongst the subjects of handwriting analysis.

A signature is a handwritten distinctive mark reflecting the name of an individual and authorizing a fact or a living condition, and therefore the signature must be placed by the person whose name is indicated on a document in question. Most

¹⁰ E. Kurapka, H. Malewski, E. Palskys, S. Kuklianskis, *Kriminalistikos technikos pagrindai (vadovėlis)*, Eugrimas, Lietuvos teisės akademija, Vilnius 1998, s. 209–212.

¹¹ See for example E. Grzeszyk-Kiliańska, *Leworęczność jako proces lateralizacji człowieka na przełomie ontogenezy*, in: R. Cieśla (ed.), *Współczesne wyzwania wobec badań dokumentów*, University of Wrocław Publishing House, Wrocław 2021, pp. 89-105.

often a signatory signs in a specific, distinctive manner, which generally differs from the form his or her name is written in the document in question. In order to have the power of authorization, the signature must be placed in a specific location, e.g. under the text of a power of attorney, contract or report, in the established sections of a payroll, etc. A signature can utilize all or a few letters of the surname, non-letter elements, a final line (swirl) and additional elements. In addition, the signatures may be encountered, which does not contain any letter at all or only the first letter of the surname, however this does not affect the will of authorizing the document¹². In the scientific literature, various definitions of signatures and their classifications can be encountered. For example, the Polish forensic scientist Antoni Feluś points out to the signatures in letter transcription consistent with the transcription of a person's name, as well as simplified signatures. Furthermore, Feluś divides simplified signatures into: monograms, abbreviated signatures, initials¹³.

Hence, the signature constitutes the essential element in a variety of documents¹⁴. In our time, absurd as it may seem, hundreds of millions of illiterate people live in the world¹⁵, who also participate in economic, political and social life and consequently are required to sign various documents very often. The analysis of signatures of illiterate people has its specifics (for instance, symbols or short signs are examined).

Another problem results from globalization i.e. a number of people from countries, continents or even civilisations use a script that is not based on the Latin alphabet. For example, when someone is born in the country where Cyrillic alphabet is predominant, his or her signature is placed according to the rules of this script, while in another part of the world this person would need to write his or her name using Latin letters. It should be noted, however, that these requirements do not apply to the signature.

A signature is a graphic object, however it differs from regular handwriting primarily due to the fact that it contains less information than handwriting. In addition, a number of handwriting characteristics do not necessarily appear in a signature. On one hand, this apparently constitutes the obstacle in identification of a writer, however

It needs to be emphasized that the law of some countries requires that the signature should consist of a full letter transcription of the name and surname of the person, whereas the spelling of the name and surname in a non-letter or abbreviated version is considered an initial. Paraphe (French: *paraphe* from Greek *paragraphos*): ¹) abbreviated signature on a document, business letter, etc.; ²) initials instead of signature. See: *Parafas*, <https://www.lietuvizodynas.lt/terminai>, accessed 06.06.2022.

¹³ See A. Feluś, *Podpisy. Studium z pismoznawstwa kryminalistycznego*, Uniwersytet Śląski, Katowice 1987, p. 16.

¹⁴ It should be recalled that there is no law that would clearly set the requirements for signatures in Lithuania, which is often pointed out by scientists and experts. Some institutions (banks, insurance companies and other business entities) when concluding contracts with private persons use special forms in which it is required to transcribe the name and surname along with the signature.

¹⁵ See, for example *International Literacy Statistics: A Review of Concepts, Methodology and Current Data*, UNESCO Institute for Statistics, Montreal 2008, pp. 56–79.

– on the other hand – it is usually characterized by a considerable or at least typical level automation, which is less evident in regular handwriting. Thus, the signature most often reflects a well-established habit of drawing signs, which may help in the identification of a writer¹⁶.

At the same time, it needs to be pointed out that signatures constitute variant objects, and the individual may have several variations of his or her signature, which is characteristic to people who often sign documents (they sign important documents with a long signature and use simplified, abbreviated paraphrases to regular documents). The examination of signatures of people under the influence of alcohol or psychotropic drugs (narcotics) also has its specifics, as these often differ from signatures made under standard conditions¹⁷.

The basic identifying features of the signature include topography, transcription, its structure (complexity), general and specific characteristics of the writing, which are reflected in the signature¹⁸. The architecture (design) of a signature is often composed of three main elements: the monogram (first letters of the name and/or surname), letter or non-letter middle part of the signature, and the closing element (final line with or without additional details)

Lithuanian scientists have frequently studied various aspects concerning the identification and diagnostics of signatures¹⁹, however the process of signature formation and the influencing conditions and factors have not been studied more extensively. Such attempt was undertaken by M. Keturkienė who analyzed the similarity between handwriting of parents and children. The author states that “Children often rely on

¹⁶ The cases of deliberate change of signature by their authors should be mentioned. This is done to question the authenticity of this signature in the future, the so-called auto-falsification. See more in: H. Malewski, A. Źalkauskienė, *Umyslna falsyfikacja własnego podpisu w celu zakwestionowania jego autentyczności*, in: Z. Kegel (ed.), *Problemy dowodu z dokumentu. Materiały VIII Wrocławskiego Sympozjum Badań Pisma 17–19 czerwca 1998 r.*, Katedra Kryminalistyki Uniwersytetu Wrocławskiego, Wrocław 1999, pp. 143–151; H. Malewski, A. Źalkauskienė, *Self-falsifications or the variants of the signature*, “Document Various Specification” 2000, no. 1, pp. 49–53; A. Koziczak, *Autofalszerstwo*, Difin SA, Warsaw 2020.

¹⁷ See for example: H. Malewski, A. Źalkauskienė, *Problematyka badania pisma osób nietrzeźwych i jego znaczenie w ustalaniu faktów prawnych*, in: Z. Kegel (ed.), *Aktualne tendencje w badaniach dokumentów. Materiały XIII Wrocławskiego Sympozjum Badań Pisma*, Wrocław 2008, Wydział Prawa, Administracji i Ekonomii Uniwersytetu Wrocławskiego, Wrocław 2010, pp. 367–379.

¹⁸ E. Palskys, *Kriminalistinis dokumentų tyrimas*, Aukštojo ir specialiojo vidurinio mokslo ministerija, Vilnius 1978, pp. 77–79.

¹⁹ А. Жалкаускене, Г. Малевски, *Почерковедческая экспертиза в Литве: состояние и тенденции перемен в: Теория та практика судової експертизи і криміналістики*, Выпуск 2, Збірник матеріалів міжнародної науково-практичної конференції (Харків, 19–20 червня 2002 р.), Харків 2002, pp. 182–190; H. Malewski, *Autografy Adama Mickiewicza w aktach Komisji Śledczej N. Nowosilcewa w sprawie Towarzystwa Filaretów*, in: R. Cieśla (ed.), *Dokument i jego badania*, Prace Naukowe Wydziału Prawa, Administracji i Ekonomii Uniwersytetu Wrocławskiego, Wrocław 2014, pp. 257–266.

their parents' experience when elaborating their signatures, so it is not uncommon that some elements of their signatures may be quite similar. There is a prevailing opinion in society that their handwriting may also be similar, however it is not clear whether these similarities are due to children's attempts to consciously or unconsciously imitate their parents' handwriting or because of genetic factors. There have been few scientific reports to confirm or contest such an assumption.²⁰ At the final stage of writing this paper, in fact already in the editorial process an interesting case study by Tadeusz Tomaszewski was published, which contains notes on the need to create a methodology for the examination of similar writings and signatures²¹. This paper has confirmed our view of the need for a more extensive study of the influence of family members on a young person's signature formation process.

Experimental – research methods and conditions

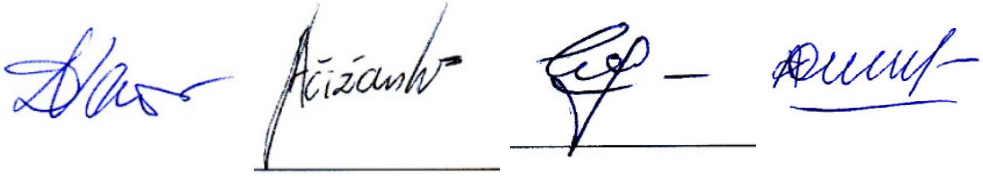
During the experiment, the attention was paid to the structure (transcription, general image) and general characteristics of the signatures. Signatures were considered similar if the structure (letter, non-letter, mixed) and most of the general characteristics (size, impetus, slope) were corresponding to one another.

The general characteristics were chosen as the basis for determination of similarity as they represent a general image of signatures, i.e. visible features noticeable even to a non-expert and applicable in practice (can be copied, redrawn, recreated from memory). In making the forgery of signatures, usually the most distinctive characteristics are used in order to facilitate the forger signing in a visually similar manner. The characteristics of signatures are difficult to notice (especially to a non-expert), and the well-elaborated signing habit, based on psychophysiological and motor processes of the brain, cannot be changed quite easily. Thus the experiment involved the comparison of signatures based on their overall image (Fig. 1).

²⁰ See: M. Keturkienė, *Vaikų ir jų tėvų rašysenų ypatumai*, in: *Kriminalistika ir teismo ekspertologija: mokslas, studijos, praktika*, Lietuvos teismo ekspertizės centras, Lietuvos kriminalistų draugija, Vilnius 2020, no. 16, p. 271. Some aspects (psychological, physiological, medico-forensic, etc.) of the similarity of the writing style of signatures of family members are pointed out by V.V. Tomilin, R.N. Iziumov, V.V. Ustinov, R. Saudek, M. Beacom et al., stressing the need for comprehensive experiments and scientific research. See for instance: Р.Н. Изюмов, В.В. Устинов, *Почерковедческое исследование подписей, выполненных родственниками*, w: *Теория и практика судебной экспертизы в современных условиях*, Материалы VII международной научно-практической конференции, Московский государственный юридический университет имени О. Е. Кутафина (МГЮА), Москва 2019, pp. 173–177.

²¹ T. Tomaszewski, *Czy łatwo odróżnić podpis ojca od podpisu syna, tj. o próbie opracowania metodyki badań pisma podobnego*, „Człowiek i Dokumenty” 2021, no. 65, pp. 48–58.

Fig. 1. Signatures of four persons, which represent apparent and significant graphical differences



Source: own study.

The result of the experiment (analysis of the signatures of members of 26 families) allows to conclude in most cases that similarities were established between the signatures of these families members, as shown in Table 1. In the case of two families, the kinship of the persons whose signatures were analyzed was not indicated. Among the members of six families, no similarity was found in regard to the transcription and general characteristics of the signatures.

Table 1. Summary of data on similarities between the members of 26 families

Family No.	Similarity of signatures pointing to family relationship	Comments
1	Grandmother–daughter (Mother) Mother–daughter (respondent)	Determined similarity
2	Grandfather–daughter (Mother) Mother–daughter (respondent)	Determined similarity
3	Mother–son Grandmother–son (Father)	Determined similarity
4	Child (respondent), mother, father, Grandmother, great-grandmother	No similarity found (no significant corresponding features between the transcription of signatures and general characteristics)
5	Mother–daughter Father–son	Determined similarity
6	Respondent, sister, mother, step-father, friend, aunt (many unrelated persons)	No similarity found (no significant corresponding features between the transcription of signatures and general characteristics)
7	Father–daughter (respondent) Father–daughter II Sister–Sister	Determined similarity

Family No.	Similarity of signatures pointing to family relationship	Comments
8	Respondent, Grandmother, Grandfather	No similarity found (no significant corresponding features between the transcription of signatures and general characteristics)
9	Respondent, Grandmother, Grandfather, Mother, father	Determined similarity
10	Father's brother–father–daughter Grandmother–daughter (Mother)	Determined similarity
11	No marital status determined	Kinship not determined
12	Grandmother–daughter (Mother)	Determined similarity
13	Grandmother–daughter	Grandmother with Parkinson's disease
14	Mother–daughter Mother–daughter	Two families: mother and daughters of two fathers
15	Mother–son–daughter Brother–sister	Determined similarity
16	–	Kinship not determined
17	Grandmother–Grandson	Determined similarity
18	Respondent, Mother, father, Sister	No similarity found (no significant corresponding features between the transcription of signatures and general characteristics)
19	Mother–son–daughter Brother–sister	Determined similarity
20	Mother–daughter Mother-in-law–mother	Determined similarity After getting married
21	(Grandmother + Grandfather) – daughter (Mother) Mother–two daughters Sister–Sister	Determined similarity
22	Respondent, Mother, Grandmother, Grandfather	No similarity found (no significant corresponding features between the transcription of signatures and general characteristics)
23	Mother–daughter	Determined similarity
24	Grandfather–son (father)	Determined similarity
25	Respondent, Mother, Friend	No similarity found (no significant corresponding features between the transcription of signatures and general characteristics)

Family No.	Similarity of signatures pointing to family relationship	Comments
26	Grandmother–daughter (mother) – daughter	Determined similarity

Source: own study.

When analyzing the experimental material, it was observed that the signatures of relatives of some families are practically not similar by differing in the structure and general characteristics: slant, impetus, size of elements, skill (see Fig. 2).

Fig. 2. Signatures of members of one family (different structure, different general characteristics: slope, impetus, size, skill)



Source: own study.

The analysis of experimental results demonstrated that in 18 out of 26 families, a similarity was found in the signatures of 32 pairs of close relatives (mother–daughter, father–son etc.); the structure of signatures and most general characteristics (transcription and consistency, size, slope, impetus) were similar.

Table 2. Relationship between the family members, whose signatures were characterized by certain degree of similarity and some general features (transcription and consistency, size, slope, impetus)

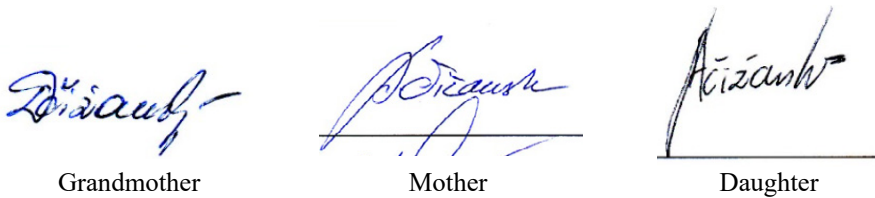
Line No.	Family relationship	Number of pairs with determined similarity between signatures
1	Mother–daughter	15
2	Mother–son	4
3	Father–daughter	4
4	Father–son	2
5	Brothers–sisters	4
6	Grandmother–grandson	1

Line No.	Family relationship	Number of pairs with determined similarity between signatures
7	Mother-in-law–daughter-in-law	1
8	Kinship not determined	1

Source: own study.

In one family, the signatures of members of three generations (grandmother–mother–daughter) demonstrated a high degree of similarity (Fig. 3).

Fig. 3. Similarity between the signatures of members of one family (three generations: grandmother–mother–daughter)



Source: own study.

The analysis of signatures in family No. 20 shows a visible transmission of general characteristics of signatures across three generations. The authors of these signatures opt for a letter transcription. Such transcription was chosen by a young person (a 19-year-old daughter), which is rather infrequent in modern practice, since nowadays younger generations would rather use computer-printed text instead of handwriting and thus prefer simple structures and short signatures. In the signatures of this family, a characteristic similarity is observed:

“D” – “č” – “i” – “ž” – “a” + “u” + swirl (final element) (first signature);

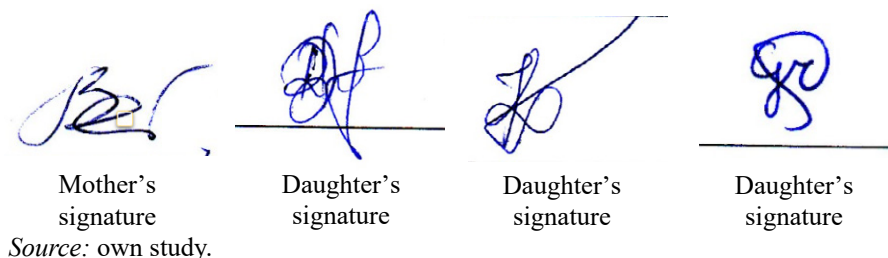
“D” – “č” – “i” – “ž” – “a” + “u” + “s” + swirl (final element) (second signature);

“A” – “č” – “i” – “ž” – “a” + “u” + swirl (final element) (third signature).

In all signatures, the first letter of the first name is much larger (vertically) than the first letter of the surname, whose size is consistent with the size of other lowercase letters. Consistency (integration) is also signature-specific: the letters “iža” are written separately, and the letters “au” are linked. The transcription of the upper elements of “au” should be noted: the upper element “a” is larger than the subsequent elements “u”. In all three signatures, their authors do not connect the letter “i” with the next letter, as they first put a dot on the “i” and then write the next letter. In a high degree of skill handwriting, the dot is often placed over a given sign only after a specific combination of letters has been written. The elongation of the first letters of the signature vertically downward and the orientation of the swirl upward also indicate that a the signature of an older member of the family was used as a model.

In the analysis of experimental material it has been observed that only a few or even one element of similarity between the signatures of family members can be found, for example, the length of the signature (Figure 4).

Fig. 4. Length of signatures of one family members (family No. 21, mother and three daughters)

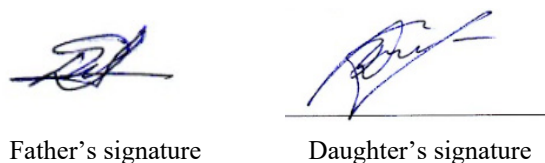


In the analysis of the experimental material, it was found that the length of signatures of older family members affects the length of signatures of younger family members (family No. 21) as well.

Mothers more often deal with their children's documents: they take children to medical clinic, manage school and club documentation, so children are able to see their mother's signatures on day-to-day basis and adapt their signatures to the visual features as seen in their mother's signatures. The material collected during the experiment allows to conclude, or to set the hypothesis that children would tend to adopt their mother's signature as the model.

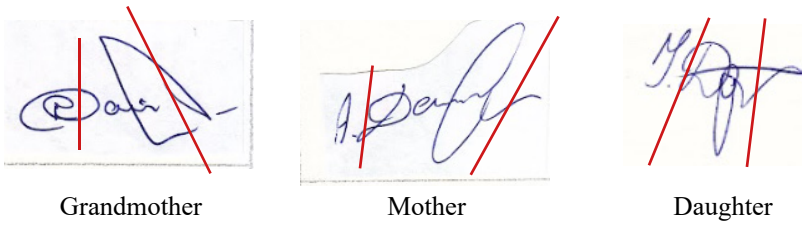
There are some families however, where younger generations take the example of the father's signature (family No. 5).

Fig. 5. Father's signature became a model example for a daughter's signature



Source: own study.

Copying of signature structure is perfectly illustrated by the example of Family No. 10 (Fig. 6).

Fig. 6. Similarity in the structure of signatures within the family

Source: own study.

The signatures are elaborated with the first letter from the name and first letter from the surname. Initial line of signatures:

monogram “RD”,

“A” – dot – “D”,

“I” – dot – “D”.

All these signatures are characterized by a distinct (large) final element (swirl). It is interesting to note that all signatures have a variable inclination of the axis of additional details: in the first signature, the monogram has a vertical axis, whereas the final element (swirl) is inclining towards the left. In the second signature, the axis of the letter “A” is almost vertical, and the axis of the final element (swirl) is characterized by a right slant. In the third signature, the axis of the initials “I.D.” moves towards the right, whereas the axis of the final element (swirl) is vertical. Such phenomenon does not appear to be common, but in this case it manifests itself in family-related signatures.



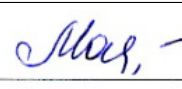
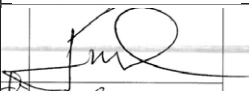
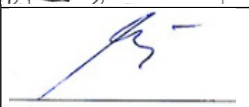
It should be noted that the pilot study was conducted which included the collection of only one known signature from individual respondents, and a single signature does not reflect the variability of the writer’s signatures at all. If more signatures of respondents were collected at certain intervals, a number of similar signatures amongst family members would probably be higher. Since a signature is a “living” (dynamic) depiction of a writing style, it can vary depending on the conditions of writing, the psychophysical state of the author as well as other factors: it can be longer or shorter, contain larger or smaller characters, can be characterized by a different slope depending on the angle of the surface on which it is deposited or a different pace of writing depending on the importance of the document. The transcription of signatures can change, as well; the documents of more significance are often signed with higher handwriting skill and contain more elements (non-letter and additional details), also the letters representing name and surname are more legible. Some documents are signed quickly, in an inconvenient position (for example, signatures for a receipt of a courier delivery), and in such cases signatures are simplified and certain elements are omitted or reduced. Thus, the variability of the signature is the characteristic common to every individual.

This feature could not be analyzed during the experiment, as the researchers had only one signature at their disposal.

Another important attribute of the signatures should be mentioned, quite difficult to evaluate, namely the degree of handwriting skill. The youngest generation in the study (students) used these signatures for the period of 3–4 years only. People consciously create their signature usually at the age of 16, when received an identity document (passport or ID card). Consequently, the time of using a signature is quite short, the need to sign happens quite infrequently nowadays (handwritten signatures are being replaced by digital signatures), and the signature itself usually does not represent a high level of skill, as it was the case with the signatures of parents and grandparents, who have been using a well-elaborated signature for decades and have a well-established writing habit. The lesser degree of skill of signatures amongst youngsters was not perceived as a difference during the experiment, as the young respondents simply did not have time to develop it.

The experiment also provided interesting insight into conventional order in which the first letters of a signature are placed. Children usually opt for the order of the initials of their first and last name based on the example of their parents. Therefore, what are the trends in forming the signatures with the location of initials?

Table 3. Peculiarities of initial line of signatures (monograms)

Line No	Structure of initial elements of signature	Number	Known signature	Name
1	First letters of name and surname	99		Danutė V.....ienė
2	First letters of surname and name	13		Marijus Č.....kas
3	First letters of surname	15		Vaidilutė M.....ienė
4	Illegible signs	18		Simonas D.....ius
5	Not suitable for identification	2		Regina S.....ienė

Source: own study.

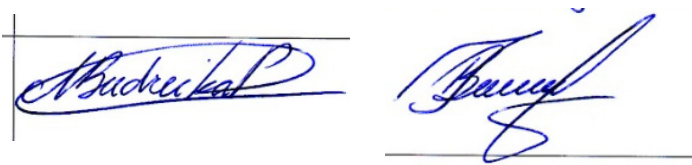
A total of 147 signatures were collected with initial lines as described in Table 3.

The results of the experiment allow to draw preliminary conclusions that in the 21st century the signatures of young people are formed under the influence of the signatures of older family members. The most common options include a similar starting line of the signature, length, structure (letter or non-letter elements, ending element of the signature, i.e. a swirl), the order of the letters of the name and surname.

Such observations also have an impact on expert practice. When examining the signatures of relatives (in such cases, it is very important to provide the expert with relevant information), it is necessary to collect more samples of known signatures to determine limits of their variability, handwriting skills and patterns of writers as well as the ability to imitate.

In practice, when information that the investigated signatures may have been made by brothers, sisters or other close family members is available, experts assess the risk due to the possible similarity of the family letters and/or signatures and usually pay a lot of attention to the amount and quality of the known material in order to evaluate graphomotor performance of the writers, the ability to imitate the handwriting and/or signatures; furthermore, the experts also need to evaluate and compare the sets of general and specific characteristics of signatures and handwriting. The results of the discussed experiment allow to set forth a preliminary opinion that if dealing with the sophisticated skill of the signatures of family members, and their transcription is similar, the probability of imitating the signature of another family member is quite high. Thus, the examination of signatures of related persons creates a number of problems in expert practice. The signatures of the father and son characterized by a high degree of sophistication (family No. 15) are presented below (Fig. 7).

Fig. 7. Signatures of father and son, characterized by high handwriting skill



Source: own study.

Some cases from expert practice may be encountered when due to a small amount of graphic sample (signatures which are too short) or a simplified transcription consisting of several regularly repeated elements, a forensic examiner is not able to determine the minimum number of features required for identification.

The examination practice of one of the authors of this paper involved the case where the determination of the author of signature (granddaughter or grandmother) which appeared in the document confirming receipt of the money was impossible. The signature in the letter transcription “Kl ... kaja” corresponded to the surname of both granddaughter and grandmother. The granddaughter’s signature was characterized by a small degree of skill, as she exhibited some signs of mental retardation and

did not complete elementary school. On the other hand, grandmother was diagnosed with Parkinson's disease. In both cases, it was not possible to establish a sufficiently stable set of identification features that would unambiguously point to the author of the signature.

In summary of experimental results, it can be stated that the pilot study of family signatures demonstrated its validity not only from a scientific but also expert practice point of view. At the same time, it was observed that the experimental setup requires certain modification and needs to involve a significantly larger number of respondents.

Conclusions

1. The importance of signatures in society remains at a very high level. In the process of socialization, a young person needs to take on responsibilities for some decisions, which often involves signing a document. The pilot studies were aimed at investigation of the influence of signatures of family members on the process of formation of signature by young men. The requirements of the experiment were fulfilled by the signatures of 26 families (147 signatures were submitted in total). During the experiment, the attention was paid to the structure (transcription, overall picture) and general characteristics of the signatures. The signatures were considered similar when their structure (letter, non-letter, mixed) and most general characteristics (size, slope, impulse, etc.) were corresponding to one another.

2. The results of the experiment have led to preliminary conclusion that in the 21st century the signatures of young people continue to be influenced by the signatures of older family members. The most common signature characteristics include a similar beginning of the signature, length, structure (letter or non-letter elements, swirl), the order of letters of the name and surname.

3. The examinations demonstrated that the signatures of most families taking part in the experiment exhibit greater or smaller degree of similarity, which can be found in overall picture: transcription of signatures and mimicking general characteristics.

4. The results of this study are of preliminary character, although it can be concluded that the signatures of family members in many cases influence the formative process of a young person's signature. In summary of experimental findings it can be concluded that pilot study of signatures within family groups demonstrated its significance not only from scientific but also expert practice perspectives. At the same time, it was noted that the experiment requires some modification, i.e. the need for a more extensive study, also at the international level.

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Conflict of interest

None

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