

Text usability for Non-Native Readers of English

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1 INTRODUCTION

Two new technologies, the personal computer and the world wide web, have had a great impact on reading technology. Suddenly there is an electronic alternative to traditional paper documents. This technological change is still not fully understood or implemented, but it is clear that text and reading are changing and will continue to change. The main important qualities of web based text are readability, browsability, searchability and assistiveness [1]. For the non-native reader of English, the most important aspect of text is readability. In electronic text, however, readability is more complex since electronic text is not always linear, and the term readability has been overshadowed by the term usability [2].

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Fig. 1 Normal Expression Forms (NEF)

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Fig. 2 Phrase Boundary Marking (PBM)

This study compares the readability of two text formats, Normal Expression Form (NEF) and Phrase Boundary Marked (PBM). Readability is an index of the ease of reading a text. Readability depends on a variety of factors, including character size, font, content, vocabulary difficulty, and sentence length [3]. NEF is the format of ordinary text. In this display form the length of the lines of text is determined by the size of the display medium (see figure 1). PBM, phrase boundary marking, is a format in which the end of each phrase or grammatical chunk is marked visually in some way, for example with a special mark (figure 2).

Our hypothesis is that, for non-native readers of

English (NNREs), PBM is more readable than NEF. PBM is impractical for application to paper media because of the extra page cost, but it is easily applicable to electronic text, where the cost of extra pages of text is negligible [2].

2 METHOD

2.1 Subjects

Thirty-four Japanese university students (27 male, 7 female), ranging in age from 19 to 20, were subjects in the experiment.

2.2 Design

An experimental tool was run on the Internet Explorer 5 Macintosh Edition using an applet (Java 1.3). Each subject was tested on reading four different texts, two of which were NEF and two PBM. The difficulty of the four texts and number of words were approximately the same.

2.3 Procedure

First, the purpose and methodology of the experiment were explained to the subjects. The subjects were then asked to start up the experiment tool, and to begin reading the text that appeared in the text box on the screen. The tool displayed only one line of text at a time. Thus it was possible to record reading time precisely. The software allowed the reader to move downwards through the text, but not upward, so the reader could not read the text repeatedly. The reading time for each text was recorded automatically as the time elapsed between selections of the "beginning to read" button to "finished reading" button.

After the subjects read each text, they were asked to answer a quiz on the content of the text. There were five multiple choice questions in each quiz, each question having four answers to choose from. The subjects were also asked to fill in a questionnaire using 1-to-7 scales. The questions were about the subjects' perceptions of reading ease, text difficulty, quiz difficulty, display format related stress, and text related stress.

3 RESULTS

There appear to be many factors which affect the readability, and there are many readability evaluation indices, as previously mentioned. In this study, the index of readability defined by [4] was used, as defined by formula (1):

$$\text{Readability} = \text{Reading speed} \times \text{Test score} \quad (1)$$

Reading speed in a formula (1) is computed from a formula (2):

$$\text{Reading Speed} = w / t \quad (2)$$

Where “w” is the number of words of the text which the subject read and “t” is reading time. The measured readability of the texts used in this experiment, obtained by using formula (1), are shown in figure 3.

The main findings of the experiment were as follows.

The readability of PBM text (mean = 4.88 scores) was higher than that of NEF (2.85 scores), $F(1,66) = 9.34, p < 0.05$.

Regarding reading time, PBM text (mean = 204 ms) took less time to read than NEF (mean = 255 ms), $F(1,66) = 7.42, p < 0.05$.

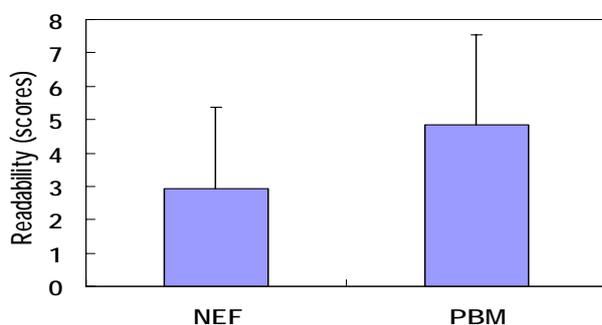


Fig.3. Readability (with standard deviation error bars).

As for reading comprehension, test scores for PBM text (mean = 3.25 scores) were higher than those for NEF text (mean = 2 scores), $F(1,66) = 22.01, p < 0.05$.

However, there was no significant difference in reading speed between NEF and PBM, as calculated using the formula (2).

Figure 4 shows the results of the subjects' subjective evaluation. These ratings were based on the average value of the subjects' scores on the 5 questions. Significant difference in main effects was found between NEF and BPM, $F(1,66) = 4.40, p < 0.05$.

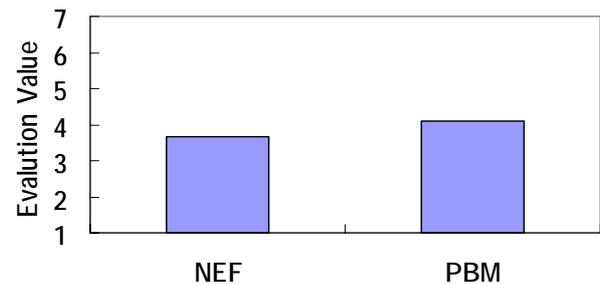


Fig.4. Subjective evaluation

4 DISCUSSION AND CONCLUSION

The results showed that PBM text was superior to NEF text in readability, reading time, test score. Moreover, an analysis of subject preferences showed that the subjects in general preferred PBM text to NEF text. The equal reading speed of NEF text and BPM text was thought to be due to the fact that the number of lines of BPM text was greater than that of NEF.

Overall, the results show that PBM is more efficiently readable than NEF. This result can be applied not only to web pages but also to other display media such as tablet PCs and PDAs (personal digital assistants) which have been attracting considerable attention in the market.

This paper provides a basis for the comparison of NEF and BPM text formats. Many challenges remain in future work. Further research is required with both one-line displays and one-sentence displays. Further consideration could also be given to various kinds of sentences, e.g., long and short sentences, complex sentences.

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