An iOS Reader for People with Dyslexia

Luz Rello
NLP & Web Research Groups
Universitat Pompeu Fabra
Barcelona, Spain
luzrello@acm.org

Ricardo Baeza-Yates
Yahoo! Labs &
Web Research Group, UPF
Barcelona, Spain
rbaeza@acm.org

Horacio Saggion
NLP Research Group
Universitat Pompeu Fabra
Barcelona, Spain
horacio.saggion@upf.edu

Clara Bayarri
Cookie Cloud
Barcelona, Spain
clarabayarri@gmail.com

Simone D. J. Barbosa
IDEIAS, Department of
Informatics, PUC-Rio, Brazil
simone@inf.puc-rio.br

ABSTRACT
We present DysWebxia, an eBook reader for iOS which modifies the form and the content of the text. This tool is specifically designed for people with dyslexia according to previous research with this target group. The settings are customizable depending on the reading preferences.

Categories and Subject Descriptors
H.5 [**Information Interfaces and Presentation**]: User Interfaces—*Screen design*; K.4 [**Computers and Society**]: Social Issues—*Assistive technologies for persons with disabilities*

General Terms
Design, Experimentation, Human Factors

Keywords
Reading software, dyslexia, readability, Spanish iOS.

1. INTRODUCTION
Around 10% of the population has dyslexia, a reading disability that negatively affects a person's ability to read and comprehend texts. Since certain text alterations can impact the reading performance of people with dyslexia, several specialized reading tools have been developed for this target group. Here, we present the first iOS reader for Spanish texts for people with dyslexia. The tool is strictly designed based on findings from previous research using eye-tracking with people with dyslexia.

2. WHAT IS NEEDED?
We present the features which, to the extent of our knowledge, lead to a significant improvement of the reading performance of people with dyslexia.

- **Font Size**: Sizes ranging from 18 points [11] to 26 points [10] lead to faster readings.
- **Font Type**: *Sans serif*, *roman* and *monospaced* fonts are good fonts for people with dyslexia, specifically, *Helvetica*, *Courier*, *Arial*, *Verdana* and *Computer Modern Unicode* [6].
- **Colors**: The color pairs which lead to a better readability were: cream/black [10], yellow/blue [10, 4], light mucky green/dark brown [10, 4], grey (25%) in the background with white font, and grey font (25%) with white background [10].
- **Character Spacing**: Larger letter spacing was found to lead to faster reading [14].
- **Synonyms**: Some studies have shown that people with dyslexia read better more frequent and shorter words [8] as well as numerical expressions written in digits and percentages [9]. However, the only user study that tested an automatic lexical simplification algorithm for Spanish [1] showed that performing automatic lexical simplifications (substituting complex words by simpler synonyms) did not improve the readability of the texts. However, when these synonyms were presented on-demand to the user, texts are perceived as significantly simpler [7].

Other parameters which did not lead to significant effects are column width, line, word and, paragraph spacing [10]. However, these are covered in the recommendations [2] and in some of the reading tools described in next section.

3. OTHER READING TOOLS
In Table 1 we compare the features of the two most popular reading applications –*Kindle reading software*[1] and *iBooks*[2]– and five specific reading software for people with dyslexia. These are: the Mozilla Firefox extension *Firefixia* [12], *SeeWord* [3] for MS Word, *IDEAL eBook Reader*[3] for Android [5], and the web service *Text4All*[4] [13].

[1] `www.amazon.com/kindle`
[2] `https://itunes.apple.com/en/app/ibooks/id364709193?mt=8`
[3] `https://play.google.com/store/apps/details?id=org.easyaccess.epubreader`
[4] `http://www.text4all.net/dyswebxia.html`

Table 1: Summary feature comparison. The asterisk ('*') means that the feature is under development. Required features, the ones which lead to significant results, are marked in bold.

Software	**Font**	**Size**	Brightness	**Color**	Spacing				Width	**Show Synonyms**
					Char.	Word	Line	Parag.		
Kindle	yes	yes	yes	yes	no	no	yes	no	yes	no
iBooks	yes	yes	yes	yes	no	no	no	no	no	no
ClaroRead	yes	yes	no	yes	yes	no	yes	yes	no	no
Firefixia	yes	yes	no	yes	yes	no	yes	no	yes	no
IDEAL eBook Reader	yes	yes	yes	yes	yes	yes	yes	yes	no	yes*
SeeWord	yes	yes	no	yes	yes	no	yes	no	no	no
Text4All	yes	yes	no	yes	yes	no	yes	no	no	yes*
DysWebxia	yes	yes	yes	yes	yes	yes	yes	yes	no	yes

4. DYSWEBXIA READER

DysWebxia reader for iOS combines all the required features that lead to a better readability for people with dyslexia in previous studies as well as most of the parameters found in the recommendations [2] (Figure 1).

For the user interface design, we first performed a competitive analysis of existing reading tools to understand the user interface and user-system interaction conventions that prospective users might expect to find in our system, followed by the creation of sketches and mock-ups.

For the implementation we used the Apple iOS SDK, building an iOS application in Objective-C from the ground up. Given a text file (pdf and epub formats), we are able to render it to the user and then display synonyms for words that appear in the text.

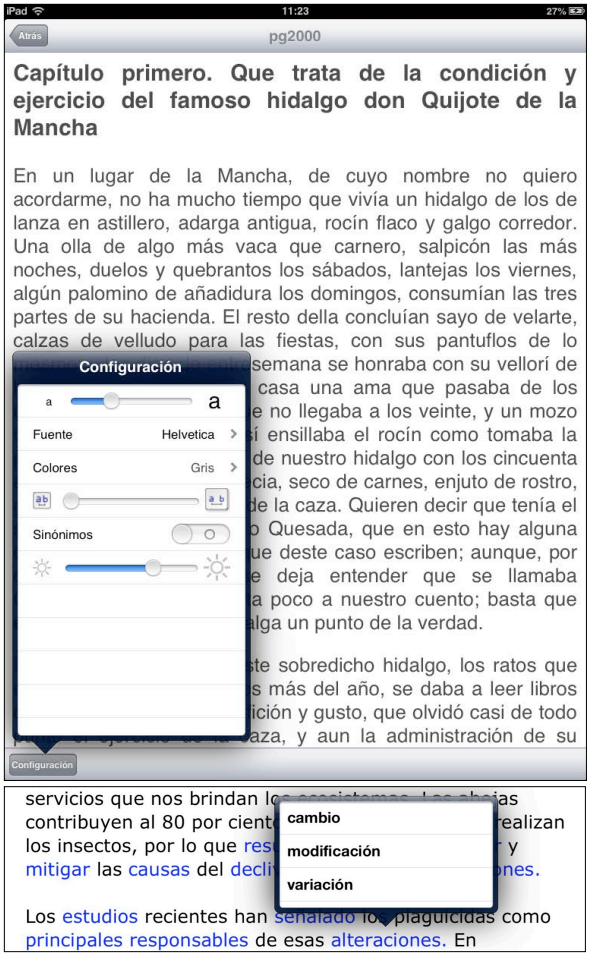

Figure 1: Screenshots of DysWebxia iOS reader.

5. REFERENCES

[1] S. Bott, L. Rello, B. Drndarevic, and H. Saggion. Can Spanish be simpler? LexSiS: Lexical simplification for Spanish. In *Proc. Coling '12*, Mumbay, India, 2012.

[2] British Dyslexia Association. Dyslexia style guide, January 2012. `http://www.bdadyslexia.org.uk/`.

[3] P. Gregor, A. Dickinson, A. Macaffer, and P. Andreasen. Seeword: a personal word processing environment for dyslexic computer users. *British Journal of Educational Technology*, 34(3):341–355, 2003.

[4] P. Gregor and A. F. Newell. An empirical investigation of ways in which some of the problems encountered by some dyslexics may be alleviated using computer techniques. In *Proc. ASSETS'00*, ASSETS 2000, pages 85–91, New York, NY, USA, 2000. ACM.

[5] G. Kanvinde, L. Rello, and R. Baeza-Yates. IDEAL: a dyslexic-friendly e-book reader (poster). In *Proc. ASSETS'12*, pages 205–206, Boulder, USA, 2012. ACM.

[6] L. Rello and R. Baeza-Yates. Good fonts for dyslexia. In *Proc. ASSETS'13*, Bellevue, Washington, USA, 2013. ACM.

[7] L. Rello, R. Baeza-Yates, S. Bott, and H. Saggion. Simplify or help? Text simplification strategies for people with dyslexia. In *Proc. W4A '13*, Rio de Janeiro, Brazil, 2013.

[8] L. Rello, R. Baeza-Yates, L. Dempere, and H. Saggion. Frequent words improve readability and short words improve understandability for people with dyslexia. In *Proc. INTERACT '13*, Cape Town, South Africa, 2013.

[9] L. Rello, S. Bautista, R. Baeza-Yates, P. Gervás, R. Hervás, and H. Saggion. One half or 50%? An eye-tracking study of number representation readability. In *Proc. INTERACT '13*, Cape Town, South Africa, 2013.

[10] L. Rello, G. Kanvinde, and R. Baeza-Yates. Layout guidelines for web text and a web service to improve accessibility for dyslexics. In *Proc. W4A '12*, Lyon, France, 2012. ACM Press.

[11] L. Rello, M. Pielot, M. C. Marcos, and R. Carlini. Size matters (spacing not): 18 points for a dyslexic-friendly Wikipedia. In *Proc. W4A '13*, Rio de Janeiro, Brazil, 2013.

[12] V. F. Santana, R. Oliveira, L. Almeida, and M. Ito. Firefixia: An accessibility web browser customization toolbar for people with dyslexia. In *Proc. W4A '13*, Rio de Janeiro, Brazil, 2013.

[13] V. Topac. The development of a text customization tool for existing web sites. In *Text Customization for Readability Symposium*, November 2012.

[14] M. Zorzi, C. Barbiero, A. Facoettia, I. Lonciari, M. Carrozzi, M. Montico, L. Bravar, F. George, C. Pech-Georgel, and J. Ziegler. Extra-large letter spacing improves reading in dyslexia. *Proceedings of the National Academy of Sciences*, 109:11455–11459, 2012.