THE IMPACT OF EMOTIONAL TONE DURING SHARED READING EXPERIENCES

by

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Abstract

Shared book reading is a pleasurable and educational activity between an adult and a child. The Ministry of Education of Ontario encourages parents to read aloud to their children in order to foster a love of reading and aid in the development of literacy skills. One Ministry recommendation is for the adult to "make it exciting: put some drama into your voice" (Ontario Ministry of Education, n.d.). The current study examined the effect of different emotional tones of voice on the eye movements of children during shared book reading and on the children's comprehension for the material. Four storybooks were each recorded in four emotional tones of voice (neutral, angry, happy, and character), and presented on a computer screen. Each child was presented with each of the storybooks in one of the four conditions, with the combination of book and emotion randomized across participants. Eye-tracking technology followed each child's eye movements during the presentation. The children were asked three comprehension questions related to each story immediately after, and two further questions at the end of all four presentations. Standardized tests of working memory capacity and basic academic skills were also administered to the children. Analyses showed that while the proportion of time the children spent on the text did not vary as a function of emotional tone, they made the most fixations and spent the most time on the text and images in the angry condition. Furthermore, the children made the fewest fixations and spent the least amount of time looking at the text and images in the happy condition. The children also scored the highest in regard to the comprehension questions in the angry condition. Finally, there were positive relationships between the children's early reading skills and auditory working memory as per standardized tests, and their performance during the shared book reading and comprehension tasks.

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The Impact of Emotional Tone During Shared Reading Experiences

The Ontario Ministry of Education places great emphasis on the importance of early pre-literacy and literacy skills, considering reading success to be the foundation of academic achievement (Expert Panel on Early Reading in Ontario, 2003). To that end, there are a number of government initiatives designed to promote early literacy skills. The Ministry of Education's website includes a link to resources for parents to help them foster literacy in their children, with suggestions tailored to different age groups. The first recommendation for parents of children from Kindergarten to grade 3 is as follows:

> **Cuddle up and read.** Quiet times together are opportunities to bond...and read. The cuddling can be as important as the reading. Make it exciting: put some drama into your voice or let your child read every other page. As you go, explain any new words or ideas (Last modified, 11/3/13).

Intuitively, this seems to make sense. Cuddling and expressive voices can make shared reading more enjoyable for both parents and children. And when reading is enjoyable, children are more motivated to do spend time doing it (Baker, Scher, & Mackler, 1997). To date, the impact of expressive voice change in shared book reading on viewing behaviour, comprehension, and retention of information has not been empirically measured. The purpose of the current experiment is to examine this impact, if any, across grade level from Senior Kindergarten (SK) to grade 2.

Reading to children has been shown to improve their reading outcomes (Scarborough & Dobrich, 1994; Bus, van IJzendoorn &Pellegrini, 1995). But how exactly does this work? Much of the data available is correlational, and the effects of shared reading can be difficult to parse out from improved reading outcomes as the result of a literacy-rich home environment (Scarborough & Dobrich, 1994, Bus et al., 1995; Levy, Gong, Hessels, Evans &

Jared, 2006). While both shared book reading and the acquisition of orthographic knowledge have been studied, there has not been much published research in terms of examination of the inter-relationship between them (Evans & Saint-Aubin, 2005). It has been suggested that shared reading helps to familiarize children with text, develop print awareness, and to learn about word structure (Pick , Unze, Brownell, Drozdal, & Hopman, 1978) and phoneme/grapheme correspondence (Bus et al., 1995). Yet studies indicate that this is not likely to be the case (Evans & St. Aubin, 2005; Roy-Charland, St. Aubin & Evans, 2007). Avram and Aviram (2009) found a correlation between the frequency of shared book reading with both oral language skills and socioemotional adjustment, but none related to alphabetic skills. Research by Baker, Mackler, Sonnenschein, and Serpell, (2001) found that parents do not generally talk about print with their preschoolers or direct attention to it during shared reading experiences.

Experiments on shared reading experiences conducted by Evans and Saint-Aubin (2005) showed that children spend significantly less time looking at storybook text than they do looking at illustrations, and that this proportion is unaffected by the spatial arrangement of text and illustrations, the appearance of the text, the attractiveness of the illustrations, or the amount of time spent on each page. Furthermore, Roy-Charland et al. (2007) has shown that children in the beginning stages of learning to read pay attention to the text approximately only 10% of the time and that the proportion of time children spend oriented to the text compared to illustrations increases with their reading ability. Justice, Skibbe, Canning, and Lankford (2005) found that children aged 4-5 years spent only 2.5% of time looking at print; when the storybook contained print-salient features such as font changes or text bubbles, the percentage of time children spent looking at text increased to only 7%, in keeping with the findings of Roy-Charland et al. If children are not focused on the text for a significant amount

of time during shared reading, it stands to reason that there is little benefit in terms of sight vocabulary or in gaining awareness of phoneme-grapheme correspondence.

As shared reading is considered to be more of an oral language activity than a reading activity for the listener (Roy-Charland et al., 2007; Avram & Aviram, 2009), it may very well be that children simply do not need to look at the text during shared reading. Baker et al., (2001) posited that shared storybook reading may benefit children simply by later influencing whether or not they choose to read. There are a number of other ways in which children may learn or otherwise benefit from shared reading activities, including learning language patterns and rhythm, and gaining comprehension (Evans & Saint-Aubin, 2005), none of which require looking at the text. In order for children to obtain literacy skills from shared reading experiences, specific strategies may be required to get them to pay attention to the text in a meaningful fashion.

There has been some research conducted into factors or strategies that may influence children's attention to print during shared book reading. Evans and Saint-Aubin (2005) attempted to determine whether the attractiveness of the illustrations, as well as the location or formatting of the text influenced children's viewing behaviour during shared reading. They found that readers could lead children to pay attention to small details in the illustrations when those details were referred to in the text. However, regardless of variations in print and illustrations, 4-5 year old children still paid only minimal attention to print during shared book reading, visually exploring the images rather than the text. Research has shown that the amount of time spent looking at text as opposed to illustrations during shared book reading increases as a function of grade level (Roy-Charland et al., 2007). Kindergarten children spend very little time fixated on text, while by grades three and four, children spend approximately 50% of their time fixated on text with no increase between these two grades

(Roy-Charland et al, 2007). The grade one and two students are those with the most variability in visual text exploration behaviour.

The strategies currently considered to be most effective for directing children's attention to print during shared reading are known as making verbal and nonverbal print references (Piasta, Justice, McGinty, & Kaderavek, 2012; Gong & Levy, 2009; Justice, Pullen, & Pence, 2008). Verbal print references refer to comments or questions related to the print such as "What letter is this? Do you remember this word from the last page?", whereas nonverbal references to print include gestures such as pointing to words and letters, or following along the print with a finger while reading aloud (Justice et al., 2008). These techniques have been shown to improve children's attention to print during shared reading (Justice et al., 2008; Roy-Charland, Perron, Boulard, Chamberland, & Hoffman, in press), as well as improvements in short and long-term positive literacy outcomes (Piasta et al., 2012).

The use of educational electronic books (e-books) has also been found to increase children's attention to text and to improve both word meaning and word recognition in emergent readers (Korat & Shamir, 2008). These enhanced e-books include multimedia effects such as sound or visual effects, oral reading by a narrator, highlighted text, and animations. The Korat and Shamir study found that options to "Read story with dictionary" and "Read story and play" resulted in improved reading outcomes, whereas simply "Read only" options did not. There was, however, no measurement or discussion published as to whether visual or audio multimedia effects were utilized more, or which of these proved most effective.

Returning to the recommendation that readers use expressive voice when reading aloud to children as a strategy to help improve reading outcomes (www.ontario.ca/abc123, 2013), the lack of empirical data to either support or discredit this recommendation to date

leaves an opening for investigating its efficacy or even a possible negative influence (Baker et al, 2001; Hoffman & Murphy, manuscript in preparation, 2015; Murphy, Driver, Hu, Wachowiak, & Van Gerven, 2013). Putting emotion and drama into one's voice when reading to children will certainly make shared reading more interesting (Expert Panel on Early Reading, 2003), but it may have absolutely no effect on children's attention to text. Additionally, there may be other, unintended effects from emotional prosody in shared reading on children's memory for, and comprehension of, the information in the text.

Prosody is the term for the tones and stress patterns in speech that factor into how our verbal communication is received and interpreted (Hoffman & Murphy, manuscript in preparation, 2015). As an example, when a mother calls her child's name, prosodic cues are what inform the child as to whether they are likely to be scolded for something, called to dinner, or merely need to let their mother know they are within hearing range. Prosody can be congruent or incongruent to the semantic meaning of speech (Dupuis & Pichora-Fuller, 2010). When prosodic cues are congruent, they support and add to the intended meaning of speech. To re-visit the previous parental example, a mother who does not see her child at a playground and calls out his/her name saying "Where are you? I need you to answer me!" in a worried tone is using prosody congruent to her meaning. Prosodic congruence in shared reading may therefore help to clarify meaning for the listener. Conversely, prosodic incongruence, as used in sarcasm or humour can literally change the meaning of the words we say. For example, when an individual replies "Fine." in a clipped voice or "Yeah, right." in a sarcastic tone, it does not actually mean that he/she is agreeing with what was said, it means the opposite. This has implications for potentially causing inadvertent misunderstanding during shared reading; if the reader does not take care with his/her tone of voice, he/she may imply a meaning that is other than the one intended.

When a reader tells a story in a consistent emotional tone, whether that tone is happy, angry, neutral, or otherwise, there will always be points in the narrative where vocal prosody is inconsistent with what is being read. In order to remember and understand what is being read to them, the listener needs to be able to inhibit the message construed by emotional prosody while simultaneously processing and retaining the presented semantic information in order to follow the text. Part of speech processing includes the ability to selectively focus on relevant speech and to inhibit irrelevant distraction; this attentional control is a primary function of working memory (Baddeley, 1986). Working memory is the active component of memory involved in the active processing and manipulation of information and is believed to play an important role in our ability to process and understand speech. Verbal working memory has been found to contribute to literacy acquisition in its early stages (Rohl & Pratt, 1995). Individuals whose ability to process, comprehend, and store verbally presented information is limited due to lower working memory are also less advantaged when required to process and integrate information presented in text, as their capacity to actively maintain previously read material is diminished (Daneman & Hannon, 2001).

Furthermore, working memory is considered to be a limited resource (Süβ, Oberauer, Wittman, & Schulze, 2002), which can be drained or "tied up" by emotion (Derakshan and Eysenck, 2010), leaving fewer working memory resources available for tasks such as the memory for, or comprehension of, verbally presented information. Shared book reading is a form of verbally presenting information and children's retention and comprehension of this information may be negatively affected by the drain of emotionality on working memory resources.Negative emotions in the form of anxiety (Eysenck, Derakshan, Santos, & Calvo, 2007) and ruminative depression (de Lissnyder, Koster, & De Raedt, 2010) have been shown to negatively affect the inhibition function of working memory, increasing distractibility and impairing performance. Intrusive, anxious, and/or ruminative thoughts may compete for

limited working memory resources, leaving less for language processing. Emotional prosody in speech has been shown to impact working memory performance on auditory and mixed-modality tasks in adults of average working memory capacity (WMC --Hoffman & Murphy, manuscript in preparation, 2015; Murphy, Driver, Hu, Wachowiak, & Van Gerven, 2013). Specifically, negative emotional prosody in speech in the form of angry tones has been shown to both decrease memory for verbally presented information (Hoffman & Murphy, manuscript in preparation, 2015), and to act as a significant auditory distracter that impairs performance in a visual task (Murphy et al., 2013) in adults. Thus, it is reasonable to consider the possibility that negative emotionality in the voice of the reader may negatively impact the mnemonic and cognitive performance of the listener for material presented during shared reading. It may also be the case that negative emotionality decreases attentional performance during shared reading experiences by impeding the inhibition function, with the result of even less visual attention being paid to the text.

Conversely, positive prosody may have a positive effect on comprehension and memory in shared reading, or no effect at all. In keeping with research by Savine (2010) showing that positive affect enhanced some aspects of working memory functioning, Hoffman and Murphy (manuscript in preparation, 2015) found that happy emotionality in speech caused a slight, albeit clinically insignificant increase in memory performance in adults. Further, Murphy et al., found that happy emotionality in speech was not a significant distracter for adults during a visual task and did not cause decrements in performance. Research by Baker et al. (2001) has led to the idea that a positive affective quality during shared storybook reading is likely to foster motivation in children to read more challenging material, although no correlation with any specific reading or comprehension skills was found.

The Hoffman and Murphy (manuscript in preparation, 2015) research also demonstrated an interaction between emotional prosody in speech and WMC, in that individuals of average WMC showed significant effects of emotion on memory for verbally presented material, but individuals of high or low WMC did not. While the specific reasons for this outcome have not yet been investigated, this finding, in conjunction with that of Conway, Cowan and Bunting (2001) which showed that increases in WMC led to increases in the ability to inhibit irrelevant speech, indicates that WMC should be examined as a possible moderator of any potential effects of emotional prosody in shared reading. It may be that children with higher working memory resources are less affected by emotion in the voice of the reader, while children with lower WMC are more vulnerable to the influence of emotional prosody.

Daneman and Hannon (2001) demonstrated a clear link between WMC and reading achievement, and have indicated that WMC is a good predictor of performance in verbal reasoning and reading comprehension abilities. This is based in part on the idea that individuals with lower WMC are disadvantaged in the processing, storing, and integrating of verbal information, written or oral, in keeping with the concept of working memory as a limited resource, (Süβ et al. 2002; Daneman & Hannon, 2001) Being unable to hold all of the competing information active in working memory may result in the misinterpretation of oral or written information (Alloway, 2009). Individuals with higher WMC have more available working memory resources to allow them to process verbal input, which may include the prosody with which it is presented, and integrate the presented information into a comprehensive whole. Working memory has also been found to play a role in the acquisition of early literacy in the area of decoding skills (Rohl & Pratt, 1995). In this case, it is posited that a higher working memory better enables a child to remember the sounds of letters or letter groups in order to combine them into words.

Looking at the relationship between WMC and reading from the opposite perspective, Silva, Faisca, Ingvar, Petersson, and Reis (2012) found that literate individuals have better executive functioning than illiterate individuals. They suggest that not only does higher working memory help to increase literacy, but literacy skills may also contribute to executive–based working memory abilities, perhaps by contributing to the cognitive reserve in a reciprocal relationship.

The current experiment will investigate the relationship(s), if any, between emotional prosody in the voice of the reader during shared reading experiences and the relative proportion of time the child spends fixated on the text, images, or other distracters, as well as the impact of emotional prosody in the reader's voice on a child's comprehension of, and memory for, the materials read to them. Additionally, working memory will be examined as a potential moderator of any of the measured effects. To my knowledge, no studies published to date have investigated the potential effects of emotional prosody on the part of the reader during shared reading experiences on the eye movements of the listeners or on the listeners' comprehension and/or memory for what was heard. Qualitative elements of shared book reading in previous studies have been largely centered on the frequency of shared book reading rather than stylistic reading differences (Bus et al., 1995). It has been generally considered that the frequency of shared book reading is more important to reading outcomes than other qualitative factors (Bus et al., 1995; Baker et al., 2001; Scarborough & Dobrich, 1994).

There have been some studies examining potential relationships between emotional prosody and reading skills; however, these have been focused on the prosody produced by children as they read text aloud. For example, Miller and Schwanenflugel (2008) found that as children increase in reading fluency, they produce prosodic cues while reading aloud that become more similar to those produced by adult readers. Fluent adult readers have also been

found to read aloud with more appropriate prosody than less fluent adults (Binder et al., 2013). Moreover, Miller and Schwanenflugel (2008) found that the development of this prosodic intonation during reading in Grade 1 was correlated to reading comprehension in Grade 3. It may be that prosodic intonation on the part of the reader during shared reading may increase comprehension in the listener. Allington (1983) noted that when pre-reading children tell a story they have memorized aloud, they do so with prosodic fluency modelled on the way they heard the story, which may indicate a relationship between oral prosody on the part of the reader during shared reading, and the listener's retention of what was heard.

There were a number of working hypotheses regarding the interplay of comprehension, memory, prosody, and WMC for the current experiment. Based on the literature, emotional prosody in the voice of the reader was expected to have a significant effect on the listener's comprehension of, and memory for, information presented during shared reading (Hoffman & Murphy, manuscript in preparation, 2015). Negative emotional prosody was expected to cause decrements in comprehension and retention across grade level; this effect was expected to be greater than that caused by neutral, positive, or character-specific prosody (Hoffman & Murphy, manuscript in preparation, 2015; Driver & Murphy, 2013). It was anticipated that positive prosody would cause a slight improvement in memory and comprehension across grade level (Hoffman & Murphy, manuscript in preparation, 2015).

The effects of character-specific prosody on memory and comprehension were more difficult to predict. Since character-specific prosody is, by nature, congruent to the narrative, it could be expected to increase memory and comprehension for shared reading materials in keeping with the literature (Dupuis & Pichora-Fuller, 2010). Furthermore, the fact that pre-literate children often recite memorized material with prosody similar to that in which it was presented (Allington, 1983) indicates that prosody may have a positive effect on memory.

However, since negative emotional prosody has been shown to be distracting (Murphy et al., 2013) and to decrease working memory performance (Hoffman & Murphy, manuscript in preparation, 2015), if some or all of the character-specific prosody is negative, it may decrease memory and comprehension in shared reading. Character-specific prosody of any emotionality during shared reading may also prove to be to be enough of a distraction as to negatively impact performance. If, for example, a child is entranced by the voice of a particular character in a story, he/she may be more focused on anticipation of hearing the voice again than on other aspects of the narrative.

Children in higher grades were expected to be less affected by prosody in shared reading overall, as they are better able to read for themselves and therefore more likely to pay attention to the text as opposed to just the reader's voice (Roy-Charland et al., 2007). WMC was predicted to have a significant effect on performance across emotion and grade-level as well as moderating the effects of emotional prosody on the memory for, and comprehension of, shared reading materials.

Finally, with regards to eye movement patterns, since this was the first systematic examination of the impact of emotional prosody on viewing behaviour, no specific hypotheses were developed in advance. In a more general sense, however, it was predicted that emotional prosody on the part of the reader, particularly negative and/or incongruent prosody would act as a distraction, leading to less attention being paid to the text than would normally be expected. This was anticipated to vary according to reading ability; children with higher reading abilities may be more likely to persist in looking at the text despite the distraction, or, in the case of negative emotional prosody, to revert to the text in order to avoid the negative emotion. Furthermore, individuals of higher WMC were expected to be better able to ignore the emotional distraction and maintain focus on the text to a higher degree.

The current experiment has a number of implications for helping to determine the underlying nature of the relationship between shared reading and the acquisition of literacy, and will further our understanding of how emotion in oral language is processed and understood. Utilizing eye-tracking technology allows for a quantifiable measure of how different emotional tones affect viewing behaviour. Examining the role of working memory in speech processing during shared reading may help educators to better predict which students are likely to experience difficulties in acquiring literacy, and offer new avenues of remediation. Working memory is trainable, and it has been shown that improvements in working memory can result in improvements in reading performance (Nevo & Breznitz, 2010; Loosli, Buschkuehl, Perrig, & Jaeggi, 2012). Finally, determining how emotional prosody in the voice of a reader affects viewing behaviour, comprehension, and memory may lead to easily and inexpensively applicable changes to the way we share reading with children and deliver other important verbal information in the classroom setting. Something as simple as altering your tone of voice may be a factor in reading and other learning outcomes.

Method

Participants

Fourteen English-language students recruited from the North Bay area took part in the current study. The sample included two Kindergarten children (both boys), four children in grade one (two girls, two boys), and eight children in grade two (six girls, two boys). All of the participants' parents completed the questionnaire. Of these, 14% reported owning between 35 and 75 children's books, 43% reported owning between 75 and 100 children's books, and the remaining 43% reported owning more than 200 children's books. All families reported reading to their children at least 3 times per week, 43% reported reading at least 5 times per week, and 29% of families read every day. All analyses were based on 11 of the children since three of the children had missing data. Both of the Kindergarten children were

among those missing from the analyses, as well as one of the grade two children. Among the children whose data was used in the analyses, one child was reported as having some difficulty with reading and writing, one child was reported as being a late reader who had received remediation in that regard, and one child was noted as being in a French Immersion program; there were no reading/academic concerns for the rest of the children.

Materials

Home Literacy Experiences Questionnaire

The Home Literacy Experiences Questionnaire (Levy et al., 2006) was sent home to the parents of each participant prior to their participation in the experiment in order to obtain information about the child's reading experiences in the home as well as general demographic information about the child's household (see Roy-Charland et al., 2007). The full questionnaire is presented in Appendix A.

Books

Four English-language storybooks were used for this experiment. The books were created using images from four books written and illustrated by Barbara Reid: 1) Have You Seen Birds?, 2) We Are Going To A Party, 3) The Subway Mouse, and 4) Picture A Tree. Each book was formatted with the text printed on one page and illustrations on the opposite page, presented side-by-side for ease of observation and eye-tracking, with a total of ten images with accompanying text in each book. The images were in full colour and similar in design, attractiveness, and appeal. The text was created by the researcher for each of the images with a level reading difficulty intended for late Grade 1 students, and consisted of one or two sentences per image. The text for each book was rated using a consensus of ratings on the Readability Consensus which is an online tool that calculates the reading difficulty, average grade level, and reading age for samples of text ("Readability Formulas", n.d.), and subjective ratings by two elementary school teachers (see Roy-Charland et al., 2007, for a

similar approach). The Readability Consensus tool obtained the consensus score using a formulation based on eight readability indexes: the Flesch Reading Ease Score; the Gunning Fog; the Flesch-Kincaid Grade Level; the Coleman-Liau Index; the SMOG Index; the Automated Readability Index; and the Linsear Write Formula (Readability Formulas, n.d.). The elementary school teachers had an average of 13.5 years of experience. The text for each of the four books was modified until each book was rated identically as "very very easy to read" and at a Grade 1 reading level, with a suitable age range of six to eight years according to the Readability Consensus. One of the teachers rated the books within the range of late SK, while the other rated them within a grade one level. Averaging the results of the Readability Consensus and the subjective ratings places the books at an appropriate grade one reading level.

Each storybook was read aloud in different emotional tones and recorded for presentation on the ViewSonic monitor. A professional radio announcer was hired to record the narrations and the recordings. Four different emotional tones were recorded for each storybook for a total of 16 recordings as follows: a neutral, even tone throughout; a stern, angry tone throughout; a happy, cheerful tone throughout; and mood/character reading, as if acting out the story with emotional tones appropriate to the text and characters. The accuracy of the emotional tones was determined by a consensus of opinion between the researcher and her supervisor, the radio announcer, and a lab assistant. Inter-rater agreement (100%) in conjunction with the intended emotional tone was the deciding criteria.

Comprehension Questions

Five questions testing general comprehension of the text were presented to each participant orally for each storybook. Three were presented to the participant immediately after each shared text in a similar procedure to that of the *Listening Comprehension* subtest from the WIAT-III tests of academic achievement (Psychological Corporation [PsychCorp],

2009). The other two questions were presented at the end of the full testing session of four storybooks in the same presentation order as the books were read for each child. This was intended to provide an indication of how emotional prosody in reading may impact the retention of information over time, similar to the concept of the Visual-Auditory Learning – Delayed subtest from the WJIII cognitive test battery (Woodcock et al., 2001).

Eye-Tracking Apparatus

Eye movements were measured with an SR Research Ltd EyeLink 1000 system. This system has high accuracy (0.25º - 0.5º) and a high sampling rate (Head Supported: 2000 Hz, monocular), as well as a quick and easy setup, which is beneficial when working with children (SR Research Ltd., 2013). The EyeLink system uses an Ethernet link between the eyetracker and the display computer for real-time saccade and gaze-position data transfer. Stimulus displays were presented on two monitors, one for the participant (21'' ViewSonic monitor) and the other for the experimenter. The experimenter's monitor was used to give feedback in real-time about the participant's computed gaze position. Feedback was given in the form of a gaze cursor measuring one degree in diameter. This allowed the experimenter to evaluate system accuracy and to initiate a recalibration if necessary.

Tests of Working Memory Capacity

All participants were administered the two subtests which comprise the Woodcock Johnston Tests of Cognitive Abilities (Woodcock et al., 2001) tests of working memory capacity (WMC). These tests included the *Numbers Reversed* and *Auditory Working Memory.* Additionally, the *Memory for Words* subtest from the WJ-III was administered to each participant (See Appendix). These tests were administered orally by a researcher/research assistant according to a standard script. These subtests required participants to perform rote memorization and mental manipulation of digits and combinations of digits and words, as well as rote memorization of words, in their heads with

oral responses which were recorded verbatim by the researcher/assistant on a hand-scoring sheet.

Numbers Reversed required participants to repeat series of numbers presented to them in reverse order (e.g. Presented: 1-7-5; Correct Response: 5-7-1). This test required the participants to keep a group of numbers in their working memory while performing a mental manipulation on the information before responding. The median reliability for this test is .86 in the ages 5 to 19 range (Woodcock et al., 2001).

Auditory Working Memory required participants to repeat presented series of mixed numbers and words back to the researcher re-ordered to present the words first in sequential presentation order followed by the numbers in sequential presentation order. For example, a participant presented with "cup, 3, door, 8, 2, house" would correctly respond "cup, door, house, 3, 8, 2. This test has a median reliability of .88 in the 5 to 19 age range (Woodcock et al., 2001).

Memory for Words required participants to repeat sets of unrelated words in correct presentation order. This is a test of rote memorization with no mental manipulation of the presented words required. The median reliability in the 5 to 19 age range for this test is .87 (Woodcock et al., 2001).

The subtest scores were entered into the WJ-III computerized scoring program, which computed each individual's subtest scores as well as their working memory capacity in the form of a standard score (SS) based on a mean of 100 and a standard deviation of 15. The WMC for each individual was generated after the participant completed the shared reading tasks in order to avoid any potential expectancy effects by the researcher, based on knowledge of the participant's WMC score. As the sample size was small, the participant's WMC in relation to eye-movements and comprehension was examined using correlational analysis.

WIAT-III Tests of Academic Achievement. All participants were administered the *Early Reading Skills, Listening Comprehension,* and *Sentence Repetition* subtests from the Wechsler Individual Achievement Test, Third Edition (WIAT-III). These tests were administered orally by a researcher/research assistant according to a standard script and scored using the WIAT-III computerized scoring software, resulting in a standard score for each subtest based on a mean of 100 with a standard deviation of 15.

Early Reading Skills provided a measure of the participants' pre-reading and early reading skills, including phonological awareness, which is the ability to manipulate the sounds within words (e.g., rhyming), and knowledge of phonological-orthographic relationships (e.g., matching words with pictures) (PsychCorp, 2009). Tasks included such skills as letter recognition, naming letters according to their sounds, and rhyming (PsychCorp, 2009). The test-retest average corrected reliability coefficient for *Early Reading Skills* is in the 0.82-0.89 range (Vaughan-Jensen, Adame, McLean & Gamez, 2009).

Listening Comprehension examines both receptive vocabulary at the one-word level and an individual's understanding of more complex verbally-presented information and offers both age-based and grade-based norms (PsychCorp, 2009). On the *Receptive Vocabulary* component of *Listening Comprehension,* the participant listened to a word or sentence and matched it to a picture (e.g. Point to 'jar'). Receptive vocabulary at a one word level is a less complex process than sentence comprehension and does not require a verbal response. The *Receptive Vocabulary* subtest has a test-retest reliability coefficient of 0.73 for the kindergarten level, 0.71 for Grade 1, and 0.67 for Grade 2 (Breaux & Frey, 2010). The *Oral Discourse Comprehension* component required each individual to listen to a spoken phrase or paragraph and answer questions about what he/she heard (e.g. Presented: "The bird lives in a nest. Where does the bird live?"; Correct Response: "In a nest"). This test measured each participant's comprehension and understanding of verbally presented information

(PsychCorp, 2009). *Oral Discourse Comprehension* has a test-retest reliability coefficient of 0.78 for the Kindergarten level, 0.84 for Grade 1, and 0.84 for Grade 2 (Breaux & Frey, 2010).

Sentence Repetition is designed to measure syntactic ability and verbal short-term memory. The examiner read sentences of increasing length and complexity aloud to the participant, who was required to repeat the sentence aloud verbatim (e.g. Cats don't like to swim) (PsychCorp, 2009). *Sentence Repetition* has been found to be a factor in phonological awareness and is considered to be a function of the auditory loop subsystem of working memory (Rohl& Pratt, 1995). The *Sentence Repetition* subtest has a test-retest reliability coefficient of 0.87 for the Kindergarten level, 0.86 for Grade 1, and 0.86 for Grade 2.

Procedure

Each child was tested individually over two testing sessions, each lasting approximately one hour and separated by a short break. Two researchers or one researcher and one parent were present during testing.

Eye-tracking and comprehension components

Before the experiment began there was a familiarization period in which the child was shown the equipment and had the tasks explained to him/her. The participant was seated in front of the computer screen at a distance of 60 cm, with a chinrest for support. The Eyelink 1000 was then calibrated using a 5-point procedure. The calibration required the child to fixate on a small cartoon face (the cartoon character *Caillou*) which appeared in five different locations on a computer screen as follows: the center top, the bottom center, the center left and the center right, as well as the middle of the screen. This procedure was performed twice and in order for the calibration to be considered successful, the mean deviation between both measures had to be 1º or less. To ensure that the calibration remained accurate during testing and to avoid drift, a blank screen appeared with a tiny cartoon character in the center; the

child had to fixate on the character in order for the next page to appear (Roy-Charland et al., 2007).

The shared reading component took place first. The child was seated in front of the computer monitor with the researcher seated beside them. The pre-recorded books were played for the child through speakers while the text and images appeared on the computer monitor. The presentation order of the books and emotional tones and their combinations was counterbalanced across participants: Each participant was presented with all four storybooks and all four emotional tones, although in varying combinations thereof. . After each book was read, the child was asked three comprehension questions about the story. Their answers were recorded verbatim by the researcher before moving on to the next story. At the end of the presentation of the four storybooks, the child was asked two further comprehension questions about each story, beginning with the first story read and proceeding in order. The comprehension questions for each story were presented regardless of whether the previous answers were correct or not.

WMC and academic testing

Once the shared reading task was completed, the child was administered the WJ-III working memory and word reasoning subtests, followed by the WIAT-III oral language and early reading skill subtests. The standard discontinue rules for each subtest as per administration guidelines were applied. Upon completion of the tasks, each child was invited to choose a reinforcement (e.g. a sticker or small toy) from the selection offered.

Results

Data Analysis

Eye movement measures were scored using the Eyelink Data viewer software. This software presents the pages of the book and superimposes the position of all fixations on the presented stimuli. Raw averages for the number of fixations on the text and illustrations as

well as the dwell time on the text and illustrations are presented in Table 1 as a function of prosody and grade level. The analyses of fixation count and dwell time across Zone (Image and Text) were computed using the mean number of fixations and of dwell times; however, the first set of analyses was computed on proportions (see Roy-Charland et al., 2007). For each child and each group (Grade 1 and Grade 2), the proportion of time spent looking at the text was computed for each prosody (Neutral, Angry, Character, and Happy), by dividing the duration of time on the text by the sum of the duration of time on text and images (see Roy-Charland et al., 2007). At least one fixation had to occur in the zone for an observation to be computed, without which an empty cell was recorded. The proportion of time spent on the text allowed for comparing the relative attention paid to the text while controlling for presentation time. The number of fixations pertained to how often the children looked at the storybook pages without controlling for presentation time. Dwell time pertained to how long children looked at the storybook pages without controlling for presentation time. The main difference between the latter two measures is that participants might make few fixations but that were very long in durations or vice versa. For all analyses, an alpha level of .05 was used, unless otherwise indicated. The results are presented in Table 1.

The children's comprehension of the presented material was analyzed across prosody and question presentation order as a combined variable. The first question asked for any of the storybooks was coded as Q1 regardless of the question content, which differed for each storybook. Prosody refers to the tone in which the storybook was presented to the participant. For example, for storybooks presented in the Neutral tone, prosody was coded as P1. Therefore, the combined variable consisted of the number of the question and the prosody in which it was presented (i.e. P1Q1, P1Q2, P2Q2, and so on). All of the comprehension questions were presented in a regular tone of voice, in a similar fashion to the standardized WIAT-III and WJIII subtests administered. The results for each comprehension question

were coded as either correct or incorrect and the proportion of correct answers for each combined variable was compared. Finally, correlational analyses were used to determine any possible relationships between performance on the eye-tracking and comprehension measures as well as performance of any of these in comparison to performance on the standardized working memory and academic subtests.

Eye Movement Measures

Proportion of Time

A 2 x 4 mixed design ANOVA was computed on the proportion of time spent on the text, with prosody (neutral, angry, character, and happy) as the within-participants factor and grade (1 and 2) as the between-participants factor. The results revealed no main effect of Grade, F (1, 9) = 4.27, p = .07, $\eta^2 p$ = .32 . Further, the tests of within-subjects effects showed no significant effects of Prosody, F (3, 27) = 1.56, p = .22, and no interaction of Prosody and Grade, F < 1.

Fixation Counts

A 2 x 4 x 2 mixed design ANOVA was computed on the raw fixation counts, with zone and prosody as the within-participants factors and grade as the between-participants factor. The main effect of Grade was not significant, F < 1. There was a significant main effect of Prosody, F (3, 27) = 3.46, p = .03, $\eta^2 p$ = .28, and of Zone, F (1, 9) = 21.56, p < .01, $\eta^2 p$ = .706. There were no significant interactions between Zone and Grade F < 1; Zone and Prosody F (3, 27) = 1.83, p = .17, $\eta^2 p$ = .169 ; Prosody and Grade F (3, 27) = 1.78, p= .18, $\eta^2 p$ = .17 ; or between Zone, Prosody, and Grade, F < 1. In regard to Zone, the children made significantly more fixations on the images than they did on the text, regardless of prosody or grade. Post hoc pairwise comparisons (LSD) in regard to Prosody revealed that overall, children made the highest number of fixations to the images and text in the Angry condition

and the least in the Happy condition. The children made significantly more fixations on the text and the images in the Angry condition and in the Character condition than they did in the Happy condition. The Neutral condition did not differ significantly from Angry, Happy, or Character conditions in regard to the number of fixations made on the text and images. Finally, there was no significant difference in fixation counts between the Angry and Character conditions. The results are displayed in Table1.

Dwell Time

The analyses for dwell time produced results that were congruent with those for fixation counts, as presented in Table 1. A 2 x 4 x 2 mixed design ANOVA was computed on dwell time, with zone and prosody as the within-participants factors and grade as the between-participants factor. The main effect of Grade, $F<1$, did not reach significance. There was a significant main effect of Zone, F (1, 9) = 22.28, p = <.01, $\eta 2p$ = .71, and of Prosody, F (3, 27) = 3.474, p = .03, $\eta 2p$ = .28. The interactions between Prosody and Grade, F (3, 27) = 1.87, p = .16; Zone and Grade, F (1, 9) = 3.48, p = .10; Zone and Prosody F (3, 27) = 2.01, p = .18; and Zone, Prosody, and Grade, $F < 1$, did not reach significance.

In regard to Zone, the children spent more time dwelling on the images than they did on the text, regardless of Grade or Prosody. Post hoc pairwise comparisons (LSD) in regard to Prosody revealed that overall, children spent the most time dwelling on the text and the images in the Angry condition and the least in the Happy condition, consistent with the results in regard to zone fixations. The children spent more time dwelling on the text and the images in the Angry condition than they did in the Happy condition. The Neutral condition did not differ significantly from the Angry, Character, or Happy conditions in regard to the amount of time spent dwelling on the text and images. The Character condition also did not differ from the Angry and Happy conditions regarding dwell time.

Comprehension Measures

A one-way within-subjects ANOVA was conducted across Prosody and Question collapsed across grade to examine the children's comprehension performance as determined by their ability to answer the comprehension questions correctly. A marginally significant main effect of Prosody F (3, 30) = 2.69, p = .06 was revealed. Post-hoc pairwise comparisons (LSD) examining this effect indicated that the comprehension scores in the Angry condition were significantly higher than in the Character and Happy conditions. Consistent with the results patterns in the eye-movement measures, the Neutral condition did not vary notably from any of the Angry, Character, or Happy conditions in regard to the children's performance on comprehension questions.

Correlational Analyses

Proportion of Text Fixations

Correlational analyses using Pearson's r revealed a positive relationship between the proportion of text fixations and standardized scores on the *Early Reading Skills* subtest in all prosodic conditions: Neutral (r = .69, p < .02); Angry (r = .74, p = .01); Character (r = .74, p < .01); and Happy (r = .67, p = .02). Standard scores on the *Auditory Working Memory* subtest were also positively correlated with the proportion of text fixations in the Happy (r = .63, p = .04) condition. There was no significant relationship between standardized overall WMC scores and the proportion of text fixations.

Number of Text Fixations

There was also a positive relationship between standard scores on the *Early Reading Skills* subtest and the number of text fixations in the Neutral (r = .66, p < .03), Angry (r = .69, p = .02), and Character (r = .75, p = <.01) conditions, but not in the Happy condition.

Standard scores for *Early Reading Skills* were negatively correlated with the number of fixations on the images in the Happy (r = -.74, p < .01) condition and mildly so in the Character (r = -.59, p < .06) condition, but was not linked to image fixations in the Neutral or Angry conditions. Additionally, standard scores for *Auditory Working Memory* were positively correlated with the number of fixations on the text in the Neutral (r = .62, p = .04) and Angry (r = .63, p = .04) conditions, although not in the Character or Happy conditions. *Oral Discourse Comprehension* was positively correlated with the number of fixations made on the text in the Angry condition (r = .64, p < .04), but not for Neutral, Character, or Happy. Finally, the number of fixations on the image in the Happy condition was negatively correlated with standard scores on the *Memory for Words* subtest (r = -.65, p = .03). The correlations between number of fixations and the *Memory for Words* subtest were not significant in the Neutral, Angry, or Character conditions.

Time Spent on Text and Images

Standard scores on the *Early Reading Skills*, *Auditory Working Memory*, and *Oral Discourse Comprehension* subtests were found to relate to the amount of time spent dwelling on the text and images. *Early Reading Skills* was negatively correlated with dwell time on the images in the Character (r = -.61, p < .05) and Happy (r = -.76, p < .01) conditions, and positively correlated with the amount of time spent on the text in the Neutral (r = .61, p < .05), Angry (r = .70, p < .02), and Character (r = .73 p = .01) conditions. *Auditory Working Memory* correlated positively with the dwell time on the text in the Angry (r = .63, p < .04) condition, and negatively in the Happy condition (r = -.59, p < .06). Lastly, standard scores on the *Oral Discourse Comprehension* subtest correlated positively with the amount of time spent dwelling on the text in the Angry condition (r = .60, p = .05).

Discussion

The current study was designed to explore the role of emotional prosody in the voice of the reader on children's attention to the text and images during shared book reading, as well as on their comprehension of, and memory for, the presented information. Specifically, the study explored whether the use of emotional tones changed the proportion of time spent on the printed text, and the number of fixations and the total time spent on the printed text and illustrations, as well as the degree of comprehension and memory for the material. This was accomplished by tracking eye movements for the former measures and by verbally presenting comprehension questions for the latter. Working memory and grade were proposed as potential moderators of any of the effects (Hoffman & Murphy, 2013; Roy-Charland et al., 2007; Conway, Cowan, & Bunting, 2001). As there is currently no published research in regard to the effects of emotional prosody on eye-movements or comprehension during shared book reading, any and/or all of these results provide prospective avenues of further investigation. The specific results will be discussed in detail individually, as well as their implications.

First, in regard to the attention on the printed text and illustrations, the current findings were consistent with the existing literature in that children made significantly more fixations on the images than they did on the text (Justice et al., 2005; Evans & Saint-Aubin, 2005, Roy-Charland et al., 2007). Also consistent with those studies and with the fixation results, children spent significantly more time dwelling on the images than they did on the text. This is supportive of the idea of shared book reading as an oral language activity rather than a reading activity for the child (Roy-Charland et al., 2007; Avram & Aviram, 2009). As opposed to actively reading, the children listened to the words and looked at the pictures, for the most part. Therefore, it is unlikely that they achieved any gains in regard to their word recognition or awareness of phoneme-grapheme correspondence from the shared-reading

experience, consistent with previous research (Evans & Saint-Aubin, 2005; Roy-Charland et al., 2007). Gains in oral language may be the area of greatest benefit from shared book reading, as suggested by Avram and Aviram (2009). This is not to suggest that oral language gains are unimportant, it merely suggests that shared book reading may be best directed to an oral language goal as opposed to goals related to written language skills and/or word recognition. Shared book reading has also been found to promote motivation for reading and a sense of reading as an enjoyable activity, which may predispose children to read frequently in later years (Baker et al., 1997).

The fixation counts and dwell time, as well as the relative proportion of time spent on text, were compared across grade and prosody. Interestingly, there was no difference in the proportion of text fixations or the number of fixations to the text between the prosodic conditions as a function of grade. Based on the findings of Roy-Charland et.al (2007), variation in text exploration was anticipated between grades, with second graders expected to pay more attention to the text than first graders. However, during the current study, while the second graders made more fixations on the text and spent more time on the text than the first graders did, the differences in fixations to the text and the proportion of time spent looking at the text between grades did not reach significance. Furthermore, there was no interaction between grade and prosody on fixation counts, dwell time, or the proportion of time spent on the on text. One possible explanation for the lack of grade effects and interactions will be discussed in detail with the academic results.

Prosody did not affect the proportion of time that the children spent looking at the text. This result was not terribly surprising, as the literature has shown that the most effective strategies for directing children's attention to the text during shared reading involve verbal and nonverbal print references (Roy-Charland et al., in press; Piasta, Justice, McGinty, & Kaderavek, 2012; Gong & Levy, 2009; Justice, Pullen, & Pence, 2008;). And even in these

circumstances, the increases in attention to the text are modest (Roy-Charland et al., in press). None of the conditions in the current study involved specific references to the print of any kind.

Prosody did, however, have a significant impact on the number of fixations and the dwell time spent on images and text overall. This is to say that although the relative proportion of time spent on text over images did not vary according to prosody, the amount of attention paid to the storybook as a whole did. While the neutral condition did not differ significantly from any of the other conditions, the children fixated their visual attention on the text and images most frequently when read to in an angry tone of voice; they also spent the most time dwelling on the text and images in this condition. The children made the smallest number of fixations and spent the least amount of time on the text and images when read to in a happy tone of voice, significantly lower than in the angry and the character conditions.

These results were diametrically opposite to expectations based on previous research. As negative emotions have been shown to impair working memory and attentional functioning in adults (de Lissnyder et al., 2010; Eysenck et al., 2007), it was expected that the children would pay less attention to the text and/or the images in the angry condition. Furthermore, angry tones were shown to be a notable auditory distraction during a visual task for adults (Murphy et al., 2013), providing support to this expectation. Happy tones were predicted to have either a small positive impact on attention (Savine et al., 2010) to the storybooks, or none at all (Murphy et al., 2013). Neither of these held true for the current study. However, some studies have demonstrated that images of negative faces capture more attention than those of positive faces, which may be of evolutionary value by allowing the prompt implementation of the "fight-or-flight" response (Eastwood, Smilek, & Merikle, 2003). Angry tones of voice may have induced a similar attentional response to the

storybooks. It is possible that age plays a role in these unexpected results; age-related differences in the ability to identify emotional prosody in speech have been found between children and adults (Morton & Trehub, 2001), and between younger adults and older adults (Dupuis & Pichora-Fuller, 2010). It may be that there are also age-related differences in the effects of emotional prosody in speech on visual attention between children and adults that can account for the unanticipated results in regard to angry and happy tones in the current study.

The amount of visual attention paid to the storybooks in the character condition was similar to the angry and neutral conditions, and higher than that in the happy condition. No specific hypotheses were posed in regard to eye movements in the character condition. However, studies have shown that identifying emotional tone in speech is less problematic when the emotional tone is congruent to the semantic meaning of what is being said (Dupuis & Pichora-Fuller, 2010; Morton & Trehub, 2001). Thus, it is reasonable to consider that emotional tones congruent to the story might not noticeably impact children's attention to the text or the images. As the character tone is, by nature, congruent to what is read, the lack of any notable effect on attention to the storybooks makes sense.

Thus far, the current research has established that children looked more often, and for longer, at the text and images when read to in angry tones, and least when listening to happy tones. The question of importance at this point becomes whether or not those differences in attention to the storybooks made a difference to the children's comprehension of the material. The present data suggests that it does: pairwise comparisons examining the effect of prosody on comprehension showed that the children's comprehension for the information in the storybooks was highest in the angry condition and poorest in the happy condition, with comprehension in the character condition lying between them. The neutral condition was not significantly different from any of the others.

These results imply that not only did the children look more often and for longer at the text and images when read to in angry tones, but that this attention was meaningful, resulting in a greater understanding of what was being read to them. Furthermore, the children's decreased attention to the storybooks in the happy condition resulted in less understanding of the material. In the character condition, the children showed less comprehension for the material than they did in the angry condition, yet more than they did in the happy condition. Forgas, Goldenberg, & Unkelbach (2009), demonstrated that weather conditions such as rainy, cloudy days, produced a naturally-induced negative affect that positively influenced adults' memory for casually observed scenes; it may be that the angry tone of voice naturally induced a degree of negative affect in the children that enhanced their ability to retain information from the text and images.

Due to the small sample size (n=11), it was not possible to include WMC as a moderating between-subjects variable in the eye movement or comprehension analyses. It was initially posited that children of higher WMC would pay more attention to the text, have greater comprehension and memory for the information, and be less susceptible to the effects of prosody, if any (Hoffman & Murphy, 2015; Silva et al., 2012; Alloway, 2009; Rohl & Pratt, 1995). However, there were not enough children in the high (SS>110) and low (SS<90) WMC groups (n=1 and n=2, respectively) to be able to statistically compare their performance to those children in the average WMC group (n=8). Therefore, Pearson's r correlations were computed to assess the relationships between the children's eye movements and their scores on standardized tests of working memory.

There were no significant relationships between standard WMC scores and the children's eye movements. Yet among the individual subtests used to calculate WMC, a connection was found between *Auditory Working Memory* (AWM) and eye movements: children who had higher scores for AWM had a higher proportion of text fixations in all

prosodic conditions, with this relationship most pronounced in the happy condition and marginal for the rest. Further, AWM was also linked positively to the number of fixations made on the text in the neutral and angry conditions, with a somewhat weaker link in the happy condition. In regard to the amount of time spent dwelling on the text, AWM correlated positively with dwell time on the text in the angry condition, and negatively with dwell time on the image in the happy condition.

The AWM subtest required the children to first listen to strings of words and numbers mixed together and then to divide their attention between the words and numbers in order to repeat the list back to the examiner with numbers brought together in presentation order and the words brought together in presentation order (Woodcock et al., 2001). This higher-level ability to divide attention and focus it on one particular aspect of verbal information at a time may be the factor that allowed the children with higher scores for AWM to focus their attention to the presented text despite the presence of emotional distraction.

The *Memory for Words* subtest from the WJIII, which measures short-term auditory memory for lists of words, was negatively correlated with the number of fixations on the images in the happy condition. Taking this finding in combination with the negative relationship between AWM and image fixations in the happy condition, it appears that children's attention to and memory for what they hear, may play an important role in children's eye movements when read to in a happy tone of voice. While the children paid the least attention to the storybooks in the happy condition, within this decreased performance, increases in auditory working and short-term memory may have permitted the children to direct more of what attention they did pay to the storybooks towards the text.

In regard to the relationships between academic abilities and eye movements during shared reading, standardized scores on the *Early Reading Skills* (ERS) subtest from the

WIAT-III (Psych Corp, 2001) were positively associated with the proportion of text fixations in all of the prosodic conditions. This factor may account for the lack of an effect of grade on the children's eye movements, as in the current sample, there was no significant relationship found between grade and ERS scores; the children's variability in early literacy skills was not found to be directly related to grade. This may stem from a sampling artifact due the small sample size, individual differences, or be the result of more individualized education within the classroom setting.

The correlation between ERS and the proportion of text fixations coincides with the findings of Roy-Charland et al. (2007), showing that the attention children pay to the text during shared reading varies as a function of reading ability; when the book difficulty level was within a child's reading ability, the child paid more attention to the text. The books in the current study were designed to be at a grade 1 reading level so as to be within the reading skill level of the grade 1 children and to be easy reading for the grade 2 children. The children with higher scores for ERS, regardless of what grade they were in, would have found the books easier to read and would therefore have made a higher proportion of text fixations than children with lower scores. ERS also correlated positively with fixations on the text in the neutral, angry, and happy conditions, as well as with dwell time on the text in the neutral, angry, and character conditions.

Higher ERS scores were negatively correlated with fixation counts and dwell time on the images in the happy and character conditions, but not in the angry or neutral conditions. Again, these were the conditions with the poorest and/or most variable performance in terms of eye movements and comprehension. The edge provided by higher reading abilities may have been what permitted some of the children to better override the distraction of these emotional tones.

The final area of note in regard to relationships between academic abilities and eye movements was the positive relationship between higher scores for *Oral Discourse Comprehension,* and the fixation counts and dwell time on the text in the angry condition. This subtest is similar to the comprehension questions used during the current research, and measures the ability to derive meaning from verbally presented material (Psych Corp, 2001). The fact that good comprehension of oral discourse is related to the condition in which the children gave their best performance in regard to paying attention to the text provides yet more support for the concept of shared book reading as an oral language activity (Roy-Charland et al., 2007; Avram & Aviram, 2009). Rather than attention to the text increasing oral comprehension, it appears that good oral comprehension increases attention to the text.

Clinical Implications

The current study has implications for classroom teaching practices; if the tones of voice in which information is presented can affect children's attention to text and images during shared reading, it puts more pressure on teachers to maintain some focus on their tones of voice and vocal quality while teaching. The effects of prosody in teachers' voices may also extend beyond the teaching of literacy skills; as comprehension was also impacted by emotional tone, it is reasonable to assume that the understanding of other verbally-presented information may also be affected. Parents sharing reading with their children may also need to develop an awareness of the possible importance of their tones of voice.

The possible positive or negative influences of prosody on attention and comprehension may also extend into other realms, such as the dissemination of medical and/or public health information. Talk therapies of all kinds may potentially be enhanced or subverted by emotional tones. There may also be similar implications for more mundane areas such as marketing practices. The possibility of age-related differences on the influence

of prosody in speech communication may require different verbal delivery styles for different audiences that include attention to vocal tones as well as semantics.

Limitations and Future Research

The current study examined children's attention to printed text and images as a function of the emotional tones used in the narration, as well as their comprehension of the storybooks. This study did not, however, examine whether or not the children's fixations to the text matched the words as they were read. This creates the possibility that the children's enhanced comprehension of the presented material in the angry condition may simply be the result of their increased attention to the storybooks, using the images and perhaps occasional words to support the spoken storyline. The improvement in comprehension may be the result of focused attention to the oral language and have little to do with reading. Future research could examine this possibility by tracking the children's eye movements in regard to each word as it is being read, and comparing differences in meaningful tracking to differences in comprehension scores. Alternatively, the comprehension questions could be designed to require that the children visually recognize specific words presented in the text in order to answer correctly.

Another limitation for the current study was the small sample size; while not particularly small for an eye-tracking study (Roy-Charland et al., 2007; Evans & Saint-Aubin, 2005), the sample was too small to allow the exploration of any causal relationships between WMC and eye movements or reading comprehension during shared book reading. A replication study with a larger sample size could provide a more thorough analysis of any WMC-related effects on viewing behaviour during shared reading and comprehension for the material.

Further research in this regard could involve the use of more than one voice in the recordings to eliminate any possibility of the results relating to a particular quality of a single narrator's voice. It may also be beneficial to use a combination of male and female voices to add another natural element to the emotional tones. Providing a range of the intensity of emotion in each of the conditions may also lead to differences in eye movements and comprehension.

Conclusion

The use of expressive or emotional tones of voice is often suggested to enhance shared reading experiences with children. We hypothesized that this strategy could have positive and/or negative effects on children's attention to the text and images during shared book reading, as well as to their comprehension for the material. Specifically, negative emotions were anticipated to decrease both, and positive emotions were expected to be beneficial. The results showed that children actually performed best in both regards in the angry condition, and worst in the happy condition, contrary to our expectations. The gains in the angry condition were modest, but nonetheless provide lucrative opportunities for future research into the effects of emotional tone during shared book reading and other forms of oral communication.

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Table 1

Means of Proportion of time spent on the text, fixation counts, and dwell time as a function of prosody and grade

		Text				Image			
	Grade	Neutral	Angry	Character	Happy	Neutral	Angry	Character	Happy
Dwell	1	152.55	285.20	63.03	160.70	3844.73	4912.93	3930.85	4044.08
Time		(158.44)	(226.81)	(39.36)	(144.77)	(818.10)	(1336.02)	(873.57)	(867.16)
	2	1508.43	1476.06	1318.13	783.51	2794.46	3504.07	3602.76	2158.14
		(1508.36)	(1154.09)	(1243.70)	(730.97)	(1048.51)	(1807.51)	(1548.96)	(1468.92)
Number of	1	0.58	1.20	0.33	0.68	13.65	17.25	14.50	14.55
Fixations		(0.55)	(0.85)	(0.17)	(0.57)	(3.09)	(3.90)	(2.61)	(3.08)
	2	6.41	6.50	5.61	3.65	10.27	13.07	13.44	7.81
		(6.02)	(5.30)	(5.65)	(2.36)	(3.06)	(7.07)	(4.07)	(3.85)
Proportion	1	0.05	0.08	0.02	0.03	-	-	-	-
of time		(0.05)	(0.08)	(0.01)	(0.03)				
	2	0.31	0.31	0.27	0.32	-	-	-	-
		(0.28)	(0.25)	(0.25)	(0.23)				

Appendices

Appendix A. Home Literacy Questionnaire

HOME EXPERIENCES QUESTIONNAIRE
M. A. Evans, B. A. Levy & D. Jared, 2001

In research it is important to understand the background of participants so that findings from different studies can be put together and understood. Please complete the following questions concerning your family and your child who is in the study. Because some questions deal with things related to reading, the parent who is most familiar with the child's activities in this area should complete this survey.

Today's date:

year month day

*1. My child in the study is _____ , born on
(full name) year month day

He/she is in what school and grade?

*2. Circle who is completing the survey: Mother Father Both Other

(specify)

3. List the sex and age of each child in your household:

_____ _____

_____ _____

EMOTIONAL TONE AND SBR

*4. Circle which best describes your home:

Father single-parent Mother single-parent Joint custody Two parent

Other _____(specify)

*5. Place an X beside the highest level of schooling the child's caregiving mother has completed or is currently enrolled in:

_____ Elementary school

____ High school grade 10

____ High school grade 12 or 13

____ Community college

____ Undergraduate university

____ Post graduate school (eg., MA PhD, MD)

*6. What is her current occupation? _____

*7. Place an X beside the highest level of schooling the child's caregiving father has completed or is currently enrolled in:

_____ Elementary school

____ High school grade 10

____ High school grade 12 or 13

____ Community college

____ Undergraduate university

____ Post graduate school (eg, MA, Ph.D, MD)

*8. What is his current occupation? _____

9. Please place an X beside the category of your annual family income before taxes:

____ Under $16,000

____ Between $16,000-$26,000

____ Over $26,000-$40,000

____ Over $40,000-$55,000

____ Over $55,000-$70,000

____ Over $70,000-$85,000

____ Between $85,000-$100,000

____ Over $100,000

9. Circle how often your home gets a newspaper: Occasionally Once a week 2-3 a week Daily

11. Circle how many books adults in your

home borrow or buy in 6 months: 0 1-2 About 5 About 10 About 15-20 25+

*12. Circle roughly how many children's books you have in your home:

1-10 10-20 20-35 35-75 75-150 150-200 200+

*13. Circle how many days in a week an adult in your home typically manages to read with your child:

0 1 2 3 4 5 6 7

*14. On a day when an adult reads to your child at home, for how many minutes would this usually be?

Up to 10 min 10-20 min 20-30 min 30-40 min 40-50 min 50-60 min An hour+

*15. Circle roughly how many times you have read the following types of books with your child in the last 4 months as **Never; 1-3 times** (maybe once a month) ; **7-15 times** (maybe 2-3 times in a month), **20-30 times**

(maybe 1-2 times in a week) **40-60 times** (maybe 3-4 times in a week) ; **80 or more times** (about every day).

ABC /alphabet/letter sound books.....	never	1-3	7-15	20-30	40-60
	80+				
Books with poems or stories that rhyme.....	never	1-3	7-15	20-30	40-60
	80+				
Long "classic" children's books (eg., Black					
Beauty, Wizard of Oz, Harry Potter).....	never	1-3	7-15	20-30	40-60
	80+				
Chapter books (eg., shortened simplified					
classic books; Babysitters' Club).....	never	1-3	7-15	20-30	40-60

80+

Short illustrated children's storybooks (eg., Red

Riding Hood, Bernstein Bears)..... never 1-3 7-15 20-30 40-60

80+

Illustrated children's non-fiction books.....never 1-3 7-15 20-30 40-60

80+

Children's magazines (eg., Chirp, Chickadee,

Sesame Street Magazine)..... never 1-3 7-15 20-30 40-60

80+

16. For a variety of reasons, adults differ in how well they read. Circle how well the child's mother reads:

With considerable difficulty With some difficulty About average Above average skill

17. Circle how well the child's father reads:

With considerable difficulty With some difficulty About average Above average skill

18. Circle how old your child was when you first started to read to him/her:

Under 2 months 2-6 mo 7-11 mo 12-24 mo 2- 3 years 3 yrs 4 yrs or more

19. Circle how old your child was when you began to read to him/her for a half hour a week or more?

Under 2 months 2-6 mo 7-11 mo 12-24 mo 2- 3 years 4 yrs Not yet

EMOTIONAL TONE AND SBR

20. Circle how old your child was when you began to read to him/her for an hour a week or more?

Under 2 months 2-6 mo 7-11 mo 12-24 mo 2- 3 years 4 yrs Not yet

21. If you have had any concerns over your child's development, such as the way he/she talks, motor problems, hearing or vision difficulty, etc., please list them here.

22. Have you consulted a professional over these concerns? If yes, please describe

23. Has or is your child receiving treatment for these concerns? If yes, please describe.

24. What language or languages are used in your home?

25. What language does your child most easily understand?

26. Which language does your child most easily speak?

27. What is the language of books your child usually looks at or listens to at home? _____

28. If your child looks at/listens to books in other language(s)

from that in #27, list it (them) here:

29. When you read to your child, how often do you point to the pictures or illustrations?

Rarely on a few pages on most of the pages on almost all the pages

30. When you read to your child, how often do you direct your child's attention to the printed text?

Rarely on a few pages on most of the pages on almost all the pages

EMOTIONAL TONE AND SBR

We are interested in the literacy activities and materials children might or not be engaged in at home. Listed below are different activities We do not expect children would pursue all of them. Rate how often your child has been involved in each of them at home in the last four months. Then, if your child has been involved in the activity, rate the extent to which he/she initiates the activity verus being led to do so by you.

HOW OFTEN INVOLVED: Circle

1 if never

2 if rarely, maybe once a month

3 if from time to time; 7-15 times,or 2-3 times a month

4 if often; 20-30 times or about once/twice a week

5 if frequently; 40-60 times or 3-4 times a week

6 if frequently; almost every day or over 80 times

HOW INDEPENDENT IN PURSUIT : Circle

1 if always initiated/led by parent; never pursues on own

2 if primarily initiated/led by parent

3 if initiated by child and parent equally

4 if primarily initiated and led by child

5 if rarely initiated/led by parent/almost always pursues on own

1	2	3	4	5	6..... **doing word games (e.g., crossword, word find)**.....	1	2	3	4	5
1	2	3	4	5	6..... **watching you print notes**.....	1	2	3	4	5
1	2	3	4	5	6 .....**reading signs or labels**.....	1	2	3	4	5
1	2	3	4	5	6.....**educational games (Spill & Spell, Boggle, etc**.).....	1	2	3	4	5
1	2	3	4	5	6 .....**listening to books you read**.....	1	2	3	4	5
1	2	3	4	5	6..... **tracing or copying letters or words**.....	1	2	3	4	5
1	2	3	4	5	6.....**listening to storybook tapes**.....	1	2	3	4	5
1	2	3	4	5	6 ..... **looking at magazines/books**.....	1	2	3	4	5
1	2	3	4	5	6 ..... **learning letters sounds/word parts.....**.....	1	2	3	4	5
1	2	3	4	5	6 .....**visiting public library**.....	1	2	3	4	5
1	2	3	4	5	6 .....**playing computer games involving reading**.....	1	2	3	4	5
1	2	3	4	5	6..... **printing his/her name**.....	1	2	3	4	5
1	2	3	4	5	6 .....**using children's picture dictionary**.....	1	2	3	4	5
1	2	3	4	5	6 .....**watching educational t.v. (e.g. Sesame Street**).....	1	2	3	4	5
1	2	3	4	5	6.....**using alphabet books**.....	1	2	3	4	5

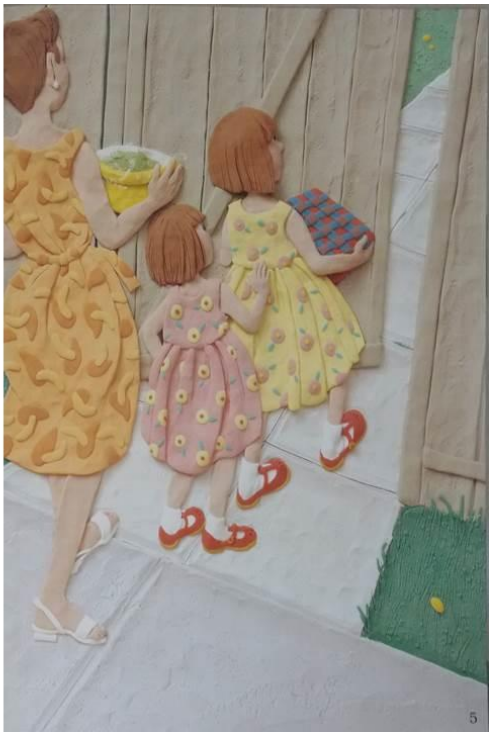
1	2	3	4	5	6.....**listening to rhyming words/rhyming stories /poems**.....	1	2	3	4	5
1	2	3	4	5	6.....**writing a note or little story**.....	1	2	3	4	5
1	2	3	4	5	6..... **reading out loud.**.....	1	2	3	4	5
1	2	3	4	5	6..... **spelling words**.....	1	2	3	4	5
1	2	3	4	5	6.....**playing with magnetic letters/letter cards**.....	1	2	3	4	5
1	2	3	4	5	6 .....**practising letter names, individual words**.....	1	2	3	4	5

Thank you for completing this survey.

Please seal it in the enclosed envelope, print your child's name on the envelope, and return it to your child's teacher.

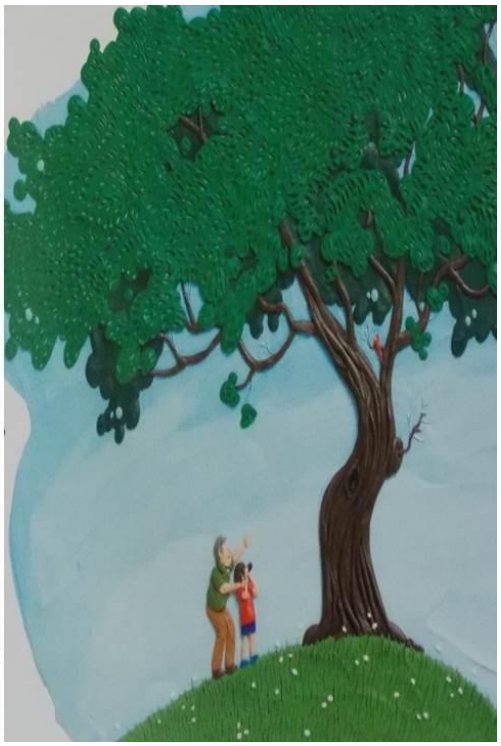
Appendix B. Sample page: We are going to a party

We bring picnic food and a blanket to sit on.



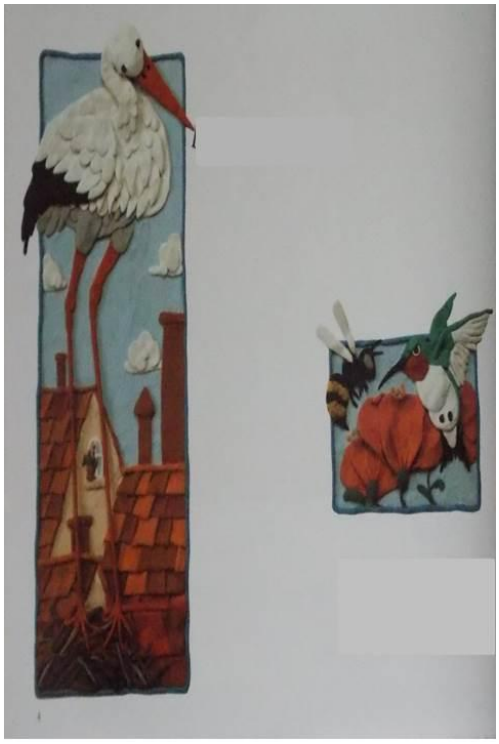
Appendix C. Sample page: Picture a tree

Trees can be very big!



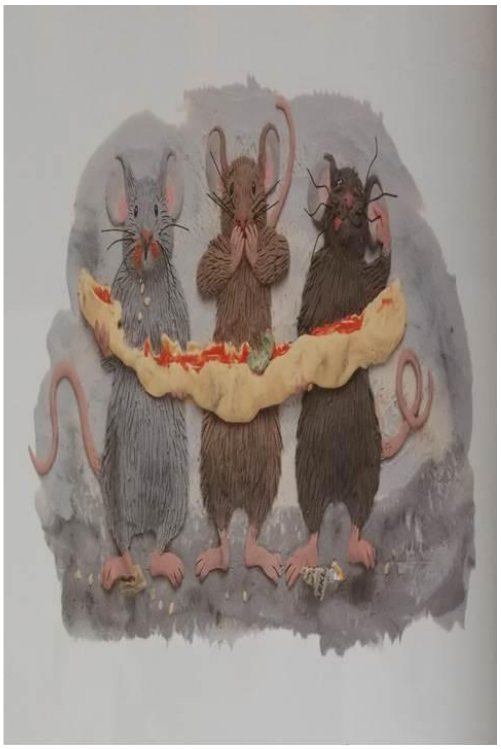
Appendix D. Sample page: Have you seen birds?

Some birds have long legs.



Appendix E. Sample page: The subway mouse

Max did not like the dark. So he left to find a new home.



Appendix F. Text from: We are going to a party

Page 1	We are going to a party. Mom helps my sister and me get dressed up.
Page 2	We bring picnic food and a blanket to sit on.
Page 3	My aunt gives me a kiss hello with her big red lips. Yuck!
Page 4	My cousins come over to say hi. Kate has a pretty new dress.
Page 5	We all want to play tag. Not it!
Page 6	We spin in circles until we are dizzy.
Page 7	Look at all of the yummy party food! I like meatballs the best.
Page 8	We hide under the table to eat cake and drink pop. Sweet!
Page 9	Then we hide from our moms. We do not want to go!
Page 10	Time for a sleepy ride home in the car. It was a very good day.

Appendix G. Text from: Picture a tree

Page 1	I love all kinds of trees.
Page 2	Or trees can be very small.
Page 3	Some trees stand alone.
Page 4	Trees look cold in the winter.
Page 5	Trees can look spooky. Can you see a face?
Page 6	Trees look pretty in the spring.
Page 7	I love all kinds of trees.
Page 8	It is fun to jump in the leaves too.
Page 9	A tree is a good place to just be me.
Page 10	

Appendix H. Text from: Have you seen birds?

Page 1	Have you seen birds?
Page 2	Some birds have long legs.
Page 3	Some birds feed worms to their babies.
Page 4	Some birds fly south for the winter. They do not want to stay in the cold.
Page 5	Some birds fly at night.
Page 6	Some birds live on a farm.
Page 7	Some birds are pets and live in a cage.
Page 8	Some birds live near the water.
Page 9	Some birds like to eat fish.
Page 10	The world is full of birds!

Appendix I. Text from: The subway mouse

Page 1	Max was a subway mouse. He lived in a subway tunnel.
Page 2	The subway tunnel was dark. And there were too many mice.
Page 3	Max did not like the dark. So he left to find a new home.
Page 4	His friend Lola went with him.
Page 5	They had a long way to go in the dark. It was scary.
Page 6	A big mean rat saw them. “Stop!” he said, “Give me your food!”
Page 7	“No way!” Max and Lola ran away fast.
Page 8	At last they came to the end of the tunnel
Page 9	They danced under the moon with joy.
Page 10	And made a happy new home.