
Alexa, Siri, and Cortana Walk into a Library: The Potential of Voice Assistants in Creating Accessible Co-Reading Experiences

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Abstract

Co-reading between parents and their children improves literacy skills and strengthens the bond between them. However, it can be difficult for parents with visual impairments (PWVI) who have sighted children. While previous work has explored the techniques used by PWVI while co-reading, they have not explored new assistive technologies to support the practice. Our research highlights 3 preliminary issues and challenges in designing voice assistants (VAs) for PWVI. First, that context of use is essential to consider in designing user interfaces, especially in settings where the CUI is secondary to other interactions. Second, designers of assistive technologies should consider the strategies that PWVI already use for completing a task and design assistive technologies that augment these strategies rather than replace them. Third, the tension between transactional and conversational styles in the design of VAs highlights the importance of designs which are aware of the user's communication styles.

Author Keywords

Auditory Assistive Technology; Blind and Low Vision; Voice Assistant; Co-reading; Parenting

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Figure 1: One of our interview participants co-reading with his 4-year-old daughter via a smartphone.

CCS Concepts

•**Human-centered computing** → **Accessibility technologies**; *Accessibility systems and tools*; •**Social and professional topics** → **People with disabilities**;

Introduction

Blind and low vision (BLV) people frequently use conversational user interfaces (CUIs) to interact with technology and augment the world around them. CUIs have become ubiquitous in assistive technologies, as they offer an intuitive and efficient way for users to interact with digital content. For example, screen readers provide a voice-based interface for reading text on a computer screen, while optical character recognition (OCR) allows users to convert printed text into an accessible, audible format. Given the prevalence of CUIs in assistive technologies, researchers have continuously explored how they can continue benefiting BLV people.

Our research is specifically focused on the potential benefits of voice assistants for parents with visual impairments (PWVI) who co-read with their sighted children [6]. Co-reading is an important activity that helps develop children's literacy skills and strengthens the bond between parents and children [1, 6]. However, co-reading can also be challenging for PWVI, who may struggle to access the same visual cues and illustrations that sighted parents can. By using voice assistants to augment the co-reading experience, PWVI may be able to participate more fully in this important activity and share the joy of reading with their children. We have gained preliminary insights into how voice assistants can be used to enhance the co-reading experience for PWVI, and more broadly, how CUIs might be refined for more effective use in specific contexts where their use is secondary to other activities.

Previous research

As VAs are becoming more prevalent in the form of a smart speaker such as Google Assistant, Alexa, Siri, and Cortana, and considering that they mainly use non-visual interactions, many researchers started to focus on how VAs can be integrated into the lives of PWVI. Multiple papers have reported on how BLV people perceive VAs [1, 2, 7, 4], finding positive sentiments towards these technologies. For instance, Pradhan *et al.* [4] found that many perceive VAs to be an essential component of their technological strategies. Abdolrahmani *et al.* discovered that VAs enable PWVI to feel the sense of independence and empowerment in doing daily tasks [2]. Moreover, compared to sighted users, PWVI wished to accomplish more complicated day-to-day tasks through VAs, which leads them to encounter more usability issues. Nonetheless, they continue to use these CUIs, as there are few alternative methods [2].

Methods

We conducted hour-long interviews with a legally blind father and a blind mother to better understand this problem space. In this initial stage, we have not done any qualitative analyses beyond team debriefings.

Issues and challenges

Intimate contexts influence the design of CUIs

The experiences of PWVIs using technology for co-reading highlight the complex trade-offs involved in designing user interfaces for specific contexts. While BLV people are often early adopters and technologically literate, our interviews found that certain technologies can still be perceived as intrusive and distracting in the context of co-reading. CUIs were identified as a potentially useful tool for enhancing the co-reading experience, but our participants noted that CUIs could be equally disruptive, particularly if they use a robotic, monotone voice commonly found in text-to-speech

software. Although the common voice is just as capable of communicating information to the user, it disrupts human connection. One possible solution, as ideated by P1, would be a voice assistant in his own voice. P2 also thought it was a promising idea. This finding underscores the importance of personalization in CUIs, particularly in settings where the CUI is secondary to other interactions, such as co-reading. Overall, these results suggest that designing CUIs for BLV people requires a careful consideration of the specific context in which they will be used, including the social and emotional dynamics involved in shared activities like co-reading.

Augmentation of existing strategies rather than proposing new ones

For assistive technology to be adopted, it must be paired with effective strategies for use. Often, new assistive technologies are designed with the assumption that users will adopt known strategies or create their own over time. However, even if the design is well-informed and feasible, the adoption of the technology still requires a significant investment of time and money for a technique that may not be beneficial. Therefore, designers of assistive technologies should consider the strategies that BLV people already use for completing tasks and design assistive technologies that augment these strategies rather than replace them.

Through our interviews and previous research on co-reading, it is evident that PWVI who co-read with their sighted children do not need some transformative technology, but rather augmented solutions that help them better conduct proven techniques. For example, text-braille books combine brailled, translucent film and printed text, allowing both sighted and BLV people to read the same page. Another strategy used by our participants was preparatory memorization before reading with their child. By designing CUIs

that augment these existing strategies, PWVI can more efficiently incorporate the technology into their co-reading sessions.

Conversational or transactional user interfaces?

A tension arises between transactional and conversational styles in the design of CUIs for BLV people. Transactional voice assistants are designed to provide a quick and efficient interaction with the user, completing specific tasks in a straightforward and streamlined manner. Abdolrahmani *et al.* found that many BLV people prefer transactional interfaces due to the productivity-oriented ways in which they are used [1, 3]. They want quick interactions that return information promptly. On the other hand, older adults are more likely to have visual impairments, and prior work at CUI 2019 proposed that more anthropomorphic systems may be preferred by this demographic [5]. These conversational interfaces provide a more human-like interaction, allowing for extended conversations that may be perceived as more engaging and personalized. The conversational approach is desired by older adults who want to feel more connected to the technology and may benefit from a more human-like experience. The tension between these two styles highlights the importance of designing CUIs that can be personalized to individual preferences.

Future work in assistive CUIs should consider the diverse preferences of different user groups, such as BLV people and older adults, and strive to provide a range of interface options that can accommodate different interaction styles, including new design strategies that balance the need for efficiency and speed with the desire for more conversational interactions. In the context of co-reading, this paradigm has a few implications for the design of a voice assistant. A VA which reads to a child in the parent's voice might be more conversational. Meanwhile, one which informs an

adult user of relevant information, such as when to turn a page or image descriptions, might be more transactional.

Conclusion

The use of VAs and CUIs for PWVI is an established area of research that holds great potential for improving quality of life. However, significant challenges remain, particularly in designing CUIs that are likely to be adopted for long-term use. Research should investigate the ways in which CUIs can augment existing strategies, rather than replace them, to better support PWVI in their daily lives. Further, there is a need for more research into the conversational and transactional paradigms of CUIs for PWVI. Finally, more research is needed to explore the potential of CUIs for supporting social interactions among PWVI and sighted individuals. With informed, user-centered design practices, these technologies hold great potential to further support communication and collaboration among people with diverse visual abilities.

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