

Reading Speed of Different Fonts in Young Ametropes

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Abstract: This study has been carried out to compare reading speed and visual comfort of different font types in young Ametropes. Nowadays every work uses computer in one way or the other. There is no other study done before for Ametropia with fonts. Thus, it becomes a crucial to find out the best font type for Ametropes to read text on a computer screen. Several studies have found no significant differences in reading efficiency between the font types at any size. But there were, however, significant differences in reading time. In this prospective study, 6 font types (Times New Roman; Arial; Verdana; Georgia; Courier new; Comic sans MS;) were chosen. The sample size for this study is 60, with 43.3% being male and 56.7% being female. They were asked to read the given passages in 6 different font types. They were also asked to grade the font types according to their visual comfort. The data collected were then analyzed by comparing the reading speed of different font types between different types of Ametropia.

Keywords: Ametropia, Emmetropia, Fonts, Verdana, Serif, Sans-Serif, Reading Speed.

I. INTRODUCTION

Nowadays text on computer screens consist of a mixture of both serif and sans serif fonts that were originally designed for computer use, as well as those that were made to use for print. Serif fonts are designed so that cross-strokes project from the main stroke of a letter, whereas sans serif fonts do not. Fonts designed for print, such as Times, were created for both legibility and economy of print space. Georgia, on the other hand, was designed specifically for computer-display. Georgia is quite similar in to Times New Roman in appearance. However, to compose Georgia more legible for computer-screen viewing, its uppercase characters were lightened and the letters' x-height (the height of the torso for lowercase letters, such as an 'x') was increased 2,3. Previous studies had found that Georgia was significantly perceived to be easier to read, sharper, and more legible than Times on computer screen 2,3. Another commonly used serif font is Courier New and it was originally designed as a typewriter face and now using as a mono-spaced font.

Table 1.1: Fonts that were studied

Serif Fonts	Sans Serif Fonts
Courier New (Courier)	Arial
Georgia	Comic Sans MS (Comic)
Times New Roman (Times)	Verdana

The most commonly used sans serif font is out to be Arial. However, Verdana is also very popular. Arial has a rather large x-height and the letters are spaced so they do not touch. Verdana are specifically intended for viewing on computer-screens by also having wider letter spacing and a large x-height. Moreover, great attempt was taken to produce the lowercase letters, j, l, and I more distinctive on computer screens. Another sans serif font that has become quite popular is Comic. Comic was made to mimic print found on comic strips, and it is preferred more among in children.

Ametropia is an error where the light by the eye from an object doesn't focus onto the retinal plane and is a common cause of visual impairment. Ametropia consists of myopia, hyperopia and astigmatism and is corrected mainly with spectacles. It is estimated that about 2.3 billion people worldwide including children are Ametropic. Previous studies of binocular reading in amblyopia have reported slower reading in adults and school-age children compared with normal controls. However, in the present study we are going to compare the ametropes' reading speed of different font types with the normal control Emmetropia.

II. METHODOLOGY

In this prospective study, we selected 60 young adults having Emmetropia and Ametropia (≤ 6 dioptries). Subjects were excluded from the study if they have any binocular anomalies or ocular diseases. 6 font types (Times New Roman, Arial, Verdana, Georgia, Courier New and Comic Sans MS) from both serif and sans serif were used. Informed consent was obtained from the patient before examination. All participants in this study spoke English. The subjects also did their high school in English medium. Complete eye examination including binocular vision assessment was done. They were asked to read the given passages of six different fonts which were selected from bedtime stories so that there should not have difficulty in comprehension of the text. The passages were from beginner reader level. Seconds to complete the given paragraph for each font were recorded. Each paragraph was designed to give the same layout consisting of approximately the same number of characteristics with spaces. They were also asked to grade the font types according to their visual comfort. This data was then analyzed by comparing the reading speed of six different font types between different types of ametropias. Texts were presented on computer screen.

III. DATA ANALYSIS AND RESULTS:

Statistical analysis was performed using Statistical Package for Social Sciences (SPSS) version 20 software. Differences of reading speed between Ametropia and Emmetropia were compared by using non parametric test called Kruskal Wallis test.

The total sample of the study was 60. Out of the total sample, there were 43.3% males and 56.7% females. The mean age of the subjects was 24.4 ± 4.1 years with a range of age 18 to 35 years. The mean reading time of six different fonts (Arial, Times New Roman, Georgia, Comic, Verdana and Courier new) are given below. Verdana was reading fastest out of the six fonts followed by comic.

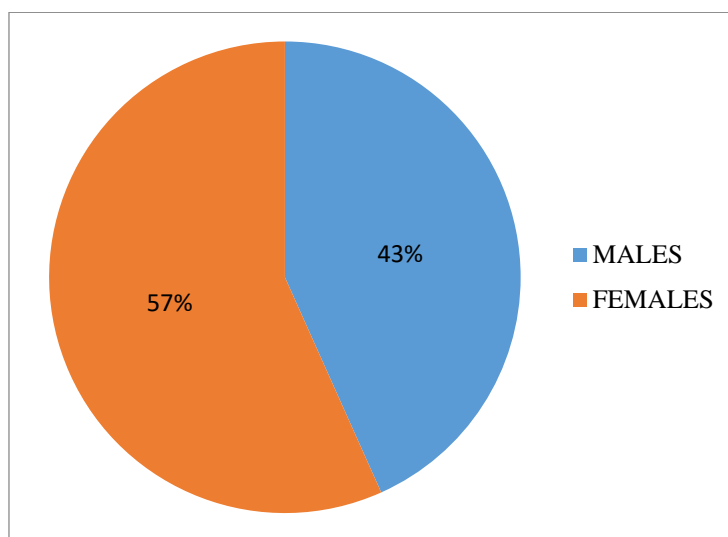


Figure 3.1: Distribution of gender

Table 3.1: Statistics

Fonts	Arial reading time	Times new roman reading time	Georgia reading time	Comic reading time	Verdana reading time	Courier new reading time
N	60	60	60	60	60	60
Mean	73.88	73.05	72.77	72.02	68.78	73.43
Std. Deviation	11.084	10.465	11.469	10.323	9.517	9.910

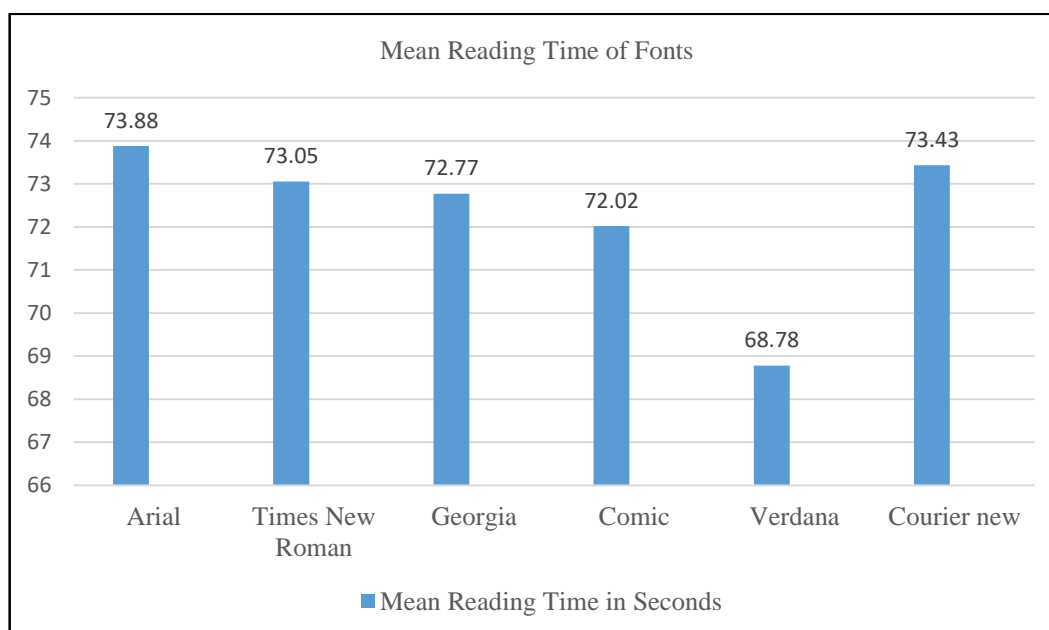


Figure 3.2: Mean Reading Time of Fonts

In comparing the reading time of different fonts between Emmetropes with Ametropes, there was no significant difference for Times New Roman, Verdana and Courier with p values 0.07, 0.9 and 0.3 respectively. On the other hand the reading time of Arial, Georgia and Comic had a significant variation between Emmetropes and Ametropes with p values 0.01, 0.001 and 0.001 respectively. The mean reading time of Emmetropes and Ametropes for different fonts are given in the following table 3.2. In Emmetropes, Verdana was reading fastest and Georgia the slowest. In Ametropes, Georgia; Comic read fast followed by Verdana and Courier being slowest.

Table 3.2: Mean Reading Time between Emmetropes and Ametropes

Group	Arial reading time	Times New Roman reading time	Georgia reading time	Comic reading time	Verdana reading time	Courier New reading time
Emmetropes						
Mean	77.53	75.17	78.17	76.43	68.33	74.97
Std deviation	10.5	11.1	9	9	8.4	9.2
Ametropes						
Mean	70.23	70.93	67.37	67.6	69.23	71.9
Std deviation	10.5	9.4	11.2	9.7	10.5	10.4

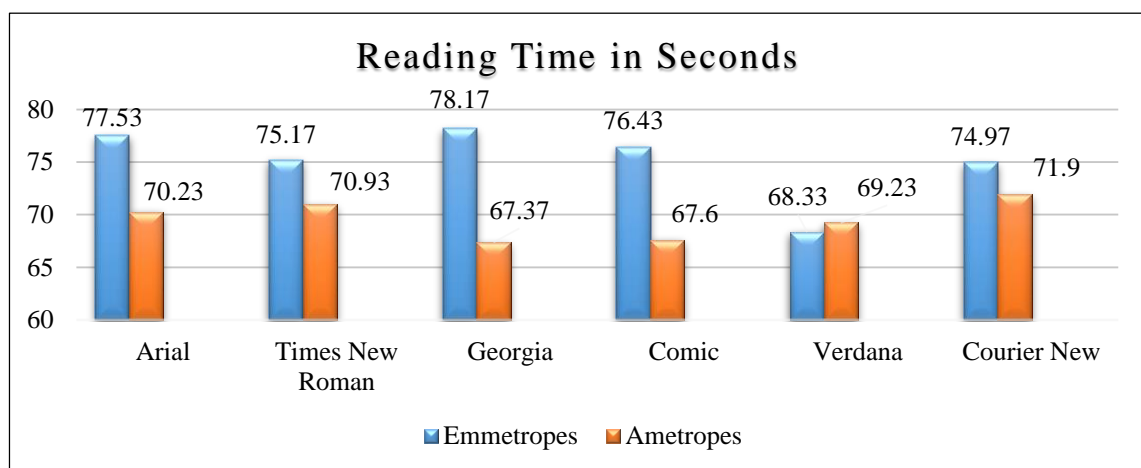


Figure 3.3: Reading Time between Emmetropes vs Ametropes

In Arial font type, there was significant variation of reading time between myopia, hyperopia and astigmatism with a p value <0.03. In Times new roman font, there was significant variation of reading time between these three independent groups with a p value <0.02. In Georgia font, there was no significant variation of reading time between these three independent groups with p value 0.2. In Comic font there was no significant variation of reading time between the three variables with p value 0.1. In Verdana font, there was no significant difference of reading time between myopia, hyperopia and astigmatism with p value 0.1. In Courier new font, there was no significant difference of reading time between myopia, hyperopia and astigmatism with p value 0.2. The mean reading time of myopia, hyperopia and astigmatism for six different fonts are given below. In myopia, Comic read fastest followed by times new roman and courier new the slowest. In hyperopia, Comic read fastest followed by Verdana. Courier was the slowest font. In astigmatism, Georgia read fastest and Courier new the slowest.

Table 3.3: Mean reading time for different types of ametropia:

Types of Ametropia	Arial Mean Reading Time	Times New Roman Mean Reading Time	Georgia Mean Reading Time	Verdana Mean Reading Time	Comic Sans MS Mean Reading Time	Courier New Mean Reading Time
Myopia	65.7±7.57	64.6±8	67.2±9.1	67.1±14.2	64.4±10	69.5±9.5
Hyperopia	77.4±10.9	77.30±10.4	73.8±16.1	74.2±8.2	71.5±9.3	77.8±11.5
Astigmatism	70.9±8	72±4.7	64±9	67.5±7.8	68.9±9.8	72.6±11.5

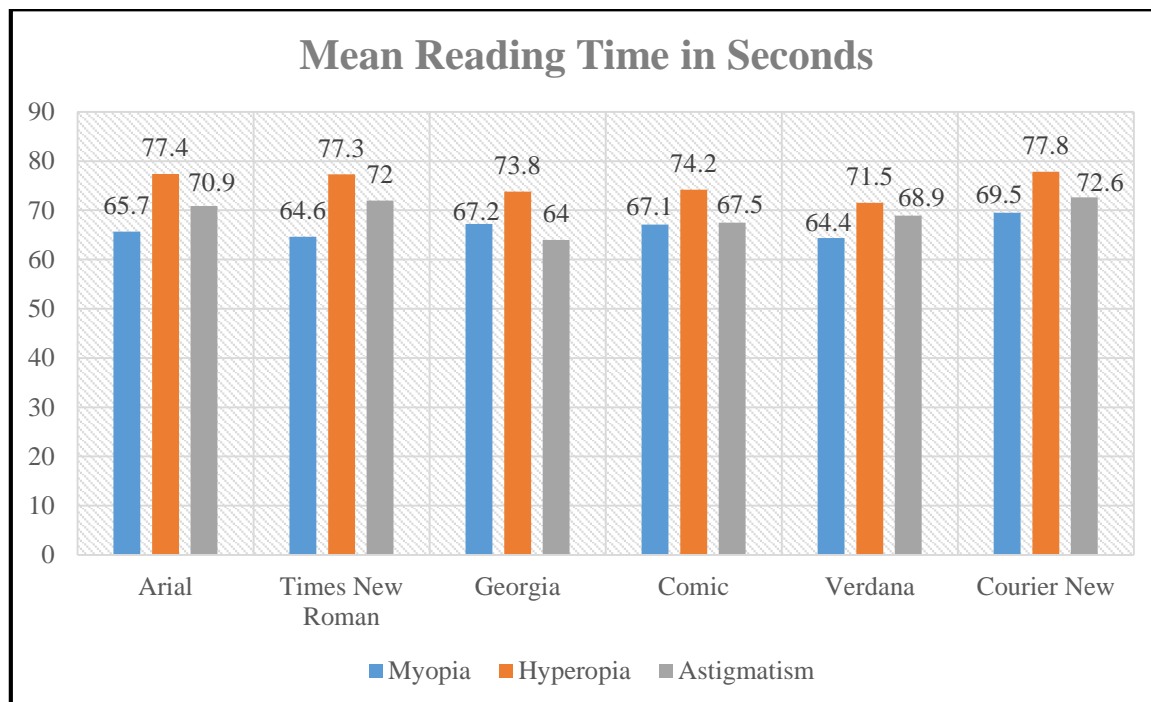


Figure 3.4: Mean Reading Time between Myopia, Hyperopia and Astigmatism

Preference on basis of visual comfort: Verdana was the most preferred font which was followed by comic and Georgia respectively, with Courier New being the least preferred font followed by Arial.

Reading Efficiency: There was no significant difference in reading efficiency (reading time/accuracy) for font type.

IV. DISCUSSION

Verdana was reading fast out of the six fonts, followed by Comic in this study, which was similar with the study done by Michael Bernard, Corrina Liao, & Melissa Mills et al. While in the study done by Michael Bernard, Melissa Mills, Talissa Frank, & Jan McKown et al, Times New Roman read faster than Georgia and Courier, followed by Arial. In previous study, it was found that the amblyopic eye read slower than the normal control group. In this study, the reading time of different fonts between Emmetropes with Ametropes, there was no significant difference for Times New Roman, Verdana and Courier with p values 0.07, 0.9 and 0.3 respectively. On the other hand, in this study the reading time of Arial, Georgia and Comic had a significant variation between Ametropes and Emmetropes with p values 0.01, 0.001 and 0.001 respectively. In previous studies by Susana T.L. Chung et al, there were relatively no significant difference of different font types or sizes between peripheral and central vision, but the mean reading time of Emmetropes and Ametropes for different fonts had a significant variation. In Arial font type, there was significant variation of reading time between myopia, hyperopia and astigmatism with a p value <0.03. In Times New Roman font, there was a significant variation of reading time between these three independent groups with a p value <0.02. In Georgia font, there is no significant variation of reading time between these three independent groups with p value 0.2. In Comic font there is no significant variation of reading time between the three variables with p value 0.1. In Verdana font, there is no significant difference of reading time between Myopia, Hyperopia and Astigmatism with p value 0.1. In Courier New font, there was no significant difference of reading time between Myopia, Hyperopia and Astigmatism with p value 0.2.

Verdana was the most preferred font in general which is followed by Comic and Georgia respectively which was similar with the other studies. Courier New was the least preferred font followed by Arial font while in other study Times new roman preferred least.

There was no significant difference in reading efficiency (reading time/accuracy) for different font types as similar with the other studies.

V. CONCLUSIONS

In general, Verdana was the most fastest and preferred font type while reading on computer screen. In this study, Verdana read fastest by Emmetropes while in Myopia and Hyperopia, Comic read fastest. Georgia read fastest by astigmatism. Courier new was the slowest font. It will be better in future if the study is carried out with larger population. Reading speed might be varied with different illumination system. It might also be affected by different lens curvatures, aberrations, etc.

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