AN IMPROVED DISPLAY FOR WORD PREDICTION SOFTWARE

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ABSTRACT

Word prediction software is designed to enhance rate and accuracy of text entry. A key factor affecting the use of word prediction software seems to be the associated visual cognitive load. Children with fine motor and visual tracking difficulties often use vision to guide their fingers, but they commonly have reduced oculo-motor control. Moving their eyes between the keyboard and the monitor costs time, reducing the benefit of word prediction. To address this, it is felt that the prediction window should be placed as close to the keyboard as possible. In a pilot project, we took an important step in reducing the load and improving performance by developing a prototype with the prediction window made available at the keyboard. The prototype display consists of a Personal Digital Assistant (PDA) with an appropriately-sized LCD module. We developed a Dynamic Link Library (DLL) to provide the software interface to the word prediction software. A pilot study evaluated the effect of the display location on performance. Participants had a physical disability affecting fine motor functions (mostly Cerebral Palsy). Clients using the prototype improved their performance (rate and accuracy) and expressed a clear preference for it. As a group, the pilot study participants showed a significant improvement in Canadian Occupational Performance Measure (COPM) of more than 2 for both performance and satisfaction. The pilot work has laid the foundation for further development of the display and validation of the results with additional client populations.

KEYWORDS

Communication, Disability, Rehabilitation, Word Prediction, Keyboard Display, Software, Technology

BACKGROUND

Word prediction is a technology that aids text entry. It is used to reduce the number of keystrokes required to enter a word by predicting what the desired word is based on the initial keystrokes and then presenting a prediction list to the user, who can then select the correct word from the list without having to enter all of its letters [1]. Software packages have been developed which use context and word frequency to predict words and groups of words for users [1]. Word prediction computer software was initially designed to increase the rate of typing for individuals with physical disabilities [2]. However, studies have shown that reduction of keystrokes does not translate into an equal amount of improvement in rate [3, 4]. Researchers found that time required for visual-cognitive tasks such as scanning the prediction list and selecting the desired words offset some of the time benefits gained from keystroke savings [4, 5]. Adjusting parameters of the word prediction programs can lessen the visual-cognitive loads associated with its use. Displaying five words on the list in a vertical manner provide a balance between keystrokes saving and visual-cognitive loads [6, 7]. Another possible parameter affecting visual search time was the placement location of the prediction list on the computer monitor [8, 9]. Previous study found that children with spina bifida preferred to have the prediction list to be placed at the lower border of the monitor so that their eyes did not have to travel very far to search for the desired word. The children also had better accuracy of typing when using the prediction this way [10].

METHODS

Equipment

The prototype display consists of a Personal Digital Assistant (PDA) with an appropriately-sized LCD module (Figure 1). We used a Toshiba e830 PocketPC PDA with Host and Slave USB support. We developed a Dynamic Link Library (DLL) to provide the software interface to WordQ, the word prediction software that was used. The PDA was connected to the computer and was used to display the WordQ prediction list vertically. The PDA was embedded in a wrist rest (Figure 2). The software utilities developed enabled the display to be a prediction window that communicated with WordQ and displayed the predicted words vertically (Figure 3). By using the keyboard to select the number of the desired word in the prediction list or by touching the words displayed on the PDA, the user could select the desired word.

Using the PDA as a display offers an additional benefit that was not explored in this research. Many children with physical disabilities have difficulties with organizational skills and would benefit from using a PDA as an organizational tool. This design allows the PDA to be disconnected easily and be used as an independent device, but further software development would be necessary to facilitate switching the mode of the PDA between functioning as a prediction window and an organization tool.

Figure 1: The PDA used as a display.

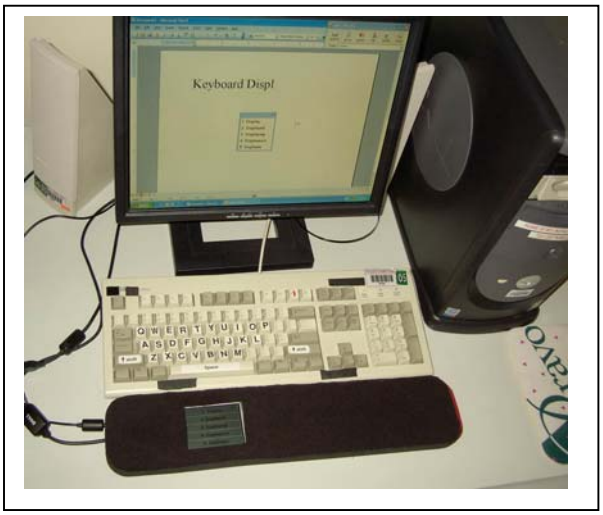

Figure 2: The PDA display embedded in a wrist rest at the keyboard level.

Participants

A two-part pilot study evaluated the effect of the display location on performance. Participants had a physical disability affecting fine motor functions (mostly Cerebral Palsy). Part I studied a random sample of ten children (aged between 11 and 14) with one to two years of previous WordQ word prediction experience. Part II studied eleven new users (aged between 10 to 18) who were assessed at the technology clinic during the time of the study. These clients were invited to participate after being considered appropriate users of WordQ by the assessing therapists. This second group had never used WordQ before.

1. the
2. they
3. their
4. to
5. there

Figure 3. An example of the prediction list seen on the display after the user enters the letter t.

Testing

In Part I of the study, a research assistant visited participants at home, and they completed a story-writing task with WordQ as they normally used it and with the keyboard display after ten minutes of practice with it. The keyboard display was then left with the participant for practice, and during a second home visit with the participants, the research assistant administered the typing tests again. Typing accuracy and rate were measured. Also, an occupational therapist contacted the participants by phone and administered the Canadian Occupational Performance Measure (COPM) for perceived performance and satisfaction of performance before the first visit and after the second visit. Participant comments regarding location of the word prediction display were also solicited and noted.

In Part II of the study, new users of WordQ performed the story-writing tasks with the standard location of word prediction on the computer monitor and with the keyboard level display. Speed and accuracy were recorded, as were user comments and preferences.

RESULTS

We have developed a keyboard level display that can help children with fine motor and visual tracking difficulties when they are using word prediction software. Clients using the prototype keyboard level display have improved their performance. Experienced users showed a significant improvement in typing

speed between using the keyboard level display at the second visit (mean, 11.3 words per minute) and using the monitor (mean, 9.8 words per minute) (p=0.04). New users showed improvement in accuracy between using the keyboard display (99%) and using the monitor (97%) (p=0.037), although accuracy was good in both cases. Clients also expressed a clear preference for the keyboard level display. Based on the qualitative comments recorded, both the experienced and new user groups had one user who preferred using the monitor, while the others in both groups preferred using the prediction list on the keyboard level display. As a group, the pilot study participants showed significant improvement in Canadian Occupational Performance Measure (COPM) of more than 2 (clinically significant) for performance and/or satisfaction. Statistically significant differences were found in the change of performance (p=0.04) and satisfaction (p=0.048) scores. The small sample size in the pilot study must be noted, since future studies with larger and more diverse samples are needed to validate these results. However, this project has laid the foundation for further development of keyboard level displays and for their clinical implementation.

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