The Effects of Font and Formatting on the Readability of Text on the Web - A review of current research -

Abstract
Text on websites serves the purpose of displaying information and it is optimal for this text to be quickly and easily readable for users. In this review we will be investigating two aspects of readability, font and formatting. Research by Sheedy, Subbaram, Zimmerman and Hayes (2005) suggests that the font Verdana is more readable than Arial, Georgia, and Times New Roman. This research also suggests that the use of thicker strokes increases readability and italics decrease readability. Research on the use of serifs and aliasing, on the other hand, have shown conflicting results. Research on formatting has suggested that medium line length, large line spacing, left-aligned text, and paging instead of scrolling all increased readability (Wästlund, Norlander, and Archer, 2008. Dyson and Haselgrove, 2001. Ling and Steak, 2007). Based on these results, it is recommended that designers choose fonts that increase readability (Verdana), use heavier weighted strokes, and avoid italics. In terms of formatting it is recommended that designers choose text that fits on a single page without the need for scrolling, use a line length of roughly 55 characters per line, align paragraphs to the left, and use 1.5 or 2-line spacing.

1. Introduction
As of 2012 an estimated 81.03% of people in the United States use the internet (International Telecommunication Union, 2013). With this increasing number of people interacting with websites, usability becomes increasingly more important. Whether browsing the web or searching for information users have a vast amount of information to sort through. This makes readability are vital to keeping a user on your page. Text is one of many vital aspect of user interface design and in this review we will take a closer look at certain attributes of text in hopes to find ways to increase readability, and thus increase usability.
There are many different ways text can be displayed on a computer screen, with some forms of text being easier and more pleasurable to read than others. If text is difficult to read, or takes too much effort to read, users may pass it by and miss the essential information being expressed. Two aspects of text will be discussed in this review, fonts and formatting.

Fonts are important to interface design because they are the small scale details that together make up the overall look and feel of the text itself. In this review we will try to understand if some aspects of fonts can increase the readability of text on a small scale. Formatting, on the other hand, is essential to interface design because it physically shapes the body of text and thus the eye movements of the user. In this review we will also try to understand if there is a way to increase readability by adjusting the formatting of text.

2. Review

2.1 Fonts

In 2005 Sheedy, Subbaram, Zimmerman and Hayes conducted a series of four experiments investigating the readability of various fonts and font attributes. In each experiment 20-30 participants from Ohio State University were given tests of visual acuity in an effort to find the smallest size at which each passage of text (depending on the experiment) is readable. These acuity scores were then translated into standardized readability ratings before being analyzed. The first of these experiment was to determine which of four fonts was most readable, and which was least readable. The results showed that Verdana had the best readability and Times New Roman had the worst, with the other two fonts (Arial and Georgia) in between (Sheedy et al., 2005).

In another of these four experiments (Sheedy et al., 2005) the readability of font weight and italics were investigated. This experiment found that the thicker stroke font (Franklin Gothic Book) was more readable than its thinner stroke versions (Franklin Gothic Medium, Demi, and Heavy), and that italics decreased readability (Sheedy et al., 2005).

A third experiment performed by Sheedy et al. (2005) looked at the readability of serif vs sans-serif fonts. In this experiment Sheedy et al. (2005) found that in general the sans-serif fonts were more legible than the serif fonts. Though, in contrast, an experiment conducted by Gasser, Boeke, Haffernan, and Tan (2005) suggested that information was recalled significantly better when reading a serif font as opposed to a sans-serif font. In the experiment by Gasser et. al. (2005), 149 students enrolled in a psychology class at Mid-Western Public University each read a passage and were then asked to recall information from the text. Each passage was written in one of four fonts: Courier (mono-spaced serif), Helvetica (proportional sans-serif), Palatino (proportional serif), and Monaco (mono-spaced sans-serif). Of these four conditions, the participants whose passages were written in the serif fonts were better able to recall facts than the participants whose passages were written in the sans-serif fonts (Gasser et al., 2005).

Another font attribute that may affect the user experience is aliasing. “Anti-Aliasing creates the appearance of smooth curves on screen by changing the brightness of the pixels or sub-pixels
along the edges of each letterform” (Lupton, 2010, p. 73). In the last of the four experiments conducted by Sheedy et al. (2005), ClearType text (a type of antialiasing) was more legible than aliased text. In contrast, an experiment conducted by Bernard, Chapter, Mills, and Halcomb (2003) found somewhat conflicting results. In this experiment 35 graduate and undergraduate student volunteers from a city in the mid-western USA were given passages to read in 8 different formats, various combinations of the following: Arial, Times, aliased, anti-aliased, 10-point, and 12-point. The participants were timed for readability. No significant difference was found overall, but there was one interaction, 10-point anti-aliased Arial text took longer to read than all other combinations (Bernard et al., 2003). Because of this lack of main effect, and the presence of only one interaction, these results may not present enough evidence against anti-aliasing. Further research will need to be done on the effect of aliasing.

In conclusion, we can see from the above research that fonts can significantly impact usability, such as Verdana and bold text being most readable, while italics are harder to read (Sheedy et al., 2005). Though, some other research had mixed, such as the effect of serif fonts being easier to recall (Sheedy et al., 2005) but sans-serif fonts being more legible (Gasser et al., 2005), and some research found anti-aliased text to be more legible (Sheedy et al., 2005) but other research found that when small enough anti-aliased text may be more difficult to read (Bernard et al., 2003).

2.2 Formatting

In 2008 Wästlund, Norlander, and Archer conducted an experiment in Sweden on the effects of page formatting on mental workload. Their study involved 48 university students divided into two groups. The students were either instructed to read and page through a multi-page document formatted to the size of the screen (screen condition), or read and scroll through a single page document of the same size (scroll condition). While reading, both groups of participants were interrupted 10 times and asked to respond to a small popup window, this reaction time was timed and used as an indicator of mental workload. The results of this study indicated that the reaction times were faster for the screen condition, suggesting a lighter mental workload (Wästlund et al., 2008).

In terms of line length, a study done by Dyson and Haselgrove (2001) found that 55 characters per line seems to be optimal overall. Participants in this study were asked to read multiple documents, each with line lengths of either 25, 55, or 100 characters per line. Each participant was timed while reading and then asked a series of comprehension questions regarding that passage. The results indicated that when the characters per line were increased from 25 to 55 a significant increase in speed was found (though not when increased from 55 to 100), but reading comprehension was significantly better when the pages per line were decreased from 100 to 55 (though static from 55 to 25) (Dyson et al., 2001). These results suggest an optimal overall line length of 55 characters per line.

In 2007 Ling and Steak conducted a study investigating line spacing and paragraph alignment. This study involved 65 undergraduate students and had both a within- and between-subjects design. The within-subjects design measured line spacing (single spacing,
line and a half spacing, and double spacing). The between-subjects design measured text alignment (left-aligned and justified). The speed and accuracy of hits was measured by having the participant find a target hyperlinked word (hits) and by counting the number of times a participant said a target word was present when it actually was not (correct rejections). The results Ling’s and Steak’s study found that, regardless of alignment, the participants performed better when more line spacing was used, and when measuring correct rejections participants performed better with left-aligned text (but the effect of spacing was not significant)(2007). Overall when a difference was significant, performance with left-aligned text was better, and performance with more line spacing was better (Ling and Steak, 2007).

In conclusion, as seen in the above research it does appear that formatting has a significant impact on usability. This includes page formatting, paragraph formatting, and line formatting, all of which had statistically significant results.

3. Discussion

3.1 Fonts
Based on the research reviewed, it is recommended that designers take font attributes into account while designing interfaces involving the use of text. When looking at font types, Verdana is recommended while Times New Roman is to be avoided. Italics should be used sparingly as it decreases readability, and bolder font weights should be used to increase readability. Sans-serif fonts are preferred overall for improved legibility, though there is slight evidence that serif fonts may increase recall. Thus, when making a decision on the use of serifs the intent and content of the text should be taken into account. Lastly, while in most situations anti-aliasing improves the readability of text and the use of it recommended, it is important to note that one of the above experiment found it took longer to read 10-point aliased Arial text.

3.2 Formatting
When designing a page with a large amount of text, it is recommended that the document be sized to fit the computer screen, as scrolling through text has been found to increase mental workload. Overall, line length should be kept to roughly 55 characters per line, much less may reduce reading speed, while much more might reduce comprehension. Lastly, when formatting paragraphs, left-aligned text and 1.5 or 2 line spacing should be used for increased readability.

3.3 Limitations
All of the research reviewed has been conducted on average sized computer screens. No large displays, mobile phones or tablets were used. This research was also conducted on adults, nobody under 18 was used. Due to these limitations caution should be used when generalizing these findings to other devices or age groups.
References


## Guidelines

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<thead>
<tr>
<th></th>
<th>Purpose</th>
<th>Context</th>
<th>Recommendation</th>
<th>Evidence/ Rationale</th>
<th>Citation</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>Decrease mental workload</td>
<td>Text read from a computer screen</td>
<td>Use paging as opposed to scrolling when displaying large bodies of text.</td>
<td>Scrolling through text increases mental workload.</td>
<td>Wästlund, Norlander, and Archer, 2008</td>
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<td>2</td>
<td>Increase readability</td>
<td>Text read from a computer screen</td>
<td>Use the font Verdana and avoid Times New Roman</td>
<td>Verdana has the highest score of readability</td>
<td>Sheedy, Subbaram, Zimmerman and Hayes, 2005</td>
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<td>3</td>
<td>Increase readability</td>
<td>Text read from a computer screen</td>
<td>Avoid italics</td>
<td>Italics decreases readability</td>
<td>Sheedy, Subbaram, Zimmerman and Hayes, 2005</td>
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<td>4</td>
<td>Increase readability</td>
<td>Text read from a computer screen</td>
<td>Use semibold or bold fonts</td>
<td>Thicker line strokes provide increased readability.</td>
<td>Sheedy, Subbaram, Zimmerman and Hayes, 2005</td>
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<td>5</td>
<td>Increase speed and accuracy of reading text</td>
<td>Text read from a computer screen</td>
<td>Keep the characters per line at roughly 55</td>
<td>When cpl is much lower than 55 speed of reading is reduced. When col is much higher than 55 comprehension is reduced.</td>
<td>Dyson, and Haselgrove, 2001</td>
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<td>6</td>
<td>Increase accuracy of reading text</td>
<td>Documents read on a computer screen</td>
<td>Use left-aligned text</td>
<td>Accuracy of reading text is higher when using left-aligned text rather than justified text</td>
<td>Ling and Steak, 2007</td>
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<td>7</td>
<td>Increase speed of reading text</td>
<td>Documents read on a computer screen</td>
<td>Use 2-line spacing text</td>
<td>Reading speed is higher at line spacing of 1.5 and 2 than it is at 1</td>
<td>Ling and Steak, 2007</td>
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<tr>
<td>8</td>
<td>Increase speed of reading text</td>
<td>Web pages, read from computer screen.</td>
<td>If using anti-aliased Arial text, keep font sizes at 12-point or above</td>
<td>It took participants significantly longer to read 10-point anti-aliased Arial text, than it did to read 12-point Arial and 10- or 12-point Times (regardless of aliasing)</td>
<td>Bernard, Chapter, Mills, and Halcomb, 2003</td>
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