Document Design for Users with Reading Disorders

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ABSTRACT

Most research on document design has focused on users of average reading ability. The needs of individuals with reading disorders have not been addressed. With the introduction of a font specifically designed for people with dyslexia, the possibility of improving readability through improved design has come under consideration. Although the design readability preferences of people with dyslexia vary greatly, general principles can be formulated. Design for an audience of users with a reading disorder should be simple, with backgrounds behind text and unnecessary symbols on the page eliminated. Font size should be slightly larger than average, and leading should be increased. Letterspacing should be normal, with care taken to avoid the formation of "rivers" on the page. Information should be grouped together into chunks, and space should be given between each chunk of text.

Categories and Subject Descriptors

General Terms

Documentation, Design.

Keywords

document design, dyslexia, readability, accessibility

1. INTRODUCTION

Research into document readability has improved our knowledge about reader-friendly documents. However, most research studies on readability use test subjects of at least average reading ability, and many use college students, who can usually be assumed to have better than average ability. But what about people who have less than average reading ability? What about people who have normal intelligence, vision, and education, and would otherwise be perfectly capable of reading, except that they have a reading disorder? How should documents be designed to accommodate these people?

Recently, an article in the magazine *Wired* [1] profiled Natascha Frensch, a graphic designer in the Netherlands, who designed a font specifically for people with dyslexia called Read Regular [7]. There is a debate currently going on about whether the font will serve its purpose to help people with dyslexia read better or whether font plays no part in the difficulties people with dyslexia face in reading. Additionally, there seems to be a general lack of guidelines for designing documents for people with dyslexia and other visual and learning impairments.

In this article, I will discuss the reading disorder dyslexia and review the literature surrounding the readability of texts for people with average reading ability and for those who have reading disabilities. I will also formulate a set of guidelines for designing documents for individuals with reading disabilities.

2. READING DISORDERS

Developmental dyslexia is a reading disorder characterized by the inability to read at a normal level, even with the appropriate intelligence and instruction [11]. It is usually first diagnosed in children as they fail to develop reading skills that are normal for their age. Alexia is a less commonly occurring reading disorder that involves the loss of the ability to understand written words. People with alexia were once able to read but can no longer do so.

Dyslexia is most frequently seen in people who speak Germanic or Romance languages; it is practically unknown in those who speak Asian languages [14]. The International Dyslexia Association estimates that 15–20% of the population has a reading disability [8]. According to the Dyslexia Research Trust, 5 to 10% of children have dyslexia [4]. Dyslexia is believed to be a neurological disorder, although the exact location of the disorder in the brain and its cause are not known. There is no cure for dyslexia, and most people continue to have the disorder as adults. The general disorder "dyslexia" is often grouped into two categories: auditory dyslexia (difficulty processing spoken words) and visual dyslexia (difficulty processing written words). Many people have both types of dyslexia, but most usually have more severe problems processing either spoken words or written words [11].

Because this article is about document readability, I will mainly focus on visual dyslexia. Individuals with visual dyslexia often have difficulty reading at an appropriate age level. They may appear to be uneducated or have a mental handicap, but their real difficulty is that words appear to blur together or letters reverse. People with dyslexia often can see part of the word correctly, but are not able to perceive the entire word or sentence. They have to construct the meaning of the word or sentence from the part that they can see, which is usually not accurate. The

symptoms of dyslexia are not exactly alike in all people, and may even change in the same person over time [11]. It has been difficult to develop an effective method of teaching individuals with dyslexia. Most strategies allow the individual to access the information on the printed page in an alternative format, such as audio. Many people with dyslexia use screen reader programs that read text displayed on a computer screen. Also, many textbooks and other books are available as audiobooks, and people with dyslexia often tape class lectures or thoughts that they would have otherwise written down. Recently, efforts on improving the access to information of people with dyslexia have focused on delivering information in customizable formats that can be altered by the user to present it in his or her preferred manner, i.e., customizable web backgrounds, font size, and font style [16].

3. DESIGN

It is well known that the design of a document can affect its readability. Typographic factors such as font, leading, serifs, and point size can affect the legibility of type, and overall design elements such as white space and proximity affect the reader's understanding. [17]

3.1 Overview of document conventions for people with normal reading ability

It is a commonly accepted design convention that serif fonts should be used for body text and sans serif fonts should be used for headings and titles. The theory behind this is that serifs lead the eye along the page and sans serifs make text stand out, so serifs aid the reader when reading dense text and sans serifs pull the reader's eye toward the important points—headings and titles [10].

Optimum line and letter spacing depend on the size and length of text. Two to four points of leading between 10 to 14-point lines of text is generally adequate, but more space may be required for larger font sizes [17]. If letter spacing is too wide, "rivers" (spaces in the same place in consecutive lines of text) may start to appear, especially when text is right justified. If letter spacing is too narrow, the words may run together [10].

Small font size may be difficult to read for many people, but if type is too large, the text will have to be spread across many pages and readers may not take it seriously. Ten to twelve-point type is usually readable and is considered the norm for printed documents. The length of lines of text should be about 10 to 20 words, or approximately 66 characters [17]. Paragraphs should not be too long, or readers may lose their place. They should also not be too short, or readers may have trouble following the thought. Optimum paragraph length is best determined by considering the audience's reading ability and expectations.

White space determines the look and feel of a page, as well as its readability. If there is not enough white space, the ink on the page will be dense and difficult to read. If there is too much, then the text elements on the page will be too spread out and difficult to pull together. It is generally better to use too much white space than too little [18].

Figure-ground segregation is the separation between text or figures on a page and their background and surrounding areas. It lets the reader know what elements on a page are important [12]. Text should not be surrounded by illustrations that distract the reader or have a dark background that makes it difficult to tell where the text stops and the background starts. If this happens, the text will be difficult to read or unreadable.

Text should be chunked into groups according to subject matter [9]. This breaks up long groups of text into more easily read sections. Chunked text should usually be grouped under a heading and spaced out, so the reader can easily tell apart each chunk [15].

Proximity tells readers what sections of a page belong together [18]. Elements on the page that the reader should read together, especially those that describe each other, should be grouped together on the page. By the same token, elements that should not be read together, such as text under separate headings, should be spaced apart.

3.2 Issues in design for people with reading impairments

The current research into design for individuals with less than average reading ability tends to focus more on designing for the visually impaired and the elderly, and less on developmental reading disabilities such as dyslexia.

Ray and Ray [13] discuss the impact of visual impairments on a reader's ability to understand a document. Many reading difficulties common in people with visual impairments such as tunnel vision, vision field loss, and hazy text also occur frequently in people with visual dyslexia [11]. However, in dyslexia, these impairments are not caused by problems with the eye or its components, but with the brain's processing of words that the eye sees clearly. Ray and Ray also describe adaptive technologies for the visually impaired such as screen-reading technologies that are also used by individuals with dyslexia. Although the authors focus on online information design and screen readers, much of their advice also holds true for hardcopy documents. These include: keeping page layouts and designs simple, developing informative text alternatives such as figures and tables, using readable fonts (those of high quality that scale well), using high-contrast colors, keeping enhancements (bold text, underlined text, and italics) to a minimum, and using consistent document navigation.

David Fiske [6] writes about the effect of the Americans with Disabilities Act on standards for readable document design. Fiske offers a list of design considerations when producing documents for the visually impaired. Like Ray and Ray, Fiske focuses on design for individuals with impaired vision, specifically the elderly, but also notes that many of the considerations he discusses also apply to individuals with learning disabilities. Among the accommodations Fiske proposes: use 12 or 14-point type; choose colors for maximum contrast (avoid patterned and gray boxes, as well as matte paper); make line length short, with columns no more than 4 inches long; give plenty of space between paragraphs and columns; and indent paragraphs. Cueing strategies should be used with text and the objectives of the text should be clearly listed, with main points identified by both the text and the design. If possible, all information should be given in one place so the reader does not have to flip back and forth. Fiske notes that the designers of buildings have made accommodations for the disabled, and says that the designers of documents should do so as well.

It seems that, according to people with dyslexia and those who work with dyslexia, font and other design elements do

play a role in the readability of documents for people with dyslexia. Many websites with information for people with dyslexia give advice on hardcopy and web design for a dyslexic audience. This advice is based more on personal experience and less on controlled research than the studies of design for the visually impaired. Also, there seems to be a wide variety of personal preference in page design among people with dyslexia. Because of this, the websites often offer contradictory and confusing information.

Dyslexic.com, [5] a website that sells reading materials to aid students with dyslexia, provides an article on fonts for dyslexic readers. According to Dyslexic.com, "dyslexic readers rely on recalling the visual shape of a word due to poor phonological awareness." Serifs "tend to obscure the shapes of letters," and many people with dyslexia prefer fonts that look like handwriting, but certain handwritten letter combinations such as *oa* and *oo* often look alike. Descenders and ascenders are important because if they are too short, it is difficult for the dyslexic reader to identify the shape of the word. As for ideal fonts for dyslexic readers, Dyslexic.com lists the font Sassoon, which was designed for beginning readers, and Read Regular, the font designed by Natascha Frensch. However, Sassoon is expensive ($106 for Windows TrueType through Agfa-Monotype), and Read Regular is not yet available. Dyslexic.com lists Comic Sans as an available, readable font, but says that their readers found it too "bold." They also say that people with dyslexia find Verdana hard to read because of its short ascenders and descenders.

The Dyslexia the Gift website [3], which promotes a method of teaching children with dyslexia, gives some information that agrees with what is found on Dyslexic.com and some that does not. They say that many people with dyslexia prefer text on a colored background because it reduces contrast, and that sans serif fonts are confusing because distinguishing a lower-case *l* from an upper-case *I* is difficult. However, Dyslexia the Gift has a running web poll of what fonts people with dyslexia prefer, and with 1841 total votes counted, Arial is preferred over Times Roman by 49.65% to 28.84%. They also say that background patterns and images make text difficult to read, that paragraphs should be kept short, and that text should be left-justified.

On their website, the British Dyslexia Association gives a "Dyslexia Style Guide" [2]. In this guide, they suggest that a sans serif font such as Arial, Comic Sans, Sassoon, or even Verdana be chosen for texts for dyslexic readers, and that the point size of the type be a minimum of 12 or 14. Matte, off-white paper that is heavy enough to prevent bleed-through from following pages be used. Line length should be limited to 60 to 70 characters, and lines of type should have 1.5 to 2 points of leading between them, with extra space between paragraphs. Margins should be wide and headings should be spaced out. Words should not be underlined or in italics. Lines of text should be left-justified with a ragged right margin. Sentences and paragraphs should be short. The text should be direct, in plain English, and, if possible, it should involve the reader by using the second person. All relevant information should be grouped together on the page. Page design should be simple and text should be short; eye strain is very common in people with dyslexia because they have to concentrate longer on the word shapes than average. Also, people with dyslexia often focus on the spaces between words rather than the text, which creates "rivers" that make the text on the page appear to move.

4. READ REGULAR

People with dyslexia often reverse letters in words, see extra lines, and miss descenders and ascenders. Natascha Frensch, who has dyslexia, designed Read Regular [7] to aid symbol recognition and reading comprehension in people with dyslexia. Frensch changed the letters that look similar in most fonts and are easily reversed—*a* and *e* with *o*, and *b*, *d*, and *p*—and shaped them slightly differently so they are more easily distinguishable (Figures 1 and 2). She also simplified the forms of letters that have extra strokes in many fonts to help people for whom they blend together (Figure 3). The lowercase *a* does not have a line over it, and the lowercase g has a simple descender. The openings of all descenders were widened so that they will not appear to close when they are read. The ascenders are tall so that they will stand out against the other letters in the word. Many people with dyslexia prefer typefaces that mimic handwriting because they find them easier to read. The letters in Read Regular stand alone, like in traditional typefaces, but the lettershapes are more similar to handprinted letters than those in traditional fonts (Appendix).
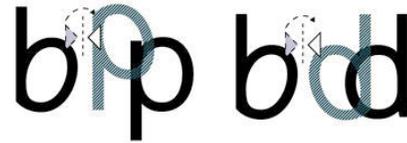

Figure 1. Shapes of lowercase *b*, *p*, and *d*.[1]

Figure 2. Shapes of lowercase *o*, *a*, and *e*.[1]

Figure 3. *C* and *e* openings and *g* and *y* descenders.[1]

However, it is not known whether the difficulties in reading associated with dyslexia originate in the perception of letters on the page, in the conversion of lettershapes into mentally audible words, or in the processing of words in the brain [11]. It is hypothesized that most people with dyslexia may comprehend written words but cannot turn them into silently heard words. If this is true, and there is no problem with visual perception, then changing the forms of letters on the page would not help reading. Also, people with dyslexia report widely different problems with reading. Those with auditory dyslexia may not be helped by Read Regular because they do not have problems processing written language. But, the design of Read Regular is also easy to read for

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[1]All figures © 2003 Natascha Frensch. Used with permission.

those who do not have reading disorders, so it is not likely that the use of the font could add to reading difficulties.

Although Read Regular was designed primarily for dyslexic readers, it may have applications beyond people with known reading disorders. Because the problems of individuals with reading disorders and visual impairments are similar, Read Regular may also be useful as a font for people with visual impairments. Frensch has designed a complementary font called Read Space, which has more space between the letters and words than Read Regular. Read Space was designed to be used with children who are learning how to read. The individualized lettershapes of Read Regular may cause less confusion when children are trying to learn the symbols of letters. Also, because dyslexia is usually first diagnosed when a children are near or past the age when they should have learned to read, reading disorders may be present in children learning to read but are not known [11]. Both Read Regular and Read Space should be tested for use in people with various kinds of difficulties perceiving written words.

5. DESIGNING DOCUMENTS FOR INDIVIDUALS WITH READING DISORDERS

Readers with reading disabilities may rely on textual cues and chunking more than readers of normal ability because many subtle visual cues may not appear [2]. People with dyslexia vary in the specific types of reading problems that they face, so while one person may need to spend time understanding each written word, another person, for whom understanding of each word might be impossible, might need to rely on context. Although large type may disrupt readers with normal reading ability, individuals with reading disorders may need larger type because it increases the legibility of lettershapes. The spacing between letters and words needs to be closely watched for the formation of "rivers," which may distract a reader with dyslexia. However, if letters and words are spaced too closely together, the lettershapes may appear to run together.

Because processing written characters on page is difficult for those with reading disorders, and any unnecessary symbols or images will take away from comprehension of necessary information, it is important to eliminate visual noise [2]. Figure-ground segregation is also important, because words often appear blurry to people with dyslexia, and words may easily blur into the background if they are not clearly separated.

More research is necessary, but from the available literature it is possible to form a preliminary set of guidelines for designing documents for an audience with reading disabilities:

- Use a sans serif font to decrease the likelihood that words will run together
- Use 12 to 14 point text to increase the size of the lettershapes
- Give ample space between lines of text and between paragraphs so that readers will distinguish them mentally
- Use plenty of white space—keep any possible visual distractions on the page to a minimum
- Distinctly separate the text from any backgrounds or surrounding figures
- Use matte paper to minimize glare

- Chunk information; keep all related information together on the page
- Simplify design for maximum clarity and readability.

6. CONCLUSION

Document design for an audience of individuals with reading disorder is not that different from designing for an audience of average readers, except that even more attention should be paid to the basic principles of design. Many document design issues were discussed by websites created for people with dyslexia, but these issues have not yet been researched.

More research on optimal typographic design and page layout as well as web design for individuals with reading disabilities is necessary to form a comprehensive guide to designing for this audience. Education researchers have done some investigation of teaching methods, but there is little research on general document design. Because many people with dyslexia have difficulty reading as adults, there is a need for technical communicators to understand how to effectively design readable documents in the business world for people with reading disorders. Although dyslexia is not fully understood and there is currently no treatment that allows individuals with dyslexia to read at the same level as individuals without dyslexia, it is possible that better document design could greatly improve readability in this population.

7. REFERENCES

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Appendix. Comparison of Fonts.

1. Read Regular

abcdefghijklmnop
qrstuvwxyz
ABCDEFGHIJKLMNO
PQRSTUVWXYZ
(0123456789)

2. Times New Roman

abcdefghijklmnop

qrstuvwxyz

ABCDEFGHIJKLMNO

PQRSTUVWXYZ

(0123456789)

3. Arial

abcdefghijklmnop

qrstuvwxyz

ABCDEFGHIJKLMNO

PQRSTUVWXYZ

(0123456789)