

Towards Universally Accessible Typography: A Review of Research on Dyslexia

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Abstract

Within the last decade, especially the last two years, there has been a great deal of research regarding the effect that typography has on the readability and accessibility of text for individuals with dyslexia. This research provides new insights into specific typographic features such as font size, letter spacing, line length, line spacing, font type (i.e., serif versus sans serif and roman versus italic), and specialized fonts for individuals with dyslexia. All of this work provides a framework for better understanding the basis behind the personal observations and preferences of many individuals with dyslexia, and presents opportunities to develop new guidelines for accessible typography. This paper will discuss how this new research fits in with existing theories of dyslexia, its implications for the development of universally accessible typography, and future research directions.

Keywords

Dyslexia, typography, literacy, reading, specific learning disability, universal design

Introduction

It is very common for individuals with dyslexia to note that when text is presented in particular ways (such as in particular editions of books) it becomes significantly easier for them to read. More recently, many individuals with dyslexia have also begun to remark that text is easier to read on mobile devices (Schneps et al.), where aspects of how type is set tend to differ from traditional print media (i.e. line length is often smaller due to the small size of screens) and users are often allowed to control certain aspects of how type is presented. While formal research regarding the effect that typography has on the readability and accessibility of text for individuals with dyslexia has historically been sparse, recently, especially within the last three years, there has been a significant amount of new research which investigates the effect of specific aspects of typography.

The remainder of this paper will discuss the new research, how it fits within existing theories of dyslexia, and potential future directions for developing more accessible typography.

Discussion

Typography and the Phonological Model

While feedback from individuals with dyslexia has been incorporated into guidelines such as the British Dyslexia Association's "Dyslexia Style Guide" and related documents (BDA New Technologies Committee), until recently, typography's impact on the readability of text for individuals with dyslexia has not been studied in a systematic and robust way.

One potential reason that the study of dyslexia and typography has only received limited scientific attention is that the dominant model of dyslexia (the phonological model) supports a physiological cause of dyslexia that is outside of the visual system, implying that changing how text appears would not address the fundamental difficulties faced by individuals with dyslexia

when reading text. However, while impairments in phonological processing are still likely the main contributor to literacy related impairments, some differences in visual processing have been well documented, for instance, differences in how individuals with dyslexia experience lateral masking (Geiger & Lettvin 1238-1243; Geiger, Lettvin, & Zegarra-Moran 39-52; Perry et al. 445-448; Lorusso, et al. 2413-2424). Furthermore, recent research, including the finding that phonetic representations are intact in individuals with dyslexia (they are just difficult to access)(Boets et. al. 1254), points towards phonological processing impairments (while still likely being the main contributor to literacy related impairments) are themselves the result of more general processing differences.

However, because we know that typography affects the readability of text for everyone (Rayner et. al. 451), recent research notwithstanding, a phonological origin of dyslexia does not in itself dismiss the possibility that manipulating typography can improve readability for individuals with dyslexia, thus making the development of literacy skills easier. Essentially, even if the primary difficulty is linking letters and words with their phonological representations rather than processing them visually (Shaywitz Kindle Locations 1718-1721), developing typography that is easier to read (and better fits the specific needs of individuals with dyslexia) would allow individuals with dyslexia to expend more cognitive effort retrieving the difficult-to-access phonological representations, as opposed to processing text visually. In addition, because individuals with dyslexia likely have a greater need for readability of text, the development of more accessible typography could have significant readability benefits for the average reader as well.

*Research on Specific Typographic Features***Letter spacing**

Because of documented differences in how individuals with dyslexia experience lateral masking (Geiger & Lettvin 1238-1243; Geiger, Lettvin, & Zegarra-Moran 39-52; Perry et al. 445-448; Lorusso, et al. 2413-2424)—a visual distortion experienced by all readers that makes letters more difficult to distinguish when they are close together—increasing the space between letters has been one of the most promising and well studied means of improving typography for individuals with dyslexia, and in three separate studies (Zorzi et. al. 11455-11459; Perea et. al. 420-430; Schneps et. al. n. pag.) increasing letter spacing has been demonstrated to improve readability for people with dyslexia, especially the dyslexic readers with the least developed literacy skills.

In the study conducted by Perea et. al., slightly increased letter spacing not only improved word identification for young readers and readers with dyslexia, but also skilled adult readers as well (420). However, Schneps et. al. found that increased letter spacing did not benefit dyslexic readers who had spent considerable time and energy developing their literacy skills, though it did allow dyslexic readers with less developed literacy skills to catch up with their more experienced peers (n. pag.). These mixed results indicate that the exact amount of spacing, as well as other variables like line length and font size, likely play a role in whether or not increased letter spacing provides a benefit in a given circumstance, but they also validate previous data indicating that larger-than-average letter spacing can improve readability for all readers, especially those with the least experience.

Line Length

When Schneps et. al. used sophisticated eye tracking techniques to investigate why some individuals with dyslexia often report that reading on mobile devices is easier, they discovered that while the short line lengths associated with reading on some mobile devices (e.g., an iPod) increased the number of times participants had to go back to the left margin, they also dramatically decreased the number of errors caused by doing this, improving readability. Schneps et. al. also speculate that these extremely short line lengths could benefit average readers as well.

Font Size

Font size is one of the least studied aspects of accessible typography for individuals with dyslexia, however O'Brien, Mansfield, and Legge have found that the critical print size (the minimum font size necessary for an individual to attain their best reading speed) for individuals with dyslexia is larger than the average (332), meaning that larger print sizes can improve the speed at which individuals with dyslexia read.

Font Type

One of the most long standing typographic recommendations for individuals with dyslexia has been the use of sans serif rather than serif fonts, which has been endorsed by the British Dyslexia Association (British Dyslexia Association). This recommendation also makes theoretical sense because serifs may increase the effects of lateral masking, by decreasing the space between letters, and recently, fonts that are sans serif, roman (not italic or bold), and monospaced, have been demonstrated to be, in general, more readable for individuals with dyslexia (Rello and Baeza-Yates).

Specialized Fonts for Individuals with Dyslexia

Some specialized fonts for individuals with dyslexia have also been developed including Dyslexie (dyslexiefont.com), OpenDyslexic (Gonzalez), and Read Regular (Frensch). While these fonts may incorporate some aspects of typography that are beneficial for individuals with dyslexia, what research that has been done has produced mixed results. Specifically research on Dyslexie (de Leeuw) has demonstrated that while it decreased one type of error, it increased others, and did not have an overall effect on reading speed (and presumably fluency) (3). This research also likely translates to OpenDyslexic because it is designed to mimic Dyslexie. Furthermore, there is evidence that, at least in some use cases, individuals with dyslexia prefer a standard sans serif font over specialized fonts (Harley et. al. 28).

While specific characteristics of individual fonts (such as x-height or inherent letter spacing) likely have an impact on the font's overall readability, research and design energy would be better spent investigating these characteristics specifically, as well as how they interact with other typographic elements not directly tied to the font (such as line height) rather than developing specialized fonts from whole cloth. Furthermore, given the potential that the research detailed in this paper has for universally accessible typography, specialized fonts do not seem necessary.

Conclusion*Research and Design Challenges*

Several challenges to both the study of typography and the nature of literacy and dyslexia complicate the development of holistic design guidelines.

In order to demonstrate statistical significance, most of the studies cited in this paper rely on testing only a limited number of specific conditions, for instance, Zorzi et. al. tested only two

letter spacing conditions (p. 11,456). While this approach provides significant validity to the notion that typography is an important component for accommodating individuals with dyslexia, it is limited to demonstrating that manipulating a particular variable has an effect, rather than determining the optimal condition for that variable.

The vast majority of the research on dyslexia and typography has also been conducted using participants under the age 18, and much of it focuses on participants who are far younger, making it difficult to extrapolate particular findings to larger populations including adults with dyslexia. A further complicating factor is the reality that both dyslexia and literacy are developmental. That is, as individuals with dyslexia develop their reading and writing skills and the types of reading related tasks they need to accomplish expand, their needs from typography will likely change (this is something that can be seen in Schnepf et. al.'s finding that increased letter spacing only benefited readers with less developed literacy skills).

Future Directions

While there remain challenges to understanding how typography affects the readability of text for individuals with dyslexia, the existing research demonstrates tremendous potential for developing reading technology that can support the widest range of users. In particular, both the research and design challenges point towards the potential of digital reading environments, especially mobile technology. Text that is digitally presented can be manipulated to fit a specific user's needs, regardless of their literacy skill, or whether or not they have dyslexia.

However, additional research is required to better understand which aspects of typography users should be guaranteed easy control over, what range of values for each typographic feature should be supported, and what the defaults for these features should be (i.e.,

what is the combination of typographic features that will result in the most readable environment for the most individuals).

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