

Legibility analysis of self-designed typeface with eye-tracking device

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Introduction

Typography appears in every aspect of our lives. It is closely intertwined with the representation of information, communication, and our cultural and national identity. Until the invention of computer in printing, only a few typefaces were in use. Then, almost overnight, a flood of new typefaces appeared in different type styles or in their combinations. Nowadays, a vast number of tools is available for designing typefaces, enabling almost anyone to do it. Nevertheless, not every typeface is well designed and useful, i.e. legible. A successful type design requires following the established aesthetic and technical principles. Moreover, it should follow perceptual principles. The communication through a page or display requires from the reader to translate symbols into meaning. Legibility refers to how easily this process is performed. To make reading possible, the text must be visible and recognisable; however, visibility and recognition are influenced by the typographical choice. Legibility and the reading process can be studied by tracking eye movement. Reading does not occur as a continuous movement of eyes along the lines of a text, but rather as a sequence of rapid eye movements (saccades) and individual fixations. Fixations are short stops on individual words or groups of words which enable the brain to process information. Saccades are extremely quick eye movements with which we change the direction of our gaze in a moment and align the image of the object of interest with the macula of retina.

Problem Description

The aim of this study was to examine the legibility of various useful typefaces in comparison to a self-designed typeface. The self-designed typeface was not based only on the principles of good legibility. Its design was based also on the paintings by the Slovenian painter Matija Jama (1872–1947), whose 150th birthday is celebrated this year. The Impressionist painter's typeface should not only have the qualities of artistic style, but also be usable, i.e. legible, for a longer text.

Methods

Legibility of the self-designed typeface was tested in comparison to three established typefaces (cf. Figure 1–4) with similar design features; the old style typeface Minion, the transitional typeface Bentham and the humanistic sans serif typeface Gill Sans.

The study was conducted by analysing texts in the Slovenian language from the book *Ernjevina kuhinja* (by Zoran

A B C Č Ć D E F
G H I J K L M N O P
Q R S Š T U V W X Y Z Ž
a b c č ć d e f g h i j k l m n
o p q r s š t u v w x y z ž

Figure 1: Typeface Mila

A B C Č Ć D E F
G H I J K L M N O P
Q R S Š T U V W X Y Z Ž
a b c č ć d e f g h i j k l m n
o p q r s š t u v w x y z ž

Figure 2: Typeface Minion

A B C Č Ć D E F
G H I J K L M N O P
Q R S Š T U V W X Y Z Ž
a b c č ć d e f g h i j k l m n
o p q r s š t u v w x y z ž

Figure 3: Typeface Bentham

A B C Č Ć D E F
G H I J K L M N O P
Q R S Š T U V W X Y Z Ž
a b c č ć d e f g h i j k l m n
o p q r s š t u v w x y z ž

Figure 4: Typeface Gill Sans

Hočevar), using an eye-tracking device (Tobii 120X). 12 texts of similar length (70 characters per line) in display sizes 16, 21 and 26 px were used. The texts were set in a CSS style sheet and displayed as an HTML document. 20 individuals were participating, 5 male and 15 female, with the average age of 20.60 years. The results were calculated for 500 characters.

Results

When presenting the results, we focused on reading time, number of fixations and saccade length.

Reading time. The results (cf. Figure 5) showed the speed of reading for each of the tested typefaces. The average reading time was the longest for the typeface Mila (in all type sizes). The texts displayed in the type size 16 px were read the quickest when set in the typeface Minion and the same outcome can be observed for the type size 21 px. At the size 26 px, the shortest reading time was measured for the typeface Bentham. On average, the shortest reading time was recorded for the texts displayed in the size 21 px (28.27 s). For the size 26 px, the average reading time was 28.43 s. The participants spent the most time reading the texts displayed in the type size 16 px (29.03 s). On average, the reading time was the shortest for the typefaces Minion and Bentham, both of which had an average of 27.94 s for all type sizes.

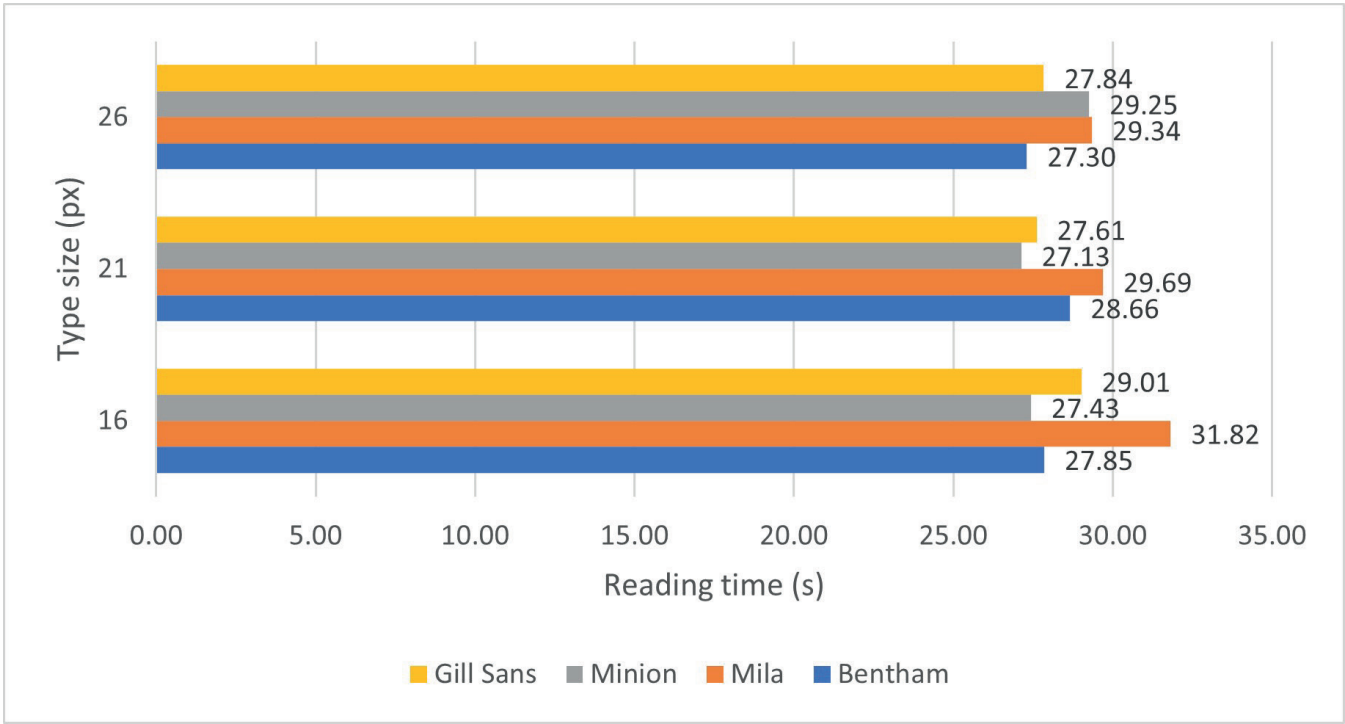


Figure 5: Comparison of average reading time (s) for all typefaces, depending on type size

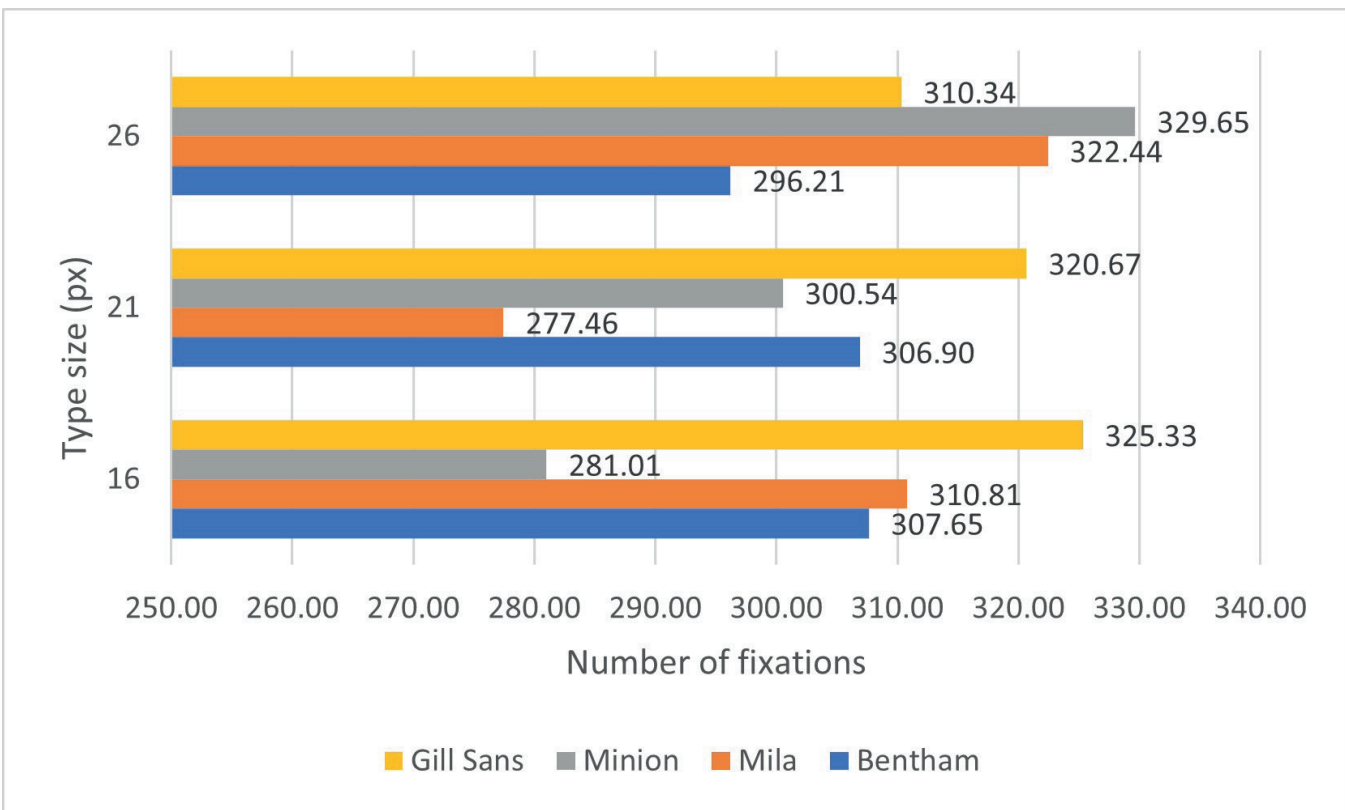


Figure 6: Comparison of average number of fixations for all typefaces, depending on type size

Number of fixations. Figure 6 shows the number of recorded fixations for each type size. On average, the type size 21 px had the smallest number of fixations (301.39). For the type size 16 px, the average number was 306.20. The most fixations were made at the type size 26 px, on average 314.66. When compared, the typefaces Bentham, Mila and Minion had a similar average number of fixations (303.57–303.73). The typeface Gill Sans had a noticeably higher number, i.e. 318.78.

Saccade length. Figure 7 shows the average length of a saccade, expressed in the number of characters. The length of saccades was the longest for the type size 16 px, where the length of a saccade was on average 2.40 characters. For the type size 21 px, the average saccade length was 2.29 characters. The shortest length recorded was for the type size 26 px, where the average saccade length was 2.08 characters. The typeface Bentham had the average saccade length of 2.43 characters. The typeface Minion had the length of 2.35 characters, followed by the typeface Mila (2.33 characters). The shortest saccade length, i.e. 1.91 characters, was recorded in the texts presented in the typeface Gill Sans.

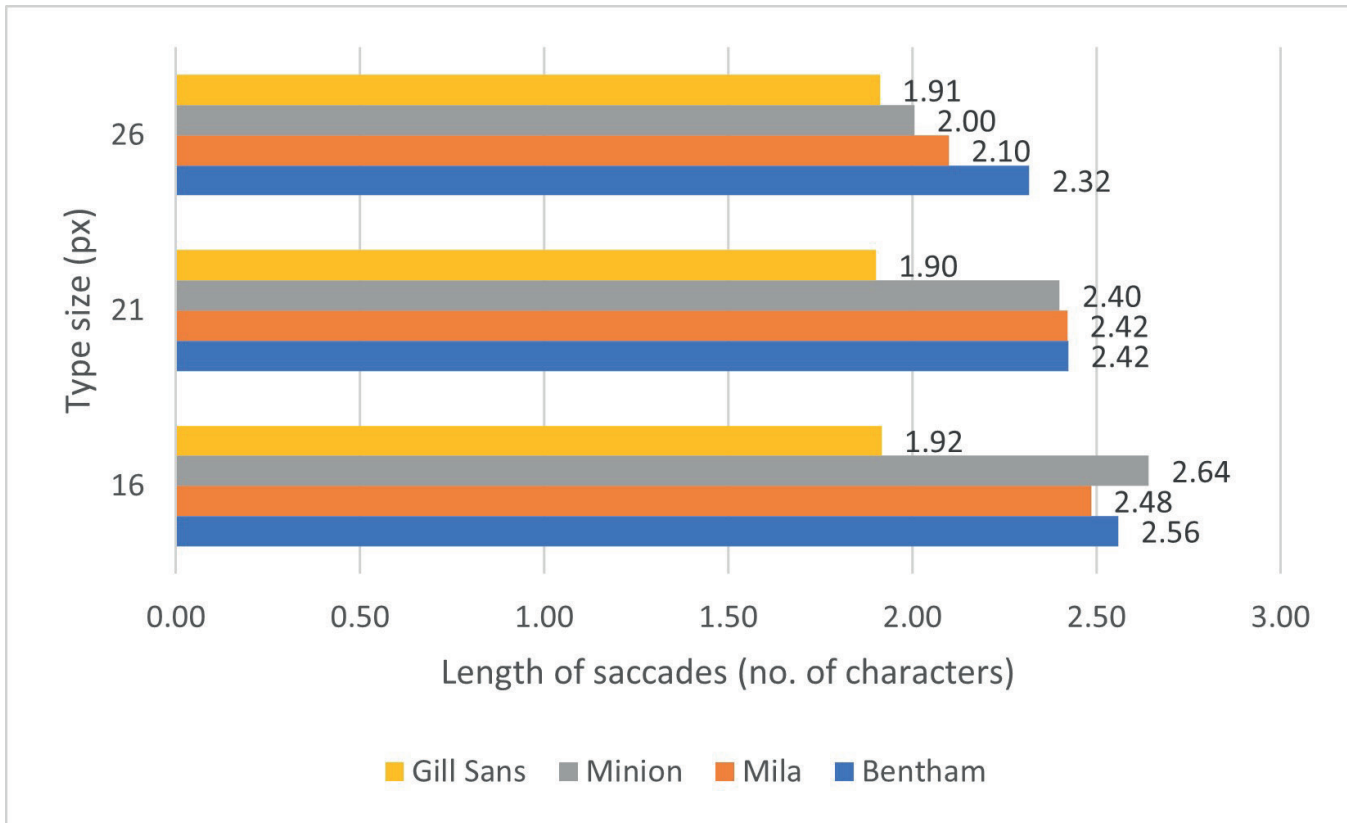


Figure 7: Comparison of average saccade length for all typefaces, depending on type size

Discussion / Conclusion

Based on the characteristics of different typefaces and the results of legibility analysis, we came to the conclusion that the typeface Bentham proved to be the most legible. The optimal results were obtained at the type size 26 px, where the length of saccades was the longest. The typefaces Bentham and Minion had the shortest reading times. Among all the studied typefaces, the texts in the typeface Mila were the slowest to read, with the reading times being the longest for all type sizes. The self-designed typeface turned out to be the most legible at larger type sizes. In smaller type sizes, legibility was worse due to thin character strokes and smaller size of serifs. The highest number of fixations and the shortest saccade length measured in texts displayed in the typeface Gill Sans indicate that this typeface is not particularly legible under the selected conditions.

This study showed interesting results, especially when observing the length of saccades, where all measured values were relatively small. Before starting this study, we assumed the self-made typeface to be useful and legible in larger type sizes, which was proven correct.

The findings and results of the research can contribute to a more appropriate type design in consideration of legibility and, consequently, to the design of more legible typefaces.