

Understanding and Supporting the Use of Accommodating Technologies by Adult Learners with Reading Disabilities

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Abstract

Developing computer accommodations for users with reading disabilities involves several challenges: diversity of needs, stigma risks, and self-advocacy issues. This paper proposes a two-fold approach to address these issues. First, participatory design with reading-disabled users will inform necessary directions for technology development. Second, to help individual users identify what accommodations can benefit them, intelligent software will be developed. This software will also aid in the configuration of the accommodations.

Introduction

The importance of reading in today's information society is without debate. This is particularly true in the later years of education (high school, college, etc.) when students move from learning to read to reading to learn [11]. However, for those with reading disabilities, the task of reading can become challenging and stressful. Developing digital technology, like electronic documents and computer-based reading, to support and accommodate this population involves several inherent challenges.

One challenge is due to the size and diversity of this user population. Dyslexia, one of the more common reading disabilities, is estimated to affect 7–15% of the population [12]. Moreover, nearly half of all university students in the U.S. who register as having a disability experience significant difficulty with reading [10]. With such large numbers, there is an unsurprising diversity of abilities, needs, and degrees of severity [7]. How one attends to these differences influences the universal helpfulness of an accommodation.

Another challenge is related to the notion of self-advocacy. Students with invisible disabilities tend to actively avoid seeking out help until a crisis motivates them [1]. This hesitancy has been traced to numerous causes, including low self-confidence due to previous bad experiences asking for help [2] and wanting to avoid the stigma of having a disability [1]. This fear of stigma can interfere not only with the adoption of technology but also in recruiting study participants [4]. Considering these issues of stigma and self-advocacy could potentially prevent a beneficial technology from collecting dust on a shelf unused.

This paper proposes a project to create a computer-based accommodation that will address these challenges. The key intention is that embracing the diversity of needs and

the notion of self-advocacy will help identify how to design technologies that not only benefit the reading process but are also usable and adopted into regular use.

Previous work

These notions of being beneficial, usable, and adopted provide a means for analyzing previous work on computer accommodations for reading disabilities. In terms of being beneficial, most of the previous research in using computers to accommodate reading disabilities has focused on text-to-speech technology (TTS) in systems like Bookwise [4] and Kurzweil 3000R[3]. Hearing the text read aloud improves word identification and can even be used for reading remediation for some people [4, 12]. TTS does require strong auditory skills to be effective, resulting in a significant subpopulation that remains unhelped by TTS.

The usability and learnability of TTS systems appear to have been mostly unstudied. The SeeWord project [7] studied interface design for people with reading disabilities. Some of their key findings include an emphasis on direct manipulation, the need for fine-tuning of visual features, and consistent design. An inspection by the author found that most TTS systems do not use these design recommendations.

Finally, the reasons why an accommodation is adopted or not has also received little research. Elkind et al. studied factors that influenced the use of Bookwise in the workplace by adults; positive factors included an environment supportive of disabilities and motivation to adapt their work practices accordingly [4]. At the college level, however, only the motivations behind students seeking help have been studied extensively [1]. Little is known about how students with reading disabilities adopt digital technologies (accessible or not) to support their reading process.

Research plan

Working from a philosophy that design should be influenced both by the needs and wants of users and the potentials of technology, this project involves two research threads.

Understanding the needs of the users

The research question in this thread is to understand the users' relationship with technology used for reading to inform new technologies and/or improvements to existing solutions. This process began with informal interviews among students with disabilities. These casual conversations were exploratory and meant to improve understanding of the problem space and to identify potential research questions. Two of the key findings were the importance of privacy to the students in regards to their use of AT and the difficulty in learning and configuring accessible technology.

Future plans are to formalize these results through several approaches. To gain perspective on how digital technologies are used by this population, a general survey on technology use is being developed that will potentially be distributed at multiple universities. Participatory design sessions using the future workshops method [9] will be conducted to identify directions on how to improve reading technology.

Technology, diversity, and self-advocacy

Given the diversity of needs among those with reading disabilities, a single accommodation is unlikely to be effective. Instead, one can provide a collection of interoperable tools for the user to choose among. This toolkit would be a component of basic computer-reading application and would contain tools like text-to-speech, text magnification, etc. Findings from the previous thread will likely suggest other accommodations to include. Each tool is then configured as needed. Importantly, though, by letting a user select only what he or she needs, this can address both the challenges of diversity and self-advocacy.

Letting users customize a base application through extensions is not a new idea; the Firefox web browser [6] does exactly that. However, Firefox provides little support in helping users determine what would benefit them. With a large number of tools, finding the few useful ones becomes difficult. Moreover, the identified tools still need to be configured. Given that fine-tuning is often required for accommodating reading disabilities [7] and that informal interviews identified configuration as a known user issue, the toolkit is not yet a sufficient solution.

Thus, a software wizard will be integrated with the toolkit to guide each user to appropriate accommodations and walk them through the configuration process. The wizard will use assessments of varying complexity: from simple preference questions to formal performance measurements. The key idea is that the wizard will be an expert system that applies the knowledge and procedures similar to those that a human disability expert would utilize when helping someone. Since the user will not have to approach others for help, the stigma risk is lessened. Furthermore, the toolkit plus the wizard gives the users a chance to advocate for their own accommodations.

To demonstrate this approach, I will develop software demonstrating the key aspects of the expert system. In particular, I will implement a software version of an established diagnosis protocol for an accommodation with a large configuration space. The accommodation addresses visual stress syndrome, a condition involving excessive eyestrain during reading that affects 15–20% of people with dyslexia [5, 13]. The standard treatment consists of an optometric examination and reading test that identifies an optimal color for the text's background [13]. This procedure, including the oral reading test, will be automated and tested for validity and reliability. This system will likely be extended to other typographic parameters in light of recent research on their potential as an accommodation [8].

Contributions

This research has several contributions. First, a better understanding of the user population, their needs, and their views on technology will help inform future work. Second, emphasizing self-advocacy and diversity forms a new design approach for accessible technology that not only addresses disabilities but also usability and adoptability. Finally, the suggested approach of an intelligent toolkit of accommodations has further applications. The same technology could aid disability experts and caretakers in their jobs or even benefit the general user in customizing complex software applications.

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