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Young Children's Knowledge about the Role of Print in Reading
by
Molly Farry-Thorn

A dissertation presented to
The Graduate School
of Washington University in
partial fulfillment of the
requirements for the degree
of Doctor of Philosophy

December 2019
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Molly Farry-Thorn

Washington University in St. Louis

December 2019

Dedicated to my grandparents who have always supported and loved me.

ABSTRACT OF THE DISSERTATION

Young Children's Knowledge about the Role of Print in Reading

by

Molly Farry-Thorn

Doctor of Philosophy in Psychological and Brain Sciences

Washington University in St. Louis, 2019

Professor Rebecca Treiman, Chair

Children begin to learn about the print in books and the role it plays in reading well before the onset of formal literacy instruction. Young children's knowledge about precisely what readers are reading when they read books and who is able to read books has been studied primarily through interviews, but conclusions from this research are limited by methodological concerns. Three experiments examined whether pre-readers understand what part of a book is read and whether they distinguish between the skill of reading and the activity of reading. Although pre-readers were typically able to locate the print in a book, they appeared to still be learning that it is the print, not the pictures, that a reader reads. Pre-readers were knowledgeable about who has the ability to read, but many also indicated that the activity of reading does not require the ability to read. The results suggest that teachers and parents should not be careful not to overestimate the knowledge about print and reading that children acquire through everyday exposure to books.

Chapter 1: Introduction


Learning to read is important not only for academic achievement but also for acquiring knowledge in other domains and later occupational opportunities (Mol & Bus, 2011). Being able to read early and well also leads to earlier and more frequent print exposure which further facilitates growth (Lonigan, Burgess, & Anthony, 2000). But learning to read requires that children be taught and acquire the component early literacy skills. Research suggests that the literacy skills that children develop before formal schooling are the foundation required for learning more complex skills and improving reading ability (Duncan et al., 2007; Lonigan, Schatschneider, & Westberg, 2008; Wagner et al., 1997; Whitehurst & Lonigan, 1998). There is significant continuity between children's abilities during preschool and their later reading skills (Duncan et al., 2007; Lonigan et al., 2008). For example, a meta-analysis of six longitudinal data sets found that reading-related skills when children enter school, such as letter knowledge, predict reading skills later in elementary school (Duncan et al., 2007). Research has explored a variety of skills and knowledge that serve as precursors to literacy. For example, a large amount of work has focused on children's phonological awareness, which is the ability to detect and manipulate rhymes, syllables, and phonemes (for meta-analyses, see Bus & van IJzendoorn, 1999; Castles & Coltheart, 2004; Lonigan et al., 2008). Another domain that has received attention over the past five decades, and the area of interest in the current studies, is children's knowledge about book reading.

Specifically, the present three studies that comprise this dissertation examine pre-readers' knowledge about what readers read when they read books as well as who is able to read books. Children begin learning about the role print plays in reading well before the onset of formal literacy instruction (e.g. Gettinger & Stoiber, 2014; Hiebert, 1981; Justice & Ezell, 2001;

Lonigan et al., 2008) and this knowledge has been found to be a predictor of later literacy skills (Lonigan et al., 2008; Storch & Whitehurst, 2002; Whitehurst & Lonigan, 1998). In order to learn about the role of print in reading, children must first learn about the appearance of print and how print conveys meaning. The first section below will summarize the existing research on young children's knowledge in those areas. Past research has frequently examined children's knowledge about written words and how they are linked to spoken language as well as whether young children understand how words represent meaning. The second section will cover the smaller amount of research that has examined what young children who cannot read know about the role written words play in reading. As children are learning about what part of a book is read, they are also learning about who has the ability to read books. The third section will examine what children know about who has the ability to read books and whether children distinguish between the ability of reading and the activity of reading. Although what children know about what readers read and who is able to read has been studied for over half a century, the present studies aim to address gaps in our understanding of what pre-readers know about these concepts.

Early Knowledge About the Appearance and Function of Print

Before children can understand the role print plays in reading, they must develop knowledge about writing that includes both what it looks like, its outer form, and how it symbolizes meaning, its inner structure. Initially, children may think that writing functions like the symbolic system most familiar to them – drawing. Although the distinctions between the systems of writing and drawing are clear to adults, children may confuse them. For example, young children sometimes seem to confuse the functions of the two systems when they say that they “read” pictures (Ferreiro & Teberosky, 1982) or “draw” their names (Robins & Treiman, 2009). Broadly, the two systems are similar in outer form in that they both rely on making marks

on surfaces. There are also similarities in the inner structure of the systems, in that they serve as symbols used to represent and convey meaning. These similarities, and children's familiarity with drawing, may cause children to initially conflate the two systems. However, there are crucial differences in both their appearance and functions (DeLoache, 2010). For example, writing is often composed of small black marks, whereas drawings are generally larger and more colorful. Writing and drawing also differ in their symbolic function. Specifically, writing is glottographic – instead of representing meaning directly, the characters of writing represent language (Justice & Ezell, 2002; Roberts, 1992). The written word <envelope> derives its meaning from the fact that it is a set of graphic signs that stand for specific units of a language, the sounds that make up the word. In order to interpret the written marks, one must know the English writing system and the correspondences between letters and sounds. The drawing , in contrast, looks like the referent and derives its meaning from the similarities between its form and its referent. Although children may know that writing stands for something, they must learn that it stands for language and that it does so differently than drawings.

The appearance of print. Research on young children's knowledge about writing and how it differs from drawing has generally focused on their knowledge about the outer form. Some researchers have examined young children's abilities through perceptual tasks in which children distinguished between writing and drawing based on characteristics such as linearity and size (e.g., Lavine, 1977), while others have examined children's productions when asked to write and draw (Levin & Bus, 2003; Otake, Treiman, & Yin, 2017; Treiman & Yin, 2011). These studies have found that, before formal literacy instruction begins, many children are already familiar with many visual characteristics of writing. For example, pre-readers frequently understand that writing tends to be laid out in lines, that the same written element (e.g., letter)

tends not to appear multiple times in a row, and that writings tend to be smaller than drawings (e.g., Otake et al., 2017; Puranik & Lonigan, 2011). Young children also make distinctions in their own productions of writing and drawing. For example, Otake et al. (2017) found that, before 3 years of age, children are more likely to use a single implement when writing than when drawing and that they create smaller writings than drawings, on average. Importantly for literacy development, children's early knowledge about the characteristics specific to writing has been found to predict both the skills that precede reading and conventional literacy skills (Puranik, Lonigan, & Kim, 2011; Storch & Whitehurst, 2002; Whitehurst & Lonigan, 1998).

In addition to knowing about some of the broad visual patterns of writing, many US preschoolers are also familiar with the letters and may even know the specific names and shapes of some alphabet letters (e.g., Phillips, Piasta, Anthony, Lonigan, & Francis, 2012; Puranik, Petscher, & Lonigan, 2014). Children must also learn that letters are grouped together to form words. A few studies have examined young children's knowledge about written words. For example, Homer and Olson (1999) used a task in which children were shown a written phrase and asked to "count the number of words." They did not statistically analyze the results of this task, but they reported that most of the 36 children, ranging in age from 4;0 to 7;2, answered correctly – except for a few children who counted the letters. Although not mentioned by these researchers, accurate performance on this word counting task requires children to know that the term *word* refers to a group of letters separated by spaces from other groups of letters and not the individual letters that make up the words. The children who counted the letters either did not know what the label 'word' refers to or incorrectly believed that the label 'word' can refer to letters. This task also required children to be able to segment the print into individual words. It is possible that the children who counted letters did so because they had not yet learned how to

identify individual words in a line of text. Although there are spaces between words, they are small and may not be salient to a non-reader. Studies of children's understanding of words in spoken language have found that reading ability and awareness of word boundaries are related (e.g., Bowey, Tunmer, & Pratt, 1984; Chaney, 1989). These findings suggest that children may need to have early reading skills before they can successfully segment written words.


Other research that has examined children's knowledge about written words did so while studying children's knowledge about reading in the context of storybooks (Justice, Bowles, & Skibbe, 2006; Justice, McGinty, Piasta, Kaderavek, & Fan, 2010; Justice & Ezell, 2001). The Preschool Word and Print Awareness (PWWA) measure contains 12 questions that tap children's knowledge about words in the storybook *Nine Ducks Nine* (Hayes, 1990). To initiate the PWWA, children are told that they will read a book with the experimenter and will need to help the experimenter read. On the first two-page spread of the storybook children are prompted "Show me just one word on this page." In one study of 30 4-year-old children, only 10% of children responded correctly to this question (Justice & Ezell, 2001). The authors noted that they observed that most of the other children either pointed to just one letter or ran their finger along all words on the page. On the three questions requiring children to identify the number of words in a string of words, less than half of the children responded accurately. The authors reported that the children who did not respond correctly counted letters, not words. These results again suggest that young children do not fully understand the difference between the terms 'letter' and 'word'. However, as mentioned earlier, it is also possible that children perform poorly because they have not yet learned how to segment print into individual words. Each question in the PWWA requires children to not only know that words are the units of written language but also to isolate each unit of print. Another possible explanation for children's poor performance on the counting tasks

is that 4-year-old children vary in their number knowledge and ability to count (Sarnecka & Carey, 2008). Because of how these tasks testing knowledge about words were designed, it remains unclear what young children know about how words make up written language. For example, it is possible that children who cannot isolate a single word in a book could successfully locate the words if the task did not require them to isolate or count individual words. Children may know that print is made up of something called words before they learn how individual words make up print. Experiment 1 of this dissertation was designed to address the question of whether pre-readers can successfully locate letters and words in a book if the task does not require them to isolate or label individual letters and words. Instead, children were shown two book pages at a time, one with print on it and one with a picture on it, and asked which page had letters or which page had words.

The function of print. Although children begin learning about the outer form of writing from an early age, and how its appearance differs from pictures, their knowledge about the differences in the inner structure of the two systems appears to develop more slowly. Children must learn how print symbolizes language and not assume that there is a physical correspondence between the way a word is written and its referent. In alphabetic systems, letters denote phonemes, so the mapping from words to meanings is through phonemes. Children must learn that words that have more sounds need more letters to represent those sounds. However, before children understand the relationship between letters and written words, they may believe that written words represent meaning similarly to how drawings represent meaning.

Experimental evidence that children first believe writing functions similarly to pictures comes from analyses of the size of children's writing productions. Treiman, Kessler, Decker, and Pollo (2016) found that children who did not correctly use letters to represent the phonemes of a word

in their spelling, called *prephonological* spellers, used on average more written elements to write plurals than to write singulars. These same children did not use more written elements for two-morpheme words than one-morpheme words when the additional morpheme did not correspond to an increase in quantity (e.g., *buying* vs, *buy*). The authors therefore concluded that these children were using more elements for words that refer to more than one object than for words that refer to a single object. Research has also found that prephonological spellers write significantly larger productions for words representing large objects than those representing small objects (Zhang & Treiman, 2015). Together, these results suggest that young children sometimes use drawing-like features to represent the meaning of words when writing. This is consistent with the idea that young children do not readily conceive of writing as a representation of phonological structure, either phonemes or syllables (Byrne, 1996). Instead, young children attend to the object that a word represents, and they do not fully grasp how writing conveys meaning.

As children learn how print symbolizes language and that spoken and written language are made up of words, they must learn that writing represents specific units of a language. The drawing  could be labeled as either *envelope* or *mail*, whereas the written word <envelope> always stands for the spoken word *envelope* and not any related words, such as *mail*. One theory of how children's knowledge about the differences between print and pictures develops is based on interviews with young Argentinian children (Ferreiro & Teberosky, 1982). These researchers suggest that children go through four stages of understanding the relationship between picture and print. In the first stage, children do not differentiate between the two and they expect text and picture to represent the same meaning. At this stage, children indicate that both print and pictures can be read. This belief is not surprising given children's early experience with books.

The pictures in storybooks are usually referenced by the print, and therefore it could appear to a child that a reader is reading the pictures. In the second stage, children distinguish between the two symbolic systems, but they expect text to only represent information about the accompanying picture. Only in the third stage do children begin paying attention to information that print can provide, such as noticing specific letters. However, they still rely on the pictures to make predictions about the meaning the print conveys. Finally, in the fourth stage, children understand that the print is not entirely predictable from the picture and use their knowledge about letters and words to predict the meaning of print.

One experimental task that examines young children's knowledge about the connection between written and spoken words is the moving word task (Bialystok, 2000). In this task, a printed word such as <horse> is placed under a picture of a horse and identified as meaning 'horse'. If the word is then moved under the picture of a car, young children frequently incorrectly report that the word now says "car" (Bialystok, 2000; Bialystok & Martin, 2003). In a study of 3- to 5-year-olds, 3-year-olds correctly reported what the moved word said on only 3% of trials, 4-year-olds were correct on 44% of trials, and 5-year-olds were correct on 51% of trials (Bialystok, 2000). These results suggest that even as children turn 5-years-old and begin to read—presumably, because these children were not given a reading test—they do not fully understand that written words represent unchanging meanings and are not influenced by any accompanying picture.

A more recent study tested the hypothesis that children might demonstrate a better understanding of how spoken and written words correspond when the written words are not accompanied by pictures, as they are in the moving word task, but rather presented in isolation (Treiman, Hompluem, Gordon, Decker, & Markson, 2016). In this task children viewed either a

printed word or a drawing and were told what the word said or what the drawing was. In both conditions, a puppet that had not heard the original label then labeled the word or drawing. The puppet used a new label that was also appropriate for the object represented by the word or drawing. For example, the puppet said “dog” for a word or drawing that the experimenter had labeled as “puppy”. Children were then asked whether the puppet was correct in his labeling. Children ranging in age from 3;0 to 5;7 were less likely to say that the puppet was correct in the writing condition than in the drawing condition. This result suggests that children have some knowledge of the fact that a written word stands for a specific spoken word, whereas a picture can be flexibly labeled in more than one way. Although these children could not read, it appears that they have some knowledge about the distinction between how words and pictures represent meaning. The results of this research suggest that children begin learning about how print represents language before they themselves can derive meaning from print. Developing this understanding of how print functions is likely an important part of learning that print, and not the pictures, are what a reader reads.

Early Knowledge About the Role of Print in Reading

At some point in their literacy development children must discover that written words allow for reading. Very little research has examined when children develop an adult-like understanding that words are required for reading to occur. There is anecdotal evidence from informal interviews that young children believe that pictures can be read (e.g. Ferreiro & Teberosky, 1982; Strommen & Mates, 1997). Early studies of young children’s knowledge about the role of print in reading relied on children answering open-ended questions. For example, in one study 78 children aged 3-5 were asked questions such as “What is reading?” and “What do people do when they read?” (Oliver, 1975). Oliver reported that most children said, “I don’t

know" or shrugged their shoulders in response to those questions. Reid (1966) and Downing (1970) asked British children around the age of 5, who had just begun formal school, "What is in books?" and found that no children mentioned words and only 2 of the total 25 children interviewed in the two studies said writing. The 13 children in Downing's study were also asked what part of a book their parents read, one child said the words, three children said the pictures, and the other children did not know. Children were then shown a storybook and asked again what part their parents look at—six of the 13 children then pointed to the print. From this, and other questions in the interview, Downing concluded that although including concrete aids helps children interpret questions about print and improve their performance, many of these children had not yet understood the role of print in reading.

In another study that examined young children's knowledge about which part of a book is read, Hiebert (1983) showed 60 U.S. children aged three to five a series of books that differed in whether print and pictures were present. Children were then asked whether a particular book could be read by someone who could read and why. To get the highest score in this task, children had to reference writing or words as the reason a page can or cannot be read. Children received fewer points if they correctly identified whether a page could or could not be read but did not explain why. Performance was reported in percentages for each type of book. Three-year-olds answered correctly and provided a correct explanation for why the book can or cannot be read on average 47% of the time for a blank book and 48% of the time for a book with only text. By the age of five, children were very accurate with the blank book and the book with only text. Five-year-old children answered correctly and provided a correct explanation for why the book can or cannot be read on average 92% of the time for the blank book and 95% of the time for the book with only text. Three-year-old children performed poorly with a book with only pictures—they

only answered correctly and provided a correct explanation for why the book could not be read 8% of the time. Although performance improved with age, the five-year-old children only answered correctly and provided a correct explanation for why the book with only pictures could not be read 65% of the time. Performance was also fairly low for a storybook with both pictures and text, with five-year-old children answering correctly and identifying the critical information for why the book could be read 70% of the time. Because Hiebert (1983) did not distinguish between correct answers and correct reasons when reporting the results of this study, it is unclear whether poor performance was due to children being incorrect or being correct but not articulating a correct reason for their choice. This raises a methodological concern common in previous studies that rely on interviews – the questions often require advanced verbal skills. Young children often gain knowledge before they develop the ability to express that knowledge verbally. For example, even if these children knew that a book with only pictures cannot be read, they might not have been able to explain why. The present studies aimed to characterize children's very early knowledge about the role of print in reading. Therefore, the tasks were designed in a way that did not require children to explain their reasoning when answering questions or to have advanced verbal skills.

One study has examined the development of children's knowledge about the role of print across a year of preschool. Munn (1995) conducted a study in which 56 Scottish children had an unfamiliar storybook read to them and then were asked to "point to where I read the story from". At the beginning of the school year the mean age of the children was 3;10, and only 12 of the 56 children pointed to the print. At the end of the year the mean age of the children was 4;7 and 27 of the 56 children pointed to the print. Around half of the children had developed some

awareness of the role of print in reading before they entered formal schooling, and presumably before they had learned to read.

More recent research on young children's knowledge about the role of print in reading comes from studies using the PWPA. The PWPA includes one question that asks children to identify what part of a book is read (Justice, Bowles, & Skibbe, 2006; Justice & Ezell, 2001). On the second page of the storybook, children are asked, "Where do I begin to read?" The illustration spreads across the two pages and the right page has four lines of text at the top. Children receive 1 point for pointing to the print and 2 points for pointing to the first word. In one study of 30 4-year-old children, only 23% correctly pointed to the first word (Justice & Ezell, 2001). In a larger study of 128 of 3- to 5-year-olds, only 13% correctly pointed to the first word (Justice et al., 2006). The authors do not report where the children pointed when they were incorrect and therefore, it is unknown whether they pointed to another part of the print or to the illustration. Additionally, to answer the question correctly children had to identify the first word on the page and, as discussed previously, young children may have difficulty isolating a single unit of print.

There are several other methodological concerns that are common in the previous research that uses the PWPA or interviews to examine children's early knowledge about the role of print in reading. One concern is that interviews often have asked only one question per topic of interest. Therefore, some of the children who answered correctly may have just guessed correctly and would have answered differently if asked multiple times. Because past research has typically relied on one question per topic, it is unknown whether multiple trials are needed to accurately assess a child's knowledge. Additionally, including multiple trials allows for informal assessment of a child's certainty. For example, if children respond inconsistently to repeated

questions about a topic of interest it may suggest that they are still in the process of understanding that topic. Therefore, in the present studies multiple trials were included for each research question. Another drawback to only asking the question once in the PWPA is that the location of the print could not be varied. For example, it is possible that if the print had been on the left page more children would have answered correctly. Another limitation of all the studies covered in this section is that they do not assess a child's reading ability. Therefore, it is unknown if reading skill accounted for the differences in knowledge across children. For example, it may be that the children who correctly identified why a book with only pictures cannot be read or where an adult begins to read knew the correct answer because they knew that print is what they themselves read. To address this concern, children in the present studies were screened for reading ability.

Perhaps it is not surprising that young children do not have a completely correct understanding of reading and the function of print, given the nature of children's exposure to books during shared book reading. In many U.S. households parents regularly read books with their children. For example, 81% of parents in a nationally representative sample of over 8,000 households reported reading at least three times a week to children 3–5 years of age (Snyder, de Brey, & Dillow, 2019). However, a study of 130 2- to 5-year-olds found that during shared book reading these children's parents primarily talked about the narrative and the pictures in a book and rarely about the print (Hindman, Connor, Jewkes, & Morrison, 2008). On average, 15% of remarks by parents and children referenced the print, but this ranged from 0% to 90% across families. Price, van Kleeck, and Huberty (2009) found that on average, 6% of parents' utterances during book reading with 3- and 4-year-olds referenced the print or book conventions, such as references to the author or that the message is conveyed by the print. Print or book conventions

were only referenced in 6% of children's utterances, on average (Price et al., 2009). Eye-tracking studies have also shown that 4- and 5-year-olds spend most of their time looking at the pictures during shared book reading (Evans & Saint-Aubin, 2005; Justice, Skibbe, Canning, & Lankford, 2005). Specifically, 3- to 5-year-olds often look at the picture of the object being named by the reader (Luke & Asplund, 2018). These results suggest that young children prefer to look at pictures over print and visually track the pictures that are referenced, not the printed words. In addition to the fact that adults do not typically draw attention to the written words they are reading, print is generally less visually salient than the pictures in children's books. An examination of U.S. children's books found that pages are more likely to include pictures than print and that the area covered by print is almost always smaller than the area covered by pictures (Treiman, Rosales, & Kessler, 2016). Additionally, the pages with print usually also include pictures. These characteristics of books make it particularly difficult for a child to know which part of the book an adult is looking at while reading. Even if the child is trying to track the gaze of the adult, the proximity of the print and pictures may mean that the child cannot discern exactly where the adult is looking. Because of the nature of children's books and how adults read these books, pre-readers may not pick up that it is the words that are read and not the pictures.

Despite the limitations of the studies covered in this section, the overall results suggest that young children may not yet understand an important distinction in the function of print and pictures: that print can be read while pictures cannot. Many children may think that pictures are read by those who can read, or they may think that anything printed in a book can be read. Pre-readers must rely on pictures to gain information from a book, and it is possible that they conceptualize that process as a form of reading. Experiments 1 and 2 of this dissertation were designed to address the question of whether pre-readers know what readers read when they read

books. The studies were also designed to address the three methodological concerns raised in this section: past studies have not assessed children's reading ability, past interviews have often had only one question per topic, and these interviews often required children to have advanced verbal knowledge.

Early Knowledge About Who Has the Ability to Read

While children are learning about what part of a book is read, they are also learning more generally about reading—including what the activity looks like and who has the ability to read. Children must understand that reading is a skill that must be learned, and they must learn who has this skill and is therefore able to read books. There is little research on what young children know about their own and other people's reading abilities. The research that does exist relies on interviews and, as in previous studies that have examined children's knowledge about the role of print in reading, one concern common to all of the studies covered in this section is that they rely on one question per topic of interest. This means that it is hard to detect both how certain a given child is in their knowledge as well as whether a child who answers correctly was simply guessing and got lucky. For example, Reid (1966) and Downing (1970) asked a total of 25 children "can your mummy and daddy read?" and found that 20 children said yes. However, some of these children might have responded differently if asked about the reading ability of a variety of adults. As mentioned earlier, in the present studies multiple trials were included for each research question.

An additional methodological concern with studies that rely on interviews is that some investigators have reported that young preschoolers show a bias to answer "yes" to yes-no questions that are asked by adult experimenters (Fritzley & Lee, 2003; Okanda & Itakura, 2010). Children may be inaccurate in reporting their knowledge because of a bias to respond "yes" to

the experimenter's questions. A final methodological concern with previous studies is that young children tend to overestimate their own knowledge. For example, 4- to 5-year-old children are more overconfident in their knowledge about objects and colors than 7- to 8-year-old children (Hagá & Olson, 2017). When asked about their reading ability, preschool-aged children may be inaccurate because of their tendency to overestimate their skills. To address these potential problems in the present studies when children were asked yes-no questions a task was included in which both "yes" and "no" were correct answers and children were only asked about the abilities of others.

There is mixed evidence about whether pre-readers can correctly evaluate their own ability to read. Two older studies found that 3- to 5-year-olds were highly accurate at reporting their own reading ability. Reid (1966) and Downing (1970) interviewed a total of 25 British children around the age of 5 who had just entered formal schooling, and found that 22 were able to accurately report whether they could read. In a study of 60 3- to 5-year-olds in the U.S., children were given a page of text and asked to read the secret message (Hiebert, 1983). Only four children incorrectly said they could read when they could not. There is some evidence that children improve in their ability to correctly evaluate their own reading ability as they get older. A study that followed 56 Scottish children across a year of preschool found that at the beginning of the school year (mean age 3;10) 24 children said they could read but at the end of the year (mean age 4;7) only 7 children said they could read (Munn, 1995). Munn concluded that almost all of the children had come to understand that reading was something they had yet to learn. As discussed above, it is also possible that as the children got older, they had less bias to say yes and were less likely to overestimate their abilities.

A larger study asked 178 U.S. preschoolers aged three to five how they felt about reading (Mason, 1967). All the children were asked “Do you like to read?” and 87% of them said yes. After interviewing about half the children, the researchers realized these children were saying they like to read but some of them were spontaneously adding that they didn’t know how. Therefore, they asked the remaining children who said they liked to read “Can you do it all by yourself?” The researchers report that around 90% of those children said yes. It appears that most of the children they asked believed they could read and that they like doing whatever it is that they define as reading. Because Mason (1967) did not report what percentage of these children actually could read, it is unknown exactly how accurate they were. However, because they were preschoolers, the percentage of readers would not be as high as 90%. Mason’s finding that children incorrectly evaluate their own reading ability may be due in part to methodological concerns discussed above, including children’s bias to say yes as well as their tendency to overestimate their knowledge.

A third explanation for why Mason (1967) found that so many children said they can read by themselves is that they may see the activity of engaging in reading as different from the ability to read. Young children may consider looking at a book to be reading, in which case reading would be something they can do by themselves without needing to know how to read. One piece of evidence that young children may consider looking at a book to be reading comes from studies that examined young children’s behaviors when they are asked to read. When Sulzby (1985) asked preschool children ranging in age from 2;5 to 4;11 to read to an experimenter, she found that a number of children first responded by silently paging through the book. These children may believe that the behavior of looking at the pages of a book constitutes reading. Across the age range studied, a few children would “read” by pointing to the pictures in

the book and naming them. For these children, labelling the pictures appeared to constitute reading. Strommen and Mates (1997) and Munn (1995) also reported that some of the three-year-old children they interviewed demonstrated reading by silently turning pages or pointing out pictures. Because the authors of all three of these studies did not report the exact number of children who engaged in these behaviors, it is impossible to know exactly how common it was. Nevertheless, these results suggest that some young children may believe that the activity of reading is independent from the ability to read.

Further evidence that young children distinguish reading ability from the activity of reading comes from Munn's (1995) longitudinal study. As discussed earlier, at the beginning of the year 24 of the 56 children said they could read, and 44 children indicated that the picture is what a reader reads. At the end of the year only 7 of the 56 children said they could read but 29 of these children still indicated that the picture is what a reader reads. Munn therefore concluded that, for some children, the understanding that they cannot engage in reading developed before they understood what the ability to read requires. Over the course of the year, some children had learned that they could not read but they still did not know precisely what the skill of reading required. These results suggest that, before children know what the complex skill of reading requires, they may believe they can engage in the activity of reading.

As discussed in the previous section, how adults talk about books while reading to children may influence children's knowledge about reading. Parents may also influence their child's knowledge about reading through everyday conversation. Research on parent-child conversations has found that parents and children sometimes discuss literacy-related matters such as reading processes or the conventions of writing (Treiman, Decker, Robins, Ghosh, & Rosales, 2018). In this study, several conversations between parents and children were

transcribed from the time when children were 1;2 until they were 5;2, as they went about their daily activities. Informal analysis of these conversations shows that parents ask children under the age of 5 if they are reading when they are looking at a book. These types of interactions may lead pre-readers to believe that they are engaging in reading when they are looking at books. Similar analyses that have examined how parents discuss writing with their children ages 1;6–5;0 found that parents support their children’s attempts at writing and rarely say that children are unable to write (Robins & Treiman, 2009). Instead, they encourage their children to engage in the activity of writing, regardless of ability. These interactions may lead pre-readers to believe that the ability to read or write is not necessary to engage in the activity of reading or writing.

The results of the studies discussed above suggest that, as U.S. children reach the age of entering kindergarten, they have developed some knowledge about writing and reading but they may not fully understand the role of print in reading or who is able to read. Considered together, the results discussed in this section indicate that pre-readers may have a definition of reading that does not require the ability to read. Pre-readers may nevertheless know who has the ability to read. However, methodological concerns including children’s bias to respond yes to yes-no questions, their tendency to overestimate their own abilities, and that interviews often include only one question for a topic of interest make it difficult to form a conclusion. Experiment 3 of this dissertation was designed to address the question of whether pre-readers know who has the ability to read books. Experiment 3 also examined whether pre-readers believe the ability to read is required in order to engage in the activity.

The Present Studies

The present studies were designed to address several questions about children’s knowledge about what readers read when they read books and who is able to read books. The

first question was whether pre-readers understand what part of a book is read. Before this question could be addressed, it was necessary to establish whether pre-readers can successfully locate letters and words in a book if the task does not require them to isolate or label individual letters and words. Therefore, Experiment 1 used a book in which each two-page spread had a picture on one page and print on the other. Children were asked to indicate which page had letters or which page had words. To address the question of whether children know that it is these words that are read, pre-readers in Experiment 1 were also asked to identify what part of a book can be read, choosing between a page with print and a page with a picture. If pre-readers indicate that they know that letters and words are present in a book but still indicate that the picture is what is read, this would suggest that children must learn more about how print represents language before they understand the role it plays in reading. To further address this question, Experiment 2 used a book that contained blank pages, pages with only a picture, pages with only print, and pages with both a picture and print. Experiment 2 investigated whether pre-readers know that printed marks must be present for reading to occur and are just confused about which marks can be read. Pre-readers may know that a blank page cannot be read but they may be less certain about whether a page with only print or a picture can be read.

The final two questions concerned whether pre-readers know who has the ability to read books and whether they distinguish between the skill of reading and the activity of reading. To address these questions, Experiment 3 examined whether pre-readers believe animals and adults are able to read books and whether they believe animals and adults can engage in the activity of reading. Together the three studies tested the hypothesis that despite pre-readers having general knowledge about print, they are still developing the awareness that reading is more than just looking at a book and that it requires print.

Chapter 2: Identifying Print in Storybooks and its Role in Reading

Prior studies investigating what young children know about the role of print in reading have predominantly relied on interviews (e.g. Downing, 1970; Ferreiro & Teberosky, 1982; Oliver, 1975; Reid, 1966). These researchers have asked children questions such as “What is in books?”, “What is reading?”, and “What do people do when they read?” These latter two questions are difficult for even an adult to answer, let alone a child, and therefore it is not surprising that these studies find that children do not understand what reading is. Children appear to demonstrate more knowledge in interviews when they are asked questions about the role of print in reading while looking at books with the interviewer, although this has not been examined statistically (e.g. Downing, 1970, Hiebert, 1983; Strommen & Mates, 1997). However, as discussed earlier, the conclusions that can be drawn from the results of these studies are limited due to several methodological concerns. The interviews typically rely on one question for each topic of interest and the knowledge children can demonstrate in these interviews is limited by their ability to express themselves verbally. Therefore, the tasks in Experiments 1 and 2 were designed tasks to examine what children know about the print in books and what they understand about the role of print in reading books that did not require children to explain their answers and asked multiple questions per topic of interest.

2.1 Experiment 1

The main objective of Experiment 1 was to address the question of whether being able to identify letters and words in a book means that pre-readers know that it is this print that allows for reading. In order to address this question, it was necessary to establish first whether pre-readers can distinguish letters and words from the pictures in a book. Although words are required for reading, U.S. children are explicitly taught about the visual appearance of letters

before they are taught about how letters make up words (Piasta, Purpura, & Wagner, 2010). Previous studies that have examined children's knowledge about written words have reported mixed results. Homer and Olson (1999) reported that most of their sample of children 4;0 to 7;2 could count the number of words in a phrase, but some children did count letters. Justice and Ezell (2001) found that their sample of 4-year-olds had difficulty pointing to just one word or counting the number of words in a string. They also reported that many children counted the letters. Although these past studies did not assess reading ability, it is likely that most of those 4-year-olds could not read. Therefore, the expected outcome was that pre-readers in the present study would be able to correctly locate letters. Although the results of past research could be taken to mean that children do not understand the difference between the terms 'letter' and 'word', it is also possible that children have difficulty counting or segmenting print into individual words. Therefore, in Experiment 1 the plural terms *letters* and *words* were used because it was expected that they would result in better performance than in tasks where children are asked to isolate or count individual letters or words.

Returning to the main objective, Experiment 1 aimed to address the question of whether children know that it is the words in a book that are read. The finding that only 23% of 4-year-old children correctly answered the question in the study of Justice and Ezell (2001) that asks where a reader begins reading suggests that many children do not understand that the words in a book are used for reading. However, as mentioned earlier, to answer the question correctly children had to identify the first word on the page. Only 13% of those same 30 children responded correctly when asked to point to the first word on the page (Justice & Ezell, 2001). It is therefore possible that the low performance on the question about where to begin reading may have been due to an inability to isolate the first word on the page. Because the researchers did

not report the behavior of the children who answered incorrectly, it is unknown whether the remaining 77% of children pointed to another part of the print or to the picture. In Experiment 1, instead of asking specifically where reading begins, children were asked which page can be read – a page with print or a page with a picture.

Experiment 1 was designed to address the methodological concerns of previous research raised in the previous sections. Instead of including only one item measuring children's knowledge about where reading occurs in a storybook, this study included multiple trials. Because there were multiple trials for each question asked, the side the text was on could be alternated, helping to control for a child's preference to point to one side. Additionally, by using multiple trials of a forced-choice task children's performance could be compared to the level of chance. To provide children a more distinct choice, the illustrations were constrained to one page of the book and did not overlap with text as they did in the book used for PWPA. Finally, unlike most of the past research examining children's knowledge about print in books, children's reading ability was assessed. As discussed above, it is unclear based on past research whether children who cannot read understand the role print plays in reading.

To address the objectives for this study, children participated in three conditions while looking at a storybook in which each two-page spread had print on one page and an illustration on the other. In the letters condition, children were asked to point to the page with letters on it. In the words condition, children were asked to point to the page with words on it. In the reading condition, children were asked to point to the page the experimenter could read. If pre-readers could correctly distinguish letters and words from pictures but still indicate that the pictures can be read, this result would suggest that the ability to locate words is necessary but not sufficient for the understanding that words are required for reading. For example, perhaps children must

have a certain level of letter-sound knowledge before they associate print with reading. Children may need more advanced knowledge about words and how they symbolize spoken language before they understand the role words play in reading.

Method

Participants

Forty-two children between the ages of 3;0 and 5;6 who were not yet in kindergarten were screened in order to find children who could not read any of the words on the reading task. Two children were excluded because they could read at least one word on the reading task. The final sample consisted of 40 children (16 girls). Children were recruited and tested at preschools in the St. Louis, Missouri area.

A given child participated in only one experiment but in order to informally compare the results of the three present studies, attempts were made to have similar sample characteristics for the three experiments. Sample sizes for each experiment were determined from power analyses of pilot studies. Data were collected at the same seven preschools for all three experiments. The average median income of the zip codes where the preschools were located was \$59,893 (the median income for Missouri is \$51,542; U.S. Census Bureau, 2017). Most of the children in the three experiments were White and from middle-class homes. The children tested in all three experiments were native speakers of English and their parents reported that the children had no history of speech, hearing, or reading disorders.

ANOVAs were used to compare the participants of the three experiments in age and letter name knowledge (see Table 1). The process of determining letter name knowledge is reported later in this methods section. There were no significant differences in age, $F(2, 102) = 0.51, p = .60$, or letter name knowledge, $F(2, 102) = 0.26, p = .77$.

Table 1

Number of Children and Characteristics of Children in the Three Experiments

	Number	Age (range, SD)	Letter Name Knowledge (range, SD)
Experiment 1	40	4;5 (3;2–5;4, 0;7)	5.38 (0–9, 3.18)
Experiment 2	42	4;5 (3;2–5;4, 0;8)	5.10 (0–9, 3.36)
Experiment 3	23	4;4 (3;1–5;5, 0;8)	4.74 (0–9, 3.53)

Materials

Reading task. The reading task consisted of a list of 22 words that Ehri and Wilce (1985) found to be the easiest for novice readers (e.g. “no,” “stop,” and “the”; see Appendix A for the full list). This list has been used as a screener for reading ability in multiple studies (e.g., Treiman, Hompluem, et al., 2016; Treiman & Rodriguez, 1999; Treiman, Sotak, & Bowman, 2001). The words were printed on 8 × 11 in. pieces of paper. Each page had two words and a picture of a familiar object to allay frustration on the part of the children.

Books. A book was created to look like a real storybook with colorful illustrations and printed text. The print and pictures took up the same amount of space on the page. The book had 12 two-page spreads for test trials. For these trials, one page had a block of text and the other page had a printed illustration (see Appendix B for examples). On half of the test trial pages, the text was on the left and on the other half the text was on the right. The pages with text had an average of 44 words (ranging from 41–48) on them. After every four test trial spreads there was a filler two-page spread where each page had a picture of a familiar object. On these filler pages, the child was asked to identify which page had a picture of a particular object on it. For example, one page had a picture of a train and one page had a picture of a butterfly and the child was asked to point to the page with a train on it.

Letter naming task. The letter name task consisted of nine letters printed individually on 4.25×5.5 in. cards. A short list of letters was created that ranged in difficulty and could be used to quickly assess a child's knowledge but would not be too taxing for young children in terms of the time or attention the task required. The letters chosen were based on previous research in which 1,113 preschoolers were asked to name all of the uppercase and lowercase letters of the alphabet (Bowles, Pentimonti, Gerde, & Montroy, 2014). These authors used a standard item response theory analysis program and reported the difficulty and discrimination of each uppercase and lowercase letter. The discrimination score indicates the extent to which knowing a particular letter corresponds to overall letter knowledge. Letters with high discrimination scores can more precisely differentiate among children on the basis of how well they know letter names. Although we wanted to use the same list of letters for all children to compare letter name knowledge across children, we did not want one of the letters to be a child's first initial. We did not want to test a child on their first initial because there is a higher chance of them knowing that letter and their knowledge of that letter may not be representative of their overall letter name knowledge (Treiman, Kessler, & Pollo, 2006; Treiman, Levin, & Kessler, 2007). Therefore, we did not use one of the several short forms created by Tortorelli, Bowles, and Skibbe (2017). Rather, we created a new list of letters and alternative letters, of equal difficulty, to replace a letter if it was the child's first initial.

Before selecting letters, we excluded lowercase letters that children frequently confuse because of visual similarities (b and d – mirror images of each other, as are p and q; l – similar to the number 1). We also excluded both cases of O and X because they may be known as either shapes or letters. We also excluded lowercase letters that look like their uppercase forms (c, k, s, u, v, w, y, z). We ranked the remaining 35 letters according to difficulty and put the letters into

eight blocks of four letters and a final block of three letters. To choose the letters for the letter naming task, we chose the letter with the highest discrimination score within each block (see Appendix C). Within each block we selected an alternate letter (also shown in Appendix C) by choosing the letter that had the closest difficulty score to the letter included on the letter naming task and was not already included in the letter name task in a different case. Children got a point for each letter named correctly and received a letter name knowledge score from 0 to 9.

Procedure

Children were tested individually in a quiet area of their preschool. At the beginning of the session the experimenter showed the child the pages of the reading task. For each page, the child was asked to identify any items that he or she knew. If the child did not identify all three items, the experimenter pointed to each one in turn and asked the child if he or she knew it. If the child could correctly identify any of the words, the experimenter thanked the child for participating and ended the session. If the child could not correctly identify any of the words, the experimenter then introduced the storybook task.

To introduce the storybook task, the experimenter told the child that she likes to read and read the first page of the book *Giraffes Can't Dance* (Andreae & Parker-Rees, 2001) aloud to the child to demonstrate that the experimenter is able to read. On this page, the illustration spreads across the two pages and the right page has four lines of text. To avoid influencing a child's ideas about reading, the experimenter looked at the center of the book while reading. The experimenter then introduced the experimental book and told the child that they would look at this book together. Each child completed all three of the conditions described below with the order of the conditions counterbalanced across children. Between conditions, children were shown a filler two-page spread and asked to identify which page had a picture of a particular

object on it. Then the experimenter introduced the next condition by saying, “Now I’m going to ask you to look for something different” and, depending on the condition, said, “Now I want you to help me find the page that has words on it/has letters on it/I can read.”

Letter condition. The experimenter opened the book to a two-page spread and asked, “Can you point to the page with letters on it?” If the child did not make a choice right away, the experimenter asked again, “Which page has letters on it?” After the child pointed to a page, the experimenter turned the page and again asked the child to point to the page with letters. This procedure was repeated for a total of four pairs of pages.

Word condition. The experimenter opened a book to a two-page spread and asked, “Can you point to the page with words on it?” If the child did not make a choice right away, the experimenter asked again, “Which page has words on it?” After the child pointed to a page, the experimenter turned the page and again asked the child to point to the page with words. This procedure was repeated for a total of four pairs of pages.

Reading condition. The experimenter opened the book to a two-page spread and asked, “Can you point to the page that I can read?” If the child did not make a choice right away, the experimenter asked again, “Which page can I read?” After the child pointed to a page, the experimenter turned the page and again asked the child to point to the page the experimenter can read. This procedure was repeated for a total of four pairs of pages.

Following the completion of all three conditions, the experimenter introduced the cards for the letter name task. For each of the nine cards, the child was asked to identify the letter. The cards were presented in a pre-determined randomized order that was the same across children (the order is shown in Appendix C). If the first letter of the child’s name was one of the nine

letters included in the task, the card with that letter was replaced by a card with the preselected alternate letter (see Appendix C).

Results

Table 2 shows the proportion of trials on which children responded correctly in the letter, word, and reading conditions. Although age was treated as a continuous variable in the analyses, the children were divided using a median split at the age of 4;6 in Table 2 in order to illustrate the findings. Children were very likely to correctly identify which page had letters and which page had words. Children were less likely to correctly choose the page with print as the page that can be read. Although there were ceiling effects in the letter and word conditions, in the reading condition older children appeared to perform better than younger children.

Table 2

Proportion of Trials on Which Children Responded Correctly in Experiment 1

	Letter		Word		Reading	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Younger children	0.94	0.24	0.95	0.21	0.42	0.50
Older children	1.00	0.00	0.93	0.25	0.75	0.44
All Children	0.97	0.17	0.94	0.23	0.58	0.50

Figure 1 shows, in more detail, how children's responses varied with age for each condition as well as how consistent children were in their responses. As can be seen in the scatter plots, a given child was usually consistent in how he or she responded within a condition.

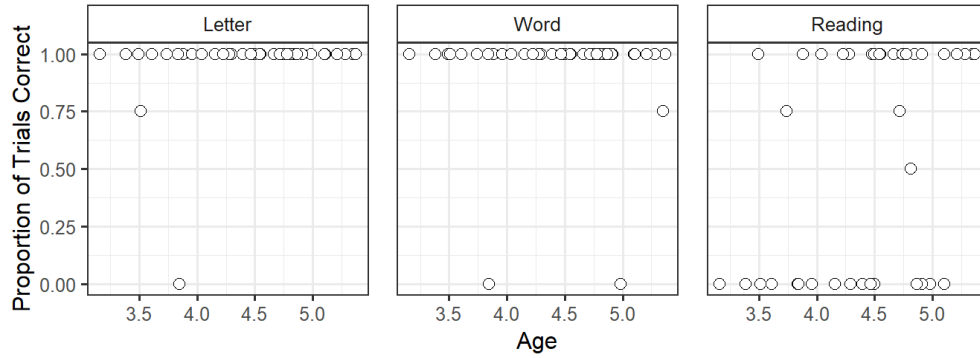


Figure 1. Scatter plots showing the relations between age and children’s performance in each condition of Experiment 1.

Due to the dichotomous nature of the dependent measure, data were analyzed with mixed effects logistic regression models. Children’s performance on the choice task was coded as 1 for correct and 0 for incorrect. All mixed-model analyses presented in this dissertation were conducted using R version 3.5.3 (R Core Team, 2019) and the packages lme4 (Bates, Mächler, Bolker, & Walker, 2015). An alpha level of .05 was used for all statistical tests. The analyses were carried out at the trial level and included random intercepts for the identity of the child. The model included the fixed effects of condition, mean-centered child age in years, and their interaction¹. The reading condition was coded as the baseline condition and responses in the other two conditions were compared to performance in the reading condition. The results for the model are shown in Table 3 in the log-odds metric and as odds ratios.

¹ We ran a second model that added in letter name knowledge and its interaction with condition as fixed effects (for the model results see Appendix F). We used a log likelihood test to compare the fit of the two models and the inclusion of letter name knowledge improved the model significantly ($\chi^2_{(3)} = 9.87$, $p = 0.020$). However, the models that included letter name knowledge in Experiments 2 and 3 failed to converge. Appendix F shows the results of Experiments 1, 2, and 3 broken down by letter name knowledge.

Table 3

Logistic Regression Model Results Showing Log Odds and Odds Ratios of Answering Correctly in Experiment 1

Effect	<i>b</i>	<i>SE</i>	<i>Odds Ratio</i>	<i>p</i>
Intercept	5.14	3.58	170.35	0.151
Letter	24.40	11.24	3.96×10^{10}	0.030
Word	25.07	8.57	7.72×10^{10}	0.003
Age	16.29	6.43	1.19×10^7	0.011
Age \times Letter	-1.59	10.09	0.20	0.875
Age \times Word	-28.35	10.87	4.86×10^{-13}	0.009

At the mean age of the sample, children were significantly more likely to answer correctly in both the letter condition and the word condition than in the reading condition. The effect of age differed significantly between the reading condition and the word condition. In the reading condition, older children were significantly more likely than young children to answer correctly. The significant interaction between age and the word condition reflects the fact that the difference in the odds of being correct between the reading condition and word condition was smaller in the older children than in the younger children. The older a child was, in other words, the more his or her performance in the reading condition resembled their performance in the words condition. Because children were almost at ceiling in the word and letter conditions, we ran three follow-up models to look at the effect of age within each condition. The effect of age was only significant in the model for the reading condition, supporting the results of the first model.

In each condition a child could have received a maximum score of 4 correct. One-tailed, one sample *t* tests were conducted to determine whether children's performance in each of the three conditions was significantly different from the score of 2 that would be expected by

chance. Children's performance in the letter condition $t(39) = 18.30, p < .001$, and word condition, $t(39) = 12.59, p < .001$, was significantly better than chance. Children's performance in the reading condition was not above the level of chance, $t(39) = 0.98, p = 0.17$. To compare the performance of younger and older children in the reading condition the children were divided using a median split at the age of 4;6. One-tailed, one sample t tests determined that performance of the older children in the reading condition was above the level of chance $t(19) = 2.87, p = 0.004$, while the performance of the younger children was not $t(19) = -1.03, p = 0.84$.

Discussion

Experiment 1 was designed to determine whether pre-readers are able to locate the letters and words in a book in a task that does not require them to isolate or label individual letters and words. The results suggest that pre-readers know about the visual appearance of letters and words and can successfully distinguish both from pictures. Although past research has found that children who were asked to count words sometimes instead counted letters (e.g. Homer & Olson, 1999; Justice & Ezell, 2001), the current results indicate that when not asked to isolate or count individual words, pre-readers demonstrate an understanding of where words are located in a book.

The main objective of Experiment 1 was to determine whether being able to identify letters and words in a book means that a pre-reader knows that it is this print that readers read. In line with past longitudinal studies (Munn, 1995) the results suggest that pre-readers are in the process of learning about the role of print in reading. On 58% of trials children chose the page with print, rather than the page with a picture, as the page that a reader could read. The understanding of what is read increased significantly from three to five years of age. The older half of the children in this sample correctly chose the page with print on 75% of trials. These

results suggest that children in the age range studied are in the process of learning about the role of print in reading.

Before concluding that some pre-readers believe that only pictures can be read, it is important to consider that, due to the study design, more nuanced knowledge children have about what part of a book is read may have been missed. Because children were asked to make a choice between pictures and print, we cannot rule out the possibility that they believe that both pictures and print can be read. The pre-readers in Experiment 1 may have thought that both pages could be read and chose the page they preferred—the page with pictures. They may have had more interest in the pages with pictures than the pages with print because they found the bright colors appealing and interesting. Another possibility is that children would not have said the pictures could be read if the page with print was not also present. Pre-readers may believe that a picture can only be read when print is also present and therefore would say that a picture with no print near it cannot be read. Therefore, Experiment 2 was designed to test how children might respond differently if asked about the components of a book individually. Children were shown book pages with print and pictures together and in isolation to determine what pre-readers think must be present for reading to occur.

2.2 Experiment 2

As discussed earlier, previous work that has examined whether young children can correctly determine what can be read found that 3- to 5-year-old children were more likely to be correct about whether a book could be read if the book was completely blank or contained only print (Hiebert, 1983). Children's performance was worse when the books contained only pictures or pictures and print. These results suggest that young children may be confused, in particular, about the role of pictures in reading. As discussed earlier however, one limitation of the Hiebert

(1983) study is that due to how the results were reported it is unclear whether poor performance was due to children being incorrect or whether children knew the right answer but were unable to articulate a reason for their choice. To measure children's very early knowledge about what part of a book can be read, a task should not require children to articulate their thinking. Therefore, children in the current study were asked whether a page of a storybook can be read but were not required to give the reasoning behind their decision.

A book was created that had four different types of pages. The book included pages that had only print, pages that had only a picture, pages that had both print and a picture, and pages that were blank. The book included blank pages to test whether pre-readers understand that something has to be present on a page for reading to occur. By comparing performance on blank pages and other page types we could examine whether pre-readers know that reading is interpreting marks on a page, even if they are confused about which marks can be read. The pages that contained only a picture were included to investigate whether pre-readers think pictures can be read and therefore would say a page with only a picture can be read. This result would support the finding of Experiment 1 that many children chose the page with a picture over the page with print as the page that can be read. If pre-readers also indicate that the pages with only print can be read, this would suggest that children's responses in Experiment 1 may have been expressing a preference for the picture and not a belief that only pictures can be read.

Because children in Experiment 2 were asked to answer a yes–no question about whether a page can be read, and past research (e.g., Fritzley & Lee, 2003; Okanda & Itakura, 2010) has reported that young preschoolers show a bias to answer yes, an introductory task in which both “yes” and “no” are correct answers was also included.

Method

Participants

Forty-four children between the ages of 3;0 and 5;6 who were not yet in kindergarten were screened in order to find children who could not read any of the words on the reading task. Two children were excluded because they could read at least one word on the reading task. The final sample consisted of 42 children (28 girls) with a mean age of 4;5 and a range of 3;2 to 5;4 (see Table 1 for a comparison to the characteristics of the children in Experiment 1). As mentioned above, children were recruited and tested at the same preschools as in Experiment 1.

Materials

Reading task. The reading task from Experiment 1 was used again.

Introductory task. A page of color pictures of six items (see Appendix D), three of which can be eaten (a banana, a carrot, and a piece of cake) and three of which cannot be eaten (a plane, a doll, and a dog), was created for children to practice answering yes/no questions.

Book. A new book was created using the print and pictures from the book in Experiment 1. Instead of having content on both pages of each two-page layout, each two-page layout had either something printed on only the right-hand page or nothing printed on it (see Appendix B for examples). Four pages had only an illustration, four pages had only text, four pages had text either above or below the illustration, and four pages were blank. On each page, the area taken up by the print, picture, or both was the same. The pages were presented to all children in the same randomized order.

Letter naming task. The letter naming task from Experiment 1 was used again.

Procedure

Children were tested individually in a quiet area of their preschool. At the beginning of the session the child completed the reading task, as in Experiment 1. Children who could not correctly identify any of the words moved on to the introductory task. To begin the introductory task the experimenter said, “I’m getting hungry and I need your help to figure out what things I can eat.” The experimenter then presented the sheet of pictures and pointed to each item in succession and asked, “Can I eat this?” Children were praised for answering correctly.

To begin the book task, the experimenter read the first several pages of the book *Giraffes Can’t Dance* aloud to the child to demonstrate that the experimenter is able to read. Then the experimenter introduced the experimental storybook and said, “Now I want to read this book, but I need your help to figure out which pages I can read.” The experimenter opened to the first two-page spread, pointed to the right-hand page and asked, “Can I read this page?” Once the child responded the experimenter moved on to the next two-page spread, pointed to the right-hand page and asked, “Can I read this page?”. This repeated for all right-hand pages of the storybook. At the end of the session, the child completed the letter naming task, as in Experiment 1.

Results

Table 4 shows the proportion of trials in which children responded that each type of page can be read. Although age was treated as a continuous variable in the analyses, the children were divided using a median split at the age of 4;6 in Table 4 in order to illustrate the findings (for the results broken down by letter name knowledge see Appendix F). Children were overall very likely to say that a page with both print and a picture can be read. They were less likely to say a page with only a picture or a page with only print can be read. Children were very unlikely to say

a blank page can be read. The proportion of trials on which children said a page with only a picture can read appeared to be lower for older children than for younger children.

Table 4

Proportion of Trials on Which Children Said Page Can Be Read in Experiment 2

	Picture Only		Print Only		Both Print and Picture		Blank	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Younger children	0.69	0.47	0.73	0.45	0.90	0.30	0.01	0.11
Older children	0.45	0.50	0.70	0.46	0.89	0.31	0.07	0.26
All children	0.57	0.50	0.71	0.45	0.90	0.03	0.04	0.20

Figure 2 shows, in more detail, how children's responses varied with age for each condition as well as how consistent children were in their responses. A given child was consistent in how he or she responded to the blank pages. However, children were less consistent in how they responded to the other page types. For the picture only pages 10 children answered inconsistently, 13 children answered inconsistently for the print only pages, and 11 children answered inconsistently for the pages with both.

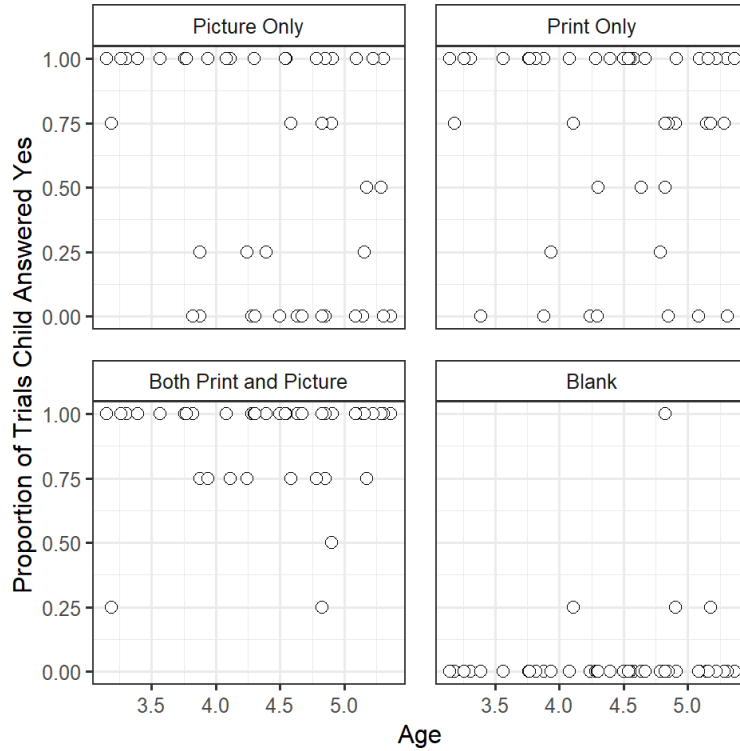


Figure 2. Scatterplots showing the relations between age and children’s performance in each of the four conditions of Experiment 2.

As in Experiment 1, the data were analyzed at the trial level with mixed effects logistic regression models that included random intercepts for the identity of the child. Children’s responses on the storybook task were coded as 1 for answering that a page could be read and 0 for answering that it could not. The first model included the fixed effects of page type, mean-centered child age in years, and their interaction. The picture-only page type was coded as the baseline condition and performance on the other three page types were compared to performance on the picture-only pages. The results for the model are shown in Table 5.

Table 5

Logistic Regression Model Results Showing Log Odds and Odds Ratios of Saying Yes in Experiment 2

Effect	<i>B</i>	<i>SE</i>	<i>Odds Ratio</i>	<i>p</i>
Intercept	0.48	0.26	1.61	0.072
Print-only	0.71	0.27	2.02	0.008
Both print and picture	2.21	0.34	9.07	< 0.001
Blank	-4.37	0.56	0.01	< 0.001
Age	-1.57	0.44	0.21	< 0.001
Age × Print only	1.25	0.44	3.50	0.005
Age × Both print and picture	1.82	0.54	6.17	< 0.001
Age × Blank	2.75	0.88	15.70	0.002

At the mean age of the sample, the odds of saying a page with only print can be read was significantly higher than the odds of saying a page with only a picture can be read. At the mean age, the odds of saying a page with both print and a picture was also significantly higher than the odds of saying a page with only a picture can be read. The odds of saying a blank page can be read were significantly lower than the odds of saying a page with only a picture can be read, at the mean age. The odds of saying a page with only a picture can be read were significantly lower in the older children than in the younger children. The significant interactions with age reflect the fact that the differences in the odds of saying yes between conditions changed as children got older. The difference between the odds of saying yes to a page with only a picture and the odds of saying yes to a blank page lessened with age. The difference between the odds of saying yes to picture-only pages and the odds of saying yes to pages with both print and a picture widened with age, as did the difference between the picture-only condition and the print-only condition. The older a child was, their performance in the picture-only condition was more accurate and

therefore more like their performance in the blank condition and less like their performance in the print-only and both print and picture conditions. Because children were almost at ceiling for the both print and picture pages and almost at floor for blank pages, we ran four follow-up models to look at the effect of age within each page type. The effect of age was only significant in the model for the picture only pages, supporting the results of the first model.

Discussion

Experiment 2 was designed to examine which written marks in a book pre-readers think that readers can read. The results of Experiment 2, like those of Experiment 1, suggest that 3- to 5-year-old children who cannot read are in the process of learning what readers read when they read a book. The results of Experiment 2 suggest that pre-readers know that something must be printed on a page for a reader to read it, but they are still learning precisely what is in a book that readers read.

Children were very accurate with the blank pages, only saying they can be read on 4% of trials. These results are in line with Hiebert's (1983) findings that most of the 3- to 5-year-olds she interviewed felt that a book with only text can be read and they viewed the blank book as an anomaly. Anecdotally, as Hiebert reported in her study, children in this experiment often giggled when asked if a blank page could be read. Some children also spontaneously said something like "there are no words" after they said no. These results for the blank pages suggest that most pre-readers in this age range know that something must present on the page for a reader to be able to read a book.

However, the results also suggest that many pre-readers believe that anything printed in a book can be read. Children were very likely to say that a page with only print can be read, and this did not differ across age. The lack of change with age is interesting given that the older

children in Experiment 1 were more likely to choose the print over the picture than the younger children. The results of Experiment 2 suggest that the younger children of Experiment 1 may have still believed that print can be read but were indicating a preference for the picture.

Children were less likely to say a page with only a picture can be read than a page with only print, but many pre-readers still said a picture can be read. Unlike for the blank pages, children rarely made any spontaneous comments about the picture-only pages. This informally supports Hiebert's (1983) finding that young children are certain that something must be present in a book for a reader to be able to read it but less confident about what specifically is read. Ferreiro and Teberosky (1982) reported that young children in the first stage of understanding the relationship between picture and print believe that both pictures and print can be read. The results of Experiment 2 are in line with their suggestion that early in development children believe that the print and picture are two different forms for representing the same meaning and therefore can both be read. The younger half of children in Experiment 2 said a picture can be read on 69% of trials. The older half of children said a picture can be read 45% of the time. As in Experiment 1, older children were significantly less likely than younger children to indicate that a picture can be read. These results are in line with the results of Munn's (1995) longitudinal study of preschoolers' knowledge about what part of a book is read. Pre-readers in this age range appear to be learning that pictures cannot be read but not all have mastered this concept.

Chapter 3: Identifying Who Has the Ability to Read Books

Chapter 2 explored whether pre-readers understand the role of print in reading books. This chapter examines whether pre-readers know who reads books. Children must understand that reading is a skill that they must learn. Although pre-readers may still be in the process of learning what readers read when reading a book, they may understand that reading is a skill that not everyone has. Past research suggests that young children demonstrate some knowledge about who has the ability to read and what the activity of reading looks like (i.e., silently turning pages). However, as discussed earlier, there are methodological concerns with past research, including that past studies have typically included only one question about reading ability and that children are likely to overestimate their own abilities. Therefore, the task in Experiment 3 was designed to include multiple questions about whether different adults and animals have the ability to read and whether they can engage in reading. Because young children often show a bias to respond yes to yes-no questions an introductory task in which both “yes” and “no” were correct answers was also included.

3.1 Experiment 3

The first goal of Experiment 3 was to examine whether pre-readers know who is able to read books. In this study pre-readers were presented with pictures of adults and animals looking at books and asked whether each adult or animal can read. Based on studies that ask children to evaluate their parents’ reading ability (e.g. Downing, 1970; Reid, 1966) the expected outcome was that most children would indicate that the adults looking at books could read. If pre-readers also indicate that the animals cannot read, this would suggest that pre-readers understand that reading is a skill and that adults have said skill while animals do not.

Our second goal of Experiment 3 was to examine whether pre-readers make a distinction between the skill of reading and the activity of reading. As discussed earlier, research has found that young children may silently page through a book when asked to read to an experimenter (Munn, 1995; Strommen & Mates, 1997; Sulzby, 1985). Adults also talk about how pre-readers looking at books are reading. It may be that pre-readers believe that looking at anything in a storybook is reading and therefore believe, for example, that an animal can engage in the activity of reading. In addition to examining who pre-readers think has the ability to read a book, children were also asked if they think a person or animal looking at a book is reading. If they indicate that animals are reading, this would suggest that pre-readers believe that the act of looking at a book is reading. If pre-readers respond that an animal cannot read, but is engaging in reading, this result would suggest that pre-readers know who has the ability to read but they also have a definition of the activity of reading that does not require the ability to read.

Method

Participants

Twenty-five children between the ages of 3;0 and 5;6 who were not yet in kindergarten were screened in order to find children who could not read any of the words on the reading task. Two children were excluded because they could read at least one word on the reading task. The final sample consisted of 23 children (14 girls) with a mean age of 4;4 and a range of 3;1 to 5;5 (see Table 1 for a comparison to the characteristics of the children in Experiments 1 and 2). As mentioned above, children were recruited and tested at the same preschools as in Experiments 1 and 2.

Materials

Reading task. The reading task from Experiments 1 and 2 was used again.

Introductory task. The pictures from Experiment 2 were used again.

Picture cards. Sixteen 4.25×5.5 in. cards were created. Each of the 16 cards had a picture printed on it showing either an adult or an animal looking at a book (see Appendix E). In all pictures there was no print on the cover of the book and what was printed on the pages of the book was not visible. The 16 cards were divided into two sets of eight cards. Set 1 was used for the first condition children completed and Set 2 was used for the second condition. Each set had two pictures of a woman, two pictures of a man, and four pictures of an animal (e.g., a chimpanzee, a dog, a cat, a bird) looking at a book.

Letter naming task. The letter naming task from Experiment 1 was used again.

Procedure

Children were tested individually in a quiet area of their preschool. At the beginning of the session the child completed the reading task, as in Experiments 1 and 2. Children who could not correctly identify any of the words moved on to the introductory task to practice answering yes/no questions. The procedure for the introductory task was the same as in Experiment 2.

Following the introductory task, children were told they were now going to look at different pictures with the experimenter. Children were shown the pictures one by one, in a pre-determined randomized order that was the same across children. Each child completed two conditions, with the conditions counterbalanced across children. In the activity condition, the experimenter introduced the condition by saying “Now I want your help to figure out which of these people and animals are reading.” For each of the eight pictures in the set the experimenter asked, “Is the person/animal reading?” In the ability condition the experiment introduced the condition by saying “Now I want your help to figure out which of these people and animals can read.” Then the experimenter asked, “Can this person/animal read?” for all eight pictures in the

second set. At the end of the session, the child completed the letter naming task, as in Experiment 1.

Results

Table 6 shows the proportion of trials in which children responded yes as a function of actor and wording. Although age was treated as a continuous variable in the analyses, the children were divided using a median split at the age of 4;3 in Table 6 in order to illustrate the findings (for the results broken down by letter name knowledge see Appendix F). Children were very likely to say that an adult can read and very unlikely to say that an animal can read. Children were very likely to say that an adult is reading and less likely to say an animal is reading. Overall, children were more likely to answer yes when the actor was an adult than when the actor was an animal. The proportion of trials on which children responded yes in the activity condition appeared to decrease as children got older when the actor was an animal and increase when the actor was an adult.

Table 6

Proportion of Trials on Which Children Said Actor Can Read and Said Actor is Reading in Experiment 3

		“Can read”		“Is reading”	
		<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Younger children	Adult	0.83	0.38	0.88	0.33
	Animal	0.08	0.28	0.81	0.39
Older children	Adult	1.00	0.00	1.00	0.00
	Animal	0.09	0.29	0.63	0.49
All children	Adult	0.91	0.28	0.93	0.25
	Animal	0.09	0.28	0.73	0.45

Figure 3 shows, in more detail, how children’s responses varied with age as well as how consistent children were in their responses. A given child was almost always consistent in how they responded to all four questions.

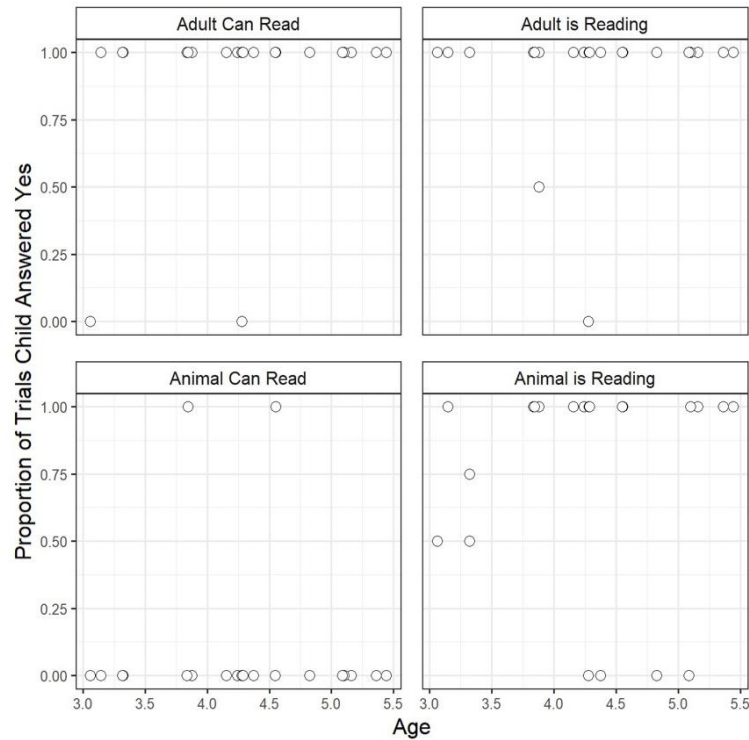


Figure 3. Scatter plots showing the relations between age and children’s performance in the two conditions in Experiment 3.

As in Experiments 1 and 2, the data were analyzed at the trial level with mixed effects logistic regression models that included random intercepts for the identity of the child. Children’s responses were coded as 1 for responding “yes” and 0 for responding “no”. The first model included the fixed effects of wording, actor, mean-centered child age in years, and their interaction. The wording was coded as 0 for “is reading” and 1 for “can read”. Actor was coded as 0 for animal and 1 for adult. The results for the model are shown in Table 7.

Table 7

Logistic Regression Model Results Showing Log Odds and Odds Ratios of Saying Yes in Experiment 3

Effect	<i>b</i>	<i>SE</i>	<i>Odds Ratio</i>	<i>p</i>
Intercept	9.45	2.24	1.28×10^4	< 0.001
Actor	6.50	1.52	667.70	< 0.001
Wording	-20.03	4.01	2.00×10^{-9}	< 0.001
Actor \times Wording	30.87	12.65	2.54×10^{13}	0.015
Age	0.03	2.35	1.03	0.989
Age \times Actor	4.15	1.55	63.67	0.008
Age \times Wording	-0.59	4.33	0.56	0.892
Age \times Actor \times Wording	12.44	10.38	2.52×10^5	0.231

When asked if the actor is reading, at the mean age, the odds of a child saying yes was significantly higher for an adult than an animal. When the actor was an animal, at the mean age, the odds of a child saying yes were significantly lower in response to the “can read” wording than in response to the “is reading” wording. The significant interaction between actor and wording reflects the fact that, at the mean age, the effect of wording was greater when the actor was an animal than when the actor was an adult. Children were overall more likely to say yes to both questions about adults than questions about animals. The significant interaction between age and actor reflects the fact that the difference between the odds of a child saying an animal is reading and the odds of saying an adult is reading widened as children get older. As can be seen in Figure 3, some of the older children said the animals were not reading while they said the adults were reading. Because children were almost at ceiling or floor for each of the questions, we ran four follow-up models to look at the effect of age for each question. The effect of age was not significant in any of those models, supporting the results of the first model.

Discussion

The first goal of Experiment 3 was to determine whether pre-readers know who has the ability to read books. The results provide strong evidence that pre-readers understand that adults, unlike animals, are able to read books. The finding that most children know that adults can read is in line with the findings of interviews in which children indicate that they know their parents can read (Downing, 1970; Reid, 1966). Our results further show that children know who has the ability to read early on in the age range studied. The lack of significant age effects in the ability condition suggest that children learn at a young age that reading is a skill specific to humans.

Our second goal was to determine whether pre-readers distinguish between the activity of reading and the ability to read. The results of Experiment 3 highlight the importance of wording when studying children's beliefs. A small change in wording of the questions about animals showed that, although many pre-readers know that animals cannot read, many believe that animals can engage in reading. That is, many pre-readers across the age range studied do not believe that the ability to read is required to engage in reading. Although children were more likely to say an adult, rather than an animal, was reading, they were still very likely to say an animal was reading. Additionally, children were more likely to say that an animal was reading than that an animal can read. This outcome suggests that pre-readers have a concept of reading that is not based purely on the skills required for reading. Instead, pre-readers' definition of the activity of reading may primarily rely on aspects of the visual appearance of the activity. These results are in line with the findings of studies that ask children to engage in reading and find that children silently look through a book (e.g. Munn, 1995; Strommen & Mates, 1997; Sulzby, 1985). Children learn from observing adults in their environment and appear to base their understanding of the activity of reading on these observations. Beginning at an early age,

children see adults around them pick up books, page through them, and sometimes talk about things in the book. These features combine to form a child's beginning concept of reading. The significant age interaction in the activity condition suggests that children's concept of what reading is changes across the age range studied. As children get older, they may be more likely to believe that the ability to read is required to engage in the activity of reading.

Chapter 4: General Discussion

From an early age, children are exposed to book reading in many ways. Adults and older children may read books to children and to themselves. Children may also learn about book reading through conversations about the activity. There is evidence that children begin to learn about the print in books and the role it plays in reading before the onset of formal literacy instruction (e.g. Justice et al., 2006, 2010; Justice & Ezell, 2001). This early knowledge about reading and the role print plays in reading plays an important role in the development of literacy skills (e.g., Puranik et al., 2011; Storch & Whitehurst, 2002; Whitehurst & Lonigan, 1998). During this time, children also begin to understand who has the ability to read and what reading looks like (e.g., Munn, 1995; Sulzby, 1985). Although children's knowledge in these areas has been studied for over 50 years, in many cases the conclusions are limited by the experimental design. For example, many of the studies that have examined young children's knowledge about reading and books have relied on interviews (e.g., Downing, 1970; Ferreiro & Teberosky, 1982; Hiebert, 1983; Mason, 1967; Oliver, 1975; Reid, 1966; Strommen & Mates, 1997; Sulzby, 1985). As discussed earlier, there are several drawbacks of interviews, including that they are limited by children's ability to express themselves verbally as well as young children's bias to respond yes to yes-no questions and their tendency to overestimate their abilities. Other methodological concerns include that asking only one question per topic of interest may not correctly evaluate a child's knowledge and that children's responses to interview questions can vary depending on slight differences in how questions are asked (e.g., Mason, 1967). Another limitation of past research is that most studies have not established whether the children being tested know how to read. Therefore, it is unknown whether the children who display more knowledge do so because they know how to read.

The present studies were designed to address some of these limitations and further our understanding of what children who cannot read know about what readers read when they read books and who has the ability to read books. These studies found that, although pre-readers were typically able to correctly locate the print in a book, they are still learning about the role it plays in reading. Our results suggest that there may be a period in development when pre-readers believe that both pictures and print can be read. Additionally, the current results suggest that pre-readers have some knowledge about who has the ability to read but they may not always consider the ability to read a prerequisite for engaging in the activity of reading.

The results of Experiment 1 suggest that children have more knowledge about words in books than previously reported. This difference could be due to the way that the current studies addressed many of the methodological concerns associated with past research. However, it is also important to consider that the past research spans over 50 years, and there are likely to have been many changes in what present-day children learn before formal schooling due to changes in parents' expectations and behaviors (e.g., Schaub, 2015). It is therefore possible that the discrepancies in the results represent an overall increase across time in young children's knowledge about words. Nevertheless, the results of Experiment 1 suggest that, although young children may have difficulty isolating individual words within a book (e.g. Justice & Ezell, 2001), children as young as three know that words are present in books and can distinguish them from the pictures. These results are in line with past findings that young children begin to learn about the outer form of writing before they can read themselves (e.g. Otake et al., 2017; Puranik & Lonigan, 2011). However, although these pre-readers could successfully locate the words in a book, they had yet to fully learn about their importance for reading.

As children are learning about the appearance of writing, they are also learning about how it represents meaning and that words, and not the pictures, are what a reader reads. Consistent with the results of Hiebert's (1983) study, the children in Experiments 1 and 2 demonstrated that, although they understand that something must be present for reading to occur, they are still learning about the role of print in reading. These results provide a clearer picture of children's knowledge, because unlike in Hiebert's study, children did not have to provide an explanation for why a page could or could not be read. In Experiment 1, the performance of the younger pre-readers was at chance when asked which page the experimenter can read. Likewise, the younger pre-readers' in Experiment 2, responded similarly to the picture-only and print-only pages, with the majority of children saying both page types could be read. Several children in Experiment 2 also answered inconsistently across the trials for picture-only and print-only pages, saying both yes and no, further suggesting children were uncertain about which part of a book is read. This finding highlights the importance of considering the number of trials per topic of interest. For example, the results of these experiments suggest that for questions such as "Which page has letters?" or "Which page has words?" one trial may be enough in future research. However, although children answered fairly consistently in Experiments 1 and 3, in Experiment 2 many children answered inconsistently to the pages with something printed on them. Some children in Experiment 2 may have been guessing and, if each page type were only shown once, our results could have over- or underestimated an individual child's knowledge. The inconsistency across trials in Experiment 2 also suggests that children in this age range are not certain in their knowledge about which part of a book is read and future research in this area should continue to use multiple trials per topic of interest. That young children appeared to believe that both print and pictures can be read is consistent with Ferreiro and Teberosky's

(1982) suggestion that, in the first stage of young children's development of knowledge about the symbolic function of print, children see print and picture as representing the same meaning and therefore both can be interpreted through reading. As discussed earlier, this belief is not surprising given that the pictures in storybooks are usually referenced in the print and therefore it could appear that a reader is reading the pictures.

Even some of the older children in both experiments still indicated that a picture can be read. However, in Experiment 2 the older children were less likely than the younger children to say that a page with only a picture can be read. Additionally, children were overall less likely to say that a page with only a picture on it can be read than to say that a page with only print on it can be read. Taken together, the results of Experiments 1 and 2 suggest that although some children in the age range studied here are uncertain about what can be read, overall, they are beginning to learn that pictures are not what a reader reads. This is in line with Munn's (1995) finding that preschoolers' knowledge about the role of print in reading improved over the course of a school year.

The results of Experiment 3 suggest that pre-readers have a definition of the skill of reading that is similar to that of an adult. In line with the finding that children know their parents can read (Downing, 1970; Reid, 1966), children were very likely to say an adult can read and very unlikely to say an animal can read. The current results suggest that even children who cannot read appear to generally understand that the skill of reading is something that animals do not have. However, many children appear to believe that both adults and animals can engage in reading. Pre-readers' definition of the activity of reading appears to be somewhat separate from their definition of the skill of reading. The suggestion that children have different definitions for different forms of the verb *read* is in line with research on how children learn about verbs.

Although nouns are generally learned before verbs, some verbs appear in children's early vocabularies (Gentner, 1981; Maguire, Hirsh-Pasek, & Golinkoff, 2006) and Maguire and colleagues have suggested that children initially do not understand some verbs in the same way as adults. Specifically, young children may think that there are specific situations for different grammatical forms of a verb (Gentner, 1981; Maguire et al., 2006). For example, one study found that 2- to 3-year-old children did not have a single, unified concept of *go* (Theakston, Lieven, Pine, & Rowland, 2002). Although children used the verb competently and appropriately, they appeared to have separate meaning representations for the different forms of *go* (e.g., *goes* meant belonging, as in 'This toy goes in the box' or *gone* meant disappear, as in 'Where has my toy gone?'). In Experiment 3, children may have had different definitions for *read* in the questions "can this animal read?" and "is this animal reading?" that informed their responses. Children appeared to believe that *reading* means the action of looking at a book while *read* means doing something beyond just looking at a book and whatever that is, animals cannot do it. Consistent with the findings that children silently look through a book when asked to engage in reading (e.g. Munn, 1995; Strommen & Mates, 1997; Sulzby, 1985), the young children in Experiment 3 appear to have a concept of the activity of reading that is based more on the visual appearance of the activity, rather than on the skill. Considered together, the results of the three experiments presented here suggest that, although pre-readers have not yet mastered the idea that reading involves the use of print and not pictures, they know that the ability to read requires more than just looking at a book.

Limitations

The current studies provide new insight into what pre-readers understand about reading. Nevertheless, there are important limitations to note. Although Experiments 2 and 3 included

practice answering yes-no questions, the possibility remains that some of the children's responses were influenced by a bias to say "yes". However, in both experiments there was a condition in which children said yes on less than 10% of trials. This suggests that children were answering what they honestly believed. Nevertheless, it is important that future studies continue to develop methods to test children's knowledge that consider the tendencies of children to respond yes, as well as their tendency to overestimate their abilities (Hagá & Olson, 2017).

Another limitation of the present studies is that they only capture children's knowledge at a single time point. Although data were collected from a relatively wide age range, a longitudinal study would be better suited to determining how children's knowledge about book reading develops. Also, the present studies were limited to typically developing monolingual speakers of English, the majority of whom were White. Future studies should investigate children from other backgrounds. Because, for example, reading books to children is a more frequent activity in high SES than in low SES homes (e.g., Chen et al., 2012; Kuo, Franke, Regalado, & Halfon, 2004; Schaub, 2015; Yarosz & Barnett, 2001), it is possible that children from low SES households enter preschool with particularly low knowledge about books and print.

Implications for Parents and Teachers

Although the present studies have some limitations, they offer implications for instruction. Perhaps the most important implications relate to the fact that our results suggest that before kindergarten begins many children have not yet learned that the print is what a reader reads. This result suggests that parents and teachers should not overestimate the knowledge that children have gained from their exposure to books in the home and preschool. Teachers probably need to provide frequent and explicit instruction to help children learn about the role of print in reading. This may require teachers to deviate from what they typically teach. For example,

research with Head Start teachers has found that alphabet knowledge is the most frequently targeted skill because of the legislatively mandated goal in Head Start that children can recognize at least ten letters by the time they enter kindergarten (Powell, Diamond, Bojczyk, & Gerde, 2008). Unfortunately, this research also suggests that preschool teachers may prioritize such benchmark-type standards over more general early literacy indicators and these benchmarks are likely to influence what is assessed within preschools. This tendency may mean that teachers neglect teaching more conceptual topics such as the role of print in reading. However, there is the possibility that in recent years many kindergarten teachers are being explicitly instructed to address this gap in children's knowledge. The Common Core State Standards include the kindergarten goals of children recognizing that "spoken words are represented in written language by specific sequences of letters" in addition to being able to name all upper- and lowercase letters of the alphabet (National Governors Association Center for Best Practices and Council of Chief State School Officers, 2010). These standards (or similar ones) were adopted, generally in 2013 or 2014, by 43 states and it will be informative to examine the impacts of these standards now that teachers have had time to implement them. It may be that more teachers are now teaching children about the role of print in reading. This provides an opportunity for researchers to provide suggestions for how teachers can best teach about this subject.

One way that adults could teach children what a reader reads is through more explicit references to the print while reading a book. Past results regarding whether adults spontaneously reference print during book reading are mixed. Some research has suggested that parents rarely talk about letters or the print while reading (Hindman et al., 2008; Hindman, Skibbe, & Foster, 2014; Price et al., 2009). In a study of parent-child conversations, on the other hand, 22% of parents' utterances that were part of literacy-related conversations occurred in the context of a

book (Treiman et al., 2018). It is possible that parents' behavior while reading in a lab differs significantly from their behaviors at home. It is also possible that the type of book parents read may matter. Stadler and McEvoy (2003) found that parents made more references to print when reading an alphabet book than a storybook. Teachers have also been found to vary in whether they reference print during book reading. In two studies of preschool classrooms, teachers typically referenced print about five times a session (Hindman et al., 2008; Zucker, Cabell, Justice, Pentimonti, & Kaderavek, 2013). Despite the infrequency of references to print, past research suggests that referencing the print can increase the time children spend looking at the print. In a study where the experimenter followed the words with her finger as she read, the average percentage of time a child spent looking at the print was around 25% compared to 6% in a condition in which words were not pointed to (Evans, Williamson, & Pursoo, 2008). Research with parents has found that both nonverbal and verbal print references appear to cause children to look more at the print (Justice et al., 2008). These findings suggest book reading could be a viable opportunity for teaching a child about the role of print in reading.

Training adults in explicit print references during book reading has been used in interventions intended to directly target children's knowledge about print. Several studies of interventions using a style of reading in which adults point to and comment on the print appear to have found that this style of reading may promote the learning of print concepts more than book reading without the addition of explicit references to the print (Anthony, Williams, Zhang, Landry, & Dunkelberger, 2014; Justice & Ezell, 2000; Justice, Kaderavek, Fan, Sofka, & Hunt, 2009; Justice, McGinty, Piasta, Kaderavek, & Fan, 2010; but see Sim, Berthelsen, Walker, Nicholson, & Fielding-Barnsley, 2014). However, these studies often use composite measures of children's knowledge about print, sometimes ones that include both knowledge about books and

the words in books as well as knowledge about letter names and sounds. It is therefore impossible to know what specific aspects of children's knowledge these interventions impacted and if these techniques could be used by parents to improve their child's knowledge about the role of print in reading. For example, the studies conducted by Justice and colleagues have used the Preschool Word and Print Awareness Test which includes items such as "Show me just one letter on this page?" and "Where do I begin to read?" It could be informative to look specifically at whether increased references to print impacted children's performance on the latter question. It is possible that explicitly referencing the print while reading may not only improve children's knowledge about the appearance of print but also teach them that print is what readers read.

In addition to training adults to explicitly reference print, another possible way to use book reading to increase children's awareness about the role of print in reading may be to increase the salience of the print. One way this has been studied is through the use of books in which the print is highly salient because of changes in font style, size, and color. This type of print salience has been found to be correlated with higher use of print referencing by preschool teachers (Dydia, Justice, Pentimonti, Piasta, & Kaderavek, 2013; Zucker, Justice, & Piasta, 2009). Another possible way to make print more salient would be to reduce the number of illustrations in a book. However, research that has compared how parents read storybooks and nonfiction informational books that contain fewer pictures than the storybooks has found that, although parents spent more time reading the informational books than the storybooks, they did not increase their rate of references to the print (Price et al., 2009). Moreover, research suggests that the illustrations help keep a child engaged during book reading. A study in which parents read an assigned book to their child found that children whose parents' read illustrated books were less likely to be rated as distracted than children whose parents' read non-illustrated books

(Greenhoot, Beyer, & Curtis, 2014). These results suggest that increasing the salience of print by removing some of the pictures from a storybook would not increase parents' references to the print and might even decrease the child's interest in the book. Additionally, research has not examined whether increasing the salience of print by changing its appearance or by removing illustrations makes children more likely to look at the print. It is likely that children would still look more at the illustrations than the print (Evans & Saint-Aubin, 2005; Justice et al., 2005). This highlights one drawback of using book reading to teach children about print—the pictures in books will always draw children's attention.

Another possible drawback to using book reading for teaching about print is that book reading has been found to have positive impacts on other aspects of children's development and asking adults to use book reading as a time to teach about print could diminish those effects. Book reading, particularly when combined with other activities focused on vocabulary, has been shown in intervention-based studies to have positive impacts on children's vocabulary growth (for review, see Wasik, Hindman, & Snell, 2016). Book reading also serves as an easy opportunity for parents and children to engage with one another and provides parents an opportunity to use more complex language. A recent study of parent-child conversations found that book reading interactions when children were between the ages of 1 and 2;6 were related to elementary receptive vocabulary, reading comprehension, and internal motivation to read, after controlling for parent language input outside of the context of book reading, the child's early language skills, and SES (Demir-Lira, Applebaum, Goldin-Meadow, & Levine, 2019). The quantity of book reading was not correlated with elementary school reading skills or math skills, suggesting the book reading is not simply a general marker of a good early learning environment. Additionally, parent's language was more complex, in terms of both vocabulary diversity and

syntactic complexity, during the book reading interactions than outside of book reading interactions. This research on the benefits of typical book reading, along with children's inherent interest in the illustrations, suggests that research should look to other activities that feature words and letters for opportunities to teach about the role of print in reading.

Some studies have examined writing as an activity where children can learn about print. From a study of parent-child conversations it appears that parents are comfortable discussing print while writing with their children. Specifically, parents were equally likely to talk about letters in the context of storybooks and the context of writing (Treiman et al., 2018). While writing with children, parents can engage in a variety of behaviors to support a child's writing such as helping a child break a word into sounds and link those sounds to letters or instructing a child in how to make the appropriate marks for the intended letter. Past research has found that these behaviors (either observed by researchers or self-reported) are positively correlated with the child's writing ability (Aram & Levin, 2016; Levin, Aram, Tolchinsky, & McBride, 2013; Puranik, Phillips, Lonigan, & Gibson, 2018; Skibbe, Bindman, Hindman, Aram, & Morrison, 2013). However, research has also found that when writing with children U.S. parents are not likely to help children isolate individual sounds in a word or physically form letters on their own (Bindman, Skibbe, Hindman, Aram, & Morrison, 2014; Skibbe et al., 2013). Training adults in these techniques could be one way to improve children's knowledge about print. When adults were trained in a joint writing program where the adult and child worked together to write words and participated in activities focused on spelling words, young children made more gains in early literacy knowledge than children who participated in a group where parents were given questions to ask during storybook reading or an untreated control group (Aram & Biron, 2004; Levin & Aram, 2012). Specifically, these studies found improvements in children's ability to distinguish

words from numerals, characters from other languages, and illegal letter repetitions as well as in their alphabet knowledge, phonological awareness, and spelling skills. One behavior that has not been explicitly studied, which would be relevant to the three present studies, is parents and teachers reading aloud what was just written as a way to highlight the role of print in reading.

One particular word that could help children understand the role of print in reading is their own name. A child's name plays an important role in early literacy development with children learning the letters in their own name before other letters, including learning about the sound associated with the first letter of their name (Both-de Vries & Bus, 2008; Levin & Aram, 2005; Levin, Both-de Vries, Aram, & Bus, 2005; Zhang & Treiman, in press). Additionally, many North American parents report in questionnaires that they teach their children to write their names (e.g., Martini & Sénéchal, 2012; Puranik et al., 2018). Perhaps parents and teachers can begin teaching children about the relationship between print and reading by showing children how to write and read their own name. In particular, adults could emphasize that to share your name with someone else you must write it with letters, as opposed to drawing a picture. A child's name, as well as other personal names important to the child, could be used to illustrate that one must read print, not a picture, to learn a name.

Overall, the current results suggest that many children may need explicit instruction in order to learn about the role of print in reading. Many simple activities, as discussed above, including those based on everyday activities such as book reading and name writing, could be used to help children master the concept that print is required for reading. Further research is needed to establish which are most effective, as well as the easiest for parents and teachers to implement.

Conclusions

The three studies presented here provide a more detailed picture than previous research of what pre-readers know about what readers read in a book and who has the ability to read. This picture differs in some ways from the one painted by studies that relied primarily on interviews and did not test children's reading abilities. These results show that pre-readers are knowledgeable about the written marks in books and who has the ability to read. However, pre-readers are still in the process of learning what the skill of reading requires. By better characterizing what children know before they enter formal schooling, researchers and teachers can better understand how to approach early reading instruction. In particular, the finding that even some 5-year-old children believe that a picture can be read suggests that some children might benefit from teachers and parents explicitly discussing the role of print in reading. Taken together, the present findings suggest that rather than assuming that children understand what reading requires when they enter formal schooling, teachers should establish what pre-readers do know about reading and tailor their instruction to fill any gaps in children's knowledge.

References

- Andreae, G., & Parker-Rees, G. (2001). *Giraffes can't dance*. New York: Orchard Books.
- Anthony, J. L., Williams, J. M., Zhang, Z., Landry, S. H., & Dunkelberger, M. J. (2014). Experimental evaluation of the value added by raising a reader and supplemental parent training in shared reading. *Early Education and Development*, 25, 493–514.
<https://doi.org/10.1080/10409289.2013.812484>
- Aram, D., & Biron, S. (2004). Joint storybook reading and joint writing interventions among low SES preschoolers: Differential contributions to early literacy. *Early Childhood Research Quarterly*, 19, 588–610. <https://doi.org/10.1016/j.ecresq.2004.10.003>
- Aram, D., & Levin, I. (2016). Mother-child joint writing as a learning activity. In *Literacy studies. Perspectives from cognitive neurosciences, linguistics, psychology and education* (pp. 29–45). New York: Springer. https://doi.org/http://dx.doi.org/10.1007/978-3-319-21136-7_3
- Bates, D., Mächler, M., Bolker, B., & Walker, S. (2015). Fitting linear mixed-effects models using lme4. *Journal of Statistical Software*, 67, 1–48. <https://doi.org/10.18637/jss.v067.i01>
- Bialystok, E. (2000). Symbolic representation across domains in preschool children. *Journal of Experimental Child Psychology*, 76, 173–189. <https://doi.org/10.1006/jecp.1999.2548>
- Bialystok, E., & Martin, M. M. (2003). Notation to symbol: Development in children's understanding of print. *Journal of Experimental Child Psychology*, 86, 223–243.
[https://doi.org/10.1016/S0022-0965\(03\)00138-3](https://doi.org/10.1016/S0022-0965(03)00138-3)
- Bindman, S. W., Skibbe, L. E., Hindman, A. H., Aram, D., & Morrison, F. J. (2014). Parental writing support and preschoolers' early literacy, language, and fine motor skills. *Early Childhood Research Quarterly*, 29, 614–624. <https://doi.org/10.1016/j.ecresq.2014.07.002>

- Both-de Vries, A. C., & Bus, A. G. (2008). Name writing: A first step to phonetic writing? *Literacy Teaching and Learning*, 12(2), 37–55.
- Bowey, J. A., Tunmer, W. E., & Pratt, C. (1984). Development of children's understanding of the metalinguistic term word. *Journal of Educational Psychology*, 76, 500–512.
<https://doi.org/10.1037/0022-0663.76.3.500>
- Bowles, R. P., Pentimonti, J. M., Gerde, H. K., & Montroy, J. J. (2014). Item response analysis of uppercase and lowercase letter name knowledge. *Journal of Psychoeducational Assessment*, 32, 146–156. <https://doi.org/10.1177/0734282913490266>
- Bus, A. G., & van IJzendoorn, M. H. (1999). Phonological awareness and early reading: A meta-analysis of experimental training studies. *Journal of Educational Psychology*, 91, 403–414.
<https://doi.org/10.1037/0022-0663.91.3.403>
- Byrne, B. (1996). The learnability of the alphabetic principle: Children's initial hypotheses about how print represents spoken language. *Applied Psycholinguistics*, 17, 401–426.
<https://doi.org/10.1017/S0142716400008171>
- Castles, A., & Coltheart, M. (2004). Is there a causal link from phonological awareness to success in learning to read? *Cognition*, 91, 77–111. [https://doi.org/10.1016/S0010-0277\(03\)00164-1](https://doi.org/10.1016/S0010-0277(03)00164-1)
- Chaney, C. (1989). I pledge a legiance to the flag: Three studies in word segmentation. *Applied Psycholinguistics*, 10, 261–281. <https://doi.org/10.1017/S0142716400008626>
- Chen, J., Pisani, L., White, S., & Soroui, J. (2012). Parental engagement in early childhood education at home. *Reading Psychology*, 33, 497–524.
<https://doi.org/10.1080/02702711.2012.703038>

- DeLoache, J. S. (2010). Early development of the understanding and use of symbolic artifacts. In U. Goswami (Ed.), *The Wiley-Blackwell handbook of childhood cognitive development* (2nd ed., pp. 312–336). Oxford, UK: Wiley-Blackwell.
<https://doi.org/10.1002/9781444325485.ch12>
- Demir-Lira, Ö. E., Applebaum, L. R., Goldin-Meadow, S., & Levine, S. C. (2019). Parents' early book reading to children: Relation to children's later language and literacy outcomes controlling for other parent language input. *Developmental Science*, 22(3), 1–16.
<https://doi.org/10.1111/desc.12764>
- Downing, J. (1970). Children's concepts of language in learning to read. *Educational Research*, 12, 106–112. <https://doi.org/10.1080/0013188700120203>
- Duncan, G. J., Dowsett, C. J., Claessens, A., Magnuson, K., Huston, A. C., Klebanov, P., ... Japel, C. (2007). School readiness and later achievement. *Developmental Psychology*, 43, 1428–1446. <https://doi.org/10.1037/0012-1649.43.6.1428>
- Dynia, J. M., Justice, L. M., Pentimonti, J. M., Piasta, S. B., & Kaderavek, J. N. (2013). Text features and preschool teachers' use of print referencing. *Journal of Research in Reading*, 36, 261–279. <https://doi.org/10.1111/j.1467-9817.2011.01502.x>
- Ehri, L. C., & Wilce, L. S. (1985). Movement into reading: Is the first stage of printed word learning visual or phonetic? *Reading Research Quarterly*, 20, 163–179.
<https://doi.org/10.2307/747753>
- Evans, M. A., & Saint-Aubin, J. (2005). What children are looking at during shared storybook reading: Evidence from eye movement monitoring. *Psychological Science*, 16, 913–920.
<https://doi.org/10.1111/j.1467-9280.2005.01636.x>

- Evans, M. A., Williamson, K., & Pursoo, T. (2008). Preschoolers' attention to print during shared book reading. *Scientific Studies of Reading, 12*, 106–129.
<https://doi.org/10.1080/10888430701773884>
- Ferreiro, E., & Teberosky, A. (1982). *Literacy before schooling*. New York: Heinemann.
- Fritzley, V. H., & Lee, K. (2003). Do young children always say yes to yes-no questions? A metadevelopmental study of the affirmation bias. *Child Development, 74*, 1297–1313.
<https://doi.org/10.1111/1467-8624.00608>
- Gentner, D. (1981). Some interesting differences between nouns and verbs. *Cognition and Brain Theory, 4*, 161–178.
- Gettinger, M., & Stoiber, K. C. (2014). Increasing opportunities to respond to print during storybook reading: Effects of evocative print-referencing techniques. *Early Childhood Research Quarterly, 29*, 283–297. <https://doi.org/10.1016/j.ecresq.2014.03.001>
- Greenhoot, A. F., Beyer, A. M., & Curtis, J. (2014). More than pretty pictures? How illustrations affect parent-child story reading and children's story recall. *Frontiers in Psychology, 5*, 738.
<https://doi.org/10.3389/fpsyg.2014.00738>
- Hagá, S., & Olson, K. R. (2017). Knowing-it-all but still learning: Perceptions of one's own knowledge and belief revision. *Developmental Psychology, 53*, 2319–2332.
<https://doi.org/10.1037/dev0000433>
- Hayes, S. (1990). *Nine ducks nine*. Cambridge, MA: Candlewick.
- Hiebert, E. H. (1983). Knowing about reading before reading: Preschool children's concepts of reading. *Reading Psychology, 4*, 253–260. <https://doi.org/10.1080/0270271830040306>
- Hiebert, E. H. (1981). Developmental patterns and interrelationships of preschool children's print awareness. *Reading Research Quarterly, 16*, 236–260. <https://doi.org/10.2307/747558>

- Hindman, A. H., Connor, C. M., Jewkes, A. M., & Morrison, F. J. (2008). Untangling the effects of shared book reading: Multiple factors and their associations with preschool literacy outcomes. *Early Childhood Research Quarterly*, 23, 330–350.
<https://doi.org/10.1016/j.ecresq.2008.01.005>
- Hindman, A. H., Skibbe, L. E., & Foster, T. D. (2014). Exploring the variety of parental talk during shared book reading and its contributions to preschool language and literacy: Evidence from the Early Childhood Longitudinal Study-Birth Cohort. *Reading and Writing: An Interdisciplinary Journal*, 27, 287–313. <https://doi.org/10.1007/s11145-013-9445-4>
- Homer, B., & Olson, D. R. (1999). Literacy and children's conception of words. *Written Language & Literacy*, 2, 113–140. <https://doi.org/10.1075/wll.2.1.07hom>
- Justice, L. M., Bowles, R. P., & Skibbe, L. E. (2006). Measuring preschool attainment of print-concept knowledge: A study of typical and at-risk 3- to 5-year-old children using item response theory. *Language, Speech, and Hearing Services in Schools*, 37, 224–235.
[https://doi.org/10.1044/0161-1461\(2006/024\)](https://doi.org/10.1044/0161-1461(2006/024))
- Justice, L. M., & Ezell, H. K. (2001). Word and print awareness in 4-year-old children. *Child Language Teaching and Therapy*, 17, 207–225.
<https://doi.org/10.1177/026565900101700303>
- Justice, L. M., & Ezell, H. K. (2002). Use of storybook reading to increase print awareness in at-risk children. *American Journal of Speech-Language Pathology*, 11, 17–29.
[https://doi.org/10.1044/1058-0360\(2002/003\)](https://doi.org/10.1044/1058-0360(2002/003))
- Justice, L. M., & Ezell, H. K. (2000). Enhancing children's print and word awareness through home-based parent intervention. *American Journal of Speech-Language Pathology*, 9, 257–269. <https://doi.org/10.1044/1058-0360.0903.257>

- Justice, L. M., Kaderavek, J. N., Fan, X., Sofka, A., & Hunt, A. (2009). Accelerating preschoolers' early literacy development through classroom-based teacher–child storybook reading and explicit print referencing. *Language, Speech, and Hearing Services in Schools*, 40, 67–85. [https://doi.org/10.1044/0161-1461\(2008/07-0098\)](https://doi.org/10.1044/0161-1461(2008/07-0098))
- Justice, L. M., McGinty, A. S., Piasta, S. B., Kaderavek, J. N., & Fan, X. (2010). Print-focused read-alouds in preschool classrooms: Intervention effectiveness and moderators of child outcomes. *Language, Speech, and Hearing Services in Schools*, 41, 504–520. [https://doi.org/10.1044/0161-1461\(2010/09-0056\)](https://doi.org/10.1044/0161-1461(2010/09-0056))
- Justice, L. M., Pullen, P. C., & Pence, K. (2008). Influence of verbal and nonverbal references to print on preschoolers' visual attention to print during storybook reading. *Developmental Psychology*, 44, 855–866. <https://doi.org/10.1037/0012-1649.44.3.855>
- Justice, L. M., Skibbe, L. E., Canning, A., & Lankford, C. (2005). Pre-schoolers, print and storybooks: An observational study using eye movement analysis. *Journal of Research in Reading*, 28, 229–243. <https://doi.org/10.1111/j.1467-9817.2005.00267.x>
- Keil, F. C. (1994). Explanation, association, and the acquisition of word meaning. *Lingua*, 92, 169–196. [https://doi.org/10.1016/0024-3841\(94\)90341-7](https://doi.org/10.1016/0024-3841(94)90341-7)
- Keil, F. C., & Batterman, N. (1984). A characteristic-to-defining shift in the development of word meaning. *Journal of Verbal Learning and Verbal Behavior*, 23, 221–236. [https://doi.org/10.1016/S0022-5371\(84\)90148-8](https://doi.org/10.1016/S0022-5371(84)90148-8)
- Kuo, A. A., Franke, T. M., Regalado, M., & Halfon, N. (2004). Parent report of reading to young children. *Pediatrics*, 113, 1944–1951.
- Lavine, L. O. (1977). Differentiation of letterlike forms in prereading children. *Developmental Psychology*, 13, 89–94. <https://doi.org/10.1037/0012-1649.13.2.89>

- Levin, I., & Aram, D. (2012). Mother-child joint writing and storybook reading and their effects on kindergartners' literacy: An intervention study. *Reading and Writing, 25*, 217–249.
<https://doi.org/10.1007/s11145-010-9254-y>
- Levin, I., Aram, D., Tolchinsky, L., & McBride, C. (2013). Maternal mediation of writing and children's early spelling and reading: The Semitic abjad versus the European alphabet. *Writing Systems Research, 5*, 134–155. <https://doi.org/10.1080/17586801.2013.797335>
- Levin, I., Both-de Vries, A. C., Aram, D., & Bus, A. G. (2005). Writing starts with own name writing: From scribbling to conventional spelling in Israeli and Dutch children. *Applied Psycholinguistics, 26*, 463–477. <https://doi.org/10.1017/S0142716405050253>
- Levin, I., & Bus, A. G. (2003). How is emergent writing based on drawing? Analyses of children's products and their sorting by children and mothers. *Developmental Psychology, 39*, 891–905. <https://doi.org/10.1037/0012-1649.39.5.891>
- Lonigan, C. J., Burgess, S. R., & Anthony, J. L. (2000). Development of emergent literacy and early reading skills in preschool children: Evidence from a latent-variable longitudinal study. *Developmental Psychology, 36*, 596–613. <https://doi.org/10.1037/0012-1649.36.5.596>
- Lonigan, C. J., Schatschneider, C., & Westberg, L. (2008). Identification of children's skills and abilities linked to later outcomes in reading, writing, and spelling. In *Developing early literacy: Report of the National Early Literacy Panel* (pp. 55-106). Washington, DC: National Institute for Literacy.
- Luke, S. G., & Asplund, A. (2018). Prereaders' eye movements during shared storybook reading are language-mediated but not predictive. *Visual Cognition, 26*, 351–365.
<https://doi.org/10.1080/13506285.2018.1452323>

- Maguire, M. J., Hirsh-Pasek, K., & Golinkoff, R. M. (2006). A unified theory of word learning: Putting verb acquisition in context. In K. Hirsh-Pasek & R. M. Golinkoff (Eds.), *Action meets word: How children learn verbs* (pp. 364–391). New York: Oxford University Press.
- Martini, F., & Sénéchal, M. (2012). Learning literacy skills at home: Parent teaching, expectations, and child interest. *Canadian Journal of Behavioural Science*, 44, 210–221.
<https://doi.org/10.1037/a0026758>
- Mason, G. E. (1967). Preschoolers' concepts of reading. *The Reading Teacher*, 21, 130–132.
- Mol, S. E., & Bus, A. G. (2011). To read or not to read: A meta-analysis of print exposure from infancy to early adulthood. *Psychological Bulletin*, 137, 267–296.
<https://doi.org/10.1037/a0021890>
- Munn, P. (1995). What do children know about reading before they go to school? In P. Owen & P. Pumfrey (Eds.), *Children learning to read: International concerns* (pp. 105–114). London: Falmer Press.
- National Governors Association Center for Best Practices & Council of Chief State School Officers (2010). *Common Core State standards for English language arts and literacy in history/social studies, science, and technical subjects: About the standards*. Washington, DC. Retrieved from <https://www.corestandards.org/about-the-standards>
- Okanda, M., & Itakura, S. (2010). When do children exhibit a “yes” bias? *Child Development*, 81, 568–580. <https://doi.org/10.1111/j.1467-8624.2009.01416.x>
- Oliver, M. E. (1975). The development of language concepts of pre-primary Indian children. *Language Arts*, 52, 865–869.

- Otake, S., Treiman, R., & Yin, L. (2017). Differentiation of writing and drawing by U.S. two- to five-year-olds. *Cognitive Development*, 43, 119–128.
<https://doi.org/10.1016/j.cogdev.2017.03.004>
- Phillips, B. M., Piasta, S. B., Anthony, J. L., Lonigan, C. J., & Francis, D. J. (2012). IRTs of the ABCs: Children's letter name acquisition. *Journal of School Psychology*, 50, 461–481.
<https://doi.org/10.1016/j.jsp.2012.05.002>
- Piasta, S. B., Purpura, D. J., & Wagner, R. K. (2010). Fostering alphabet knowledge development: A comparison of two instructional approaches. *Reading and Writing: An Interdisciplinary Journal*, 23, 607–626. <https://doi.org/10.1007/s11145-009-9174-x>
- Powell, D. R., Diamond, K. E., Bojczyk, K. E., & Gerde, H. K. (2008). Head start teachers' perspectives on early literacy. *Journal of Literacy Research*, 40, 422–460.
<https://doi.org/10.1080/10862960802637612>
- Price, L. H., Kleeck, A., & Huberty, C. J. (2009). Talk during book sharing between parents and preschool children: A comparison between storybook and expository book conditions. *Reading Research Quarterly*, 44, 171–194. <https://doi.org/10.1598/RRQ.44.2.4>
- Puranik, C. S., & Lonigan, C. J. (2011). From scribbles to scrabble: Preschool children's developing knowledge of written language. *Reading and Writing: An Interdisciplinary Journal*, 24, 567–589. <https://doi.org/10.1007/s11145-009-9220-8>
- Puranik, C. S., Lonigan, C. J., & Kim, Y.-S. (2011). Contributions of emergent literacy skills to name writing, letter writing, and spelling in preschool children. *Early Childhood Research Quarterly*, 26, 465–474. <https://doi.org/10.1016/j.ecresq.2011.03.002>

- Puranik, C. S., Petscher, Y., & Lonigan, C. J. (2014). Learning to write letters: Examination of student and letter factors. *Journal of Experimental Child Psychology*, 128, 152–170.
<https://doi.org/10.1016/j.jecp.2014.07.009>
- R Core Team (2019). *R: A language and environment for statistical computing*. R Foundation for Statistical Computing, Vienna, Austria. Retrieved from <https://www.R-project.org/>
- Reid, J. (1966). Learning to think about reading. *Educational Research*, 9, 56–62.
<https://doi.org/10.1080/0013188660090109>
- Robins, S., & Treiman, R. (2009). Talking about writing: What we can learn from conversations between parents and their young children. *Applied Psycholinguistics*, 30, 463–484.
<https://doi.org/10.1017/S0142716409090237>
- Sarnecka, B. W., & Carey, S. (2008). How counting represents number: What children must learn and when they learn it. *Cognition*, 108, 662–674.
<https://doi.org/10.1016/j.cognition.2008.05.007>
- Schaub, M. (2010). Parenting for cognitive development from 1950 to 2000: The institutionalization of mass education and the social construction of parenting in the united states. *Sociology of Education*, 83, 46–66. <https://doi.org/10.1177/0038040709356566>
- Sim, S. S. H., Berthelsen, D., Walker, S., Nicholson, J. M., & Fielding-Barnsley, R. (2014). A shared reading intervention with parents to enhance young children’s early literacy skills. *Early Child Development and Care*, 184, 1531–1549.
<https://doi.org/10.1080/03004430.2013.862532>
- Skibbe, L. E., Bindman, S. W., Hindman, A. H., Aram, D., & Morrison, F. J. (2013). Longitudinal relations between parental writing support and preschoolers’ language and literacy skills. *Reading Research Quarterly*, 48, 387–401. <https://doi.org/10.1002/rrq.55>

- Snyder, T. D., de Brey, C., & Dillow, S. A. (2019). Digest of education statistics 2017 (NCES 2018-070). In *National Center for Education Statistics, Institute of Education Sciences, U.S. Department of Education*. Washington, DC.
- Stadler, M. A., & McEvoy, M. A. (2003). The effect of text genre on parent use of joint book reading strategies to promote phonological awareness. *Early Childhood Research Quarterly*, 18, 502–512. <https://doi.org/10.1016/j.ecresq.2003.09.008>
- Storch, S. A., & Whitehurst, G. J. (2002). Oral language and code-related precursors to reading: Evidence from a longitudinal structural model. *Developmental Psychology*, 38, 934–947. <https://doi.org/10.1037/0012-1649.38.6.934>
- Strommen, L. T., & Mates, B. F. (1997). What readers do: Young children’s ideas about the nature of reading. *The Reading Teacher*, 51, 98–107.
- Sulzby, E. (1985). Children’s emergent reading of favorite storybooks: A developmental study. *Reading Research Quarterly*, 20, 458–481. <https://doi.org/10.2307/747854>
- Theakston, A. L., Lieven, E. V. M., Pine, J. M., & Rowland, C. F. (2002). Going, going, gone: The acquisition of the verb ‘go.’ *Journal of Child Language*, 29, 783–811. <https://doi.org/10.1017/S030500090200538X>
- Tortorelli, L. S., Bowles, R. P., & Skibbe, L. E. (2017). Easy as AcHGzrjq: The Quick Letter Name Knowledge Assessment. *Reading Teacher*, 71, 145–156. <https://doi.org/10.1002/trtr.1608>
- Treiman, R., Decker, K., Robins, S., Ghosh, D., & Rosales, N. (2018). Parent–child conversations about literacy: A longitudinal, observational study. *Journal of Child Language*, 45, 511–525. <https://doi.org/10.1017/S0305000917000307>

- Treiman, R., Hompluem, L., Gordon, J., Decker, K., & Markson, L. (2016). Young children's knowledge of the symbolic nature of writing. *Child Development*, 87, 583–592.
<https://doi.org/10.1111/cdev.12478>
- Treiman, R., Kessler, B., Decker, K., & Pollo, T. C. (2016). How do prephonological writers link written words to their objects? *Cognitive Development*, 38, 89–98.
<https://doi.org/10.1016/j.cogdev.2016.02.002>
- Treiman, R., Kessler, B., & Pollo, T. C. (2006). Learning about the letter name subset of the vocabulary: Evidence from US and Brazilian preschoolers. *Applied Psycholinguistics*, 27, 211–227. <https://doi.org/10.1017/S0142716406060255>
- Treiman, R., Levin, I., & Kessler, B. (2007). Learning of letter names follows similar principles across languages: Evidence from Hebrew. *Journal of Experimental Child Psychology*, 96, 87–106. <https://doi.org/10.1016/j.jecp.2006.08.002>
- Treiman, R., & Rodriguez, K. (1999). Young children use letter names in learning to read words. *Psychological Science*, 10, 334–338. <https://doi.org/10.1111/1467-9280.00164>
- Treiman, R., Rosales, N., & Kessler, B. (2016). Characteristics of print in books for preschool children. *Writing Systems Research*, 8, 120–132.
<https://doi.org/10.1080/17586801.2015.1074058>
- Treiman, R., Sotak, L., & Bowman, M. (2001). The roles of letter names and letter sounds in connecting print and speech. *Memory & Cognition*, 29, 860–873.
<https://doi.org/10.3758/BF03196415>
- Treiman, R., & Yin, L. (2011). Early differentiation between drawing and writing in Chinese children. *Journal of Experimental Child Psychology*, 108, 786–801.
<https://doi.org/10.1016/j.jecp.2010.08.013>

- U.S. Census Bureau (2017). American community survey 5-year estimates. Retrieved from <https://factfinder.census.gov>
- Wagner, R. K., Torgesen, J. K., Rashotte, C. A., Hecht, S. A., Barker, T. A., Burgess, S. R., ... Garon, T. (1997). Changing relations between phonological processing abilities and word-level reading as children develop from beginning to skilled readers: A 5-year longitudinal study. *Developmental Psychology*, 33, 468–479. <https://doi.org/10.1037/0012-1649.33.3.468>
- Wasik, B. A., Hindman, A. H., & Snell, E. K. (2016). Book reading and vocabulary development: A systematic review. *Early Childhood Research Quarterly*, 37, 39–57. <https://doi.org/10.1016/j.ecresq.2016.04.003>
- Whitehurst, G. J., Falco, F. L., Lonigan, C. J., Fischel, J. E., DeBaryshe, B. D., Valdez-Menchaca, M. C., & Caulfield, M. (1988). Accelerating language development through picture book reading. *Developmental Psychology*, 24(4), 552–559. <https://doi.org/10.1037/0012-1649.24.4.552>
- Yarosz, D. J., & Barnett, W. S. (2001). Who reads to young children?: Identifying predictors of family reading activities. *Reading Psychology*, 22, 67–81. <https://doi.org/10.1080/02702710151130235>
- Zhang, L., & Treiman, R. (2015). Writing dinosaur large and mosquito small: Prephonological spellers' use of semantic information. *Scientific Studies of Reading*, 19, 434–445. <https://doi.org/10.1080/10888438.2015.1072820>
- Zhang, L., & Treiman, R. (in press). Learning to spell phonologically: Influences of children's own names. *Scientific Studies of Reading*. <https://doi.org/10.1080/10888438.2019.1662027>

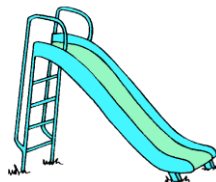
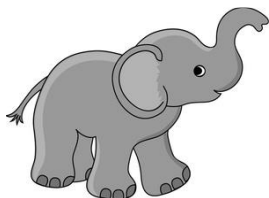
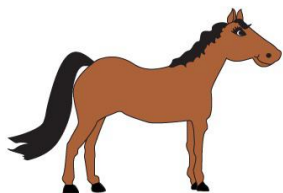
- Zucker, T. A., Justice, L. M., & Piasta, S. B. (2009). Prekindergarten teachers' verbal references to print during classroom-based, large-group shared reading. *Language, Speech, and Hearing Services in Schools, 40*, 376–392. [https://doi.org/10.1044/0161-1461\(2009/08-0059\)](https://doi.org/10.1044/0161-1461(2009/08-0059))
- Zucker, T. A., Cabell, S. Q., Justice, L. M., Pentimonti, J. M., & Kaderavek, J. N. (2013). The role of frequent, interactive prekindergarten shared reading in the longitudinal development of language and literacy skills. *Developmental Psychology, 49*, 1425–1439. <https://doi.org/10.1037/a0030347>

Appendix A

Words in reading task in Experiments 1, 2, and 3.

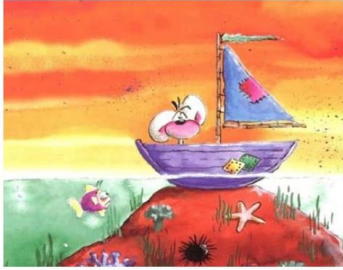
book, come, dog, eat, go, green, in, is, it, jump, look, no, play, red, see, stop, the, up, we, yellow,
yes, you

Filler pictures in reading task in Experiments 1, 2, and 3.



Appendix B

Example pages of books in Experiments 1 and 2



A little mouse was running in and over the big stones carrying peas and beans to her family in the wood. He asked her the way to the gate but she had such a large pea in her mouth that she could not say a thing.



He came to the next town and walked through the big garden. He loved looking at all of the flowers and trees.

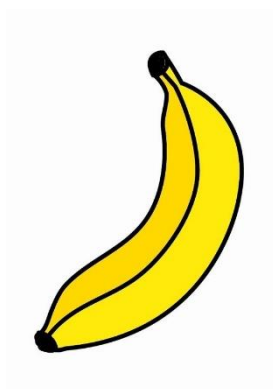
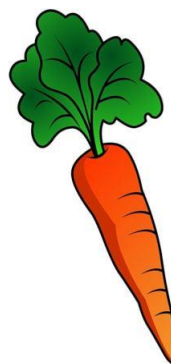
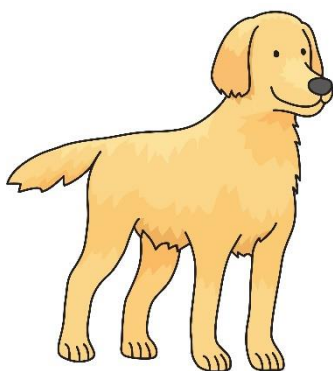
Appendix C

Random order of letters presented in letter naming task in Experiments 1, 2, and 3 (alternates in parentheses).

N (J), Q (i), L (Z), R (S), g (t), U (m), E (K), f (V), P (D)

Appendix D

Pictures used in the introductory task in Experiments 2 and 3.



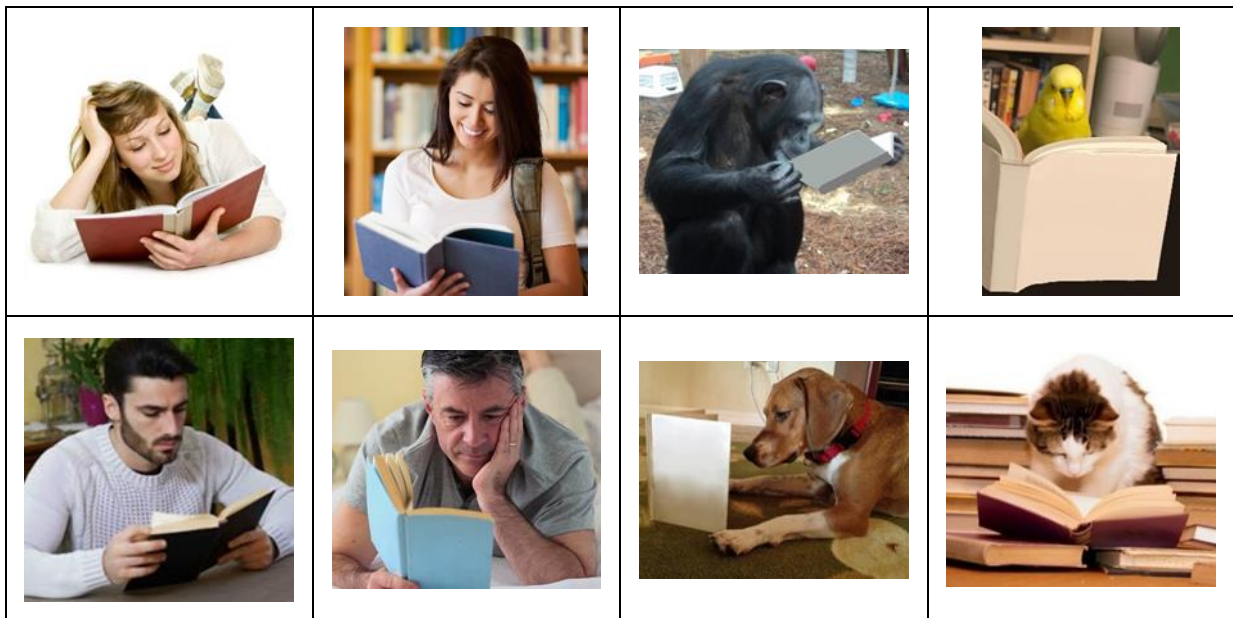
Appendix E

Pictures for Experiment 3

Set 1



Set 2



Appendix F

Tables showing the results of Experiments 1, 2, and 3 grouped by letter name knowledge

Proportion of Trials on Which Children Responded Correctly in Experiment 1

Letter Knowledge Score	Letter	Word	Reading
0-2 (N = 10, mean age = 4;2)	1.0	0.90	0.45
3-6 (N = 11, mean age = 4;4)	0.88	0.91	0.41
7-8 (N = 11, mean age = 4;7)	1.0	1.00	0.64
9 (N = 8, mean age = 4;9)	1.0	0.97	0.88
All Children	0.97	0.94	0.58

Logistic Regression Model Results Showing Log Odds and Odds Ratios of Answering Correctly in Experiment 1

Effect	<i>b</i>	<i>SE</i>	<i>Odds Ratio</i>	<i>p</i>
Intercept	4.01	2.08	55.37	0.053
Letter	56.73	48.78	4.36×10^{24}	0.245
Word	23.69	6.67	1.93×10^{10}	< 0.001
Age	10.40	5.04	3.28×10^4	0.039
Letter Name Knowledge	2.35	0.67	10.44	< 0.001
Age \times Letter	37.13	49.04	1.33×10^{16}	0.449
Age \times Word	-16.66	7.33	5.82×10^{-8}	0.023
Letter Name Knowledge \times Letter	-10.79	10.09	2.05×10^{-5}	0.285
Letter Name Knowledge \times Word	-2.87	1.62	0.06	0.077

Proportion of Trials on Which Children Said Page Can Be Read in Experiment 2

Letter Knowledge Score	Picture Only	Print Only	Both Print and Picture	Blank
0-2 (N = 13, mean age = 4;3)	0.65	0.64	0.75	0.02
3-6 (N = 8, mean age = 4;2)	0.56	0.56	0.94	0.00
7-8 (N = 11, mean age = 4;8)	0.52	0.86	0.98	0.00
9 (N = 10, mean age = 4;8)	0.53	0.78	0.80	0.25
All Children	0.57	0.71	0.90	0.04

Proportion of Trials on Which Children Said Actor Can Read and Said Actor is Reading in Experiment 3

Letter Knowledge Score	“Can read”		“Is reading”	
	Adult	Animal	Adult	Animal
0-2 (N = 9, mean age = 3;11)	0.89	0.11	0.94	0.81
3-7 (N = 7, mean age = 4;7)	1.00	0.14	1.00	0.71
8-9 (N = 7, mean age = 4;6)	0.86	0.00	0.86	0.50
All Children	0.91	0.09	0.93	0.73