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INCREASING THE READING RATE OF BRAILLE THROUGH TELEGRAPHIC TEXT AND SCAFFOLDING

by

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This is to certify that the thesis prepared by Michael Eskenazi, entitled Increasing the reading rate of Braille through telegraphic text and scaffolding, has been approved by this committee as satisfactory completion of the requirement for the degree of Master of Arts in Experimental Psychology in the department of Psychology.

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ABSTRACT

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Michael Eskenazi

Braille reading is a significantly slower process than sighted reading, but manipulations can be introduced to affect this speed (Knowlton & Wetzel, 1996). This study removed 20% of words within the text (known as telegraphic text) and provided context-based scaffolding to increase reading rate and maintain high levels of recall. Participants read six stories, were timed for reading rate, answered questions concerning details, and completed a demographic questionnaire about their reading experiences with Braille. Telegraphic text significantly increased reading rate and scaffolding significantly increased participants' memory for story details. Age, age of Braille acquisition, and age of blindness were negatively correlated with reading rate and amount of time spent using Braille was positively correlated with reading rate. User preference does not coincide with either speed or ability to recall story details. Implications for future research and applied technologies are discussed.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

1.

INTRODUCTION

Until the early 1800s, blind people were illiterate, not by their own choice, but because of the lack of a unified, effective reading system. In 1825 a blind Frenchman, Louis Braille, changed the course of history for blind individuals by providing a system that afforded them access to printed material. Braille's reading system gained momentum and by 1960 50% of blind school-age children were taught to read Braille. However, by 2008 that number had dropped to 12%, and a likely contributor of this decline was the Rehabilitation Act of 1973, which called for thousands of students to be mainstreamed into public schools (Ranalli, 2008). Unfortunately, only a very small number of these schools could afford to teach Braille, resulting in the heavy reliance on non-Braille adaptive technologies for education. Unfortunately, mainstreaming blind students without appropriate Braille education support, and greater use of non-Braille adaptive technologies had the unwitting and negative consequence of promoting illiteracy for blind students. Outrage would be justified if teachers decided to stop teaching reading to sighted children. Is the same outrage justified when curricula do not include Braille education for blind students? The indisputable answer is yes; illiteracy in the United States should not be acceptable for any child.

2.

LITERATURE REVIEW

Braille Literacy Research

Very little research has been conducted comparing blind children who read Braille with sighted children who read printed text and just as little research has been conducted comparing blind students who learn Braille to blind students who do not. Ryles (1999) compared students who learned Braille early in their education, students who learned Braille less than three days a week in grades one through three, and students who did not learn Braille. She administered the Stanford Achievement Test and the Woodcock Johnson R test to assess literacy differences. On comprehension tests there were no significant differences between infrequent Braille readers and non-Braille readers. Ryles then combined sighted readers and Braille readers, and infrequent Braille readers and non-Braille readers to compare these groups. The sighted/Braille reading group comprehended significantly more than the infrequent/non-reading group. On vocabulary tests Braille readers and sighted readers performed similarly, whereas infrequent Braille readers performed significantly more poorly, and non-Braille readers performed the worst of all groups. The same trend was observed for punctuation and spelling, but in these categories surprisingly Braille readers were significantly better than sighted readers. Ryles' (1999) results suggest that literacy is better for blind children who learn Braille at an early age and that early Braille readers may be able to achieve the same level of literacy as their sighted counterparts.

Ryles (1996) also studied employment rates and reading habits of blind Braille readers and non-Braille readers. Based on a survey conducted in Washington State she found that 77% of non-Braille readers were unemployed as compared to 44% of Braille readers. Nationally, estimates show that 90% of Braille readers are employed whereas only 33% of non-Braille readers are employed (Ranalli, 2008). These findings suggest that greater literacy leads to better employment rates among Braille readers. However, it may be overly simplistic to believe that reading Braille alone creates better employment opportunities. Rather, it is likely that literate individuals feel their disability does not impede functioning in the workplace and are more likely to seek employment due to higher self-esteem.

Braille readers read significantly more books and spent significantly more time reading than non-Braille readers (Ryles, 1996). The literacy benefits of being a Braille reader are clear. Withholding Braille instruction may put blind individuals at an unfair disadvantage in terms of employment, literacy, and income. Schroeder (1996) compared Braille readers and non-Braille readers for their perceptions of the Braille language and its role in their lives. Results from this study indicate that Braille readers feel more independent, competent, and have a greater sense of equality than their non-Braille reading counterparts. Braille functions not only as a literacy aid, but also as an emotional and social aid.

On average, people read Braille at a slower rate of speed than sighted people read text (Knowlton & Wetzel, 1996; Mousty & Bertelson, 1985). Mousty and Bertelson (1985) found average reading speed of prose for congenitally blind people to be 123 words per minute. Sighted people read at a much higher rate of 250 to 300 words per minute (Ziefle, 1998). It is likely that slow reading is one of the main contributors to public schools' resistance to teaching Braille. If it takes students more time to read using Braille, instruction takes longer and there is less time for intensive practice. Thus, researchers were interested to find the conditions under which reading speed could be accelerated. Knowlton and Wetzel (1996) explored increasing reading speeds by asking participants to use different reading methods. In the *oral reading category* participants had to read out loud with no concern for comprehension and in the *scanning condition* participants were told what to look for before reading the passage. The results demonstrated that reading rates were fastest for the scanning condition with an average of 202.9 words per minute. Participants were slower in the oral reading condition with an average of 135.9 words per minute.

Knowlton and Wetzel’s (1996) results suggests that the reading rate depends on the task the person is asked to perform. In the scanning condition the participants knew what type of material they were looking for and reading rates were faster. They could pay less attention to unimportant information, which allowed them to focus on the most relevant information. This study points to two potential variables that may be helpful in increasing Braille reading speed and comprehension: (a) eliminating less important words throughout the text, a process known as "telegraphing", and (b) supporting readers with high-level information that provides context, a process known as "scaffolding.” Similar to the scanning condition, telegraphic text allows readers to skip unimportant words, encouraging them to read faster. Additionally in Knowlton and Wetzel's work, the scanning condition highlighted a scaffolding technique in that participants were told what type of information to find, which may have helped them read and recognize words more quickly.

Technology and Braille

Adaptive technologies are a recent innovation that has greatly helped the blind community by increasing accessibility to computers, cell phones and other technologies. However, adaptive technologies may also have some drawbacks. The integration of audio adaptive technologies, such as audio books, screen readers and National Federation of the Blind (NFB) Newsline, may be a contributing factor to the decline of Braille reading as they encourage listening over reading. These technologies are easy to use and less expensive than refreshable Braille displays. However, the refreshable Braille display, a recent adaptive technology itself, also has many benefits. This device instantly converts text files into Braille, can store files, and individuals can type documents using either the QWERTY keyboard or a Braille configuration. The majority of Refreshable Braille displays contain 32 to 80 Braille cells. These displays present lines of text, one-at-a-time, and advance only when the individual presses a "forward" key, allowing them to read at their own pace. Integrating this technology into education with appropriate teaching strategies could increase Braille reading speed among school-age children, contributing to their overall literacy. Adaptive technology is the wave of the future, and refreshable Braille displays allow educators to combine modern tools with an age-old important literacy skill – reading Braille. The current thesis explores the integration of telegraphic text, scaffolding, and use of refreshable Braille displays to determine if there is an optimal blend between increasing reading speed and maintaining high levels of recall - two components that are vital to one's ability to read efficiently and effectively.

Reading Development

Reading can be defined as a process by which a sensory modality receives information from the outside world and converts it into information that can be interpreted (Steinmain, LeJeune, & Kimbrough, 2006). In sighted reading, the sensory modality is vision and the information from the outside world is light reflected from print. Received information is processed in the brain, and based on previous knowledge we are able to understand what we see. In Braille reading the sensory modality is tactile, and information is contained in bumps configured on a 3 X 2 Braille matrix. Beyond the initial processing of sensory information, it is thought that the brain uses the same processes in sighted and Braille reading (Steinman, 2006). However, it is important to understand the differences between sighted and Braille reading as one learns to read.

Preparation for reading begins when children produce their first words at about 10-12 months. At around 18 months, children begin to learn many words quickly, a stage known as fast-mapping. When a child is born blind these stages are not disrupted, but the relationship between the word and the referent are different. A sighted child has the ability to use vision to map an object to its referent label. For example, a sighted child will be able to see an apple as a red, round fruit. However, a blind child does not have the ability to know what red is, nor perceive roundness in visual form. A blind child must rely on touch to understand what the object is. They may describe an apple as smooth and round instead of round and red. It is important to compare and understand these modal differences so that parents and educators learn to provide appropriate support to blind children during the pre-reading stage (Steinman et al., 2006).

There are two types of models of reading: text-based and reader-based (Steinman et al., 2006). In a text based model, the focus is on bottom-up processing based on isolated units such as letters or words. In contrast, a reader-based model uses top-down processing in a constructivist approach. In this approach meaning is built on schemata, knowledge structures about the relationships between concepts or objects. When readers are faced with new words or phrases they use previously known schemata to comprehend them. Both bottom-up and top-down processes are important in different stages of reading. No single text-based or reader-based model alone works well. Chall (1983) developed a six-stage model integrating both cognitive processes to understand the development of reading.

Stage zero is the first stage of reading, which lasts from birth until around five (Chall, 1983). This stage involves gaining insight into the nature of words and speech. Sighted children may become familiar with many repeated signs or logos that they see but cannot read (e.g., a stop sign). Encouragement from adults to become actively involved in reading is very important in this stage. Blind children are at a disadvantage in this stage since relationships between their sensory modalities and written symbols (their future Braille alphabet) may be unclear. Blind children must be deliberately taught to make connections between their other senses and the symbol system that ultimately represents these objects. It is most important in this stage for parents of blind children to provide detailed descriptions of objects and to provide verbal feedback. Also, in this stage sighted children are exposed to graphemes that they will use in the future to read, but blind children must be deliberately exposed to Braille. Very young blind children should be exposed to tactile sensitivity training to build their knowledge for structures that will later be important in reading (Steinman et al., 2006).

In stage one, children begin to build their reading skills with formal training. They learn what sounds and sound combinations graphemes represent. They learn rules for irregular combinations and varying types of sounds. Most important in this stage is bottom-up processing where the majority of attention is directed to the process of reading rather than reading for information. Braille reading is similar in this stage since blind children will develop relationships based on tactile representations and sounds. This stage may take longer for blind children who were not previously exposed to Braille matrices. Further, blind children also have more symbols to learn than sighted readers because Braille includes a contracted component. Whether or not the child learns contracted Braille at this age, the same steps are taken when the child finally does learn contracted Braille. Once the connections are made between the grapheme or the matrix, the same process is undergone by both types of readers. As they become more practiced, the use of phonetics decreases in decoding words (Steinman et al., 2006).

Children continue to learn phonetic patterns in stage two, but reading becomes more complex. They begin to see words as a whole rather than letter-by-letter, and begin to break away from phonetic decoding. For reading to become more automatic, children are dependent on familiar words and phonetic patterns. Practice texts are still intended for bottom-up processing and have little to do with gaining knowledge. In Braille reading children can break away from phonetic decoding by becoming proficient with contracted Braille[1]. Braille readers will encounter a disadvantage as compared to sighted readers in this stage. For sighted readers the perceptual span, or amount of information gained in one eye fixation, is about 10-20 characters. This allows a sighted reader to process multiple words at the same time in a single glance. Children reading Braille may not have this advantage because they need to move their fingers over one letter at a time. Some more advanced Braille readers are able to process multiple characters in parallel, but still cannot process an entire word at once. Cognitive demands are clearly greater for Braille readers and are illustrated through techniques that inefficient readers use, such as scrubbing (Wormsley and D'Andrea 2000). Scrubbing is a term used to describe moving a finger back and forth over a letter to recognize it. This is done when the reader cannot automatically recognize the letter. Another technique is backtracking, which is when the reader will go back to the beginning of the word to remember the original letters. This is associated with inadequate integration of information (Steinman et al., 2006).

Stage three marks a shift in focus from learning how to read to gaining knowledge from reading. Texts in this stage are not complex, but express ideas simply through one point of view. There is some degree of overlap allowing knowledge gaps that are large to be filled with the child’s previous knowledge. The new information in this stage is also age-appropriate so that children can integrate it into their existing knowledge base. There is no reason to believe that blind and sighted children perform differently at this stage. A necessary prerequisite for both groups is sufficient life experiences and previous

[1] Contracted Braille is a shortened system of Braille that represents multiple letters by one Braille cell.

knowledge to interpret and create new knowledge. If these conditions are met then both groups will perform equally (Steinman et al., 2006).

Stage four involves more complex learning of new knowledge including abstract cognitive representations from multiple points of view. The only disadvantage that Braille readers might encounter in this stage is the ability to read at the same pace as their sighted counterparts. Finally, in stage five readers can now use analysis, judgment, and synthesis to determine what is important to read, integrate new knowledge, and create new abstract ideas. Readers in this stage can read selectively and determine where to spend their cognitive resources based on well-developed schemata (Steinman et al., 2006). Throughout these stages of development it appears that sighted people and blind people take a similar path Blind people are not inherently worse at reading because of their disability. The thing that holds them back is their inability to read as quickly as their sighted counterparts and the lack of Braille instruction.

Telegraphic Text

Telegraphic text is defined as the removal of words from a sentence. An important assumption in telegraphic text is that there are certain words in a sentence that are less important to the overall meaning of the sentence, and that they can be deleted without memory decrement.

Telegraphic text has been tested in a variety of populations. For the deaf, Ward, Wang, Paul and Loeterman (2007) studied telegraphic speech with television captioning using verbatim, near-verbatim, and edited captions. In this study participants watched a children's show while reading one of the three types of captioning. At the end participants took a memory test. Results indicated that there was no difference between the three different types of captioning. This suggests that words can be removed from sentences without affecting meaning. Interestingly, participants reported that they preferred the edited captioning since it was easier and more efficient to read. This is important because it shows that in certain circumstances creating telegraphic text does not have negative consequences on comprehension, and it may even be preferred by readers.

A similar study investigated different captioning rates, but also measured the reading skill level of the participant (Burnham et al., 2008). The researchers varied captioning speed by 130, 180, and 230 words per minute and varied text reduction at 100%, 92%, and 84%. They found that comprehension depended on reading skill level. Proficient readers were better at comprehending stories at different speeds, especially the two slowest, and less proficient readers were worse in all speeds. There was no significant difference between proficient and non-proficient readers using telegraphic text, however proficient readers were marginally better at larger reductions. It is possible that if the text reduction had been greater, a difference would have been seen between the two groups.

With regard to blind individuals, a study compared sighted and blind participants' ability to understand telegraphic text (Martin & Sheffield, 1976). In this study participants first ranked all the words of a passage by how important they felt the words were to the meaning of the passage. The experimenters then eliminated 10%, 30%, and 50% of these words. Participants read passages and were given a comprehension test for each passage. Both sighted and blind participants had no difficulty with 10% and 30% of words removed, but sighted participants had comprehension impairment at the 50% telegraphic level whereas blind participants did not. This study suggests that blind people are less affected by missing words than sighted people. It is possible that sighted readers rely on words to draw meaning since they can continually see and process these words as they read, but blind people focus on one word at a time to create connections between these content words (Martin and Sheffield, 1976). However, this study only explored comprehension. It is also important to look at reading speed and rate of telegraphic text.

Martin and Bassin, (1977) investigated two deletion schemes at two telegraphic levels to measure the effects on reading speed and comprehension. This study used two types of deletion: subjective and frequency. In the subjective method, participants ranked every word in each sentence from least important to most important. Each word was then systematically deleted until the desired telegraphic percentage was reached. The frequency method was done by computer and was based on the frequency of each word in the text. The words were listed from most frequent to least frequent and words were deleted from most to least until the desired telegraphic percentage was achieved.

Participants read stories in both types of deletion schemes at 20% and 40% telegraphic text (Martin and Bassin, 1977). There were no differences in comprehension at either level of deletion or by either deletion scheme. However, reading rates were significantly slower for the 40% telegraphic level. Martin and Bassin (1977) argued that unfamiliarity with reading telegraphic text likely caused the slower reading speeds. This study adds to Martin and Sheffield's (1976) findings in that both studies found that blind people can read telegraphic text at high rates without affecting comprehension, but this study shows that the 20% telegraphic level is ideal for maintaining comprehension as well as reading speed.

While both the frequency method and the subjective method are acceptable methods of creating telegraphic texts there are practical problems with both of them. First, the subjective method requires that researchers conduct a preliminary study to rank order all of the words of the sentences. This is time-consuming and not practical for real-world application. The frequency method is computer generated, which solves the time problem of the subjective method, but it does not solve the accuracy problem. Since this method uses frequency of word as a criterion for word deletion it is likely that many important content words could be deleted. Even though Martin and Bassin (1977) did not find difference in comprehension between the two methods, it is still important to maintain the integrity of text as best as possible, particularly if a universal method is to be adopted for all readers and literature.

The present study proposes a third method - providing a concrete list of word types that can be deleted while maintaining content words. This eliminates the efficiency problem of the subjective method and the content problem of the frequency method. Martin and Bassin (1977) reported that the most frequent words to be deleted from both methods were “the,” “a,” “and,” and “that.” This created a starting point - articles and conjunctions could be deleted without taking away from overall meaning. Additionally demonstrative adjectives, interjections, auxiliary verbs, possessives after a noun or pronoun, “to” in front of infinitives, and the universal you were candidates for elimination.

As previously mentioned, the refreshable Braille display only has a limited number of cells. In developing a method to present the text it was important to take this into consideration. Using telegraphic text with a refreshable Braille display would be consistent with the research of Knowlton and Wetzel (1996) who found that participants read fastest when scanning through the text for important information. Although it only takes a very small amount of time to read short and unimportant words, this time adds up. When people do not have to read these words it can free up more time to focus on the content words of the sentence.

Scaffolding

Scaffolding is a theoretical structure providing context around details within a passage of information. Scaffolding is meant to facilitate prior knowledge. The facilitation of prior knowledge makes anything relevant to the new information more readily available (Bransford, Brown, & Cocking, 2000). Once the scaffold is removed the person has a more "sophisticated cognitive system related to the field of learning," which can lead to overall higher comprehension (Raymond, 2000, p. 176).

There is no true guideline or definition for how scaffolding should be implemented. However, researchers have theorized ways of implementing scaffolding with successful outcomes. Hartman (2002) suggested that scaffolds can include models, cues, prompts, hints, partial solutions, think-aloud modeling and direct instruction. Since scaffolding lacks a unified method of implementation, this concept has been tested in many different ways. For example, Mautone and Mayer (2007) tested scaffolding with the comprehension of geographical maps by introducing a structural organizer to help students see relationships between objects. Kim and White (2008) also tested scaffolding by teaching parents to provide literacy guidance during summer reading. Both of these tests revealed superior effects of scaffolding.

Current Study

The current study combined telegraphic text and scaffolding as a method of increasing reading speed while maintaining memory accuracy for text details. With regard to telegraphic text, a specific list of words were removed, including articles, conjunctions, demonstrative adjectives, interjections, auxiliary verbs, possessives after a noun or pronoun is already introduced, to in front of infinitives, and the universal you.

There were three conditions for scaffolding. The first condition (Full Scaffolding) included a brief summary in the beginning followed by a set of reminders halfway through the story. The Full Scaffolding condition is consistent with the theory that it is important to present information in the beginning and eventually decrease the number of cues presented. The second scaffolding condition (Partial Scaffolding) included a summary only in the beginning. The third condition served as a control and included program-associated data (PAD) such as author and title as is the current practice of introducing a song or talk show in the radio industry. It was introduced to explore whether the current radio practice is acceptable, or if other scaffolding conditions would produce better memory and reading rate results for blind readers. Since past research does not indicate preferred scaffolding techniques, the current research explores two methods of scaffolding to determine how much information is optimal.

There are three hypotheses and two research questions for this thesis. The first is that telegraphic text will produce faster reading rates than non-telegraphic text. The second is that telegraphic text will not decrease memory accuracy. The third is that both scaffolding conditions will lead to better memory than the PAD control condition. Additionally, we were interested to determine the demographic characteristics of blind readers that correlated to reading rates. Finally, we wanted to determine which conditions participants would find more enjoyable and easy to read thereby discovering potential parallels between efficiency and preference.

3.

METHOD

Participants

Twenty-four blind adults and six deaf-blind adults participated in this study. Participants were recruited by using the Washington Ear radio reading service and by announcements circulated by the National Federation of the Blind (NFB). Participants completed the research at two conferences held by the NFB in Annapolis, MD and in Falls Church, VA, at National Public Radio (NPR) headquarters in Washington DC, at the Helen Keller National Center (HKNC) in Sands Point, NY, and at the NFB headquarters in Baltimore, MD. Participants were paid a $40 stipend for their participation.

The average age of participants was 47.03 and ranged from 13 to 78. There were 18 (60%) females and 12 (40%) males. Participants read at an average rate of 81.13 words per minute with a standard deviation of 37.81 and a range of 22.91 to 165.75. Half of participants learned Braille in public schools, 33.3% learned Braille in private schools, and 13.3% learned Braille from a private tutor. Most participants (73.3%) were completely blind, 13.3% were legally blind, and 10% were visually impaired[2]. For a full list of demographic information see Tables 1 and 2.

[2] Completely blind is defined as visual acuity less than 20/200, legally blind is defined as visual acuity less than 20/70, and visually impaired is defined as visual acuity less than 20/60.

Materials and Equipment

Participants read the stimuli using a BrailleConnect32 refreshable Braille display, which contains 32 Braille cells. Braille displays range from eight to 80 cells. Although an 80 cell Braille display is easier to read, a 32 cell Braille display provided for greater external validity because they are more affordable and more commonly used. A 32 cell display is also much more portable. Braille displays of eight and 16 cells are also very portable; however, the 32 cell display provides the best combination of portability and readability.

All text documents were converted into contracted grade two Braille. There were three sets of survey materials used in the experiment: (a) a Braille literacy questionnaire (See Appendix C), (b) an assessment of how much the participant enjoyed reading from the refreshable Braille display, and (c) a list of memory questions. All of these materials were presented orally and responses were recorded verbatim by the experimenter.

Stimuli

Stimuli were selected from National Public Radio's (NPR) transcription archives. Transcriptions from radio shows were selected to explore how telegraphic text and scaffolding would affect people's reading ability in the real-world context of reading news and current events. If results of this research showed that telegraphic text and scaffolding successfully increase reading speed while maintaining acuracy, the next step would be to design a new product, the Radio-Refreshable Braille Display, using these techniques. External validity would be higher since the research incorporated talk radio pieces. The specific content was taken from the Pinkwater Files, a radio show airing in the 1990's. The Pinkwater Files, a monologue by David Pinkwater, covered human interest stories and stories from his life. The content was neutral, important so that it would not affect recall or how much the participant enjoys reading the stories. Stories were similar in their appeal and complexity, which is also important to maintain consistency. See Appendix D for an example of a Pinkwater story.

Because it is important that each story presented to participants was equally memorable, a preliminary study was conducted with 30 stories to narrow the selection to six stories. In this study participants read ten randomly selected stories and were given a memory test after two groups of five stories. The memory tests included eight questions, four were about the details of the story and four were about the gist of the story. From each of those categories, two questions were multiple-choice and two were free recall. Six stories from the medium range of correct answers were selected, ranging from an average memory score of 5.33 to 5.86. See Table 3 for information regarding average score, words per story, reading time, and reading rate.

In order to create the telegraphic text conditions, each story was read over and each word from the unnecessary word categories was eliminated. An average of 20.43% of words were removed. See Table 4 for a summary of number of words removed and telegraphic text rate for each story.

There were three scaffolding conditions. The Full Scaffolding condition included a two-sentence summary. The first sentence contained the main points of the first half of the story and the second sentence contained the main points of the second half of the story. The reminder section consisted of three short phrases, which were the main points from the beginning, middle, and end of the story. The reminder section was placed roughly halfway through the story. The Partial Scaffolding condition was the same as Full Scaffolding, but it did not include the reminder section. The Program Associated Data (PAD) condition consisted of the title of the story, a fake author name, and NPR Radio. See Appendix E for examples of the three different scaffolding conditions. All stories were presented in counterbalanced order with every combination of scaffolding and telegraphic text presented to each participant.

Procedure

Participants began with a practice story if they were unfamiliar with reading on a refreshable Braille display. During the practice session participants read until they were comfortable reading from the display. After the practice session participants read six stories in random order. After each story participants answered several opinion questions about reading with the display. After reading all six stories participants completed Braille literacy questionnaire before answering the memory questions.

4.

RESULTS

Preliminary Analyses

MANOVAs revealed no significant differences for memory or reading rate for age (*F* (44, 6) = 2.48, *p* >.05), gender (*F* (2, 24) = .33, *p* > .05), education (*F* (6, 44) = 1.16, *p* > .05), income (*F* (4, 28) = .45, *p* > .05), type of blindness (*F* (4, 46) = .07, *p* > .05), type of education (*F* (4, 46) = 1, *p* > .05), or employment status (*F* (8, 42) = 1. 27, *p* > .05) and therefore these variables were collapsed during analysis. There were no significant differences for reading rate or memory between all six stories (F (8, 44) = 2.49, p > .05) or any counterbalanced presentation order (F (8, 44) = .93, p > .05), suggesting that individual story content and story order had no effect on main results.

Reading Speed

A 3 (Scaffolding) X 2 (Telegraphic) repeated measures ANOVA was conducted to investigate if scaffolding and telegraphic text increased reading rate. The test revealed a significant main effect of telegraphic text, Wilks' Lambda = .516, *F* (1, 29) = 27.23, *p* < .05, η^2 = .48, Power = 1. Participants' reading rates were significantly faster in the telegraphic condition (*M* = 87.04, *SD* = 41.12) than the non-telegraphic condition (*M* = 75.22, *SD* = 37.43)(See Figure 1). This indicates that the telegraphic text condition successfully increased reading rate. There was no main effect of scaffolding and no interaction, which indicates that scaffolding did not affect reading rate.

Memory

A 3 (Scaffolding) X 2 (Telegraphic) repeated measures ANOVA was conducted to investigate if scaffolding and telegraphic text affected memory. The test revealed a significant main effect of scaffolding, Wilks' Lambda = .38, $F = (2, 26) = 20.90$, $p < .05$, $\eta^2 = .62$, Power = 1. Confidence intervals revealed that participants answered significantly more questions correctly in Full Scaffolding ($M = 6.56$, $SD = 1.25$) and Partial Scaffolding ($M = 6$, $SD = 1.57$) than PAD ($M = 4.86$, $SD = 1.775$) (See Figure 2). This indicates that scaffolding successfully increased memory accuracy compared to the control PAD condition. There was no main effect of telegraphic text and no interaction, which indicates that telegraphic text did not affect memory.

Reading Speed Predictors

The next analyses were conducted to investigate which demographic characteristics predict reading rate. A factor analysis was conducted with the variables of current age, age that the participants became blind, age that the participants began to learn Braille, how many hours a week the participants use Braille, what percentage of reading is done by Braille, and the participants' self assessment of reading proficiency. A factor analysis was used because these variables were highly correlated. The factor analysis was conducted using varimax rotation to extract three factors and accounted for 86.56% of the variance. The three factors that emerged were "age" (i.e., current age, age that the participant became blind, and age that the participant began to learn Braille), time spent reading Braille (i.e., how many hours a week the participants use Braille and what percentage of reading is done by Braille) and proficiency (i.e., participants' self-assessment of reading proficiency). (See Table 4 for correlation values for each group).

These three factors were used as predictor variables in a multiple regression to predict average reading rate. The multiple regression was significant, F (3, 29) = 13.27, $p < .05$, $R^2 = .61$. There were two significant predictors (See Table 5): time spent reading Braille, $t = 5.65$, $p < .05$, and age, $t = -2.24$, $p < .05$. The proficiency factor was not significant. The time spent reading Braille factor was the best predictor ($\beta = .70$) and age was the second best predictor ($\beta = -.29$). This indicates that as participants spend more hours a week reading Braille and a higher percentage of their reading is done with Braille their reading rate increase (See Figure 3). It also indicates that as their current age, age that they become blind, and age that they begin to learn Braille decreases their reading rate increases (See Figure 4).

A series of one way ANOVAs were conducted to determine if participants had different reading speeds for any of the coded variables. These tests revealed no differences for the following variables: gender, education, income, type of blindness, technology use, employment status, frequency of use of a refreshable Braille display, frequency of use of an accessible Braille PDA, and whether or not the participant was blind or deaf-blind.

User Preference

Finally, a series of 3 (scaffolding) X 2 (telegraphic) repeated measures ANOVAs were conducted to measure variables of user preference. There were no significant differences for how easy it was to read the stories, how much participants enjoyed reading the stories, or finger fatigue. However, there was a significant main effect of scaffolding for the number of times participants had to go back to reread words, F (1.58, 42.55) = 3.55, $p < .05$, $\eta^2 = .12$, power = .56. On a scale of 1 (never re-read words) to 7 (frequently re-read words) participants re-reads words most on the control condition (M = 2.25, SD = 1.13), second most in the Full Scaffolding condition (M = 2.02, SD = 1.13), and least in the Partial Scaffolding condition (M = 1.89, SD = .90) (See Figure 5).

Participants were asked how easy it was to read telegraphic and non-telegraphic stories on a one to seven scale. A one way repeated measures ANOVA revealed a significant difference, Wilks' Lambda = .522, F (1, 29) = 26.53, $p < .05$, $\eta^2 = .48$, power = 1. Participants reported that non-telegraphic stories were easier to read (M = 1.37, SD = .72) than telegraphic stories (M = 2.80, SD = 1.58) (See Figure 6).

Participants were also asked how enjoyable it was to read telegraphic and non-telegraphic stories on a one to seven scale. A One Way Repeated Measures ANOVA revealed a significant difference, Wilks' Lambda = .65, F (1, 29) = 15.60, $p < .05$, η^2 = .35, power = 1. Participants reported that non-telegraphic stories were significantly more enjoyable (M = 1.63, SD = 1.45) than telegraphic stories (M = 3.13, SD = 2.24) (See Figure 7).

5.

DISCUSSION

There were two main goals of this research: (a) to examine whether reading rate would be accelerated when Braille readers were presented with telegraphic text, and (b) to explore whether recall would be better if readers were supported with scaffolding. For this study, it was essential to develop a list of words that could be eliminated to test readers. However, the end-goal was much larger – we were interested in designing a standard elimination methodology that the radio industry could use on an everyday basis for all radio content. In addition, we were interested in the demographic characteristics that contributed to faster reading speeds, and user preferences for Braille reading.

With regard to accelerated reading, the elimination of text that we chose significantly increased reading speed. This result is consistent with Martin and Bassin's (1977) finding that Braille readers were positively affected by telegraphic text and that 20% decrement is the ideal level. In the present study participants read at an average of 11.82 words per minute faster in the telegraphic condition than in the non-telegraphic condition.

Rather than measuring overall reading time of stories, this study measured participants' reading rates in words per minute. If we simply measured overall reading time after removing 20% of the words from a story we assume we would see a decrease. Instead, this study measured how fast participants read words per minute, which created a more accurate and fine-grained measure. Even though it might take a participant less time to read a story with 20% of the words removed, it is a more convincing statement to say that they also read more words each minute. For example, if a story contained 500 words and it took a participating five minutes to read a non-telegraphic story the reading rate would be 100 words per minute. The telegraphic story in this case would contain 400 words, and even if it took the participant 4 minutes to read the story, the reading rate would still be 100 words per minute. Therefore, in this case even though it takes less time to read a telegraphic story, the participant still reads both stories at the same rate.

How does the removal of words allow Braille readers to read faster? Martin and Sheffield (1976) discuss the differences between sighted reading and Braille reading. They suggest that sighted reading may rely more on function words to draw meaning between content words. However, since blind readers read one word at a time they focus more heavily on the content words. Thus, they are not as troubled as sighted readers by the elimination of small words.

Alternatively, Braille readers may already be processing words in an abbreviated way, and be more comfortable with telegraphing as a technique. As previously mentioned, contracted Braille represents multiple Braille cells in a single Braille cell. For example, the common combination of letters "-tion" is represented by one Braille cell in contracted Braille. Contracted Braille itself may be a type of telegraphic text at the letter level. To date, no research has been conducted on the process by which Braille readers read individual letters. It is not known whether blind people process contracted Braille cells as separate letters or as representations of the multiple letters that they represent. If the latter is the case, it can be said that blind readers are even practicing telegraphic text at the letter level. Further research must be conducted before drawing a conclusion about this hypothesis. However, if this is true it could explain why blind people are so good with telegraphic text, particularly at very high levels when sighted readers are failing miserably.

Martin and Bassin (1977) found that blind people read more slowly at 40% telegraphic text than 20% telegraphic text. They suggested that this effect was caused by unfamiliarity with reading telegraphic text. For the current study, this raises a question: Can participants read even faster as they become more familiar with telegraphic text? The answer is yes. We conducted an exploratory study in which 55 college students read the same six stories from this study in telegraphic text. We measured their reading rates over the six stories and found a significant positive linear tread. Participants read significantly faster from story one to story six, with the increase occurring between story three and story four (See Figure 8).

This result suggests that it may take multiple exposures to telegraphic text to become familiar and comfortable with using it for day-to-day reading. This result also strengthens the current study's findings about the immediate benefits of telegraphic text. Participants only read three telegraphic stories, and did not have enough exposure to become "easy readers" with abbreviated text. Had they had even more of a chance, we assume the benefits would have been even greater.

Even thought participants can read faster with telegraphic text it is also important to note that it does not affect their memory for story details. Results from this study indicate that there was no difference in recall between telegraphic text and non-telegraphic text. However, interestingly, both scaffolding conditions did increase recall compared to the non-scaffolding conditions. Thus, this study demonstrated that providing a framework of information consistent with scaffolding theories increased readers' memory. There was no difference between the two types of scaffolding, suggesting that providing a two-sentence summary in the beginning of a story works just as well as providing it and a three-phrase reminder in the middle of the story. It is important to note that the stories that participants read were fewer than 1,000 words. When dealing with longer and more complex stories, readers may need scaffolding presented more often, particularly as the subject slightly shifts or the prose gets more complicated.

Participants were also asked how often they had to reread parts of the story during each scaffolding condition. Participants reported rereading significantly more frequently in the non-scaffold condition, less frequently in the full scaffolding condition, and the least in the partial scaffolding condition. Rereading would indicate that the reader might have been confused or unclear about something that they read and that rereading would serve to clarify this confusion. The fact that participants reread most frequently in the non-scaffold condition indicates that they may have lacked contextual information to understand everything during the first read. This also indicates that our scaffolding provided enough information for participants to read through the whole story without interruption or confusion. This satisfied the goals of scaffolding and further demonstrates its effectiveness.

Demonstrating that telegraphic text works to increase reading speed, while theoretically interesting, does not provide sufficient guidance to industries that may need to eliminate words effectively and efficiently in order to provide this service. As previously mentioned, there are flaws with established forms of telegraphic deletion. The subjective method, which uses a rank-order deletion system, is inefficient and labor-intensive, and the frequency method, which uses an automated computer deletion system, runs the risk of deleting too many content words. However, this new system, which uses a finite list of words, is efficient and does not remove content words. It effectively increased reading rate while not affecting recall, allowing Braille readers to most efficiently process text. Thus, this deletion scheme addresses the shortcomings of other methods and can be used easily in the telecommunications industry.

With regard to determining which characteristics contribute to reading speed, results from this study showed that age (i.e., current age, age of blindness, age participant began to read Braille), and time spent reading Braille were important. Age significantly predicted reading speed, with reading speed increasing for participants who became blind earlier and learned Braille earlier. This result should be encouraging to advocates of teaching Braille to very young children. It argues for more Braille instruction at an earlier age, and more increased opportunity to use Braille during the formative school years. The second significant factor was time spent reading Braille, including the number of hours a week that the participant reads Braille and percentage of reading that is done by Braille. This result indicates that reading speed increases as the participant reads more hours a week and a higher percentage of that reading is done by Braille. This result is also encouraging for advocates of Braille reading as it shows that the more people read Braille, the faster they become. It suggests that using adaptive technologies such as talking books or text-to-speech devices to gather information, while extremely useful in today's world, may be in fact detrimental to becoming proficient at reading Braille.

Results suggest that if blind people wish to increase their reading speed they simply need to read more hours each week and use Braille as their main source of input.

With regard to user preference for the telegraphic stories, participants were asked how easy it was to read the telegraphic and non-telegraphic stories and they reported that the telegraphic stories were more difficult to read. This argues against the use of telegraphic stories as a common practice. However, it is important to look at the reported scores of participants before abandoning the idea. Although participants reported that the telegraphic stories were more difficult, the scores indicate that participants did not find them difficult either. On a scale of 1 (*very easy*) to 7 (*very difficult*) participants rated the non-telegraphic stories as 1.37 and the telegraphic stories as 2.80. Even though the telegraphic stories were rated less easy they fell well below the halfway rating of 3.50, indicating that they were still on the "easy" side of the scale.

The same finding occurred when participants were asked how enjoyable the telegraphic and non-telegraphic stories were. Participants rated the non-telegraphic stories as more enjoyable, but by a similar margin. On a 1 (*enjoyable*) to 7 (*not enjoyable*) scale participants rated the non-telegraphic stories as a 1.63 and the telegraphic stories as a 3.13. Again, the telegraphic story was still on the "enjoyable" side of the scale.

Nonetheless, the telegraphic stories are still rated to be less easy and less enjoyable than the non-telegraphic stories, even though the telegraphic stories produce better reading rates. This disconnect between efficiency and user preference has been shown many times in research. Sheffield, Starling, and Schwab (2011) tested deaf and hard-of-hearing people for their recall of details from stories and their preference of different types of captioning. They found that although participants claimed yellow text on a black background was more interesting and enjoyable, they had worse memory for story details in this condition. The researchers recommended efficiency over preference in situations such as emergency alerting, but preference over efficiency during leisure reading. Thus, we believe readers might prefer a more flexible product design in which they can choose to turn on or off the type of scaffolding summary and telegraphic text as the situation dictates.

There are several limitations to this study. First, although using a refreshable Braille display lead to greater external validity and this is the first known study to use this device while testing Braille, it did create some problems. Some participants reported being unfamiliar with some configurations of Braille that this device displayed, and the display sometimes took extra time to load the next line of text. Both of these issues lead to overall slower reading speeds. Therefore our reading speeds may not be taken literally. Secondly, we might not have found the optimal telegraphic deletion scenario, as it is possible other types words could be removed to create better effects. A final study limitation is the small sample size of the deaf-blind population. Although no differences were found between the blind and deaf-blind groups, it is possible that some might appear with a larger sample size.

There are many applications for this research. One of the applications could be for the radio and telecommunications industry. This study indicated that blind and deaf-blind people do not perform differently with regard to scaffolding or telegraphic text and thus the conclusions from this study may be applicable to the deaf-blind population.

Currently, the deaf-blind have no access to radio. This can create a serious problem for emergency alerting access. When radio is broadcast with captions, the deaf-blind will be able to access many radio programs and emergency alerts through a Braille radio. This technology, currently being developed at the International Center for Accessible Radio Technology, allows the captioned radio to "speak" to a refreshable Braille display, allowing a deaf-blind individual to access anything that is being transmitted on radio. We recommend that Braille radios should incorporate telegraphic text and scaffolding to enhance reading speeds of the deaf-blind. However, it should still be noted that participants enjoyed telegraphic stories less and found them less easy to read than non-telegraphic stories (although their preference did not match their true level of efficiency). We suggest that Braille radio should allow the user to turn telegraphic and scaffolding on or off, but should also inform users of their benefits and encourage them to practice using both while listening to the radio.

There are many directions for future research emanating from the findings of this study. This study identified five predictors of proficient and fast Braille readers, but it is likely that there are still more predictors. Future research should investigate other factors that might contribute to Braille reading proficiency, such as overall literacy or a more fine-grained examination of methods of learning Braille. Further investigations should also test the limits of telegraphic text. The exploratory project we conducted demonstrated that telegraphic text reading rate can be increased after reading only four stories, but how far can this increase go? Researchers should determine its maximum efficiency and functionality in different genres. Finally, further investigations need to be conducted with scaffolding to determine how this technique might function for stories that are over 1,000 words.

In conclusion, this study has clearly demonstrated the malleability of Braille reading. This is a process that can be enhanced and improved by simple additions or deletions. Using Chall's (1983) reading model, Steinman et al. (2006) concluded that blind and sighted children go through essentially the same process of becoming literate. Therefore, educators should not be intimidated by Braille instruction, but rather should integrate innovating methods of instruction to promote literacy. There are clear cognitive, social, and emotional benefits of being literate in Braille for both children and adults (Ryles 1996; Ryles, 1999; Schroeder 1996). This area of research is ripe for theoretical as well as applied advances. Researchers should continue to investigate methods of increasing the effectiveness and efficiency of Braille, which can promote Braille literacy for children and contribute to adaptive technological advancements, which can assist the blind and deaf-blind communities.

APPENDICES

APPENDIX A: LIST OF TABLES

Table 1

Descriptive Statistics

Variable	Minimum	Maximum	Mean	Standard Deviation
Current Age	13	78	47.03	17.46
Age of Blindness	0	18	3.58	6.02
Age that you began to learn Braille	3	23	8.83	6.37
Percent of reading done by Braille	10	100	54.31	31.59
Hours spent reading Braille	2	70	36.28	22.64
Braille Proficiency	5	10	9	1.67
Reading Rate	22.91	165.75	81.13	37.81

Table 2

Frequency Descriptive Statistics

Variable	Levels	N	Percent
Other Impairment	None	6	20%
	Deaf	24	80%
Employment	Full Time	20	69%
	Part Time	1	3.4%
	At Home	1	3.4%
	Retired	3	10.3%
	Student	4	13.8%
How did you learn Braille?	Public School	15	50%
	Private School	10	33.3%
	Private Tutor	5	13.7%
Type of Blindness	Completely Blind	22	73.3%
	Legally Blind	4	13.3%
	Visually Impaired	3	10%
Education	Less than High School	1	3.4%
	High School	3	10.3%
	College	13	44.8%
	Graduate School	12	41.4%
Gender	Male	12	60%
	Female	18	40%

Table 3

Descriptive Statistics of Stimuli

Story #	Average Score	Words	Words Removed	Telegraphic Percent	Reading Time (sec)	Words/Minute
Story 1	5.64	492	100	20.3	153.3	192.34
Story 2	5.36	593	139	23.4	223.8	158.98
Story 3	5.86	294	54	18.4	124.62	141.55
Story 4	5.62	292	64	21.9	117.07	149.66
Story 5	5.69	673	122	18.2	261.22	154.71
Story 6	5.33	486	99	20.4	227.83	128.23
Average	5.58	471.67	96.33	20.43	184.64	154.25

Table 4

Rotated Component Matrix

Variable	Component 1	Component 2	Component 3
Proficiency			.979
Age Blind	.820		
Age of Braille	.873		
Current Age	-.787		
Hours Reading Braille		.914	
Percent of Reading by Braille		.906	

Table 5

Significant Beta Weights of Linear Regression

Variable	Beta Weight
Age Factors	-.287
Time with Braille Factors	.696

APPENDIX B: LIST OF FIGURES

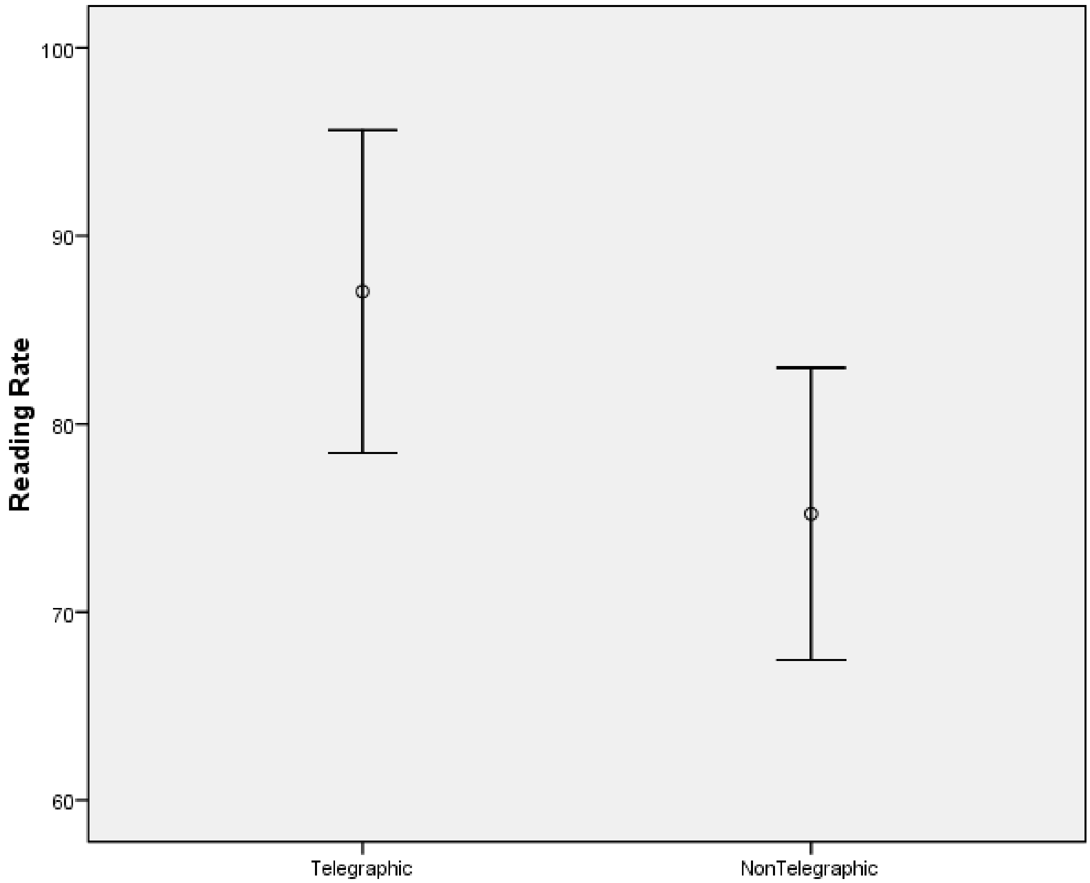

Figure 1. Telegraphic v NonTelegraphic Reading Rate

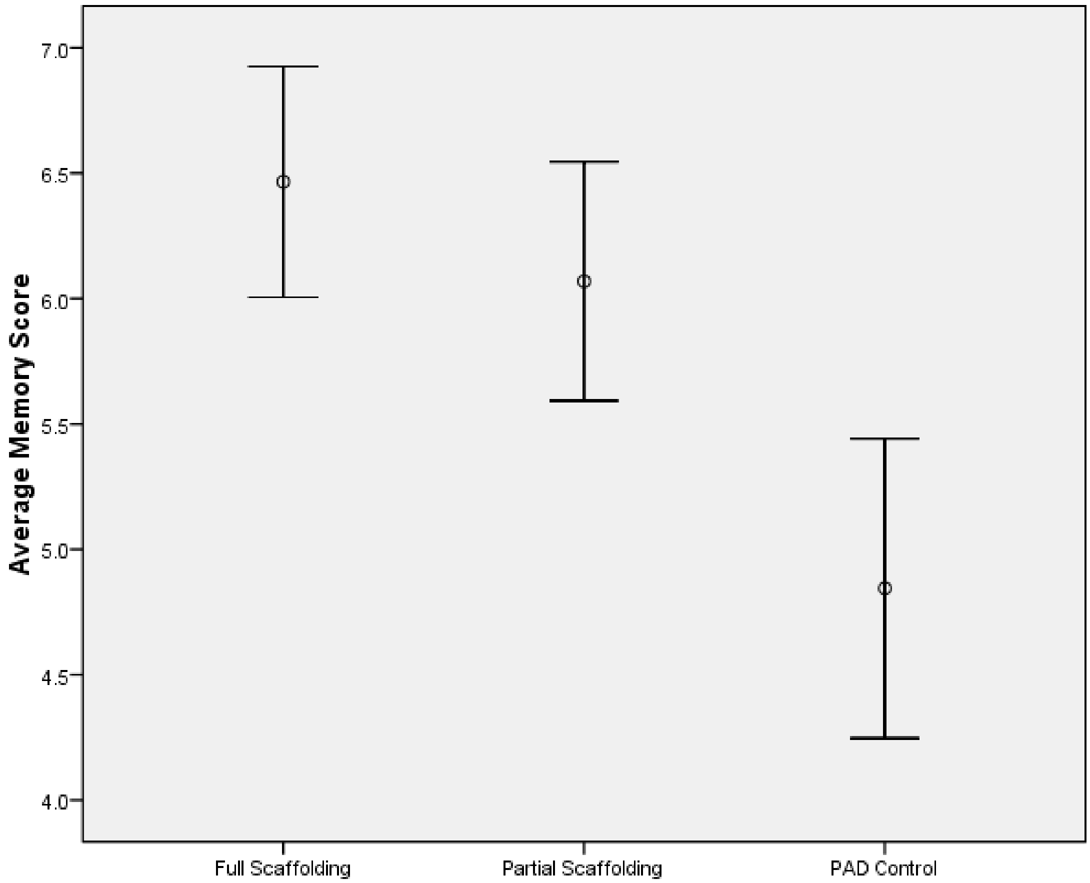

Figure 2. Scaffolding and Average Memory Score

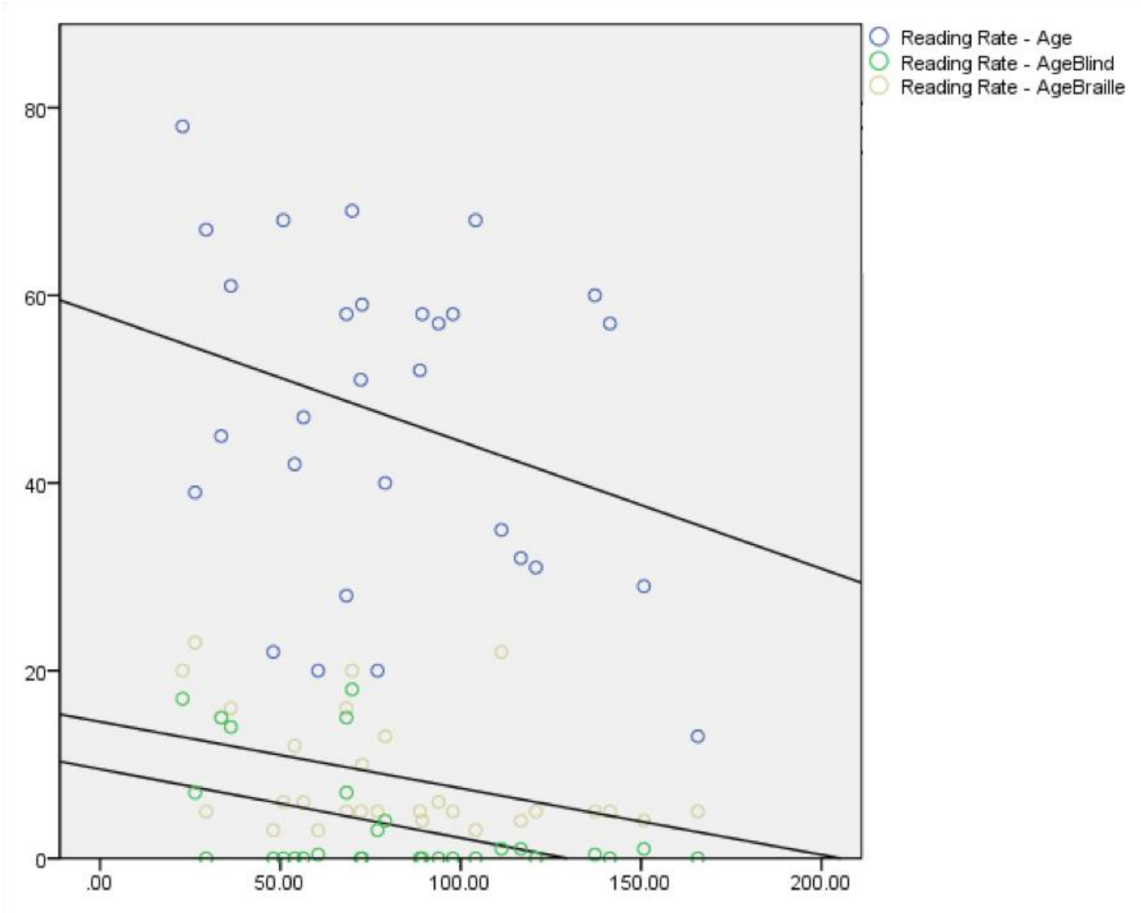

Figure 3. Scatter Plot of Age Variables and Reading Rate

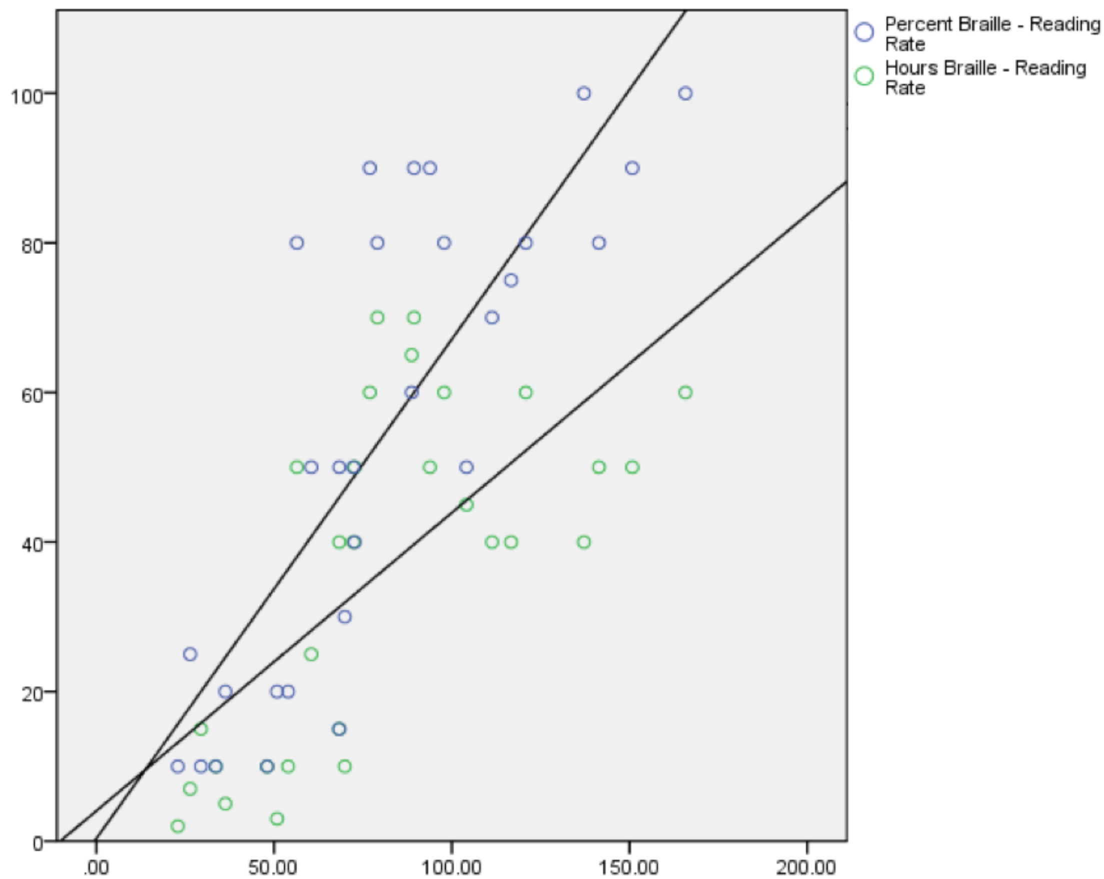

Figure 4. Scatter Plot of Time Variables and Reading Rate

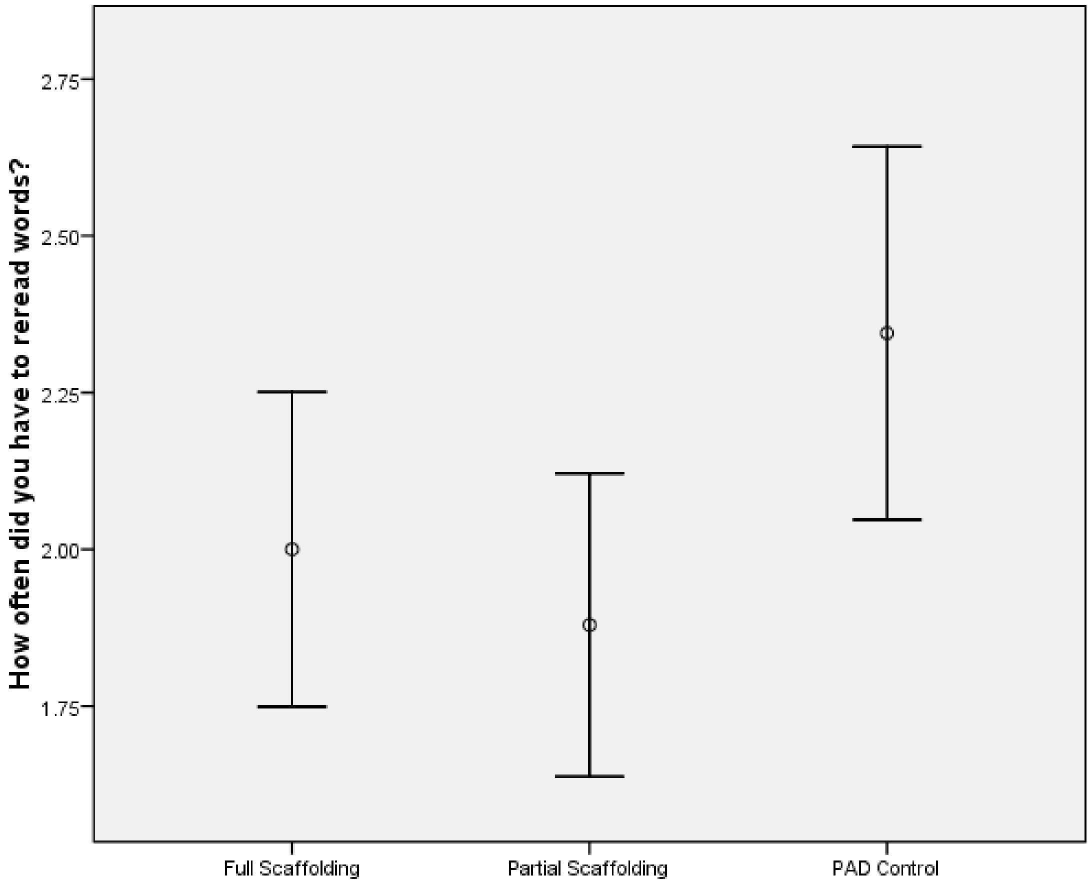

Figure 5. Re-reading for Each Scaffolding Condition

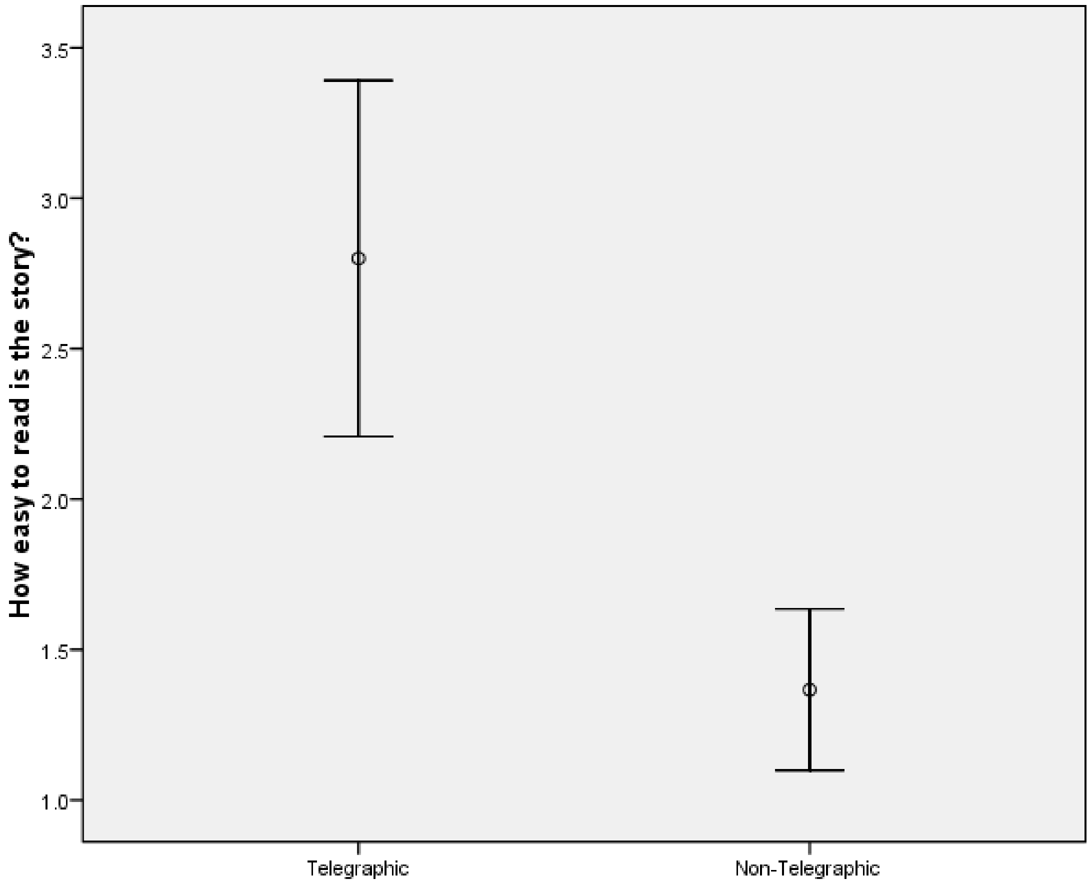

Figure 6. Easiness Rating for Telegraphic and Non-Telegraphic Stories

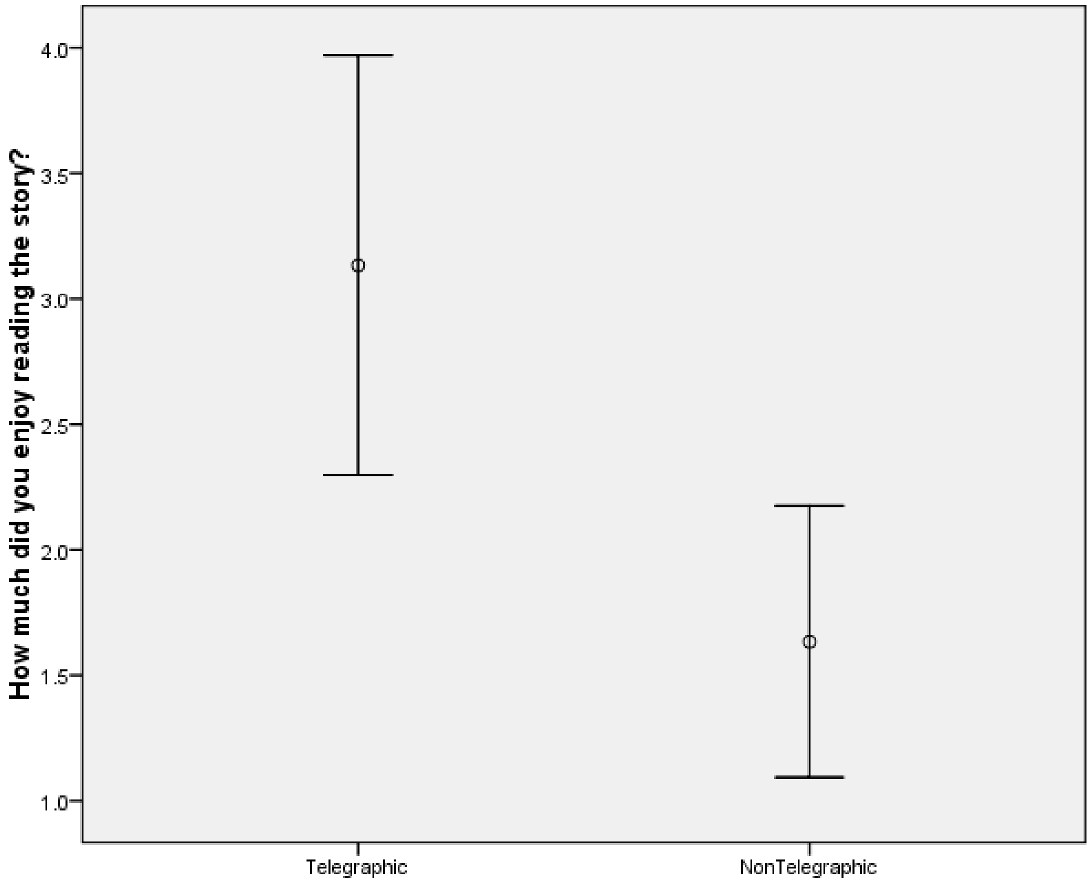

Figure 7. Enjoyable rating for Telegraphic and Non-Telegraphic Stories

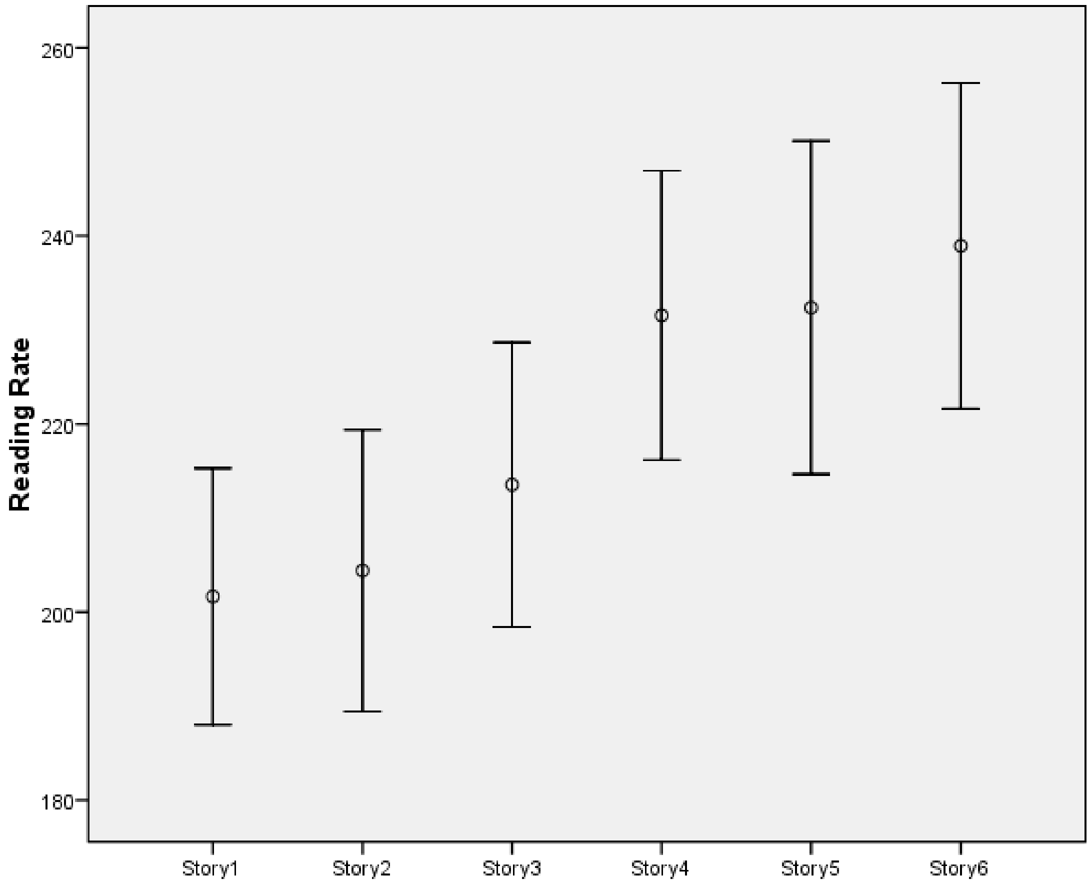

Figure 8. Reading Speeds for Exploratory Study

APPENDIX C: Braille Questionnaire

Demographic Information

Age_________

Gender______

Highest Level of Education

Less than high school

High school

College

Graduate School

Household Income OPTIONAL

Under 20k

20k – 40k

40k – 75k

Over 75k

Braille Literacy Questions

Type of visual impairment

Completely blind

Legally blind

Visually impaired

Other____

What age did you become impaired?________________

What age did you begin to learn Braille?___________

How did you learn Braille?

____

____

On a scale of 1 to 10 how proficient do you feel you are with Braille?_________________

How many hours a week do you use Braille?_____________

Do you use Braille in your profession?____________________

Do you use contracted Braille?____________

Employment

Full time

Part time

Work in home

Unemployed

Retired

Student

Technology use

Technology enthusiast/early adapter

Frequent technology user

Infrequent technology user

Never use technology

Screen Reader (JAWS, WindowsEyes, etc)

Daily

Weekly

Monthly

Never

Screen Magnifier (ZoomeText, MAGic, etc)

Daily

Weekly

Monthly

Never

Accessible PDA (Braille Note, Pac Mate, Icon, Braille Plus, etc)

Daily

Weekly

Monthly

Never

Refreshable Braille Display for a computer

Daily

Weekly

Monthly

Never

What percentage of your reading is done by Braille?_______

What other methods of reading do you use?_______________________________________

Is English your first language?_______

What other languages do you speak?____

What other sensory impairments do you have?

APPENDIX D: Pinkwater File Sample Story

My Experience in the Serengeti

Alex Chong, NPR Radio

I am in a tent at a camp on the Serengeti Plain. This was a place where smart tourists rinsed with ginger ale after brushing their teeth. In those days, meat was delivered uncovered in open trucks, flies buzzing around. So what do I do, old Africa hand that I am? I eat the stew, I laugh at the delicate tenderfoots who munch on crackers and cheese and drink bottled water. Naturally, I am as sick as can be: cramps, sweating, many trips to the smallest tent. While I lie on my cot, these Red and blue lizards visit me. They are bright red from their noses to where they would wear their belts, if lizards wore belts; bright blue from midsection to tip of tail; and about the size of a hero sandwich. They come and go freely under the sod cloth of my tent, which is plainly labeled snake proof, apparently not lizard proof. They look at me, I look at them, they scamper out, they scamper back in. Animals known as hyraxes are using the roof of my tent as a slide. The hyrax equivalent of saying whee is a blood-curdling scream. On my third trip to the out tent, I notice I am sharing it with a reptile. Just that day, I had been looking at a poster showing what snakes in the Serengeti can kill you. Short answer: all of them. Under the circumstances, I decided we can coexist. What choice do I have? And on my many hurried walks back and forth with my kerosene lantern, I hear a lion coughing. He sounds close. And yet, even while all this was happening, I sort of knew that looking back on it, I was going to remember this as my best night in Africa.

APPENDIX E: Examples of Scaffolding

Full Scaffolding:

Summary: A man goes on a trip in the Serengeti. He eats some bad meat, which causes him to get sick, and has experiences with many different exotic animals.

Reminder: Trip to Serengeti, gets sick, sees exotic animals

Partial Scaffolding:

Summary: A man goes on a trip in the Serengeti. He eats some bad meat, which causes him to get sick, and has experiences with many different exotic animals.

No Reminder

PAD (Control):

Title: My Experience in the Serengeti

Author: Alex Chong, NPR Radio

APPENDIX F: INSITUTIONAL REVIEW BOARD APPROVAL

TOWSON UNIVERSITY

Date: Wednesday, September 29, 2010

NOTICE OF APPROVAL

TO: Mike Eskenazi **DEPT:** PSYC

PROJECT TITLE: *Increasing Braille reading speed through scaffolding and telegraphic text*

SPONSORING AGENCY: NIDRR

APPROVAL NUMBER: 11-A025

The Institutional Review Board for the Protection of Human Participants has approved the project described above. Approval was based on the descriptive material and procedures you submitted for review. Should any changes be made in your procedures, or if you should encounter any new risks, reactions, injuries, or deaths of persons as participants, you must notify the Board.

A consent form: [✓] is [ ] is not required of each participant

Assent: [ ] is [ ] is not required of each participant

This protocol was first approved on: 29-Sep-2010

This research will be reviewed every year from the date of first approval.

Steven Mogge, Member

Towson University Institutional Review Board

APPENDIX G: CONSENT FORM

Principal Investigator: Michael Eskenazi, Department of Psychology, Towson University

I am a graduate student conducting this research as a Master's Thesis. This is a study in which we are measuring your reading speed and comprehension for six different stories. You will read these stories on a refreshable Braille display and be given a comprehension test after reading all six stories.

There are no known risks associated with participating in this study. Should you become distressed or uncomfortable, we will terminate the session immediately. The results of this study will be used to design a refreshable Braille display that will be used for radio. This device will directly benefit the blind and blind-deaf community.

Participants must be 18 years of age, be blind, and be able to read Braille.

Your participation in this study is entirely voluntary. You do not have to participate in this study. If you choose to participate, you may discontinue your participation at any time.

All information about your responses will remain confidential. We will not show your information to anyone outside of our research team unless you give us written permission. Your responses will never be linked to your name. If you have any questions, you may ask them now or at any time during the study. If you should have questions after today, you can call 978-979-1479, and ask for Mike Eskenazi, the faculty sponsor Dr. Sheffield at 410-704-3068, or call 410-704-2236 and ask for Dr. Debi Gartland, Chairperson of the Institutional Review Board for the Protection of Human Participation at Towson University.

I, ____________________________________ affirm that I have read and understand the above statements and have had all of my questions answered.

Date:_____________________________

Signature:____

THIS PROJECT HAS BEEN REVIEWED BY THE INSTITUTIONAL REVIEW BOARD FOR THE PROTECTION OF HUMAN PARTICIPATION AT TOWSON UNIVERSITY

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Thesis: Increasing the reading speed of Braille through telegraphic text and scaffolding, under the direction of Dr. Ellyn Sheffield

Quinnipiac University - Hamden, CT — Graduated 2009
Bachelor of Arts Degree, Magna Cum Laude — GPA: 3.71
Double Major in Psychology and Spanish — GRE: 1260, Writing: 5

La Universidad de Granada - Granada, España — Summer 2008

Peabody Veterans Memorial High School - Peabody, MA — Graduated 2005
High School Diploma

RESEARCH EXPERIENCE:

June 2010 – Present — National Public Radio Labs — Washington DC
Technical Research Assistant
- Assist with and design research projects
- Continuation of projects listed below
- Recruit participants and conduct experiments
- Write final manuscripts/ attend conferences

August 2009 – May 2010 — Towson University — Towson, MD
Graduate Assistant
- Assist with current research projects
  - Emoticons for deaf captioning
  - Fatigue of ratings and memory over time
- Design research projects and assist in writing grant applications
- Run participants through experiments
- Analyze data and write up results for publication

Fall 2006 – May 2009 — Speech and Language Perception Lab — Hamden, CT
Research Assistant
- Cross-modal priming research on phoneme perception
- Guide participants through experimental apparatus
- Assist in writing the final manuscript/attend conferences

Teaching Experience

August 2009 – Present Towson University Towson, MD

Teaching Assistant – Behavioral Statistics

Teach classes throughout the semester
Confidence intervals, ANOVAs, regressions
Tutor students individually
Create tests and assignments

Guest Lecturer – Psychology of Language

Lecture on Language Perception

Achievements / Recognition:

2011	Experimental Psychology Department Outstanding Graduate Student
2011	Psychology Department Outstanding Graduate Student
2010-2011	Campus Representative for APA of Graduate Students
2009	Aurea C. Schoonmaker Spanish Award for Highest GPA
2009	Modern Language Department Essay Contest Winner, 1st Place
2008	Sigma Delta Pi – National Spanish Honor Society, Inducted April 2008
2007	Psi Chi – National Honor Society of Psychology, Inducted April 2007
	Treasurer 2007-2008
	President 2008-2009
2005-2009	Dean's List

Skills:

Proficient in MS Word, Excel, SPSS, and E-Prime
Advanced Statistics: Logistic Regression, Discriminant Analysis, Canonical Correlation, Factor Analysis, Time Series Analysis, Multidimensional Scaling, Cluster Analysis
Fluent in Spanish

Confernce Presentations:

Eskenazi, M. (March, 2011). Oral superiority in the key-word method for learning vocabulary of a second language. Poster to be presented at the 2011 Annual Meeting of the Eastern Psychological Association, Cambridge, MA.

Eskenazi, M., Starling, M., Sheffield E. G. (November, 2010). Using telegraphic text and scaffolding to increase Braille reading speeds. Discussion held at the Helen Keller National Center for Deaf-Blind Youths and Adults, Sands Point, NY.

Starling, M., Sheffield E. G., **Eskenazi, M.** (June, 2010). Towards a Braille Radio Service. Paper presented at Research in the Rockies: Braille Research Summit, Denver, CO.

LoCasto, P., **Eskenazi, M**., Ferra, M. A. (March, 2009). Processing time effects on phonological variant processing. Poster presented at the 2009 Annual Meeting of the Eastern Psychological Association, Pittsburgh, PA.

LoCasto, P., Ferra, M. A., **Eskenazi, M**. (March, 2008). Probability of occurrence and no-release variant processing. Poster presented at the 2008 Annual Meeting of the Eastern Psychological Association, Boston, MA.

Manuscripts in Progress:

Eskenazi, M., and Sheffield, E. G. (in preparation). Increasing reading rate of Braille through telegraphic text and scaffolding.

Sheffield, E. G., **Eskenazi, M.,** and Louie, B. (in prepation). Portraying emotion through colored emoticons in captioned radio to the deaf and hard-of-hearing.

Eskenazi, M. (in preparation). Oral superiority in the key-word method for learning vocabulary of a second language.

Sheffield, E. G., and **Eskenazi, M.** (in preparation). The effects of poor audio quality on listener's memory and quality rating of speech and music over time.

Ferrara T., **Eskenazi, M.,** Chong, A., Zirpoli, J. (in preparation). Increasing spatial ability with D-Serine in rats through the Morris water maze.

Grants:

National Institute on Disability and Rehabilition Research ($600,000), Role: Cognitive Psychology Researcher.