



"It's All About the Pictures:" Understanding How Parents/Guardians With Visual Impairments Co-Read With Their Child(ren)

Sohyeon Park
University of California, Irvine
Irvine, California, USA
sohyepark@uci.edu

Cameron Cassidy
University of California, Irvine
Irvine, California, USA
camcass@uci.edu

Stacy M. Branham
University of California, Irvine
Irvine, California, USA
sbranham@uci.edu

ABSTRACT

Co-reading, an activity where adults collaboratively read books with child(ren), is important for literacy learning and forming human connection. However, parents and guardians with visual impairments do not experience the same level of access to resources when co-reading with their child(ren) as their sighted counterparts, especially as regards images in children's books. Through conducting an interview study with five visually impaired parents/guardians, we illuminate the importance parents place on images in children's books, how they access visual information in children's print books, and the potential of smart speakers in assisting their existing co-reading practices.

CCS CONCEPTS

• **Human-centered computing** → **Empirical studies in accessibility**; **Accessibility technologies**; **Human computer interaction (HCI)**.

KEYWORDS

accessibility, blind or low vision, parents/caregivers, co-reading

ACM Reference Format:

Sohyeon Park, Cameron Cassidy, and Stacy M. Branham. 2023. "It's All About the Pictures:" Understanding How Parents/Guardians With Visual Impairments Co-Read With Their Child(ren). In *The 25th International ACM SIGACCESS Conference on Computers and Accessibility (ASSETS '23)*, October 22–25, 2023, New York, NY, USA. ACM, New York, NY, USA, 4 pages. <https://doi.org/10.1145/3597638.3614488>

1 INTRODUCTION & RELATED WORK

Co-reading, an activity in which parents/guardians collaboratively read books with their child(ren), is an important process for both parents/guardians and their child(ren). For children, it not only develops their literacy skills [13], but it also facilitates their social-emotional growth [6]. It also allows parents/caregivers to create a special bonding time that fosters intimacy and common ground with their child(ren) [13]. However, this task can be especially

challenging for parents/guardians with visual impairments¹ (PGVI). According to Storer *et al.* [12], PGVI considered co-reading to be an activity with great importance but had to seek for alternative co-reading strategies due to having limited resources for accessible reading materials.

Given the importance and beneficiaries of co-reading, multiple researchers have studied ways to support co-reading practices and design technologies that can enhance the experience. For example, Vezzoli *et al.* [13] explored various types of parent-child interactions and how intimacy is fostered while co-reading using digital books and suggested new design opportunities that can support their practices. Additionally, Zhang *et al.* [14] designed a human-AI collaborative chatbot, Storybuddy, to support parent-child bonding while minimizing the parents' workload.

In contrast, studies that have explored ways to support co-reading in mixed-visual-abilities settings are scarce. The few studies that have explored ways to support co-reading when one reader is blind and the other is sighted mainly focused on asynchronous reading. For instance, Attarwala *et al.* [3] presented an accessible, large print, listening, and talking e-book to support mixed-visual-abilities families, which lets the family member with a visual impairment record their voice synchronized to the text that can later be accessed by another family member. However, this type of shared reading does not provide the same benefits of physical and synchronous co-reading.

To address this gap, we conducted an interview study with five PGVI to understand their co-reading practices. We discovered that they find images in children's books to be important for their sighted child(ren), as it helps them engage in entertaining and deeper conversations; they sought out various methods to access the images; and they find voice assistant-based devices, such as smart speakers, as the least intrusive and the most useful type of assistive device to use while co-reading.

2 METHODS

Initially, two participants were recruited via convenience sampling from a researcher's personal social network, which then snowballed to a total of five participants. The inclusion criteria for the study required the participants to be legally blind, have at least one sighted child aged between 2 and 7, engage in book-reading activities with their child(ren), reside in the United States, and communicate in English. More comprehensive details about the participants, including their identifiers, demographics, and visual abilities, are provided

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ASSETS '23, October 22–25, 2023, New York, NY, USA

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ACM ISBN 979-8-4007-0220-4/23/10.

<https://doi.org/10.1145/3597638.3614488>

¹We ascribe to the person-first phrasing instead of *visually impaired person* as justified in Language of Disability from the ACE Disability Network, <https://www.acedisability.org.au/information-for-providers/language-disability.php>

Table 1: Participant demographics. (*VI=Visual Impairment)

ID	Approx. Age	Gender	Onset of VI*	Children	Primary Co-Reading Tool
P1	40s	Male	4 months old	1, Age 4	Youtube
P2	30s	Female	From birth	1, Age 2	Twin vision books
P3	30s	Female	From birth	2, Ages 1 & 3	Twin vision books
P4	40s	Female	From birth	1, Age 3	Twin vision books
P5	30s	Female	From birth	2, Ages 3 & 6	Twin vision books

in Table 1. Also, please refer to Figure 1a for an example of a twin vision book

We conducted semi-structured interviews that lasted for an hour on average via video conferencing tools chosen based on each participant's preference. All the interviews were audio-recorded and were transcribed by the research team. The questions asked were about their experiences and strategies of co-reading, book formats used, technologies used, and any difficulties they faced while co-reading. The first author conducted qualitative thematic analysis of interviews using open and axial coding and constant comparative method [5]. The research team collaboratively discussed and iterated themes over several months. Each participant received \$40 per hour as compensation.

3 FINDINGS

3.1 The Importance of Images in Children's Books for Blind Parents/Guardians

All participants emphasized the importance of showing the visual contents of the book to their child(ren) as they strongly believed that sighted children learn a lot from visual information. For example, P1 shared:

"When children are at the earlier age, the main communication medium with them is those funny illustrations, bold figures, colors, all that beautiful patterns that they learn to read."

Moreover, the majority of the participants found pictures to be helpful in setting a "common ground" (P1) with their child(ren), allowing them to engage in deeper conversations during co-reading. Pictures also allowed PGVI to make co-reading more entertaining and capture their child(ren)'s attention.

To incorporate images into co-reading, participants who are expert Braille readers (P2 to P5) used twin vision books as shown in Figure 1a. These books allowed both their child(ren) and themselves to access the book simultaneously—the Braille texts for them and the illustrations for their child(ren).

"And so that way as I'm reading the book, she's also able to see the pictures and follow along with me as I'm reading because she's right next to me, so she could see what's on the book as well." (P2)

Even P1, who is a novice Braille reader and therefore mainly uses Youtube videos to co-read, made sure that the videos he chose showed the visual content of a book.

Nonetheless, an intriguing observation was noted from multiple participants who utilize twin vision books. Due to the fact that these books are typically designed for sighted parents reading with their blind children - not the reverse - they lack image descriptions.

Please refer to Figure 1b for an example image description. This sometimes caused confusion to PGVI in understanding the context of a book. For example, P4 was informed by a sighted parent that the illustrations and the text do not match, which made P4 rethink the whole concept of the book:

"And well, it changes the whole concept when you realize they are actually dressed up little piggies and took pictures and that's what the book was. I'm like, oh my god. I never would have known."

Overall, all participants desired to know more about the images of a book. P1 also had a strong desire to access the visual information as this would allow him to try out physical books and exploit the co-reading time to learn how to read Braille: *"...learning Braille at the same time with reading books for kids is fun because books for kids are using you know, simple words, short sentences."*

3.2 How Blind Parents/Guardians Access Visual Information

Despite parents indicating that images are important, most books they read with their child(ren) did not include image descriptions. In the absence of image descriptions, the most common method participants used to access the visual information was to frequently prompt their child(ren) about the images. This helped them naturally access the images without requiring assistance from technology or someone other than their child. However, for PGVI with child(ren) who are too young to describe the images, illustrations were an inaccessible component of co-reading.

Several participants sought out or considered other ways to access images. For example, P4 considered using an image description service, called Imagination Storybook ², which provides an overlay of detailed image descriptions:

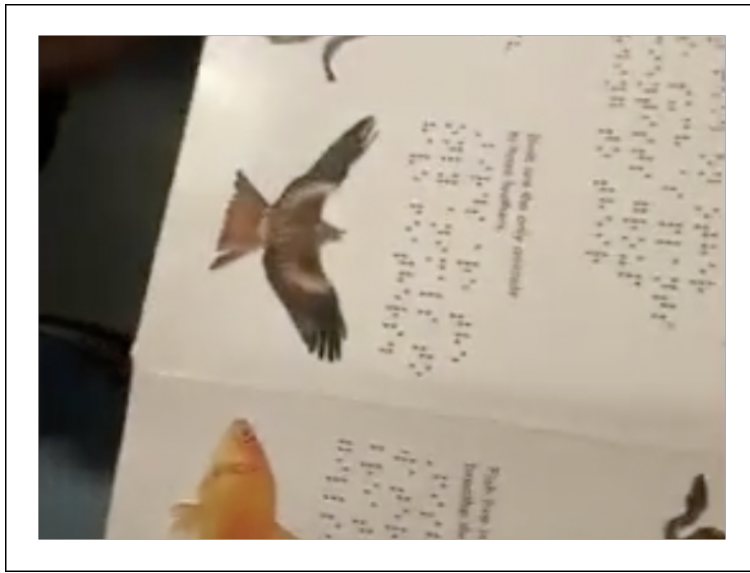
"So there is a group of people who are doing, basically doing, they're describing all the pictures in the books. So you're getting the text of the book but they're going into very intense detail and I think using voices for the various characters and everything, so it's like hearing a story narrated but they're also overlaying all the picture descriptions."

Another method used was to receive assistance from applications such as Aira ³ or SeeingAI ⁴, but the participants had opposing views on the use of such applications. For instance, P4 had once used SeeingAI, an application that provides people with visual impairments audio feedback on images they took pictures of, and

²Imagination Storybook: <https://imaginationstorybooks.org/>

³Aira: <https://aira.io/>

⁴SeeingAI: <https://www.microsoft.com/en-us/ai/seeing-ai>



(a) A twin vision book shown by P5 which consists of both Braille and printed visual content.



Image Description: Lumen looks surprised next to a magical staff. A small yellow orb floats above her and the staff.

(b) An image from the children's book "The Dream Weaver" along with the image description provided by ©Joel Riley.

Figure 1: Each figure shows an example of a term; (a) twin vision books and (b) image descriptions

was open to the idea of using similar applications to access the images of a book that are not Brailled:

"Because I use SeeingAI a lot on my phone. And I've actually used that to try to ... read bits of her books to her with that. She's like, 'What are you doing with your phone?', 'I'm trying to read the words because my eyes can't do it, and I don't have Braille bumps.'"

On the other hand, P1 did not like using such applications and described them as an "unwelcomed third party." He perceived them as a stranger intruding on the most intimate moment with his child: *"Let me reassure you because that's just a stranger out of nowhere jumping into your most intimate ritual moment of the time with your... child."*

3.3 The Potential for Smart Speakers

While talking about the types of assistive devices participants own in their households, we noticed that all the participants were very strict with the types of technologies that can be introduced into the child(ren)'s bedroom but had at least one smart speaker in the room. The majority of the participants had a no-screen-time policy in the bedroom and would only allow audio-based devices. As we saw with P1 above, some participants even found screen-based technologies to be intrusive. The types of intrusive technologies were those that require physical interaction or additional attention away from their child(ren), such as laptops, iPads, or smartphones, as they interfere with maintaining intimacy and physical contact during co-reading. Participants usually used the smart speaker, generally Amazon Alexa, to listen to audio-based stories right before bedtime, as it does not go against the no-screen-time policy:

"Amazon story time is what they listen to when they're going to bed at night instead of like music or something. So for them, it's just a chance to chill out." (P3)

On this matter, even though P1 uses mobile devices for co-reading, he did not feel comfortable bringing such devices into the intimate setting: *"Because I still don't feel good to bring, for example, my laptop with me to the bedroom."*

One thing to note is that most of the participants believed having their own voices heard by their child(ren) while co-reading is crucial and showed positive responses to the idea of having their own voices incorporated into smart speakers. Additionally, regarding the various types of assistance smart speakers can provide, P4 was enthusiastic about the idea of using smart speakers to access the images in advance to co-reading, to prepare prompts: *"I would activate it and say, 'Hey thing, what's the picture?' That'd be neat. I would probably use that to prepare ahead of time rather than using it to read with her. Because I would know what to talk about. I would know to be like, 'Okay, what do you see?' And I would already know what to cue her."*

4 DISCUSSION

The interview findings revealed that PGVI find images important, as they allow for deeper conversations between readers. This correlates with findings from Storer *et al.* [12], where participants who use Youtube videos to co-read identified the importance of image descriptions in the videos. However, the PGVI in our study predominantly used twin vision books, which rarely provide image descriptions, leading them to find alternative methods to access important visual information. These alternatives, unfortunately, require additional effort and do not provide direct and convenient

access. Thus, there is a need for alternative means to access the visual content of physical children's books.

Prior work addressing reading accessibility for people with visual impairments has mainly focused on adults reading in an individual setting [9, 11] or blind children reading [7, 10], instead of blind or low vision parents/guardians reading with one of their sighted child(ren). Those that studied shared reading among mixed-visual-abilities families [3, 4] have explored asynchronous reading, but the needs that arise during synchronous co-reading are only just being documented by scholars. While prior work on asynchronous shared reading has leveraged digital books, most PGVI in our study desired co-reading using physical books, in which they could leverage Braille reading skills while maintaining the visual and tactile focus of their young child(ren). Though our sample is small and skewed toward people with Braille reading skills, it suggests the need for accessible computing scholars to further study how to support and enhance the practices of PGVI in synchronous co-reading settings with physical print books.

Moreover, the interview findings revealed that the participants generally do not prefer having screen-based technologies in the children's bedroom, as they are intrusive and go against the no-screen-time policy. However, nearly all assistive reading technologies for people with vision impairments, such as OCR (Optical Character Recognition)-based technology (KNFB reader⁵), crowd-sourced-based technology (VizWiz⁶, TapTapSee⁷, BeMyEye⁸, and AIRA), and computer-vision-based technology (VizWiz and SeeingAI), run on devices with screens (e.g., smartphones, laptops, tablets). Considering that the majority of the participants currently own a smart speaker in their child(ren)'s bedroom, which aligns with several work that explored the use of smart speakers among people with visual impairments [1, 2, 8], we suggest designing a smart speaker-based application as a new type of assistive co-reading technology for PGVI.

5 CONCLUSION & FUTURE WORK

Our work presents insight into what PGVI consider important when co-reading and the types of strategies they adopt to achieve their standards. The interview findings revealed the urgent need of PGVI to access the images in children's books and the already prevalent use of smart speakers in their child(ren)'s bedroom. This indicates that an assistive technology using smart speakers that can resolve the issue of visual components being inaccessible is needed for them to better improve their co-reading practices. However, the research team acknowledges that drawing a conclusion with only five interview participants is not enough. Thus, we plan on recruiting more participants for deeper insight into such a matter. Moreover, we hope to expand our research by designing a smart speaker-based application that helps PGVI access the images in physical children's books and understand the potential of audio-based systems in co-reading among mixed-visual-abilities families.

ACKNOWLEDGMENTS

This work was sponsored by the National Science Foundation, award #2048145. We are grateful to our participants for their time and insights.

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⁵KNFB reader: <https://nfb.org/programs-services/knfb-reader>

⁶VizWiz: <https://vizwiz.org/>

⁷TapTapSee: <https://taptapseeapp.com/>

⁸BeMyEye: <https://bemyeye.com/>