Literature Review 03/2022

Readability and Optimal Text Settings

-Taryn Bipat

Overview

Bibliography

Optimal Text Settings - Annotated Bibliography

Introduction

With the development of the web and new technological hardware, the spread of information is boundless and instantaneous. It has now become easier than ever for anyone to gather digital content. There now exists a large body of information accessible at your fingertips and you can gain new information faster than ever. Wikipedia[1]is considered one of the more text-heavy web pages, where users can read information on just about any subject. The expansion of information has led to new questions about how humans can easily access digital information on different types of digital devices through scanning and reading digital text.

This document is the start of the literature review conducted on this topic. This annotated bibliography gave me the opportunity to understand some of the core concepts of this topic. The academic and industry publications cover some of the key findings about optimal web settings.

Process

In a month's time it is just not feasible to cover the entirety of the type of research that is there. To better scope this study within a months time frame, I began with the literature presented in the project scope and worked outwards. I began to see many papers cross-sited across papers and ones that showed up repeatedly. During the first two weeks of this project, I began reading the literature in the project proposal document. Through those references, I compiled a list of 47 papers that together could weave a cohesive story about readability and optimal text settings. These 47 papers additionally demonstrate how broad this research is. The topics cover different disciplines from computer science, communication, design and beyond.

Structure

This annotated bibliography is organized in three parts: a table of contents by theme; an alphabetical review of 50 relevant or influential articles, papers and book chapters; and a list of further reading. Each bibliography has the full reference, a summary of the study and how they tied to the ultimate goal of this literature review and an overview of the methodology.. I additionally add information so that these papers will be easily accessible.

[1] https://en.wikipedia.org/wiki/Main_Page

Table of Contents by Theme

A

Citation	**Abubaker and Lu, 2012**
Full Reference	Abubaker, A. A., & Lu, J. (2012, May). The optimum font size and type for students aged 9-12 reading Arabic characters on screen: A case study. In Journal of Physics: Conference Series (Vol. 364, No. 1, p. 012115). IOP Publishing.
Type	Journal Article
Theme	Language
Keywords	Readability; Arabic; Font size; Length; Font type; Reading speed; Reading errors
Link to Paper	https://iopscience.iop.org/article/10.1088/1742-6596/364/1/012115/meta
In Repository?	Yes – PDF
Summary	The Arabic language has a different set of characters with a unique cursive font. Additionally, Arabic is written in a script from right to left and also read that way. Abubakar and Lu focused on web factors such as font size, line length and font type in the Arabic language. In their study, they used two font types (Arabic Traditional and Simplified Arabic) in 10-, 14-, 16- and 18- point fonts. They had participants read text blocks aloud. Then they measured reading errors and reading speed. Their findings focus on students and found that smaller sizes in any font type was not readable for 10-12 year olds. On the other hand, font sizes 16- and 18- are more readable than any smaller-sized font, the averages of error size 18 improve in all font types, while age has a significant impact on reading speed. Simplified Arabic font is reported as readable to students aged 10-12, especially in sizes 14 and 18. Interestingly, compared to the findings of studies presented about English, Arabic needs to be presented in a larger size font for students to have good readability.
Methods	Experimental design: participants read fonts in different font sizes, types and line lengths. Then the authors measured reading errors and reading speed.

Citation

Ali et al., 2013

Full Reference

Ali, A. Z. M., Wahid, R., Samsudin, K., & Idris, M. Z. (2013). Reading on the Computer Screen: Does Font Type Have Effects on Web Text Readability?. International Education Studies, 6(3), 26-35.

Type

Journal article

Theme

Web Factors

Keywords

Font; Readability; San serif; Serif; Text; Web

Link to Paper

https://eric.ed.gov/?id=EJ1067757

In Repository?

Yes – PDF

Summary

The authors wanted to better understand how font type impacts text readability. Ali et al. tested four fonts, Georgia (serif) and Verdana (san serif) for the first respondents and Times New Roman (serif) and Arial (san serif) for the second respondents. Georgia and Verdana were designed for computer screens. Unlike other researchers, the findings from this study showed that there was no significant difference between the readability between serif and san serif font of both screen display category and print display category. However, the findings do show that Verdana was the best choice for websites with long text. Since there was no significant difference in readability, Ali et al. suggest that both San serif and serif fonts are options for web usage.

Methods

Empirical study: The authors created reading passages or text blocks using those two fonts. The passages were the same size and approximately the same difficulty to read. They had each participant read both blocks of text and the participant could rest between each activity.

Citation

Ardit and Lu, 2008

Full Reference

Arditi, A., & Lu, J. (2008, September). Accessible web browser interface design for users with low vision. In Proceedings of the Human Factors and

	Ergonomics Society Annual Meeting (Vol. 52, No. 6, pp. 576-580). Sage CA: Los Angeles, CA: SAGE Publications.
Type	Journal Article
Theme	Accessibility
Keywords	User interface; Readability; Low vision
Link to Paper	https://journals.sagepub.com/doi/abs/10.1177/154193120805200614
In Repository?	Yes – PDF
Summary	Technology helps low vision users be more efficient and effective when reading online. Ardit and Lu developed a technology called Basic LowBrowse View that will help users with low vision read web pages faster. Using principles and guidelines for low vision people, their tool divides a web page into multiple frames. The top frame is for reading text, while the bottom frame has the entire web page with all the original content. The reading frame uses a single size font of the user's choice, with configurable reading frame size, font size, colors, contrast and letter spacing. Their findings show that LowBrowse View significantly helped people with low vision with digital readability.
Methods	No methodology: The authors built a technology to help support low vision users.

B

Citation	**Banerjee et al., 2011**
Full Reference	Banerjee, J., Majumdar, D., Pal, M. S., & Majumdar, D. (2011). Readability, subjective preference and mental workload studies on young indian adults for selection of optimum font type and size during onscreen reading. Al Ameen Journal of Medical Sciences, 4(2), 131-143.
Type	Journal article
Theme	Web Factors
Keywords	Serif fonts; Sans serif fonts; Reading; Ranking; Overall mental workload

Link to Paper	https://www.researchgate.net/publication/50853367_Readability_Subjective_Preference_and_Mental_Workload_Studies_on_Young_Indian_Adults_for_Selection_of_Optimum_Font_Type_and_Size_during_Onscreen_Reading
In Repository?	Yes – PDF
Summary	The authors test various fonts and sizes to find the optimal combination for onscreen reading. Two types of fonts were used, serif fonts: Times New Roman , Georgia and Courier New and the Sans serif fonts included Arial, Verdana and Tahoma. These fonts were presented in 10-, 12- and 14- point sizes. Their findings highlighted that Serif fonts were better for readability compared to Sans serif. They recommended 14- point font size for onscreen reading and Courier New for the fastest reading time. Verdana was recommended based on subjects' ranking and mental workload scoring.
Methods	Empirical study: Within subject design, font conditions were compared by having participants read eighteen passages. The text of each passage consisted of a font from one of the eighteen type and font size conditions.
See Also	Josephson, S. (2008). Keeping your readers' eyes on the screen: An eye-tracking study comparing san serif and serif typefaces. Visual Communication Quarterly, 15(1&2), 67-79. http://dx.doi.org/10.1080/15551390801914595

Citation	**Bernard et al., 2003**
Full Reference	Bernard, M. L., Fernandez, M., Hull, S., & Chaparro, B. S. (2003, October). The effects of line length on children and adults' perceived and actual online reading performance. In Proceedings of the Human Factors and Ergonomics Society Annual Meeting (Vol. 47, No. 11, pp. 1375-1379). Sage CA: Los Angeles, CA: SAGE Publications.
Type	Conference Proceedings
Theme	Web Factors
Keywords	Line length; Readability; Children; Performance; Online; Adults
Link to Paper	

	https://journals-sagepub-com.offcampus.lib.washington.edu/doi/abs/10.1177/154193120304701112
In Repository?	Yes – PDF
Summary	Bernard et al. (2003) investigated line length effects on reading time, reading efficiency and perceived reading efficiency for children and adults. In this study, the findings showed no significant differences for reading time or efficiency for either population. However, adult users preferred shorter line lengths rather than full-screen line lengths. Additionally, adults perceived that the full text lengths resulted in better scrolling amounts than narrower line lengths. The narrowest line length condition was perceived as promoting the highest amount of reader concentration, while the medium line-length condition was considered to be the most optimally presented length for reading. Unlike the adults, children had no significant difference in perceived readability (Bernard et al., 2003).
Methods	Experimental design: Line conditions were compared by having participants read three passages, each with different line lengths. The conditions were counterbalanced by means of a Latin square design. Both the adults' and children's passages were 12-point Arial, which was black on a white background.

Citation	**Bernard et al., 2002**
Full Reference	Bernard, M., Lida, B., Riley, S., Hackler, T., & Janzen, K. (2002). A comparison of popular online fonts: Which size and type is best. Usability news, 4(1), 2002.
Type	Journal article
Theme	Web Factors
Keywords	Font type; Readability
Link to Paper	https://www.semanticscholar.org/paper/A-Comparison-of-Popular-Online-Fonts%3A-Which-Size-is-Bernard-Lida/21a32bc134881ef07726c0e45e3d01923418f14a
In Repository?	No

Summary

Bernard et al. compared different fonts at the 10-, 12-, and 14- point sizes. They compared the most commonly used serif and san serif fonts to understand differences in "reading effectiveness, reading time, perceptions of font legibility, font attractiveness, and general preference. They had 60 volunteer participants with normal or corrected vision read twelve passages. For reading efficiency, they found no significant font size or type effects.Fonts at the 12-point size were read faster than fonts at the 10-point size. In addition, a font type x size interaction was found for the perception of font legibility. In general, however, Arial, Courier, and Georgia were perceived as the most legible.

Methods

Experimental design: participants read twelve passages in different fonts and sizes.

See Also

Bernard, M., Liao, C. H., & Mills, M. (2001, March). The effects of font type and size on the legibility and reading time of online text by older adults. In CHI'01 extended abstracts on Human factors in computing systems (pp. 175-176).

Citation

Bernard et al., 2001

Full Reference

Bernard, M., Mills, M., Frank, T., & McKown, J. (2001). Which fonts do children prefer to read online. Usability News, 3(1), 2001.

Type

Journal Article

Theme

Web Factors

Keywords

Children; Font type; Readability; Web

Link to Paper

https://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.529.6655&rep=rep1&type=pdf

In Repository?

Yes – PDF

Summary

Research has also shown that different populations benefit from different font sizes. Bernard et al., 2001 conducted a similar study with the older population. They tested a 12- and 14- point font for sans and serif fonts and found that a significant main effect of size was found for font legibility in that 14-point fonts were more legible to read than 12-point fonts. A marginal interaction was also found for reading time in that participants read 12-point serif fonts significantly slower than 14-point serif or sans serif fonts.

Methods	Experimental design: Prticipants were asked to read passages with different fonts and with different sizes. The participants were asked about their perceptions and qualitative feedback.

Citation	**Beymer et al., 2008**
Full Reference	Beymer, D., Orton, P. Z., & Russell, D. M. (2007, September). An eye tracking study of how pictures influence online reading. In IFIP Conference on Human-Computer Interaction (pp. 456-460). Springer, Berlin, Heidelberg.
Type	Conference Proceedings
Theme	Web Factors
Keywords	Eye tracking; Viewing pictures; Online reading.
Link to Paper	https://www.researchgate.net/profile/Daniel-Russell-15/publication/221053664_An_Eye_Tracking_Study_of_How_Pictures_Influence_Online_Reading/links/58061cee08ae5ad1881620b5/An-Eye-Tracking-Study-of-How-Pictures-Influence-Online-Reading.pdf?origin=publication_detail
In Repository?	Yes – PDF
Summary	Beymer et al. (2008) actually show that there were no significant effects when comparing font size and font type. While using smaller font size (10 points), fixation durations were significantly longer as compared to 14- points, whereas there were no significant differences in serif vs. sans serif fonts. In almost all of the studies that analyzed the effects of font size on reading, the findings show that font size is also highly dependent on the font type that is being used.
Methods	Experimental design: between-subjects design, each participant was assigned a one-page story and asked to read the story. Eye-tracking data was collected.

Citation	**Bhatia et al., 2011**

Full Reference	Bhatia, S. K., Samal, A., Rajan, N., & Kiviniemi, M. T. (2011). Effect of font size, italics, and colour count on web usability. International journal of computational vision and robotics, 2(2), 156-179.
Type	Journal Article
Theme	Web Factors
Keywords	Web usability; Web factors; User interfaces; Font selection; Colour selection
Link to Paper	https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3866130/
In Repository?	Yes – PDF
Summary	The authors wanted to better understand the impact of font size, font style and color count on reading comprehension. They showed participants various web pages with a combination of these factors. They found that larger text sizes are more readable than smaller sizes. However, font size for a web page has no statistically significant effect on the subjects' performance of knowledge, comprehension, and analysis tasks for a web page. Bhatia et al. tested italics by giving participants three web pages with no italics, moderated italics (web page with short phrases italicized) and high italics (web page with full italicized sentences). On the other hand, they found that italics did not have an effect on subjects' performance of knowledge and comprehension tasks. Students viewing pages with no italics performed better than those viewing pages with moderate italics. In addition, students viewing pages with high italic performed better than the students viewing pages with moderate italics. Italics did not have a significant effect on students' response times to the web page. Overall based on the likeability and ease of use self-reported scores, there was no significant effect of italicized test. Essentially, italics had no impact on efficiency and satisfaction. Lastly, color count had no effect on the performance of the subjects for knowledge, comprehension, and analysis type tasks.
Methods	Empirical study: Font tasks were developed to measure effectiveness on the three web factors.

Citation

Boyarski et al., 1998

Full Reference	Boyarski, D., Neuwirth, C., Forlizzi, J., & Regli, S. H. (1998, January). A study of fonts designed for screen display. In Proceedings of the SIGCHI conference on Human factors in computing systems (pp. 87-94).
Type	Conference Proceedings
Theme	Web Factors
Keywords	On-line typography, reading performance assessment, legibility, readability, CRT display, font design, anti-aliased, on-line help, World Wide Web
Link to Paper	https://dl.acm.org/doi/abs/10.1145/274644.274658
In Repository?	Yes – PDF
Summary	Boyarski et al. (1998) studied plain Verdana font against Verdana Italic. They asked participants to complete a reading comprehension test with both of these font styles on a screen display. The finding from this study that readers preferred Verdana and had overall better readability.
Methods	Empirical design: Participants were asked to read the test, then they were given the Nelson-Denny Test of reading comprehension and a subjective perception questionnaire.

Citation	**Burmistrov et al., 2016**
Full Reference	Burmistrov, I., Zlokazova, T., Ishmuratova, I., & Semenova, M. (2016, October). Legibility of light and ultra-light fonts: Eyetracking study. In proceedings of the 9th Nordic conference on human-computer interaction (pp. 1-6).
Type	Journal article
Theme	Web Factors
Keywords	Font weight; Light fonts; Ultra-light fonts; Legibility; Text-background contrast; Text-background polarity, Eyetracking; Cognitive load.
Link to Paper	https://dl-acm-org.offcampus.lib.washington.edu/doi/abs/10.1145/2971485.2996745
In Repository?	Yes – PDF

Summary	Burmistrov et al. used eye-tracking to understand the legibility of light and ultra light fonts. They used an infrared-video-based eye tracker (SMI iView-X Hi-Speed 1250) at a sampling rate of 500 Hz and an instrument spatial resolution of 0.01 degrees. The authors used the eye-tracking device to calculate search time, duration of fixations and saccadic amplitude. Their findings, unlike other studies, also includes the saccadic amplitude: the distance traveled by the eye between two fixation points. The results of our preliminary study show that light and ultra-light fonts are less legible than their regular and bold counterparts in two variations of text-background contrast (low vs high) and two variations of text background polarity (positive vs negative). Oculomotor indicators like mean fixation duration and saccade amplitude show that light and ultra-light fonts also induce higher cognitive load.
Methods	Eye-tracking with a word search taskEmpirical study: Participants were asked to read the text in different font types and styles. Texts were prepared from the Nelson-Denny Test. After each reading, participants completed the comprehension test.

C

Citation	**Chaparro et al., 2005**
Full Reference	Chaparro, B. S., Shaikh, A. D., & Baker, J. R. (2005). Reading online text with a poor layout: Is performance worse. Usability News, 7(1), 1-4.
Type	Journal Article
Theme	Web Factors
Keywords	Layout; Readability; Comprehension; White space; Reading time
Link to Paper	https://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.561.5593&rep=rep1&type=pdf
In Repository?	Yes – PDF

Summary	Chapparo et al., conducted a study that demonstrated that whitespace does not typically lead to better reading times and comprehension. Participants were given an “enhanced” page layout that included headers, indentation, and figure placement and a normal layout. The findings showed that reading and comprehension was not impacted by the layout. However, participants preferred the “enhanced” format as it made it easier and more comfortable to read.
Methods	Experimental design: Participants were asked to read pages with different layouts. Then they were then given a comprehension test.
See Also	Chaparro, B., Baker, J. R., Shaikh, A.D., Hull, S., & Brady, L. (2004). Reading Online Text: A Comparison of Four White Space Layouts. Usability News, v. 6.2, (available at http://psychology.wichita.edu/surl/usabilitynews/62/whitespace.asp)

Citation	**Chen et al., 2014**
Full Reference	Chen, G., Cheng, W., Chang, T. W., Zheng, X., & Huang, R. (2014). A comparison of reading comprehension across paper, computer screens, and tablets: Does tablet familiarity matter?. Journal of computers in education, 1(2), 213-225.
Type	Journal Article
Theme	Screen Size
Keywords	Paper; Computer screens; Tablet; Reading comprehension; Familiarity
In Repository?	Yes – PDF
Summary	Chen et al. found that familiarity with screen size is a factor that just generally influences how well someone can read from a particular screen size. Users who are more familiar with a certain screen size will have increased readability.
Methods	Empirical study: Participants were asked the read text and then a reading comprehension test was given. The questions ranged from shallow level comprehension and summarization as deep level comprehension.

D

Citation	**Darroch et al., 2005**
Full Reference	Darroch, I., Goodman, J., Brewster, S., & Gray, P. (2005, September). The effect of age and font size on reading text on handheld computers. In IFIP conference on human-computer interaction (pp. 253-266). Springer, Berlin, Heidelberg.
Type	Book Chapter
Theme	Screen Size
Keywords	Font size; Age; Handheld computers; Screen size
Link to Paper	https://link-springer-com.offcampus.lib.washington.edu/book/10.1007/11555261
In Repository?	Yes – PDF
Summary	Darroch et al. found there is no one perfect font size on handheld devices. Their findings show that there was no significant difference in 6- to 16- point and scrolling behavior did not impact font size.. However, older people did prefer larger size texts than younger people. They additionally tried to better understand the impact scrolling had one making font size more readable. They found that the amount of text presented did not make too much of a difference so scrolling did not really have an impact. They suggest to future designers that with a screen resolution of 640x480, there should be a range of 8-, 10- and 12- point fonts to make sure that older and younger people can easily read and comprehend text on a smaller device.
Methods	Experimental design: Participants were asked to read different passages on the handheld device in different font sizes. Reading speed and reading accuracy were recorded.

Citation

Dyson, 2004

Full Reference Dyson, M. C. (2004). How physical text layout affects reading from screen. Behaviour & information technology, 23(6), 377-393.

Type Journal Article

Theme Web Factors

Keywords Layout; Readability; Screen reading

Link to Paper https://www-tandfonline-com.offcampus.lib.washington.edu/doi/abs/10.1080/01449290410001715714

In Repository? Yes – PDF

Summary Dyson reviewed empirical evidence on various layout web factors such as columns, line length, window size and line spacing. Their findings fro4m the literature suggest that spacing between the lines of a text, also impacts speed of reading on-screen. Furthermore, double spacing led to faster reading times than single spacing. This study stands out because they also compared window size, showing that window size changes the line length and also the need for scrolling. Users typically prefer larger screens and smaller screens lead to slower reading times. Each of these web factors influence each other but Dyson typically looked at them individually based on research that was currently available in 2004.

Methods Literature Review

Citation

Dyson and Haselgrove, 2001

Full Reference Dyson, M. C., & Haselgrove, M. (2001). The influence of reading speed and line length on the effectiveness of reading from screen. International Journal of Human-Computer Studies, 54(4), 585-612.

Type Journal Article

Theme Web Factors

Keywords Comprehension; Legibility; Typography; Reading rate; Scrolling; Skimming

Link to Paper	https://www-sciencedirect-com.offcampus.lib.washington.edu/science/article/pii/S1071581901904586
In Repository?	Yes – PDF
Summary	While readers typically have preferences for short and long lines, research has been inconclusive about the optimal line length for faster reading. Dyson and Haselgrove investigated the impact of a fast and normal reading speed on different line lengths on comprehension, reading rate and scrolling patterns. Overall, their findings show that comprehension is reduced if reading fast. Additionally, a line length of 55 characters per line was the best length for both normal and fast reading. This medium length was the best for speed and comprehension. These findings demonstrate that the needs of the reading task (comprehension or speed) may lead to different needs for line length. Overall, the literature again does not suggest one perfect line length and this remains true for other web factors, as well.
Methods	Empirical study: Participants were asked to read fast and normal and the line length varied for each text they had to read. The authors collected comprehension, reading speed and scrolling patterns.

Citation	**Dyson and Kipping, 1998**
Full Reference	Dyson, M. C., & Kipping, G. J. (1998). The effects of line length and method of movement on patterns of reading from screen. Visible language, 32(2), 150.
Type	Journal Article
Theme	Web Factors
Keywords	Line length; Readability; Scrolling
Link to Paper	https://www.proquest.com/openview/49f4fd2296eb9ecef039e3cd3921fe0b/1?cbl=1821103&pq-origsite=gscholar
In Repository?	No

Summary	The authors found that longer line length on monitors resulted in faster reading times. Dyson and Kipping ran two different studies to explore how line length impacts reading and scrolling on digital texts. This research was conducted in the late 1990s and has become the foundation for out line length research. Their findings show that longer lines (100 characters) were read faster than shorter lines (25 characters). However, across these two conditions there was no significant difference in comprehension of the digital text. Moderate lines (55) characters had the best readability of all conditions. Additionally, their findings show that scrolling does impact readability and leads to novel eye movements. Their study reflects the need to understand the difference between paper and digital text and their line length findings are not the same as previously studied with paper.
Methods	Experimental design: Within-subjects design, participants were asked to read texts with different line lengths.

F

Citation	**Flanders and Willis, 1998**
Full Reference	Flanders, V., & Willis, M. (1998). Web pages that suck: Learn good design by looking at bad design. SYBEX Inc.
Type	Book
Theme	Methodology
Keywords	Usability; Heuristic evaluation; Guidelines; Web factors
Link to Paper	http://www.webpagesthatsuck.com/
In Repository?	No

Summary	Flanders and Willis conducted a literature review to better understand web usability. They explored "bad design" to better understand how to do good design. They found eight factors that are critical to good readability including font or text style. They noted that actually web pages that they defined as having good usability, typically do not have italicized words. They also noted that white space is one of the factors critical to web usability.
Methods	Heuristic evaluation of websites. The authors used readability guidelines to see if websites followed the various design principles for good readability.

G

Citation	**Granquist et al., 2018**
Full Reference	Granquist, C., Wu, Y. H., Gage, R., Crossland, M. D., & Legge, G. E. (2018). How people with Low vision achieve magnification in digital reading. Optometry and vision science: official publication of the American Academy of Optometry, 95(9), 711.
Type	Journal Article
Theme	Accessibility
Keywords	Low vision; Reading; Acuity; Magnification
Link to Paper	https://pubmed.ncbi.nlm.nih.gov/30169350/
In Repository?	Yes – PDF
Summary	Granquist et al. conducted an Online survey to understand user's vision history and also acuity and magnification. Their findings demonstrate that people self-reported being engaged in digital reading and typically had to enlarge physical character size or reduce the viewing distance by putting their faces closer to the screen.
Methods	The survey asked subjects to arrange a text passage for typical reading and to report viewing distance, screen dimensions, and the number of characters per line.

H

Citation	**Hasagawa et al., 2008**
Full Reference	Hasegawa, S., Fujikake, K., Omori, M., & Miyao, M. (2008). Readability of characters on mobile phone liquid crystal displays. International Journal of Occupational Safety and Ergonomics, 14(3), 293-304.
Type	Doctoral Dissertation
Theme	Screen Sizes and Language
Keywords	VDT small display; legibility; reading speed; viewing distance; graphic text
Link to Paper	https://pubmed.ncbi.nlm.nih.gov/18954539/
In Repository?	Yes – PDF
Summary	The width of line strokes in various languages' characters smight be harder to read on smaller screens. Hasegawa et al. studied readability of English and Japanese text on mobile phones with liquid crystal displays. They conducted an experimental study and measured subjective evaluation, reading speed, number of errors and viewing distance. They tested English and Japanese settings on two different types of displays on different resolutions with various font sizes and fonts. Their results showed that readability was better when the resolution of the screen was higher. Additionally, as font size decreased on the screen, young subjects had to move the screen closer to their faces to read. However, older subjects increased the viewing distance irrespective of the size of characters. Characters of 3-5 mm are appropriate for the young but inadequate for the elderly. Moreover, the readability of Japanese characters improved when they were vertically enlarged to approximately twice the width on a mobile phone.
Methods	Experimental design: graphic characters were displayed on mobile phones and read aloud by users.

Citation

Hill and Scharff, 1997

Full Reference

Hill AL, Scharff LV. Readability of screen displays with various foreground/background color combinations, font styles, and font types. Proceedings of the Eleventh National Conference on Undergraduate Research. 1997;Vol. 2:742–746.

Type

Journal Article

Theme

Web Factors

Keywords

Foreground/background color combinations; Font types; Word styles; Readability

Link to Paper

https://www.laurenscharff.com/research/AHNCUR.html

In Repository?

No – but text can be found at the linked website.

Summary

Some authors have done research to better understand readability and word style. Hill and Scharff studied foreground/background color combinations, font types and word styles on the readability websites. In their study with 42 participants scanning a website for target words, they found that participants were quicker to respond to plain text than to italics. They also found main effects for font type and color combination. The authors also note that there is no one color combination, font type or word style to use but all conditions impact each other.

Methods

Empirical study: A large scale survey was used to choose the foreground/background color combinations. Then participants were asked to scan a screen of text and find a target shape word.

Citation

Hill, 1994

Full Reference

Hill, A. L. (1997). Readability of screen displays with various foreground-background color combinations, font styles, and font types. In

	Proceedings of the Eleventh National Conference on Undergraduate Research (pp. 742-746).
Type	Masters Thesis
Theme	Scanning
Keywords	Readability; Screen display; Foreground/background color; Font style; Font types
Link to Paper	https://www.proquest.com/docview/250765601?parentSessionId=XxVUHfbDjmiHHGOhwO2izl1bZECIjENsAQDdLjUoVdA%3D&pq-origsite=primo&accountid=14784
In Repository?	Yes - PDF
Summary	Unlike most studies that did not specifically call out scanning, Hill analyzed readability for various web factor combinations of foreground/background color combinations, font styles and font types. They had participants scan simulated websites for a specific target word. Readability was based on reaction time. Their findings showed generally there was no one combination of foreground, background color, font or word style that leads to a fasted reaction time. However, it is important to note that this methodology allowed researchers to specifically understand scanning. The limitation of this scanning test is that when users are put in the context of a laboratory setting, they may instead feel the need to deep read rather than just quickly browse.
Methods	Experimental design: Within subject design, used three independent variables leading to a 3 (background luminance levels) x 2 (text/background combinations) x 6 (luminance contrasts) mixed factorial design. Participants scanned each onscreen text paragraph for the hidden target shape word. Once they located the target word, they quickly and accurately as possible used the mouse to click on the corresponding shape at the bottom of the screen.

Citation

Hojjati and Muniandy, 2014

Full Reference	Hojjati, N., & Muniandy, B. (2014). The effects of font type and spacing of text for online readability and performance. Contemporary Educational Technology, *5*(2), 161-174.
Type	Journal Article
Theme	Web Factors
Keywords	Font type; Readability; Spacing; On-screen text; Serif; San serif
Link to Paper	https://files.eric.ed.gov/fulltext/EJ1105535.pdf
In Repository?	Yes – PDF
Summary	The authors conducted this study to better understand how students read online as they now spend more time viewing text on computer screens than on printed media, Hojjati, N., & Muniandy, B. look at the effects of font-type and spacing of text for digital readability. Two font types were selected: Times New Roman (serif) and Verdana (san serif) for participants of the study. It was found that Verdana was the student's preferred font-type for reading long text on the computer screen.
Methods	Experimental study: A repeated experimental design where students read digital passages in two different font types, one serif and one san-serif.

Citation	**Holmqvist et al., 2003**
Full Reference	Holmqvist, K., Holsanova, J., Barthelson, M., & Lundqvist, D. (2003). Reading or scanning? A study of newspaper and net paper reading. In The Mind's Eye (pp. 657-670). North-Holland.
Type	Book Chapter
Theme	Scanning
Keywords	Newspaper; Scanning; Behaviors
Link to Paper	https://www.sciencedirect.com/science/article/pii/B9780444510204500359
In Repository?	Yes – PDF

Summary

Holmqvist et al. (2003) demonstrated that users reading digital papers scan more and read less than traditional newspaper readers. They also further explain reasons for why this may be true. According to Homqvist et al. (2003), “traditional printed media exist in parallel to the new media. Reading traditional newspapers implies looking for headlines, briefs, photos, and drop quotes. On the one hand, the new media differ considerably from the traditional printed media. Online readers read from a computer screen and move around by clicking on links and menu buttons.” (Holmqvist et al., 2003). Essentially, these new types of features of a web page such as buttons, hyperlinks, headers and more lead to users jumping around a page.

Furthermore, readers themselves reported that reading on paper “is something they do with pleasure and, if possible, in a situation that allows distraction (along with breakfast, in a coffee break after lunch, on the train, or in the subway). It is a relaxing activity to traverse through the folds and it usually takes quite a long time”. With web news, they read usually when they have much less breaks. They can easily get to the media online whenever they have a quick moment (Holmqvist, 2003). It is also important to note that user’s self-reported feelings also demonstrate why it is important for users to need high readability, so they can quickly scan and comprehend online news when they have a quick break in their daily lives.

Methods

Eye-tracking The authors created two recordings of eye movement data from readers of two net papers and two newspapers. 12 subjects read the net papers and 15 subjects read the newspapers. Eye movement was captured and a post questionnaire was given to both groups. The post-questionnaire asked about their experience. Participants noted that the eye tracking device did not bother their reading in the post-questionnaire. The fixation was captured for all participants.

See Also

Kurniawan, S. H., & Zaphiris, P. (2001). Reading online or on paper: which is faster?.

Kong, Y., Seo, Y. S., & Zhai, L. (2018). Comparison of reading performance on screen and on paper: A meta-analysis. Computers & Education, 123, 138-149.

Citation

Hussain et al., 2011

Full Reference Hussain, W., Sohaib, O., Ahmed, A., & Qasim Khan, M. (2011). Web readability factors affecting users of all ages. Australian Journal of Basic and Applied Sciences.

Type Journal Article

Theme Web Factors

Keywords Content usability; Web readability; Web accessibility

Link to Paper https://opus.lib.uts.edu.au/handle/10453/117586

In Repository? Yes – PDF

Summary One of the easiest ways to improve web usability is through readability. Hussain et al. analyzed eight readability factors i.e. color contrast, white space, line spacing, font style, font size, text width, headings, graphics and animation. These eight factors are compared to understand their impact on different age group reading performance. The chosen eight factors were based on prior literature around online readability. Based on their literature review, they demonstrate how for each population type (children, teenagers and older users) requires different designs with varying web factors for their online content.

Methods Literature Review

J

Citation

Jang et al., 2007

Full Reference Jang, Y. G., Kim, H. Y., & Yi, M. K. (2007). A color contrast algorithm for e-learning standard. International Journal of Computer Science and Network Security, 7(4), 195-201.

Type Journal Article

Theme Web Factors

Keywords E-learning; Color contrast; Color temperature; Learning disorders; Accessibility; Readability

Link to Paper	http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.599.4529&rep=rep1&type=pdf
In Repository?	Yes – PDF
Summary	Jang et al., 2007, combined usability guidelines and proposed their own color contrast guideline that utilizes color temperature. They test their color contrast algorithm on normal adults and children that have sensitivities to color contrast (Jang et al., 2007).
Methods	Empirical study: Evaluated the satisfaction frequency of current web-safe colors. Then conducted a readability evaluation to test color contrast. Participants were asked to read sentences presented on the screen with different color contrast combinations.

L

Citation	**Legge, 2016**
Full Reference	Legge, G. E. (2016). Reading digital with low vision. Visible language, 50(2), 102.
Type	Journal Article
Theme	Accessibility
Keywords	Low vision
Link to Paper	https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5726769/
In Repository?	Yes – PDF
Summary	Prior research had delved into how current technology helps support users with low vision. Currently, digital documents allow users to change many features including font size, character and line spacing, font style, color contrast and page layout to meet any individualistic needs of a reader. According to Legge, for users with low vision they typically need larger font sizes or screen sizes than those with normal vision. For those with loss of vision, magnification to over 20- points may be needed. Also, those with loss of vision need to bring the phone closer to their face or pinch-to-zoom.

	Additionally, Legge focused on spacing for users of low vision because of the concept of crowding (Bouma, 1970). According to Bouma, 1970 crowding is the interfering effects of one target on the identification of a nearby target in the visual field. The spatial extent of crowding increases in peripheral vision (Bouma, 1970). Thus, content needs to be farther apart to be easily recognizable. Legge's findings also show that there is no significant difference for larger line separation but double spacing can have a small advantage. The author also noted that high contrast is often essential for those with low vision. In short, people with low vision have reduced contrast sensitivity, and a more pressing need for high-contrast text. Reading will often benefit from a brighter display, and from care in controlling ceiling light from external glare sources.
Methods	Literature review

Citation	**Lemmerich et al., 2019**
Full Reference	Lemmerich, F., Sáez-Trumper, D., West, R., & Zia, L. (2019, January). Why the world reads Wikipedia: Beyond English speakers. In Proceedings of the Twelfth ACM International Conference on Web Search and Data Mining (pp. 618-626).
Type	Journal Article
Theme	Language
Keywords	Wikipedia; Reading; Global
Link to Paper	https://dl.acm.org/doi/10.1145/3289600.3291021
In Repository?	Yes – PDF

Summary	The authors deployed a large-scale survey across Wikipedia to create a typology of readers on the platform. Lemmerich et al. demonstrated that each language edition of Wikipedia has unique motivations for readers coming to the platform demonstrating that Wikipedia is used differently around the world. Readers in countries with a lower human development index (HDI) were more likely to read for in-depth understanding compared to readers in high-HDI countries. The findings of this paper are critical to this bibliography for two reasons (1) it shows that online readership comes from all corners of the globe and (2) the behaviors across different languages may be different.
Methods	Large scale multiple-choice survey: Sent to readers of 14 Wikipedia languages and receiving more than 210,000 responses. The authors additionally used quantitative data found from Wikipedia logs that trace a sample of users through their usage of the platform. Furthermore, they use country-level datasets to understand socio-economic and cultural indicators.

Citation	**Li et al., 2019**
Full Reference	Li, Q., Morris, M. R., Fourney, A., Larson, K., & Reinecke, K. (2019, May). The impact of web browser reader views on reading speed and user experience. In Proceedings of the 2019 CHI Conference on Human Factors in Computing Systems (pp. 1-12).
Type	Journal Article
Theme	Reading
Keywords	Reader View; Online Reading; Dyslexia; Website Design
Link to Paper	https://dl.acm.org/doi/pdf/10.1145/3290605.3300754
In Repository?	Yes – PDF

Summary

The authors tested how often Reader View finds webpages transformable. Reader View changes the standard reading to web factors that are easier to read such as font size and white space. The authors did their own heuristic evaluation on 100 websites. Additionally, they ran an empirical test with participants to understand the impact of the reader view.Typically these Reader Views reduce the complexity of web pages by removing menus, images and content. They tested a Reader View web page with a normal web page with participants both with and without dyslexia. For both participants, the simple Reader View web page helped both populations increase their reading speed by 5%, and overall, users reported improved readability and visual attractiveness.

Methods

In another study, prior to running an experimental design study, Li et al., 2019 tested how often Reader View finds webpages transformable. Reader View changes the standard reading to web factors that are easier to read such as font size and white space. The authors did their own heuristic evaluation on 100 websites. Li et al. (2019), after doing a heuristic evaluation of website reader view, the authors conducted a 10-minute within subjects study to better understand the two conditions of Standard Web Page vs. Reader View.

Participants were given the text in each condition then asked to read the webpage word by word and then respond to a few comprehension questions. After they finished reading the passages, they author also presented users with a survey that had 7 readability questions, 9 user experiences question and 1 RSD question for the last condition they read

N

Citation

Ling and van Schaik, 2007

Full Reference

Ling, J., & van Schaik, P. (2007). The influence of line spacing and text alignment on visual search of web pages. Displays, 28(2), 60-67.

Type

Journal Article

Theme

Web Factors

Keywords

Web Usability; Text presentation; Line spacing; Alignment

Link to Paper	https://www-sciencedirect-com.offcampus.lib.washington.edu/science/article/pii/S0141938207000133
In Repository?	Yes – PDF
Summary	Ling and van Schaik conducted an experimental design study that focused on visual search tasks rather than just reading word for word. Interestingly, the visual search task reflects most closely to what we would consider scanning. In a visual search task, participants are asked to quickly browse an interface gathering key insights about features such as menu buttons, hyper texts and labels. Ling and Shaik, 2007 also demonstrated that line spacing had a significant impact on task performance. Wider line spacing led to better comprehension accuracy and faster reading times. Their findings show that participants performed better with double line spacing than with 1.5 spacing, and better with 1.5 than single spacing.
Methods	Empirical study: Within subjects task with independent variable of line spacing. The between subjects factor was text alignment of left aligned and justified. Participants were presented with different readings. They had to perform a visual search task that required them to find a hyperlink on the screen.

Citation	**Liu et al., 2016**
Full Reference	Liu, N., Yu, R., & Zhang, Y. (2016). Effects of font size, stroke width, and character complexity on the legibility of Chinese characters. Human Factors and Ergonomics in Manufacturing & Service Industries, 26(3), 381-392.
Type	Journal Article
Theme	Language
Keywords	Stroke; Width; Font Size
Link to Paper	https://onlinelibrary.wiley.com/doi/full/10.1002/hfm.20663
In Repository?	No

Summary	Liu et al. investigated font size, stroke width and character complexity. Character complexity is based on the number of strokes in the character. Their findings confirm that font size and character complexity had significant effects on legibility, while stroke width did not show any significant differences. However, the interactions between the different factors did show significant effects. Stroke width is critical to the legibility for characters with high-level complexity, whereas font size is the critical factor influencing the legibility for characters with low-level complexity. The combination of 12-point font size and 1:10 stroke width resulted in the best legibility for both character complexity levels. These findings demonstrate the importance of understanding other web factors such as character complexity and stroke width. These other forms of web factors also demonstrate the need to understand different web factors across different language texts.
Methods	Empirical study: participants were required to search for characters in digital texts. The search time per target character, correct response number, and correct response rate were used to measure the legibility.

M

Citation	**Miniukovich et al., 2017**
Full Reference	Miniukovich, A., De Angeli, A., Sulpizio, S., & Venuti, P. (2017, June). Design guidelines for web readability. In Proceedings of the 2017 Conference on Designing Interactive Systems (pp. 285-296).
Type	Journal Article
Theme	Accessibility
Keywords	Web; Readability; Accessibility; Dyslexia; WCAG 2.0.
Link to Paper	https://dl.acm.org/doi/abs/10.1145/3064663.3064711
In Repository?	Yes – PDF

Summary

According to Miniuokovich et al. (2017), “high readability becomes a necessity for the users with reading difficulties.” The authors noted that there are few websites designed for high readability and typically they are under-investigated when thinking about Web Usability. For users, with additional needs for reading and writing, being able to have high readability allows them to reduce users’ frustration and time wasting (Miniukovich et al., 2017). In this paper, the authors developed a set of 61 guidelines that discuss proper web factor characteristics for users with Dyslexia. Their unique methodology of guideline-building workshops and the push for accessibility is why this paper was included in the literature review.

Methods

Another methodology, reviewed in the literature, was the formation of web usability guidelines. Experts in usability, practitioners and researchers came together using their own knowledge to build a set of guidelines to learn from.

They initially began with two researchers reviewing the entire corpus of guidelines and excluded those belonging to one of three categories. Then the experts were invited to resolve contradictions and review the validity of guidelines. Each guideline was printed on a card, they reviewed them individually and then discussed further.

See Also

Miniukovich, A., Scaltritti, M., Sulpizio, S., & De Angeli, A. (2019, May). Guideline-based evaluation of web readability. In Proceedings of the 2019 CHI Conference on Human Factors in Computing Systems (pp. 1-12).

Citation

Moran, 2020

Full Reference

Moran, K. (2020). How people read online: new and old findings. Nielsen Norman Group. (Accessed March 11th, 2022).

Type

Web Article

Theme

Scanning

Keywords

Eye tracking; Readability; Scanning; Longitudinal

Link to Paper

https://www.nngroup.com/articles/how-people-read-online/

In Repository?

No

Summary	The Nielsen Norman group has been doing research on web readability for over 20 years. In 1997, Jakob Nielsen posted a report that discussed how users read on the web. This data was recently updated in 2020 by Kate Moran from the Nielsen Norman group. I use this data as a foundation for a lot of this literature review. In this article, Kate Moran discusses the changes from 1997-2020. Typically, the findings are the same. People still scan their content online but the content online has changed a bit. Currently, there are new layouts, formats and technologies presented. The findings show a new set of eye-tracking data that shows that there are new patterns in scanning text. For example, there is now a lawn-mower pattern where users begin in the top left cell, move to right until the end of the row then drop down to the next row and continue this pattern.
Methods	Eye-tracking: Large scale eye-tracking study to understand general eye movement patterns.

N

Citation	**Nanavati and Bias, 2005**
Full Reference	Nanavati, A. A., & Bias, R. G. (2005). Optimal line length in reading-A literature review. Visible Language, 39(2), 120.
Type	Journal Article
Theme	Web Factors
Keywords	Line length; Eye movement; Readability, Screen size
Link to Paper	https://eric.ed.gov/?id=EJ749012
In Repository?	Yes – PDF

Summary	Nanavati and Bias conducted a literature review that encompasses more modern computer research. In this literature review, they attempt to answer two questions: what is the optimal reading length and how many columns should content be presented in for faster reading? Their findings on line length research showed that on computer monitors should not be more than 70 characters. If lines are not the appropriate length on digital screens, this could lead to different eye movement patterns that are not comfortable for users.
Methods	Literature Review

Citation	**Nielsen and Pernice, 2009**
Full Reference	Nielsen, J., & Pernice, K. (2009). Eyetracking web usability. New Riders.
Type	Book
Theme	Methodology
Keywords	Eyetracking; Readability; Eye movement
Link to Paper	https://learning.oreilly.com/library/view/eyetracking-web-usability/9780321549730/?sso_link=yes&sso_link_from=UnivofWashington
In Repository?	No – book found online but not a downloadable link
Summary	Eye-tracking technology has become an important tool in conducting usability studies. Eye-tracking allows usability researchers to record and analyze a person's eye movements. These systems typically capture a person's fixations, saccades and scanpaths. In this book, the authors delve into a relatively new technology, at the time, eye-tracking. They cover literature around eye-tracking and detail the technology and its various uses in 2009. Additionally, Jakob Nielsen and Kara Pernice conduct a large scale usability methodology with eye-tracking technology to collect 1.5 million eye movement instances or around 300 GBs of data. In their three year study, they are able to use the eye movement instances to create heat maps and eye gaze plots to show eye movement patterns when people interact with web pages.

	They were able to not only demonstrate the value of eye-tracking but additionally show what may be usable or not in the design of web pages.
Methods	Eyetracking

O

Citation	**Öquist, 2006**
Full Reference	Öquist, G. (2006). Evaluating readability on mobile devices (Doctoral dissertation, Institutionen för lingvistik och filologi).
Type	Doctoral Dissertation
Theme	Screen Size
Keywords	RSVP; Leading; Scrolling; Paging; Mobile devices; Readability
Link to Paper	http://citeseerx.ist.psu.edu/viewdoc/summary?doi=10.1.1.134.4359
In Repository?	Yes – PDF
Summary	Öquist, 2006 produced their dissertation on evaluating readability on mobile devices. Through 5 different studies performed on mobile devices, they found that mobile phones led to a 10% decrease in reading speed compared to PDAs that have a 50% larger screen. In their research, Öquist tested different types of text presentation types commonly found on mobile phones: Scrolling, Paging, RSVP and Leading. Öquist (2006) found that for longer texts, there were no significant differences in reading speed on mobile devices in the different formats. Thus, they proposed a Adaptive RSVP that performed better and reduced task load then the common Fixed RSVP.
Methods	Experimental design: Within-subject repeated-measurement, participants were given texts to read using different presentation styles on mobile phones.

R

Citation	**Reiber-Kuijpers et al., 2021**

Full Reference	Reiber-Kuijpers, M., Kral, M., & Meijer, P. (2021). Digital reading in a second or foreign language: A systematic literature review. Computers & Education, 163, 104115.
Type	Journal article
Theme	Language
Keywords	Applications in subject areas; Information literacy; Media in education; Teaching/learning strategies; 21st century abilities
Link to Paper	https://www.sciencedirect.com/science/article/pii/S0360131520303134
In Repository?	Yes – PDF
Summary	The authors demonstrated the importance of reading for second language learners through a systematic literature review that noted several characteristics of second language digital reading environments, tasks, and readers. One type of characteristics they focused on were format and layout of online text for second language learners. There is research currently on this topic that shows how web factors need to be designed for high readability for second language learners. Some of the key points in the literature review include that integrated formats allowed for better online comprehension. Additionally, sometimes web factors like text color, fonts and images can be helpful but additionally the overuse of these web factors can make it difficult to read and can be distracting to second language learners. t There are different ways to make it easier for second language learners to scan especially using nonlinear texts. Overall, visual elements of digital pages multi-media appeared to enhance motivation and participation. Reading online is critical for online learning and thus this literature review demonstrates not only the importance of making digital content readable but also across different languages. For those learning a second language, high readability is necessary for comprehension and legibility.
Methods	Systematic Literature Review

Citation	**Rello and Baeza-Yates, 2016**
Full Reference	Rello, L., & Baeza-Yates, R. (2016). The effect of font type on screen readability by people with dyslexia. ACM Transactions on Accessible Computing (TACCESS), 8(4), 1-33.

Type	Journal Article
Theme	Accessibility
Keywords	Dyslexia; Learning disability; Best practices; Web accessibility; Typeface font; Readability; Legibility; Eye-tracking
Link to Paper	https://dl.acm.org/doi/abs/10.1145/2897736
In Repository?	Yes – PDF
Summary	The eye movements of readers with dyslexia are different from regular readers. People with dyslexia, as well as beginner readers, make longer fixations and more fixations than normal readers. The fonts that are more readable for people with dyslexia are also beneficial for people without dyslexia. For the tested fonts, sans serif, monospaced, and roman font styles significantly improved the reading performance over serif, proportional, and italic fonts. The findings from this study show that a combination of font types create a more accessible font type for users with or without Dyslexia.
Methods	Eye-tracking: to measure the effect of typespace on reading speed, They were asked to read the 12 texts in silence and complete the comprehension control questions after each text. In answering the question they could not look back on the text. Their reading was recorded by the eye-tracker.

Citation	**Rello and Bigham, 2017**
Full Reference	Rello, L., & Bigham, J. P. (2017, October). Good background colors for readers: A study of people with and without dyslexia. In Proceedings of the 19th international ACM SIGACCESS conference on computers and accessibility (pp. 72-80).
Type	Conference Proceedings
Theme	Accessibility
Keywords	Background colors; Dyslexia; Readability; Reading Speed
Link to Paper	3132525.3132546
In Repository?	Yes – PDF

Summary	Similarly, in another study by Rello and Bigham (2017), they measure the impact of background colors on screen readability. They conducted a large scale user study with 341 participants, 84 of those self-reported as having dyslexia. Their findings show that using certain background colors have a significant impact on people with and without dyslexia. Warm background colors, Peach, Orange and Yellow, significantly improved reading performance over cool background colors, Blue, Blue Grey and Green.
Methods	Empirical: The independent variable was background color. There were 10 different backgrounds used. A within-subject design was used so each participant read all 10 texts on 10 different backgrounds. Then participants had to answer comprehension questions. The authors measured reading time and mouse distance (the number of pixels that the mouse traveled over the text).

Citation	**Rello and Marcos, 2012**
Full Reference	Rello, L., & Marcos, M. C. (2012, October). An eye tracking study on text customization for user performance and preference. In 2012 Eighth Latin American Web Congress (pp. 64-70). IEEE.
Type	Journal Article
Theme	Web Factors
Keywords	User Interfaces; Usability; Text Customization; Read-ability Performance; User Preference; Eye Tracking; Grey Scales; Colors; Font Size; Character, Line and Paragraph Spacing; Column Width
Link to Paper	https://flatisbad.com/resources/Rello-LA-WEB12.pdf
In Repository?	Yes – PDF

Summary	Rello and Marcos used eye-tracking to test four values for line spacing: 0.8, 1, 1.2 and 1.4 lines. Participants preferred 1.4 lines among lines. Similar to other research in this literature review, Rello and Marcos note that there is no concluding evidence for the interaction of other web factors. These authors propose a set of guidelines that will combine the data from different web factors to customize text for the best readability. This is not the only study in this literature review that notes that web factors are strongly tied to each other. Thus, most research studies combine more than one web factor to better understand their impact on each other.
Methods	Empirical study: utilizing eye tracking testing and questionnaires

Citation	**Rello et al., 2016**
Full Reference	Rello, L., Pielot, M., & Marcos, M. C. (2016, May). Make it big! The effect of font size and line spacing on online readability. In Proceedings of the 2016 CHI conference on Human Factors in Computing Systems (pp. 3637-3648).
Type	Journal Article
Theme	Web Factors
Keywords	Readability; comprehension; font size; line spacing; online reading; text presentation; eye-tracking; Wikipedia
Link to Paper	https://dl.acm.org/doi/abs/10.1145/2858036.2858204
In Repository?	Yes – PDF

Summary	Rello et al. tested objective and subjective readability and comprehension for articles within Wikipedia. They tested font sizes from 10 to 26 points and line spacings from 0.8 to 1.8 in the Arial font. Their findings provide evidence that readability, measured via mean fixation duration, increased significantly with font size. Further, comprehension questions had significantly more correct responses for font sizes 18 and 26. For line spacing, they found marginal effects, suggesting that the two tested extremes (0.8 and 1.8) impair readability. These findings provide evidence that text-heavy websites should use fonts of size 18 or larger and use default line spacing when the goal is to make a web page easy to read and comprehend. This study is different from most of the other studies explored in this literature review because they covered fonts way above 14. Interestingly, up to a font size of 18 points, subjective and objective readability and comprehension improved continuously. Beyond 22- there were no further effects of the objective measures and a decrease of subjective readability. Line spacing, in contrast, had no effect on the subjective readability but extreme spacings negative affected objective and subjective comprehension. The authors recommend using 18 points font size and default line spacing if the goal is to optimize readability and comprehension of web text content.
Methods	Eye-tracking

S

Citation	**Salmerón et al., 2017**
Full Reference	Salmerón, L., Naumann, J., García, V., & Fajardo, I. (2017). Scanning and deep processing of information in hypertext: an eye tracking and cued retrospective think-aloud study. Journal of Computer Assisted Learning, 33(3), 222-233.
Type	Journal Article
Theme	Scanning
Keywords	Scanning; Deep processing; Student; Learning
Link to Paper	https://www.uni-frankfurt.de/67186547/salmeron-2015---JCAL.pdf
In Repository?	Yes – PDF

Summary	The authors demonstrate that there are also special instances where it is important for users to quickly scan but also deeply process. In one study there, they demonstrate how high school students articulate scanning and deeper processing of answering questions using a Wikipedia document, and how their reading comprehension skills and the question type interact with these processes. The authors found that scanning of information led to poor comprehension while deep processing allowed users to perform better. Scanning led to lower performance especially for those that are good comprehenders, while the positive effect of deep processing was independent of reading comprehension skills.
Methods	Experimental design, Eye-tracking & Thick aloud: Students were given a reading comprehension test. Then asked to answer questions about specific Wikipedia articles. Then they completed a retrospective think-aloud protocol. They watched a screen recording video of their learning session that included one dot representing their gaze. Students needed to remember what they were learning in that video.

Citation	**Shaikh and Chaparro, 2004**
Full Reference	Shaikh, A. D., & Chaparro, B. S. (2004, September). A survey of online reading habits of Internet users. In Proceedings of the Human Factors and Ergonomics Society Annual Meeting (Vol. 48, No. 5, pp. 875-879). Sage CA: Los Angeles, CA: SAGE Publications.
Type	Journal Article
Theme	Screen Size
Keywords	Readability; Paper; Digital reading
Link to Paper	http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.964.7704&rep=rep1&type=pdf
In Repository?	Yes – PDF

Summary	In general, we know that reading on screens leads to different behaviors. Shaikh and Chaparro (2004) found that screens typically used to consume different types of information than on paper. In their 2004 survey, their findings demonstrated that longer articles, such as technical reports and journal articles are typically read on paper. While, online news, newsletters and other types of shorter readings are preferred onscreen.
Methods	Large scale-survey

Citation	**Shreshta et al., 2007**
Full Reference	Shrestha, S., Lenz, K., Chaparro, B., & Owens, J. (2007, October). "F" pattern scanning of text and images in web pages. In Proceedings of the Human Factors and Ergonomics Society Annual Meeting (Vol. 51, No. 18, pp. 1200-1204). Sage CA: Los Angeles, CA: SAGE Publications.
Type	Conference Proceedings
Theme	Scanning
Keywords	F-pattern; Scanning; Readability; Text-based; Image-based; Web
Link to Paper	https://journals-sagepub-com.offcampus.lib.washington.edu/doi/abs/10.1177/154193120705101831
In Repository?	Yes – PDF
Summary	Shreshta et al. (2007) conducted a study to better understand how users can text. Participants were asked to search or browse either a text-based or image-based web page the authors found. The findings show a uniform scan path with longer fixations on the images Nielsen's 'F' pattern (2006) was confirmed in both the text-browse and text-search tasks.
Methods	Experimental design: Participants were asked to browse a text-based page or an image-based page and search for a particular piece of information. They were given 20 seconds for each task.

Citation	**Singer and Alexander, 2017**

Full Reference	Singer, L. M., & Alexander, P. A. (2017). Reading on paper and digitally: What the past decades of empirical research reveal. Review of educational research, 87(6), 1007-1041.
Type	Journal Article
Theme	Reading
Keywords	Editing activities; Editor behavior; Social networking
Link to Paper	https://journals.sagepub.com/doi/10.3102/0034654317722961
In Repository?	No
Summary	The authors of this paper conducted a systematic literature to understand the role that print and digital content plays in reading comprehension. Singer & Alexander's findings show that depending on the context or task conditions, the type of content can result in varied comprehension. Their findings also show that there is not a clear definition of reading or digital reading and most of the studies were experimental designs created by that specific researcher. They also note that in general, the literature review is really broad - across many different devices and contexts.
Methods	Systematic Literature Review

T

Citation	**TeBlunthuis et al., 2019**
Full Reference	TeBlunthuis, N., Bayer, T., & Vasileva, O. (2019, August). Dwelling on Wikipedia: investigating time spent by global encyclopedia readers. In Proceedings of the 15th International Symposium on Open Collaboration (pp. 1-14).
Type	Journal Article
Theme	Scanning
Keywords	Peer production; Wikipedia; Readership; Digital divides; Quantitative methods; Web analytics; Dwell time

Link to Paper	https://dl.acm.org/doi/abs/10.1145/3306446.3340829
In Repository?	Yes – PDF
Summary	The authors spent time trying to understand Wikipedia reader's dwell time or the time users spend on a given page on the platform. In this paper, the authors create a model of reading times on Wikipedia and show the various reading patterns. They furthermore show the reading patterns across language editions. Their findings show that Global South readers are more likely to use Wikipedia to gain in-depth understanding of a topic. Additionally, Global South readers spend more time per page view and that this difference is amplified on desktop devices, which are thought to be better suited for in-depth information seeking tasks. This paper also demonstrates that readers read in-depth and scan content on online platforms such as Wikipedia.
Methods	Authors collected reading time data across various language editions. They then created a stratified sample of that data and completed a regression analysis.

W

Citation	**Wu et al., 2020**
Full Reference	Wu, Y. H., Granquist, C., Gage, R., Crossland, M. D., & Legge, G. E. (2020). Online survey of digital reading by adults with low vision. Optometry and vision science: official publication of the American Academy of Optometry, 97(4), 249.
Type	Journal Article
Theme	Accessibility
Keywords	Low vision; Readability; Online survey
Link to Paper	https://pubmed.ncbi.nlm.nih.gov/30169350/
In Repository?	Yes – PDF

Summary	Wu et al. (2020) conducted an online survey with 133 participants with low vision to better understand the history of those individuals' vision loss and how they use various assistive technologies. Their survey demonstrates the diversity in the population of people with low vision. Their findings show that people with vision loss suffered from mainly three diseases: albinism, retinitis pigmentosa and glaucoma. Participants ranged from 18 to 98 years old. Each participant, additionally, reported using vision, audio or braille to read. Most users did 50% of their reading visually and most spent more time doing digital reading than paper reading. Most participants used at least one technology from each of our digital content magnifiers and hard-copy content magnifiers for visual reading.
Methods	Large-scale Survey