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Comparing Latin with Cyrillic Scripts in Handwriting Identification?

Abstract

Identifying handwriting has always represented a challenge as there is no such instrument that could identify the scriptor in a clear and unambiguous way. In fact, identification has to be made by a handwriting expert, while instruments are used only as tools in his or her work.

Materials used for handwriting and signature examination involve all types of documents, including wills, contracts, checks, credit card sales slips, anonymous letters, threatening messages, receipts, authorizations, farewell letters, notary public registers, passports, notes, lottery tickets etc.

The aim of this paper is to examine the possibilities of handwriting analysis of documents written in different alphabets (Latin vs Cyrillic alphabet, and vice versa).

The professional standards used for evaluating handwriting and signature in the Latin alphabet can also be applied to those in the Cyrillic alphabet. The most important element is the movement of a writing instrument on a writing surface, leaving a trace on the paper that has an important role in identifying the scriptor.

In order to answer research questions in this paper, testing and an analysis have been conducted of the handwriting of 12 volunteers from the Vukovar area (a place in Croatia near the Serbian border) who use both alphabets on a daily basis. The photographs used in this paper have been made by scanning the original materials.

Keywords: *forensic science, handwriting examination/identification, different alphabet/script, cyrillic script, latin script, anonymous letters.*

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INTRODUCTION

The method of handwriting examination is a subjective comparative method and no instrument is designed exclusively that would replace human expertise for handwriting examination. In this type of examination, the most important factor is the expert witness carrying out the examination and his or her experience and ability to notice details as well as understand relationships between them (perception of the material). [1]

Some optical instruments (video-spectral comparators, stereomicroscopes etc.) used in handwriting and document examination are indispensable tools for evidence collection. The professional standards and methods used for evaluating handwriting and signatures in the Latin alphabet can also be applied to those in the Cyrillic alphabet. The most important element that has an important role in identifying the writer is the movement of a writing instrument on a writing surface, leaving a trace on the paper. [2] [3]

When an expert witness analyzes text in the Cyrillic alphabet, such as Russian, Serbian, Bulgarian, Ukrainian or other languages in which some letters are similar to the letters of the Latin alphabet, while others are completely different, he or she has to take into consideration all the possible variations of the alphabet. Also the fact that in the Cyrillic alphabet it is more difficult to evaluate printed than cursive letters so the expert has to have access to writing samples from that particular country or region. [4]

The Croatian alphabet has 30 letters, and 27 of them contain only one character, in other words: *a b c č ć d đ e f g h i j k l m n o p r s š t u v z ž* and 3 of them contain two characters, in other words: *dž lj nj*. The Cyrillic alphabet is used by some Slavic languages such as: Russian, Ukrainian, Serbian, Macedonian and Montenegrin. The Cyrillic alphabet has 30 to 38 letters, depending on the language using it and in addition to the letters, soft signs are also used, but there is such a big differences if we compare printed and cursive letters.

Пуштам семафорима да ми одреде смјер. Гђе ми се упали зелено онамо скрећем. Ходам уз ограду ботаничког врта и гледам према тужној бари која ће у свибњу постати романтично језеро. Корачам асфалтираном траком травнатог дворишта пред школом. Школска менза у ово јутро има мирис пржене пилетине па воњ уља плута околу и лијепи се за хрђаве кошеве на игралишту иза клупе.

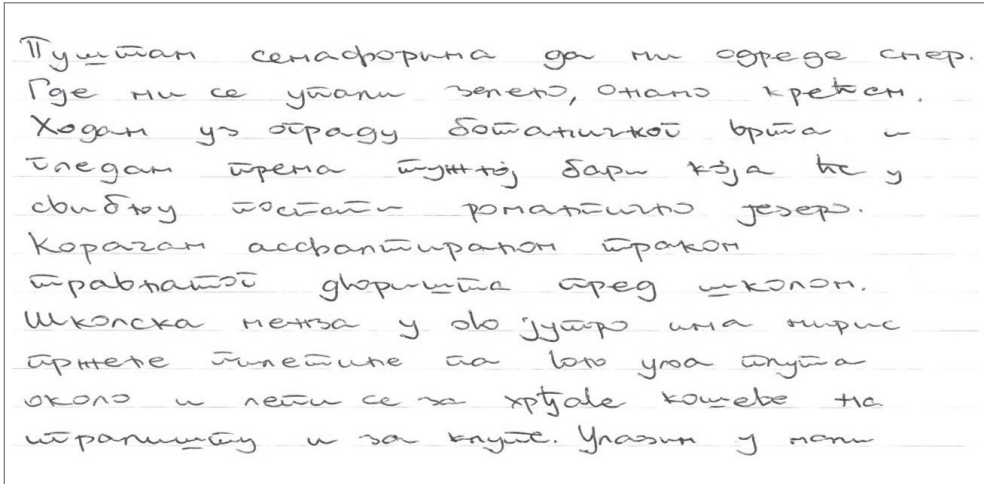


Figure 1. A printed text in the Cyrillic alphabet and a handwritten production of the same text

Table 1. Letters used in the Latin and the Cyrillic alphabet in Macedonian language

Cyrillic	Latin	Cyrillic	Latin
А а	A a	М м	M m
Б б	B b	Н н	N n
В в	V v	Њ њ	Nj nj
Г г	G g	О о	O o
Д д	D d	П п	P p
Ѓ ѓ	G g	Р р	R r
Е е	E e	С с	S s
Ж ж	Ž ž	Т т	T t
З з	Z z	Ќ ќ	Ќ ќ
С с	Dz dz	У у	U u
И и	I i	Ф ф	F f

Table 2. Letters used in the Latin and the Cyrillic alphabet in Bulgarian language

Cyrillic	Latin	Cyrillic	Latin
А а	A a	О о	O o
Б б	B b	П п	P p
В в	V v	Р р	R r
Г г	G g	С с	S s
Д д	D d	Т т	T t
Е е	E e	У у	U u
Ж ж	Ž ž	Ф ф	F f
З з	Z z	Х х	H h
И и	I i	Ц ц	C c
Ј ј	I i	Ч ч	Č č
Ј ј	J j	Ш ш	Š š
К к	K k	Щ щ	Šć šć
Л л	L l	Ю ю	Ju
М м	M m	Я я	Ja
Н н	N n	Ь ь	-

Table 3. Letters used in the Latin and the Cyrillic alphabet in Ukrainian language

Cyrillic	Latin	Cyrillic	Latin
А а	A a	Н н	N n
Б б	B b	О о	O o
В в	V v	П п	P p
Г г	H h	Р р	R r
Ґ ґ	G g	С с	S s
Д д	D d	Т т	T t
Е е	E e	У у	U u
Є є	Je je	Ф ф	F f
Ж ж	Ž ž	Х х	H h (Kh kh)
З з	Z z	Ц ц	C c
И и	Y y	Ч ч	Č č
І і	I i	Ш ш	Š š
Ї ї	Ji ji	Щ щ	Šč šč
Й й	J j	Ю ю	Ju ju
К к	K k	Я я	Ja ja
Л л	L l	Ь ь	‘ (this is not a letter, this is a spelling sign)
М м	M m		

While listing and comparing the characters of both alphabets, you can notice that there are letters whose form is the same in both the Latin and Cyrillic alphabet, but they are pronounced in a different way.

While listing and comparing the characters the text that is being analyzed, although it is not crucial for the analysis of the stroke.

However, the fact that there are some letters that are the same but have a different meaning makes the comparison of two alphabets easier. [5]

Table 4. Letters used both in the Latin and the Cyrillic alphabet [6]

Latin alphabet	Cyrillic alphabet
a/A	a/A
B	Pronounced „V“ [v] as in vault
c/C	Pronounced „S“ [es] s as in salt, but with the tip of the tongue touching the edge of the lower teeth
e/E	E
H	Pronounced „N“ [en] n as in not but the tongue touches the back of the uppere teeth
K	K
M	M
o/O	o/O
p/P	Pronounced „R“ [er] r tilled
T	T
u	Pronounced „I“ [ē]
y/Y	Pronounced „u“ [u] or [oo] u as in flute, but the lips much rounder
x/X	Pronounced „h“ [xa] ch in German ach

The structure of some letters in the Cyrillic alphabet is more complex than in the Latin alphabet and this is why the handwriting in Cyrillic might be easier to evaluate due to its complexity it has more individual features that can be detected to identify the writer. [5]

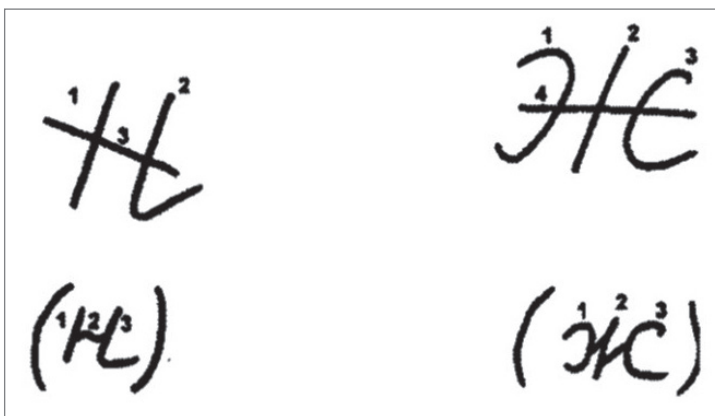


Figure 2. Structure of the letters „N“ i „Ž“

1. THE AIM OF THE RESEARCH

The objective of this research was to examine the possibilities of handwriting analysis for documents written in different alphabets by comparison of handwriting using different alphabet/writing styles.

2. MATERIALS AND METHODS

In order to prove that it is possible to identify the writer by comparing disputed handwriting in the Cyrillic alphabet and undisputed handwriting in the Latin alphabet, or vice versa, we have carried out the analysis of the handwriting of 12 persons (11 persons under the age of 19, and 1 person over the age of 40) in texts written both in the Latin and the Cyrillic alphabet. There are 12 volunteers from the Vukovar area (the small city near the Serbian border) who use both alphabets on a daily basis and the photographs are scans the original material.

In order to collect handwriting samples, every person was asked to copy the same text both in the Latin and the Cyrillic alphabet. Each of the specimens included both continuous text and signatures. Every sample in the group written in the Latin alphabet matched the sample in the Cyrillic alphabet that had been written on the same day with the same instrument and consisting of exactly the same text.

In the first phase of the research, a preliminary analysis was performed in order to check whether the collected handwriting samples meet handwriting analysis professional standards, regarding their quality and quantity, as is the standard practice under ISO 17025.

Next, a detailed examination of general and individual handwriting features was carried out on all handwriting samples written in the Latin and the Cyrillic alphabet for each person individually. Finally, the comparative analysis was performed, taking into account the following features: general appearance, height of central zone, width of characters proportions of upper and lower zone letters to central zone letters, shape and direction of the baselines, legibility, speed of writing, line quality, pen pressure, writing impulse level (a writing impulse begins when the pen starts move and ends when it is lifted), slant, direction of executing ovals and horizontal strokes as well as general structure of characters, formation of letters (especially the same letters which are used in both alphabets), combination of letters, their start and finish, formation of loops, size, shape and inclination, direction and curvature of strokes, similarities and closeness between different alphabet among other features. [7].

The above mentioned features of the Latin and the Cyrillic alphabet handwritings were examined in term of their degree of similarity using the comparative method.

In order to present the results of the analysis more clearly, handwriting similarities were marked by red arrows, circles and lines.

A Leica stereomicroscope and VSC 6000 HS were used to compare handwriting samples as well as for capture of images and for measurements the size of letters and handwriting in general.

Each feature's degree of similarity was rated by two experts independently.

3. EXAMINATION

At the first phase of analyzing all handwriting samples written in the Latin and the Cyrillic alphabet big similarity in general and individual characteristics has been noticed between the same handwriting samples written in the Latin and Cyrillic alphabet as well (for example between sample 1 written in the Latin alphabet and sample 1 written in the Cyrillic alphabet, between sample 2 written in the Latin alphabet and sample 2 written in the Cyrillic alphabet etc.).

Among the features that were subjected to measurements were line and word spacing. The distance between baselines was taken at the beginning of and at the end of each neighbouring pair of lines. This feature was shown to be similar in both groups (Latin and Cyrillic) as well as the apparent pen pressure, slant, line quality, speed of writing and the middle zone characters (e.g. in the miniscules “l”, “m”, “n”, “u” and “z”).

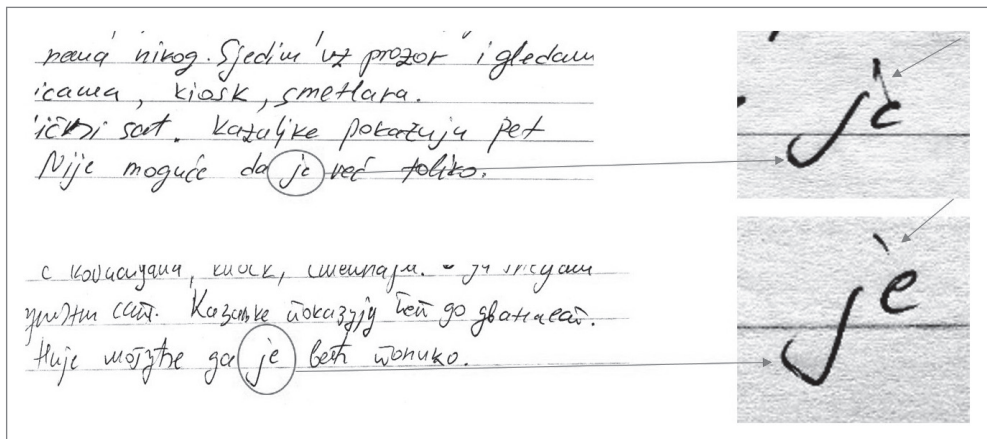


Figure 3. Letter „j“ in Latin and Cyrillic script (example handwriting 12.)

When analyzing the size of writing, all the letters of the upper and lower zones as well as in the middle zone, was shown to be similar in both groups as well.

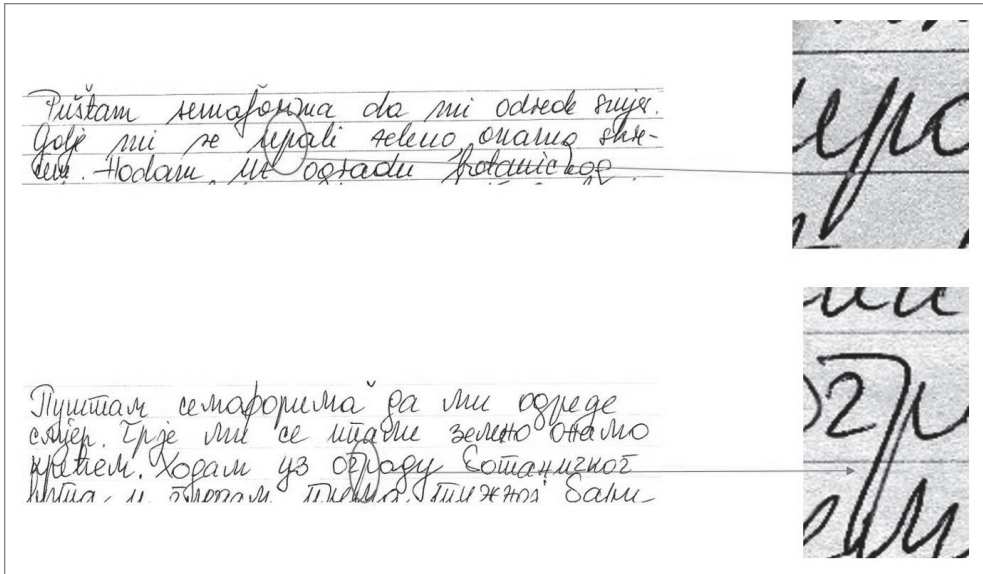


Figure 4. Letter „p“ in Latin and letter „р“ (means „r“) in Cyrillic script (example handwriting 4.)

Shapes of side margins were similar in both sample groups, since the left margins were generally straight, while the right ones strongly irregular.

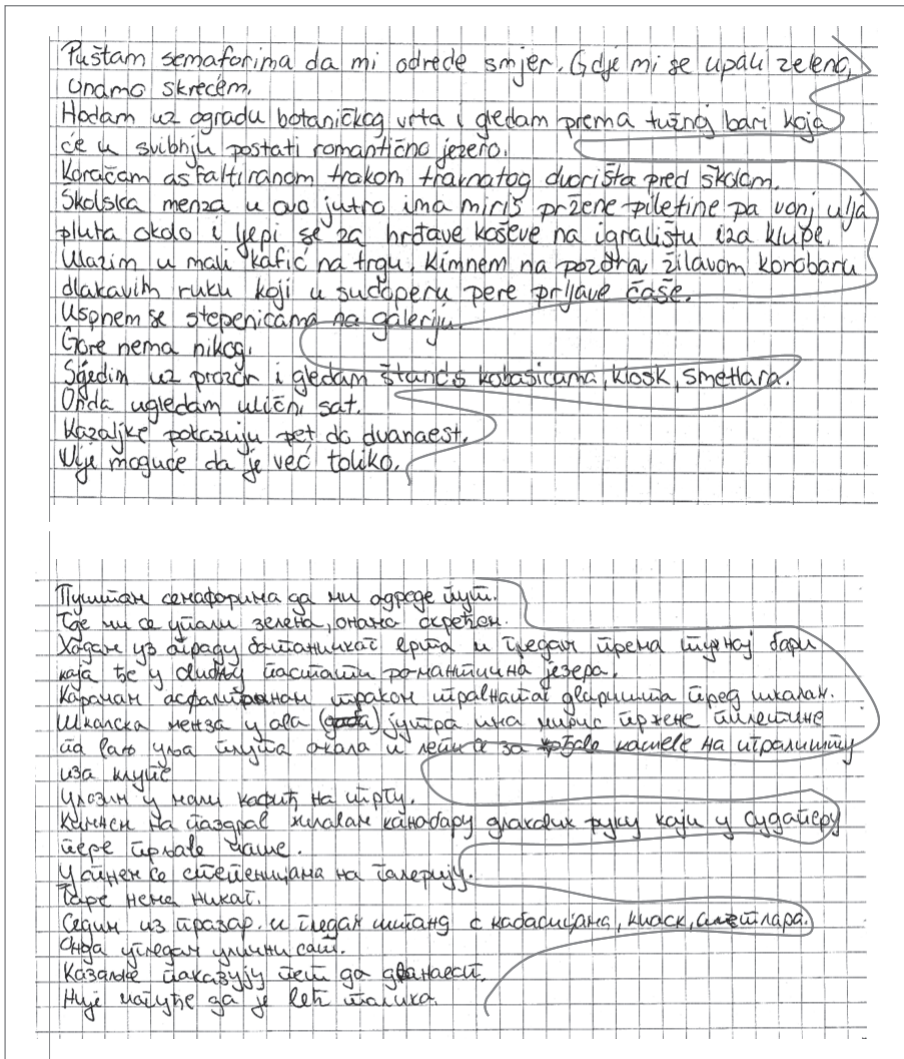


Figure 5. Straight left margin (red line) and irregular the right one in the example of handwriting 3.)

Structural features of the same characters in the Latin and the Cyrillic alphabet samples of the same writer presented a peculiar distribution of similarities and differences. This is the result from the fact that particular characters in both alphabets (sample groups) were actually executions of the similar motor program in the writer's memory which writer used to write, but the similarities were specific rather than general. That's why it is possible to describe what kind of similarities as well as differences occurred in the structure of characters [7].

After that, it was found out that big similarity in general characteristics has been noticed between all handwriting samples 1, 6, 10, as well as between handwritings 5, 7 and 11 written in the Latin and the Cyrillic alphabet.

By comparing the handwriting sample 1 written in the Latin alphabet, and the handwriting sample 1 written in the Cyrillic alphabet as well as the handwriting samples 6 and 10 both in Latin and Cyrillic alphabet, the following similarities in the relevant handwriting characteristics were detected:

- General writing style (slightly messy handwriting, small graphemes, well connected within a word)
- Writing skills (poor)
- Writing rhythm and dynamics (corresponds to the writing skills)
- Slope of the graphemes (uneven, from right to vertical)
- Writing direction (horizontal writing direction)
- Writing margin (the left one – almost straight, the right one – wavy)
- Specific features in forming some graphemes (for handwriting sample 1: “a”, “o”, “K”, “p”, “j” – Latin “j” is used also in the Cyrillic, “d”, “g”, for handwriting sample 6: “k”, “j”, “g”, for handwriting sample 10: “a”, “p”, “K”, “j”, “g”).

Relevant differences in the same handwriting samples (Latin and Cyrillic) were not detected, but a complete comparative analysis could not be carried out due to limitation of comparing Latin and Cyrillic form.

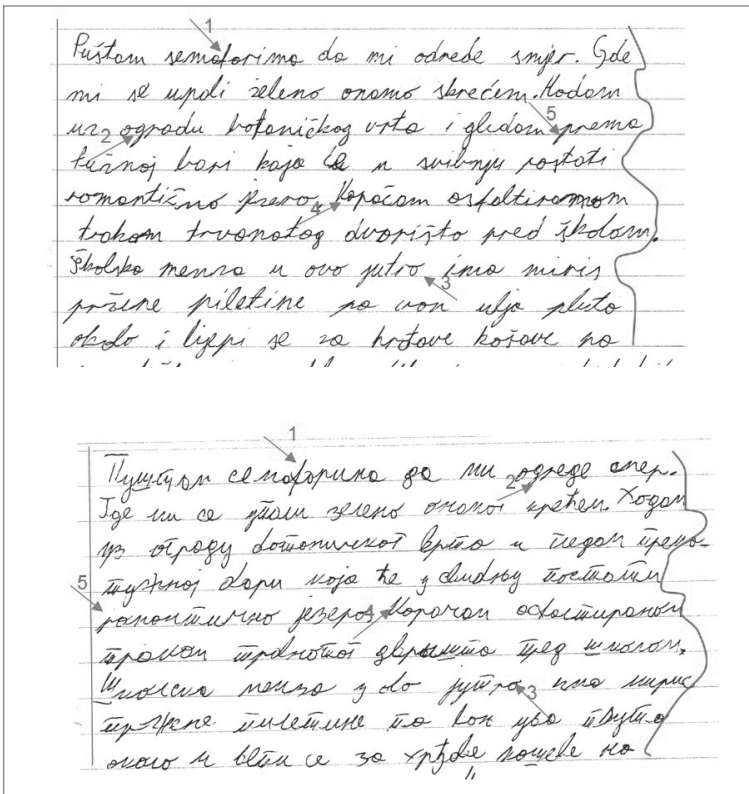


Figure 6. Comparison of handwriting 1. Latin and Cyrillic script

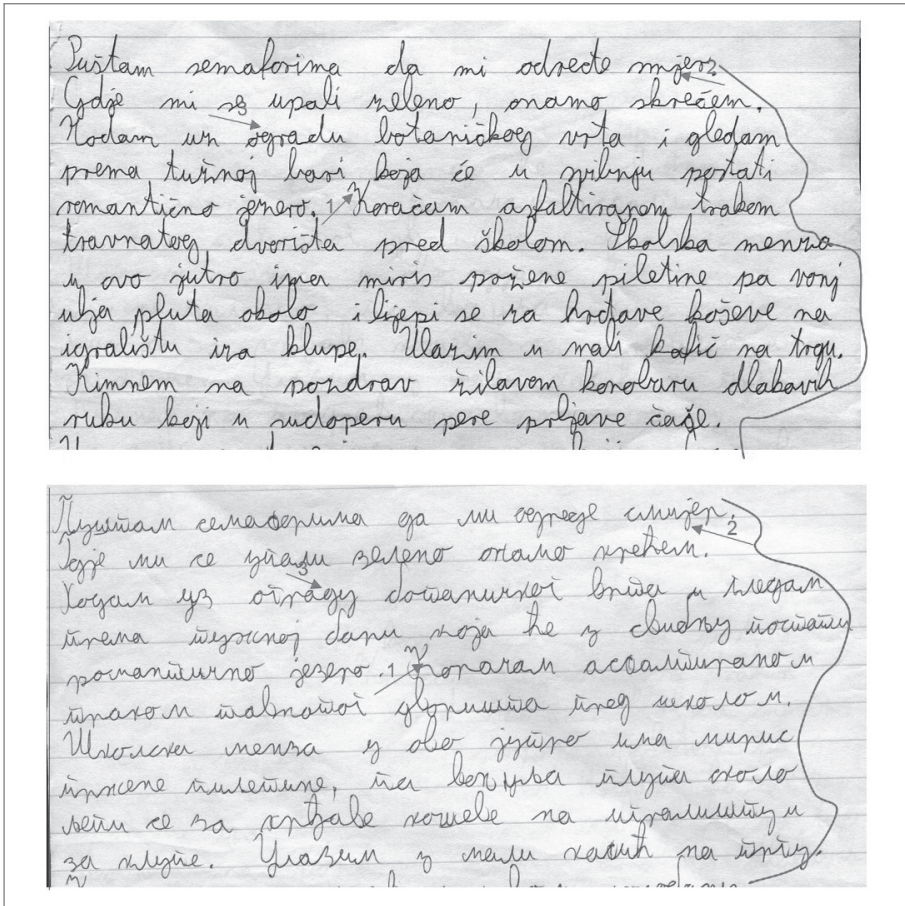


Figure 7. Comparison of handwriting 6. Latin and Cyrillic script

Relevant differences in the same handwriting samples (Latin and Cyrillic) were not detected, but a complete comparative analysis could not be carried out due to limitation of comparing Latin and Cyrillic form.

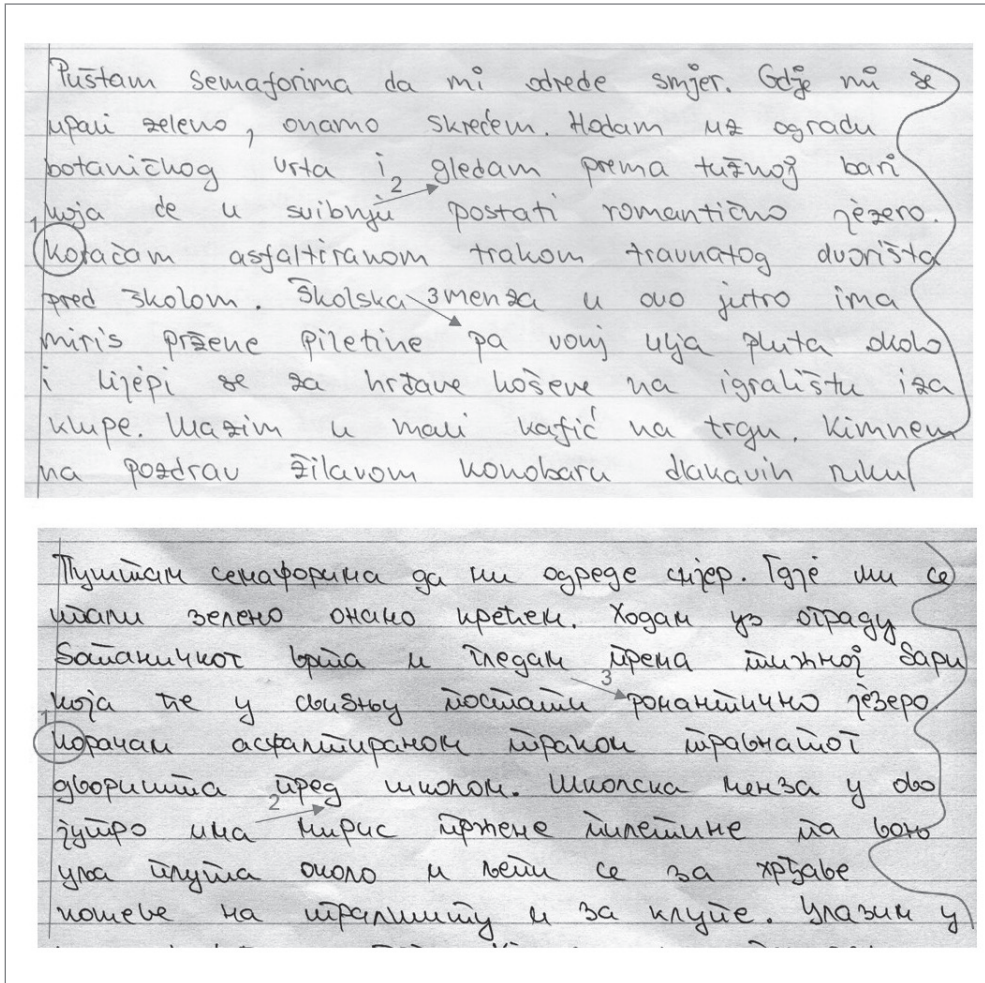


Figure 9. Comparison of handwriting 5. Latin and Cyrillic script

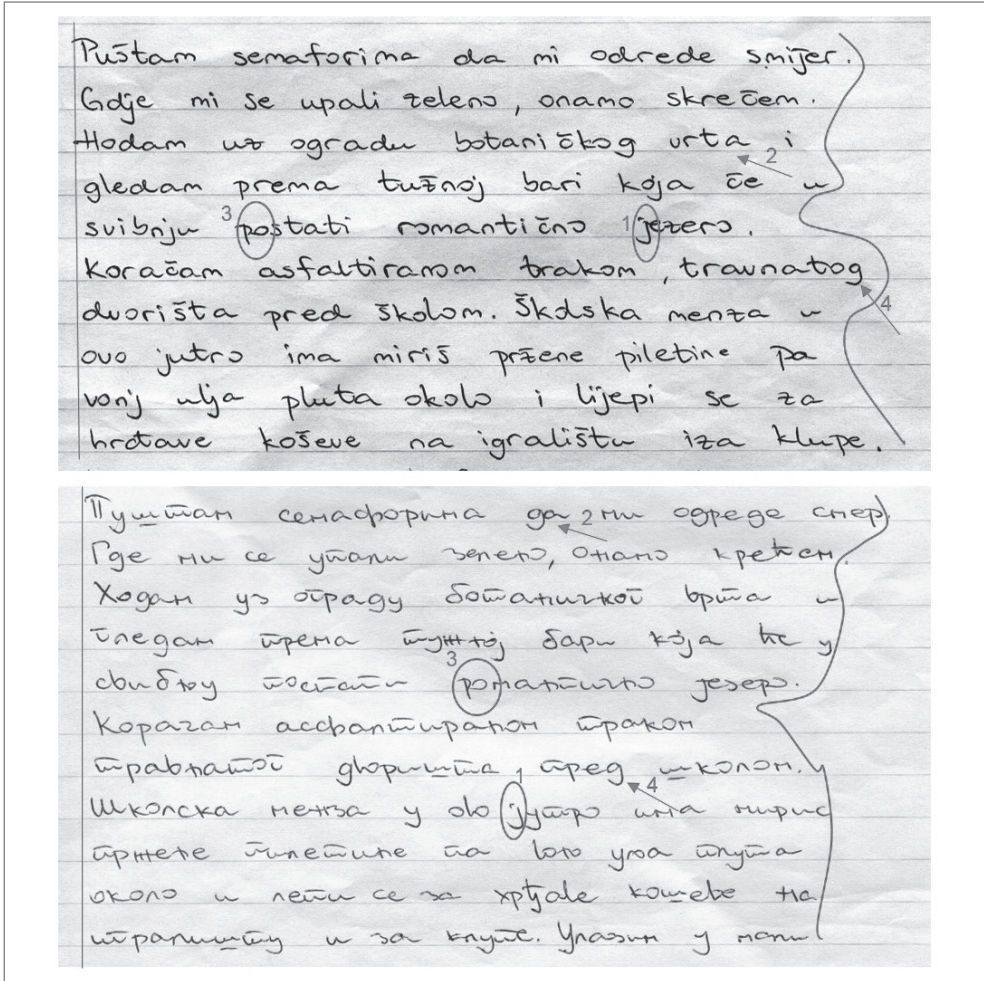


Figure 10. Comparison of handwriting 7. Latin and Cyrillic script

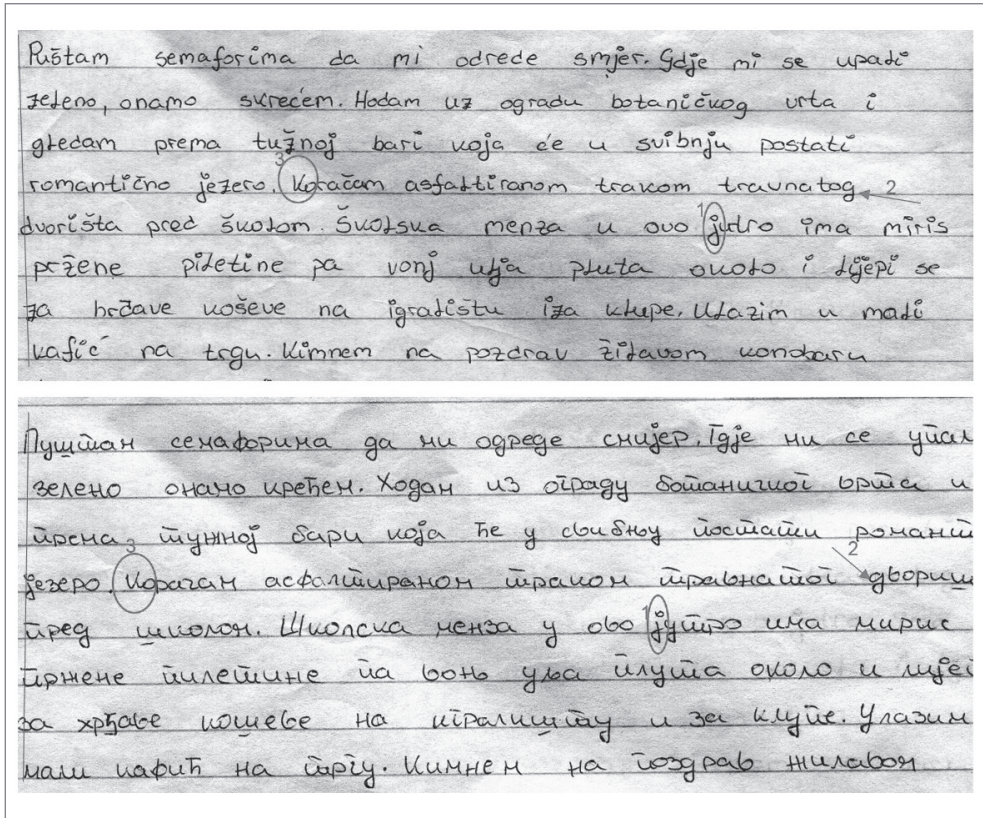


Figure 11. Comparison of handwriting 11 Latin and Cyrillic script

RESULTS AND CONCLUSION

As a result of this research, groups of similar features were distinguished (legibility, the width and shape of the right margin and shape of the left one, word width, line spacing, counter clockwise execution of ovals, line quality, writing speed, impulse level, pen pressure, slant, shape and tendency of baseline, heights of characters, among other features).

Would a handwriting expert thus be able to recognize an attempt to disguise handwriting when given disputed writing produced by writer who freely writes in both alphabets (Latin and Cyrillic)?

Through the study and examination of the samples, and the observations thus obtained, it is very possible for expert to undertake the examination of a disputed document consisting of writings in any unfamiliar script in the case and to render an opinion thereon because Latin and Cyrillic scripts have many letters that are similar or identical.

The results of the research comparing disputed and undisputed handwriting samples written in different alphabets will probably not be widely used, as similar cases of handwrit-

ing evaluation are rather rare. However, the possibility of their expert evaluation should not be neglected, particularly in situations when a potential writer refuses to write in an alphabet that they normally do not use, and if they claim that they can write in only one alphabet, which is not the disputed alphabet (e.g. disputed text is written in the Cyrillic and the person claims that he or she cannot write in the Cyrillic).

The obtained results have shown that it is possible to evaluate samples of handwritten text written in different alphabets.

However, when interpreting the results we should take into consideration all the limitations suggested by handwriting and signature analysis professional standards, (e.g. photocopies, quality and quantity of materials, similarities in handwritings of various writers, diversity of the content etc.).

Finally, it should be emphasized that the present research is only a case study. In order to draw universal conclusion, one would have carry out an experiment on a large group of individuals and real case subjects.

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