ON-SCREEN TEXT LEGIBILITY AMONG CROATIAN AND SLOVENIAN LANGUAGE GROUPS

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Abstract: *The aim of the study was to examine the influence of serif and sans serif typefaces on the legibility of texts. Six typefaces took part in the experiment. Three of the tested typefaces were sans serif (Tahoma, Arial, Verdana), while the other three (Georgia, Times News Roman, Palatino) were serif typefaces. The main difference in the presented typefaces is in the purpose for which a certain typeface was made. Mainly, the presented typefaces were produced for printing purposes; however, they still have the features which are suitable for an on-screen presentation. Two of the typefaces (Georgia, Verdana) were especially designed for screen use and should thus be better accepted by the viewers. Nevertheless, the results show that the suitability of typefaces according to theoretical knowledge is not as expected. The goal was to investigate how six different typefaces affect the reading speed and comprehension of presented text. The participants were Croatian and Slovenian students who took the test in the English language.*

Keywords: *comprehension, fixation, language, legibility, typeface.*

1 INTRODUCTION

When considering typefaces for an on-screen presentation, there are certain aspects that need to be examined first. As we know, an important aspect of typefaces for on-screen reading is legibility [1]. Some studies of font legibility by means of reading efficiency resulted in no significant typeface effect [2, 3]. In the study by Erdogan [4], the legibility of web pages which are designed for instructional purposes were compared according to typefaces and foreground/background colour combinations. It was found out that Verdana is considered as the most legible typeface. There are some typeface characteristics, which are just as important when observing legibility. For small typeface sizes (the case in our study), the difference in stroke weight and size of x-height is important [5]. The differences in these two parameters are evident, yet the question arises how exactly these facilitate or impede fast reading and good comprehension [6]. Of course, distinctive character features, ascender, descender, contrast, size, leading, serifs etc are of the essence as well. In the study by Arditi & Cho [7], it was established that the presence or absence of serifs makes no difference in the reading speed. Five percent of serif typefaces were slightly more legible than the sans serif typefaces. The observed effect was barely noticeable. When researchers report about better legibility for serif typefaces for print and sans serif typefaces for screen, their findings are based on the subjective perception of participants rather than objectified test results [8−10]. Web designers, on the other hand, agree that sans serif fonts give better computer screen legibility, especially with small typeface sizes [11−13]. A study by Tullis et al [14] found no difference in the reading speed between serif and sans serif typefaces. While investigating information recall, it was established that serif typefaces significantly improve information recall [15, 16]. While comparing the effects of text size and text format on the legibility of computer-displayed text in Times New Roman and Arial, it was found out that the 10-point anti-aliased Arial typeface was read more slowly than other typefaces [17]. The analysis of popular online fonts indicated that both Times and Arial were read significantly faster than Courier, Schoolbook and Georgia [17, 18].

2 EXPERIMENTAL

The main parameter when preparing tests for this study was the objectiveness of results. To achieve such testing, a thorough preparation of studied texts plays an important part. The theme of presented texts was popular science which is not difficult to read and facts are easily memorable, which was important after the reading, as each test person had to answer a question regarding the content. All presented texts consisted

of 200 words in 12 lines, as it is suggested by Dyson and Kipping [19]. In this case, the extent of the visible area was almost the same while the prediction was that this variable should not affect text comprehension [20]. The visual angle of presented words was the same (1.2°) for each typeface and the distance from the screen to the reader varied between 60 and 65 cm [21]. Different typefaces took part in the research. The presentation time was limited to three minutes for each text. Researchers have so far reported that the typeface on its own has little effect on the reading speed [1, 22].

2.1 Methodology

The testing was performed with the help of an eye tracking device [23, 24]. The visual attention of each person was measured using a Tobii Eye Tracker X120. There was one important difference among the testees. One group of tested persons were the native speakers of Croatian while the other group were Slovenians. This fact is important, since the testing for both groups was performed in the English language. Each group consisted of 20 persons. The eye tracker provided information about the reading time and the number of fixations for each person. Typefaces which took part in our study belong to two groups, i.e. serif (Georgia, Times News Roman, Palatino) and sans serif (Tahoma, Arial, Verdana). Furthermore, two of the tested typefaces are made especially for on-screen use (Georgia, Verdana), whereas the basic usability of other typefaces is for printed text [8, 25]. Nevertheless, some characteristics of the typefaces for print use are appropriate for screen use and can hence be tested on-screen [26, 27]. The main variables that were observed in the study were time and fixation [24].

3 RESULTS AND DISCUSSION

The average reading time for each typeface gives data about typeface legibility and visibility. In addition, the ratio between the average reading time and average number of fixations provides for comparisons between the Croatian and Slovenian readers of the English language. The average ratio (cf. Figures 1 and 2) between the time and fixations was 2.40. It was noticed that the Slovenian readers with the average ratio of 2.39 are slightly better readers compared to the Croatian readers with the average ratio of 2.41. Furthermore, the average time when comparing serif and sans serif typefaces must be exposed. The average reading time for sans serif typefaces (for both language groups) was 77.63 s, while for serif typefaces, the average reading time was 78.77 s. This gives the difference of 1.14 s, which seems small but when observing fast reading and the time limited presence of text, each additional second can affect comprehension. These numbers are calculated on the basis of average times for each typeface and test person, and can be seen in Figure 1. When comparing typefaces, the longest average reading times were observed at the serif typefaces Georgia, Times and Palatino (cf. Figure 1) where the typeface Georgia proved as the least appropriate typeface for screen reading. When comparing sans serif typefaces (Tahoma, Arial, Verdana), Arial turned out as the least legible typeface according to the required reading time, which was the longest. A full review of tested typefaces showed that Tahoma was the typeface that was the best accepted. Both, the Croatian and Slovenian readers needed the least time to read the text in this typeface. The average time was not the shortest; however, the difference when observing standard deviation was the smallest (0.82).
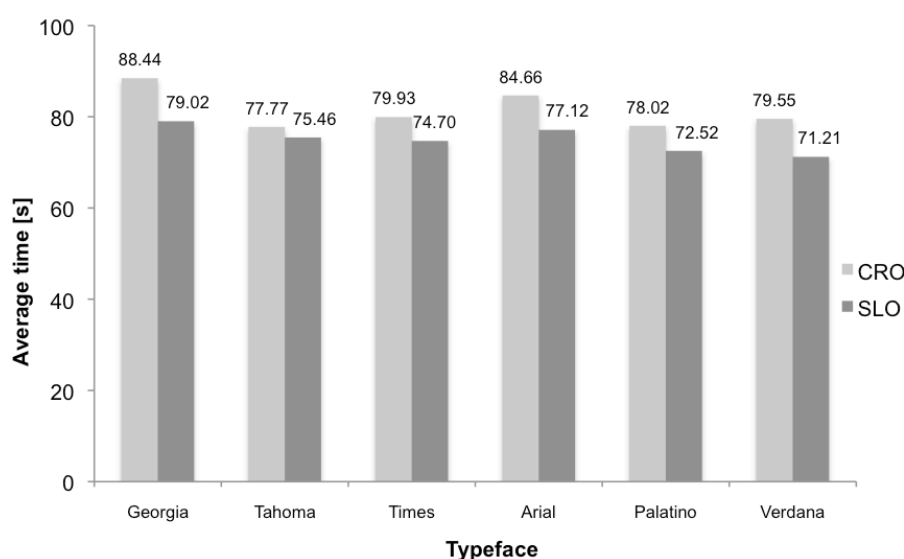

Figure 1: Average reading times for Croatian and Slovenian viewers.

An important aspect when observing visibility and legibility of typefaces is the number of fixations (cf. Figure 2), which was measured with an eye tracking device. The number of fixations should be proportional to the reading time. If there are more fixation points, the reading time is longer. However, in this case, the results show an inversely proportional relationship. It is seen that the number of fixations is disorderly distributed among the testees. For example the typeface Georgia (cf. Figure 1), where the reading times were the longest, was not characterised by the highest number of fixations. Another example was the typeface Verdana where the average reading time for all participants was 75.38 s, which was slightly below the average reading time (77.63 s) for sans serif typefaces. The number of fixations in this case was the highest for both groups of participants (cf. Figure 2). Relevant parallels can be drawn at the average reading time (cf. Figure 1) for the typeface Tahoma and the number of fixations (cf. Figure 2) for this typeface. The smallest deviation when comparing the reading times is seen at the typeface Tahoma. Similar findings can be observed when fixations are compared. It is true that the average number of fixations is not the smallest, however, the difference in the number of fixations for the Croatian and Slovenian group is. According to the results, the Croatian readers needed on average one fixation more than the Slovenian readers when the texts where presented in the typeface Tahoma (cf. Figure 2).
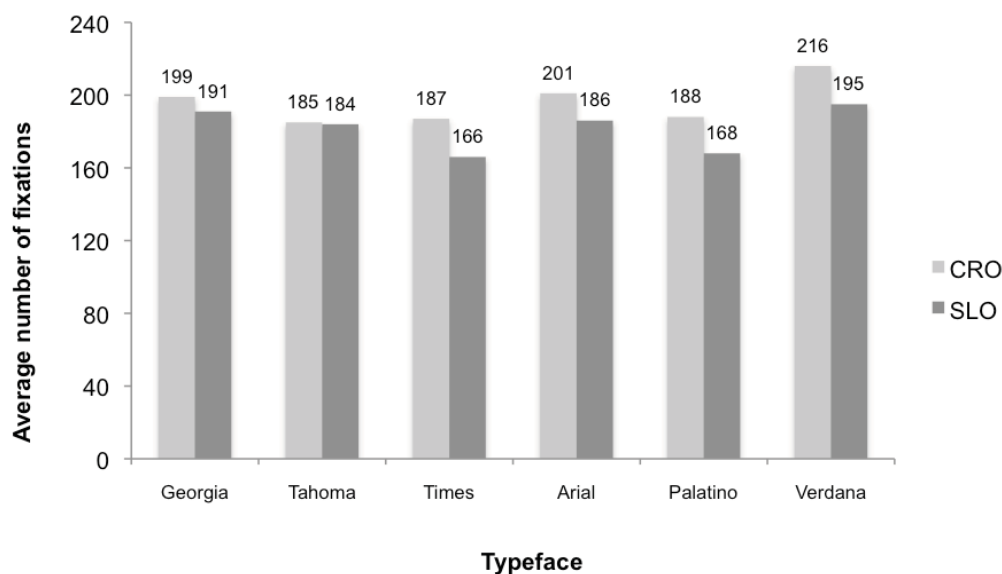

Figure 2: Average number of fixations for Croatian and Slovenian viewers.

On average, the Croatian readers got 19 out of 20 answers correct (cf. Figure 3). In this aspect, the Slovenian readers responded slightly worse with the average 18.8 correct answers out of 20. Moreover, when the typeface Palatino was used, the correctness of answers was the highest (for both language groups). The reason for this can be found in the shape of letters. While the typefaces Georgia and Times News Roman are slightly narrower (shape of letters), the typeface Palatino has a larger counter size. Wider letter shapes seem to ensure better legibility and consequently recalling. According to the number of correct answers, the typefaces Times and Arial are the least acceptable (cf. Figure 3). Despite the same number of correct answers for Croatians and Slovenians, the average value 18 is below the overall average value, which is in this case 18.9 (of correct answers). A comparison of correct answers for the typeface Tahoma is interesting, while the number of correct answers is not the highest. It would be expected that, since the difference in the average reading time was the smallest for both groups as well as the deviation in the number of fixations, the correctness of answers would be the highest. It turned out that character features are not as distinctive as it was meant, while the typefaces Georgia, Palatino and Verdana provided for the highest correctness of answers.
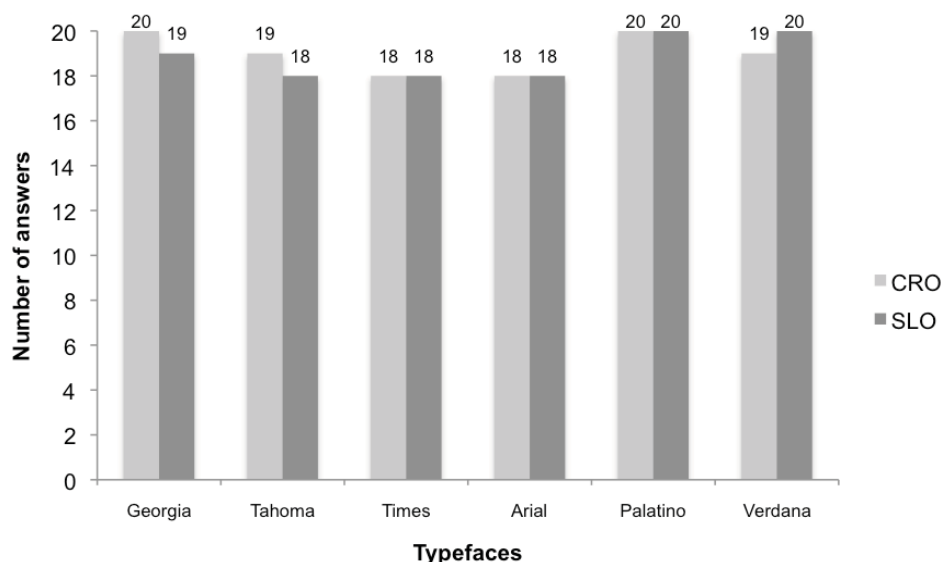
Figure 3: Correctness of answers for each typeface and language group.

4   CONCLUSION

The main differences when comparing typefaces are hidden in the details of typefaces. Even though the sans serif typefaces should provide better legibility on-screen, the study shows that this is not the case here, as, when compared to serif typefaces, the differences are small. Nevertheless, on average, sans serif typefaces have the shortest reading times. In this comparison, the number of fixations did not play an important role. According to the number of fixations for serif typefaces, the number is smaller compared to the sans serif typefaces. This indicates that the number of fixations does not affect the reading time. Another observation is among the number of fixation points and the number of correct answers. It turns out that the number of fixation points does not affect the correctness of answers. The results do not indicate a meaningful connection between these two variables. There is a small difference in the reading time for the Croatian and Slovenian students. On average, the texts were read more slowly among the Croatian students, however, this did not affect the correctness of answers. The number of incorrect answers is within the normal range between both groups. The Croatian and Slovenian languages are in the same language group but somehow different. Understanding the opposite language could cause some difficulties among the testees. This is the reason why all the tests were performed in the English language, as this is the second language for both test groups and can hence provide objective results.

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