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Storytelling Study

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STORYTELLING STUDY

A Look at the Impact of Prosody on Visual Attention and Comprehension Levels for Preschoolers During a Read-Aloud Story

BY

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Abstract

Expressive prosody (i.e., a manner of communication that is characterized by lively rhythm and tempo) and inexpressive prosody (i.e., monotone speech) present different environments for listening to a story during a read-aloud session. This study aims to assess whether there are visual attention differences for preschoolers in these varied prosodic environments and how this affects comprehension.

1. Introduction

Story-time is a concept that has been incorporated into the routines of preschool aged children for decades. Researchers and educators alike have seen the educational benefit of children being exposed to narratives at a young age; it has been found to increase the child's interest in reading and overall increase the literary success of the child. Children who have had more exposure to read-aloud story-times have generally scored higher on reading comprehension tasks and rate their enjoyment of reading higher than children who have had limited exposure to stories. Therefore, it is a commonly accepted fact that there is immense value in read-alouds for younger children; what researchers evaluate *now* is how to maximize that value for the children who encounter story-time in the classroom and at home—whether that is the manner in which the language is presented, the amount the language is presented, or another linguistic element that will impact language learning.

Language can be broken down into two components—segmental and suprasegmental. Segmental components of language pertain to events that occur on the phonemic level (Veenendaal, 2014), which consist of the sounds that create meaningful contrasts. On the other hand, suprasegmental components of language are from a broader perspective than segmental components. Suprasegmental elements are viewed in terms of not *what* is said, but *how* it is said. These elements provide information about the emotional intent of language, boundaries that indicate grammatical or structural intentions (syntax), variations in vocabulary based on stress patterns, a hierarchy of information within an utterance, social intent, as well as other higher level qualities of language. An umbrella term for variations in language in regards to the aforementioned components is prosody of speech (Veendendaal, 2014; Cutler & Swinney, 1987; Hirschberg, 1999; Ladd, 1996).

Prosody of speech can be described as the "tune" and "rhythm" of speech (Ladd, 1996). Prosody has several communicative functions. Many of the communicative properties of speech prosody can be broken down into either linguistic or paralinguistic categories (also called non-linguistic). Linguistic communicative functions refer to the interaction between suprasegmentals and their segmental functions. An example of a linguistic communicative property is how syllable stress may influence a semantic or lexical category of a word, for instance changing the stress pattern of the word "record" can change the word from a noun to a verb. Another example is changing the significance of a word during an utterance using increased stress and intonation, such as when you are emphasizing a significant point (e.g., if you were emphasizing the fact that an individual did not eat, you may put more stress on the word "didn't" in the sentence "She *didn't* eat the food"). Paralinguistic functions refer to the use of prosody as the addition of circumstantial information (Hirschberg, 1999). An example of using prosody for paralinguistic purposes is using it to show emotional intent, irony, humor, or hinting other pragmatic elements (Hirschberg, 1999; Veenendaal, 2014; Mitchell, Rachel et al, 2016). The only communicative function of speech prosody that does not quite fit into either of these categories is the use of prosody to show breaks in words and sentences, which is critical for children who are in the process of acquiring their native language. For this function, the duration and intensity cues are the most significant and can assist a child with determining when a sentence or thought ends and where a new thought begins, as well as what combination of phonemes its own word and which is separate (Hirschberg, 1999; Veenendaal, 2014). Though this property *is* a function of language, it does not fall perfectly into either the paralinguistic category or the linguistic category and can be somewhat qualified for both. It is variable among researches as to which category segmentation falls into, as stated by Hirschberg (1999).

Without prosody, speech may sound monotone (Veenendaal, 2014). With the efficient and productive use of prosody, as well as other factors such as social interactions and gestures, our productions demonstrate an accurate portrayal of our intentions and thoughts. This is critical in conversation and discourse on a daily basis for adults, and it is fundamental for the acquisition of language (Veenendaal, 2014). Before a child becomes literate, the understanding of language (i.e., naming of objects, demands, expressions of wants and needs, and understanding of the world) comes solely from spoken speech and what can be visually observed from social interactions between individuals and cues such as facial expression and physical gesture. Without effective use of prosody, certain mechanisms of language would be lost entirely on young children. For example, without prosody children may not know the difference between the noun "attribute" and the verb "attribute," or be able to distinguish what information is more important than other bits of information. Some of the main ways that children learn social cues as well as word segmentation and word learning from spoken speech is through labeling, conversation with peers and adults, and read-aloud sessions of stories, therefore the manner in which these things are communicated is critical. If the communicative partner of a child is labeling objects, conversing with the child, and reading stories in an expressively prosodic manner, the impact may be different and more impactful than if they do so in an inexpressive prosodic manner (Cutler & Swinney, 1987; Mira & Schwanenflugel, 2013).

Prosody can be examined by analyzing its acoustic correlates, often categorized by fluctuations in these areas. The primary acoustic correlates of prosody include fundamental frequency (which has a perceptual correlate of pitch), intensity (which has a perceptual correlate of loudness), and duration (which is seen in terms of prosody as breaks and longer time spent vocalizing a segment) (Ladd, 1996). Many studies that examine the effects of prosody view

fundamental frequency (pitch) fluctuations as the primary mechanism determining whether or not we perceive the prosody of someone's speech as being expressive or inexpressive (Mira & Schwanenflugel, 2013). However, the other two factors influencing prosodic perception also play a key role when combined with pitch. For example, duration, pitch, and intensity all come together to indicate accentuation that can be placed on a syllable, a word, or a phrase of an utterance (Cutler & Swinney, 1987). Different types of accentuation can influence how expressive we perceive an utterance, the importance of a word, or the semantic meaning of a word. In addition, prosodic variation in these correlates and the placement of pauses (breaks) can indicate word boundaries for preliterate children. In other words, breaks indicate to children who cannot read what is part of a word and what is a separate word, which helps for word learning (Hirschberg, 1999).

In addition, we perceive speech streams with more exaggerated pauses after sentences or key words as being more expressive. These types of durational cues are a critical factor in child directed speech (CDS), sometimes also referred to as "Motherese" (Zellou & Scarborough, 2017). It has been noted in studies conducted previously that when there are few fluctuations in fundamental frequency (also annotated as f0),few fluctuations in durations of words, and little intensity variation, adults and children alike view the speech as being inexpressive (Mira, & Schwanenflugel, 2013).

In the case of prosody, expressiveness is characterized by fluctuations in pitch, loudness, and duration that give a speech stream the impression of liveliness (Mira, & Schwanenflugel, 2013; Ladd 1996). There has been a positive correlation previously noted between numbers of fluctuations in fundamental frequency and perceived expression in a speech segment (Mira & Schwanenflugel, 2013). When there are few fluctuations in the aforementioned factors

influencing prosody of speech, we view the speech as being inexpressive or more commonly referred to as monotone. Mira and Schawanenflugel (2013) examined whether or not the expressive nature of prosody during a read-aloud session impacted comprehension of the story for preschool aged children. The expressiveness of the prosody was actively controlled and regulated for the study. When controlling for inexpressive prosody during a sample for their study, Mira and Schwanenflugel (2013) ensured that there was an average fundamental frequency across the entire sample as well as a common level of intensity, and that each syllable lasted for approximately the same amount of time (which controlled for number of syllables influencing duration cues). This ensured that there were minimal fluctuations in the acoustic correlates, which therefore allowed for the monotone perception of the tone.

There have been studies that have been done that have examined the correlation between expressive prosody, inexpressive prosody, and comprehension of speech, with the most prominent study being the aforementioned Mira and Schwanenflugel study (2013). There were two-way between-subjects condition for this study, one in which an expressive version of a story was read and one in which an inexpressive version of a story was read. Children sat and listened to one of the two versions of the story and then answered open-ended as well as cued-recall questions about the story. Also, there was an examination of whether or not the prosodic features of the story impacted the comprehension abilities of the children who were listening to them. The study concluded that, in fact, there was significant evidence that children who listened to the expressive condition of the story had better comprehension scores of the story than those who listened to the inexpressive condition (Mira and Schwanenflugel, 2013).

One factor that this study did not take into account was whether or not the children had varied levels of visual attention given the prosodic expressiveness condition that they

experienced. For example, if a child is listening to a story that is being read in an expressive manner, are they more likely to pay closer attention to the content than if they are being read to in an inexpressive manner? Connected to that question is the inquiry of whether visual attention connects with the comprehension of the story, and whether this is a third variable mediating prosody and speech comprehension. This question is the basis of the current study, where it is asked if attention acts as a possible third variable in the correlation between prosody of speech and comprehension for preschool aged children in a read-aloud setting (Mira and Schwanenflugel, 2013).

Attention is something that is difficult to measure, as it is an aspect of our thought processes that is oftentimes internal and not something outwardly expressed, particularly for children. There are several ways in which researchers have measured attention, and the most common way to measure attention in children by looking at where they visually attend. It has been researched and determined that children are most likely to express their attention via eye gaze, shifting from one object to another given their interest levels. For children without fully developed lexicons, and without the discourse skills to be able to describe their thought processes in attention tasks, tracking the eye gaze is the most concrete and least subjective way to ensure that attention is being focused (Murphy & Bennett, 2007).

For the purposes of this study, eye gaze will help determine whether or not the child is focused on the speech being presented to them or elsewhere. Eye gaze will represent general interest in the content of the story without a specific target. Instead of specifically locating areas of interest that the child's eyes are more prone to go to, there will be several locations that are considered within and out of the range of visual attention.

Mira and Schwanenflugel found that the children in their study scored better on cued recall questions than open-ended questions, which was the basis of their original study, regardless of which condition they were experiencing. To connect the current study with previous research, this study also includes a comprehension component. Adding the cued-recall questions adds another dimension, so that it is not simply a task of whether children pay better attention during one prosodic setting or another, but also about how that may influence their comprehension of speech. This may provide information about different methods of speaking or reading to children to increase their attention levels in a classroom and in-home settings. Changes in prosodic expressiveness may then influence the way children learn to read or retain information.

The hypothesis of the current study is if a child is read to in a prosodically expressive manner, then they will have increased visual attention compared to if they are read to in a prosodically inexpressive manner. A secondary hypothesis for this study is that if a child is read to in a prosodically expressive manner and shows increased visual attention then they will perform better on cued-recall questions and therefore have improved comprehension of the story in the read aloud setting. These hypotheses are based on prior results by Mira and Schwanenflugel (2013) as well as research and analysis by Hirschberg (1999) and Cutler & Swinney (1987).

2. Methods

2.1. Participants

In this study, there were nine children included for analysis. Of those, five were females and four were males. All of the participating children came from dual parent homes, four had both parents working and five had at least one parent at home. All were considered within the

range of middle class, and all were Caucasian. All of the children additionally attended some form of educational daycare or preschool program. In order to participate, children had to be considered typically developing and have no confirmed diagnosis of the following: intellectual disability, hearing loss, attention deficit disorders, or speech or language disorders. They must have normal or corrected vision and have English as the primary language spoken at home. Children were not disqualified if there was more than one language at home, as long as they spoke English primarily. One child did not complete participation in one stage of the study (the language assessment, PPVT), but all other participants completed all sections of the study to the best of their ability. The mean age of the participants is 3 years and 8 months of age, with a range of 2 years and 11 months of age through 4 years and 9 months of age.

The study was completed in the Communication Sciences and Disorders Research Laboratories (CSDRL) in Hewitt Hall at the University of New Hampshire. The beginning stages, including paperwork and free play, were conducted outside of the testing room. The language assessment and story-telling portion were conducted in a testing room with a table and two small chairs facing each other at an angle. All data were stored on a computer in the CSDRL, and all video recordings were made using VALT, which stands for Video Audio Learning Tool and is a secure location for the documents (Intelligent Video Solutions, 2018). The study was completed between the years of 2018 and 2019.

2.2. Materials

The wordless picture book that was used for the study is *Frog, Where Are You?* by Mercer Mayer. A unique script was written and used in conjunction to the book (see Appendix A for the full script). The Flesch reading ease score was 0, which was deemed age appropriate for preliterate preschool aged children. There was an average of 7 words per page. There were two

Table 1. The demographics of participants in regards to age, which reading condition they experienced, and PPVT standard score.

Participant ID	Age	Condition	PPVT Standard Score
ST01	3;11	Expressive	106
ST02	3;11	Inexpressive	110
ST03	4;6	Expressive	82
ST04	2;11	Inexpressive	96
ST05	4;3	Expressive	98
ST06	3;8	Expressive	114
ST07	3;6	Inexpressive	104
ST08	4;9	Inexpressive	103
ST09	3;9	Expressive	91

audio recordings that were created. One was a prosodically expressive version and one was a prosodically inexpressive version. The expressive version contained an average fundamental frequency of 318.16Hz, an average intensity of 63.4dB, and with a total duration of 169 seconds. The inexpressive version was controlled for minimal fluctuations in pitch, intensity, and duration. The inexpressive version contained an average fundamental frequency of 223Hz, an average intensity of 54dB, and with a total duration of 160 seconds.

The language assessment that was used is the Peabody Picture Vocabulary Test version 4-A (PPVT). The iPod that was used to hold the recordings is an iPod Nano second generation (2006). The speakers were placed at an angle approximately three feet from the child. The sound was controlled to be the same the entire time, with the dial in the same location, approximately

halfway to the loudest setting. The paperwork that the parent of the participant received is a consent form and demographic form.

2.3. Procedure

When the child arrives, the procedure is explained to the parent as the child explores some of the toys that are provided for the free-play, warm-up portion of the study. As the parent is filling out the consent form and demographic form, the researcher and the child played for approximately ten minutes to build trust and dialogue. Once the child is comfortable and the parent has signed the forms, the researcher brings the child to the lab room. The child completes the PPVT-4 language assessment, which takes approximately ten minutes. Once that is completed, the child gets a reward for the participation (a sticker) and the storytelling portion begins. During this portion, the child listens to the story coming from the speakers, while the researcher turns the pages of the picture book. This takes no more than five minutes. The child only gets one version of the story: prosodically expressive or inexpressive. Afterwards, there are five comprehension questions about the story that are asked to the child (see full list of questions in Appendix B).

2.4. Analysis

The cued-recall questions are scored on a scale of 0, 1, 2, and 3. A score of 0 is awarded for totally inaccuracy, 1 is scored for mild accuracy, 2 is awarded for moderate accuracy (some missing parts, but you are able to follow the train of thought), and 3 for full accuracy. The total cued recall score is the sum of the points divided by the total possible points. The video recording is analyzed for eye-gaze and is measured in seconds, which is done by the program ELAN. The videos were coded for the duration and percentage of no visual attention, duration

and percentage of visual attention, duration and percentage looking at the book, and duration and percentage looking at the speakers.

3. Results

An independent-samples t-test was conducted to compare the percentage of visual attention between the expressive and inexpressive conditions of the study. There was not a significant difference between the expressive (*M*=93.00%, *SD*=0.06) and inexpressive (*M*=85.53%, *SD*=0.21118) conditions (*t*=0.073, *p*=0.551). An independent-samples t-test was additionally conducted to compare the percent of time looking at the book (as opposed to the audio speakers) between the expressive and inexpressive conditions of the study. There was a significant difference between the expressive (*M*=96.98%, *SD*=0.02) and inexpressive (*M*=93.45%, *SD*=0.02) conditions (*t*=5.098, *p*=0.041). Lastly, there was an independent-samples t-test conducted to compare the total cued recall score between expressive and inexpressive conditions of the study. There was not a significant difference between the expressive (*M*=10.4, *SD*=3.29) and inexpressive (*M*=10, *SD*=1.41) conditions (*t*=0.887, *p*=0.414). Additionally, there was a correlation run between the PPVT Standard Scores and the cued recall question total score. The results showed a moderate positive relationship between PPVT Standard Scores and cued recall question total score (*r*=0.495).

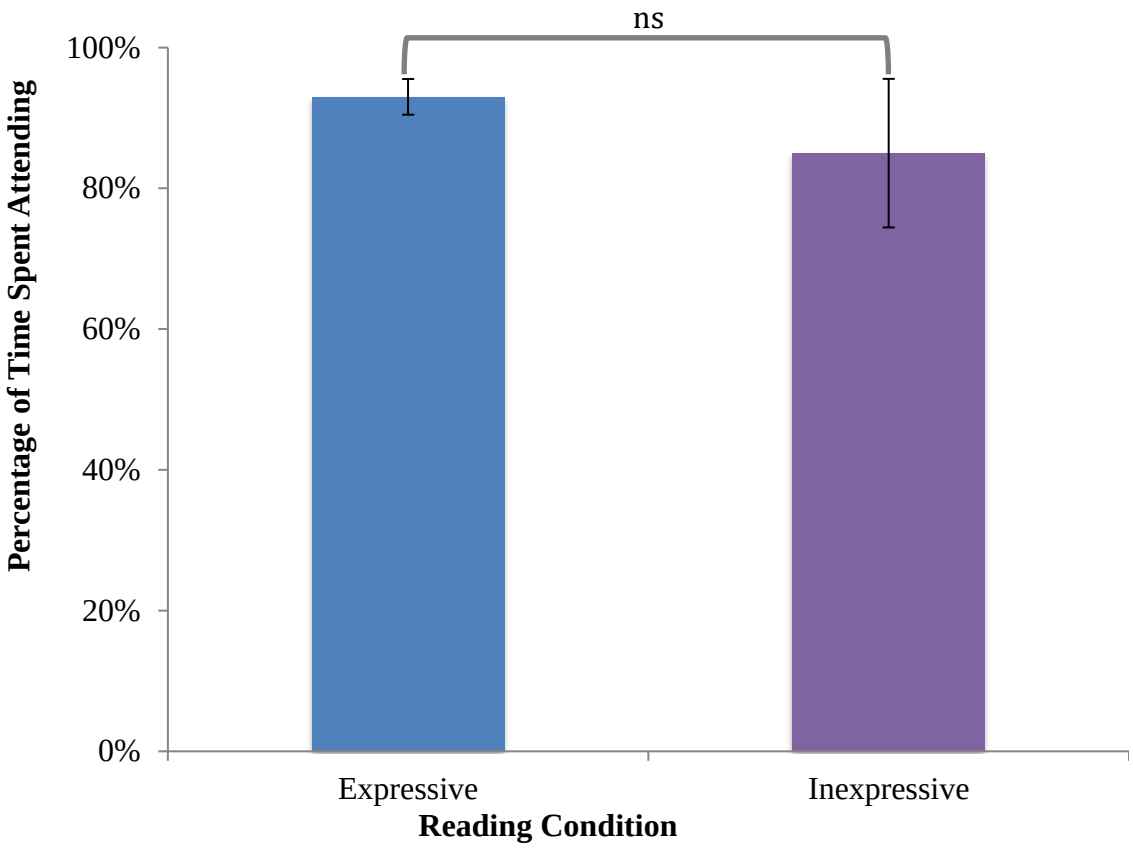


Figure 1. The relationship between reading condition and the percentage of time attending during the story. Error bars show standard error.

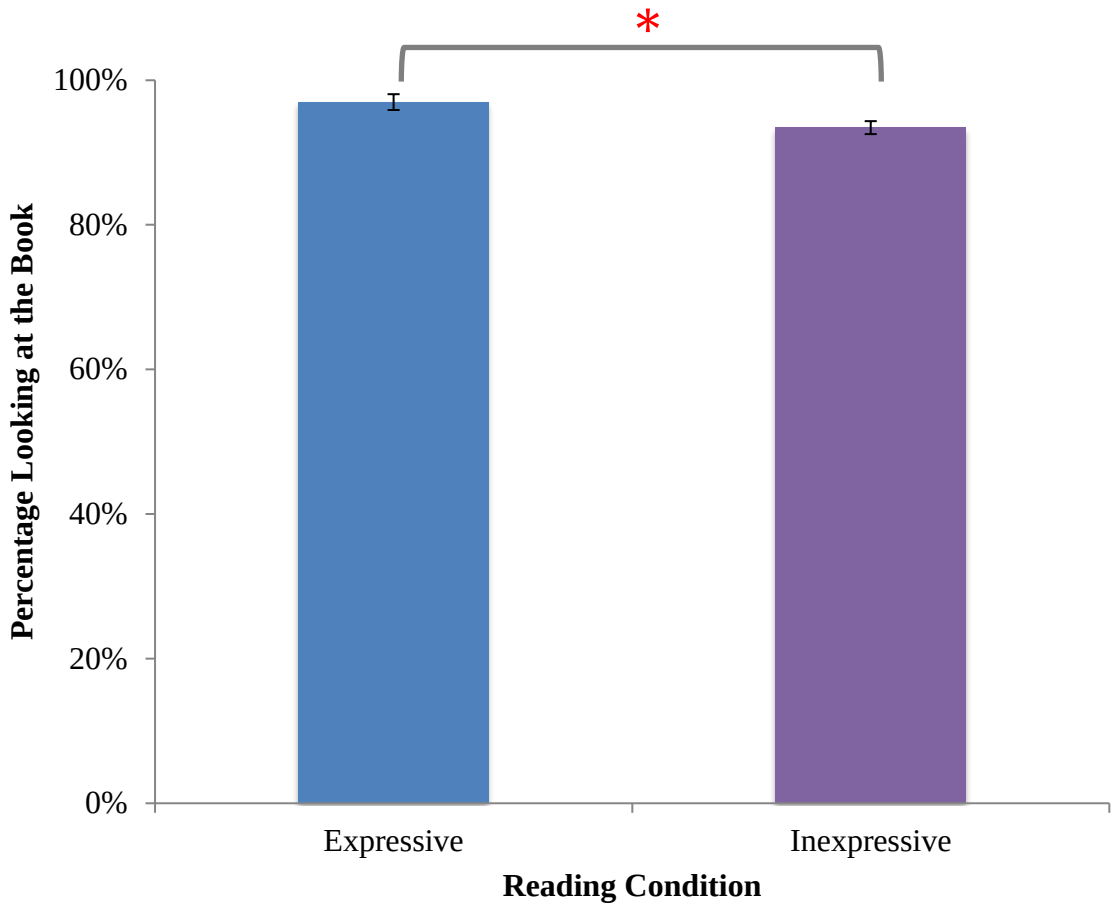
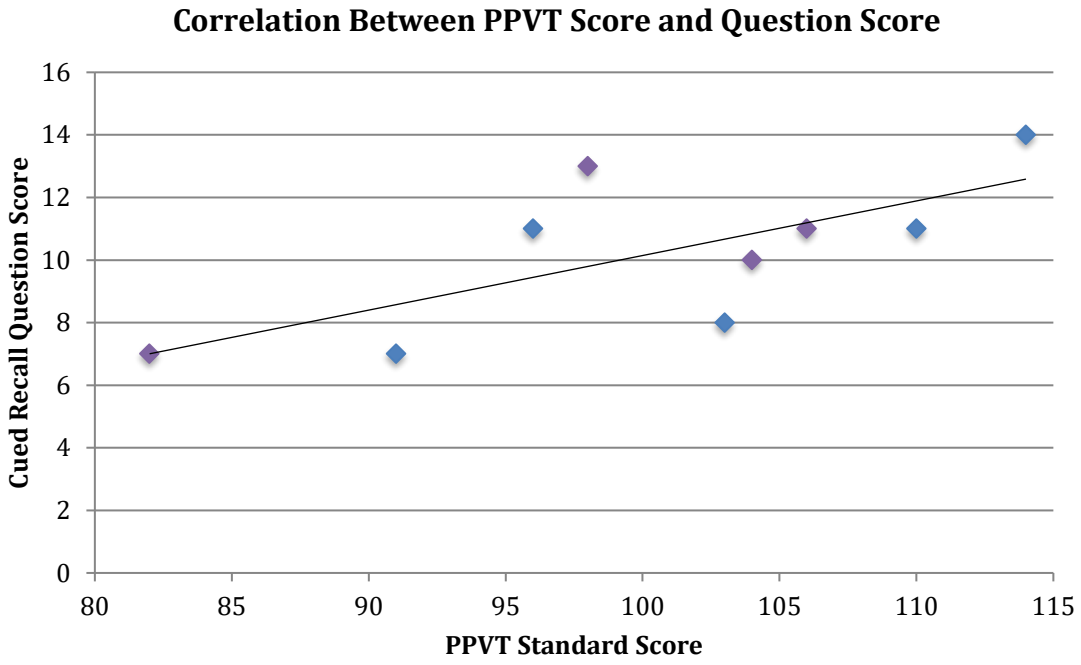


Figure 2. The relationship between reading condition and the percentage of time spent attending to the visual stimulus of the book (as opposed to the speakers). Error bars show standard error.

Figure 3. The Pearson's Correlation between the PPVT Standard Scores and the Cued Recall Question Scores. Purple indicate inexpressive, and blue indicate expressive conditions.



4. Discussion

The purpose of this study was to determine the impact of reading expressiveness on visual attention levels of preschool aged children. A second explored was the impact of reading expressiveness on comprehension of a story when asked cued recall questions. Overall analysis of the data did not confirm either the primary or secondary research hypotheses that more expressive reading of stories to young children would improve both visual attention and comprehension scores compared to inexpressive reading of the same story. However, there was evidence that there was more focus on the book rather than the speakers when the story was read more expressively than when it was read inexpressively. Additionally, there was a correlation found between a child's receptive language score on a PPVT-4 test and their comprehension

score on cued recall questions. In other words, there is a connection between a child's ability to access receptive language and how much they comprehended the story via read aloud.

Further analyses of visual attention of the participants in the expressive reading condition showed that they did not attend significantly more than children in the inexpressive reading condition. There was a difference in averages between the two groups (Figure One) that is mostly reflecting the fact that one participant scored in the lower range for visual attention and is an outlier in comparison to the rest of the group. If that participant was not included in the data set, the averages would be extremely close together and the results would be much less significant than they currently are. In-depth analyses into where the children paid attention during the study revealed that looking at the picture book was generally a more prominent site of visual attention, regardless of condition (96.98% of the time during the expressive condition and 93.45% of the time during the inexpressive condition). However, despite the fact that both conditions had a higher presence of looking at the picture book than at the audio speakers, there was a statistically significant amount of difference between the conditions. Children who were read to expressively had higher levels of visual attention toward the picture book than children who were read to in an inexpressive manner. This suggests that the more expressive the reading is, the more a child pays direct attention to the context of the story.

Critically, the second hypothesis of the study which stated if a child is read to expressively then they will score higher on comprehension questions, which echoed previous research questions put forth in Mira and Schwanenflugel (2013), did not result in statistically significant differences. Though this did not align with the previous research, the lack of statistical significance in regard to comprehension levels between conditions may be due to limitations of the current study. Most of the participants scored in the higher range on the cued

recall questions. For those children who did scored lower, these numbers were still relatively equal across conditions (i.e., an equal number of children scored poorly on the questions in both the expressive and inexpressive conditions). However, upon further analysis of the cued recall questions it was revealed that the participants who scored with more points on the cued recall questions similarly scored higher on the PPVT. After a Pearson's correlation test was run, it was concluded that there was a moderate correlation between the PPVT score and comprehension, regardless of the reading condition of the study. Essentially, this relates back to the previous study conducted by Mira and Schwanenflugel that stated that comprehension levels had more to do with reading condition than receptive language. My findings did not align with those findings, and found that receptive language ability was more tightly related to comprehension levels than reading condition.

4.1 Limitations

There were several limitations of this study that were not present during previous research and may have impacted portions of the results. One of the major limitations was that there were only nine participants that were able to participate in the study. The study by Mira and Schwanenflugel (2013) had over thirty participants, increasing their statistical power to detect differences between the groups. Another potential limitation is that many of the participants came from a nearly identical background. That is, they were all Caucasian and middle class with a majority of parents interested in higher education and all children attending preschool programs. This heterogeneity may have impacted the results as they may have been at less risk to have lower language comprehension and likely have had more exposure to read-aloud stories in the past during school than children who have not been exposed to academia (Mira and Schwanenflugel, 2013). Most of the children additionally scored higher on the PPVT, showing

that they were very strong in language which may have made their results more likely to be high regardless of which condition of the study they participated.

4.2 Future Research

Future research would benefit from examining visual attention and language comprehension in similar conditions of children who did not fall within the parameters of this study. In other words, this study examined the visual attention levels of children who are identified as being typically developing with normal hearing with no known diagnosis of intellectual disability or attention deficit disorder. It would be beneficial to examine how children with hearing loss, or children who are classified as having diagnoses that make attention and learning more challenging than those who are considered typically developing, would perform on a read-aloud story language comprehension task. It would additionally be beneficial to explore different sites of visual attention in more depth. In the present study it was made apparent that the audio speakers and the picture book were different focal sites of visual attention and that the data from those different sites of attention were significant—if there was more to look at, such as toys or words on the pages, would that also be impactful for comprehension and would that affect the pattern of results.

5. Conclusions

In sum, the present study suggests that there is no difference in visual attention between being read to in an expressive manner or in an inexpressive manner. In addition, there is no evidence that suggests that language comprehension is increased due to being read to in a prosodically expressive manner as opposed to a prosodically inexpressive manner. However, there is evidence that suggests that being read to with expressive prosody increases the amount of visual attention that is focused on the picture book rather than audios speakers. Finally, there

is a moderate correlation between receptive language scores and story comprehension scores regardless of the reading condition. This research does not align with previous research, which may potentially be due to the limitations in sample size and participant diversity. The present study adds to strategies that educators may have to increase the attention of children who appear to have difficulty during read-aloud settings and may add to future research on the topics of prosody and language comprehension in preschool aged children.

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Appendix A

Storytelling Study – Samantha Pepe

Story Script for *Frog, Where Are You?* By Mercer Mayer (1969)

Once upon a time there were three friends.

They were a boy, a frog, and a dog.

One night, the frog climbed out of his jar.

In the morning, the boy and dog couldn't find the frog.

They looked everywhere!

The boy checked his shoe—no frog!

The dog checked the jar—no frog!

They both looked outside for the frog.

They boy said, "Where are you frog!"

The dog jumped out the window. The boy was worried.

The boy jumped out the window too.

He told the dog to be careful.

They looked on a hill for the frog.

The boy said "Where are you frog!"

The boy looked in a hole for the frog.

The dog looked up a tree for the frog.

There were bees on the tree!

They scared the dog!

There was a mole in the hole.

It scared the boy!

The boy climbed a tree and looked inside.

There was an owl!

It scared the boy and he fell.

The bees were still chasing the dog!

They ran away so fast!

The boy climbed a rock.

He leaned against a branch.

He said, “Where are you frog!”

The branches were antlers.

It was a deer!

It picked up the boy and carried him far away!

The dog followed them.

The deer saw a cliff and stopped.

The boy and dog fell all the way down!

They landed SPLASH into some water!

The boy thought he heard something.

It sounded like the frog!

“Shhhhh!” he said to the dog.

They looked into the log…

And found the frog!

The frog had a new friend.

The frogs showed the boy and the dog their babies.

It was late.

The boy and dog had to go home.

Frog decided to stay with his family.

A baby frog chose to go home with boy and the dog.

Now they had a new friend.

Everyone was so happy.

The End

Appendix B

Cued Recall Questions:

1) Who ran away at night?
2) What was something that scared the boy or the dog?
3) Why did the boy fall into the water?
4) Where did the boy and the dog find the frog?
5) Who went home with the boy and the dog?