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# Developing Text Customisation Functionality Requirements of PDF Reader and Other User Agents

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**Abstract.** This paper addresses the text customisation needs of people with low vision, dyslexia, and related conditions that impact reading, including people with declining eyesight due to ageing. It reports on a literature review and an initial study that explores the aspects of text that users customize (e.g., size, colour, leading, linearization/reflow, and more) for reading RTF and PDF documents, in operating system settings, and in web browser settings. It presents the gap between users' needs and PDF user agent (primarily Adobe Reader) functionality. The existing literature and this exploratory study indicate that with the technology currently available, PDF is not sufficiently accessible to many people with low vision, dyslexia, and related conditions that impact reading. This paper aims to encourage additional text customisation functionality in Adobe Reader; and to encourage more rigorous studies to understand, document, and communicate how to better meet users' text customisation needs through mainstream user agents.

**Keywords:** low vision, dyslexia, readability, adaptability, PDF, Adobe Reader, text customisation, accessibility guidelines, accessibility standards, user agents.

## 1 Introduction

Communications and interactions are increasingly provided through the Web and electronic media. This offers the opportunity for unprecedented access to information and interaction for people with print disabilities because the accessibility barriers to print can be more easily overcome through technology. Print disabilities encompass people who cannot effectively read "normal" print because of a visual, physical, perceptual, developmental, cognitive, or learning disability [1].

Much of the effort to date in this area has been on providing access for people who are blind [2]; for example, providing screen reader access to PDF (portable document format) documents. However, less effort has been invested to meet the needs of other people with print disabilities, including people with low vision and people with dyslexia. Many user agents (i.e., the tools that people use to interact with electronic information, such as web browsers) do not sufficiently meet the needs of these users. They do not provide adequate text customisation that is necessary for some people to be able to read, understand, and interact with information.

Of particular concern is PDF because of the:

- widespread use of PDF as the only way of providing large amounts of essential information, such as tax instructions, scientific papers, educational material, medical information, etc.
- lack of sufficient text customisation functionality available, even for advanced users, in Adobe Reader<sup>1</sup> and other PDF user agents.

Many managers, policy makers, and even accessibility specialists and disability advocates are not aware of the specific PDF accessibility barriers explored in this paper. For many people with print disabilities, there currently is no such thing as “accessible PDF” because they cannot customize the text to be readable.

While electronic media provides an opportunity to increase readability for large groups of people who have difficulty reading and processing text, this opportunity remains unrealized in several areas. Additional research, guidance, and education is needed to encourage user agent developers to provide the text customisation functionality required by people with conditions that impact reading.

This paper reports on one phase of a research project<sup>2</sup> to address these needs. While the project investigates the issue broadly, this paper focuses on PDF.

## 2 Readability Beyond Legibility

In order to understand the needs of people with low vision, dyslexia, and related conditions that impact reading, it is important understand the distinction between *legibility* and *readability*<sup>3</sup>. [3] *Legibility* is related to perceiving text by distinguishing letters. *Readability* is related to reading and comprehending textual information. Thus text could be somewhat legible to a user, yet not functionally readable; that is, with effort the user could distinguish one letter from another, but could not effectively read sentences because of the text formatting.

Many research studies on text legibility focused on perceiving small amounts of text [4]. Even many studies on readability use work periods as short as one to ten minutes [4]. A study on reading and visual fatigue found little negative effect after six hours of reading; however, these were people without print disabilities [5]. In the study reported in this paper, participants reported that strain, discomfort, and fatigue are significant limiting factors when reading text that is not well formatted for them.

The author assumes that many of the accessibility guidelines for electronic media are also focused on small amounts of text, such as website navigation, forms, and short descriptions. Thus the guidelines may be sufficient for legibility, but not for readability. PDF is often used for providing large amounts of text, where readability is essential. To read large amounts of text, users need to be able to customize more aspects of text formatting.

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<sup>1</sup> Adobe is a registered trademark and Reader is a trademark of Adobe Systems Incorporated.

<sup>2</sup> TAdER Text Adaptability is Essential for Reading - <http://www.tader.info>

<sup>3</sup> In his seminal research, Tinker [4] used only the term legibility to avoid confusion with readability formulas for the level of difficulty of the language; however, most literature disShawn tinguishes between legibility and readability as used in this paper.

### **3 User Group**

Millions of people cannot read “normal” text, and millions more will not be able to in the coming years as their vision declines due to aging [6-7]. An estimated 15–20% of the population has symptoms of dyslexia [8] and 246 million have low vision (compared to 39 million who are blind) [6].

This project focuses on the largest groups of people with print disabilities: those who can see and can read, but have difficulty reading text in common formats and need to specify different text format in order to read effectively [6-7]; including:

- people with low vision,
- people with declining eyesight due to ageing, and
- people with dyslexia and other reading-related impairments.

The outcomes of this project focus on people who use mainstream technologies and do not regularly use assistive technologies (such as screen magnification) because of cost, complexity, availability, or other factors. It also addresses people who do not use technology much or at all because they have difficulty reading text—that is, for whom readability of text has been a limiting factor to technology adoption.

### **4 Existing Research Summary**

The needs of people who have disabilities and conditions that impact reading have been addressed in a wide range of research studies. Most of the research focuses on one user group, such as older users, and one domain, such as websites. An extensive literature review and analysis is being conducted for this project.

Most research on making text more readable for people with low vision is designed to determine optimum characteristics such as font face and size [9]. There is similar on improving readability of text for people with dyslexia [10]. Many of the results suggest characteristics for readability in print, and more recent literature addresses electronic media. There are some recommendations for online readability, both for older technology and for newer technology such as is available in e-book readers.

There is less research on what users should be able to customize in order to optimize readability for their particular impairment and situation. Work in this area tends focus on a specific user group and situation, such as older users who are new to the Web or adult students with dyslexia. Specialized software has been developed for such users, for example, [11-14]. Yet most of this customisation has not been well integrated in mainstream user agents, nor is it sufficiently included in some accessibility standards and support material (such as the Section 508 standards [15]).

Additional research is needed to understand, document, and communicate the needs of users in order to encourage inclusion of additional text customisation functionality in mainstream user agents. [16] says, “...end user customization plays a central role in accessibility considering dyslexia. Nevertheless, only two guidelines were found regarding this subject. Thus, a deeper study on end user customization is an identified gap that needs to be bridged.”

## 5 Approach: Analysing Specific User Needs

The goal of the study is to explore how advanced users customize text when they have a wide range of options available, and to observe their use of PDF documents, which has few options. This paper reports on an initial exploratory study.

Participants included people with low vision from birth, people with declining vision due to ageing, and people with dyslexia, in Europe and the U.S. All are advanced users, recruited through accessibility and disability contacts and mailing lists. Most participants had customized their operating systems settings for text, including colours. Most did not use assistive technology; one used a screen magnifier and a screen reader concurrently.

Participants were first given a rich text file (RTF)<sup>4</sup> and asked to open it in a word processor and change it so that they could read it easily. Then they were asked to read it, aloud or to themselves. Next they were given a PDF file<sup>5</sup> and asked to change it so that they could read it easily. Next they were asked to explain their operating system settings and browser settings. Finally, they were asked to rate the importance of specific aspects of text customisation (listed below) on a scale of 1 to 4.

Participants were encouraged to “think aloud” and share information throughout the sessions. Most voluntarily showed some problems they have with specific websites. Most sessions lasted between one and two hours.

## 6 Information Gathered

Information was gathered through recorded phone calls and some included viewing and recording the participant’s screen.

Data captured included observations on what each user did with each file, which aspects of text they customized with the RTF file and what values (e.g., which font, what leading), and how they handled the PDF file; their system settings for text; and their browser settings related to text. Participants who use custom cascading style sheets (CSS) provided those files. Related information was collected, including screen resolution, monitor size, and details of their impairment.

Participants had different perspectives on the importance of being able to customize specific aspects of text format. The range of responses (with 1 being most important) reported below shows the differences in priority:

- text size – 1
- linearization/reflow, e.g., changing from multiple columns to a single column – 1-2
- text colour and background colour – 1-3
- leading/line spacing – 1-3

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<sup>4</sup> The RTF was slightly modified from  
<http://www.acm.org/sigs/publications/pubform.doc>

<sup>5</sup> The PDF was an excerpt of  
<http://www.adobe.com/accessibility/products/indesign/pdf/accessibledocswithindesignCS4.pdf>

- justification – 1-4
- text style, e.g., underlining, italics, all capital letters – 1-4
- other visual characteristics such as borders, margins, indentation – 1-4 (white space / padding to separate the main text from the material around it were mentioned as important by both a participant with low vision and a participant with dyslexia)
- font face/typeface/font family – 2-3
- kerning, letter spacing, and word spacing – 2-4
- line length, i.e., the number of characters per line – 2-4
- hyphenation – 3-4

**Text customisation at the element level** was not included in the list of aspects participants were asked to rate in this initial study; however, three participants were observed customizing headings different from the main text in the RTF file. Some changed the headings using “Styles” in the word processor. One participant who was having trouble with the Styles, selected all the text and set the text size. He then commented about losing the distinction of the headings.

Two participants pointed out that they set headings smaller than the main text because headings are easier to read because they are short and have space around them. One participant converted both the RTF and the PDF file to HTML and used a custom CSS which has the body text set to 28pt Tahoma, the headings to 0.9em Comic Sans MS, and different coloured text and borders on each heading level. (Markup editing was needed to get the PDF file to work with the participant’s CSS.)

## 7 Outcomes: The Need for Text Customisation

The primary finding from the literature review was that there is not a single text format that will meet most users needs; instead, users need to be able to customize text to meet their particular needs. The need for text customisation was supported by findings from this initial user study.

Research results and published guidelines have different recommendations for many aspects of text format. As just one example, leading/line spacing recommendations for people with low vision, dyslexia, or who are older, range from 1.25 to 2.0 [17-26].

Without customisation, a users’ needs can conflict with general best practice. For example, a participant with dyslexia said, “I write and read a lot better in all upper case”; whereas, all guidelines found in the literature review suggest avoiding all caps [e.g., 20-25].

Without customisation, one user’s needs can conflict with another user’s needs. For example, many people with declining eyesight due to ageing need high contrast between text and background colour [24], [26]; whereas many people with dyslexia and other reading impairments need low contrast [14]. The participants in this study used a range of settings, from black text on a brown background to white text on black background. Regarding choosing from pre-defined text and background colour combinations, a participant said: “Someone else’s idea [of what I need] is useless.”

Not only are there differences between users, but an individual user's needs can change. Participants in this study reported that their needs varied depending on the amount of text to be read, the time of day, fatigue, and complexity of the information.

In summary, the existing literature and the findings from this initial study clearly point to the requirement for users to be able to customize text according to their specific needs at a given time.

## **8 Gap Between Users' Needs and Current Functionality**

Most mainstream web browsers provide functionality for users to customize text size, text colour and background colour, font face, and provide zoom functionality. They provide functionality for users to set their own style sheets to additionally customize leading/line spacing (line-height), letter spacing, word spacing, width, text style, justification, and more. (Improving the usability of such functionality is an importance issue, yet outside the scope of this paper.)

In contrast, several aspects of text customisation are not provided by Adobe Reader, even to advanced users. Adobe Reader does provide some functionality: text and background colour customisation, zoom, and reflow that temporarily puts text in a single column. However, there are limitations to the latter two, described below. Additionally, PDF documents cannot be printed when zoomed or reflowed. The importance of printing for people with dyslexia is described in [27].

Adobe says of Reader's reflow limitations: "Text that does not reflow includes forms, comments, digital signature fields, and page artifacts, such as page numbers, headers, and footers. Pages that contain both readable text and form or digital signature fields do not reflow." [28] In reflow mode, the search/find-in-document feature does not work at all.

Documents with some layouts are not functionally readable to some users when zoomed, such as research papers formatted in two columns. When users get to the bottom of a column, they have to scroll up to find the top of the next column and the physical and cognitive effort required can break the flow of reading and understanding substantially. As an example of how significant this is for most users, a participant with dyslexia said about reading text in one column not requiring scrolling: "I struggle with getting to the start of the next line". Getting from the bottom of a column to the top of the next is even more difficult.

Adobe Reader does not provide functionality for users to set font face, text size for specific elements, leading/line spacing, and most other aspects of text formatting. To the authors knowledge, currently no other PDF user agents provide the text customisation that users need. Thus the existing literature and this exploratory study indicate that with the technology currently available, PDF is not sufficiently accessible to many people with low vision, dyslexia, and related conditions that impact reading.

## 9 Conclusion

To realize the potential of technology to facilitate reading by people with low vision, dyslexia, and related conditions that impact reading, users need to be provided the functionality to customize several aspects of text. The initial work reported in this paper aims to:

- encourage more rigorous studies to understand, document, and communicate the text customisation needs of users with low vision, dyslexia, and related conditions that impact reading; and
- encourage inclusion of specific text customisation functionality in Adobe Reader.

While this paper focuses on PDF, the broader project explores other technologies and user agents. Additional work will further analyze gaps in available knowledge and research, and provide suggestions to fill those gaps. The ultimate goal is to provide specific guidance on text customisation functionality requirements to user agent developers, standards developers, content providers, and policy makers.

## References

1. Reading Rights Coalition. The definition of "print disabled". <http://www.readingrights.org/definition-print-disabled>
2. Hanson, V. The user experience: designs and adaptations. In Proceedings of the 2004 international cross-disciplinary workshop on Web accessibility (W4A) (W4A '04), 1-11. ACM, New York, NY, USA. (2004)
3. Tracy, W. Letters of Credit: A View of Type Design. London: Gordon Fraser. (1986)
4. Tinker, M.A. Legibility of Print. Ames, Iowa: Iowa State University Press. (1963)
5. Carmichael, L. and Dearborn, W.F. Reading and Visual Fatigue. Boston: Houghton Mifflin Co. (1947)
6. World Health Organization. Fact Sheet # 282: Visual Impairment and Blindness. Geneva. (2011) <http://www.who.int/mediacentre/factsheets/fs282>
7. 7teinmetz, E. Americans with disabilities: 2002, Washington, DC: U.S. Census Bureau. (Current Population Reports, P70-107) (2006)
8. International Dyslexia Association. Dyslexia Basics. (2008) <http://www.interdys.org/ewebeditpro5/upload/BasicsFactSheet.pdf>
9. Poole, A. Which Are More Legible: Serif or Sans Serif Typefaces? <http://alexpoole.info/which-are-more-legible-serif-or-sans-serif-typefaces> (2008)
10. McCarthy, J. and Swierenga, S. What we know about dyslexia and Web accessibility: a research review. *Univers. Access Inf. Soc.* 9, 2,147-152. (2010)
11. Hanson, V. and Richards, J. A web accessibility service: update and findings. In Proceedings of the 6th international ACM SIGACCESS conference on Computers and accessibility (Assets '04), 169-176. ACM, New York, NY, USA. (2003)
12. Dickinson, A., Gregor, P., & Newell, A. F. Ongoing investigation of the ways in which some of the problems encountered by some dyslexics can be alleviated using computer



- techniques. In Proceedings of the 5th international ACM conference on assistive technologies, pp. 97-103. Edinburgh, Scotland: ACM Press. (2002)
13. Gregor, P., Dickinson, A., Macaffer, A. and Andreasen, P. SeeWord—a personal word processing environment for dyslexic computer users. In *British Journal of Educational Technology*, 34: 341–355. (2003)
  14. Gregor, P. and Newell, A. An empirical investigation of ways in which some of the problems encountered by some dyslexics may be alleviated using computer techniques. In Proceedings of the fourth international ACM conference on Assistive technologies (Assets '00). New York, NY, USA: ACM, 85-91. (2000)
  15. US Access Board. Section 508 Homepage: Electronic and Information Technology. <http://www.access-board.gov/508.htm>
  16. Santana, V.F., Oliveira, R., Almeida, L.D.A.; Baranauskas, M.C.C. Web Accessibility and People with Dyslexia: A Survey on Techniques and Guidelines, Proceedings of the International Cross-Disciplinary Conference on Web Accessibility (W4A '12). New York, NY, USA: ACM. (2012)
  17. Calabrèse A, Bernard JB, Hoffart L, Faure G, Barouch F, Conrath J, Castet E. Small effect of interline spacing on maximal reading speed in low-vision patients with central field loss irrespective of scotoma size. *Invest Ophthalmol Vis Sci*. 2010 Feb;51(2):1247-54. (2010)
  18. Hartley, J. What does it say? Text design, medical information, and older readers. In D.C. Park, R.W. Morrell, and K. Shifren, eds. *Processing of Medical Information in Aging Patients*, 233-48. Mahwah, NJ: Lawrence Erlbaum Associates. (1999)
  19. Bix, L. The Elements of Text and Message Design and Their Impact on Message Legibility: A Literature Review. *Journal of Design Communication*, No. 4. <http://scholar.lib.vt.edu/ejournals/JDC/Spring-2002/bix> (2002)
  20. Kitchel, J.E. APH Guidelines for Print Document Design  
<http://www.aph.org/edresearch/lpguide.htm>
  21. Arditi, Aries. *Making Text Legible: Designing for People with Partial Sight*. New York: Lighthouse International. (1999, 2002)
  22. British Dyslexia Association. *Dyslexia Style Guide*  
<http://www.bdadyslexia.org.uk/about-dyslexia/further-information/dyslexia-style-guide.html>
  23. CCLVI. *Best Practices and Guidelines for Large Print Documents used by the Low Vision Community* <http://www.cclvi.org/large-print-guidelines.html>
  24. Morrell, R. W., Dailey, S. R., Feldman, C., Mayhorn, C. G., & Echt, K. V. 2002. *Older adults and information technology: A compendium of scientific research and Web site accessibility guidelines*. Bethesda, MD: National Institute on Aging. (2002)
  25. The Center for the Partially Sighted. *Print Guidelines*  
[http://low-vision.org/en/Print\\_Guidelines](http://low-vision.org/en/Print_Guidelines)
  26. Holt, Barbara. *Creating Senior-Friendly Web Sites*. Center For Medicare Education Issue Brief 1(4):1-8. (2000)
  27. Rainger, P. *A Dyslexic Perspective on e-Content Accessibility*. JISC TechDis. (2003)  
[http://www.jisctechdis.ac.uk/techdis/resources/detail/learnermatter/Jan03\\_Dyslexia](http://www.jisctechdis.ac.uk/techdis/resources/detail/learnermatter/Jan03_Dyslexia)
  28. *About Adobe Reader X*  
[http://help.adobe.com/en\\_US/reader/using/WS4bebcd66a74275c3-7d28390112a81b3ebff-8000.html](http://help.adobe.com/en_US/reader/using/WS4bebcd66a74275c3-7d28390112a81b3ebff-8000.html)