Critical Analysis of a Research Article

Christine M. Bagwell
Drexel University

As the use of computers has become more prevalent in society, scientists have been studying various aspects of computer use and its impacts. In 2003, Bernard, Chaparro, Mills and Halcomb released a research article titled "Comparing the effects of text size and format on the readability of computer-displayed Times New Roman and Arial text." Specifically, they questioned which typeface, size and format combination is most readable and preferred for reading on a computer display. This is the first study to address the readability of aliased versus anti-aliased type in the context of typeface and type size.

Times New Roman and Arial were the typefaces selected for the study; they are arguably the most common typefaces in use today, as both are widely available. Times New Roman is a serif font with both thick and thin strokes that was created in 1931 for use in a newspaper. Arial is a simple sans serif that incorporates strokes of uniform thickness and was developed in 1982 as a less expensive alternative to Helvetica.

The two most frequently used type sizes in large bodies of text, 10-point and 12-point, were chosen for the study. The point size of a typeface is based on the entire body size of the type, from the tops of the ascenders to just below the bottoms of the descenders. Although two typefaces might have the same point size, their x-heights may differ significantly. The x-height is the measure of a typeface from the baseline to the midline, or about the equivalent of a lowercase 'x.' The majority of a letterform's information falls within the x-height region and the perceived height of a letterform is based on x-height. Proportionally, Arial's x-height is larger than that of Times New Roman.

Aliased and anti-aliased effects were the analyzed typeface formats. Computer displays use pixels, or small squares of information, to create type and images on the screen. Aliased, or dot-matrix, type has a jagged appearance because the edges of the pixels are visible along

diagonals and curves. Anti-aliased type incorporates various shades of color along the edges of the type to reduce the visibility of the jagged edges. As a result, anti-aliased type can often end up looking fuzzy or blurry.

The 35 study participants were volunteer undergraduate and graduate students who self-reported reading from computer displays at least a few times per week. Text passages were presented on a computer display at a resolution of 1024 x 768 pixels. At this resolution, Times New Roman has an x-height of 1.8 mm at 10-point and 2.0 mm at 12-point, and Arial has an x-height of 2.0 mm at 10-point and 2.5 mm at 12-point. The participants were asked to read eight on-screen passages, each with a different typeface/size/format combination, as quickly and accurately as possible while looking for substitution words, which may or may not be present. The substitution words were out of context with the rest of the text, but rhymed with the word that should have been used as a clue to the reader that they had discovered the substitute. Readability was measured based on the participants' accuracy as well as an adjusted accuracy score that took reading times into account. At the conclusion of each passage, each participant filled out a Likert scale questionnaire that asked subjective questions regarding the legibility of the text used in the passage. This questionnaire also served as a brief break between the reading passages.

The results were analyzed for readability and reading speed, as well as for opinions on legibility, sharpness, reading difficulty, and general preference. The researchers looked at the variance in the responses, pairwise comparisons using Dunn's multiple comparison procedure, and preference measures based on Friedman χ^2.

There was no significant difference in accuracy or adjusted accuracy between the typeface/size/format criteria. The researchers analyzed the statistical power of the study and

determined that the differences between the criteria yielded a very small probability of detecting a significant difference unless the sample size was increased substantially. That being said, the results align with previous studies of printed text, showing that adjustments within common standards for typeface and size do not greatly affect readability.

When accuracy was taken out of the equation, reading times showed significant interaction between typeface, size and format. The reading times for dot-matrix type did not significantly differ in the different typefaces and sizes, but the reading time was significantly longer for 10-point anti-aliased Arial than for the other combinations. Overall, the reading times for the passages with smaller text were slowest and that is consistent with previous studies. However, one is left to wonder why reading times would be analyzed without also incorporating accuracy if a true measure of readability is to be ascertained. If a participant cannot accurately read a passage, how can the readability be determined?

Subjectively, the participants believed the 12-point text was the most legible, sharpest, and easiest to read, regardless of typeface or format. The researchers were surprised that the format did not affect the participants' opinions on legibility, particularly because the blurring effect of anti-aliasing lowers the contrast between the text and the background, but acknowledged that the readability effects of anti-aliasing may be minimal at standard body-text sizes. Times New Roman was perceived as being harder to read than Arial, which the researchers see as a function of the serifs reducing legibility on a computer display. Previous studies have shown that, on computer displays, sans serif typefaces perform better and are preferred. In addition, Times New Roman has less space between type characters than Arial has, which may impact perceived readability. Overall, the participants ranked 12-point dot-matrix Arial as the preferred combination, followed by both 12-point dot-matrix Times New Roman and 12-point

anti-aliased Arial. Ten-point anti-aliased Times New Roman was the least preferred combination by a significant margin.

In summary, the objective results yielded no significant differences between the text combinations, with the exception of the slow reading time for 10-point anti-aliased Arial. Subjectively, 12-point text was considered most readable and was the preferred choice. The researchers claim that Times New Roman was significantly more difficult to read than Arial despite 12-point Times New Roman and 10-point Arial having the same x-height, and Arial was generally preferred over Times New Roman. The researchers concluded that, in agreement with past studies, 12-point dot-matrix Arial is the most readable and preferred text. They also noted that 57% of the participants used 12-point Times New Roman as their default text, compared to 8.6% using 12-point Arial, 8.6% using 10-point Times New Roman, and 24.9% either unsure of which font they used or using some other font. They believe that the increased familiarity with Times New Roman should have resulted in favorable results for that font. They close with the acknowledgement that this study only examined two fonts at two sizes, and should not be expected to correlate with other fonts or sizes, especially since many other factors can influence readability.

It is unclear how the researchers came to their conclusions regarding the subjective data, particularly as 12-point Times New Roman compares to 10-point Arial, which share the same x-height and therefore the same perceived text size. Table 3 (Bernard et al., 2003, page 831) shows that 12-point Times New Roman had higher legibility and sharpness scores, along with lower reading difficulty scores, than 10-point Arial regardless of format. Table 4 (Bernard et al., 2003, page 832) shows that 12-point dot-matrix Times New Roman has, by far, the highest preference over 12-point anti-aliased Times New Roman and 10-point Arial in either format. Figure 1

(Bernard et al., 2003, page 833) shows that 12-point dot-matrix Times New Roman, at about 27% preference rating, is significantly preferred over 12-point anti-aliased Times New Roman (about 7%), 10-point dot-matrix Arial (about 5%), and 10-point anti-aliased Arial (about 3%). It puts into question the legitimacy of comparing fonts based on body size of the type rather than x-height.

It is interesting to note that many recent typography studies involve the fonts Arial and Times New Roman. While the accessibility and familiarity of these two fonts can be an advantage, that same familiarity may prove to be a disadvantage in certain research situations. Does a study participant find one typeface more readable simply because he/she uses it frequently? Or does the novelty of a less familiar font hold their attention more? Is it better to study the readability of unfamiliar fonts for a more objective approach? Or is it better to continue to study these two specific typefaces so that the full body of research has a common thread running through it?

Reference List

Bernard, M. L., Chaparro, B. S., Mills, M. M., & Halcomb, C. G. (2003). Comparing the effects of text size and format on the readability of computer-displayed times new roman and arial text. *International Journal of Human – Computer Studies, 59*(6), 823-835. doi:10.1016/S1071-5819(03)00121-6