Declaration

I hereby declare that this thesis has not been and will not be submitted in whole or in part, to another University for the award of any other degree.

Signed:

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Thesis (by papers) submitted for the degree of Doctor of Philosophy

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University of Sussex

An Investigation Into How Children Gain Vocabulary Via Storybooks

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For many children, storybooks are ubiquitous, forming a unique and special part of their childhood. Storybooks are a critical aspect of young children's emerging literacy. Exposing them to phoneme word sounds, a rich varied vocabulary and print knowledge. This thesis explores one aspect of the amazing relationship children have with storybooks. Specifically, how do children learn new words from books, and it further discusses the best ways to use storybooks to facilitate this learning.

Through the use of purpose-made storybooks, which help to control for all the different book elements (e.g. ensuring the story plot and the words that children were learning were novel). This thesis presents an empirical examination of the cognitive processes that help children learn new words through shared storybook reading. A series of experiments investigate the relationship between repetition of words, sleep consolidation and book formats – and their effects on vocabulary acquisition in 3.5-year-old children.

These experiments have allowed us to isolate factors that increase the likelihood of children learning more words, and knowledge that can be used to support children's vocabulary development. Importantly, we have discovered that children benefit from the same contextually cueing effects as adults supporting Horst, Parsons, and Bryan (2011) theory for repeated effects during repeated book readings. In addition, children demonstrate similar memory consolidation effects as adults when learning immediately proceeds sleep (Stickgold & Walker, 2005a). By examining the effects of rhyme books, we can further contribute to Hayes, Chemelski, and Palmer (1982) levels of processing theory for memory function in children.

Overall, this thesis examines how understanding the cognitive processes supported by regular storybook reading can provide benefits for all preschool children, and outlines accessible and feasible techniques to help children's emergent literacy.

Dedication

This thesis is dedicated to my husband, Dominick, who always believed in me (without you this would never have been possible), to my four children, Axl, Attlas, Arianthe and Auriella; you made me want to know how you know, and to my Mum - thank you for everything.
Families are an amazing place to learn, especially mine.

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> "Everybody reads, and reading is now the greatest single influence upon humanity. The day of the orator has passed, the day of print has long been upon us. No adult remains long uninfluenced by what he reads persistently, and every child receives more impressions from his reading than from all other sources put together."
> *(Sylvester, 1922, p. 4)*

> If you want your children to be intelligent, read them fairy tales. If you want them to be very intelligent, read them more fairy tales.
> *(Einstein, 1879-1955)*

Shortly before going to sleep at night, a young child asks his mother, "Can I have a story please?". Opening the storybook, together they travel for the first time to Neverland where they meet wonderful characters and share in their adventures. Coming to the end of the story, a familiar cry, *"Again please, again"*. Off they fly back to Neverland. Finally shutting the book, the mother tucks in her son and turns off the light. In the morning he says, *"Mummy, I think the crocodile is near"*. *"What crocodile, why do you say that?"*. The mother is surprised to hear that he can hear the ticking of the clock and thinks that it's coming from the crocodile's tummy. The mother is amazed that her son remembered 'tick-tick' words from the story last night (Barrie, 1911).

Vocabulary growth in a child is an amazing phenomenon; for years, the speed and agility with which most children learn to speak has occupied the minds of philosophers (e.g. Aristotle (335 BC), John Locke, Jean Jacques Rousseau; Aristotle, 2014; Locke, 1995; Rousseau & Scott, 2009) and theorists (e.g. Carey & Bartlett, 1978; Nagy, Herman, & Anderson, 1985) alike. There have been many estimates of the number of words children acquire in the first few years. Previously, researchers believed that children's rate of vocabulary acquisition for root words (primary words with no prefix or suffix attached to change the meaning, e.g. '**use**' a root word and

*mis***use**, or **use***d* are part of the family) was high; 7 to 8 words a day (e.g Carey, 1978; Medina, Snedeker, Trueswell, & Gleitman, 2011; Nagy et al., 1985). However, estimates are now more conservative; around 2 words a day in the early years (Beck & McKeown, 1991; Biemiller & Slonim, 2001; Bion, Borovsky, & Fernald, 2013).

It is clear that young children's vocabulary development cannot occur from explicit teaching alone. It is more likely through a complex combination of parent child-directed speech (Fernald & Morikawa, 1993), explicit teaching (Axelsson, Churchley, & Horst, 2012; Coyne, Simmons, Kame'enui, & Stoolmiller, 2004) extensive reading (Nagy et al., 1985) and dialogic techniques (Sénéchal, 1997). Several decades of research has demonstrated that shared storybook reading is a successful method to develop vocabulary (e.g. Coyne et al., 2004; Dunn, Wooding, & Hermann, 1977; Horst, Parsons, & Bryan, 2011; Sénéchal, 1997; Sénéchal & Cornell, 1993; Snow & Goldfield, 1983). However, which specific features of the storybook are best for developing vocabulary remains unclear.

Previous research into word learning has generally focused on the social aspects of storybook reading, such as parental reading styles (Lonigan & Whitehurst, 1998; Namy, Acredolo, & Goodwyn, 2000), the quality of parental involvement (Bus & van Ijzendoorn, 1997) and parental relationships (Bus, 2001). Whilst it is clear that traditional shared storybook reading is an intensely social activity (e.g. Vygotskian view of children being socially scaffolded to learn and interact past their capabilities, which facilitates language acquisition amongst other cognitive skills, Vygotsky, 1980), the focus of word learning throughout this thesis is in understanding the cognitive processes and factors that influence preschool (age 3-4 years) children's word learning from storybooks.

Aims

The current thesis examines which conditions and non-dialogic techniques are best for developing vocabulary. Specifically, it addresses the following overarching questions:

a. How do multiple exposures of a story aid word learning?

b. What role does sleep play in word learning from stories; do preschool children benefit from the same memory consolidation effects as adults?

c. Does changing the format in which stories are written influence word learning? If so, does the effect from rhyme change when children's emergent literacy develops?

This thesis offers an empirically-based insight into preschool children's word learning via storybooks (Papers 1,1a 2, 2a, 2b and 3). It advances knowledge of preschool children's ability to benefit from contextual cueing effects (Horst et al., 2011) with the repeated readings paradigm set up in Paper 1, and repeated in Paper 2. Evidence from Paper 2 supports the theory that preschool children benefit from sleep-related memory consolidation (Stickgold & Walker, 2005a) in a similar way to adults. Paper 3 builds upon the multi-processing account for rhyme and non-rhyme in vocabulary development (Hayes et al., 1982) for both preschool and young school-aged children.

Background

Word learning is a cognitively complex and demanding task that requires memory, perception, attention, visual and listening skills. Children in the early years of life are constantly learning new words and they amass vocabulary quickly. Recent research draws a complex picture, with the number of words learnt dependent on the

percentile of productive vocabulary (the words a child says) into which a young child falls. Actual acquisition rates for children under 6 years range between 1- 3 words a day (Biemiller & Slonim, 2001; Bion et al., 2013). Children do not learn words in isolation; the construction of their vocabulary takes place concurrently to other words and context knowledge (Axelsson & Horst, 2014), and the greater part of children's word learning occurs incidentally from language exposure rather than through explicit teaching (Cunningham & Stanovich, 1998; Markson & Bloom, 1997; Nagy et al., 1985).

Learning From Storybook Reading

Shared storybook reading is a common activity for 18- to 30-month-old children (Simcock & Deloache, 2006) and there are clearly defined links to word learning (Fletcher & Reese, 2005; Lever & Sénéchal, 2011). Thus, shared storybook reading is critically important to young children's language development (Justice & Kaderavek, 2002; Kaderavek & Justice, 2002). Over 84% of parents from high socioeconomic backgrounds with young children under 13 years report reading together regularly and 92% of parents with children older than 13 years agreed that they used to read regularly together (Gleed, 2013).

It is clear that preschool children learn from storybooks (e.g. Blewitt, Rump, Shealy, & Cook, 2009; Cornell & Sénéchal, 1993; Elley, 1989; Sénéchal & LeFevre, 2002; Sénéchal, Thomas, & Monker, 1995). Storybooks help children learn to recognise letter shapes (Bus, Van Ijzendoorn, & Pellegrini, 1995), gain alphabet and print knowledge (Chiong & DeLoache, 2013; Snow & Ninio, 1986), and develop their vocabulary (Sénéchal, 1997). Storybooks also increase children's narrative and plot comprehension (Kendeou, Bohn-Gettler, White, & Van Den Broek, 2008), help them to understand story structure (van Kleeck, 2008), influence conceptual

knowledge (Ganea, Canfield, Simons-Ghafari, & Chou, 2014) and capture attention, which increases listening and comprehension skills (Sénéchal & LeFevre, 2002). In addition, shared storybook reading facilitates story re-enactments (Sulzby & Teale, 1987), enhances the parent-child relationship (Bus, 2001) and, importantly, increases children's interest and enjoyment of reading (Arnold & Whitehurst, 1994; Justice & Kaderavek, 2002).

Stories and storybooks have been used to understand many aspects of preschool children's comprehension, language and literacy acquisition. This includes emerging literacy (Levy, Gong, Hessels, Evans, & Jared, 2006; Sénéchal & Young, 2008), word learning (Elley, 1989; Hargrave & Sénéchal, 2000), expressive and receptive language (Newman, 1996; Sénéchal, 1997), phonological and memory skills (Blewitt et al., 2009; Cain, Lemmon, & Oakhill, 2004), vocabulary extension (Ard & Beverly, 2004; Biemiller & Boote, 2006; Elley, 1989), reading comprehension (de Jong & Leseman, 2001), increasing inferential conversations (Milburn, Girolametto, Weitzman, & Greenberg, 2014) and predictions for later language acquisition and academic success (Blewitt et al., 2009; Burch & Looker, 2007; Fletcher & Reese, 2005; Rimm-Kaufman & Pianta, 2000). Reading out loud can be an effective way to expose preschool children to new vocabulary because new words are not only spoken and repeated, but they are often visually depicted within the storybook, providing plenty of consolidation opportunities.

Preschool children are exposed to a more lexically rich vocabulary via storybooks than through typical adult speech, although both exposures positively influence language development throughout a child's early life (Fletcher & Reese, 2005; Hayes & Ahrens, 1988; Mason & Allen, 1986). Cunningham and Stanovich (1998) measured words in storybooks written for 1st grade-11th grade American

children and found that the average rank of rare words in children's books was 627 ('*the*' ranked number 1, the most common word). In contrast, the rank of rare words in adult speech is 496. The average number of rare words per 1,000 words is 30.9 for children's books, and 17.3 for adult speech. Moreover, in an American corpus comparison of 100 young children's picture books, there were found to be more unique words in books than in child-directed speech (Montag, Jones, & Smith, 2015).

Throughout children's early development, storybooks continue to aid language acquisition. From early joint shared storybook readings through to independent reading for young school-aged children (Coyne et al., 2004), children develop a love and enjoyment of reading; they deepen conceptual understanding, increase phonological skills, and begin to take an important step towards gaining alphabetical and print knowledge. This makes shared storybook reading an exceptional way to help children develop language and vocabulary.

Dialogical techniques. Book reading is most effective when there are interactions during reading (Huebner & Meltzoff, 2005; Whitehurst et al., 1988). Shared storybook reading rarely occurs in isolation; readers and children naturally talk and ask questions, increasing the understanding of the text and developing word knowledge. Shared storybook reading actively engages preschool children whilst interactive reading provides additional benefits (e.g. dialogical reading techniques), especially for explicitly and implicitly taught words (Coyne et al., 2004), i.e., words children learn from context without intentional instruction.

Dialogical reading involves training parents or teachers with specific techniques. Reversing traditional read-aloud methods, the children go from being the passive listener to the storyteller and the adult becomes the active listener, providing

feedback and increasing the sophistication levels of open-ended questions being posed to the child (Arnold & Whitehurst, 1994; Whitehurst et al., 1994; Whitehurst et al., 1988). Dialogic reading benefits younger children (aged 2-3 years) more than older children (aged 4-5 years old, a meta analysis by Mol, Bus, de Jong, & Smeets, 2008). One explanation of this finding is that 4-5-year-old children are distracted by the interruption of questions (Mol et al., 2008).

Learning From Storybook Reading From A Dynamic Systems Perspective

Dynamic systems theory (DST) attempts to explain child development by examining the multiple causes that influence children's behaviour in any given situation (Thelen & Smith, 1994). Dynamic systems theory originally emerged from an area of mathematics where it is used to describe the behaviour of complex nonlinear dynamical systems (e.g., planetary obits – minor planes and orbital resonance with larger planets, Roy, 2012). Dynamic systems theory is now widely employed in many areas of psychology including motor development (Thelen & Smith, 1994), situational awareness and decision making (Endsley, 1995), development of antisocial behaviour (Granic & Patterson, 2006), and cognitive development (Smith, 2005). Originally applied to developmental psychology as a way to explain motor development in infants (Thelen, 1989), dynamic systems theory has become a key theoretical approach to understand all aspects of cognitive and behavioural development (e.g., Spencer, 2009; Thelen & Smith, 1994). With the emphasis on many different systems being involved and being affected; the brain, the body, social and environmental factors across developmental timescales.

Critically, the role of time is central to dynamic systems theory (Elman, 2003; Thelen & Smith, 1994). From the dynamic systems perspective, behaviour is the

product of multiple, nested timescales. That is, what the child has previously experienced will influence his/her subsequent behaviour. As a consequence, the individual child's developmental history (the past timescale) and what has recently been happening, for example, how the child is asked to use working memory and make decisions about the incoming information ("just previous past" timescale), can both affect current behaviour (the present timescale, Samuelson & Horst, 2008).

These timescales are also observed in children's word learning from storybook reading. In this situation, the nested timescales include what knowledge of words and books the child brings to the lab (i.e., developmental history), what happens during and around the reading phase (e.g., storybook format, dialogic techniques, naptime, i.e., just previous past) and what the child is asked to do at test (test trial format, test type, i.e., the present). Each of these timescales is examined in this thesis, although I concentrate on how the just previous past influences children's word learning from storybooks. Specifically, I examine the just previous past in the investigations of global repetition of stories (Paper 1, Paper 2), local repetition of words and sounds (Paper 3) and whether children are given the opportunity to sleep shortly after hearing storybooks (Paper 2). In addition, this thesis also examines the present by presenting children with test trials that do and do not include direct competitors (Paper 2), and by presenting children with both pictures and objects across test trials (Paper 3). Finally, developmental history is a factor in Paper 3, where I test developmental differences in children's ability to learn from storybooks that rhyme.

In addition to a focus on time, proponents of dynamic systems theory argue that children's behaviour is affected by different factors, which in turn are affected by the specific task and contexts (see e.g., Samuelson, Schutte, & Horst, 2009). In terms of child development behaviour is softly assembled: many different elements

(not one singular factor) interact to drive behaviour. As such, one small change in the task or context can lead to a big change in children's behaviour. This aspect of dynamic systems theory is particularly relevant to my research. For example, I demonstrate in Paper 2 that what children do immediately after the stories have been read (e.g., nap, remain awake) has a dramatic effect on subsequent word learning

Approaching children's word learning from a dynamic systems perspective allows us to understand the complex biological, social and psychological systems that interplay with nested processes (Miller, 2010). Although the studies in this thesis are carefully controlled to minimise methodological effects, there is an awareness that - in children's everyday experiences learning from storybooks - a multitude of factors interact with one another which impacts children's subsequent word learning. For example, children rarely encounter storybooks solely by hearing the text and looking at the pictures, that is without a degree of interaction between the storyteller and themselves. The research in this thesis, however, will demonstrate that children do, in fact, learn words from storybooks well without this interaction.

Memory and Cognitive Functions

Early work in understanding the functions of memory by Atkinson and Shiffrin (1968) proposed that incoming information from the environment initially comes into a temporary, short-term storage system, which acts as a reception area for the more permanent, long-term memory storage. The short-term storage system also functioned as a work-memory area where long-term-memory learning could occur and other complex cognitive functions such as decision-making and language comprehension could take place. Work with neuropsychological patients, specifically those with aphasia (Shallice & Warrington, 1970), highlighted inconsistency on just

two distinct components of memory – specifically the short-term storage system. Baddeley and Hitch (1974) proposed a multi-component working memory system, which had three parts: a limited-capacity attentional control system (the central executive, which controls the whole system and integrates multiple tasks and functions) that is supported by the phonological loop, which processes verbal and acoustic information and the visuospatial sketchpad that processes visual information. To further extend the three-component model of working memory and to allow an account for more phenomena, a fourth component was later introduced (Baddeley, 2000): the episodic buffer is a limited storage capacity system, integrating information from subsidiary systems and the long-term memory. Specifically, the episodic buffer integrates new information from the more isolated subsystems in the model, such as integrating visual, spatial and verbal in chronological sequence (e.g., the plot of a story). The inclusion of the episodic buffer in multi-component working memory system allows for greater understanding of the complex working memory. Information is principally retrieved by conscious awareness from the episodic buffer.

The phonological loop is of particular importance when understanding how children learn new words. The phonological loop includes two subcomponents; the first is a temporary storage system in which memory traces are held for just seconds and will decay rapidly unless strengthened by the subvocal rehearsal system. The second component of the phonological loop maintains the current memory trace and helps to create links to ‘named’ visual information that have been previously stored (Baddeley, 2003). The phonological loop plays a crucial role in the learning of new novel word. Its primary function is to temporarily store sound patterns, whilst the construction of robust memories takes place (Baddeley, Gathercole, & Papagno,

1998). This temporary storage is vital, as children's ability to store and retrieve information from the working memory is closely linked to word learning (Hansson, Forsberg, Löfqvist, Mäki‐Torkko, & Sahlén, 2004) and academic achievement (Alloway, Gathercole, Willis, & Adams, 2004).

Repetition. Memory is critical in word learning; children need to be able to process the new words they hear and recall them correctly (Sénéchal et al., 1995). To do this, the new vocabulary needs to be integrated into children's lexical memory (Dumay & Gaskell, 2007). To comprehend the story, reading requires combining different parts of text or narrative and encoding them to create robust memories, or causal network (a narrative representation between events and outcomes in the story), which links the text to other memories (van den Broek, Tzeng, Risden, Trabasso, & Basche, 2001). Semantic story information is processed at a deeper level than phonological information, resulting in stronger memory traces (Craik & Lockhart, 1972; Lockhart, 2002).

Preschool children especially gain word learning benefits when they hear the same stories repeatedly (Hargrave & Sénéchal, 2000; Horst et al., 2011; McLeod & McDade, 2011; Morrow, 1988; Robbins & Ehri, 1994; Sénéchal, 1997). In particular, there are many benefits for 3-to-4-year-old children as both their receptive and expressive vocabulary benefit from repeated readings (Sénéchal, 1997). Children's receptive word learning is significantly improved when stories are read repeatedly, when compared to hearing one long story (word exposure is controlled across conditions, McLeod & McDade, 2011). Recently, Horst et al. (2011) tested 3-year-old children after they had heard multiple different stories, or the same stories repeated, and found that repeated readings significantly increased word learning. Repeating storybooks to children not only creates more opportunities for children to

encode new information successfully (Horst, 2013; Horst et al., 2011), but it also reduces the cognitive demands of language acquisition. Horst (2013) compares this effect to contextual cueing, where increased repetition creates predictability, which reduces the cognitive demand on processing incoming information (for a review see Smith, Colunga, & Yoshida, 2010) .

Contextual cueing is an effect where learning becomes more efficient when the context of the target stimuli is repeated across exposures (Chun, 2000; Chun & Jiang, 1998). For example, during a visual search task, when half of the trial locations are repeated, adults are more accurate in detecting the target from familiar contexts than from contexts not previously seen (Chun & Jiang, 1998). By repeating the contextual information, such as stable spatial information and object covariance, contextual cueing guides and focuses attention to novel aspects not previously encountered (Chun, 2000). In reality, words and objects rarely appear in isolation; they are nearly always embedded into contextually rich environments, and exposures occur in conjunction with many other factors (Oliva & Torralba, 2007). This situation is replicated with storybook reading where new words and visual information—from repeated illustrations and text—are introduced in an ecologically valid way.

Consolidation. In addition to contextual repetition, sleep-related memory consolidation facilitates word learning in both 7-12-year-old children (Brown, Weighall, Henderson, & Gareth Gaskell, 2012) and adults (Gaskell, Davis, Dumay, & Macdonald, 2005). Sleep is highly important for children's vocabulary development (Edgin et al., 2015). Newly learnt information is encoded via neural processes and becomes more stable over time, such that the information can be

recalled later as a more stable, strengthened and enhanced memory (Müller & Pilzecker, 1900; Stickgold, 2013b; Stickgold & Walker, 2005a).

Sleep onset results in a loss of consciousness and behavioural control, and comprises 90-minute cycles of rapid eye-movement sleep (REM) and non-REM sleep (NREM), which is partly slow-wave sleep (SWS). Both REM and SWS have been associated with off-line memory processing (Stickgold, 2005). Specifically, hippocampus-dependent memories are linked with one of the stages of sleep cycles SWS; activation is seen in the prefrontal-hippocampal circuitry at the SWS stage of sleep (Marshall & Born, 2007; Stickgold, 2005). Children sleep for longer than adults and spend more than twice the amount of time in SWS sleep, which is associated with memory consolidation (Stickgold, 2013a).

The connection between sleep and memory has long been established (Müller & Pilzecker, 1900; Walker, Brakefield, Hobson, & Stickgold, 2003). A compelling amount of research and behavioural studies provide support for the role that sleep plays in long-term memory consolidation for adults (Diekelmann & Born, 2010; Marshall & Born, 2007; Stickgold & Walker, 2005a) and infants (Hupbach, Gomez, Bootzin, & Nadel, 2009). Until recently, the specific benefits to young children and their emergent literacy skills has been largely neglected. By using the word learning paradigm set up in Paper 1, we are able to explore the effects of sleep and memory consolidation on young children in Paper 2.

General Methods for Empirical Papers

This thesis comprises three empirical papers (Papers 1-3). When conducting empirical research on word learning from storybooks, commercially available books can make it difficult to control because of the types of pictures, the number of words

that children hear, and the possible familiarity of the words. Choosing the right type of book for shared storybook reading is critical. For example, 18-36-month old children demonstrate greater word learning from books with higher iconity and realistic storylines (Chiong & DeLoache, 2013; Simcock & Deloache, 2006, 2008; Tare, Chiong, Ganea, & DeLoache, 2010). In addition, age-appropriate books enhance children's enjoyment and engagement at least until age 4 (Dwyer & Neuman, 2008). To replicate the effect of repeated readings on children's ability to learn new words and concepts from new stories, purposely-written storybooks were read. These storybooks included natural photographs, only slightly altered in Photoshop

Various methods for reading to young children have been employed in this research area, including recorded stories (Hayes, Chemelski, & Palmer, 1982), books presented on a laptop (Read, 2014), and with parents or teachers reading out loud (Whitehurst et al., 1994; Whitehurst & Lonigan, 1998), which makes it difficult to separate the benefits for word learning in storybooks from the reading style. With purposely-written storybooks containing novel words, being read by the same person, I am able to control for all variables other than the factors being manipulated.

Developing novel storybooks is critical to enable the examination of the developmental and cognitive processes that underpin children's word learning in the most ecologically valid way. Nine purposely-written storybooks were used across the three empirical papers (see Supplementary Study, Paper 1 a). All of the storybooks used in the present studies contain age-appropriate protagonists and storylines with a moral. This is important because a story that captures children's attention and interest will aid vocabulary development (Coyne et al., 2004).

Synonyms are common in much storybook research (see Ard & Beverly, 2004, for a related discussion). Use of synonyms presents difficulty in controlling whether children have pre-existing knowledge of the words, which are then mapped on to known concepts (e.g. infant for baby, ladle for spoon). In order to create a rigorous and valid test of children's word learning and to avoid issues created by having synonyms and commercial books, I chose to use novel nouns in the purposely-written books. The choice of nouns as target words makes for a more effective study. The training phases are faster and in line with children's typical experiences, as English speaking children are quicker to acquire nouns and learn them before verbs (Childers & Tomasello, 2002; Robbins & Ehri, 1994).

Although 3- and 4-year-old children demonstrate remarkable retention for a single word (e.g. Markson & Bloom, 1997), children do not learn words in isolation. Preschool children are able to learn multiple new words at once (Axelsson & Horst, 2013). Through the use of multiple novel name-object pairs throughout these stories, I was able to challenge 3-year-old children in a more realistic way by forcing them to demonstrate word learning when faced with multiple alternative referents. Children choose an object at test by discriminating objects on the basis of the phonetic content of the associated word rather than simply on the basis of it being the only novel word they were introduced to (Axelsson & Horst, 2013). This replicates as closely as possible how children legitimately learn a word that they have never encountered previously (Cain, Oakhill, & Elbro, 2003; McLeod & McDade, 2011; Sénéchal & Cornell, 1993). In addition, using purposely-written storybooks in all studies has allowed me to control for the total number of words and target words that the children hear. Importantly, across all conditions, children within the same experiment had the same number of exposures to target words so that any effects of

the experimental manipulations could not be attributed to differences in the number of exposures.

Finally, to isolate specific factors that help children learn new words from storybooks, I employed a pure reading technique (Papers 1-3). In this method of reading, pictures are not pointed to and questions from the child are dealt with only to refocus attention back to story, e.g. "I don't know, why don't we read on and find out together". In addition, I used implicit vocabulary learning, where children heard the text of the story, but target words were not highlighted or drawn attention too (e.g. Sénéchal et al., 1995).

Paper 1. The Same Old Story: Contextual Cueing Facilitates Word Learning via Storybooks

> "If one cannot enjoy reading a book over and over again,
> there is no good in reading it at all."
> *(Wilde, 1889, p.42)*

School-aged (4-11-year olds) children often request the same storybooks over and over again (Martinez & Roser, 1985; Sulzby, 1985). Repeating the story allows children to become more engaged and familiar with the plot (Martinez & Roser, 1985). Three-year-old children who are read the same story consecutively learn more words than children who are read different stories (Horst et al., 2011), one longer story (McLeod & McDade, 2011) or fewer stories (Sénéchal & Cornell, 1993), presumably due to contextual cueing effects (e.g. Horst, 2013).

The goal of this paper is to explore whether 3-year-old children are benefiting from contextual cueing effects when stories are repeated, but not consecutively, i.e., repeated across days; not during the same session. Going beyond previous studies, we repeated a set of same stories over the course of one week. Children in a control

condition heard different stories over the same period. All children heard three storybooks during each visit; they heard either the same three stories or three different stories at each visit. All children had the same exposure to novel name-objects pairings.

Supplementary Study: Adult Ratings of Storybooks

Parents were asked to rate whether the 3- to 4-year-old children in our subsequent studies would find the nine purposely-written storybooks similar to other commercially available storybooks that they might experience. This measure is essential to employing rigorous experimental controls, whilst maintaining as much ecological validity to shared storybook reading as possible. Maintaining ecological validity for the children, during the empirical studies, is important to ensure that they have a similar experience to their regular shared storybook reading (for further discussion see Supplementary Materials, Paper 1).

Paper 2. Goodnight Book: Sleep Consolidation Improves Word Learning via Storybooks

> "I cannot sleep unless I am surrounded by books."
> *(Borges, 1899-1986)*

During the preschool period, there are many changes in children's sleep behaviours (Kurdziel, Duclos, & Spencer, 2013). This is a key age for the development of children's literacy abilities (Durand, Hulme, Larkin, & Snowling, 2005). However, to our knowledge, the potential beneficial impact of sleep on word learning has been generally neglected in research with preschool children.

Young children (2-5-year olds) regularly take daytime naps (Mednick, 2013) and often experience storybook reading before naps or bedtime. Sleep research has

found consolidation benefits for how much adults can retain from what they have learned as a result of sleep (e.g. Mednick, Nakayama, & Stickgold, 2003; Stickgold & Walker, 2005a, 2005b), but do preschool children experience the same effects? If preschool children experience a word learning benefit from sleeping soon after exposure to the new words, then we should see greater vocabulary gains for children who napped directly after hearing stories when compared to those children who heard the same stories and stayed awake. However, if sleep does not help preschool children's memory for novel words, there should be no difference between groups, or a possible benefit for the children that stayed awake (see, e.g., Werchan & Gómez, 2014).

All children were tested at the same time of the day; those who still naturally napped took their nap shortly after hearing the story, and those who no longer required a nap stayed awake. All children were tested again 3 hours after the story exposures, and again one day later. Finally, retention of newly learned words was tested after one week. Therefore, the effects of napping as well as nocturnal sleep were investigated in this study.

Supplementary Study: Story Plot Questions

To investigate whether 3-year-old children were demonstrating better word learning due to increased interest or attention when hearing the same or different stories, I designed and included plot questions to ask the children about the story that they had heard. To minimise any additional advantage to the children in my studies, I used a closed question structure (e.g., "Is Rosie *happy* or *sad* in the morning?), as this has been shown to be ineffectual in supporting learning (McKeown & Beck, 2003) when compared to rich dialogical questions and discourse (Nystrand, 2006; Nystrand, Wu, Gamoran, Zeiser, & Long, 2003). These questions allowed me to

measure young children's attention to the stories, to ensure that they all received the same word learning exposure, and similarly how well they had understood the story they had heard. This procedure ensured that the children could recognise the referents after hearing the stories, but I do not make any judgements about their implicit understanding about the story plot (for further discussion see Supplementary Materials, Paper 2a).

Supplementary Study: Storybook Enjoyment Ratings

To further extend our understanding of the benefits that preschool children gain from story repetition, I designed a measure to investigate children's enjoyment of the stories they had heard. I piloted a judgment scale with nine smiley faces, to find three faces to represent a measure on the ratings scale. There were three faces in each set, to represent each choice ('liked it a lot,' 'liked it a little,' 'did not like it') to be used in conjunction with a 3-point rating scale. The aim was to find a 'smiley' (from a set of three) that best represented each point on the ratings scale.

The 3-point rating scale has been used in several previous studies with children in this age group (Anderson et al., 2000; Asher, Singleton, Tinsley, & Hymel, 1979; Crawley, Anderson, Wilder, Williams, & Santomero, 1999; Grimshaw, Dungworth, McKnight, & Morris, 2007), as have 'smiley' faces and emoticons (Airey, Plowman, Connolly, & Luckin, 2002; Rademacher & Koschel, 2006; Tung & Deng, 2007; Wong & Baker, 1988). When combining both the scale and pictorial representations (i.e., smileys), it becomes a sensible measurement technique that can be used to help preschool children share their views and experiences of the storybooks after they hear them (for further discussion see Supplementary Materials, Paper 2b).

Paper 3. Neither Rhyme Nor Reason: Rhyming Children's Books Help Young Readers But Not Pre-Schoolers Learn Words

> "The more that you read, the more things you will know.
> The more that you learn, the more places you'll go."
> *(Dr Seuss, 1978, p.13)*

A widely held belief is that children prefer books that rhyme, and many rhymes are used to help teach 0-4-year-old children numbers, letters and different concepts (Dwyer & Neuman, 2008; Pentimonti, Zucker, & Justice, 2011). Teaching children (0-29-month-olds) to be aware that words share a particular sound gives them an important insight into word structures (Bus & van Ijzendoorn, 1999). Increasing preschool children's phonemic awareness and alphabet knowledge prior to entering school gives them an advantage for early reading and writing (Bus & van Ijzendoorn, 1999; Raz & Bryant, 1990). However, there have been conflicting findings as to whether books that rhyme do actually provide learning benefits (see Hayes, 1999; Hayes, 2001; Hayes et al., 1982; Johnson & Hayes, 1987; and see also Read, 2014; Read, Macauley, & Furay, 2014). Hayes and colleagues (Hayes, 1999; Hayes et al., 1982; Johnson & Hayes, 1987, see also Craik, 2002; Craik & Lockhart, 1972) have argued that 3-5-year-old children fail to attend to the semantic content in rhyming books, which requires deeper processing, due to the increased attentional draw towards the phonological characteristics of words.

To explore whether the types of books children hear do affect word learning, two identical purpose-written storybooks in rhyme and non-rhyme were used with an established word-learning paradigm (Horst et al., 2011; Williams & Horst, 2014; Williams, Horst, & Oakhill, 2011). To our knowledge, ours is the first study to use identical books to explore the effects of rhyme. In Experiment 1, preschool children were either read a book that rhymed or one that did not rhyme, using a version of the

word learning paradigm (Papers 1 and 2). Storybooks were novel and identical in every way except that the words were arranged to rhyme in one version. To investigate whether the children learned more words due to increased interest in, and attention to, hearing the rhyme or non-rhyme stories, they were asked closed questions about the story plot.

Previous research has highlighted a connection between 4-7-year old children's reading ability and phonological awareness (e.g. Bryant et al., 1990; Kirtley, Bryant, MacLean, & Bradley, 1989; Raz & Bryant, 1990). Once children have begun to learn to read, they may be less distracted by rhyme; rhyme may facilitate learning, similar to adults' learning in the Hayes et al.'s (1982) study. To explore whether rhyme effects can be found developmentally I examine the impact of rhyme on young school-aged children's ability to learn words from stories that rhyme, in Experiment 2, by repeating the study with Year 1 children (early readers) and adding a measure of enjoyment (see Supplementary Materials, Paper 2b) and a retention test one week later.

Much of young children's learning (incidental and explicit) occurs through the transfer of knowledge. Children can transfer knowledge from one context to another from a young age (1-year-old); a skill that develops rapidly throughout childhood (Ganea, Ma, & DeLoache, 2011; Ganea, Pickard, & DeLoache, 2008). Transference occurs from 2D representations, such as books and television, to 3D representations by retelling stories, or acting out scenes from television shows (Ganea et al., 2011; Ganea et al., 2008). Children (15-24-month olds) are even able to extend transference knowledge to identify a 3D object, even after it changes colour from its initial 2D presentation (Ganea, Allen, Butler, Carey, & DeLoache, 2009). The ability to transfer knowledge is an important skill as children have a great

deal of exposure to new language, concepts and domain knowledge via storybooks that can be applied to the real world.

By using both 2D and 3D representations of objects as a word learning measure, I am able to see whether children have encoded new words and are able to transfer the knowledge successfully. This provides us with a more valid measure of their word learning (Barr, 2010). To date, there has been relatively little empirical research into the transfer of knowledge from storybooks, especially when preschool children are learning consistently from stories, television and computers in educational environments.

Summary of Current Research

This thesis investigates children's word learning from shared storybook reading and includes three empirical papers. Paper 1 demonstrates that children are better able to learn new words from stories when the storybooks are repeated across several days. That is, a small change of simply repeating the same stories to children results in significant word learning. This global repetition allows for more successful consolidation of new words by creating robust connections for these new words in children's lexicons. Paper 2 highlights the beneficial effects of sleep consolidation on memory. Children benefit from learning new information from stories prior to the onset of sleep. Sleep is especially beneficial for children in the more challenging situation of trying to learn new words from different stories. Paper 3 examines the developmental effects of local repetition for learning new words by comparing stories that rhyme to those that do not rhyme. Stories in rhyme reduce preschool children's ability to process deeper, semantic information and hinder robust word

learning. School-aged children are able to learn words from stories in rhyme, but this effect is fleeting.

Collectively, these papers provide a novel insight into the roles of both global and local repetition on how children learn words from shared storybook reading.

References

Airey, S., Plowman, L., Connolly, D., & Luckin, R. (2002). *Rating Children's Enjoyment of Toys, Games and Media.* Paper presented at the 3rd World congress of the international toy research association on toys, games and media, London.

Alloway, T. P., Gathercole, S. E., Willis, C., & Adams, A.-M. (2004). A structural analysis of working memory and related cognitive skills in young children. *Journal of Experimental Child Psychology, 87*(2), 85-106. doi:http://dx.doi.org/10.1016/j.jecp.2003.10.002

Anderson, D. A., Bryant, J., Wilder, A., Santomero, A., Williams, M., & Crawley, A. M. (2000). Researching Blue's Clues: Viewing Behavior and Impact. *Media Psychology, 2*(2), 179 - 194 doi:10.1207/S1532785XMEP0202_4

Ard, L. M., & Beverly, B. L. (2004). Preschool Word Learning During Joint Book Reading: Effect of Adult Questions and Comments. *Communication Disorders Quarterly, 26*(1), 17-28. doi:10.1177/15257401040260010101

Aristotle. (2014). *Complete Works of Aristotle, Volume 1: The Revised Oxford Translation: The Revised Oxford Translation* (Vol. 1): Princeton University Press Original work (335BC).

Arnold, D. S., & Whitehurst, G. J. (1994). *Accelerating Language Development Through Picture Book Reading: A Summary of Dialogic Reading and its Effect*. Malden: Blackwell Publishing.

Asher, S. R., Singleton, L. C., Tinsley, B. R., & Hymel, S. (1979). A Reliable Sociometric Measure for Preschool Children. *Developmental Psychology, 15*(4), 443-444. doi:10.1037/0012-1649.15.4.443

Atkinson, R. C., & Shiffrin, R. M. (1968). *Human memory: A proposed system and its control processes* (Vol. 2): Academic Press,.

Axelsson, E. L., Churchley, K., & Horst, J. S. (2012). The Right Thing at the Right Time: Why Ostensive Naming Facilitates Word Learning. *Frontiers in Psychology, 3*, 88. doi:10.3389/fpsyg.2012.00088

Axelsson, E. L., & Horst, J. S. (2013). Testing a Word is Not a Test of Word Learning. *Acta Psychologica, 144*(2), 264-268. doi:10.1016/j.actpsy.2013.07.002

Axelsson, E. L., & Horst, J. S. (2014). Contextual repetition facilitates word learning via fast mapping. *Acta Psychologica, 152*, 95-99. doi:10.1016/j.actpsy.2014.08.002

Baddeley, A. (2000). The episodic buffer: a new component of working memory? *Trends in Cognitive Sciences, 4*(11), 417-423. doi:10.1016/S1364-6613(00)01538-2

Baddeley, A. (2003). Working memory and language: an overview. *Journal of Communication Disorders, 36*(3), 189-208. doi:10.1016/S0021-9924(03)00019-4

Baddeley, A., Gathercole, S., & Papagno, C. (1998). The phonological loop as a language learning device. *Psychological Review, 105*(1), 158. doi:10.1037/0033-295X.105.1.158

Baddeley, A., & Hitch, G. (1974). *Working memory* (Vol. 8,). New York: Academic Press.

Barr, R. (2010). Transfer of Learning Between 2D and 3D Sources During Infancy: Informing Theory and Practice. *Developmental Review, 30*(2), 128-154. doi:10.1016/j.dr.2010.03.001

Barrie, J. M. (1911). *Peter Pan* Charles Scribner's Sons, New York, .

Beck, I., & McKeown, M. (1991). *Conditions of Vocabulary Acquisition* (Vol. Vol. 2.). Hillsdale, NJ, England: Lawrence Erlbaum Associates, Inc, xvii: Psychology Press.

Biemiller, A., & Boote, C. (2006). An Effective Method for Building Meaning Vocabulary in Primary Grades. *Journal of Educational Psychology, 98*(1), 44-62. doi:10.1037/0022-0663.98.1.44

Biemiller, A., & Slonim, N. (2001). Estimating Root Word Vocabulary Growth in Normative and Advantaged Populations: Evidence for a Common Sequence of Vocabulary Acquisition. *Journal of Educational Psychology, 93*(3), 498-520. doi:10.1037/0022-0663.93.3.498

Bion, R. A., Borovsky, A., & Fernald, A. (2013). Fast Mapping, Slow Learning: Disambiguation of Novel Word-Object Mappings in Relation to Vocabulary Learning at 18, 24, and 30 Months. *Cognition, 126*(1), 39-53. doi:10.1016/j.cognition.2012.08.008

Blewitt, P., Rump, K. M., Shealy, S. E., & Cook, S. A. (2009). Shared Book Reading: When and How Questions Affect Young Children's Word Learning. *Journal of Educational Psychology, 101*(2), 294-304. doi:10.1037/a0013844

Brown, H., Weighall, A., Henderson, L. M., & Gareth Gaskell, M. (2012). Enhanced Recognition and Recall of New Words in 7-and 12-year-olds Following a Period of Offline Consolidation. *Journal of Experimental Child Psychology, 112*(1), 56-72. doi:10.1016/j.jecp.2011.11.010

Bryant, P. E., MacLean, M., Bradley, L. L., & Crossland, J. (1990). Rhyme and Alliteration, Phoneme Detection, and Learning to Read. *Developmental Psychology, 26*(3), 429. doi:10.1037/0012-1649.26.3.429

Burch, M., & Looker, E. (2007). *Picture Book Reading With Toddlers: Exploring Changes in Maternal Support Over Time*. Paper presented at the Cognitive Development Society, Santa Fe, New Mexico. poster retrieved from

Bus, A. G. (2001). *Joint Caregiver-child Storybook Reading: A Route to Literacy Development* (Vol. 1).

Bus, A. G., & van Ijzendoorn, M. H. (1997). Affective Dimension of Mother-infant Picturebook Reading. *Journal of School Psychology, 35*(1), 47-60. doi:10.1016/s0022-4405(96)00030-1

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*(3), 403-414. doi:10.1037/0022-0663.91.3.403

Bus, A. G., Van Ijzendoorn, M. H., & Pellegrini, A. D. (1995). Joint Book Reading Makes for Success in Learning to Read: A Meta-analysis on Intergenerational Transmission of Literacy. *Review of Educational Research, 65*(1), 1-21. doi:10.3102/00346543065001001

Cain, K., Lemmon, K., & Oakhill, J. (2004). Individual Differences in the Inference of Word Meanings From Context: The Influence of Reading Comprehension, Vocabulary Knowledge, and Memory Capacity. *Journal of Educational Psychology, 96*(4), 671-681. doi:10.1037/0022-0663.96.4.671

Cain, K., Oakhill, J., & Elbro, C. (2003). The Ability to Learn New Word Meanings from Context by School-Age Children with and Without Language

Comprehension Difficulties. *Journal of Child Language, 30*(03), 681-694. doi:10.1017/S0305000903005713

Carey, S. (Ed.) (1978). *The Child as Word Learner*. Cambridge, MA: MIT Press.

Carey, S., & Bartlett, E. (1978). Acquiring a Single New Word. *Papers and Reports on Child Language Development., 15*, 17 - 29.

Childers, J. B., & Tomasello, M. (2002). Two-Year-Olds Learn Novel Nouns, Verbs, and Conventional Actions from Massed or Distributed Exposures. *Developmental Psychology, 38*(6), 967-978. doi:10.1037/0012-1649.38.6.967

Chiong, C., & DeLoache, J. S. (2013). Learning the ABCs: What kinds of Picture Books Facilitate Young Children's Learning? *Journal of Early Childhood Literacy, 13*(2), 225-241. doi:10.1177/1468798411430091

Chun, M. M. (2000). Contextual Cueing of Visual Attention. *Trends in Cognitive Sciences, 4*(5), 170-178. doi:10.1016/S1364-6613(00)01476-5

Chun, M. M., & Jiang, Y. (1998). Contextual Cueing: Implicit Learning and Memory of Visual Context Guides Spatial Attention. *Cognitive Psychology, 36*(1), 28-71. doi:10.1006/cogp.1998.0681

Cornell, E. H., & Sénéchal, M. (1993). Vocabulary Acquisition Through Shared Reading Experiences. *Reading Research Quarterly, 28*(4), 360-374. doi:10.2307/747933

Coyne, M. D., Simmons, D. C., Kame'enui, E. J., & Stoolmiller, M. (2004). Teaching Vocabulary During Shared Storybook Readings: An Examination of Differential Effects. *Exceptionality, 12*(3), 145-162. doi:10.1207/s15327035ex1203_3

Craik, F. I. M. (2002). Levels of Processing: Past, Present... and Future? *Memory, 10*(5), 305 - 331. doi:10.1080/09658210244000135

Craik, F. I. M., & Lockhart, R. S. (1972). Levels Of Processing: A Framework For Memory Research. *Journal of Verbal Learning and Verbal Behavior, 11*(6), 671-684. doi:10.1016/S0022-5371(72)80001-X

Crawley, A. M., Anderson, D. R., Wilder, A., Williams, M., & Santomero, A. (1999). Effects of Repeated Exposures to a Single Episode of the Television Program Blue's Clues on the Viewing Behaviors and Comprehension of Preschool Children. *Journal of Educational Psychology, 91*(4), 630-637. doi:10.1037/0022-0663.91.4.630

Cunningham, A. E., & Stanovich, K. E. (1998). What Reading Does for the Mind. *American Educator, American Federation of Teachers, 22*(1-2), 8-15.

de Jong, P. F., & Leseman, P. P. M. (2001). Lasting Effects of Home Literacy on Reading Achievement in School. *Journal of School Psychology, 39*(5), 389-414. doi:10.1016/s0022-4405(01)00080-2

Diekelmann, S., & Born, J. (2010). The Memory Function of Sleep. *Nature Reviews Neuroscience, 11*(2), 114-126. doi:10.1038/nrn2762

Dr Seuss. (1978). *I Can Read With My Eyes Shut: Green Back Book (Dr Seuss - Green Back Book)*. Random House Books for Young Readers.

Dumay, N., & Gaskell, M. G. (2007). Sleep-Associated Changes in the Mental Representation of Spoken Words. *Psychological Science, 18*(1), 35-39. doi:10.1111/j.1467-9280.2007.01845.x

Dunn, J., Wooding, C., & Hermann, J. (1977). Mothers' Speech to Young Children: Variation in Context. *Developmental Medicine & Child Neurology, 19*(5), 629-638. doi:10.1111/j.1469-8749.1977.tb07996.x

Durand, M., Hulme, C., Larkin, R., & Snowling, M. J. (2005). The Cognitive Foundations of Reading and Arithmetic Skills in 7- To 10-Year-Olds.

Journal of Experimental Child Psychology, 91(2), 113-136. doi:10.1016/j.jecp.2005.01.003

Dwyer, J., & Neuman, S. (2008). Selecting Books for Children Birth Through Four: A Developmental Approach. *Early Childhood Education Journal, 35*(6), 489-494. doi:10.1007/s10643-008-0236-5

Edgin, J. O., Tooley, U., Demara, B., Nyhuis, C., Anand, P., & Spanò, G. (2015). Sleep Disturbance and Expressive Language Development in Preschool-Age Children With Down Syndrome. *Child Development*, n/a-n/a. doi:10.1111/cdev.12443

Einstein, A. (1879-1955). [If you want your children to be intelligent, read them fairy tales. If you want them to be very intelligent, read them more fairy tales.].

Elley, W. B. (1989). Vocabulary Acquisition from Listening to Stories. *Reading Research Quarterly, 24*(2), 174-187. doi:10.2307/747863

Elman, J. (2003). Development: It's about time. *Developmental Science, 6*(4), 430-433. doi:10.1111/1467-7687.00297

Endsley, M. R. (1995). Toward a Theory of Situation Awareness in Dynamic Systems. *Human Factors: The Journal of the Human Factors and Ergonomics Society, 37*(1), 32-64. doi:10.1518/001872095779049543

Fernald, A., & Morikawa, H. (1993). Common Themes and Cultural Variations in Japanese and American Mothers' Speech to Infants. *Child Development, 64*(3), 637-656. doi:10.2307/1131208

Fletcher, K. L., & Reese, E. (2005). Picture Book Reading with Young Children: A Conceptual Framework. *Developmental Review, 25*(1), 64-103. doi:10.1016/j.dr.2004.08.009

Ganea, P. A., Allen, M. L., Butler, L., Carey, S., & DeLoache, J. S. (2009). Toddlers' Referential Understanding of Pictures. *Journal of Experimental Child Psychology, 104*(3), 283-295. doi:10.1016/j.jecp.2009.05.008

Ganea, P. A., Canfield, C. F., Simons-Ghafari, K., & Chou, T. (2014). Do Cavies Talk?: The Effect of Anthropomorphic Books on Children's Knowledge About Animals. *Frontiers in Psychology, 5*. doi:10.3389/fpsyg.2014.00283

Ganea, P. A., Ma, L., & DeLoache, J. S. (2011). Young Children's Learning and Transfer of Biological Information from Picture Books to Real Animals. *Child Development, 82*(5), 1421-1433. doi:10.1111/j.1467-8624.2011.01612.x

Ganea, P. A., Pickard, M. B., & DeLoache, J. S. (2008). Transfer Between Picture Books and the Real World by Very Young Children. *Journal of Cognition and Development, 9*(1), 46-66. doi:10.80/15248370701836592

Gaskell, M. G., Davis, M. H., Dumay, N., & Macdonald, M. (2005). Sleep and the Acquisition of Spoken Words: Neural and Behavioral Consequences. *Journal of Cognitive Neuroscience*, 73-73.

Gleed, A. (2013). *Booktrust Reading Habits Survey 2013. A National Survey of Reading Habits and Attitudes to Books Amongst Adults in England*. Retrieved from http://www.booktrust.org.uk/usr/library/documents/main/1576-booktrust-reading-habits-report-final.pdf

Granic, I., & Patterson, G. R. (2006). Toward a comprehensive model of antisocial development: a dynamic systems approach. *Psychological Review, 113*(1), 101. doi:10.1037/0033-295X.113.1.101

Grimshaw, S., Dungworth, N., McKnight, C., & Morris, A. (2007). Electronic Books: Children's Reading and Comprehension. *British Journal of*

Educational Technology, 38(4), 583-599. doi:10.1111/j.1467-8535.2006.00640.x

Hansson, K., Forsberg, J., Löfqvist, A., Mäki‐Torkko, E., & Sahlén, B. (2004). Working memory and novel word learning in children with hearing impairment and children with specific language impairment. *International Journal of Language & Communication Disorders, 39*(3), 401-422. doi:10.1080/13682820410001669887

Hargrave, A. C., & Sénéchal, M. (2000). A Book Reading Intervention with Preschool Children who have Limited Vocabularies: The Benefits of Regular Reading and Dialogic Reading. *Early Childhood Research Quarterly, 15*(1), 75-90. doi:10.1016/s0885-2006(99)00038-1

Hayes, D. P., & Ahrens, M. G. (1988). Vocabulary Simplification for Children: A Special Case of 'Motherese'? *Journal of Child Language, 15*(02), 395-410. doi:10.1017/S0305000900012411

Hayes, D. S. (1999). Young Children's Exposure to Rhyming and Nonrhyming Stories: A Structural Analysis of Recall. *The Journal of genetic psychology, 160*(3), 280-293. doi:10.1080/00221329909595399

Hayes, D. S. (2001). Young Children's Phonological Sensitivity After Exposure to a Rhyming or Nonrhyming Story. *The Journal of genetic psychology, 162*(3), 253-259. doi:10.1080/00221320109597482

Hayes, D. S., Chemelski, B. E., & Palmer, M. (1982). Nursery Rhymes and Prose Passages: Preschoolers' Liking and Short-Term Retention of Story Events. *Developmental Psychology, 18*(1), 4949-4956. doi:10.1037/0012-1649.18.1.49

Horst, J. S. (2013). Context and Repetition in Word Learning. *Frontiers in Psychology, 4*, 149. doi:10.3389/fpsyg.2013.00149

Horst, J. S., Parsons, K. L., & Bryan, N. M. (2011). Get the Story Straight: Contextual Repetition Promotes Word Learning from Storybooks. *Frontiers in Psychology, 2*, 17. doi:10.3389/fpsyg.2011.00017

Huebner, C. E., & Meltzoff, A. N. (2005). Intervention to Change Parent–Child Reading Style: A Comparison of Instructional Methods. *Journal of Applied Developmental Psychology, 26*(3), 296-313. doi:10.1016/j.appdev.2005.02.006

Hupbach, A., Gomez, R. L., Bootzin, R. R., & Nadel, L. (2009). Nap-Dependent Learning in Infants. *Developmental Science, 12*(6), 1007-1012. doi:10.1111/j.1467-7687.2009.00837.x

Johnson, J. L., & Hayes, D. S. (1987). Preschool children's retention of rhyming and nonrhyming text: paraphrase and rote recitation measures. *Journal of Applied Developmental Psychology, 8*(3), 317-327. doi:10.1016/0193-3973(87)90007-4

Justice, L. M., & Kaderavek, J. (2002). Using Shared Storybook Reading to Promote Emergent Literacy. *Teaching Exceptional Children, 34*(4), 8-13. doi:10.1177/004005990203400401

Kaderavek, J., & Justice, L. M. (2002). Shared Storybook Reading as an Intervention Context Practices and Potential Pitfalls. *American Journal of Speech-Language Pathology, 11*(4), 395-406.

Kendeou, P., Bohn-Gettler, C., White, M. J., & Van Den Broek, P. (2008). Children's Inference Generation Across Different Media. *Journal of research in reading, 31*(3), 259-272. doi:10.1111/j.1467-9817.2008.00370.x

Kirtley, C., Bryant, P. E., MacLean, M., & Bradley, L. (1989). Rhyme, Rime, and The Onset of Reading. *Journal of Experimental Child Psychology, 48*(2), 224-245. doi:10.1016/0022-0965(89)90004-0

Kurdziel, L., Duclos, K., & Spencer, R. M. (2013). Sleep Spindles in Midday Naps Enhance Learning in Preschool Children. *Proceedings of the National Academy of Sciences, 110*(43), 17267-17272. doi:10.1073/pnas.1306418110

Lever, R., & Sénéchal, M. (2011). Discussing Stories: on how a Dialogic Reading Intervention Improves Kindergartners' Oral Narrative Construction. *Journal of Experimental Child Psychology, 108*(1), 1-24. doi:10.1016/j.jecp.2010.07.002

Levy, B. A., Gong, Z., Hessels, S., Evans, M. A., & Jared, D. (2006). Understanding Print: Early Reading Development and the Contributions of Home Literacy Experiences. *Journal of Experimental Child Psychology, 93*(1), 63-93. doi:10.1016/j.jecp.2005.07.003

Locke, J. L. (1995). *The Child's Path to Spoken Language*. Cambridge, Massachuetts: Harvard University Press.

Lockhart, R. S. (2002). Levels of Processing, Transfer-Appropriate Processing, and the Concept of Robust Encoding. *Memory, 10*(5), 397. doi:10.1080/09658210244000225

Lonigan, C. J., & Whitehurst, G. J. (1998). Relative Efficacy of Parent and Teacher Involvement in a Shared-Reading Intervention for Preschool Children from Low-Income Backgrounds. *Early Childhood Research Quarterly, 13*(2), 262-290. doi:10.1016/S0885-2006(99)80038-6

Markson, L., & Bloom, P. (1997). Evidence Against a Dedicated System for Word Learning in Children. *Nature, 385*(813-815). doi:10.1038/385813a0

Marshall, L., & Born, J. (2007). The Contribution of Sleep to Hippocampus-Dependent Memory Consolidation. *Trends in Cognitive Sciences, 11*(10), 442-450. doi:10.1016/j.tics.2007.09.001

Martinez, M., & Roser, N. (1985). Read It Again: The Value of Repeated Readings During Storytime. *The Reading Teacher*, 782-786.

Mason, J. M., & Allen, J. (1986). A Review of Emergent Literacy with Implications for Research and Practice in Reading. *Review of research in education*, 3-47. doi:10.3102/0091732X013001003

McKeown, M. G., & Beck, I. L. (2003). *Taking Advantage of Read-Alouds to help Children make Sense of Decontextualized Language*. Routledge.

McLeod, A. N., & McDade, H. L. (2011). Preschoolers' Incidental Learning of Novel Words During Storybook Reading. *Communication Disorders Quarterly, 32*(4), 256-266. doi:10.1177/1525740109354777

Medina, T. N., Snedeker, J., Trueswell, J. C., & Gleitman, L. R. (2011). How Words can and Cannot be Learned by Observation. *Proceedings of the National Academy of Sciences, 108*(22), 9014-9019. doi:10.1073/pnas.1105040108

Mednick, S. (2013). Napping Helps Preschoolers Learn. *Proceedings of the National Academy of Sciences, 110*(43), 17171-17172. doi:10.1073/pnas.1316489110

Mednick, S., Nakayama, K., & Stickgold, R. (2003). Sleep-Dependent Learning: A Nap is as Good as a Night. *Nature neuroscience, 6*(7), 697-698. doi:10.1038/nn1078

Milburn, T. F., Girolametto, L., Weitzman, E., & Greenberg, J. (2014). Enhancing Preschool Educators' Ability to Facilitate Conversations During Shared Book Reading. *Journal of Early Childhood Literacy, 14*(1), 105-140. doi:10.1177/1468798413478261

Miller, P. H. (2010). *Theories of Developmental Psychology*: Worth Publishers.
Mol, S. E., Bus, A. G., de Jong, M. T., & Smeets, D. J. H. (2008). Added Value of Dialogic Parent–Child Book Readings: A Meta-Analysis. *Early Education and Development, 19*(1), 7-26. doi:10.1080/10409280701838603
Montag, J. L., Jones, M. N., & Smith, L. B. (2015). The Words Children Hear Picture Books and the Statistics for Language Learning. *Psychological Science*, 0956797615594361. doi:10.1177/0956797615594361
Morrow, L. M. (1988). Young Children's Responses to one-to-one Story Readings in School Settings. *Reading Research Quarterly, 23*(1), 89-107. doi:10.2307/747906
Müller, G. E., & Pilzecker, A. (1900). *Experimentelle beiträge zur lehre vom gedächtniss* (Vol. 1): JA Barth.
Nagy, W. E., Herman, P. A., & Anderson, R. C. (1985). Learning Words from Context. *Reading Research Quarterly, 20*(2), 233-253. doi:10.2307/747758
Namy, L. L., Acredolo, L., & Goodwyn, S. (2000). Verbal Labels and Gestural Routines in Parental Communication with Young Children. *Journal of Nonverbal Behavior, 24*(2), 63-79. doi:10.1023/a:1006601812056
Newman, S. B. (1996). Children Engaging In Storybook Reading: The Influence of Access to Print Resources, Opportunity, and Parental Interaction. *Early Childhood Research Quarterly, 11*(4), 495-513. doi:10.1016/S0885-2006(96)90019-8
Nystrand, M. (2006). Research on the Role of Classroom Discourse as it Affects Reading Comprehension. *Research in the Teaching of English*, 392-412.
Nystrand, M., Wu, L. L., Gamoran, A., Zeiser, S., & Long, D. A. (2003). Questions in Time: Investigating the Structure and Dynamics of Unfolding Classroom Discourse. *Discourse processes, 35*(2), 135-198. doi:10.1207/S15326950DP3502_3
Oliva, A., & Torralba, A. (2007). The Role of Context in Object Recognition. *Trends in neurosciences, 11*(12), 520. doi:10.1016/j.tics.2007.09.009
Pentimonti, J. M., Zucker, T. A., & Justice, L. M. (2011). What are Preschool Teachers Reading in Their Classrooms? *Reading psychology, 32*(3), 197-236. doi:10.1080/02702711003604484
Rademacher, U., & Koschel, K.-V. (2006). *Coming to Terms with Emotions.* Paper presented at the Athens: Esomar Qualitative ŰŰŰŰ Conference Papers.
Raz, I. S., & Bryant, P. E. (1990). Social Background, Phonological Awareness and Children's Reading. *British Journal of Developmental Psychology, 8*(3), 209-225. doi:10.1111/j.2044-835X.1990.tb00837.x
Read, K. (2014). Clues Cue The Smooze: Rhyme, Pausing and Prediction Help Children Learn New Words from Storybooks. *Frontiers in Psychology, 5*, 149. doi:10.3389/fpsyg.2014.00149
Read, K., Macauley, M., & Furay, E. (2014). The Seuss Boost: Rhyme helps Children Retain Words from Shared Storybook Reading. *First Language, 34*(4), 354-371. doi:10.1177/0142723714544410
Rimm-Kaufman, S. E., & Pianta, R. C. (2000). An Ecological Perspective on the Transition to Kindergarten A Theoretical Framework to Guide Empirical Research. *Journal of Applied Developmental Psychology, 21*(5), 491-511. doi:10.1016/s0193-3973(00)00051-4
Robbins, C., & Ehri, L. C. (1994). Reading Storybooks to Kindergartners Helps them Learn New Vocabulary Words. *Journal of Educational Psychology, 86*(1), 54-64. doi:10.1037/0022-0663.86.1.54

Rousseau, J.-J., & Scott, J. T. (2009). *Essay on the Origin of Languages and Writings Related to Music*: University Press of New England.

Roy, A. E. (2012). *Predictability, Stability, and Chaos in N-Body Dynamical Systems*. New York and London: Plenum Press.

Samuelson, L. K., & Horst, J. S. (2008). Confronting complexity: Insights from the details of behavior over multiple timescales. *Developmental Science, 11*(2), 209-215. doi:10.1111/j.1467-7687.2007.00667.x

Samuelson, L. K., Schutte, A. R., & Horst, J. S. (2009). The dynamic nature of knowledge: Insights from a dynamic field model of children's novel noun generalization. *Cognition, 110*(3), 322-345. doi:Palm Drive

Sénéchal, M. (1997). The Differential Effect of Storybook Reading on Preschoolers' Acquisition of Expressive and Receptive Vocabulary. *Journal of Child Language, 24*(01), 123-138. doi:10.1017/S0305000996003005

Sénéchal, M., & Cornell, E. H. (1993). Vocabulary Acquisition Through Shared Reading Experiences. *Reading Research Quarterly, 28*(4), 360-374. doi:10.2307/747933

Sénéchal, M., & LeFevre, J. A. (2002). Parental Involvement in the Development of Children's Reading Skill: A Five-Year Longitudinal Study. *Child Development, 73*(2), 445-460. doi:10.1111/1467-8624.00417

Sénéchal, M., Thomas, E. M., & Monker, J. A. (1995). Individual Differences in 4-Year-Old Children's Acquisition of Vocabulary During Storybook Reading. *Journal of Educational Psychology, 87*(2), 218. doi:10.1037/0022-0663.87.2.218

Sénéchal, M., & Young, L. (2008). The Effect of Family Literacy Interventions on Children's Acquisition of Reading from Kindergarten to Grade 3: A Meta-Analytic Review. *Review of Educational Research, 78*(4), 880-907. doi:10.3102/0034654308320319

Shallice, T., & Warrington, E. K. (1970). Independent functioning of verbal memory stores: A neuropsychological study. *The quarterly journal of experimental psychology, 22*(2), 261-273. doi:10.1080/00335557043000203

Simcock, G., & Deloache, J. (2006). Get The Picture? The Effects of Iconicity on Toddlers' Reenactment from Picture Books. *Developmental Psychology, 42*(6), 1352-1357. doi:10.1037/0012-1649.42.6.1352

Simcock, G., & Deloache, J. (2008). The Effect of Repetition on Infants' Imitation from Picture Books Varying in Iconicity. *Infancy, 13*(6), 687-697. doi:10.1080/15250000802459102

Smith, L. B. (2005). Cognition as a dynamic system: Principles from embodiment. *Developmental Review, 25*(3), 278-298. doi:10.1016/j.dr.2005.11.001

Smith, L. B., Colunga, E., & Yoshida, H. (2010). Knowledge as Process: Contextually Cued Attention and Early Word Learning. *Cognitive Science, 34*(7), 1287-1314. doi:10.1111/j.1551-6709.2010.01130.x

Snow, C. E., & Goldfield, B. A. (1983). Turn the Page Please: Situation-Specific Language Acquisition. *Journal of Child Language, 10*(03), 551-569. doi:10.1017/S0305000900005365

Snow, C. E., & Ninio, A. (1986). *The Contracts of Literacy. What children Learn from Learning to Read Books.* . Norwood: NJ: Ablex Publishing Corporation.

Spencer, J. P. (2009). *Toward a Unified Theory of Development. Connectionism and Dynamic System Theory Re-Considered*. Developmental Cognitive Neuroscience: Oxford University Press.

Stickgold, R. (2005). Sleep-dependent Memory Consolidation. *Nature, 437*(7063), 1272-1278. doi:10.1038/nature04286

Stickgold, R. (2013a). Early to Bed: How Sleep Benefits Children's Memory. *Trends in Cognitive Sciences, 17*(6), 261-262. doi:10.1016/j.tics.2013.04.006

Stickgold, R. (2013b). Parsing the Role of Sleep in Memory Processing. *Current opinion in neurobiology, 23*(5), 847-853. doi:10.1016/j.conb.2013.04.002

Stickgold, R., & Walker, M. P. (2005a). Memory Consolidation and Reconsolidation: What is the Role of Sleep? *Trends in neurosciences, 28*(8), 408-415. doi:10.1016/j.tins.2005.06.004

Stickgold, R., & Walker, M. P. (2005b). Sleep and Memory: the Ongoing Debate. *Sleep, 28*, 1225-1227.

Sulzby, E. (1985). Children's Emergent Reading of Favorite Storybooks: A Developmental Study. *Reading Research Quarterly, 20*(4), 458-481. doi:10.1598/RRQ.20.4.4

Sulzby, E., & Teale, W. H. (1987). *Young Children's Storybook Reading: Longitudinal Study of Parent-Child Interaction and Children's Independent Functioning. Final Report*. Retrieved from U.S. Department Of Education: http://files.eric.ed.gov/fulltext/ED334541.pdf

Sylvester, C. H. (1922). *Journeys Through Bookland, Volume 10 the Guide*: Bellows-Reeve Company Publishers.

Tare, M., Chiong, C., Ganea, P. A., & DeLoache, J. (2010). Less is More: How Manipulative Features Affect Children's Learning From Picture Books. *Journal of Applied Developmental Psychology, 31*(5), 395-400. doi:10.1016/j.appdev.2010.06.005

Thelen, E. (1989). Self-organization in developmental processes: Can systems approaches work? . In M. Gunnar & E. Thelen (Eds.), *Systems and Development: The Minnesota Symposia on Child Psychology* (Vol. 22, pp. 77-117). Hillsdale, NJ, England: Lawrence Erlbaum Associates.

Thelen, E., & Smith, L. B. (1994). MIT Press/Bradford book series in cognitive psychology. A dynamic systems approach to the development of cognition and action: Cambridge, MA: The MIT Press.

Tung, F.-W., & Deng, Y.-S. (2007). Increasing Social Presence of Social Actors in E-Learning Environments: Effects of Dynamic and Static Emoticons on Children. *Displays, 28*(4), 174-180. doi:10.1016/j.displa.2007.06.005

van den Broek, P., Tzeng, Y., Risden, K., Trabasso, T., & Basche, P. (2001). Inferential Questioning: Effects on Comprehension of Narrative Texts as A Function of Grade and Timing. *Journal of Educational Psychology, 93*(3), 521. doi:10.1037/0022-0663.93.3.521

van Kleeck, A. (2008). Providing Preschool Foundations for Later Reading Comprehension: The Importance of and Ideas for Targeting Inferencing in Storybook‐Sharing Interventions. *Psychology in the Schools, 45*(7), 627-643. doi:10.1002/pits.20314

Vygotsky, L. S. (1980). *Mind In Society: The Development of Higher Psychological Processes*: Harvard University Press.

Walker, M. P., Brakefield, T., Hobson, A. J., & Stickgold, R. (2003). Dissociable stages of human memory consolidation and reconsolidation. *Nature, 425*(6958), 616-620.

Werchan, D. M., & Gómez, R. L. (2014). Wakefulness (Not Sleep) Promotes Generalization of Word Learning in 2.5-Year-Old Children. *Child Development, 85*(2), 429-436. doi:10.1111/cdev.12149

Whitehurst, G. J., Arnold, D. S., Epstein, J. N., Angell, A. L., Smith, M., & Fischel, J. E. (1994). A Picture Book Reading Intervention in Day Care and Home for Children From Low-Income Families. *Developmental Psychology, 30*(5), 679-689. doi:10.1037/0012-1649.30.5.679

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. doi:10.1037/0012-1649.24.4.552

Whitehurst, G. J., & Lonigan, C. J. (1998). Child Development and Emergent Literacy. *Child Development, 69*(3), 848-872. doi:10.1111/j.1467-8624.1998.tb06247.x

Wilde, O. (1889). *The decay of lying: A dialogue*: Kegan Paul, Trench & Company.

Williams, S. E., & Horst, J. S. (2014). Goodnight Book: Sleep Consolidation Improves Word Learning via Storybooks. *Frontiers in Psychology, 5*, 184. doi:10.3389/fpsyg.2014.00184

Williams, S. E., Horst, J. S., & Oakhill, J. (2011). The Same Old Story: Contextual Cueing Facilitates Word Learning via Storybooks. *In Early shared book reading: what are the requirements for effective sessions? Symposium, British Psychological Society, Developmental Section Conference, Newcastle, UK*.

Wong, D. L., & Baker, C. M. (1988). Pain in Children: Comparison of Assessment Scales. *Pediatric Nursing, 14*(1), 9-17.

Same Old Story: Contextual Cueing Facilitates Word Learning Via Storybooks

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Author note

The initial idea for the paper was the foundation of the studentship, advertised by JH and JO. An undergraduate project student tested 16 children. SW completed data collection with children and completed all data collection for the adult ratings (Supplementary study 2 a). SW completed all statistical analyses and wrote the paper under the supervision of JH, who contributed to discussions on theoretical implications. JO commented on previous versions of the paper.

Abstract

Word learning research has consistently demonstrated the numerous benefits for children via storybooks (Blewitt, Rump, Shealy, & Cook, 2009), improving children's encoding of narrative and pictorial cues, with gains in expressive and receptive vocabulary (Sénéchal, 1997), increasing memory and language skills (Bion, Borovsky, & Fernald, 2013; Marchman & Fernald, 2008) and resulting in greater academic success (Rimm-Kaufman & Pianta, 2000). The current study examines a more parsimonious explanation of how children learn implicitly from being read stories; specifically how children also benefit from contextually cueing effects. Three-year-old children heard purpose-written stories books over the course of one week (Horst, Parsons, & Bryan, 2011). Half of the children heard the same storybooks and the other half heard different storybooks on each visit. Shared storybook reading took place in the children's homes and - importantly - all children had the same exposure to the novel name-object pairs. The children's recognition was examined through a forced-choice task. Overall, children who encountered the same stories were significantly more accurate in recalling novel words on each visit, and over time. Results are discussed in terms of the benefits for contextual repetition on learning words via shared storybook reading.

Same Old Story: Contextual Cueing Facilitates Word Learning Via Storybooks

Shared storybook reading is a common activity for many preschool children (Simcock & Deloache, 2006), which has been shown to foster language and literacy skills that further support later academic success (Blewitt et al., 2009; Burch & Looker, 2007; Fletcher & Reese, 2005). However, much of the research in this area focuses on the social interactions of shared storybook reading, for example the impact and quality of parental reading styles (Lonigan & Whitehurst, 1998; Namy, Acredolo, & Goodwyn, 2000), early intervention programmes (Fletcher & Jean-Francois, 1998), and the quality of parental involvement (Bus & van Ijzendoorn, 1997). In contrast, the current study focuses on general cognitive processes that underlie preschool children's ability to learn new words from shared storybook readings.

Preschool children are very adept at learning words through a variety of different contexts, including face-to-face conversations (Markson & Bloom, 1997), monitoring third party dialogues (Akhtar, Jipson, & Callanan, 2001), and watching television (Rice, 1990). Previous research suggests that children also acquire a considerable amount of new vocabulary from shared storybook reading. When kindergartners were read a story twice, children were more likely to learn the new words when target words appeared four times rather than twice (Robbins & Ehri, 1994). Overall, the amount of storybook exposure is directly related to kindergartners' oral language skills (Cornell & Sénéchal, 1993; Sénéchal, LeFevre, Thomas, & Daley, 1998). Recently, Horst, Parsons and Bryan (2011) presented 3-year-old children with stories depicting novel name-object pairs and tested children's word

learning using both recognition and retention tasks, and found that children's word learning increased with repeated readings of stories.

Repetition in Word Learning

Studies that have tested preschool children's ability to learn words from shared storybook reading have consistently found that repetition plays a vital role in facilitating vocabulary growth in this context (e.g. Dwyer & Neuman, 2008; Fletcher & Jean-Francois, 1998). Specifically, Sénéchal (1997) read 3- and 4-year-old children the same story either once or three times, and found that children's ability to acquire both expressive and receptive vocabulary increased with multiple readings of storybooks. Similarly, 2-year-old children's imitation of actions on real objects, such as a toy rattle depicted and described, were improved with repeated readings (Simcock & Deloache, 2008). Repetition also aides children's learning from television; 3- and 5-year-old children were exposed to a 24-minute episode of the curriculum-based television program *Blue's Clues* once or once a day over 5 consecutive days (Crawley, Anderson, Wilder, Williams, & Santomero, 1999). Not only did children's enjoyment of the programme increase with repeated viewings but their comprehension, and verbal and non-verbal interactions increased as well. The authors concluded that repetition is a highly effective method to facilitate learning and increases both children's comprehension and enjoyment (see also Anderson et al., 2000).

Recently, Horst et al., (2011) demonstrated a large advantage for novel word learning when storybooks were read repeatedly. Specifically, they presented 3-year-old children with storybooks containing novel name-object

pairs. Children either encountered the pairs across different stories or from hearing the same stories repeatedly. Importantly, children in both conditions had the same exposure to the novel name-object pairs. Children who heard the same stories repeatedly learned the target words significantly better than chance and performed better—on both recognition and retention tests—than children who had heard different stories. Horst et al., (2011) argue that this finding is due to a contextual cueing effect.

Contextual Cueing

In the visual cognition literature, "contextual cueing" refers to significantly faster reaction times and accuracy during visual searches when contexts are repeated. In Chun and Jiang's (1998) seminal paper, they repeated the locations of the target stimuli on half the trials in a visual search task and found that adults were more accurate at detecting the target in the previously viewed contexts than in unique ones. Strong effects of contextual cueing have also been found in a number of other domains, including inhibition of return (IOR Dodd, Van der Stigchel, & Hollingworth, 2009), face recognition (Monetta, Grindrod, & Pell, 2009), conditioned fear responses (Grillon & Davis, 1997), e-book memory processes (Therrien, Wickstrom, & Jones, 2006) and real-world scenes (Brockmole & Henderson, 2006); the latter two having clear implications for storybook reading. According to Chun (2000), the repeated contextual information such as stable spatial information and object covariance guides participants to attend to novel aspects that were previously not encountered. Oliva and Torralba (2007) argue that the objects never appear by themselves as they are always embedded into environmentally rich scenes, such as the pictures depicted in storybooks, and that a statistical review of real-

world scenes allows people to become more effective in guiding perception and attention. That is, people are quicker to attend to objects of particular interest when they are presented in familiar scenes (e.g. it is faster to attend to an unfamiliar chair appearing in your office than locating the same chair when it is presented in an unfamiliar office scene).

Horst et al., (2011) argue that the same type of effect is responsible for children's increased word learning after repeatedly hearing the same stories. Repeatedly seeing the same storybook pictures provides a rich source of context knowledge that aids in the encoding of information about novel names and objects. Importantly, this allows children to focus their attention to new elements of the story more effectively without becoming overwhelmed. However, the contexts (stories) in the Horst, et al., (2011) study were encountered consecutively, whereas the contexts in the contextual cueing literature are typically encountered periodically - that is - intermittently (see also Chun, 2000; Oliva & Torralba, 2007). If the advantage for repeated readings observed by Horst, et al., (2011) is in fact due to a contextual cueing effect, then children should also demonstrate better word learning when the same stories are repeated intermittently (see also Chao & Yeh, 2006; Chun, 2000; Ono, Jiang, & Kawahara, 2005).

The current study. Thus, the goal of the current study is to test whether contextual cueing facilitates preschool children's word learning from storybooks. To test this, we read children storybooks three separate times over the course of one week and tested their novel name recognition for six novel name–object pairs on each visit. Half of the children encountered these novel name-object pairs from being read the same three storybooks repeatedly while

the other half encountered these pairs by being read nine different storybooks. Importantly, all children encountered the novel name-object pairs the same number of times on each visit and over the course of the week. If contextual cueing supports word learning from storybooks, then the children in the repeated story condition should learn the novel words better than those in the non-repeating stories condition. In contrast, if consecutive readings and not contextual cueing is responsible for the previous findings, then children should perform equally poorly in both conditions.

Method

Participants Twenty-four 3-year-old monolingual, British English speaking children participated. Children were from primarily white, middle-class backgrounds and lived in an urban area on the South Coast of England. Families were recruited from a lab database of parents interested in participating in child language research. Parents were contacted by email and telephone. Ethical approval was granted by the Schools of Psychology and Life Sciences Ethics Committee, and adhered to the guidelines set out by the British Psychology Society. Informed consent was obtained from each child's parent and each child consented to participating.

Children were randomly assigned to either the repeated stories condition (n = 12, 8 girls, M_{age} = 42m, 19d, *SD* = 4m, range = 36m, 30d to 49m, 25d) or to the non-repeated stories condition (n = 12, 8 girls, M_{age} = 42m, 18d, *SD* = 3m, 13d, range = 37m, 6d to 48m, 6d). There was no difference between groups in age, $t(22) = .022$, *ns,* $d = .009$. Children were visited in their homes three times within approximately one week, with approximately four days between visits (*M* = 3.75 days, *SD* = 1.07 days, range = 1.5 – 4.5 days).

There were no differences between groups in socioeconomic status, $t(22) = -.415$, *ns*, $d = .17$, all children came from middle-class families using ACORN classification scores. There was also no difference between groups in maternal education as all of the parents had completed high school. In the repeated stories condition, 3 parents had a completed Higher National Diploma (cf. associates degree), 15 had a bachelor's degree, 1 had a Master's degree and 1 parents was an MD. In the non-repeated stories condition, 4 parents had a completed Higher National Diploma (cf. associates degree), 9 had a bachelor's degree, 4 had a Master's degree and 2 parents had a PhD (Table 1). Each child received a small gift after each of the first two visits (e.g., a sparkly pencil) and a larger gift (e.g., soft animal toy) after the final visit.

Table 1. Educational level of parents between groups.

	Repeated Stories	Non-repeated Stories
Higher National Diploma (HND)	3	4
Bachelor degree	15	9
Master degree	1	4
MD or Ph.D.	1	2

Stimuli The same nine storybooks used in Horst et al., (2011) were used in this study. Throughout each story, two novel objects were each named four times but were not the focus of the plot (see Table 2). Storybook plots surrounded the everyday activities of one family with either the brother (Josh) or sister (Rosie) as the protagonist. Stories were written in standard British English for 3-year-old children and included an age-appropriate moral.

Storybook illustrations included digital photographs of models acting out individual scenes that were then edited in Photoshop using the poster edges feature to make them look like drawings of models acting out individual scenes that were then edited in Photoshop using the poster edges feature to make them look like drawings typical of commercially available children's books.

Each story was ten pages long, including the cover and included approximately 380 words (*SD* = 29.75, range = 340 - 428) and 42 words per page (*SD* = 3.07, range = 38 – 47). The length and complexity of the books reflected those of commercially available books suitable for preschoolers. All 9 books where compiled in one soft covered book where they appeared as chapters. Results from a pilot study with adult raters indicated there were no differences between stories for their impressions for how likely children were to like them overall (see Supplementary Study Paper 1). For more information on the storybooks, see Horst et al., (2011).

Table 2. Storybooks in which the target novel name-object pairs occurred.

Set	Object Word Pairs	Relevant Storybooks
1	*Sprock* (kinetic wheel) *Tannin* (inverted sling-shot)	*The Naughty Puppy, Nosy Rosie at the Restaurant, Rosie's Bad Baking Day*
2	*Manu* (blue pen with orange strings) *Zorch* (striped cup-and-ball game)	*I Don't Want to Share!, Mischief at the Toyshop, The Mystery Auntie*
3	*Coodle* (plastic ball catcher) *Gaz* (black-and-white orb)	*New Friend At the Park, The Surprisingly Good Bad Day, Trouble At the Library*

Test stimuli. To test whether children learned the words presented in the stories, a test booklet with three practice pages and 13 test pages was created. Each A4 page of the test booklet included four pictures that were approximately the same size (*M* = 4.07 x 6.43cm *SD* = 1.25cm) on a plain white background. We did not use the same pictures as in the storybooks because testing with different pictures forces children to extend their newly formed name-object associations to a new representation of the referent (see, Sénéchal & Cornell, 1993; for a similar argument see also, Schafer, 2005). These pictures were prepared in the same way as the storybook pictures (i.e., photographs of real objects altered using poster edges). Each quadrant contained one picture (i.e. top left, top right, bottom left, bottom right (see also Robbins & Ehri, 1994; Sénéchal, 1997)). Each practice page included four different familiar objects (e.g., duck, chair, airplane and dog). Each test page included four novel objects, all of the novel objects shown appeared in the stories. Throughout the booklet, the novel objects appeared both with and without their direct competitors. For example, the *sprock* (kinetic wheel) and *tannin* (inverted sling shot) were direct competitors because they appeared in the same stories (see Table 1). The *sprock* and *tannin* both appeared on four test pages (i.e. with their direct competitor) and appeared individually on nine pages (i.e. without their direct competitor). The locations of the individual pictures (e.g. top left) were counterbalanced across pages.

Other stimuli. A plastic toy tea set (1 teapot, 1 lid, 2 cups, 2 saucers) was used to familiarise the child with the experimenter at the beginning of the first visit (see Horst et al., 2009; 2011).

Procedure and Design

On each of the three visits, the experimenter sat with the child in a quiet room (usually on the living room sofa) and asked if they would like to read a story. When the child assented they were either read the same three stories in differing order or three different stories during each visit. The reading of each story was consecutive in both conditions.

Reading phase. During the reading phase children sat next to the experimenter to ensure the pictures were easy to see. If the child asked questions during the story, the experimenter avoided naming any objects and encouraged the child to return attention to the story (e.g. "Hm. I don't know - let's read on and find out!"). Children's questions and comments were neither encouraged nor discouraged (for a similar method see Cornell & Sénéchal, 1993). Parents were seated nearby and were asked to remain quiet and avoid talking during the reading phase, but to help encourage the child to re-focus if required.

Children in the repeated stories condition were read one book from each set during the course of the week (see Figure 1). For example, one child was read *The Naughty Puppy* (*sprock* and *tannin*), *I Don't Want to Share!* (*manu* and *zorch*) and *The Surprisingly Good Day Bad Day* (*coodle* and *gaz*). The order in which each child heard the stories on each visit was counterbalanced across participants using a Latin Square design. In the example above, the child heard the stories in that order on visit 1, whilst visit 2 started with *The Surprisingly Good Day Bad Day* and visit 3 started with *I Don't Want to Share!* Children in the non-repeated stories condition were read three different stories on each visit and thus were read all nine stories by the

end of the week (see Figure 1). For example, one child was read *The Naughty Puppy* (*sprock* and *tannin*), *I Don't Want to Share!* (*manu* and *zorch*) and *The Surprisingly Good Day Bad Day* (*sprock* and *tannin*) on visit 1, *The Mystery Auntie* (*manu* and *zorch*), *New Friend At the Park,* (*coodle* and *gaz*), *Rosie's Bad Baking Day* (*sprock* and *tannin*) on visit 2 and *Trouble At the Library* (*coodle* and *gaz*), *Nosy Rosie at the Restaurant* (*sprock* and *tannin*) and *Mischief at the Toyshop* (*manu* and *zorch*) on visit 3. Therefore on each visit, every child encountered all six name-object pairs 12 times each. Importantly, the number of naming instances and encounters were identical across conditions.

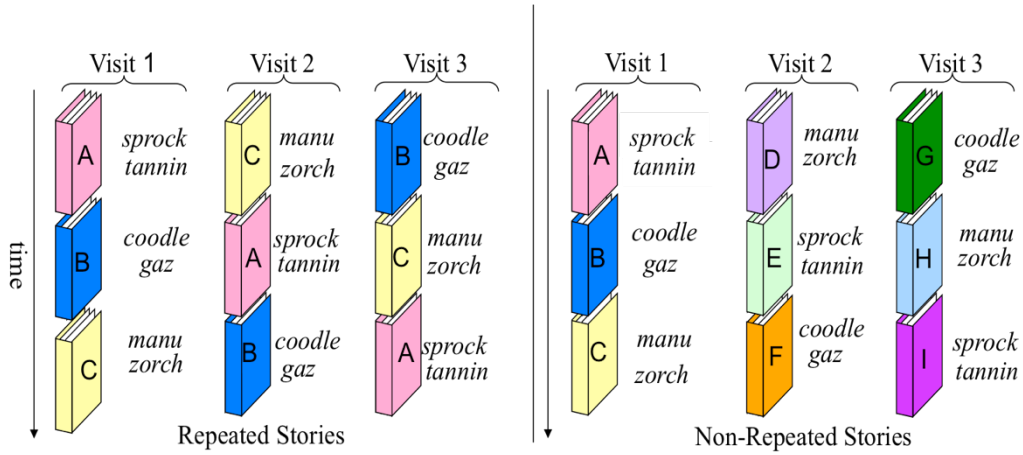

Figure 1. Schematic of the Experimental Design. Note that the order of books on visits 2 and 3 were counterbalanced; however, to simplify the schematic we have shown one illustration of the orders here.

Warm-up trials. Immediately after the third story, the experimenter proceeded to the test phase. This began with warm-up trials to get the child used to pointing to pictures in the test booklet and to ensure that the child understood the task. The experimenter opened the test booklet to a practice page and asked the child to point to each of the four pictures in a pseudo-random order (e.g. "Can you point to the dog?") for a total of four warm-up

trials. Therefore, at the end of the warm-up trials, the child had practiced pointing to an object in each quadrant (e.g. top left) and children were praised for correct choices (100% of trials). A different practice page was used on each visit and the order in which the practice pages were used was counterbalanced across participants using a Latin Square. The trial order for each page was randomly determined for each child.

Recognition trials. Next, the experimenter tested recognition by using the test booklet. In total, the child was asked to point to each novel object twice. On each trial, the experimenter turned to a different test page and asked the child to point to a specific novel object. Across trials, targets were presented once with their direct competitor (i.e. the other novel object encountered with them in the same story) and once without their direct competitor. For example, the child would be presented with one *sprock* trial where the *tannin* was also present among the competitors and one *sprock* trial where the *tannin* was not present among the competitors (for a similar testing method see Horst et al., 2011). Trial order, pages used and quadrant were counterbalanced within and across participants. The experimenter used a different test page for each test trial. Across participants, the same page was used to test different words.

***Coding*.** Children's responses were noted on a datasheet by the experimenter during the session. To ensure reliability, parents also noted children's responses for 50% of the children in each condition for all 16 trials (four warm-up, 12 recognition trials) on the final visit. Parents were naïve to the experimental hypotheses and design of the study. Parents were given a coding sheet on which to mark the quadrant that the child pointed to (e.g. top left). During the reliability sessions, the child sat between the experimenter and

parent, and the experimenter noted children's responses to the side out of the parent's view. Parents also noted responses out of the experimenter's view. In general, children made very clear, unambiguous choices during the test trials. Inter-coder reliability was 100%.

Results

Preliminary analyses indicated that there were no differences between conditions in the total number of days over the course of the experiment ($t(22) = .36$, *ns*, $d = .15$), $\eta_p^2 = .13$ or average number of days between experimental sessions ($t(22) = .36$, *ns*, $d = .16$) $\eta_p^2 = .24$. In the following analyses, we first compare children's performance to chance levels and then compare children's performance between conditions.

Overall, children did very well on the recognition trials (see Figure 2). Children in the repeated stories condition chose the target object significantly more than expected by chance on each of the three visits, all ps $< .001$ (with Bonferroni's correction) and children in the non-repeated stories condition also chose the target object significantly more than expected by chance on each of the three visits, all ps $< .01$ (with Bonferroni's correction).

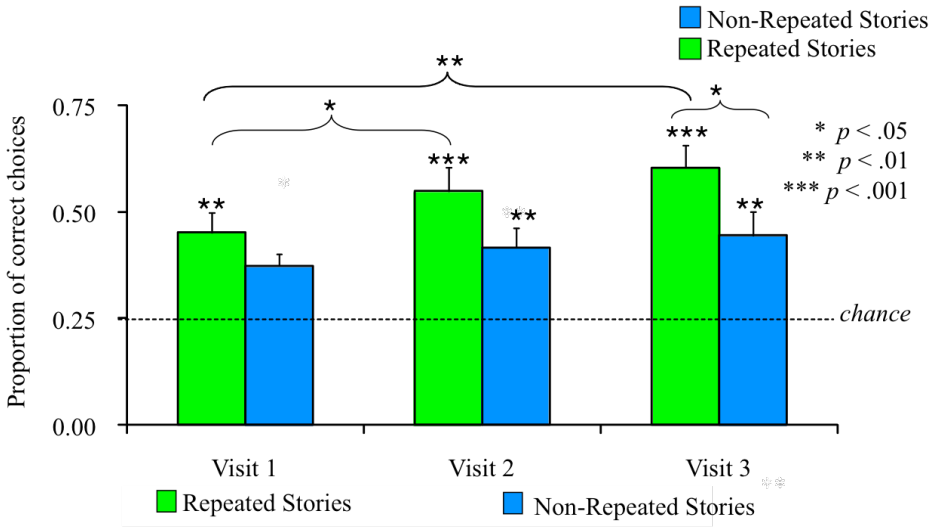

Figure 2 Results from the recognition trials as a function of visit. The *y*-axis represents proportion of correct choices on the four-alternative test trials. The dotted line represents chance (0.25). Error bars represent + 1 SEM. All *p*'s are two-tailed

To test for differences between conditions and over time, children's proportions of correct choices were entered into a mixed-design ANOVA with condition (Repeated Stories, Non-Repeated Stories) as a between-subjects factor and Visit (First, Second, Third) as a repeated-measure. The ANOVA yielded a main effect of condition, $F(1,44) = 5.16$, $p < .05$, $\eta_p^2 = .29$. A Follow-up Fischer's PLSD confirmed that children in the repeated stories condition were significantly better at choosing the target object at test than children in the non-repeated stories condition, $p < .05$ and the ANOVA also yielded a main effect of Visit, $F(2,44) = 6.53$, $p < .01$ $\eta_p^2 = .29$. Clearly, reading children the same three stories repeatedly over time has a strong, positive effect on their recognition of the name-object pairs. A follow-up Fisher's PLSD indicated that children performed significantly better on visit 2 than they did on visit 1, $p < .05$, and significantly better on visit 3 than visit 1, $p < .001$. No other significant effects were found.

Tests of simple effects. To better understand how repeating or not repeating stories over time influenced children's word learning via storybooks, we also conducted tests of simple effects. For children in the repeated stories condition, the proportion of correct choices was entered into an ANOVA with Visit (First, Second, Third) as a repeated-measure, $F(2,44) = 6.53$, $p < .05$, $\eta_p^2 = 1.86$, which shows a significant improvement in word learning over time. For children in the non-repeated stories condition, the proportion of correct choices was also entered into an ANOVA with Visit (First, Second, Third) as a repeated-measure, $F(2,44) = .928$, $p > .05$, η_p^2 1.86. In contrast to the children who heard the same stories repeatedly, these children did not show any significant improvement in word recognition over the course of the study. Implications of these findings show that even though novel words were repeated and the children in both conditions had the same exposure to novel words, the children in the non-repeating condition did not improve as greatly as they did in the repeating condition. This suggests that the importance for greatly increasing word learning is the repeating of the context.

Discussion

Young children are constantly learning new words and acquire language at a vast rate (Biemiller & Slonim, 2001; Sénéchal, Thomas, & Monker, 1995). There are considerable differences in children's early vocabulary and comprehension abilities when entering kindergarten (Biemiller & Boote, 2006; Biemiller & Slonim, 2001; Coyne, Simmons, Kame'enui, & Stoolmiller, 2004; Hickman, Pollard-Durodola, & Sharon, 2004). Children with under-developed emergent literacy abilities or from lower socioeconomic backgrounds often begin education with lower standards of school readiness

skills (Justice, Mashburn, Hamre, & Pianta, 2008). Young children who have a proficient knowledge of vocabulary perform better in memory and language tasks years later (Bion et al., 2013; Marchman & Fernald, 2008). Early word learning starts with fast mapping superficial lexical representations (Horst & Samuelson, 2008). However, further exposure, (McMurray, Horst, & Samuelson, 2012) repetition (Horst, 2013) and focused attention (Smith, Colunga, & Yoshida, 2010) is required to form a strong lexical entry. Bion et al. (2013) propose that word learning is a gradual progression of forming lexical representations via different contexts and repetition (see also McMurray et al., 2012).

We examined whether repetition of storybook context facilitates children's attention to - and recognition of - the novel name-object pairs they encounter. In each of the three visits to the child's home, children either encountered the same three storybooks repeatedly or three different storybooks. Importantly, all children had the same exposure to all six novel name-object pairs (four exposures to each pair on each visit). Recognition was examined through a forced-choice task using pictures of the novel objects. Children who encountered the repeated stories were significantly more accurate in recalling novel name-objects pairs on each visit and over time, whereas we found no significant improvement over time for children in the non-repeating stories condition. All children performed better than chance at each visit, showing positive effects for hearing the same words repeatedly. Overall, there was an impressive increase in the children's ability to recall the novel name-object pairs that they had been exposed to via shared storybook reading when the context was repeated intermittently. That is, children benefit

from having the same story repeatedly read to them, allowing them to become more efficient in learning novel words over time.

In line with the advantage of contextual cueing in visual tasks (Chun & Jiang, 1998), by repeatedly reading the same storybooks our findings provide considerable support to the Horst et al. (2011) hypothesis. That is, that contextual cueing via storybooks is important for the significant improvement to the children in the repeating stories condition. The specific benefit is that greater cognitive resources are available for encoding the new words and the novel objects they encounter, ensuring optimal employment of cognitive resources for memory, attention and comprehension. As we repeat the story context in intermittent presentations, the novel objects co-vary and embed into global context (Oliva & Torralba, 2007). This allows children to use their implicit knowledge of the environment (Chun & Jiang, Brockmole, Castelhano, & Henderson, 2006; 1998) to more accurately learn words.

Research with adults demonstrates the benefits of repetition, allowing them to form robust representations of the natural environment by activating strong memory retention for objects featured in familiar scenes (Tatler, Gilchrist, & Rusted, 2003). It also facilitates faster search by using real world scenes (Hollingworth, 2009) and using the real world relationships between objects embedded in their natural environments, allowing quicker and more accurate attentional focus (Oliva & Torralba, 2007). We have found similar contextual cueing effects in children by using edited photographs in the storybooks and repeating them intermittently. This provides a plentiful source of information with environmentally rich scenes that consolidate into declarative memory, binding the novel name-objects in their real world

locations (Hollingworth, 2009). It also enables children to draw on implicit knowledge such as parental relationships or animal behaviour, i.e. in the 'Naughty Puppy' story, engaging their explicit semantic memory to facilitate learning the novel name-object pairs.

Word learning literature has consistently demonstrated the benefits for children learning via storybooks, which includes encoding both narrative and pictorial cues (Sénéchal, 1997), providing a platform for dialogical techniques (Blewitt et al., 2009), increasing children's expressive and receptive vocabularies (Sénéchal, 1997) and resulting in children's academic success (Rimm-Kaufman & Pianta, 2000). Similarly, Crawley et al. (1999) showed the beneficial effects in children's verbal vocabulary and non-verbal interactions when children repeatedly watched the same educational television show. This can also be explained by contextual cueing effects. When repeatedly watching the same show, children can use their explicit knowledge of co-variation of scenes for implicitly improving recognition when identifying target objects in pictures and can verbally demonstrate a deeper comprehension and memory in answering verbal questions (Crawley et al., 1999). Cueing effects were found when using real world moving scenes stimuli, as even moving objects such as cars or boats have consistent behavioural movements and stable structures to guide visual attention (Brockmole et al., 2006).

Benefits of contextual repetition could be further explored by understanding the effects of contextual repetition in storybook reading, next steps should explore what role memory plays in increasing the ability to consolidate information alongside contextual presentation of storybooks. This may have wide-reaching implications for assisting children's language

development by increasing schematic knowledge and supporting children at risk of failing academically. Future research should systematically examine children's schematic knowledge of novel words and comprehension. For example, children's plot knowledge after hearing stories would be a good indicator of comprehension and would help to understand the robustness of children's memories for the stories they have heard. Finally, designing storybooks where the novel name-object pairs can be interchanged for alternative objects, could allow greater exploration of contextual cueing, whether certain features of an object are more salient to a child within different contexts.

Our research implications of how contextually cueing affects and benefits children's language development and word learning are clear; helping typically developing preschool children during their early years and providing greater academic advantages later on (Blewitt et al., 2009; Burch & Looker, 2007; Fletcher & Reese, 2005). Similarly, beneficial for preschoolers at risk of learning difficulties (Justice, Meier, & Walpole, 2005; Snowling & Hulme, 2012; Swanson et al., 2011) and for those from lower socioeconomic backgrounds (Pungello, Iruka, Dotterer, Mills-Koonce, & Reznick, 2009). In a recent report, the Office for Standards in Education, Children's Services and Skills (Ofsted) highlighted the extent of the problem of falling literacy levels in England; as many as 1 in 5 children fail to reach expected literacy standards by the end of primary school, with the number increasing to 1 in 3 children from at-risk groups. In 2011 this accounted for 100,000 children (Wilshaw, 2012). Furthermore, if children are not able to read securely by the age of 7, the struggle continues for the rest of their school education and beyond (Field,

2010; Lonigan, Farver, Phillips, & Clancy-Menchetti, 2011). Clearly, these findings have important repercussions as literacy is the cornerstone of children's ability to learn and engage with all school subjects. Providing parents and caregivers with the ability to effectively structure shared storybook reading will maximise the benefits to help children increase their vocabulary and enrich their enjoyment through this important activity. Our research shows that just a few minutes of reading several times a week has a substantial impact on word learning.

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References

Akhtar, N., Jipson, J., & Callanan, M. A. (2001). Learning Words through Overhearing. *Child Development, 72*(2), 416-430. doi:10.1111/1467-8624.00287

Anderson, D. A., Bryant, J., Wilder, A., Santomero, A., Williams, M., & Crawley, A. M. (2000). Researching Blue's Clues: Viewing Behavior and Impact. *Media Psychology, 2*(2), 179 - 194 doi:10.1207/S1532785XMEP0202_4

Biemiller, A., & Boote, C. (2006). An Effective Method for Building Meaning Vocabulary in Primary Grades. *Journal of Educational Psychology, 98*(1), 44-62. doi:10.1037/0022-0663.98.1.44

Biemiller, A., & Slonim, N. (2001). Estimating Root Word Vocabulary Growth in Normative and Advantaged Populations: Evidence for a Common Sequence of Vocabulary Acquisition. *Journal of Educational Psychology, 93*(3), 498-520. doi:10.1037/0022-0663.93.3.498

Bion, R. A. H., Borovsky, A., & Fernald, A. (2013). Fast mapping, slow learning: disambiguation of novel word-object mappings in relation to vocabulary learning at 18, 24, and 30 months. *Cognition, 126*(1), 39-53. doi:10.1016/j.cognition.2012.08.008

Blewitt, P., Rump, K. M., Shealy, S. E., & Cook, S. A. (2009). Shared Book Reading: When and How Questions Affect Young Children's Word Learning. *Journal of Educational Psychology, 101*(2), 294-304. doi:10.1037/a0013844

Brockmole, J. R., Castelhano, M. S., & Henderson, J. M. (2006). Contextual cueing in naturalistic scenes: Global and local contexts. *J Exp Psychol Learn Mem Cogn, 32*(4), 699-706. doi:10.1037/0278-7393.32.4.699

Brockmole, J. R., & Henderson, J. M. (2006). Recognition and attention guidance during contextual cueing in real-world scenes: evidence from eye movements. *Q J Exp Psychol (Colchester), 59*(7), 1177-1187. doi:10.1080/17470210600665996

Burch, M., & Looker, E. (2007). *Picture Book Reading With Toddlers: Exploring Changes in Maternal Support Over Time*. Paper presented at the Cognitive Development Society, Santa Fe, New Mexico. poster retrieved from

Bus, A. G., & van Ijzendoorn, M. H. (1997). Affective Dimension of Mother-infant Picturebook Reading. *Journal of School Psychology, 35*(1), 47-60. doi:10.1016/s0022-4405(96)00030-1

Chao, H.-F., & Yeh, Y.-Y. (2006). Inhibition of return lasts longer at repeatedly stimulated locations than at novel locations. *Psychonomic Bulletin & Review, 13*(5), 896-901. doi:10.3758/bf03194016

Chun, M. M. (2000). Contextual Cueing of Visual Attention. *Trends in Cognitive Sciences, 4*(5), 170-178. doi:10.1016/S1364-6613(00)01476-5

Chun, M. M., & Jiang, Y. (1998). Contextual Cueing: Implicit Learning and Memory of Visual Context Guides Spatial Attention. *Cognitive Psychology, 36*(1), 28-71. doi:10.1006/cogp.1998.0681

Cornell, E. H., & Sénéchal, M. (1993). Vocabulary Acquisition Through Shared Reading Experiences. *Reading Research Quarterly, 28*(4), 360-374. doi:10.2307/747933

Coyne, M. D., Simmons, D. C., Kame'enui, E. J., & Stoolmiller, M. (2004). Teaching Vocabulary During Shared Storybook Readings: An Examination of Differential Effects. *Exceptionality, 12*(3), 145-162. doi:10.1207/s15327035ex1203_3

Crawley, A. M., Anderson, D. R., Wilder, A., Williams, M., & Santomero, A. (1999). Effects of Repeated Exposures to a Single Episode of the Television Program Blue's Clues on the Viewing Behaviors and Comprehension of Preschool Children. *Journal of Educational Psychology, 91*(4), 630-637. doi:10.1037/0022-0663.91.4.630

Dodd, M. D., Van der Stigchel, S., & Hollingworth, A. (2009). Novelty is not always the best policy. *Psychological Science, 20*(3), 333. doi:10.1111/j.1467-9280.2009.02294.x

Dwyer, J., & Neuman, S. (2008). Selecting Books for Children Birth Through Four: A Developmental Approach. *Early Childhood Education Journal, 35*(6), 489-494. doi:10.1007/s10643-008-0236-5

Field, F. (2010). *The Foundation Years: Preventing Poor Children Becoming Poor Adults: The Report of the Independent Review on Poverty and Life Chances*: The Stationery Office.

Fletcher, K. L., & Jean-Francois, B. (1998). Spontaneous Responses During Repeated Reading in Young Children from 'At Risk' Backgrounds. *Early Child Development and Care, 146*(1), 53-68. doi:10.1080/0300443981460106

Fletcher, K. L., & Reese, E. (2005). Picture Book Reading with Young Children: A Conceptual Framework. *Developmental Review, 25*(1), 64-103. doi:10.1016/j.dr.2004.08.009

Grillon, C., & Davis, M. (1997). Fear-potentiated startle conditioning in humans: Explicit and contextual cue conditioning following paired versus unpaired training. *Psychophysiology, 34*(4), 451-458. doi:10.1111/j.1469-8986.1997.tb02389.x

Hickman, P., Pollard-Durodola, S., & Sharon, V. (2004). Storybook Reading: Improving Vocabulary and Comprehension for English-Language Learners. *The Reading Teacher, 57*(8), 720-730.

Hollingworth, A. (2009). Two forms of scene memory guide visual search: Memory for scene context and memory for the binding of target object to scene location. *Visual cognition, 17*(1-2), 273-291. doi:10.1080/13506280802193367

Horst, J. S. (2013). Context and Repetition in Word Learning. *Frontiers in Psychology, 4*, 149. doi:10.3389/fpsyg.2013.00149

Horst, J. S., Parsons, K. L., & Bryan, N. M. (2011). Get the Story Straight: Contextual Repetition Promotes Word Learning from Storybooks. *Frontiers in Psychology, 2*, 17. doi:10.3389/fpsyg.2011.00017

Horst, J. S., & Samuelson, L. K. (2008). Fast Mapping but Poor Retention by 24-month-old Infants. *Infancy, 13*(2), 128-157. doi:10.1080/15250000701795598

Justice, L. M., Mashburn, A. J., Hamre, B. K., & Pianta, R. C. (2008). Quality of language and literacy instruction in preschool classrooms serving at-risk pupils. *Early Childhood Research Quarterly, 23*(1), 51-68. doi:10.1016/j.ecresq.2007.09.004

Justice, L. M., Meier, J., & Walpole, S. (2005). Learning new words from storybooks: An efficacy study with at-risk kindergartners. *Language Speech and Hearing Services in Schools, 36*(1), 17-32. doi:10.1044/0161-1461(2005/003)

Lonigan, C. J., Farver, J. M., Phillips, B. M., & Clancy-Menchetti, J. (2011). Promoting the development of preschool children's emergent literacy skills: a

randomized evaluation of a literacy-focused curriculum and two professional development models. *Reading and Writing, 24*(3), 305-337. doi:10.1007/s11145-009-9214-6

Lonigan, C. J., & Whitehurst, G. J. (1998). Relative Efficacy of Parent and Teacher Involvement in a Shared-Reading Intervention for Preschool Children from Low-Income Backgrounds. *Early Childhood Research Quarterly, 13*(2), 262-290. doi:10.1016/S0885-2006(99)80038-6

Marchman, V. A., & Fernald, A. (2008). Speed of word recognition and vocabulary knowledge in infancy predict cognitive and language outcomes in later childhood. *Developmental Science, 11*(3), F9-F16. doi:10.1111/j.1467-7687.2008.00671.x

Markson, L., & Bloom, P. (1997). Evidence Against a Dedicated System for Word Learning in Children. *Nature, 385*(813-815). doi:10.1038/385813a0

McMurray, B., Horst, J. S., & Samuelson, L. K. (2012). Word learning emerges from the interaction of online referent selection and slow associative learning. *Psychological Review, 119*(4), 831-877. doi:10.1037/a0029872

Monetta, L., Grindrod, C. M., & Pell, M. D. (2009). Irony comprehension and theory of mind deficits in patients with Parkinson's disease. *Cortex, 45*(8), 972-981. doi:10.1016/j.cortex.2009.02.021

Namy, L. L., Acredolo, L., & Goodwyn, S. (2000). Verbal Labels and Gestural Routines in Parental Communication with Young Children. *Journal of Nonverbal Behavior, 24*(2), 63-79. doi:10.1023/a:1006601812056

Oliva, A., & Torralba, A. (2007). The Role of Context in Object Recognition. *Trends in neurosciences, 11*(12), 520. doi:10.1016/j.tics.2007.09.009

Ono, F., Jiang, Y., & Kawahara, J. (2005). Intertrial temporal contextual cuing: association across successive visual search trials guides spatial attention. *Journal of experimental psychology. Human perception and performance, 31*(4), 703. doi:10.1037/0096-1523.31.4.703

Pungello, E. P., Iruka, I. U., Dotterer, A. M., Mills-Koonce, R., & Reznick, J. S. (2009). The Effects of Socioeconomic Status, Race, and Parenting on Language Development in Early Childhood. *Developmental Psychology, 45*(2), 544-557. doi:10.1037/a0013917

Rimm-Kaufman, S. E., & Pianta, R. C. (2000). An Ecological Perspective on the Transition to Kindergarten A Theoretical Framework to Guide Empirical Research. *Journal of Applied Developmental Psychology, 21*(5), 491-511. doi:10.1016/s0193-3973(00)00051-4

Robbins, C., & Ehri, L. C. (1994). Reading Storybooks to Kindergartners Helps them Learn New Vocabulary Words. *Journal of Educational Psychology, 86*(1), 54-64. doi:10.1037/0022-0663.86.1.54

Sénéchal, M. (1997). The Differential Effect of Storybook Reading on Preschoolers' Acquisition of Expressive and Receptive Vocabulary. *Journal of Child Language, 24*(01), 123-138. doi:10.1017/S0305000996003005

Sénéchal, M., & Cornell, E. H. (1993). Vocabulary acquisition through shared reading experiences. *Reading Research Quarterly, 28*(4), 361-374.

Sénéchal, M., LeFevre, J. A., Thomas, E. M., & Daley, K. E. (1998). Differential Effects of Home Literacy Experiences on the Development of Oral and Written Language. *Reading Research Quarterly, 33*(1), 96-116. doi:10.1598/RRQ.33.1.5

Sénéchal, M., Thomas, E. M., & Monker, J. A. (1995). Individual Differences in 4-Year-Old Children's Acquisition of Vocabulary During Storybook Reading.

Journal of Educational Psychology, 87(2), 218. doi:10.1037/0022-0663.87.2.218

Simcock, G., & Deloache, J. (2006). Get The Picture? The Effects of Iconicity on Toddlers' Reenactment from Picture Books. *Developmental Psychology, 42*(6), 1352-1357. doi:10.1037/0012-1649.42.6.1352

Simcock, G., & Deloache, J. (2008). The Effect of Repetition on Infants' Imitation from Picture Books Varying in Iconicity. *Infancy, 13*(6), 687-697. doi:10.1080/15250000802459102

Smith, L. B., Colunga, E., & Yoshida, H. (2010). Knowledge as Process: Contextually Cued Attention and Early Word Learning. *Cognitive Science, 34*(7), 1287-1314. doi:10.1111/j.1551-6709.2010.01130.x

Snowling, M. J., & Hulme, C. (2012). Interventions for children's language and literacy difficulties. *International Journal of Language and Communication Disorders, 47*(1), 27-34. doi:10.1111/j.1460-6984.2011.00081.x

Swanson, E., Wanzek, J., Petscher, Y., Vaughn, S., Heckert, J., Cavanaugh, C., . . . Tackett, K. (2011). A synthesis of read-aloud interventions on early reading outcomes among preschool through third graders at risk for reading difficulties. *Journal of Learning Disabilities, 44*(3), 258-275. doi:10.1177/0022219410378444

Tatler, B. W., Gilchrist, I. D., & Rusted, J. (2003). The time course of abstract visual representation. *Perception, 32*(5), 579-592. doi:10.1068/p3396

Therrien, W. J., Wickstrom, K., & Jones, K. (2006). Effect of a Combined Repeated Reading and Question Generation Intervention on Reading Achievement. *Learning Disabilities Research & Practice, 21*(2), 89-97. doi:10.1111/j.1540-5826.2006.00209.x

Wilshaw, M. (2012). *Moving English forward: Action to raise standards in English', based on visits to over 250 schools* (110118). Retrieved from http://www.ofsted.gov.uk/resources/110118

Running Head: *Preliminary Research*

Supplementary Study 1

Preliminary Research.

Adult Storybook Rating: a Pilot Study

Background and Aims

Investigating how preschool children acquire language through exposure to stories can be a complex process. Rigorous experimental controls of the storybooks used in such studies are critically important to ensure that we are measuring these children's learning and not individual differences in prior storybook experience. It also ensures that children have the same experience reading stories in studies as they do at other times. Often preschool children are tested using commercially available books (e.g. Evans & Saint-Aubin, 2005; Justice, Skibbe, Canning, & Lankford, 2005; Sénéchal, 1997), but it is possible that children may have had previous exposure to these stories (e.g. through nursery, playgroup, friends house). Further, some storybooks have embedded synonyms as the target word (Coyne, Simmons, Kame'enui, & Stoolmiller, 2004; Sénéchal, 1997), which may mean that preschool children are merely learning a new word for an already known object or concept (e.g. infant for baby).

Another difficulty that arises from commercial storybooks is the ability to control the frequency of target word exposure (e.g Elley, 1989; Robbins & Ehri, 1994) and the length of each book (McLeod & McDade, 2010). To address these methodological issues, nine novel storybooks were designed with each containing the same number of target words, total words, pictures and pages. To determine if these books were comparable to commercial storybooks, twelve parents rated them for comparability to each other, and to commercially available books.

Method

Participants

Twelve parents took part (M_{age} = 28 years, 10 days, SD = 8 years, 9 months, 4 days range = 18 years, 1 month, 29 days to 46 years, 1 month, 4 days, 11 women) and all participants reported reading with their children on a daily basis. Parents were recruited through a local nursery childcare, or through visits to The Word Lab at The University of Sussex.

Materials .The materials were the nine storybooks from the main experiment. Story plots in the books were designed to appeal to 3-year-old children and contain a moral. Two novel objects were named four times throughout each story but were not the main focus of the plot. The nine books were further divided into three subsets of three books, where the two novel objects (e.g. Sprock and Tannin) were the same pair of novel word objects within the three books in each set (see main text for a full description).

Procedure

Participants were tested individually in the lab. Informed consent was obtained from each participant. Participants were told that they would be rating the stories on several measures after each reading, although they remained blind to both the hypotheses and to the design of the main experiment. Stories were read from a PowerPoint display on a Dell laptop computer, and participants read at their own pace using the arrow keys to turn the page. Stories appeared in pseudo-random order, counterbalanced across participants using a Latin Square design.

Participants read all nine stories. After each story, they completed a questionnaire with a 5-point likert-scale to measure how likely they believed a 3-year-old would enjoy the story in comparison to other storybooks, how much the plot

reflected a commercially available storybook for a 3- to 4-year-old, and how similar the pictures in the story were compared to other commercially available storybooks for 3 to 4-year-olds.

Results

Only 11 participants' responses were included in the analysis, due to one participant answering with a neutral score to every question. There were no differences of the participants' rating as to how likely preschool children were to enjoy the stories overall compared to other books $F(8,80) = 1.66$, p=.12, $\eta_p^2 = .13$ or how the plots and pictures, $F(3.74,41.15) = 1.77$, p =.16 , $\eta_p^2 = .14$, were comparable to commercially available books for 3 to 4-year-olds. We analysed an aggregate score from participants' ratings for plot and picture similarity to commercial books, as the storybook text and illustrations would never appear in isolation for the children. We used standardised z-scores to analyse the data and to take into account individual variability but the same pattern of results were found with the raw scores.

Discussion

Participants' ratings of the purpose-written storybooks suggested that 3 to 4-year-old children in our subsequent studies would find the books similar to other books they might experience. This was critical to ensure that children would have a similar reading experience during our studies as to the one they are used to, maintaining as much ecological validity to shared storybook experience as possible. Using purpose-written storybooks ensured that all of the children taking part in subsequent studies would not have previously seen nor heard the stories. This further allowed us to ensure that any effects we found were due to children's word learning rather than the quality of storybooks children were hearing.

References

Coyne, M. D., Simmons, D. C., Kame'enui, E. J., & Stoolmiller, M. (2004). Teaching Vocabulary During Shared Storybook Readings: An Examination of Differential Effects. *Exceptionality, 12*(3), 145-162. doi:10.1207/s15327035ex1203_3

Elley, W. B. (1989). Vocabulary Acquisition from Listening to Stories. *Reading Research Quarterly, 24*(2), 174-187. doi:10.2307/747863

Evans, M. A., & Saint-Aubin, J. (2005). What Children Are Looking at During Shared Storybook Reading. *Psychological Science, 16*(11), 913. doi:10.1111/j.1467-9280.2005.01636.x

Justice, L. M., Skibbe, L., Canning, A., & Lankford, C. (2005). Pre-Schoolers, Print and Storybooks: An Observational Study Using Eye Movement Analysis. *Journal of research in reading, 28*(3), 229-243. doi:10.1111/j.1467-9817.2005.00267.x

McLeod, A. N., & McDade, H. L. (2010). Preschoolers' Incidental Learning of Novel Words During Storybook Reading. *Communication Disorders Quarterly*. doi:10.1177/1525740109354777

Robbins, C., & Ehri, L. C. (1994). Reading Storybooks to Kindergartners Helps them Learn New Vocabulary Words. *Journal of Educational Psychology, 86*(1), 54-64. doi:10.1037/0022-0663.86.1.54

Sénéchal, M. (1997). The Differential Effect of Storybook Reading on Preschoolers' Acquisition of Expressive and Receptive Vocabulary. *Journal of Child Language, 24*(01), 123-138. doi:10.1017/S0305000996003005

Goodnight Book: Benefits of Sleep Consolidation on Word Learning via Storybooks

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Author note

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SW designed the experiment, including the children's enjoyment ratings task and plot questions task, edited the storybooks as necessary, completed 100% of the data collection, including additional data collection for supplemental studies, and completed all statistical analyses and wrote this version of the paper.

Abstract

Reading the same storybooks repeatedly helps preschool children learn words. In addition, sleeping shortly after learning also facilitates memory consolidation and aids learning in older children and adults. The current study explored how sleep promotes word learning in preschool children using a shared storybook reading task. Children were either read the same story repeatedly or different stories, and either napped after the stories or remained awake. Children's word retention was tested 2.5 hours later, 24 hours later and one week later. Results demonstrate strong, persistent effects for both repeated readings and sleep-related memory consolidation on young children's word learning. A key finding is that children who read different stories before napping learned words just as well as children who had the advantage of hearing the same stories. In contrast, children who read different stories and remained awake never caught up to their peers on later word learning tests. Implications for educational practices are discussed.

Goodnight Book: Sleep Consolidation Improves Word Learning via Storybooks

Young children frequently ask for a favourite story to be read repeatedly (Sulzby, 1985) —particularly at bedtime (Burke, Kuhn, & Peterson, 2004; Sénéchal & LeFevre, 2001). This may be highly beneficial because reading stories can reduce the length of the bedtime routine (Field & Hernandez-Reif, 2001) and repeatedly reading the same stories facilitates word learning (Horst, Parsons, & Bryan, 2011; McLeod & McDade, 2010; Sénéchal, 1997; Wilkinson & Houston-Price, 2013). Recent research also demonstrates a profound effect of sleep-related memory consolidation on word recall in adults (e.g., Dumay & Gaskell, 2012) and school-aged children (e.g., Brown, Weighall, Henderson, & Gareth Gaskell, 2012; Gais, Lucas, & Born, 2006). In the current study we explore how shared storybook reading immediately before a period of sleep can facilitate preschool children's word learning.

Shared Storybook Reading

Shared storybook reading helps young children learn new vocabulary (Hargrave & Sénéchal, 2000; Reese, Sparks, & Leyva, 2010) and it is also related to later academic success (Rimm-Kaufman & Pianta, 2000; Whitehurst et al., 1988). Preschool children especially benefit when the same stories are read repeatedly (Horst et al., 2011; McLeod & McDade, 2010; Sénéchal, 1997). For example, when Sénéchal (1997) tested children either after a single reading of a storybook or after repeated readings of the same storybook. Repeated readings increased both expressive and receptive word learning. Recently, McLeod and McDade (2010) explored the effects of repeated readings and contextual diversity. Preschool children either heard a storybook, which contained each novel word once, read three times or

they heard a storybook, which contained each novel word in three different contexts, read once. Children who heard the same story three times demonstrated significantly better word learning than children who heard the diverse storybook once. Taken together, these studies demonstrate a clear advantage for reading stories repeatedly. However, the strength of this advantage remains unclear due to the methodological differences between conditions. For example, children in the single reading conditions spent less overall time engaged with the storybooks (see also Horst, 2013 for further review of methodological concerns).

In another recent study, overall storybook exposure was experimentally controlled by either reading preschool children the same stories repeatedly or different stories (Horst et al., 2011). Children in both conditions heard three stories during each session and all children had the same exposure to the novel words embedded within the stories. The only difference between conditions was whether the story context changed with each story reading or remained the same for the three readings. Children in the same stories condition learned significantly more novel words over the course of one week than children in the different stories condition. The authors argued that children learned more words when read the same stories repeatedly because such contextual repetition reduces the cognitive demands of the task, which leads to better long-term learning (see also Horst, 2013).

To further test this explanation, Williams, Horst and Oakhill (2011) also read preschool children the same and different stories using the same storybooks; however, they increased the difficulty of the repeated readings condition by repeating the stories across days. Children in both conditions heard three different stories during each session over the course of one week. Here the only difference between groups was whether the same three stories were read during each session or whether

three new stories were read during each session. Despite increasing the difficulty, children in the same stories condition learned significantly more novel words than children in the different stories condition.

Horst (2013) has argued that preschool children in these studies, as well as others (e.g., Ard & Beverly, 2004; McLeod & McDade, 2010) benefited from contextual repetition, which lowers the cognitive demands of the word learning task and consequently frees up cognitive resources to facilitate encoding of new information. However, encoding is only one stage of memory processing (Diekelmann & Born, 2010; Robertson, 2009). For robust word learning to occur, (24-month old) children must also consolidate the new information and retrieve it after a delay (Horst & Samuelson, 2008).

Sleep-related Memory Consolidation

Sleep is a powerful aid in memory consolidation (see Diekelmann & Born, 2010 for a review), allowing children and adults to better recall newly encoded information at a later time (Wilhelm et al., 2013). Sleep supports many cognitive functions including learning object locations (Kurdziel, Duclos, & Spencer, 2013), relationships among objects (Lau, Tucker, & Fishbein, 2010), and face processing (Mograss, Godbout, & Guillem, 2006). In particular, sleep supports the consolidation of declarative memory (see Ellenbogen, Payne, & Stickgold, 2006 for a review) — the kind of memory involved in recalling new words (Robertson, 2009).

Sleep is most effective if it follows within a few hours of learning, to reduce interference of the memory traces (Diekelmann & Born, 2010; Gais et al., 2006). Even short naps provide beneficial effects of memory encoding. For example, Lahl and colleagues (2008) gave adults lists of adjectives to learn before napping or an equivalent period awake. Adults remembered words significantly better after an ultra

short nap of only 6 minutes than after remaining awake for the same amount of time. However, napping for approximately 30 minutes promoted even better learning.

Naps also facilitate early language acquisition, particularly abstraction (e.g. learning one element predicts another later element as in "See the car*s*? Do you like *them*?"). For example, Gómez, Bootzin and Nadel (2006) exposed 15-month-old toddlers to an artificial language for 15 minutes at home. Then the toddlers either napped or remained awake. When tested 4 hours later in the lab, toddlers who had slept demonstrated an understanding of the abstract structure of the language. But the toddlers who remained awake did not, indicating sleep-facilitated abstraction. However, another possible explanation is that toddlers who napped were simply better-rested at test.

In a follow-up experiment, toddlers were exposed to the same language before a regular nap time and tested 24 hours later (Hupbach, Gomez, Bootzin, & Nadel, 2009). Again, when toddlers napped shortly after exposure to the language, they learned the general abstract structure suggesting that the original effect found by Gómez and colleagues (2006) was due to sleep and not simply being well-rested at test. In another condition, toddlers were familiarised to the artificial language at least four hours before their next nap and tested 24 hours later (Hupbach et al., 2009). When toddlers did not nap shortly after the learning phase they did not learn the abstract structure of the language, suggesting that the benefits of sleep are strongest if sleep follows shortly after learning (see also (Diekelmann & Born, 2010; Gais et al., 2006).

Work by Gaskell and colleagues (Brown et al., 2012; Dumay & Gaskell, 2007, 2012; Henderson, Weighall, Brown, & Gareth Gaskell, 2012) also demonstrates a benefit of sleep-related memory consolidation on language

processing (see also Backhaus, Hoeckesfeld, Born, Hohagen, & Junghanns, 2008). For example, adults incorporate novel pseudo-words into their existing lexicons better if they learn the words in the evening prior to sleeping compared with if they learn the words in the morning (Dumay & Gaskell, 2007, 2012). A similar result has been found with 9-year-old children (Henderson et al., 2012). In this case, children were randomly assigned to learn new pseudo-words in the early morning or late afternoon. Children who learned the words in the evening prior to sleeping performed significantly better on cued word recall tests and continued to perform well the next day and one week later. Children who learned the words in the morning only performed well after they had had their overnight sleep, and then also continued to perform well one week later.

A similar effect has also been found by Backhaus and colleagues (2008), who trained 9-12year-old children on lists of noun pairs both in the evening before sleep and in the morning. When children learned the words in the evening, they were significantly better at cued recall on both retention tests (the next morning and the next evening) than when they learned the words in the morning. In both conditions, children's performance improved following a period of sleep. That is, when children learned the list before a period of wakefulness, their recall also improved after their normal nocturnal sleep. Similarly, 7-year-old children are significantly more accurate on cued recall tests of newly learned pseudo-words after a longer retention interval, including a period of night-time sleep, than after a shorter retention interval of only 3-4 hours, that did not include sleep (Brown et al., 2012). Taken together, these studies present compelling evidence that sleep promotes memory consolidation in word learning studies for both older children and adults.

The Current Study

In the current study we explored how sleep promotes word learning in preschool children using a shared storybook reading task. Half of the children routinely took afternoon naps and half of the children did not. Children were either read the same story three times or were read three different stories (for a similar method see Horst et al., 2011). Each story contained two novel name-object pairs and all children received the same exposure to each name-object pair (and the number of words children can learn from storybooks, see Biemiller & Boote, 2006; this is in line with the number of words children this age can learn within a given day, see Bion, Borovsky, & Fernald, 2013). Children's word learning was tested immediately, after their nap (nap conditions) or after the same amount of time had lapsed (no nap conditions), as well as after their regular nocturnal sleep (24 hours later) and after 7 days.

To extend the previous research on repeated readings, we also tested children's story comprehension via inferential plot questions. In addition, we also included a ratings task to better understand the impact of repeated readings on children's enjoyment. Based on previous research (e.g., Horst et al., 2011; Wilkinson & Houston-Price, 2013; Williams et al., 2011) we expect that children in the same stories conditions will demonstrate better word learning than children in the different stories conditions. Importantly, if sleep-related memory consolidation promotes word learning, then children who nap after hearing the stories should perform better than children who do not nap and performance should generally improve after nocturnal sleep. A critical test for the benefit of sleep-related memory consolidation on word learning will be the performance of the children who hear different stories and then nap. Learning words from different stories is challenging (e.g., Horst et al., 2011),

however, sleep-related memory consolidation is highly effective if it occurs shortly after learning (Diekelmann & Born, 2010; Gais et al., 2006; Hupbach et al., 2009). If sleep-related memory consolidation has a strong influence on word learning, then these children should later perform at levels similar to children who had the advantage of hearing the same story read repeatedly. In contrast, if sleep-related memory consolidation has little influence on word learning, then both groups of children who hear different stories should perform similarly and we should find no effect of sleep.

Method

Participants

Forty-eight 3-year-old monolingual, British English speaking children without any known learning disabilities participated. Children were from primarily white, middle-class families and lived in an urban area on the South coast of England. Children were recruited through nurseries and preschools and, as a thank you, the nurseries and pre-schools received book tokens and each child received several stickers. An additional four children were tested but their data was not included in the final sample because they failed to cooperate (n = 1) or missed the final test due to absence (n = 3).

Children were quasi-randomly assigned to four conditions based on whether or not they habitually napped. Half of the children were read the same stories and half were read different stories. This resulted in the following groups: same story nap (8 girls, 4 boys), same story no nap (5 girls, 7 boys), different stories nap (8 girls, 4 boys), and different stories no nap (6 girls, 6 boys). There was no difference in age between groups, $F(3,44) = .71$, $p = .55$.

Stimuli. Children were read either one or three short storybooks minimally modified

from those created by Horst et al., (2011): *Rosie's Bad Baking Day*, *The Very Naughty Puppy* and *Nosy Rosie at the Restaurant*. All three stories were compiled into one spiral-bound covered book where they appeared as chapters. For more information on the storybooks see Horst et al., (2011). Throughout each story, two novel objects were each depicted and named four times but were not the focus of the plot; an inverted slingshot that functioned like a hand mixer (*sprock*) and a kinetic wheel that functioned like a rolling pin (*tannin*). The objects appeared twice on their own pages and twice together.

Test stimuli. To test whether children learned the target words, a spiral-bound test booklet with three practice pages and 13 test pages was used. Each A4 page of the test booklet included a picture in each quadrant (e.g., top left). Each practice page included four different familiar objects (e.g., ball, fish, plane, and car) and each test page included four novel objects (M = 4.07cm x 6.43cm SD = 1.25cm). Throughout the test booklet the novel targets (*sprock*, *tannin*) appeared both individually (on nine pages) and together (on four test pages). The other novel objects were novel distractors that the children had not previously seen (see also Werchan & Gómez, 2014). Picture locations (i.e. quadrants) were counterbalanced across pages.

Procedure and Design

Children were tested individually in their normal nursery setting four times within 8 days; immediately after they heard the stories, after a 2.5 hour delay (during which time the children who habitually napped took their naps), after a 24-hour delay and after a one-week delay (7 days after the initial visit) - see Figure 1. To increase ecological validity and to allow the children to become familiar and comfortable with the experimenter, they spent a week at the nursery before the experiment helping

with routine activities and play (see also Dunn, Wooding, & Hermann, 1977; McLeod & McDade, 2010).

Children were read stories and tested individually in a quiet room (either another classroom or a quiet common area). However, because testing took place in a nursery or preschool setting, other people and activities could be sometimes heard. This reflected children's typical daytime shared storybook reading experiences. Note, Riley and McGregor (2012) recently manipulated background noise (quiet, moderate white noise) when novel words were introduced to school-age children. They tested children's novel word comprehension using 4 alternative forced-choice trials with pictures, as we do in the current study. Importantly, they found no effect of background noise on children's novel name comprehension.

Reading phase.

During the reading phase, children sat beside the experimenter to ensure the illustrations were easy to see. Children were either read the same story three times or all three different stories once each. Importantly, all children encountered both name-object pairs 12 times each and the number of naming instances and encounters was the same across conditions. Children's questions and comments were neither encouraged nor discouraged (for a similar method see, Cornell & Sénéchal, 1993). If the child asked questions during the story, the experimenter encouraged the child to return their attention to the story (e.g. "let's keep reading and see!") and avoided naming any objects. The order in which children in the different story conditions heard the stories was counterbalanced across participants using a Latin Square and, the single story that children, in the same story condition, heard was counterbalanced across participants. Children were given a sticker after each reading to keep them engaged in the task, as the nursery/preschool setting is otherwise alluring.

Story enjoyment ratings. Children's enjoyment of the stories was examined using a 3-point ratings task (for a similar method rating television programs see Anderson et al., 2000). Immediately after hearing each story, the child was asked to indicate his/her enjoyment of the story by giving the experimenter a laminated smiley face card (2in diameter) from an array. The experimenter asked the child, "How much did you enjoy reading this story today?", and set each card on the table one at a time, explaining what each card represented. For example, "Pick this card if you liked the story a lot", or, "Pick this card if you didn't like the story". The order the cards were set on the table was counterbalanced across and within participants but "a lot" was always placed on the left, "a little" in the middle and "didn't like" on the right. Finally, after hearing all three stories (or after the third reading of the same story), the experimenter asked the child, "How much did you enjoy reading all three stories today?". See supplementary study 1b.

Plot comprehension questions. Immediately after asking the story enjoyment questions, plot comprehension questions were administered as an additional control. This was to check if the children were paying attention to the stories in the different story conditions. The plot comprehension questions were presented as forced-choice questions and both potential answers were words or phrases that had occurred in the relevant story (to ensure both answers appeared in the text, the stories were minimally edited from the originals used by Horst et al., 2011). For example, a question for *Rosie's Bad Baking Day* asked, "Was Rosie's daddy gone a long time - or was he quick?" (He was gone a long time, which is why Rosie continues mixing and accidentally uses salt instead of sugar.) Across children, the correct answer appeared equally often as the first and second choice in the question (i.e. half of the children were asked "Was Rosie's daddy quick or was he

gone a long time?"). For each child, the correct answers alternated between the first and second choice and whether the answer to Question 1 was first or second was counterbalanced across children. If children answered, "[I] don't know" the experimenter moved on and that question was not included in the child's score (i.e. proportion correct was calculated as the number correct out of the number of questions answered).

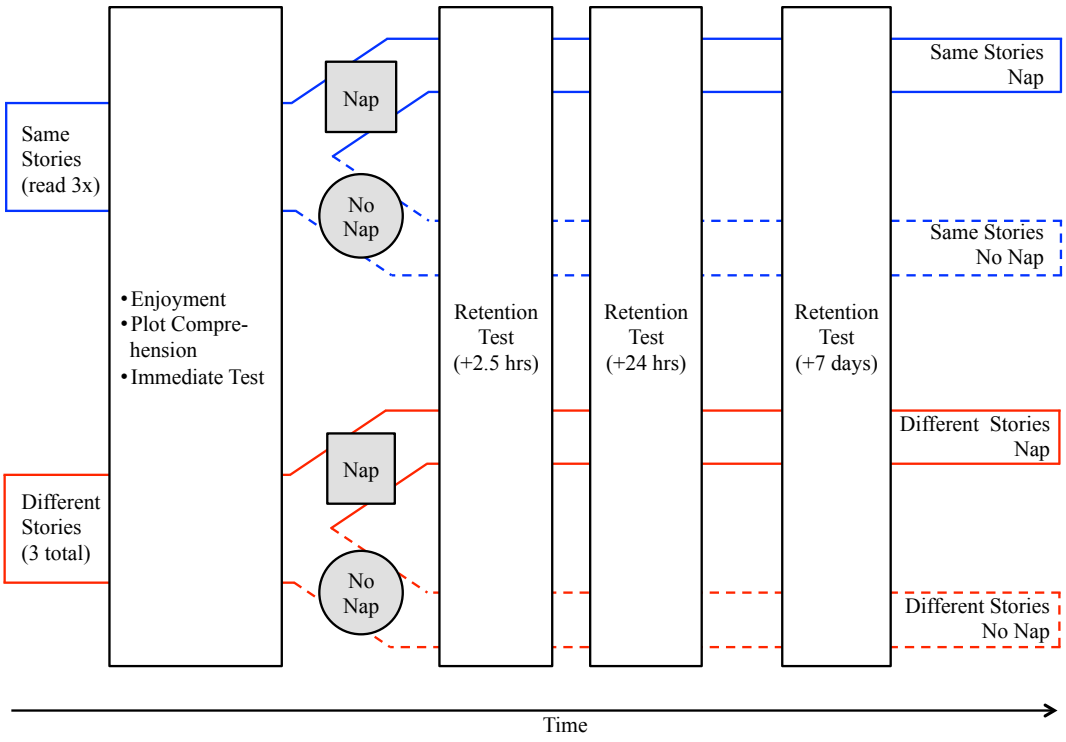

Figure 1. Schematic representation of the experimental design. Children participated in one of the four conditions (same story nap, same story no nap, different story nap, different story no nap). Children's recall was tested immediately after reading stories and then children either napped or did not nap. Children's word retention was subsequently tested 2.5 hours later, 24 hours later, and 7 days later**.**

We first piloted 12 questions from each story with 12 monolingual, British 3-year-old children (5 girls, 7 boys). Children heard each story once and answered all 12 plot comprehension questions immediately after each story. From these questions we selected nine for use in the main study, excluding the easiest and most difficult

questions but maintaining the same number of questions per story (see supplementary study 1a). There was no difference in difficulty among the remaining plot comprehension questions between $\chi \cdot^2(16) = 3.44$, $p = .99$ (M_{baking} =.77, SD_{baking} = .14; M_{puppy} =.73, SD_{puppy} = .21; $M_{restaurant}$ =.72, $SD_{restaurant}$ = .27). Children in the same story conditions were asked nine questions about their story after they had heard it once. Children in the different stories conditions were asked three questions about each story after they had heard the story once (for a total of nine questions). Which questions were asked for a given story was pseudo-randomly determined for each child as questions always occurred in story-chronological order. Plot questions were administered after the story enjoyment ratings so that discussing the plot would not influence children's ratings.

Immediate word learning test. The first word learning test immediately followed the reading phase and included four warm-up trials to ensure that the child understood the task. The experimenter told the child that they were going to play a "pointing game" and asked the child to show his or her pointing finger. Then the experimenter opened the test booklet to a practice page and asked the child to indicate each of the pictures in a pseudo-random order (e.g. "Can you point to the car?"). Thus, at the end of the warm-up trials the child had practiced pointing to an object in each quadrant (e.g. top left). Children were praised for correct choices (100% of trials). Practice page, trial order and target quadrants were counterbalanced within and across participants.

Next, the children's comprehension of the target novel words was tested using the test pages from the test booklet. A different test page was used on each trial. Children were asked to point to each target twice for a total of four test trials. Across trials, targets were presented twice individually and twice together. For

example, the child was presented with one *sprock* trial where the *tannin* was also present among the competitors, and one *sprock* trial where the *tannin* was not present among the competitors. Trial order, pages used and quadrant were counterbalanced within and across participants. The word learning task was the same as that used in previous research (Horst et al., 2011; Williams et al., 2011).

Delay phase. Working with the staff at the individual nurseries helped ensure that the learning phase was timed to occur no more than 30-45 minutes before children's regular nap times. After the immediate test and plot questions, children who habitually napped took their naps and children who did not habitually nap played without any constraints except that they should not be read any more stories until after their next test phase. Children who did not nap were yoked to children who did nap to ensure that there was no difference in the length of the delay phase between groups, see Table 1, $F(3,44) = 1.05$, $p = .38$. Specifically, for each child who napped, a child in the same condition (same, different stories) at the same preschool who did not nap was randomly assigned as the child's yoked partner. Once the delay between the reading phase and subsequent word learning test was established for the partner who napped (nap length was a primary factor in delay phase length), the no nap yoked partner was assigned the same length of delay. There was also no difference in nap length between the same story nap and different stories' nap conditions, $t(24) = .44$, $p = .67$.

Subsequent word learning tests (+2.5 hours, + 24 hours, + 7 days).

Children were re-tested on their comprehension for the novel target names three more times. The second test occurred approximately 2.5 hours after the immediate test (see Table 1). The same procedure as the immediate test was used. The third test occurred approximately 24 hours after the immediate test and the final

test occurred one week after the immediate test.

Coding. The experimenter recorded children's responses during each test. A member of the nursery/preschool staff observed the final test for each child to also record responses for inter-coder reliabilities (for a similar method see Horst et al., 2011). Staff members were naïve to the experimental hypotheses and design of the study. Staff members recorded children's responses out of the experimenter's view. Inter-coder reliability was 100%.

Table 1. Delays between the immediate test and post consolidation test, including nap length.

	Same story		**Different Stories**	
	Nap	**No Nap**	**Nap**	**No Nap**
Initial Delay	143.33 min. (21.60 min.) 105-170 min.	139.00 min. (21.15 min.) 110-175 min.	150.00 min. (18.00 min.) 120-165 min	143.00 min. (17.00 min.) 110-170 min.
Nap Length	62.01 min. (8.65 min.) 50-75 min.		64.12 min. (13.90 min.) 45-90 min.	

Standard deviations presented in parentheses

Results

Word Comprehension

Results are depicted in Figure 2. As can be clearly seen, children who heard the same story repeated (thin blue lines) learned more words than children who heard different stories (solid red lines), thus replicating previous research. Further, children who napped (solid lines) performed significantly better than children who did not

nap (dotted lines). Importantly, children who heard different stories but then napped (solid red line) recovered after sleeping and continued to perform just as well as children who had heard the same story repeatedly and did not nap (dotted blue line). In contrast, children who heard different stories and did not nap (dotted red line) did not recover and did not perform as well as their peers on the retention tests.

We first present analyses comparing children's word learning against chance and then between conditions. Children's word learning was assessed via 4-alternative forced-choice trials. Overall, children's novel name recall and retention accuracy was significantly better than expected by chance (.25), see Figure 2, all *p*s < .01 (all of our reported *t*-tests are two-tailed). However, some of the test alternatives were never-before-seen novel objects (see e.g., Werchan & Gómez, 2014), which may have made the test easier than desired (Axelsson & Horst, 2013). Recall - half of the trials that the children received included three novel distractors and half of the trials included the other target as a competitor along with two novel distractors. Presenting items as both targets and non-targets creates a stringent test of word learning (Axelsson & Horst, 2013; Schafer & Plunkett, 1998).

To gain more insight into how well children really learned the target words, we also compared only the trials in which the other target appeared as a distractor to a very conservative level of chance (.50), see Table 2. When measured in this stringent way, children in the different stories no nap condition failed to demonstrate word learning at any point during the study (all means < .50). Children in the different stories nap condition did demonstrate word learning, but only after they had slept. Children in the same story conditions generally demonstrated significant word learning, as would be expected from previous research (e.g., Horst et al., 2011), with the exceptions that the same story nap condition performed only marginally above

chance before their naps (p = .10) and the same story no nap condition was no longer performing significantly above chance after 7 days (p = .27). Note, if chance on these trials is considered .25, both same stories conditions consistently performed significantly above chance even on these challenging trials (both ps < .01).

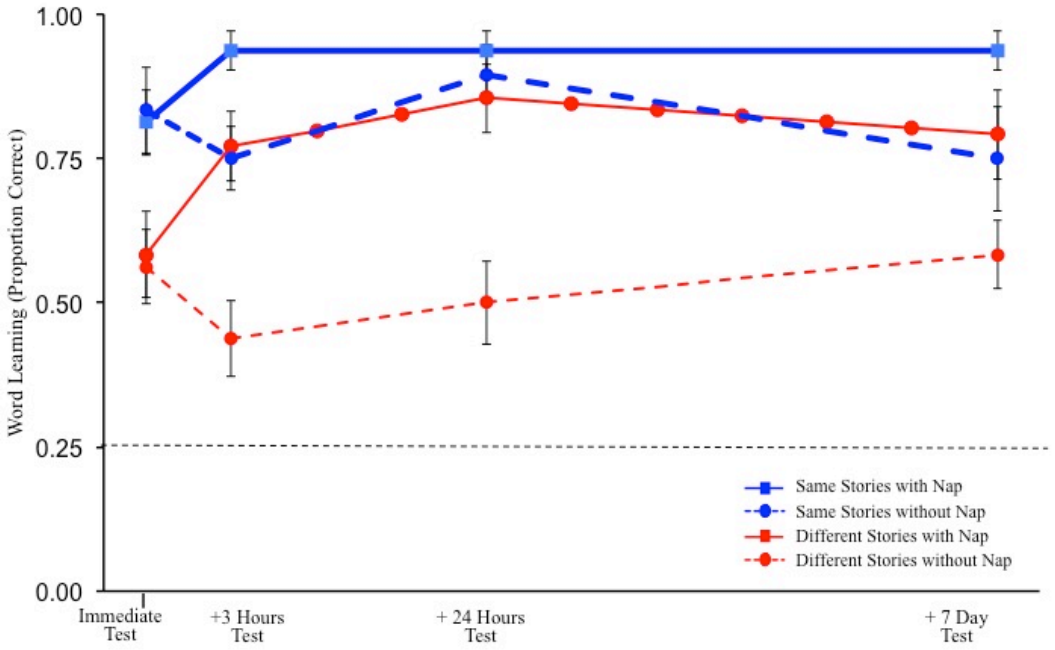

Figure 2. Children's word learning on each test for each of the four sub conditions. Chance is .25. Error bars indicate one standard error of the mean.

Effects of Repeated Reading and Sleep-related memory consolidation

Our main interest was the interaction between sleep and story exposure across time. In the following analyses we included data from all of the test trials because including all of the data provides the fullest picture of children's performance in the study (Axelsson & Horst, 2013). We ran these analyses only on the data from those trials where both targets were present and obtained the same pattern of results.

To test for differences between sleep and story conditions across time, children's proportions of correct choices were entered into a mixed-design ANOVA with Stories (Same, Different) and Sleep (Nap, No Nap) as between-subjects factors and Test (Immediate, +2.5 hours, +24 hours, + 7 days) as a repeated-measure. The ANOVA yielded a Stories by Sleep by Test Interaction, $F(3,132) = 3.24$, $p = .02$, $|\eta^2 = .07$. The ANOVA also found a Sleep by Test Interaction, $F(3,132) = 9.35$, $p < .0001$, $|\eta^2 = .18$. Thus, both stories and sleeping shortly after hearing the stories continued to have a profound effect that persisted.

Table 2. Children's responses on word learning trials with the other target as a distractor.

	Same Story		Different Stories	
	Nap	No Nap	Nap	No Nap
Immediate Test	.67† (.33)	.79* (.33)	.38 (.43)	.38 (.38)
+2.5 hours	.92*** (.19)	.58†† (.29)	.71* (.26)	.25* (.34)
+24 hours	.92*** (.19)	.87** (.23)	.79** (.26)	.25* (.34)
+7 days	92*** (.19)	.625†† (.38)	.75* (.34)	.38 (.31)

Standard deviations presented in parentheses. * $p < .05$, ** $p < .01$ *** $p < .001$ against chance (.50); † $p < .05$, †† $p \leq .01$ against chance (.25).

Children who heard the same stories learned significantly more words than children who heard different stories, $F(1,44) = 19.45$, $p < .001$, $|\eta^2 = .31$. Further,

children who napped learned significantly more words than children who did not nap, $F(1,44) = 10.68$, $\eta = .002$, $|\eta^2 = .20$. Finally, the ANOVA yielded a main effect of Test, $F(3,132) = 5.61$, $p = .001$, $|\eta^2 = .11$. Children performed significantly better after 24 hours than immediately after they heard the stories ($p < .001$) and than 2.5 hours after they heard the stories ($p < .01$). Children also performed better 7 days later than immediately after they heard the stories ($p \leq .01$). No other significant effects were found.

Tests of simple effects. To better understand how sleep-related memory consolidation influences children's word learning via storybooks, we also conducted tests of simple effects. We ran separate ANOVAs for children in both the same story and different stories conditions. For children in the same story conditions, the proportion of correct choices was entered into a mixed-design ANOVA with Sleep (nap, no nap) as a between-subjects factor and Test (Immediate, Delayed, 24-hr later, 7days later) as a repeated-measure.

The ANOVA yielded a significant Sleep by Test Interaction, $F(3,66) = 4.51$, $p = .006$, $|\eta^2 = .17$. The ANOVA also yielded a main effect of Test, $F(1,22) = 4.51$, $p = .05$, $|\eta^2 = .11$. Follow-up tests confirmed that children performed significantly better after 24 hours than immediately after they heard the stories ($p < .01$), than 2.5 hours after they heard the stories ($p < .05$) and than 7 days after they heard the stories ($p < .05$). No main effect of Sleep was found; however, given that children have done well in previous studies in which they have heard the same stories repeatedly without napping (e.g., Horst et al., 2011), this is not unexpected.

We conducted an identical ANOVA for children in the different stories conditions. The ANOVA yielded a significant Sleep by Test Interaction, $F(3,66) =$

7.75, $p < .001$, $|\eta^2 = .29$. The ANOVA also found a main effect of Sleep, $F(1,22) = 8.84$, $p < .007$, $|\eta^2 = .55$, indicating that children who napped learned significantly more words than children who did not nap. Finally, the ANOVA found a main effect of Test, $F(3,66) = 4.11$, $p = .009$, $|\eta^2 = .16$. Follow-up tests confirmed that children performed significantly better after 24 hours than immediately after they heard the stories ($p < .01$). Children also performed significantly better after 7 days than both immediately after they heard the stories ($p < .01$) and 2.5 hours after they heard the stories ($p = .03$).

Story Enjoyment Ratings

Overall, children liked the stories. Only three children answered they did not like a particular story (one child in the same stories no nap condition did not like *Nosy Rosie at the Restaurant,* and one child in each of the different stories conditions did not like *Rosie's Bad Baking Day*). A three-way Story Repetition x Storybook x Rating contingency test, found no interactions between conditions or stories, all *p*s > .32.

All children were asked, "How much did you enjoy reading all three stories today?". The majority of children in the same stories conditions (83%) answered that they liked reading "a lot", compared to only one-third (33%) of children in the different stories conditions, confirming that children do enjoy hearing the same stories read repeatedly - see Table 3. This finding is supported by both a Fisher's Exact Test, $p < .001$, and an unpaired t-test on answers transformed into a 3-point scale as, "liked a lot" (3), "liked a little" (2) and "didn't like" (1), $t(46) = 3.85$, $p < .001$, $d = 1.34$. Importantly, there was no difference in enjoyment ratings between children who napped and did not nap in the same story conditions, $t(22) = 0.39$, $p =$

.70, and different stories conditions, $t(22) = -1.28$, $p = .21$. This suggests that the word learning differences observed between the two different stories conditions were due to the effect of sleep-related memory consolidation and not due to *a priori* differences in story enjoyment (in fact, the children who did not nap enjoyed the stories slightly more ($M = 2.25$, $SD = .86$) than the children who did nap ($M = 1.83$, $SD = .72$).

Plot Comprehension

Plot comprehension questions were included as a check to ensure that if children in the different stories condition did not perform as well as their peers, this effect would not be due to these children not attending to the stories during the shared storybook reading episode. Children in the different stories conditions answered three plot questions after each story. Overall, children in the different stories conditions answered the plot comprehension questions at levels significantly better than expected by chance (50%, $M = .59$, $SD = .11$, $t(22) = 3.14$, $p = .005$, $d = 1.34$). Data from two girls (one in each different stories condition) were excluded from these analyses because they scored more than 2.5 standard deviations below (no nap) and above (nap) the means for their conditions. Both children performed similarly to the other children in the conditions on the other tests. There was no effect of story order ($F(2,42) = 1.41$, $p = .25$) or storybook ($F(2,40) = .55$, $p = .58$) on plot comprehension scores.

Plot comprehension questions were administered before the initial delay phase and there was no difference in performance between children who did and did not nap $t(21) = 0.83$, $p = .42$. Importantly, this again suggests that the word learning differences observed between the two different stories conditions were due to the

effect of sleep-related memory consolidation and not due to *a priori* differences in story understanding.

Table 3. Children's responses to the question, "How much did you enjoy reading all three stories today?"

	Same Story	Different Stories
"liked a lot"	20***	8
"liked a little"	3	9
"did not like"	1	7
Total	24	24

***$p < .001$, exact binomial test based on $p = .33$ for 20 or more such responses out of 24.

Children in the same stories conditions answered nine questions about their story after the first reading. Children answered the questions at levels significantly better than expected by chance (50%, $M = .71$, $SD = .18$, $t(23) = 7.02$, $p < .001$, $d = 1.88$), and there was no difference in performance between children who did and did not nap, $t(22) = 0.19$, $p = .85$. Data from one child (same stories no nap condition) were missing and not included in these analyses (this child performed similarly to the other children in her condition on the other tests). There was no difference in plot comprehension as a function of which storybook children heard ($F(2,21) = .65$, $p = .53$).

Predictive effects of story repetition and sleep.

Finally, we conducted a series of multiple regression analyses to determine if story repetition (same stories, different stories), sleep (nap, no nap), story enjoyment and/or plot comprehension predict children's word learning performance on each retention test.

Table 4. A series of regression models predicting children's word retention 2.5 hours after story exposure based on story repetition, sleep, story enjoyment and plot comprehension

	Word Learning β (standardized)			
	Model 1	Model 2	Model 3	Model 4
Story Repetition	.48***	.48***	.45***	.42**
Sleep		.52***	.52***	.52***
Story Enjoyment			.06	.01
Plot Comprehension				.06
R^2 (adjusted R^2)	.23 (.21)	.50 (.47)	.50 (.46)	.50 (.45)

** $p < .001$ ** $p < .01$ * $p < .05$.

Table 4 depicts the first retention test (2.5 hours after story exposure). Story repetition is a significant predictor of word retention ($t(47) = 3.68$, $p < .001$, $d = 1.13$) accounting for approximately 23% of the variation in word learning scores. Controlling for story repetition, sleep is also a significant predictor of word retention ($t(47) = 4.99$, $p < .001$). Together, story repetition and sleep account for approximately 50% of the variation in word learning scores ($F(2,47) = 22.136$, $p < .001$, $|\eta^2 = .33$). Neither story enjoyment ($p = .63$) nor plot comprehension ($p = .65$) were significant predictors of word retention 2.5 hours after story exposure.

Table 5. A series of regression models predicting children's word retention 24 hours after story exposure based on story repetition, sleep, story enjoyment and plot comprehension.

	Word Learning β (standardized)			
	Model 1	Model 2	Model 3	Model 4
Story Repetition	.48***	.48***	.52***	.47**
Sleep		.40**	.39**	.41**
Story Enjoyment			-.07	-.09
Plot Comprehension				.10
R^2 (adjusted R^2)	.23 (.22)	.39 (.37)	.40 (.35)	.42 (.36)

*** $p < .001$ ** $p < .01$.

Table 5 depicts the models predicting performance on the second retention test (24 hours after initial story exposure). Again, story repetition is a significant predictor of word retention ($t(47) = 3.74$, $p < .001$) accounting for approximately 23% of the variation in word learning scores. Controlling for story repetition, sleep (napping after story exposure) is also a significant predictor of word retention ($t(47) = 3.43$, $p < .001$). Together, story repetition and sleep account for approximately 39% of the variation in word learning scores the next day ($F(2,47) = 14.50$, $p < .001$, $|\eta^2 = .28$).

Neither story enjoyment ($p = .62$) nor plot comprehension ($p = .43$) were significant predictors of word retention 24 hours after story exposure.

Finally, Table 6 depicts the models predicting performance one week later. Story repetition is a significant predictor of word retention ($t(47) = 2.21$, $p < .05$), but accounts for much less variation one week later than at the earlier time points (approximately 10% of the variation). Again, sleep (napping after story exposure) is

also a significant predictor of word retention ($t(47) = 3.04$, $p < .01$). In fact, napping after story exposure is a stronger predictor than story repetition. Together, story repetition and sleep account for approximately 25% of the variation in word learning scores one week later ($F(2,47) = 7.50$, $p < .01$, $|\eta^2 = .20$). Neither story enjoyment ($p = .58$) nor plot comprehension ($p = .39$) were significant predictors of word retention one week after story exposure.

Table 6. A series of regression models predicting children's word retention 7 days after story exposure based on story repetition, sleep, story enjoyment and plot comprehension

	Word Learning β (standardized)			
	Model 1	Model 2	Model 3	Model 4
Story Repetition	.31*	.31*	.35*	.31†
Sleep		.39**	.38**	.41**
Story Enjoyment			-.08	-.14
Plot Comprehension				.12
R^2 (adjusted R^2)	.10 (.08)	.25 (.22)	.26 (.21)	.30 (.22)

** $p < .01$, * $p < .05$, † $p = .05$.

Taken together, these data clearly demonstrate that both reading the same stories repeatedly and sleeping shortly after story exposure significantly facilitated children's ability to learn words via shared storybook reading.

Discussion

Preschool children who have the same stories read to them repeatedly perform better at word learning tasks when compared to children who hear different stories (Horst et al., 2011; Sénéchal, 1997). The goal of the current study was to replicate the finding that preschool children benefit from word learning via repeated

shared storybook readings (Horst et al., 2011; Williams et al., 2011) and extend it further to understand how sleep-related memory consolidation facilitates to word learning. Preschool children who habitually napped or did not nap were either read the same story three times or three different stories prior to their normal naptime. Their word learning was immediately measured. Children were tested on their word learning again after a 2.5 hour delay during which time half the children took their normal nap. Children were then tested the next day and a week later.

As expected from previous research, we found that children who heard the same stories learnt words better than children who heard different stories. We also found that children who habitually napped showed a clear benefit for word learning compared to children who did not habitually nap. Importantly, the children who were read different stories and then napped performed as well as the children in same stories condition who did not nap. We know that learning words from different stories is more difficult; therefore it is important to understand that children can gain great benefit from sleep-related memory consolidation post-learning episodes. This is in contrast to the children who heard different stories but were not able to catch up with their peers, even after benefiting from sleep at night (recovery sleep). Further, regression analysis revealed that both story repetition and sleep predicted later word learning. In fact, sleep was a stronger predictor. Overall, the current findings make important contributions to both the shared storybook reading and developmental sleep literatures.

Shared storybook reading. Preschool children show clear benefits in their word learning when they have the same story read to them repeatedly. Whereas learning words from different stories – even when the number of exposures to new words is the same – is more difficult (Horst et al., 2011; Wilkinson & Houston-Price,

2013; Williams et al., 2011). To further explore these findings, we included an intermediate test between the first immediate test and the final test one week later, which allowed us to determine the effect that sleep - not just time - has on memory consolidation. We found that sleep immediately post-learning leads to a dramatic improvement, especially for those children who heard different stories. In addition, we also tested children's story comprehension via plot memory questions, for which novel insight is provided by having two groups of children to compare. Overall, the inclusion of plot memory questions further revealed that children who heard the same story repeatedly were able to remember the plot better than those who heard different stories.

Children enjoy having the same story read to them repeatedly. Understanding what young children enjoy during shared storybook time is essential for helping children learn to read for pleasure. This is related to greater academic performance later in life, as it leads to better cognitive and vocabulary development (Formby, 2014; Sullivan & Brown, 2013). For example, a recent cohort study found that 16-year-old children who read for pleasure develop superior maths, spelling and language skills when compared to children who do not or rarely read for pleasure (Sullivan et al., 2013). In the current study, the majority of children who heard the same stories repeatedly enjoyed the stories a lot (83.33%), compared with only a small proportion of the children who heard different stories (16.67%). It is important to note that, at a certain point, children will have extracted all the new information from the story and will enjoy moving on to new stories. Allowing children to develop a pleasure for reading will have important positive long-term academic consequences.

Although young children learn more words from repeated stories, it is worth

noting that children who heard different stories do make gains in word learning. In the current study, all children in the different stories condition performed better than expected by chance because they also had repeated exposure to the novel words, even with changing context around the novel words in the storybooks. Children being read different stories may be getting other benefits that were not tested for in the current study. Horst (2015) proposes that the benefits may be found in children's knowledge of the objects or concept, and current studies may be testing too early in the encoding process. By reading a greater variety of books (e.g. parents different bedtime reading to children at night) at the same time as repeating the same books to children, would help them gain the benefits from both repeated stories and different stories (Horst, 2013). Another possibility is that the children who heard different stories had greater difficulty in extracting the critical information across the stories and thus may be consolidating irrelevant details along with the weakly encoded name-object associations (Werchan & Gómez, 2014), similar to a generalisation condition. However, the children who heard different stories and napped did perform better than the children who heard different stories and did not nap. Future research should explore the relationship between retention and generalisation, and how sleep plays a role in this learning.

Sleep literature. Sleep can foster children's learning (Henderson et al., 2012; Kurdziel et al., 2013; Mednick, 2013; Mednick, Nakayama, & Stickgold, 2003). We combine a repeated stories paradigm —where children who hear the same stories recall significantly more new words than children who hear different stories —with children who regularly take a daytime nap. Importantly, all children receive the same number of exposures to the novel words. Children who took their regular nap after

having shared storybook reading performed significantly better than the children who heard the same books but did not nap.

Sleep has beneficial effects for adults for both declarative and procedural memory tasks. Benefits can be found for declarative memory consolidation (Ellenbogen et al., 2006) after immediate sleep, after offline consolidation (Diekelmann, Wilhelm, & Born, 2009), and after nocturnal sleep - even 8 hours or more later (Mednick et al., 2003). It is important to consider that sleep may not have the same effects on children as on adults; young children's sleep cycles are different, in that children spend more time asleep and have greater periods of slow wave sleep (SWS - Stickgold, 2013b; Stickgold & Walker, 2005). Slow wave sleep is one of the of sleep cycles that supports long term consolidation of explicit declarative memory and is associated with activation in the prefrontal-hippocampal circuitry, which sees activated during the encoding stage (Marshall & Born, 2007; Stickgold, 2005).

Wilhelm, Diekelmann, and Born (2008) examined both procedural (a finger tapping task) and declarative (2D object location and a word pair task) memory in children and adults. By comparing the consolidation effects of night-time sleeps and daytime wakefulness, they found that children show similar beneficial recall for declarative memory to adults, but not in procedural memory. This suggests that certain memory consolidation effects may depend on age stage. Kurdziel et al., (2013) found that sleep supports learning by enhancing memories—a benefit that was greater for those young children who regularly napped. We tested children's declarative memory with word recall trials using 2D pictures of objects and found that children who napped recalled words significantly better than children who had not napped.

The current study is the first to demonstrate the effects of napping on children's word learning, by testing children immediately after shared storybook time, again after their regular daytime nap and both 24 hours and one week later. Interestingly, we found that the children's scores for word learning were 33% higher in the different stories group after they had napped compared to before they napped. In previous studies, children who heard new words via different stories did not do as well as children who heard new words via the same stories; an effect maintained over time (Horst et al., 2011; McLeod & McDade, 2010; Williams et al., 2011). A possible explanation for this effect may be that it is cognitively more demanding for children who hear different stories to learn new information due to the context changing around them, so the memory traces for the new words are weaker. Once children nap, this provides the opportunity for the new words to consolidate off-line, creating a much more stable memory trace. This explanation is also consistent with Diekelmann et al., (2009) who argue that it was weak memory traces that received greater benefit from sleep-related memory consolidation.

Sleep research designs have been problematic in ensuring participants are exposed to learning and sleep at the same time of day across conditions. Often sleep and wake groups are tested at different times of day. For example, the performance of participants trained in the evening and tested in the morning is compared to performance of participants trained in the morning and tested in the evening (e.g. Backhaus et al., 2008; Dumay & Gaskell, 2007, 2012; Gais et al., 2006; Henderson et al., 2012; Kurdziel et al., 2013). Performance, especially in children, can be affected by the time of the day that learning (training) and testing takes place. There is an optimum time for learning and, if people are at different stages of the circadian rhythm, this can cause a confound in performance (Duffy & Czeisler, 2009). In the

current study, we tested children in both conditions at the same time of the day. By spending time in the nurseries prior to testing, the experimenter became familiar with the children's normal routines; no encouragement was needed to assist children in falling asleep (c.f. Kurdziel et al., 2013 with children; and Lau et al., 2010 with adults). It also ensured we did not need to randomly assign children to the nap or wake conditions, we were able to use children who had naturally stopped napping instead.

We carefully controlled for environment familiarity, time of testing and circadian tiredness; adhering to children's natural patterns of wake and sleep with no intervention, eliminating wake groups exposure to memory interference. Unlike other studies, the current study is unlikely to have been affected by methodical limitations. We are also able to address a gap in research highlighted by Mednick (2013) that no study has yet examined differences between preschool children who habitually and non-habitually nap, and their sleep-dependent memory consolidation. Our findings show that even for the children who do still nap, when measured against children who no longer habitually nap, they gain significantly from memory consolidation during their nap. Note, this finding contrasts the argument that children who no longer nap are more mature neurologically, so they are able to go for longer without needing sleep to consolidate newly learnt material (Kurdziel et al., 2013; Mednick et al., 2003). However, it may still be the case that a developmental milestone of brain maturation explains why some children no longer need to nap (Lam, Mahone, Mason, & Scharf, 2011). For example, it may be that the children who are not habitual nappers perform better in procedural recall tasks (Gomez et al., 2006; Wilhelm, Diekelmann, & Born, 2008) and children who napped habitually were more efficient nappers, able to transition into SWS sleep, which provides a greater

advantage for declarative memory tasks. Consistent with a dynamic systems perspective, normative individual differences in children's need to nap may not be purely biological. Rather, the transition to non-napper can be affected by a wide range of social, environmental and behavioural factors (Staton et al., 2016).

Although it is common for preschools and nurseries may schedule sleep time, many have far from ideal sleeping environments for children (for a review see Staton et al., 2016), which can effect children's ability or quality of nap. In addition, some pre-school children no longer nap due to parental request Some parents currently believe that daytime napping effects the quality and duration of night-time sleep—a view supported in National newspapers (Reporter, 2015). By working for an extended time period in the schools and with the feedback from nursery and pre-school teachers, as far as was possible only those children who did not nap due to child characteristics, rather than parental preference, were selected for the study.

There is much debate in sleep research as to whether sleep plays an active or passive role in consolidation (for a review see Ellenbogen et al., 2006). Our research, coupled with a repeated stories paradigm (Horst et al., 2011; Williams et al., 2011), provides a unique insight to the active benefits that sleep can provide young children. Recently, Stickgold (2013a) raised concerns that when no immediate declarative memory is measured, then it is unclear as to whether sleep has increased memory in comparison to wakefulness. By taking an immediate test to establish a baseline measure, we are able to show that sleep actively consolidates memory traces from weak to robust, as all preschool children within their groups (hearing same or different stories) performed at the same level prior to sleep. It is interesting to note that all groups showed improvements after nocturnal sleep. Overall, we can be

confident that the benefits come from active sleep-dependent processes that the state of sleep provides for consolidation for declarative memories.

Implications. Our current findings have important implications, especially in light of the difficulties faced by many children in modern society. Children can have restrictions in accessing books or having shared storybook reading (Neuman & Celano, 2001). This is a common problem faced by children from disadvantaged backgrounds, with over twice the number of children from higher socio-economic families are read to daily (Coley, 2002). Children are sleeping less than ever before (Matricciani, Olds, Blunden, Rigney, & Williams, 2012; Mednick, 2013), nurseries and day-care facilities are finding it increasingly difficult to provide naps due to over-crowding, lack of staff, funding or simply the curriculum does not incorporate sleep (Kurdziel et al., 2013). By promoting naps, increasing exposure to books, even simple maths problems (Overdeck, 2012) prior to sleep, we can significantly help children's learning.

Conclusions

Children enjoy shared storybooks. We know this as the children in this study have told us themselves. Adults enjoy the experience of reading books with children as it promotes a closeness between adult and child (Audet, Evans, Williamson, & Reynolds, 2008). Reading with children leads to greater academic success (Whitehurst & Lonigan, 1998), and children who enjoy reading stories are more likely to have above-average vocabulary scores (Formby, 2014). Many families read stories before bedtime (Hale, Berger, LeBourgeois, & Brooks-Gunn, 2011). Positive night-time routines calm children down prior to sleep and lead to fewer sleep disturbances (Mindell, Kuhn, Lewin, Meltzer, & Sadeh, 2006).

In addition, previous sleep studies that examined word learning in children of different developmental ages have had the sleep and wake conditions taking place at different times of the day, between conditions. We controlled for that, by testing both the children who habitually napped and the children who didn't nap at the same times each day, for learning and recall. By replicating and extending previous research that showed clear benefits for repeated readings, we are able to investigate the effects of sleep-related memory consolidation on word learning. Shared storybook reading is an activity that is freely available to all parents, and books can be chosen together with the children. Trips to the library can actively engage and lead to greater enjoyment of storybooks. Reading stories that are chosen together adds no more than a few minutes to the bedtime routine, and rarely has a way of teaching your child been so fun or practical.

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References

Anderson, D. A., Bryant, J., Wilder, A., Santomero, A., Williams, M., & Crawley, A. M. (2000). Researching Blue's Clues: Viewing Behavior and Impact. *Media Psychology, 2*(2), 179 - 194 doi:10.1207/S1532785XMEP0202_4

Ard, L. M., & Beverly, B. L. (2004). Preschool Word Learning During Joint Book Reading: Effect of Adult Questions and Comments. *Communication Disorders Quarterly, 26*(1), 17-28. doi:10.1177/15257401040260010101

Audet, D., Evans, M. A., Williamson, K., & Reynolds, K. (2008). Shared Book Reading: Parental Goals Across the Primary Grades and Goal–Behavior Relationships in Junior Kindergarten. *Early Education and Development, 19*(1), 112-137. doi:10.1080/10409280701839189

Axelsson, E. L., & Horst, J. S. (2013). Testing a Word is Not a Test of Word Learning. *Acta Psychologica, 144*(2), 264-268. doi:10.1016/j.actpsy.2013.07.002

Backhaus, J., Hoeckesfeld, R., Born, J., Hohagen, F., & Junghanns, K. (2008). Immediate as well as Delayed Post Learning Sleep but not Wakefulness Enhances Declarative Memory Consolidation in Children. *Neurobiology of Learning and Memory, 89*(1), 76-80. doi:10.1016/j.nlm.2007.08.010

Biemiller, A., & Boote, C. (2006). An Effective Method for Building Meaning Vocabulary in Primary Grades. *Journal of Educational Psychology, 98*(1), 44-62. doi:10.1037/0022-0663.98.1.44

Bion, R. A. H., Borovsky, A., & Fernald, A. (2013). Fast mapping, slow learning: Disambiguation of novel word–object mappings in relation to vocabulary learning at 18, 24, and 30 months. *Cognition, 126*(1), 39-53. doi:10.1016/j.cognition.2012.08.008

Brown, H., Weighall, A., Henderson, L. M., & Gareth Gaskell, M. (2012). Enhanced Recognition and Recall of New Words in 7-and 12-year-olds Following a Period of Offline Consolidation. *Journal of Experimental Child Psychology, 112*(1), 56-72. doi:10.1016/j.jecp.2011.11.010

Burke, R. V., Kuhn, B. R., & Peterson, J. L. (2004). Brief Report: A “Storybook” Ending to Children's Bedtime Problems—The use of a Rewarding Social Story to Reduce Bedtime Resistance and Frequent Night Waking. *Journal of Pediatric Psychology, 29*(5), 389-396. doi:10.1093/jpepsy/jsh042

Coley, R. J. (2002). *An Uneven Start: Indicators of Inequality in School Readiness. Policy Information Report*. Retrieved from http://eric.ed.gov/?id=ED466473

Cornell, E. H., & Sénéchal, M. (1993). Vocabulary Acquisition Through Shared Reading Experiences. *Reading Research Quarterly, 28*(4), 360-374. doi:10.2307/747933

Diekelmann, S., & Born, J. (2010). The Memory Function of Sleep. *Nature Reviews Neuroscience, 11*(2), 114-126. doi:10.1038/nrn2762

Diekelmann, S., Wilhelm, I., & Born, J. (2009). The Whats and Whens of Sleep-Dependent Memory Consolidation. *Sleep Medicine Reviews, 13*(5), 309-321. doi:10.1016/j.smrv.2008.08.002

Duffy, J. F., & Czeisler, C. A. (2009). Effect of Light on Human Circadian Physiology. *Sleep Medicine Clinics, 4*(2), 165-177. doi:10.1016/j.jsmc.2009.01.004

Dumay, N., & Gaskell, M. G. (2007). Sleep-Associated Changes in the Mental Representation of Spoken Words. *Psychological Science, 18*(1), 35-39. doi:10.1111/j.1467-9280.2007.01845.x

Dumay, N., & Gaskell, M. G. (2012). Overnight lexical consolidation revealed by speech segmentation. *Cognition, 123*(1), 119-132. doi:10.1016/j.cognition.2011.12.009

Dunn, J., Wooding, C., & Hermann, J. (1977). Mothers' Speech to Young Children: Variation in Context. *Developmental Medicine & Child Neurology, 19*(5), 629-638. doi:10.1111/j.1469-8749.1977.tb07996.x

Ellenbogen, J. M., Payne, J. D., & Stickgold, R. (2006). The Role of Sleep in Declarative Memory Consolidation: Passive, Permissive, Active or None? *Current opinion in neurobiology, 16*(6), 716-722. doi:10.1016/j.conb.2006.10.006

Field, T., & Hernandez‐Reif, M. (2001). Sleep Problems in Infants Decrease Following Massage Therapy. *Early Child Development and Care, 168*(1), 95-104. doi:10.1080/0300443011680106

Formby, S. (2014). *Children's Early Literacy Practices at Home and in Early Years Settings: Second Annual Survey of Parents and Practitioners*. Retrieved from London: http://www.literacytrust.org.uk/assets/0002/4082/EY_Final_report_2014.pdf

Gais, S., Lucas, B., & Born, J. (2006). Sleep After Learning Aids Memory Recall. *Learning & Memory, 13*(3), 259-262. doi:10.1101/lm.132106

Gomez, R. L., Bootzin, R. R., & Nadel, L. (2006). Naps Promote Abstraction in Language-Learning Infants. *Psychological Science, 17*(8), 670-674. doi:10.1111/j.1467-9280.2006.01764.x

Hale, L., Berger, L. M., LeBourgeois, M. K., & Brooks-Gunn, J. (2011). A Longitudinal Study of Preschoolers' Language-Based Bedtime Routines, Sleep Duration and Well-Being. *Journal of Family Psychology, 25*(3), 423. doi:10.1037/a0023564

Hargrave, A. C., & Sénéchal, M. (2000). A Book Reading Intervention with Preschool Children who have Limited Vocabularies: The Benefits of Regular Reading and Dialogic Reading. *Early Childhood Research Quarterly, 15*(1), 75-90. doi:10.1016/s0885-2006(99)00038-1

Henderson, L. M., Weighall, A. R., Brown, H., & Gareth Gaskell, M. (2012). Consolidation of Vocabulary is associated with Sleep in Children. *Developmental Science, 15*(5), 674-687. doi:0.1111/j.1467-7687.2012.01172.x

Horst, J. S. (2013). Context and Repetition in Word Learning. *Frontiers in Psychology, 4*, 149. doi:10.3389/fpsyg.2013.00149

Horst, J. S. (2015). Word Learning Via Shared Storybook Reading. In B. Kümmerling-Meibauer, J. Meibauer, K. Nachtigäller, & K. Rohlfing (Eds.), *Learning from Picturebooks: Perspectives from Child Development and Literacy Studies* (pp. 181-193). New York: Routledge.

Horst, J. S., Parsons, K. L., & Bryan, N. M. (2011). Get the Story Straight: Contextual Repetition Promotes Word Learning from Storybooks. *Frontiers in Psychology, 2*, 17. doi:10.3389/fpsyg.2011.00017

Horst, J. S., & Samuelson, L. K. (2008). Fast Mapping but Poor Retention by 24-month-old Infants. *Infancy, 13*(2), 128-157. doi:10.1080/15250000701795598

Hupbach, A., Gomez, R. L., Bootzin, R. R., & Nadel, L. (2009). Nap-Dependent Learning in Infants. *Developmental Science, 12*(6), 1007-1012. doi:10.1111/j.1467-7687.2009.00837.x

Kurdziel, L., Duclos, K., & Spencer, R. M. (2013). Sleep Spindles in Midday Naps Enhance Learning in Preschool Children. *Proceedings of the National Academy of Sciences, 110*(43), 17267-17272. doi:10.1073/pnas.1306418110

Lahl, O., Wispel, C., Willigens, B., & Pietrowsky, R. (2008). An Ultra Short Episode Of Sleep Is Sufficient To Promote Declarative Memory Performance. *Journal of Sleep Research, 17*(1), 3-10. doi:10.1111/j.1365-2869.2008.00622.x

Lam, J. C., Mahone, E. M., Mason, T. B. A., & Scharf, S. M. (2011). The Effects of Napping on Cognitive Function in Preschoolers. *Journal of Developmental and Behavioral Pediatrics, 32*(2), 90-97. doi:10.1097/DBP.0b013e318207ecc7

Lau, H., Tucker, M., & Fishbein, W. (2010). Daytime Napping: Effects on Human Direct Associative and Relational Memory. *Neurobiology of Learning and Memory, 93*(4), 554-560. doi:10.1016/j.nlm.2010.02.003

Marshall, L., & Born, J. (2007). The Contribution of Sleep to Hippocampus-Dependent Memory Consolidation. *Trends in Cognitive Sciences, 11*(10), 442-450. doi:10.1016/j.tics.2007.09.001

Matricciani, L. A., Olds, T. S., Blunden, S., Rigney, G., & Williams, M. T. (2012). Never Enough Sleep: A Brief History of Sleep Recommendations for Children. *Pediatrics, 129*(3), 548-556. doi:10.1542/peds.2011-2039

McLeod, A. N., & McDade, H. L. (2010). Preschoolers' Incidental Learning of Novel Words During Storybook Reading. *Communication Disorders Quarterly*. doi:10.1177/1525740109354777

Mednick, S. (2013). Napping Helps Preschoolers Learn. *Proceedings of the National Academy of Sciences, 110*(43), 17171-17172. doi:10.1073/pnas.1316489110

Mednick, S., Nakayama, K., & Stickgold, R. (2003). Sleep-Dependent Learning: A Nap is as Good as a Night. *Nature neuroscience, 6*(7), 697-698. doi:10.1038/nn1078

Mindell, J. A., Kuhn, B., Lewin, D. S., Meltzer, L. J., & Sadeh, A. (2006). Behavioral Treatment of Bedtime Problems and Night Wakings in Infants and Young Children. *Sleep: Journal of Sleep and Sleep Disorders Research*.

Mograss, M., Godbout, R., & Guillem, F. (2006). The ERP Old-New Effect: A Useful Indicator In Studying The Effects of Sleep on Memory Retrieval Processes. *Sleep, 29*(11), 1491.

Neuman, S. B., & Celano, D. (2001). Access to Print in Low-Income and Middle-Income Communities: An Ecological Study of Four Neighborhoods. *Reading Research Quarterly, 36*(1), 8-26. doi:10.1598/rrq.36.1.1

Overdeck, L. (2012). Bedtime Math: Counting Sheep and Pennies. *Bedtime Math™*. Retrieved from http://www.bedtimemath.org

Reese, E., Sparks, A., & Leyva, D. (2010). A Review of Parent Interventions for Preschool Children's Language and Emergent Literacy. *Journal of Early Childhood Literacy, 10*(1), 97-117. doi:10.1177/1468798409356987

Reporter. (2015, 18 February 2015). Daytime naps 'should stop at the age of two': Children have poorer quality sleep if they rest during the afternoon. *Daily Mail*. Retrieved from http://www.dailymail.co.uk/health/article-2957907/Daytime-naps-stop-age-two.html

Riley, K. G., & McGregor, K. K. (2012). Noise Hampers Children's Expressive Word Learning. *Lang Speech Hear Serv Sch, 43*(3), 325-337. doi:10.1044/0161-1461(2012/11-0053)

Rimm-Kaufman, S. E., & Pianta, R. C. (2000). An Ecological Perspective on the Transition to Kindergarten A Theoretical Framework to Guide Empirical

Research. *Journal of Applied Developmental Psychology, 21*(5), 491-511. doi:10.1016/s0193-3973(00)00051-4

Robertson, E. M. (2009). From Creation to Consolidation: A Novel Framework for Memory Processing. *PLoS Biol, 7*(1), e1000019. doi:10.1371/journal.pbio.1000019

Schafer, G., & Plunkett, K. (1998). Rapid Word Learning by Fifteen‐Month‐Olds Under Tightly Controlled Conditions. *Child Development, 69*(2), 309-320. doi:10.1111/j.1467-8624.1998.tb06190.x

Sénéchal, M. (1997). The Differential Effect of Storybook Reading on Preschoolers' Acquisition of Expressive and Receptive Vocabulary. *Journal of Child Language, 24*(01), 123-138. doi:10.1017/S0305000996003005

Sénéchal, M., & LeFevre, J. A. (2001). Storybook Reading and Parent Teaching: Links to Language and Literacy Development. *New Directions for Child and Adolescent Development, 2001*(92), 39-52. doi:10.1002/cd.14

Staton, S., Marriott, A., Pattinson, C., Smith, S., Sinclair, D., & Thorpe, K. (2016). Supporting sleep in early care and education: an assessment of observed sleep times using a sleep practices optimality index. *Sleep Health*. doi:10.1016/j.sleh.2015.12.005

Stickgold, R. (2005). Sleep-dependent Memory Consolidation. *Nature, 437*(7063), 1272-1278. doi:10.1038/nature04286

Stickgold, R. (2013a). Early to Bed: How Sleep Benefits Children's Memory. *Trends in Cognitive Sciences, 17*(6), 261-262. doi:10.1016/j.tics.2013.04.006

Stickgold, R. (2013b). Parsing the Role of Sleep in Memory Processing. *Current opinion in neurobiology, 23*(5), 847-853. doi:10.1016/j.conb.2013.04.002

Stickgold, R., & Walker, M. P. (2005). Sleep and Memory: the Ongoing Debate. *Sleep, 28*, 1225-1227.

Sullivan, A., & Brown, M. (2013). Social Inequalities in Cognitive Scores at age 16: The Role of Reading. *CLS Working Papers, 2013*.

Sulzby, E. (1985). Children's Emergent Reading of Favorite Storybooks: A Developmental Study. *Reading Research Quarterly, 20*(4), 458-481. doi:10.1598/RRQ.20.4.4

Werchan, D. M., & Gómez, R. L. (2014). Wakefulness (Not Sleep) Promotes Generalization of Word Learning in 2.5-Year-Old Children. *Child Development, 85*(2), 429-436. doi:10.1111/cdev.12149

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. doi:10.1037/0012-1649.24.4.552

Whitehurst, G. J., & Lonigan, C. J. (1998). Child Development and Emergent Literacy. *Child Development, 69*(3), 848-872. doi:10.1111/j.1467-8624.1998.tb06247.x

Wilhelm, I., Diekelmann, S., & Born, J. (2008). Sleep in Children Improves Memory Performance on Declarative but not Procedural Tasks. *Learning & Memory, 15*(5), 373-377. doi:10.1101/lm.803708

Wilhelm, I., Rose, M., Imhof, K. I., Rasch, B., Büchel, C., & Born, J. (2013). The Sleeping Child Outplays the Adult's Capacity to Convert Implicit into Explicit Knowledge. *Nature neuroscience, 16*(4), 391-393. doi:10.1038/nn.3343

Wilkinson, K. S., & Houston-Price, C. (2013). Once upon a time, there was a pulchritudinous princess...: The role of Word Definitions and Multiple Story

Contexts in Children's Learning of Difficult Vocabulary. *Applied Psycholinguistics, 34*(03), 591-613. doi:10.1017/S0142716411000889

Williams, S. E., Horst, J. S., & Oakhill, J. (2011). The Same Old Story: Contextual Cueing Facilitates Word Learning via Storybooks. *In Early shared book reading: what are the requirements for effective sessions? Symposium, British Psychological Society, Developmental Section Conference, Newcastle, UK.*

Running Head: *Preliminary Research*

Supplementary Study 1a

Preliminary Research.

Plot Comprehension Questions: A Pilot Study

Background and Aims

Posing questions to children is a very common activity in shared storybook reading, and has many benefits that include engaging preschool children dialogically (Whitehurst & Lonigan, 1998), helping to increase comprehension and decoding skills (van den Broek, Tzeng, Risden, Trabasso, & Basche, 2001), increasing expressive and receptive vocabulary (Sénéchal, 1997), and enhancing storybook comprehension (van Kleeck, 2008).

Questions provide the greatest advantage for 4-8-year old children who are stronger readers and more engaged with the story (Oakhill, 1984; Zucker, Justice, Piasta, & Kaderavek, 2010). Questions that are asked during shared storybook reading can increase children's memory and inferential comprehension for preschool (van Kleeck, 2008; Zucker et al., 2010) and 7-9-year olds (Therrien, Wickstrom, & Jones, 2006; van den Broek et al., 2001) whereas questions asked post-reading have importance when testing older children 9-15-year old children memory for the story, context and word learning (Oakhill, 1984; van den Broek et al., 2001). However, questions that are asked after shared storybook reading are not as beneficial for word learning or inference comprehension, possibly because they test already-established connections (e.g. between the questions and answers, Van Oostendorp & Goldman, 1998).

There are two primary types of questions used to investigate children's memories for stories. The first is inferential questions, which can have more than one

correct answer and require the reader to apply knowledge or experience to the text in order to infer the correct answer. For example, an inferential question for the extract below could include, “Where is Alice sitting?”, or, “What time of the year is it?”. Although not explicitly stated, the answer might be, “sitting on grass in the summer” (daisies grow in the grass and it is a hot day).

> “So she was considering in her own mind (as well as she could, for the hot day made her feel very sleepy and stupid) whether the pleasure of making a daisy-chain would be worth the trouble of getting up and picking the daisy, when suddenly a White Rabbit with pink eyes ran close by her.”
> *(Carroll, 1948, p. 2).*

In contrast, literal questions require the reader to use explicit information given in the text to provide the correct answer (Oakhill, 1984; Zucker et al., 2010). For example, a literal question for the extract above is, “what colour were the White Rabbit’s eyes?”, (the text explicitly states that they are pink).

To extend previous research that demonstrates the benefits for reading the same stories repeatedly (e.g., Horst, Parsons, & Bryan, 2011), we explored how repeated readings influence how well preschool children understood the story (plot) because children’s ability to understand the story helps to support word learning (Basaraba, Yovanoff, Alonzo, & Tindal, 2013). For each of the three storybooks that the children were read in the main experiment, we designed a measure to test children’s comprehension using plot memory questions (Walsh & Blewitt, 2006; Zucker et al., 2010).

As preschool children’s processing of literature operates on a more basic level than older children’s, drawing attentional resources from high-level comprehension activities (Just, Carpenter, & Keller, 1996; van Kleeck, 2008), we designed a set of

literal questions for each story. Literal questions assess whether children had explicitly recalled the plot, but not to make judgements about children's implicit comprehension of the story. For example from *The Naughty Puppy* storybook knowing that Rosie felt sorry that the puppy had messed up the kitchen; this is explicitly stated in the text but not an inferential judgement that Rosie was feeling sorry because her mother might give the puppy away. This is only inferred by the text.

Twelve forced-choice questions for each storybook were piloted; each question had a choice of two answers. By using words that children heard as part of the story, we were able to control for word novelty (to ensure they were not just guessing the only word they had heard). Importantly, to answer correctly, children needed to have attended to the stories to recall the plot because both word choices appeared in the story.

This created the possibility that either option may be the correct choice, making it cognitively more demanding. We used forced-choice questions because a less dialogic approach was needed to ensure that no extra word learning exposure and scaffolding was given during the testing phase in our main study (Blewitt, Rump, Shealy, & Cook, 2009; Walsh & Blewitt, 2006). From the 12 questions piloted, nine were selected for the main study to ensure equal difficulty across questions and across the three storybooks.

Method

Participants

Twelve British 3-year-old children (5 girls, 7 boys, M= 46 months, 9 days, SD = 1 month, 4 days, range = 44 months, 14 days-48 months, 2 days) took part in a

within-participant counterbalanced design. Children were monolingual, with no reported learning difficulties and recruited through the Word Lab database.

Plot Comprehension Questions

Twelve questions were developed for *The Naughty Puppy*, *Nosy Rosie at the Restaurant* and *Rosie's Bad Baking Day* (36 total). See appendix supplementary study 1 a for the full list (the three storybooks were slightly edited from the, Horst et al., 2011 original books to ensure that both the word choices were heard in the text). The plot comprehension questions were presented as forced-choice questions and both potential answers were words or phrases that had occurred in the relevant story. For example, a question for *The Naughty Puppy* story was, "When Rosie saw the mess the next morning, was she *mad* or *sorry*?" (Rosie was sorry; the text reads, '"*Sorry* mummy", said Rosie,' on the next page "Rosie's Mum was happy again, and no longer *mad*,"). The novel-object target words were used once in the 12 questions for a given story due to the difficulties of structuring 12 meaningful questions from the short 9-page book. This was the only other time children heard the novel-object words other than the four exposures within the story text. Unlike children in the main study, children in the pilot study were not tested on novel word learning.

Procedure and Design

Children were tested individually in the laboratory, in a calm area designed to be appealing to them. They played with toys whilst they settled in and after a short time were asked if they would like to hear a story. With the child's assent the experimenter sat next to the child and the book was placed so the child could see the illustrations. Stories were read as in the main experiment. All participants heard all three stories. Story order was counterbalanced with a Latin square design across participants.

After each story had been read, children were rewarded with a sticker, and asked if they could "help (the experimenter) answer some questions about the story?" All 12 questions were asked in the story's chronological order, but correct answers alternated between first or second options, (e.g. half of the children were asked, "When Rosie saw the mess the next morning, was she *mad* or *sorry*?", and the other half were asked, "When Rosie saw the mess the next morning, was she *sorry, or mad*?"). Children were rewarded with another sticker when they had completed the question set, and then asked if they would like to hear another story. When they assented, this procedure was repeated until the children had heard all three stories and answered all 36 questions.

Coding. There were four possible responses to each question; the correct choice, the incorrect choice, 'I don't know' or 'no response.' If children said they didn't know the answer, the experimenter continued with a comment to reassure (e.g. "You don't know? That's fine, can you help me with the next question?"). For children who didn't answer the question at all (i.e. 'no response'), the experimenter would try asking the question a second time, and then move on in the same way as with the 'I don't know' response.

Results and Discussion

Children's comprehension of the 9 questions for each book was analysed to ensure equal levels of difficulty across questions. No significant differences were

Table 1. Number of correct answers for each question out of a possible 12

Storybook	Q 1	Q 2	Q 3	Q 4	Q 5	Q 6	Q 7	Q 8	Q 9	Q 10	Q 11	Q 12
The Naughty Puppy	7	3◆	9	11	12◆	12◆	9	9	9	11	8	8
Nosy Rosie at the Restaurant	11	7	11	12◆	10	12◆	4◆	11	8	11	10	8
Rosie's Bad Baking Day	11	8	12◆	8	11	12◆	6	10	8	7	8	12◆

(◆ denotes questions excluded from the main experiment for ceiling or floor performance).

found between books, $^2(4) = 6.00$, $p = .19$.

The highest and lowest performing questions were removed for each story (see Table 1), which resulted in 9 remaining questions for each story. Children's accuracy for these remaining questions did not differ by story, $F(8,16) = 1.44$, $p>.05$, $r = .48$ (see Figure 1). Mauchly's test indicated that the assumption of sphericity had not been violated.

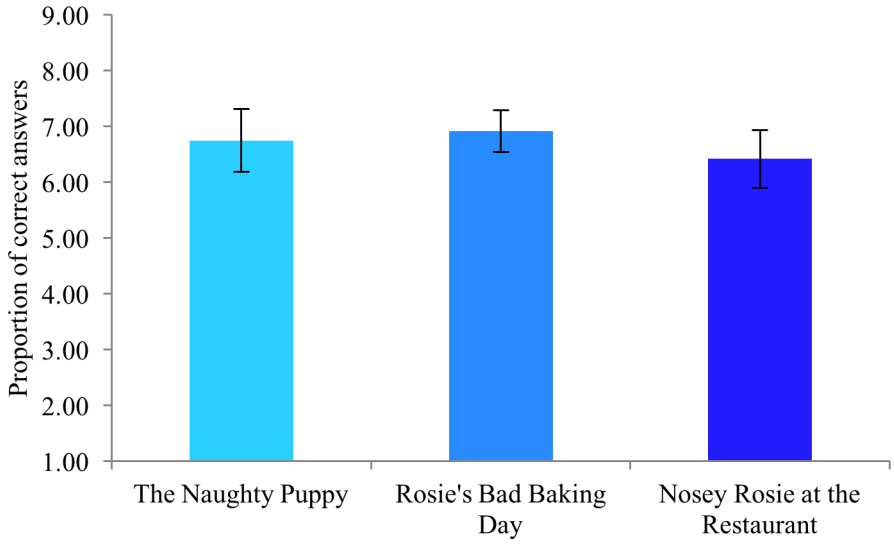


Figure 1. Mean correct answers to the final 9 selected questions. Error bars represent one standard error of the mean.

Having determined the 9 best questions, the questions were further divided into three sets of three for each story. This enabled the same questions to be used in subsequent studies in which some children heard three different stories. In the main experiment, children in the same story condition were asked all nine questions about their story after the first reading, and the children who heard different stories were asked three questions after each of their three stories.

References

Basaraba, D., Yovanoff, P., Alonzo, J., & Tindal, G. (2013). Examining the Structure of Reading Comprehension: Do Literal, Inferential, and Evaluative Comprehension Truly Exist? *Reading and Writing, 26*(3), 349-379. doi:10.1007/s11145-012-9372-9

Blewitt, P., Rump, K. M., Shealy, S. E., & Cook, S. A. (2009). Shared Book Reading: When and How Questions Affect Young Children's Word Learning. *Journal of Educational Psychology, 101*(2), 294-304. doi:10.1037/a0013844

Carroll, L. (1948). *Alice's Adventures in Wonderland*. Macmillan and Co Limited St Martin's Street London: Macmillan and Co Limited.

Horst, J. S., Parsons, K. L., & Bryan, N. M. (2011). Get the Story Straight: Contextual Repetition Promotes Word Learning from Storybooks. *Frontiers in Psychology, 2*, 17. doi:10.3389/fpsyg.2011.00017

Just, M. A., Carpenter, P. A., & Keller, T. A. (1996). The Capacity Theory of Comprehension: New Frontiers of Evidence and Arguments. *Psychological Review, 103*(4), 773-780. doi:10.1037/0033-295x.103.4.773

Oakhill, J. (1984). Inferential and Memory Skills in Childrens Comprehension of Stories. *British Journal of Educational Psychology, 54*(1), 31-39. doi:10.1111/j.2044-8279.1984.tb00842.x

Sénéchal, M. (1997). The Differential Effect of Storybook Reading on Preschoolers' Acquisition of Expressive and Receptive Vocabulary. *Journal of Child Language, 24*(01), 123-138. doi:10.1017/S0305000996003005

Therrien, W. J., Wickstrom, K., & Jones, K. (2006). Effect of a Combined Repeated Reading and Question Generation Intervention on Reading Achievement. *Learning Disabilities Research & Practice, 21*(2), 89-97. doi:10.1111/j.1540-5826.2006.00209.x

van den Broek, P., Tzeng, Y., Risden, K., Trabasso, T., & Basche, P. (2001). Inferential Questioning: Effects on Comprehension of Narrative Texts as A Function of Grade and Timing. *Journal of Educational Psychology, 93*(3), 521. doi:10.1037/0022-0663.93.3.521

van Kleeck, A. (2008). Providing Preschool Foundations for Later Reading Comprehension: The Importance of and Ideas for Targeting Inferencing in Storybook-Sharing Interventions. *Psychology in the Schools, 45*(7), 627-643. doi:10.1002/pits.20314

Van Oostendorp, H., & Goldman, S. R. (1998). *The Construction of Mental Representations During Reading*. Mahwah, New Jersery London: Lawrence Erblum Associates.

Walsh, B. A., & Blewitt, P. (2006). The Effect of Questioning Style During Storybook Reading on Novel Vocabulary Acquisition of Preschoolers. *Early Childhood Education Journal, 33*(4), 273-278. doi:10.1007/s10643-005-0052-0

Whitehurst, G. J., & Lonigan, C. J. (1998). Child Development and Emergent Literacy. *Child Development, 69*(3), 848-872. doi:10.1111/j.1467-8624.1998.tb06247.x

Zucker, T. A., Justice, L. M., Piasta, S. B., & Kaderavek, J. N. (2010). Preschool Teachers' Literal and Inferential Questions and Children's Responses During Whole-Class Shared Reading. *Early Childhood Research Quarterly, 25*(1), 65-83. doi:10.1016/j.ecresq.2009.07.001

Appendix Supplementary Study 1 a

Nosy Rosie at the Restaurant Pilot Questions:

1 Were Rosie and her family eating at *home* or at a *restaurant*?

Restaurant Home d. know NR

2 When Rosie wanted to go to the toilet, did she ask her *mummy* or *Daddy*?

3 Did Rosie go to the or the *kitchen* or the *toilet*?

4 Was Rosie distracted by something on the *floor* or on the *worktop*?

5 Did Rosie think, if she picked up the Sprock, she *wouldn't* or *would* get into trouble?

6 When Rosie grows up does she want to be a *chef* or a *waitress*?

7 When the chef came into the kitchen did Rosie *see her* or *hear*?

8 When the chef found Rosie with the cooking tool(s), did she *take them away* or let her *keep them*?

9 When Rosie came back did they decide to play *games* or *order*?

10 Who apologised to the chef: *Rosie's family* or *Rosie*?

11 When the chef came back to the table was Rosie *surprised* or *worried*?

12 Who gave Rosie the Tannin: the *chef* or the *waitress*?

The Naughty Puppy Pilot Questions:

1 Was Rosie's new pet *big* or *little*?

2 When Mummy started to make dinner did Rosie *forget* or *help*?

3 Did Rosie's Mummy ask her to roll the *pastry* or tidy the *kitchen*?

4 When Rosie saw Daddy bring home the puppy, was Rosie *surprised* or did she *kn*

5 Did Rosie's Daddy ask her to put the Tannin on the *table or* in the *drawer* ?

6 Did the new puppy *ruin* the kitchen, or sleep *peacefully*?

7 Did the puppy break things in the *morning* or at *night*?

8 When Rosie saw the mess the next morning, was she *sorry* or *mad*?

9 Who threw the Sprock in the bin: Rosie's *Daddy* or *Mummy*?

10 Who brought home the new things: Rosie's *Daddy* or *Mummy*?

11 Did Rosie pass her Mummy the *book* or the *phone*?

12 Did Rosie's Mummy say the new puppy could *stay* or had to *go*?

Rosie's Bad Baking Day Pilot Questions:

1 Did Rosie *listen* to her Daddy or did she not pay *attention*?

2 Did Rosie get the tannin from the *cupboard* or the *worktop?*

3 Did they run out of *eggs* or *chocolate chips*?

4 Did Rosie's Daddy tell her *not to touch* anything, or to start *to mix*?

5 Was Rosie's Daddy *quick* or was he gone a *long time*?

6 When Rosie's daddy came back was he *cross* or *happy*?

7 When her daddy came back did they *need to make* the cookies, or were they *ready*?

8 Who cleaned the sprock: was it *Rosie* or her *Daddy*?

9 Did Rosie give her mummy the cookies in a *bowl* or on a *plate*?

10 When Rosie's mum tried the cookies did she spit them out or *eat* them?

11 What did Rosie's mummy say Rosie had used in the cookies, sugar or *salt*?

12 Did they all decide to *go out* to eat or stay at *home*?

Running Head: *Preliminary Research*

Supplementary Study 1b

Preliminary Research.

Story Enjoyment Ratings: A Pilot Study

Background and Aims

For all children their motivation and enjoyment of reading is a critical factor in determining their relationship with books and their ongoing academic achievements (Baker, Scher, & Mackler, 1997; The Reading Agency, 2015). Reading for pleasure can help compensate for the effects of preschool and school-age children's socioeconomic background and parental educational levels on later academic attainment (Campbell, Voelkl, & Donahue, 1997; Sullivan & Brown, 2013). Despite considerable research that has investigated learning outcomes from storybooks (see Biemiller & Boote, 2006 for a review), how much preschool children enjoy this interaction has either not been investigated or has mainly been determined by children's performance in studies. That is, direct feedback from the children about their enjoyment of the stories, or the shared reading experience, has not been measured.

Three-to-four-year-old children who hear the same storybooks repeatedly perform better than children who hear different stories when learning the same new novel words (Horst, Parsons, & Bryan, 2011; Williams, Horst, & Oakhill, 2011). To extend this research, and to understand if preschool children who are hearing repeated stories actually enjoy them more than children who are hearing different stories—and whether this may be a predictor for children being more successful in word learning—we designed a rating study specifically for young children to indicate their enjoyment.

Anderson and colleagues (2000) used a small rating measure to understand how much children liked the educational television show *Blue's Clues.* Three-year-old children were asked to rate on a numerical scale if they like the show, *not at all* (0), *a little bit* (1), or *a lot* (2). They found that children's enjoyment increased with repeated exposures to the programme. Grimshaw, Dungworth, McKnight, and Morris (2007) measured 8-9-year-old children's enjoyment of electronic and printed books with a similar 3-point scale and found children's enjoyment increased with immediate access to words in electronic book format. However, very preliminary piloting determined that it was difficult to engage 3-year-old children using this rating scale alone. A further measure that could resonate with preschool children was needed (Wong & Baker, 1988 also found preschool children struggled with a purely numerical scale).

Smiley faces or Emoticons (emotional icons) are facial representations of the user's emotional state or expression, such as a frown or smile, commonly depicted as a simple round face or a combination of keystrokes. The use of smiley faces can be traced back to the 1950s but the wider use in popular culture was attributed to Harvey Ross Ball, an American graphic artist, who developed the smiley for an ad campaign in 1963 (Smithsonian.com, 2013). Today, emoticons and smiley faces are found in many aspects of children's everyday life, e.g. on television programmes, toys, computers, apps, books, clothing and even on food.

Wong and Baker (1988) adapted pain rating scales in hospitals for use with children as young as 3-years old; using a five-point smiley face scale with varying features and colours to measure hospitalised children's pain levels (see Eland, 1981 for colour measurements). Red has been closely associated with increased pain and negative emotions whereas yellow, green and blue were more positively associated

(Hammond & Full, 1982; Scott, 1978).

Due to preschool children having difficultly in understanding and answering questions related to enjoyment (Airey, Plowman, Connolly, & Luckin, 2002), we combined questions with a smiley face rating scale. To assist in understanding the scale we decided to associate a smiley face with each point, so they could select a smiley to indicate that they either '*liked a lot*,' '*liked a little* (neutral)' or '*didn't like it*' in relation to the stories we read to them. Four-six-year-old children are familiar with attributing emotional meaning to such images (Airey et al., 2002; Asher, Singleton, Tinsley, & Hymel, 1979; Wong & Baker, 1988) so we investigated which smileys had the correct emotional valance associated with our rating scale.

Methods

Participants

Twenty 3-year-old monolingual British children (10 girls, 10 boys, $M = 42$ months, 23 days, $SD = 1$ month, 17 days, range = 40 months 11 days- 45 months, 9 days) participated. Children were recruited via local nurseries and The Word Lab database. All the children were typically developing with no known language, hearing or sight problems. Neither children nor their families had any history of colour-blindness. Testing took place in The Word lab.

Materials

The choice of colours and facial styles for the emoticons were based on the Wong and Baker (1988) pain rating scales. Nine faces were laminated in 2 inch diameter circles (see figure 1, Panel A-C), using three different faces for each enjoyment rating. Panel A had exaggerated happy smiling faces (Read, MacFarlane, & Casey, 2001), and the children were asked to select which one they thought best

represented the answer *'I enjoyed reading the story a lot'*. Panel B had neutral faces (Rademacher & Koschel, 2006) and the children could select which face they thought best represented the answer *'I enjoyed reading the story a little'*. Panel C had unhappy faces (McDougald, Carpenter, & Mayhorn, 2011) and the children could select which one they thought best represented the answer, *'I did not enjoy reading the story.'*

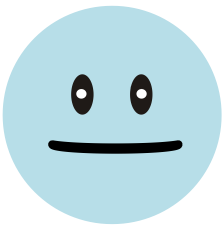
Panel A			
	6 (5)	5 (5)	9 (10)
Panel B			
	4 (3)	6 (6)	10 (11)
Panel C			
	2 (3)	13***(13***)	5(4)

Figure 1. Faces used in the pilot experiment to rate a "*liked at lot*" (Panel A), "*liked a little*" (Panel B) and "*did not like*" (Panel C). Scores under each face indicate number of children (out of 20) who chose each face for the story task. Number of children who chose each face for the toy-rating task noted in parentheses.

Procedure and Design

First, children were asked to select three toys from a toy box in the testing room (toys were a selection of trains, blocks, a doll, balls, and figures). Children selected one toy that they enjoyed playing with, and one toy they liked only a little and one toy that they didn't really want to play with. They placed them on a clear tray, which was then hidden out of sight. Then, children sat next to the experimenter on a sofa and the storybook was positioned so they could both see the pages. Children were read one of the three storybooks that we would be using in the main study, and story order was counterbalanced across participants (Horst et al., 2011; Williams et al., 2011).

After listening to the story, children were asked to imagine that they liked the story a lot, and if they did, which of the three faces would they choose to show how much they liked it (see Figure 1, Panel A). Each face was laid on the table in front of them, and the children were asked to place the face that they thought represented them enjoying the story the most into a small transparent plastic box (for similar procedure see Namy, Smith, & Gershkoff-Stowe, 1997). Exactly the same procedure was repeated for Panel B (neutral 'liked a little,') and for Panel C ('did not like') faces. The order that the children were asked to imagine and select was counterbalanced across participants.

Finally as an additional check, children were shown the tray with the three toys they had previously selected and asked to rate each of the three toys individually using the same procedure as the story; selecting a face from each Panel that best described how much they enjoyed playing with the toys. Children were given two stickers as rewards; one after the story rating and one after the toys rating.

Results and Discussion

For Panel A, '*I liked it a lot*',11 out of 20 children selected face 3, Panel A, exact binominal $p = .02$ (though there was no significant preference between the positive faces, $\chi^2 (2) = 4.29$, $p = .12$, see Figure 1 for all children's individual choices). For, *'I liked it a little',* 11 out of the 20 children chose face 3, Panel B, exact binominal p = .02 (again, however, there was no significant preference between the neutral faces, $\chi^2 (2) = 4.89$, p = .08). Finally for, *'I didn't like it',* 13 out of the 20 children chose face 2, Panel C, exact binominal showed p=.003, ($\chi^2 (2) = 9.09$, $p = .01$, significantly preferring face 2). The same general pattern was found for the face selections on the toy rating trials (see Figure 1 for the number of children who chose each face on those trials).

Children in both the storybook rating measure and the toy rating check showed a clear preference for certain faces from each Panel that most represented the three points from the 3-point rating scale. The preferred faces were used in the main experiment (Panel A, face 3; Panel B, face 3; Panel C, face 2). Use of the 3-point rating has been a robust measure in studies examining 3-5-year-old (Anderson et al., 2000; Asher et al., 1979; Crawley, Anderson, Wilder, Williams, & Santomero, 1999) and 9-10-year-old children's enjoyment (Grimshaw et al., 2007) as have smiley faces and emoticons for 3-18-year-old children (Airey et al., 2002; Asher et al., 1979; Rademacher & Koschel, 2006; Tung & Deng, 2007; Wong & Baker, 1988). When combining them together as we have here, it becomes a strong measurement technique that can be used to help preschool children share their own views and experience on the shared storybook readings.

References

Airey, S., Plowman, L., Connolly, D., & Luckin, R. (2002). *Rating Children's Enjoyment of Toys, Games and Media.* Paper presented at the 3rd World congress of the international toy research association on toys, games and media, London.

Anderson, D. A., Bryant, J., Wilder, A., Santomero, A., Williams, M., & Crawley, A. M. (2000). Researching Blue's Clues: Viewing Behavior and Impact. *Media Psychology, 2*(2), 179 - 194 doi:10.1207/S1532785XMEP0202_4

Asher, S. R., Singleton, L. C., Tinsley, B. R., & Hymel, S. (1979). A Reliable Sociometric Measure for Preschool Children. *Developmental Psychology, 15*(4), 443-444. doi:10.1037/0012-1649.15.4.443

Baker, L., Scher, D., & Mackler, K. (1997). Home and Family Influences on Motivations for Reading. *Educational psychologist, 32*(2), 69-82. doi:10.1207/s15326985ep3202_2

Biemiller, A., & Boote, C. (2006). An Effective Method for Building Meaning Vocabulary in Primary Grades. *Journal of Educational Psychology, 98*(1), 44-62. doi:10.1037/0022-0663.98.1.44

Campbell, J. R., Voelkl, K. E., & Donahue, P. L. (1997). *NAEP 1996 Trends in Academic Progress. Achievement of US Students in Science, 1969 to 1996; Mathematics, 1973 to 1996; Reading, 1971 to 1996; Writing, 1984 to 1996*. Retrieved from Office of Educational Research and Improvement, U.S. Department of Education, 555 New Jersey Avenue, N.W., Washington, DC 20208-5641: http://www.ed.gov/NCES/naep

Crawley, A. M., Anderson, D. R., Wilder, A., Williams, M., & Santomero, A. (1999). Effects of Repeated Exposures to a Single Episode of the Television Program Blue's Clues on the Viewing Behaviors and Comprehension of Preschool Children. *Journal of Educational Psychology, 91*(4), 630-637. doi:10.1037/0022-0663.91.4.630

Eland, J. M. (1981). Minimizing Pain Associated with Prekindergarten Intramuscular Injections. *Issues in comprehensive pediatric nursing, 5*(5-6), 361-372. doi:10.3109/01460868109106351

Grimshaw, S., Dungworth, N., McKnight, C., & Morris, A. (2007). Electronic Books: Children's Reading and Comprehension. *British Journal of Educational Technology, 38*(4), 583-599. doi:10.1111/j.1467-8535.2006.00640.x

Hammond, N. I., & Full, C. A. (1982). *Nitrous Oxide Analgesia and Children's Perception of Pain.* University of Iowa. Retrieved from http://www.aapd.org/assets/1/25/Hammond-06-04.pdf

Horst, J. S., Parsons, K. L., & Bryan, N. M. (2011). Get the Story Straight: Contextual Repetition Promotes Word Learning from Storybooks. *Frontiers in Psychology, 2*, 17. doi:10.3389/fpsyg.2011.00017

McDougald, B. R., Carpenter, E. D., & Mayhorn, C. B. (2011). *Emoticons What does this one mean?* Paper presented at the Proceedings of the Human Factors and Ergonomics Society Annual Meeting.

Namy, L. L., Smith, L. B., & Gershkoff-Stowe, L. (1997). Young Children's Discovery of Spatial Classification. *Cognitive Development, 12*(2), 163-184. doi:10.1016/S0885-2014(97)90011-3

Rademacher, U., & Koschel, K.-V. (2006). *Coming to Terms with Emotions.* Paper presented at the Athens: Esomar Qualitative ŰŰŰŰ Conference Papers.

Read, J. C., MacFarlane, S., & Casey, C. (2001). Measuring The Usability of Text Input Methods for Children *People and Computers XV—Interaction without Frontiers* (pp. 559-572): Springer.

Scott, R. (1978). "It Hurts Red:" A Preliminary Study of Children's Perception of Pain. *Perceptual and motor skills, 47*(3), 787-791. doi:10.2466/pms.1978.47.3.787

Smithsonian.com. (2013). Who Really Invented the Smiley Face? Retrieved from http://www.smithsonianmag.com/arts-culture/who-really-invented-the-smiley-face-2058483/?no-ist

Sullivan, A., & Brown, M. (2013). Social Inequalities in Cognitive Scores at age 16: The Role of Reading. *CLS Working Papers, 2013*.

The Reading Agency. (2015). Reading Facts. Retrieved from http://readingagency.org.uk/news/reading-facts003/

Tung, F.-W., & Deng, Y.-S. (2007). Increasing Social Presence of Social Actors in E-Learning Environments: Effects of Dynamic and Static Emoticons on Children. *Displays, 28*(4), 174-180. doi:10.1016/j.displa.2007.06.005

Williams, S. E., Horst, J. S., & Oakhill, J. (2011). The Same Old Story: Contextual Cueing Facilitates Word Learning via Storybooks. *In Early shared book reading: what are the requirements for effective sessions? Symposium, British Psychological Society, Developmental Section Conference, Newcastle, UK.*

Wong, D. L., & Baker, C. M. (1988). Pain in Children: Comparison of Assessment Scales. *Pediatric Nursing, 14*(1), 9-17.

Neither rhyme nor reason: rhyming children's books help young readers - but not pre-schoolers - learn words

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Author note:

A version of this paper is in preparation, to be submitted as follows:
Williams, S. E., Oakhill, J & Horst, J. S. (In Prep) The end of the line: children learn more words from storybooks that do not rhyme.

SW designed the experiments, including the rhyme/onset task and plot questions, under the guidance of JH and JO. Two undergraduate project students helped SW complete data collection for Experiment 1 under direct supervision of SW. SW completed 100% of the data collection for Experiment 2. An undergraduate wrote the original text for the storybooks, which SW edited to enable the plot question manipulation. SW completed all statistical analyses and wrote this version of the paper. JH and JO contributed to discussions on theoretical implications and commented on previous versions of the paper and literature review.

Abstract

Over half of the most popular books for young children during the last 100 years have rhymed (The Book Trust, 2013a), yet research to date offers conflicting results as to whether rhyme helps preschool children learn new words. Across two experiments we examine how stories written in rhyme affect children's word learning and whether the effects change across reading experience. We presented both preschool and school-aged children with purpose-written storybooks, either in a rhyme or non-rhyme format, using the same words and illustrations. Rhyme had different effects on word learning depending on children's age. Specifically, preschool children demonstrated better immediate word learning from the non-rhyme version whereas school-aged children demonstrated better immediate word learning from the rhyme version. We demonstrate, for the first time, that the benefit of stories in rhyme is not sustained over time; ultimately, school-aged children have better long-term word retention from the non-rhyme version.

Neither Rhyme nor Reason: Rhyming Children's Books Help Young Readers - But Not Pre-Schoolers - Learn Words

Rhyme is a ubiquitous part of a young child's everyday life and is perceived to be beneficial—if not essential—to children's language development (Bryant, MacLean, Bradley, & Crossland, 1990; Dwyer & Neuman, 2008; Raz & Bryant, 1990). Babies are exposed to rhyming lullabies that sooth (e.g. *"twinkle, twinkle, little star, how I wonder what you are"*). Toddlers often hear nursery rhymes that include actions to help develop motor skills (e.g. "*Incy Wincy spider climbed up the spout, down came the rain and washed poor Incy out*", miming a spider climbing up and falling down to tickle). And preschoolers are taught rhymes to assimilate useful information such as cardinal numbers (e.g., "*1, 2, 3, 4, 5, once I caught a fish alive*")*.*

During shared storybook reading, children are frequently exposed to books with rhyme. Indeed, over 40% of the books listed in The Book Trust's 'Best Book Guide for 0-5-Year-Olds' use rhyme (The Book Trust, 2013b, 2014). In The Book Trust's list of '100 Best Books for Children over the Last 100 Years' (2013a) for 0-5-year-old category, 32% were rhyme storybooks, 16% had alliteration in the narrative, 8% used repetition and only 44% were prose storybooks. This demonstrates the long-term and enduring place that rhyme has in children's literature. Nevertheless, the added benefit of rhyme over other types of language exposure has been largely neglected in literature.

Benefits of Rhyme Books

Bryant and colleagues (Bryant et al., 1990; Kirtley, Bryant, MacLean, & Bradley, 1989; Maclean, Bryant, & Bradley, 1987) argue that rhyme is responsible for 4-7-year-old children's emerging phonological awareness and early reading success. For example, primary school children who have had the greatest exposure to

nursery rhymes during their preschool years perform better in both phonological discrimination and productions tasks (Bryant et al., 1990). Similarly, after hearing rhyme and non-rhyme stories, 6-year-old school children recalled the story's plot via open-ended questions and a picture-sequencing task (Sheingold and Foundas, 1978). Hearing the rhyme story helped children with the picture-sequencing task but there was no benefit to children's recall of the story.

Recently, Read (2014) tested 2-4-year-old preschool children's word learning of novel monster names by varying the placement of rhyming words within an illustrated story. Specifically, for one group of children the target words rhymed at the end of the stanzas (predictive rhyme) and for another group of children the target words rhymed in the first line of the stanzas (non-predictive rhyme).

Non-predictive rhymes	***Predictive rhymes***
This clever monster's called a ***flook***	*Here's a monster who likes to cook*
He really likes to bake and cook	*and on his head is a useful hook*
and on his head is a useful hook	*to help him find recipes in his book*
to help him find recipes in his book	*this clever monster's called a* ***flook***

(excerpt from appendix, Read, 2014, p. 10)

For a control group, the target words were in the middle of the lines and therefore did not rhyme. Children who heard the predictive rhymes learned significantly more monster names than children in the control group. Read (2014) argues that the placement of the target word at the end of the rhyming stanza creates greater predictability and that it would ultimately increase children's language acquisition if more storybooks were written in rhyme. All children in the study heard rhyming stories; that is, no comparison was made to a similar text in non-rhyme format. Thus, although predictive rhymes aided learning within a rhyming story, it remains unclear whether rhyming storybooks are better for assisting word learning than non-rhyming storybooks.

Read, Maclauley and Furary (2014) further tested 2-4-year-old preschool children's word learning for animal names with a rhyme and non-rhyme version of the same story. They found that children learned words better in the rhyme condition, especially when coupled with parental dialogic reading styles (e.g. parents tended to pause prior to saying the target word more when reading the rhyme story than when compared to reading the non-rhyme story). While children in the rhyme condition were able to name and identify more animals than children in the non-rhyme condition, the target words were not novel. Rather, they were familiar animals names that 2-4-year-old children would already know (e.g. bear, butterfly, bunny, which are already known by 70% of 18-month-old children, Fenson et al., 1994). More rigorous experimental controls are needed to fully understand the word learning effects of rhyme storybooks.

Benefits of Non-Rhyme Books

In contrast, Hayes and colleagues (Hayes, 1999, 2001; Hayes, Chemelski, & Palmer, 1982; Johnson & Hayes, 1987) argue that rhyme has a *negative* influence on word learning. Using rhyme and non-rhyme stories across several experiments, Hayes (1999) examined 3-5-year-old children's short-term memory for the story plot with multiple-choice questions and free recall. Children who heard the non-rhyme stories demonstrated significantly better comprehension of story narrative. This is in sharp contrast to the earlier belief that children's preference for rhyme over non-rhyme material indicated an increased level of attention resulting in better learning (Hayes et al., 1982; see also Sheingold & Foundas, 1978). Note, Hayes and colleagues (1982) found the opposite effect with adults whereby rhyme material enhanced overall recall in comparison to non-rhyme material.

Hayes (1999) further examined which story aspects were negatively effected

by rhyme by breaking the story into six different nodes; setting, beginning, reaction, attempt, outcome and ending. Four-year-old American preschool children were read either a rhyme or non-rhyme story and then retold the story. Children who heard the non-rhyme story performed better than children who heard the rhyme story. Specifically, children who heard the non-rhyme story recalled more propositions, especially in the 'setting' and 'outcome' nodes of the story. Hayes (1999) conducted a second experiment to compare recall following rhyme, non-rhyme and rhythmic stories (a non-rhyming version written with meter; a rise and fall pattern). As in the first experiment, preschool children who heard the non-rhyme story recalled more of the plot and demonstrated better overall retention for key aspects of the story than children who heard the rhyme story.

Finally, in order to explore possible benefits from rhyme storybooks such as whether rhyme increases attentiveness to certain phonological features of the story, Hayes (2001) presented four-and-a-half-year-old American preschool children with phonological detection or deletion tasks. In the rhyme detection task, children in the rhyme condition performed better than children in the non-rhyme condition.

Different Methodological Approaches

Clearly, there are methodological differences between studies that have found a benefit for rhyme (e.g., Read, 2014; Read et al., 2014) and those that have found a benefit for non-rhyme (e.g., Hayes, 1999, 2001; Hayes et al., 1982; Johnson & Hayes, 1987; Sheingold & Foundas, 1978), see Table 1for an overview. However, Hayes and colleagues argue that a possible explanation for such differences is the different level at which rhyme is processed in memory (Hayes, 1999, 2001; Hayes et al., 1982; Johnson & Hayes, 1987). Craik and Lockhart's (1972) seminal paper

Table 1. Review of research into the benefits of rhyme and non-rhyme stories. Sorted by test, then by age.

Study	Age Range	Test	Outcome	Notes
Read & Macauley, Furay, 2014	2-3 yrs	Word recall (animal names)	Recall for rhyme > non-rhyme	*Animal names were highly familiar (e.g., bunny, bear).*
Read, 2014	3 yrs	Word recall (proper, monster) names)	Recall for predictive rhyme > non-predictive rhyme	*All of the conditions rhymed.*
Johnson & Hayes, 1987[a]	3.5 yrs	Verbatim story recall	Verbatim recall for rhyme > non-rhyme semantic paraphrasing for non-rhyme > rhyme	*Nursery rhymes*
Hayes, Chemelski,& Palmer, 1982[a,b]	3-4 yrs	Story comprehension	Comprehension scores for non-rhyme > rhyme.	*Nursery rhymes*
Hayes, 1999	4 yrs	Story comprehension	Comprehension scores for non-rhyme> rhyme	*Novel stories*
Hayes, 2001	4 yrs	Rhyme/Alliteration task; phonological deletion	Rhyme/Alliteration scores and phonological deletion scores for rhyme > non-rhyme	*Commercial story.*
Sheingold & Foundas, 1978	6.5 yrs	Picture sequencing; story comprehension	Picture sequences scores for rhyme > non-rhyme No difference in story comprehension.	*Commercial stories selected from the 'easy' section of the children's library.*
Maclean, Bryant & Bradley, 1987[c]	3-4 yrs	Phonological skills; reading ability.	Nursery rhyme knowledge correlated with phonological skills and reading ability	*No direct test of learning from rhyme or non-rhyme stories*
Kirtley, Bryant, MacLean & Bradley, 1989[d]	6-7 yrs	Onset phoneme identification; reading ability.	Onset phoneme categorization correlated with reading ability	*No direct test of learning from rhyme or non-rhyme stories*
Bryant, MacLean, Bradley & Crossland, 1990[e]	4-6 yrs	Phonological skills; reading ability.	Sensitivity to rhyme leads to awareness of phonemes and correlated with reading ability	*No direct test of learning from rhyme or non-rhyme stories*

[a] children had a possible preexisting knowledge of the materials; [b] (experiment 1-4 only); [c] 15 month longitudinal study; [d] (Experiment 2 only); [e] Longitudinal 4 test points over 2years

proposed a model in which incoming information is processed at different depths; phonological information (the sounds of words) is processed at a shallower level leading to less stable encoding. In contrast, semantic information (story comprehension) requires a deeper, more elaborate processing, which in turn

facilitates highly durable memory traces and retention (for an additional review see Craik, 2002; Lockhart, 2002; Nyberg, 2002). In line with this model, Johnson and Hayes (1987) found that preschool children who heard a rhyme story accurately recited the story (e.g. verbatim), but children who heard a non-rhyme story processed semantic information (e.g. plot comprehension) more successfully.

As children progress from preschool through school their exposure to various types of rhyme increases. British teachers are encouraged in foundation years, through the National Literacy Strategy to use word sounds, alliteration, rhyme, poems and tongue twisters as part of the national curriculum (DfEE, 2001). As children become increasingly familiar with rhyme, it may be that they become more attentive to the structural patterns (Calvert & Tart, 1993), with rhyme starting to aid their verbatim recall of new vocabulary and comprehension (Hyman & Rubin, 1990). Although Johnson and Hayes (1987) state that linguistic information is rarely remembered verbatim over time; rhythmic structure can make the content immediately more memorable for those who have experience using rhyme in an educational setting.

A common assumption among researchers is that rhyme increases young children's attention during shared storybook reading (Baker, 1976; Calvert, 2001; Moore, 1992). However, increased attention during shared storybook reading does not necessarily result in encoding the correct information or increased word retention (Craik, 2002). It may be that children's attention is captured by rhyme but they fail to attend to the meaning of the stories. Thus, whether rhyme storybooks help or hinder children's ability to learn new words and information from shared storybook reading remains unknown.

The current study. To investigate the effect of rhyme storybooks on children's word learning we presented preschool children with either a rhyming or a non-rhyming storybook. Children were read purpose-written storybooks containing identical words and content. The only difference was the arrangement of the words. The rhyme format included rhyming words at the end of lines and the non-rhyme version included the same words but they were re-arranged so the lines no longer rhymed. We tested children's word learning using both pictures and objects (see also Barr, 2010; Ganea, Allen, Butler, Carey, & DeLoache, 2009; Ganea, Pickard, & DeLoache, 2008) to gain a comprehensive understanding of how well children both remember and generalise new words learned from storybooks that rhyme. In addition to word learning, we also tested children's preference for rhyme or alliteration, as well as memory for story events.

In Experiment 1 we tested 3.5-year-old preschool children because young listeners (pre-readers) are regularly exposed to rhyme to facilitate early learning. If rhyme facilitates word learning for preschool children, then children in the rhyme condition should learn more new words than children in the non-rhyme condition. In contrast, if rhyme hinders word learning then children in the non-rhyme condition should demonstrate greater word learning. We also tested children's recall of story events by asking two-alternative forced-choice questions about the story plot. If all children are attending to the plot, then we expect to find no difference between children hearing rhyme or non-rhyme. However, if rhyme or non-rhyme captures children's attention less, we would expect to see a difference in recall between groups.

In addition, we may see developmental differences in the effect of rhyme on children's word learning from storybooks. Specifically, older children, who have

longer attention spans and are learning to read, may not be as distracted by the rhyme format. Such findings would be consistent with Bryant et al. (1990) who found that beginner readers showed a sensitivity to rhyme. In that study, children were tested longitudinally (from ages 4 to 6) on various phonological tasks; for example at age 6 children were tested on reading and comprehension. The authors found that rhyme and alliteration scores explained 65-71% of the variance in reading performance. Further, Bryant et al. (1990) proposed that phonological sensitivity may be important to reading success in the future (see also Fisher & Craik, 1977; Read et al., 2014). Exploring developmental differences in the effects of rhyme storybooks will provide us with a unique insight into how rhyme influences children's word learning over time. Thus, to explore how rhyme influences word learning as children learn to read, we tested 5-year-old novice readers in Experiment 2. If new readers are more sensitive to rhyme, then school children in the rhyme condition should learn more words than the children in the non-rhyme condition. In contrast, if rhyme hinders word learning then children in the non-rhyme condition should demonstrate greater word learning.

Experiment 1

Method

Participants

Twenty-four 3-year-old monolingual, British-English-speaking children without any known learning disabilities participated. Children were primarily from white, middle-class families and lived in an urban area on the South coast of England. They were recruited through a database of families interested in participating in language research. The children were randomly assigned to one of

two conditions; rhyme condition (6 girls, 6 boys, *M* = 42 months, 1 day, *SD* = 2 months, 10 days, range = 39 m 26 d – 48 m 8 d), or non-rhyme condition (6 girls, 6 boys, *M* = 42 months and 13 days, *SD* = 1 month, 12 days, range 40 m 22 d – 44 m 28 d). There was no significant difference in age between conditions, $t(22) = 0.478$, $p = .64$. As a thank you, each child received several stickers during the experiment and a small gift (e.g. Play Doh or a book) at the end.

Stimuli

Storybooks. Two versions of a novel storybook called, *If Only I Had Listened,* were created for a preschool-aged audience (modified from *Rosie's Bad Baking Day* Horst, Parsons, & Bryan, 2011), and the characters and storyline were designed to engage preschool children. The story was written in AABB end rhyming format, which is common to many children's storybooks and nursery rhymes. Over 77% of the rhyming words were in true/end rhyme. Children find this type of rhyme the most readily identifiable and it harnesses a natural ability to distinguish between phonemes (Ham, 2007). The non-rhyme storybook version included the same words but the text was rearranged so that it no longer rhymed (see Table 2). Note, the non-rhyme version was written without meter, because meter and inflection have been argued to influence learning from books that do not rhyme (Johnson & Hayes, 1987). Stories were presented as a spiral-bound covered book.

Table 2. The text from page 6 in *If Only I Had Listened.* Rhyming words are indicated in red bold.

Rhyme Version	Non-Rhyme Version
Later that day Millie felt really **bad**, because she had made her mummy feel **sad**. She went to her daddy to ask if he **knew** of any nice things for her mum she could **do**.	Millie felt really **bad** later that day because she had made her mummy feel **sad**. She went to her daddy to ask if he **knew** of any nice things she could **do** for her mum.

Target words. Throughout the story, two novel objects were each depicted and named four times, but they were not the focus of the plot; an inverted slingshot that was used like a hand mixer (*jine*) and a kinetic wheel that was used like a rolling pin (*frot),* see Figure 1, (for a full description see Zurif & Horst, 2014).

Figure 1**:** Novel objects from *If Only I had Listened* storybook and test booklet (target novel objects with names are on the left and unnamed novel distractors are on the right).

Test stimuli. To test whether children learned the target words, a spiral-bound test booklet with three practice pages and 13 test pages was used. Throughout

the test booklet a total of six novel objects were used; four novel distractors (other novel objects) previously unseen by children (see also Werchan & Gómez, 2014), and the two novel targets (*frot*, *jine*) appeared both individually (on eight pages) and together (on four test pages); see Williams and Horst (2014) for a full description. On each practice page, four familiar objects were depicted (e.g. spoon, toy bike, frog and cup). To test whether children could generalise from the stories, we also presented 3D objects (the novel objects that had been pictured in the story and the test booklet). Familiar objects (e.g. teddy-bear, fork, butterfly and toy car) were presented to the children on warm-up trials before the object testing took place. Finally, flashcards of 24 different familiar objects were used on the word sound trials (see Table 3). Objects were photographed against a white background and printed double-sided, creating 3-inch square laminated pictures cards.

Table 3. Word sound trial sets included a target word, an onset match and a rhyming match. Neither choice was correct or incorrect.

Target word	Onset Match	Rhyming Match
Boat	Book	Coat
Cake	Car	Snake
Chair	Chalk	Bear
Hat	House	Cat
Moon	Mop	Spoon
Pen	Purse	Hen
Sock	Sun	Clock
Tree	Train	Key

Procedure and Design

Children were tested individually in a quiet room at the university lab-testing suite. Before starting the experiment, children were shown a selection of coloured cards with clip art images on them and were asked to choose one card to put stickers on. Children could 'win' the stickers for listening to stories and by playing games. The stickers were designed to help keep the children's attention and engagement through the various trials (e.g. Samuelson, Horst, Schutte, & Dobbertin, 2008). The experimenter kept the card between tasks until all trials had been completed. To minimise experimenter error and informative, extra-textual cues such as pauses (see Read, 2014; Read et al., 2014), children were first tested in the non-rhyme condition, then the rhyme condition (see Table 4 for experimental timeline).

Reading phase. Children were asked if they would like to hear a story. After they assented, they sat next to the experimenter on a small sofa with the storybook between them to ensure the illustrations were easy to see. Parents sat in the same room but were not directly involved in reading the storybooks. To control for reading variances (e.g. different reading styles), children were read either the rhyme or non-rhyme storybook by the same experimenter. After reading the story, children 'won' a sticker for their reward card and were asked if they would like to hear the story again. This procedure was repeated until the story had been read three times. Children's questions and comments were neither encouraged nor discouraged (for a similar method see, Cornell & Sénéchal, 1993), and the children were simply encouraged by the experimenter to attend to the story (e.g., "why don't we read on and find out!"). All children encountered both name-object pairs 12 times each.

Word learning test. Immediately after the third reading, the first word-learning test took place in an adjacent lab testing room. Children sat next to their

parents on one side of a table and the experimenter sat opposite the child. The experimenter asked the child whether he/she would like to play a pointing game and asked the child to show his or her pointing finger. When seated at the table, the experimenter opened the test booklet to a practice page and asked the child to point to a familiar object (e.g. "can you point to the cup?"). In total, children completed four warm-up trials to ensure they understood the task and, by the end of the four trials, each child had practised pointing to an object in each quadrant (e.g. bottom right). Children were given positive encouragement for correct choices (100% of trials). Practice page, trial order and target quadrants were counterbalanced within and across participants.

Next, children's comprehension of the target novel words was tested using a different test page on each trial. The word-learning task was the same as that used in previous research (Horst et al., 2011; Williams, Horst, & Oakhill, 2011; Zurif & Horst, 2014) and children were asked to point to each target twice for a total of four test trials. During the trials, targets were presented twice individually and twice together. For example, the child was presented with one *jine* trial where the *frot* was also present among the competitors, and one *jine* trial where the *frot* was not present among the competitors. Page, trial order and target quadrants were counterbalanced within and across participants. After all of the recognition trials, the children were rewarded with a sticker for their reward card.

Extension trials. Next, word learning was further investigated by repeating the word learning procedure with the 3D objects (see Ganea et al., 2008 for discussion on children transfering information from books to the real world). The child was asked if he/she would like to play another "pointing game", and here objects were presented on a transparent tray divided into four sections (for similar

use of transparent materials see Namy, Smith, & Gershkoff-Stowe, 1997). Before each trial the experimenter arranged the objects on the transparent tray out of sight of the child. First, the experimenter placed the tray on the table with a familiar object in each of the four sections of the tray, and the child was asked to point to one (e.g. "can you point to the bike for me?"). Objects changed locations between trials (see Horst, Scott, & Pollard, 2010 for a similar procedure). Children were asked for each object in a pseudo-random order and were given positive encouragement for correct choices (100% of trials). By the end of the four warm-up trials, the child had practised pointing to an object in each section of the tray (e.g. far left). Trial order, objects and locations were counterbalanced within and across participants.

Next, as with the 2D trials, children's comprehension of the target novel-object words was tested. Test trials included an additional four novel objects. The two target novel objects from the story were shown twice separately and twice together alongside the other novel distractor objects using different target locations across trials. The novel trials followed the same procedure as the warm-up trials except no feedback was given. For example, the child was presented with one *jine* object trial where the *frot* object was also present among the competitors, and one *jine* object trial where the *frot* object was not present among the competitors. Trial order, objects and locations were counterbalanced within and across participants. Again, after all of the extension trials, children were rewarded with another sticker for their reward card.

Word sound trials. Next, children were asked if they would like to play a different game and win more stickers (for a similar word matching task see McConnell, Wackerle-Hollman, Roloff, & Rodriguez, 2014). This time, a small transparent box was placed on the table. The experimenter began by showing a target

card (e.g. hat) to the child and asked, "If I put this hat in the box, could you put in the card that you think sounds like hat?". Then the other two cards were laid to the left and the right of the box and named as they were placed down (e.g. "cat" and "house"). Target word order and card position (e.g. rhyme left/onset right or rhyme right/onset left) were counterbalanced within and across participants. At the end of all 8 trials, children were rewarded with another sticker. [1]

Plot comprehension questions. Finally, plot comprehension questions were verbally administered as an additional control to ensure children were paying attention to the stories and to determine if either condition affected their comprehension of the story content (See Supplementary Study, Paper 2 a for further discussion). Plot comprehension questions were presented in forced-choice format, with both potential answers being words or phrases that had occurred in the story.

For example, one question asked, "When Millie reached into the cupboard, did she fall on the *floor* or the *chair*?" (Millie fell on the floor, but she was standing on a chair). Across children, the correct answer appeared equally as often as the first and second choice within the question (e.g. half of the children were asked, "When Millie reached into the cupboard, did she fall on the *chair* or the *floor*?"). There were four possible responses to each question; the correct choice, the incorrect choice, 'I don't know', or 'no response'. If children said they didn't know the answer, the experimenter continued with a comment to reassure (e.g. "You don't know? That's okay. Would you like to try and help me with the next question?"). For children who

[1] Before running this experiment, we trialed a spontaneous rhyming task with another group of 3.5-year-old children. In that task the experimenter said a word e.g. 'cat', and asked if the child could think of a word that sounded like 'cat'. Even after providing additional promoting words to help e.g. 'mat' 'bat', this proved too challenging for the children. Children would either say they didn't know, not answer, or discuss the target word e.g. 'we have a cat…'.

didn't answer the question at all (i.e. 'no response'), the experimenter would try asking the question a second time, and then move on in the same way as the, 'I don't know', response.

Table 4. Timeline for trials in Experiment 1 and 2

Experimental tasks	**Experiment 1 (Preschoolers)**	**Experiment 2 (School children)**
Reading Phase	3 consecutive readings	3 consecutive readings
Immediate Test		
Recognition Trials (Pictures)	4 warm-up trials 4 test trials	4 warm-up trials 4 test trials
Generalization Trials (Objects)	4 warm-up trials 4 test trials	4 warm-up trials 4 test trials
Rhyme/Onset task	8 test trials	8 test trials
Plot questions	8 trials	8 trials
Enjoyment rating	-	1 trial
7-Day Retention Test		
Retention Trials (Pictures)	-	4 warm-up trials 4 test trials
Delayed Generalization Trials (Objects)	-	4 warm-up trials 4 test trials

All of the questions were asked in the same impartial but child-friendly tones with which the story had been read, without providing any feedback as to whether the child had answered correctly or incorrectly but whilst remaining encouraging towards the child.

Coding. A ceiling camera recorded children's responses during each test. Coders were naïve to the experimental hypotheses and coded the children's selections from video recordings of the sessions. Inter-coder agreement was 100%.

Results

Word Comprehension and Extension

First, we present analyses comparing preschool children's word learning against chance and then between conditions for the immediate tests after hearing the story. Word comprehension and extension results are depicted in Figure 2. Overall, children's novel name comprehension accuracy was significantly better than expected by chance (.25) in the non-rhyme condition on both the 2D recognition trials, (M = .76, SD = .16, $t(11) = 5.65$, $p < .001$, $d = 3.21$) and the 3D extension trials, (M = .77, SD = .23, $t(11) = 4.81$, $p <$. 001, $d = 2.26$). However, children in the rhyme condition performed significantly better than chance on the 3D extension trials, (M = .52, SD = .29, $t(11) = 2.72$, $p < .02$, d = .93), but not on the 2D recognition trials (M = .42, SD = .17, $t(11) = 1.61$, $p < .14$, d = .98). A mixed-design ANOVA with story format (non-rhyme, rhyme) as a between-subjects factor and test type (pictures, objects) as a repeated-measures factor yielded a significant main effect of story format ($F(1,22) = 4.43$, $p = .04$, $\eta_p^2 = .17$). Fisher's PLSD confirmed that children in the non-rhyme condition performed significantly better than the children in the rhyme condition, $p < .04$. There was no main effect of test type $p >.41$ and no interaction between story format and test type $p = .28$.

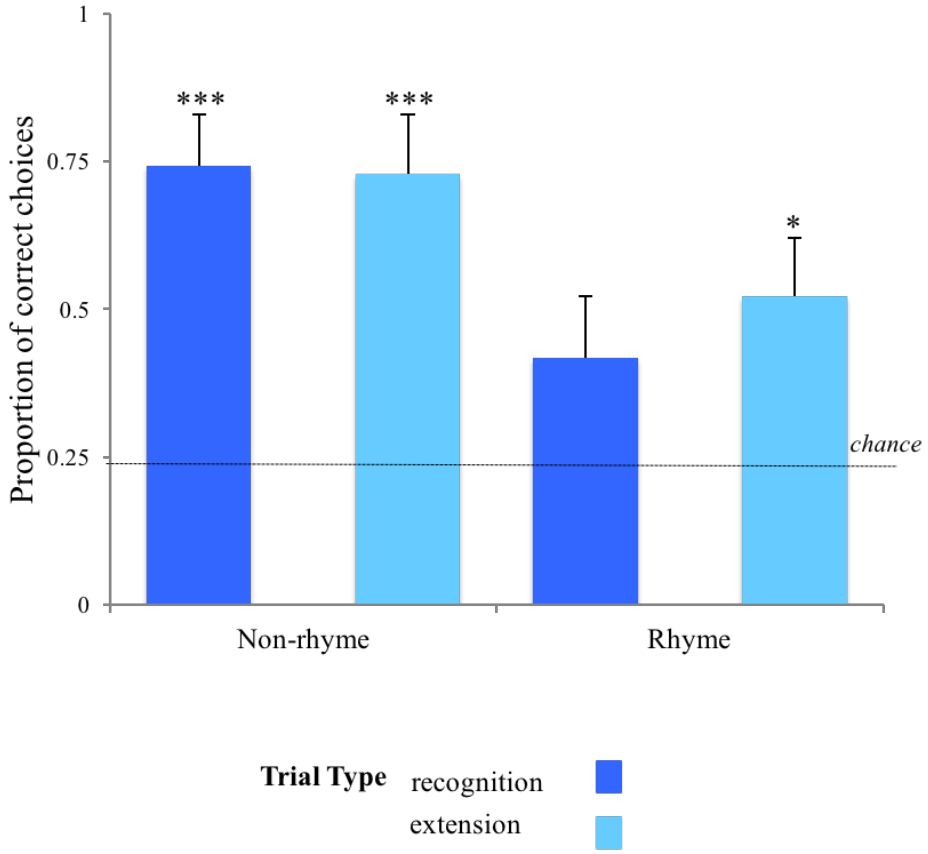

Figure 2. Preschool children's word learning in Experiment 1 (error bars represent 1 standard error of the mean). * $p < .05$ *** $p < .001$

In order to understand how well preschool children actually learned the target words, we also conducted a more conservative comparison, and compared the recognition and extension test trials in which children saw both targets to a stricter level of chance (.50, see Zurif & Horst, 2014 for a similar analysis). When measured in this stringent way, children who heard the non-rhyme story demonstrated significant word learning on the recognition trials M =.76 SD = .76 ($t(11) = 2.94$, $p <$ .02), and on the extension trials M =.77, SD = .35, ($t(11) = 2.73$, $p = .02$). In contrast, children who heard the rhyme story did not perform above chance on either the recognition trials M =.42, SD = .36, ($t(11) = 0.81$, $p = .43$), or the extension trials M =.52, SD = .34 ($t(11) = 0.21$, $p = .84$). Note, if chance on these trials is measured at .25, all children performed significantly above chance even on these challenging

trials for word learning (all *p*s < .001). Overall, children who heard the non-rhyme story demonstrated an advantage for word learning over children who heard the rhyme storybooks.

Word sound trials. Children in both conditions showed a preference for rhyming cards over onset cards. Preschool children who heard the non-rhyme story preferred rhyming cards significantly more than expected by chance (.50), M = .72, SD = .23, $t(11) = 3.25$, p <.007, d = .94, but children who heard the rhyme story did not, M =.52, SD = .29, $t(11) = 0.19$, p = .85, d = 0.06. There was a marginal difference in rhyme preference between children in the non-rhyme condition and children in the rhyme condition $t(22) = 1.92$, p = .06, d = 0.76).

Plot comprehension. In addition, to ensure that all children were listening to the story, we asked children 8 plot questions after the word learning trials to see if hearing non-rhyming stories provided children with a comprehension advantage for the story plot (Hayes et al., 1982; Johnson & Hayes, 1987). Children who heard the non-rhyme story answered more questions correctly than expected by chance (.50), M =.74, SD = .16, $t(11) = 3.72$, p <.003, as did children who heard the rhyme story M =.69, SD = .17, $t(11) = 3.76$, p <.003. An independent samples t-test showed that there was no difference in performance in answering the plot questions between children in the non-rhyme and rhyme condition $t(22) = 1.02$, p = .32. This suggests that the word learning differences found are not due to differences in attending to the story, as all children showed high comprehension of the story plot.

Discussion

Overall, preschool children who heard the non-rhyme story learned significantly more words than children who heard the rhyme story. This high level of

word learning in the non-rhyme condition is consistent with several previous experiments in which preschool children heard the same non-rhyme story three times (Horst et al., 2011; McLeod & McDade, 2010; Sénéchal, 1997; Zurif & Horst, 2014). Critically, all children heard the same words accompanied by the same illustrations. The only difference between conditions was the *order* of the words, therefore we can be confident that the difference in word learning is due to the story format. Indeed, additional analysis revealed that children in both conditions were equally accurate at answering questions about the plot, suggesting that the word learning differences were not to do with failure to attend to the story. Interestingly, children who heard the non-rhyme story showed a preference for rhyming words in the sound trials, which may indicate that preschool children do have a preference for hearing rhyme.

These findings provide evidence that rhyme does not facilitate word learning in preschool children. This is consistent with the argument by Hayes and colleagues (Hayes, 1999, 2001; Hayes et al., 1982; Johnson & Hayes, 1987) that rhyme has a negative influence on word learning. However, it conflicts with Read's (2014) finding that children learned novel names better in rhyme condition. To further explore the effects of rhyme in storybooks, we investigate whether rhyme provides school-aged children (who had started to read and write) with an advantage. Evans and Saint-Aubin found that young children rarely look at text during shared storybook reading (see Johnson & Hayes, 1987 for a more detailed dicussion), whereas emerging readers become more attentive to text and decoding graphemes. Thus, in Experiment 2 we tested whether young school-aged readers, who were more familiar with using rhyme to decode oral and written words, found an advantage for word acquisition in the rhyme condition. To maintain robust experimental control, we sought to maintain the same storybooks as in Experiment 1. Therefore, we tested

5-6-year-old children, because testing children any older could have led to developmental differences due to the story being too easy to understand, rather than due to the storybook format (i.e., rhyme, non-rhyme). We also tested the effect of rhyme on long-term word learning (i.e., retention), which had been neglected in the literature. Hayes (2001) questioned whether the beneficial effects, that some researchers have found for rhyme, would fade over time. Specifically, if rhyme stories are being processed at a more shallow level than non-rhyme stories, then any immediate word learning benefits may be reduced over time.

Experiment 2

Rhyme may assist those children learning to read by increasing phonological sensitivity (Bryant et al., 1990; Kirtley et al., 1989). It is possible that, once children have started to learn to read, they are less distracted by rhyme and it begins to facilitate, rather than interfere with, retention; as it did for the adults in Hayes et al. (1982) study. If novice readers are less distracted by rhyme than pre-readers (Bryant et al., 1990), and are able to use them in word learning, we would expect school-aged children in the rhyme condition to learn words better that the children in the non-rhyme condition. Importantly, using novice readers, we can have a direct comparison between groups. For even older children the task demands would be significantly easier with the same storybooks. Five-to-six-year old children will still be familiar with shared storybook reading and maintaining the empirical design in a naturalistic domain, whilst using the same storybooks. In addition, rhythmic structure can make it immediately more memorable for those who have more experience using rhyme in an educational setting (Johnson & Hayes, 1987). As in Experiment 1, half the children would hear the story that rhymed; children were tested again with picture

and object trials, using the two versions of *If Only I Had Listened* storybook. We also included a retention test after one week in order to examine the stability of any word learning benefits of rhyme or non-rhyme storybooks. A commonly held belief is that children enjoy rhyme stories more than non-rhyme stories (Ham, 2007; Hayes et al., 1982; Read, 2014), and enjoyment of reading has been closely linked with greater success academically (Evans & Saint-Aubin, 2005; PISA, 2011; Warren & Paxton, 2014; Weinberger, 1996). Therefore, we introduced a measure to examine whether children enjoyed rhyme books more than non-rhyme books.

Method

Participants. Thirty-six, 5-to-6-year-old monolingual, British English-speaking children without any known learning disabilities participated. Teachers reported that all children were able to sound read (blend words and read simple books; many were far more proficient) and all children were able to write their name on the cards themselves. Children were primarily from white families and lived in an urban area on the South Coast of England. They were recruited through local primary schools, and parents provided written consent before the start of the study. Half of the children were read the rhyme story (6 girls, 12 boys, M = 62 months and 8 day, SD = 3 months 11 days, range 57 months, 19 days – 67 months, 19 days) and half of the children were read the non-rhyme story (6 girls, 12 boys, M = 63 months and 15 days, SD = 3 months 25 days, range 57 months, 13 days – 68 months 8 days). There were no differences in age between the groups, $t(34) = 0.99$, $p = .32$. Further, there were no differences in age between the children from the two different schools, $t(34) = 0.72$, $p = .48$.

Stimuli. The same stimuli as in Experiment 1 were used, with the addition of smiley faces for the enjoyment rating trials (see, Supplementary Study 2 b).

Procedure and Design

All aspects of the procedure and design were the same as in Experiment 1, except that children were tested at their school. A ratings task was included after the plot questions and a 7-day retention test was added (see Table 4). As in previous research (e.g., Williams & Horst, 2014), the experimenter spent time with the children in school prior to running the study; taking part in circle story-time, where the children would sit in a circle to hear a story. Interaction during this time helped ensure that the children were comfortable with the experimenter during the reading and testing phases.

Each child was tested individually in the school library; a room that was both familiar and inviting for children, and somewhere they regularly had shared storybook reading sessions. The experimenter asked each child in their classroom if they would like to go to the library with her to hear some stories and play some games. When the child assented they went to the library and sat together at a table. The book was placed on the table to enable the child to clearly see the pages and illustrations. The reading phase and test phase followed using the same procedure as in Experiment 1.

Story enjoyment ratings. After the plot questions, children were asked to indicate story enjoyment by selecting a smiley face card (2 inch diameter) from a choice of three (Formby, 2014; Sullivan & Brown, 2013). The experimenter asked, "How much did you enjoy hearing the stories today?", while laying each face onto the table in turn and explaining what each card represented; "Choose this card if you liked hearing the story a lot", "Choose this card if you liked hearing the story a little", "Choose this card if you didn't like hearing the story". The cards were set on

the table in a counterbalanced order across participants, but "a lot" was always placed on the left, "a little" in the middle and "didn't like" on the right. These cards and this ratings task were used in a previous study with the same age group (Williams & Horst, 2014). After the enjoyment trials children were rewarded with another sticker.

Retention tests. After seven days the experimenter visited the children at school again and administered the word learning retention trial tests and the extension trials again. The procedure was the same as in the initial trials; the child was asked if he/she would like to play the game again and, upon agreeing, accompanied the experimenter to the library. The child was awarded stickers after the trial.

***Coding*.** The experimenter recorded children's responses during each test. At each school, a member of staff also observed and recorded responses for 87% of the children for inter-coder reliability. Staff members were blind to the hypothesis (see Zurif & Horst, 2014 for similar coding methods) and inter-coder reliability was 100%.

Results

Word Comprehension

As in Experiment 1, we first present analyses comparing children's word learning against chance and then between conditions for the immediate tests after hearing the story. For the children in the non-rhyme condition, novel name comprehension accuracy was significantly better than expected by chance (.25) on both the recognition trials, (M = .67, SD = .25, $t(17) = 7.14$, $p < .0001$, d = 1.69), and the extension trials, (M = .75, SD = .26, $t(17) = 8.25$, $p <$. 001, d = 1.98). Likewise, for children in the rhyme condition, novel name comprehension accuracy was

significantly better than expected by chance on both the recognition trials, (M = .79, SD = .25, $t(17) = 9.33$, $p < .0001$, $d = 2.17$) and extension trials, (M = .85, SD = .19, $t(17) = 13.04$, $p < .0001$, $d = 3.14$), see Figure 3, Panel A. To ensure that there was not an advantage for one school over another, we ran unpaired t-tests which demonstrated that there was no difference in performance between the schools for recognition trials $t(34) = 0.42$, $p = .68$, , $d = 0.14$ and no difference in performance between the schools for extension trials $t(34) = 0.89$, $p = .38$, $d = 0.30$. A mixed-design ANOVA with story format (rhyme, non-rhyme) as a between-subjects factor and test type (pictures, objects) as a repeated-measure yielded a significant main effect of test type, ($F(1,34) = 5.27$, $p < .03$, $\eta_p^2 = .79$). Fisher's PLSD confirmed that children performed significantly better on the object trials than on the picture trials, $p < .03$, especially in the extension trials. There was no main effect of story format and no interactions.

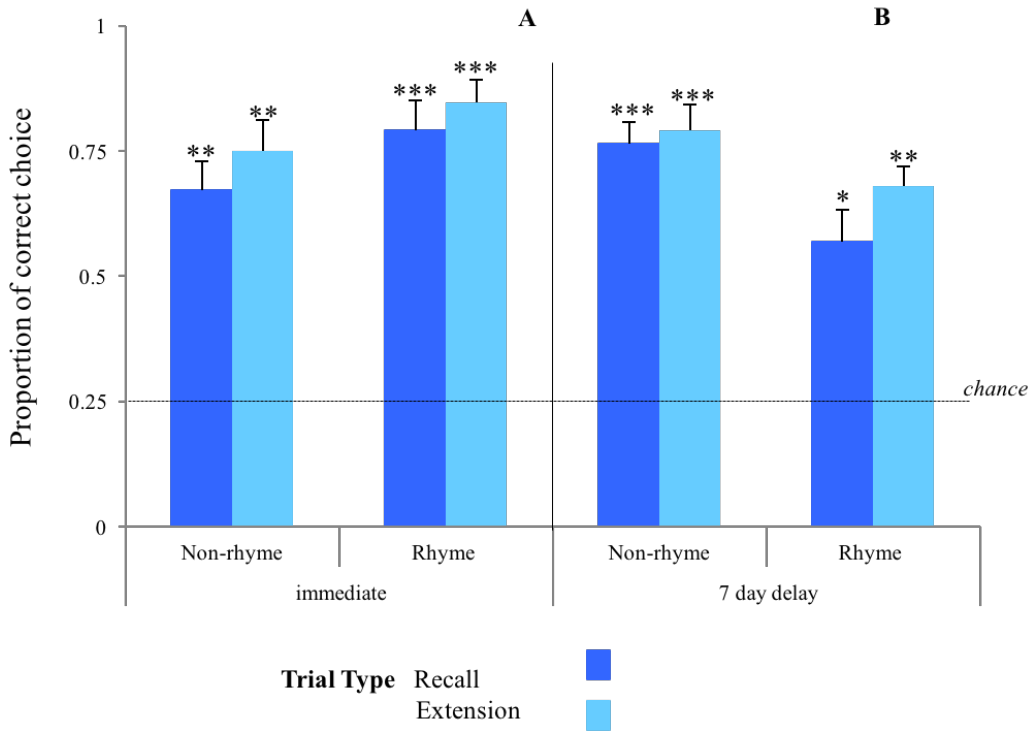

Figure 3. School-aged children's word learning in Experiment 1 (error bars represent 1 standard error of the mean). * $p < .05$ *** $p < .001$

As in Experiment 1, we compared the recognition and extension immediate trials, in which preschool children saw the other target picture or object appearing as a distractor, to a cautious level of chance (.50). This allowed us to understand how well children actually learned the target words. When measured in this more conservative way, children who heard the non-rhyme story did not demonstrate significant word recognition, M =.44, SD = .36, ($t(17)$ = -0.57, p = .58), but did demonstrate word extension, M =.69, SD = .31, ($t(17)$ = 2.12, p = .04). Children who heard the rhyme story showed marginally significant word recognition, M =.67, SD = .32, ($t(17)$ = 1.84, p = .08), but successful word extension, M =.81, SD = .29, ($t(17)$ = 4.27, p = .001). Note, if chance is measured at .25 on these trials, all children performed significantly above chance; even for the more challenging trials (all ps < .0001).

Word retention. To examine the stability of any word learning benefits of rhyme or non-rhyme storybooks (Hayes et al., 1982), we included a retention test after 7 days. Overall, children were able to retain the novel names. For all the children in the non-rhyme condition, novel name comprehension accuracy was significantly better than expected by chance (.25) on both the recognition trials, (M = .76, SD = .18, $t(17)$ = 12.02, p < .0001, d = 2.83) and extension trials, (M = .79, SD = .21, $t(17)$ = 10.72, p < . 001 d = 2.53). Likewise, for children in the rhyme condition, novel name comprehension accuracy was significantly better than expected by chance on both the recognition trials, (M = .57, SD = .27, $t(17)$ = 5.05, p < .0001, d = 1.19) and the extension trials, (M = .68, SD = .17, $t(17)$ = 10.92, p < .0001, d = 2.53), see Figure 3, Panel B.

We also examined performance on these trials with our conservative test by comparing the trials, in which children saw the other target picture or object

appearing as a distractor, to a cautious level of chance (.50). When measured in this conservative way, children in both conditions demonstrated word retention over time. In the recognition trials children in the non-rhyme condition M =.83, SD = .19, (t(17) = 5.83, p < .001) and children in the rhyme condition M =.79, SD = .25, (t(17) = 4.61, p < .0001) demonstrated significant retention word learning. Children in the non-rhyme condition M =.75, SD = .18, (t(17) = 3.43, p <.01) demonstrated word extension a week later. However, children who heard the rhyme story in the learning trials M =.58, SD = .27, (t(17) = 1.37, p < .19) did not demonstrate word extension over time. Note, this time those school children that heard the rhyme story performed below chance for word learning after the extension trials. This was in contrast to the immediate trials where they had performed better on the extension trials than the recognition trials.

Effect of rhyme over time. We ran a pre-planned mixed-design ANOVA on children's word learning accuracy with story format (non-rhyme, rhyme) as a between-subjects factor and delay (immediate, 7-day) and test type (pictures, objects) as repeated-measures factors. The ANOVA yielded a significant story format by delay by test type interaction, F(1,34) = 4.47, p = .04, η_p^2 = .53 as well as a story format by delay interaction, F(1,34) = 23.92, p = .0001, η_p^2 = .99. The ANOVA also yielded significant main effects for delay, F(1,34) = 5.65, p = .02, η_p^2 = .64 and test type F(1,34) = 7.38, p = .01, η_p^2 = .76 and but not condition, F(1,34) = 0.12, p = .73 η_p^2 = .06. Together, these findings indicate that the different story formats had different learning advantages for children at different points in time depending on the test format. For example, children who heard a rhyme story demonstrated better word learning immediately after reading but children who heard a non-rhyme story demonstrated better word learning over time.

To better understand this interaction, we ran tests of simple effects on each story format separately. For children who heard the non-rhyme storybook, the ANOVA yielded a main effect of delay (F (1,17) = 11.61, p = .003 η_p^2 = .91), confirming significantly better accuracy on the retention tests than the immediate tests. Over time, children had consolidated their word learning and demonstrated better retention a week later when compared to their immediate test. Test type (pictures, objects) made no difference to children in the non-rhyme condition. That is, children performed equally well on both the recognition and extension trials (F (1,17) = 2.18, p = .15 η_p^2 = .27). Children in the rhyme condition also demonstrated word learning retention (F (1,17) = 15.28, p = .001 η_p^2 = .97), but there was a main effect of test type (pictures, objects) (F (1,34) = 5.66, p = .02 η_p^2 = .61) in that children learnt words better from the recognition trials. Although the children in the rhyme condition demonstrated word learning consolidation, performing better than chance a week later, the results provide evidence that rhyme storybooks help significantly more in the short term than over time.

Word sound trials. To further explore the effect of rhyme, we measured children's preference for rhyming cards over onset cards. Overall, children in the non-rhyme condition selected rhyme flash cards no more than expected by chance, M =.43, SD = .28, t(17) = -1.02, p = .29, d = - 0.25. Children in the rhyme condition, however, did choose the rhyme cards more often than expected by chance (.50), M =.81, SD = .24, t(17) = 5.49, p <.0001, d = 1.30. Children in the rhyme condition selected rhyme cards more often than children in the non-rhyme condition t(34) = 4.39, p <.0001, d = 1.46. There was no difference in preference for selecting rhyme flash cards between schools, t(34) = 1.06, p = .30.

Plot comprehension. Overall, all children in both conditions performed significantly better than chance (.50) when answering the 8 plot questions after the word learning trials. School children who heard the non-rhyme story answered more questions correctly than expected by chance (M =.80, SD = .10), $t(17) = 13.05$, p <.0001, as did children who heard the rhyme story M =.75, SD = .13, $t(17) = 8.34$, p <.0001. An independent samples t-test showed that there was no difference in performance in answering the plot questions between the two groups $t(34) = 1.24$, p = .22. This suggests that the word learning differences found are not due to differences in attending to the story, as all children showed high comprehension of the story plot. There was also no difference between schools in the responses to the plot questions $t(34) = 0.11$, p = .91.

Story enjoyment ratings. Overall, children liked the stories (see Table 5). The majority of children who heard the non-rhyme story (66.67%) answered that they liked reading it, *"a lot,"* compared to children who heard the rhyme storybook (77.78%). This confirmed that children do enjoy hearing rhyme stories (see Horst et al., 2011; Williams et al., 2011 for similar coding methods). Binomial tests confirmed that more children enjoyed the stories than expected by chance, in both the non-rhyme condition (exact binomial $p < .001$) and the rhyme condition (exact binomial $p < .001$).

Predictive effects of story format and test-type. *A* series of multiple regression analyses were conducted to determine if story format (non-rhyme, rhyme), test type (pictures or objects), plot comprehension, story enjoyment and/or rhyme word preference predict children's word learning performance on their retention tests and delayed extension tests (table 6).

Table 5. Number of children who chose each enjoyment rating.

	Liked "a lot"	Liked "a little"	Disliked
Non-Rhyme Condition (n = 18)	12***	6	0
Rhyme Condition (n = 18)	14***	2	2

*** $p < .001$, exact binomial test.

Story format was a significant predictor of word retention ($t(30) = 4.28$, $p < .001$, $d = 1.27$), accounting for approximately 55% of the variation in word learning scores one week later (see Table 6, model 2). Controlling for story format, picture test type was also a significant predictor of word retention ($t(30) = 4.11$, $p < .001$, $d = 1.27$). Together, story format and picture trials account for approximately 56% (see Table 5, model 4) of the variation in word learning scores ($F(1,30) = 7.62$, $p < .001$, $d = 1.27$). Neither plot comprehension ($p = .13$) nor story enjoyment ($p = .63$), or rhyme word preference ($p = .82$), were significant predictors of word retention one week after story (see Table 6, model 5).

Story format was also a significant predictor of delayed word extension ($t(30) = 3.07$, $p < .01$, $d = 1.56$) accounting for approximately 44% of the variation in word learning scores (see Table 6, model 2). Controlling for story format, picture test type was also a significant predictor of extension over time ($t(30) = 5.75$, $p < .001$, $d = 1.56$). Together, story format and object trials account for approximately 74% of the variation (Table 7, model 2). in word learning scores ($F(5,30) = 9.34$, $p < .001$, $d = 1.56$). Neither plot comprehension ($p = .49$) nor story enjoyment ($p = .94$), or rhyme word preference ($p = .77$), were significant predictors of word retention one week after story exposure (Table 7, model 5).

Table 7. A series of regression models predicting children's word retention one week after story exposure based on story format, immediate word learning (objects), plot comprehension, story enjoyment and rhyme word selection *** $p < .001$ ** $p < .01$ * $p < .05$.

Word Learning 7-day tests (Objects) β (Standarised)					
	Model 1	Model 2	Model 3	Model 4	Model5
Story Format (Non-Rhyme, Rhyme)	.28	.44**	.42**	.42**	.44**
Immediate Pictures Objects learning Test		.74***	.73***	.73***	.72***
Plot Questions			.08	.08	.01
Enjoyment				.01	.01
Rhyme Words					.05
R^2 (R^2adjusted)	.08 (.05)	.60 (.57)	.61 (.57)	.61 (.55)	.61 (.54)

Taken together, these data clearly demonstrate that both non-rhyme stories and type of word learning trials facilitated children's ability to learn words via shared storybook reading.

Developmental Differences

Finally, in order to better understand the developmental differences in how children are affected by rhyme storybooks, we compared the results from preschool children (non-readers, Experiment 1) to the school children (novice-readers, Experiment 2). To this end, we ran a pre-planned, mixed-design ANOVA on children's word learning accuracy with reading experience (preschool non-readers, school-age novice-readers) and story format (non-rhyme, rhyme) as between-subjects factors and test type (pictures, objects) as a repeated-measure. Preschool

children only completed the immediate tests so we only compared performance on the immediate tests. The ANOVA yielded a significant reading experience by story condition interaction, $F(1,56) = 5.60$, $p = .02$, $\eta_p^2 = .64$ (see Figure 5). Specifically, preschool non-readers learned more words from non-rhyme storybooks but school-age novice-readers learned more words from rhyme storybooks, when tested immediately after story exposure. The ANOVA also yielded a significant interaction for story format and test type $F(1,56) = 3.92$, $p = .05$, $\eta_p^2 = .48$, supported by Fisher's PLSD for word learning, which arose because school-age novice readers who heard the rhyme story performed significantly better on word learning trials than preschool non-readers who heard the rhyme story ($p = .04$). No significant main effect of condition was found ($F(1,56) = 1.34$, $p = .25$ $\eta_p^2 = .19$).

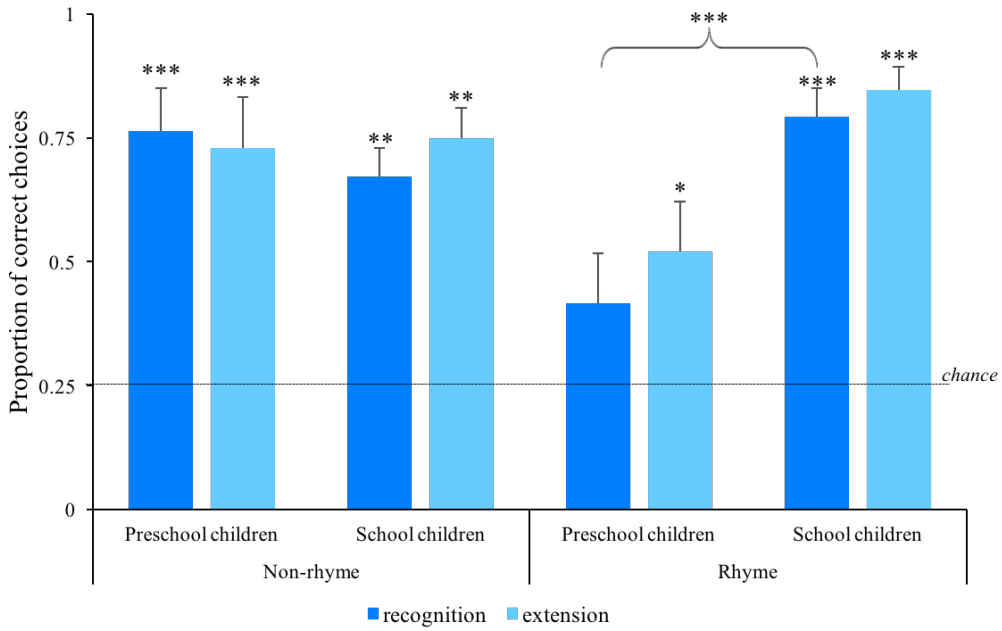

Figure 4. Preschool and school age children's word learning from Experiment 1 and Experiment 2 (error bars represent 1 standard error of the mean). *** $p < .001$

To further understand these developmental differences, we also conducted tests of simple effects to explore the interaction between reading experience and story condition. The proportion of correct choices on immediate word learning for children

who heard the rhyme story was entered into a mixed-design ANOVA with reading experience (preschool non-readers, school-age novice-readers) and test type (pictures, objects) as a repeated-measure, see Figure 5. The ANOVA yielded a significant main effect of experience $F(1,28) = 13.34$, $p = .001$, $\eta_p^2 = .96$ and a marginal main effect of test type, $F(1,28) = 3.74$, $p = .06$, $\eta_p^2 = .45$. Follow-up tests, Fisher's PLSD for word learning, confirmed that the early readers (i.e. the older children) learned significantly more words after hearing the rhyme stories than the younger children ($p < .001$). This suggests that learning materials that use rhyme provide a greater benefit to children who have more established phonological awareness.

An identical ANOVA for children who heard the non-rhyme storybook yielded no significant effects (all ps > .24), indicating that non-readers and novice readers were equally as good at learning words from non-rhyme storybooks. No other significant effects were found.

Overall, these analyses revealed that hearing a story that rhymes has different effects across development, School children learnt significantly more words when hearing the story in rhyme than preschool children. This suggests that hearing a story in rhyme is more beneficial for children who have great phonological experience and more distracting for younger children.

Discussion

By using the same methods and materials as in Experiment 1, we found that children at a later developmental stage of literacy demonstrated an advantage when learning material was presented in rhyme. All children demonstrated significant word learning, but the children who heard the rhyme story showed greater *immediate*

word learning, whereas children who heard a non-rhyme story showed greater word *retention* when tested a week later.

Importantly, we found that the benefit provided by rhyme was not sustained over time. Hayes et al., (1982) argued that rhyme produces transient memory traces, impeding short-term memory for story retention. This means those children who hear non-rhyme stories create a deeper semantic memory of the story and the novel words that they were exposed to (see also Craik, 2002; Craik & Lockhart, 1972; Hayes, 1999; Johnson & Hayes, 1987). Due to increased attention to the phonological characteristics in rhyming words, children fail to attend to the semantic content that requires deeper processing and greater subsequent retention.

Interestingly, stories that rhyme have different effects on children's language acquisition when children are at different stages of emergent literacy. Younger children learn words more effectively from books that do not rhyme, whereas novice readers have better immediate word learning results from stories that do rhyme.

We explored whether children themselves report a preference for rhyme stories and the effect this has on their word learning. Counter to our expectations, we found no difference in children's enjoyment of stories; we had expected children to prefer rhyme due to the common assumption amongst researchers (Baker, 1976; Calvert, 2001; Ham, 2007; Jalongo & Ribblett, 1997; Moore, 1992). Finally, regression analyses revealed that story format was a stronger predictor of long-term word retention than test type. To understand if the type of stories children heard made them more sensitive to rhyme, we tested children with sound trials. As expected, children in the rhyme condition showed a significantly higher preference for rhyming flash cards over onset congruent flash cards, when compared to the children in the non-rhyming condition.

General Discussion

Across two experiments we explored the effects that storybooks written in rhyme have on children's word learning and whether the effects change with different emergent literacy abilities. We presented both preschool (Experiment 1) and school-aged children (Experiment 2) with purpose-written storybooks, either in a rhyme or non-rhyme format. Specifically, all children heard the same words accompanied by the same illustrations; only the word order varied between conditions. Rhyme differentially influenced word learning depending on children's reading ability. Specifically, preschool children (non-readers) learned more words from the non-rhyme version but school-aged children (early-readers) demonstrated better immediate word learning from the rhyme version. Critically, this benefit for rhyme is not sustained over time; school-aged children demonstrated better long-term word retention from the non-rhyme storybook. Word sound trials showed that children attended more to rhyme than onset congruent words. Interestingly, there was no difference in children's plot comprehension or enjoyment between non-rhyme and rhyme stories, despite these differences in word learning.

The impact of rhyme on memory consolidation has been previously neglected in the literature. Based on previous research, we expected that children hearing the non-rhyme book several times would have increased consolidation over time (Horst et al., 2011; Zurif & Horst, 2014). Interestingly, hearing a rhyme story repeatedly did not lead to the same pattern of memory consolidation. School children who heard rhyme stories had poorer retention a week later, especially in the extension trials.

Overall, our findings are consistent with Hayes and colleagues' argument (Hayes, 1999, 2001; Hayes et al., 1982; Johnson & Hayes, 1987) that rhyme has a *negative* influence on word learning. For example, preschool children who heard

non-rhyme stories demonstrated greater overall comprehension of the story were able to comprehensively retell the story and had better knowledge of the story settings and outcome when compared to the children who heard the story in rhyme. By examining school children's retention over time, we are able to demonstrate that the initial benefits of hearing a storybook in rhyme are not robust. In fact, it is non-rhyme stories that provide children with the greatest overall benefit. This finding supports the theoretical account that rhyme and non-rhyme passages are processed on different levels (Craik & Lockhart, 1972; Hayes et al., 1982). Specifically, during shared storybook reading, rhyme helps young preschool children with sequential word-for-word recognition of the narrative they hear whereas non-rhyme increases semantic knowledge of the text (see also Calvert, 2001; Johnson & Hayes, 1987).

The current findings do, however, conflict with Read (2014), who found that the predictability of rhyme aided preschool children's word learning. In that study, all material was written in rhyming stanza but whether the target rhyming word was placed at the beginning or end of a stanza varied between conditions. Thus, school-aged children's ability to learn in the rhyme condition may be better understood as a benefit for prediction rather than for rhyme per se. Read (2014) did not include a non-rhyme control condition.

In addition, and unlike the current study, parents read the stories in the Read (2014) study. Parents and caregivers naturally provide rich contextual cues in reading and employ dialogical facilitation (Lonigan & Whitehurst, 1998). Read and colleagues (2014) recently found parental reading style to be a contributory factor in learning from rhyming stories. For example, parents pause for longer before target words when reading predictive rhymes. Although Read (2014) measured the parents' length of emphasis and the pause before reading the target word, emphasises on other

words and pauses were not measured. Having parents read to their children maintains high levels of ecological validity but it raises questions about the origin of the benefits found. One explanation is that such pauses implicitly alerted children to key elements of the story (e.g. target words).

It may be that stories that rhyme do benefit children after they begin reading. Various studies have highlighted a strong connection between 5-7-year-old school children's reading ability and phonological awareness (e.g. Bryant et al., 1990; Kirtley et al., 1989; Raz & Bryant, 1990). Specifically, sensitivity to rhyme in pre-reading children is seen as a precursor to developing reading ability (Bryant et al., 1990). Additionally, the phonological awareness of words helps children with phoneme detection. Children are frequently asked to divide words into onset sound and end rhyme, and they are better able to categorise words with similar endings than words sharing the same onset (Kirtley et al., 1989). There is evidence to support that school children that perform well in rhyme tasks have better reading levels, reinforcing a relationship between understanding rhyme and early reading (Bryant et al., 1990; Hayes, 2001; Kirtley et al., 1989). Similar to Hayes (2001), who demonstrated that preschool children performed better on rhyming tasks after hearing rhyme stories, school children hearing stories in rhyme in our study demonstrated an increased preference for rhyme during the phonological task. In addition, older children may be more attentive to the structural pattern of rhyme (Calvert & Tart, 1993), which provides cues to facilitate verbatim recall (e.g., songs providing automatic rehearsal Hyman & Rubin, 1990).

We administered plot questions to address whether children enjoy rhyme because it captures their attention and makes them more attentive to the content of the story. All children in the current study performed well on the plot questions.

However, the similarity in performance between conditions may be due to the type of questions asked, which were explicit literal questions designed for preschool children (see Williams & Horst, 2014, supplementary materials 2 a). In addition, cued recall of verbatim words from the story may have unintentionally provided an additional performance boost for children who heard rhyme. A more sophisticated question design may provide better insight into whether rhyme provides a boost for verbatim recall and non-rhyme creates a deeper, more predictive knowledge of storybooks (Fisher & Craik, 1977; Read et al., 2014). For example, employing open-ended inferential questions, which focus on plot structure, requires a more elaborate recall of the stories' semantic information.

Similar to early findings by Sheingold and Foundas (1978), but counter to Hayes et al., (1982), we found no differences in children's enjoyment of the rhyme vs. non-rhyme stories.

Parents and teachers often choose rhyme books over non-rhyme books as natural rhythm make them more enjoyable to read out loud (Dunst, Meter, & Hamby, 2011; Duursma, Augustyn, & Zuckerman, 2008; Maclean et al., 1987). Books in rhyme are the most commonly chosen read-a-louds by preschool teachers (Pentimonti, Zucker, & Justice, 2011). It is important to note that even if something is believed (by parents and educators) to be beneficial for children, such as rhyme, it does not naturally follow that it will aid their learning, e.g. stories with anthropomorphic animals (Ganea et al., 2014), stories with cartoon drawings (Ganea et al., 2008) and interactive storybooks with manipulative features (Tare et al., 2010) are all less helpful for learning than traditional books. Therefore, it is possible that parents and teachers choose texts that rhyme in response to market forces. The sheer

availability of rhyme books for preschool children underpins the belief that rhyme is beneficial for children (Dwyer & Neuman, 2008; Pentimonti et al., 2011).

The existence of rhyme in children's lives remains pervasive. From an early age, children are aware of its presence and are able to recognise it (Maclean et al., 1987). Young children find rhymes more engaging when they are active participants; clapping, finger snapping, pointing or swaying to the cadence of rhyme (Buchoff, 1995). If adults were to employ actions alongside the rhyme, preschool children may be able to demonstrate a deeper understanding of the material (Biemiller & Boote, 2006). Future research should explore how different ways of presenting rhyme may promote learning of different types of information, e.g. object action in addition to object names.

Rhyme both enhances and inhibits learning in children. It is clear that, depending on children's literacy stage, rhyme can aid children's enjoyment and engagement. But it can also distract children from developing deeper semantic knowledge and consolidating new words over time. Linguistic information is rarely remembered verbatim over time; rather the essence of the new information is what is retained (Johnson & Hayes, 1987). Thus, it may not be correct to say that more children's books should be written in rhyme (cf. Read 2014). Pre-school children may gain greater benefit from a combination of rhyme to learn phonemes and non-rhyme to consolidate semantic learning, which should be explored in future work.

The current study demonstrates that reading different formats of stories to young children provides them with many language acquisition benefits, and these benefits change depending on reading ability; preschool children learn more new words when books are written in non-rhyme whereas school children learn more new words immediately from books that rhyme. However, school children that heard non-

rhyme stories have better retention for new words. Reading with preschool children is an important activity to foster language development, alphabet awareness and literacy (Coyne, Simmons, Kame'enui, & Stoolmiller, 2004; Hargrave & Sénéchal, 2000; Lonigan, Farver, Nakamoto, & Eppe, 2013). Both rhyme and non-rhyme stories provide a rich language acquisition context for children and should be encouraged. However, children's individual level of reading experience should be taken into account when the goal is developing vocabulary and semantic knowledge.

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References

Baker, K. R. (1976). *The Nursery School: Human Relationships And Learning*. Philadelphia: WB Saunders Co.

Barr, R. (2010). Transfer of Learning Between 2D and 3D Sources During Infancy: Informing Theory and Practice. *Developmental Review, 30*(2), 128-154. doi:10.1016/j.dr.2010.03.001

Biemiller, A., & Boote, C. (2006). An Effective Method for Building Meaning Vocabulary in Primary Grades. *Journal of Educational Psychology, 98*(1), 44-62. doi:10.1037/0022-0663.98.1.44

Bryant, P. E., MacLean, M., Bradley, L. L., & Crossland, J. (1990). Rhyme and Alliteration, Phoneme Detection, and Learning to Read. *Developmental Psychology, 26*(3), 429. doi:10.1037/0012-1649.26.3.429

Buchoff, R. (1995). Jump Rope Rhymes …in the Classroom? *Childhood Education, 71*(3), 149-151. doi:10.1080/00094056.1995.10521830

Calvert, S. L. (2001). Impact of Televised Songs on Children's and Young Adults' Memory of Educational Content. *Media Psychology, 3*(4), 325-342. doi:10.1207/S1532785XMEP0304_02

Calvert, S. L., & Tart, M. (1993). Song versus verbal forms for very-long-term, long-term, and short-term verbatim recall. *Journal of Applied Developmental Psychology, 14*(2), 245-260. doi:10.1016/0193-3973(93)90035-T

Cornell, E. H., & Sénéchal, M. (1993). Vocabulary Acquisition Through Shared Reading Experiences. *Reading Research Quarterly, 28*(4), 360-374. doi:10.2307/747933

Coyne, M. D., Simmons, D. C., Kame'enui, E. J., & Stoolmiller, M. (2004). Teaching Vocabulary During Shared Storybook Readings: An Examination of Differential Effects. *Exceptionality, 12*(3), 145-162. doi:10.1207/s15327035ex1203_3

Craik, F. I. M. (2002). Levels of Processing: Past, Present... and Future? *Memory, 10*(5), 305 - 331. doi:10.1080/09658210244000135

Craik, F. I. M., & Lockhart, R. S. (1972). Levels Of Processing: A Framework For Memory Research. *Journal of Verbal Learning and Verbal Behavior, 11*(6), 671-684. doi:10.1016/S0022-5371(72)80001-X

DfEE. (2001). *The National Literacy Strategy. Developing Early Writing*. Retrieved from Sanctuary Buildings. Great Smith Street. London SW1P 3BT:

Dunst, C. J., Meter, D., & Hamby, D. W. (2011). Relationship Between Young Children's Nursery Rhyme Experiences and Knowledge And Phonological and Print-Related Abilities. *Center for Early Literacy Learning, 4*(1).

Duursma, E. v., Augustyn, M., & Zuckerman, B. (2008). Reading Aloud to Children: The Evidence. *Archives of disease in childhood, 93*(7), 554-557. doi:10.1136/adc.2006.106336

Dwyer, J., & Neuman, S. (2008). Selecting Books for Children Birth Through Four: A Developmental Approach. *Early Childhood Education Journal, 35*(6), 489-494. doi:10.1007/s10643-008-0236-5

Evans, M. A., & Saint-Aubin, J. (2005). What Children Are Looking at During Shared Storybook Reading. *Psychological Science, 16*(11), 913. doi:10.1111/j.1467-9280.2005.01636.x

Fenson, L., Dale, P. S., Reznick, J. S., Bates, E., Thal, D. J., Pethick, S. J., . . . Stiles, J. (1994). Variability in Early Communicative Development. *Monographs of the society for research in child development*, i-185. doi:10.2307/1166093

Fisher, R. P., & Craik, F. I. (1977). Interaction Between Encoding and Retrieval Operations in Cued Recall. *Journal of Experimental Psychology: Human Learning and Memory, 3*(6), 701. doi:10.1037/0278-7393.3.6.701

Formby, S. (2014). *Children's Early Literacy Practices at Home and in Early Years Settings: Second Annual Survey of Parents and Practitioners*. Retrieved from London: http://www.literacytrust.org.uk/assets/0002/4082/EY_Final_report_2014.pdf

Ganea, P. A., Allen, M. L., Butler, L., Carey, S., & DeLoache, J. S. (2009). Toddlers' Referential Understanding of Pictures. *Journal of Experimental Child Psychology, 104*(3), 283-295. doi:10.1016/j.jecp.2009.05.008

Ganea, P. A., Pickard, M. B., & DeLoache, J. S. (2008). Transfer Between Picture Books and the Real World by Very Young Children. *Journal of Cognition and Development, 9*(1), 46-66. doi:10.80/15248370701836592

Ham, L. (2007). *Reason in the Rhyme: The Translation of Sound and Rhythm in Children's Books.* University Ottawa, Ottawa. Retrieved from http://hdl.handle.net/10393/27850 Thèses, 1910 - 2005 // Theses, 1910 - 2005 database.

Hargrave, A. C., & Sénéchal, M. (2000). A Book Reading Intervention with Preschool Children who have Limited Vocabularies: The Benefits of Regular Reading and Dialogic Reading. *Early Childhood Research Quarterly, 15*(1), 75-90. doi:10.1016/s0885-2006(99)00038-1

Hayes, D. S. (1999). Young Children's Exposure to Rhyming and Nonrhyming Stories: A Structural Analysis of Recall. *The Journal of genetic psychology, 160*(3), 280-293. doi:10.1080/00221329909595399

Hayes, D. S. (2001). Young Children's Phonological Sensitivity After Exposure to a Rhyming or Nonrhyming Story. *The Journal of genetic psychology, 162*(3), 253-259. doi:10.1080/00221320109597482

Hayes, D. S., Chemelski, B. E., & Palmer, M. (1982). Nursery Rhymes and Prose Passages: Preschoolers' Liking and Short-Term Retention of Story Events. *Developmental Psychology, 18*(1), 4949-4956. doi:10.1037/0012-1649.18.1.49

Horst, J. S., Parsons, K. L., & Bryan, N. M. (2011). Get the Story Straight: Contextual Repetition Promotes Word Learning from Storybooks. *Frontiers in Psychology, 2*, 17. doi:10.3389/fpsyg.2011.00017

Horst, J. S., Scott, E. J., & Pollard, J. A. (2010). The Role of Competition in Word Learning via Referent Selection. *Developmental Science, 13*(5), 706-713. doi:10.1111/j.1467-7687.2009.00926.x

Hyman, I. E., & Rubin, D. C. (1990). Memorabeatlia: A naturalistic study of long-term memory. *Memory & Cognition, 18*(2), 205-214. doi:10.3758/BF03197096

Jalongo, M. R., & Ribblett, D. M. (1997). Using Song Picture Books to Support Emergent Literacy. *Childhood Education, 74*(1), 15-22. doi:10.1080/00094056.1997.10521908

Johnson, J. L., & Hayes, D. S. (1987). Preschool Children's Retention of Rhyming and Nonrhyming Text: Paraphrase and Rote Recitation Measures. *Journal of Applied Developmental Psychology, 8*(3), 317-327. doi:10.1016/0193-3973(87)90007-4

Kirtley, C., Bryant, P. E., MacLean, M., & Bradley, L. (1989). Rhyme, Rime, and The Onset of Reading. *Journal of Experimental Child Psychology, 48*(2), 224-245. doi:10.1016/0022-0965(89)90004-0

Lockhart, R. S. (2002). Levels of Processing, Transfer-Appropriate Processing, and the Concept of Robust Encoding. *Memory, 10*(5), 397. doi:10.1080/09658210244000225

Lonigan, C. J., Farver, J. M., Nakamoto, J., & Eppe, S. (2013). Developmental Trajectories of Preschool Early Literacy Skills: A Comparison of Language-Minoraity and Monolingual-English Children. *Developmental Psychology, 49*(10), 1943-1957. doi:10.1037/a0031408

Lonigan, C. J., & Whitehurst, G. J. (1998). Relative Efficacy of Parent and Teacher Involvement in a Shared-Reading Intervention for Preschool Children from Low-Income Backgrounds. *Early Childhood Research Quarterly, 13*(2), 262-290. doi:10.1016/S0885-2006(99)80038-6

Maclean, M., Bryant, P. E., & Bradley, L. (1987). Rhymes, Nursery Rhymes, and Reading In Early Childhood. *Merrill-Palmer Quarterly, 33*(3), 255-281.

McConnell, S. R., Wackerle-Hollman, A. K., Roloff, T. A., & Rodriguez, M. (2014). Designing a Measurement Framework for Response to Intervention in Early Childhood Programs. *Journal of Early Intervention, 36*(4), 263-280. doi:10.1177/1053815115578559

McLeod, A. N., & McDade, H. L. (2010). Preschoolers' Incidental Learning of Novel Words During Storybook Reading. *Communication Disorders Quarterly, 32*(4), 256-266. doi:10.1177/1525740109354777

Moore, V. (1992). *Pre-School Story Hour* (3rd ed.): Scarecrow Press.

Namy, L. L., Smith, L. B., & Gershkoff-Stowe, L. (1997). Young Children's Discovery of Spatial Classification. *Cognitive Development, 12*(2), 163-184. doi:10.1016/S0885-2014(97)90011-3

Nyberg, L. (2002). Levels of Processing: A view from Functional Brain Imaging. *Memory, 10*(5-6), 345-348. doi:10.1080/09658210244000171

Pentimonti, J. M., Zucker, T. A., & Justice, L. M. (2011). What are Preschool Teachers Reading in Their Classrooms? *Reading psychology, 32*(3), 197-236. doi:10.1080/02702711003604484

PISA. (2011). *PISA in Focus. Do Students Today Read for Pleasure?* Retrieved from http://www.oecd.org/pisa/pisaproducts/pisainfocus/48624701.pdf

Raz, I. S., & Bryant, P. E. (1990). Social Background, Phonological Awareness and Children's Reading. *British Journal of Developmental Psychology, 8*(3), 209-225. doi:10.1111/j.2044-835X.1990.tb00837.x

Read, K. (2014). Clues Cue The Smooze: Rhyme, Pausing and Prediction Help Children Learn New Words from Storybooks. *Frontiers in Psychology, 5*, 149. doi:10.3389/fpsyg.2014.00149

Read, K., Macauley, M., & Furay, E. (2014). The Seuss Boost: Rhyme helps Children Retain Words from Shared Storybook Reading. *First Language, 34*(4), 354-371. doi:10.1177/0142723714544410

Samuelson, L. K., Horst, J. S., Schutte, A. R., & Dobbertin, B. N. (2008). Rigid Thinking About Deformables: Do Children Sometimes Overgeneralize the Shape Bias? *Journal of Child Language, 35*(03), 559-589. doi:10.1017/S0305000908008672

Sénéchal, M. (1997). The Differential Effect of Storybook Reading on Preschoolers' Acquisition of Expressive and Receptive Vocabulary. *Journal of Child Language, 24*(01), 123-138. doi:10.1017/S0305000996003005

Sheingold, K., & Foundas, A. (1978). Rhymes for Some Reasons: Effect of Rhyme on Children's Memory for Detail and Sequence in Simple Narratives. *Psychological Reports, 43*(3f), 1231-1234. doi:10.2466/pr0.1978.43.3f.1231

Sullivan, A., & Brown, M. (2013). Social Inequalities in Cognitive Scores at age 16: The Role of Reading. *CLS Working Papers, 2013*.

The Book Trust. (2013a). 100 Best Books for Children for the Last 100 Years : 0-5 year olds. Retrieved from http://www.booktrust.org.uk/books/children/booklists/241/

The Book Trust. (2013b). Best Book Guide 2013 Children's Book Week. The Book Trust Best Book Guide is produced each year and contains reviews of our favourite new children's books. Retrieved from http://booktrustadmin.artlogic.net/usr/resources/943/cbw_best_book_guide_2013.pdf

The Book Trust. (2014). Best Book Guide 2014 Children's Book Week. The Book Trust Best Book Guide is produced each year and contains reviews of our favourite new children's books. Retrieved from http://fileserver.booktrust.org.uk/usr/resources/1120/bestbookguide_2014.pdf

Warren, H., & Paxton, W. (2014). *Read on Get On. How Reading Can Help Children Escape Poverty*. Retrieved from Save the Children on behalf of the Read On. Get On. campaign: http://www.savethechildren.org.uk/sites/default/files/images/Read_On_Get_On.pdf

Weinberger, J. (1996). A Longitudinal Study of Children's Early Literacy Experiences at Home and Later Literacy Development at Home and School. *Journal of research in reading, 19*(1), 14-24.

Werchan, D. M., & Gómez, R. L. (2014). Wakefulness (Not Sleep) Promotes Generalization of Word Learning in 2.5-Year-Old Children. *Child Development, 85*(2), 429-436. doi:10.1111/cdev.12149

Williams, S. E., Horst, J. S., & Oakhill, J. (2011). The Same Old Story: Contextual Cueing Facilitates Word Learning via Storybooks. *In Early shared book reading: what are the requirements for effective sessions? Symposium, British Psychological Society, Developmental Section Conference, Newcastle, UK.*

Zurif, E. B., & Horst, J. S. (2014). Goodnight Book: Sleep Consolidation Improves Word Learning via Storybooks. *Frontiers in Psychology, 5*, 184. doi:10.3389/fpsyg.2014.00184

Appendix Paper 3

Rhyme Version

Page 1
One cold, wet and miserable day,
Millie McSilly couldn't go out to play.
Her mummy suggested she wait for the sun,
but Millie replied, "No, that won't be fun!"
"Alright," said her mummy, "I think we should bake,
The rain may have stopped in the time that will take"
Page 2
"YAY!!" Millie cried, "We can use my new Jine!
It's so good to bake with, there's no better time!"
"Wait Millie!" cried mummy, "It's too high, you'll fall!"
But Millie just ignored her dear mother's call.
She stood on a chair to reach the right shelf,
"I'm 4 now", she whispered, "I'll get it myself!"
She stretched out her arm and took a big jump,
but missed it and fell to the floor with a bump.
Page 3
Her mother came running saying "are you OK?!
You really must listen to things that I say."
"I'm sorry", said Millie, "I swear to be good,
I'll listen from now on like good children should"
So mummy reached up and passed Millie the Jine,
"In future just listen, then things will be fine".
Page 4
While Mummy went looking for her pots and pans,
Millie was lost in a whole world of plans.
As she thought through the options she played with the frot,
"Don't do that" warned mum, "that's the best one I've got!"
But Millie did not hear what her mum said,
For there was just cookie ideas in her head!
Page 5
Spin-whirl-spin! Millie went with the frot,
She spun it so fast that it got very hot!
Before she could stop it and leave it to stand,
it broke in two pieces right there in her hand!
"Oh Millie, you haven't been listening all day!
My very best one has to be thrown away".
"I'm sorry", sobbed Millie, "I swear to be good,
I'll listen from now on like good children should".
Page 6
Later that day Millie felt really bad,
because she had made her mummy feel sad.
She went to her daddy to ask if he knew
of any nice things for her mum she could do.
Daddy came up with 'The great cookie plan'
and went off to find the frot, jine and pan.

Page 7
Millie got out the bowl and other things too,
"I'm four now," she whispered "I know what to do".
Dad was taking too long and so Millie began.
She didn't notice she had salt in her hand!
She started to mix everything with the jine,
Millie was sure her cookies would be fine!
Page 8
Her daddy came back but the cookies were done!
And Millie was happy; she'd had so much fun!
"You made them without me", her dad sounded mad,
"Didn't you know that not listening is bad?"
Not knowing about Millie's salty mistake,
they popped the cookies in the oven to bake.
Millie cleaned up and took care with the frot,
carefully carrying it back to its spot.
Page 9
A little while later the cookies came out,
Millie ran quickly and gave mum a shout.
But soon as mum gave the first cookie a bite,
"They're salty" she cried "They just do not taste right!"
Page 10
Millie was upset she'd spoilt her surprise,
All she'd wanted to do was to apologise.
"I'm sorry" sobbed Millie, "I swear to be good,
I'll listen from now on like good children should"
Mum gave her a hug and then all was forgotten.
Though Millie McSilly now listens more often!!!

Prose Version:

Page 1
One cold and miserable wet day, Millie McSilly couldn't go out to play.
Her mummy suggested she wait for the sun, "No that won't be fun" Millie replied.
"Alright" her mum said "I think we should bake, In the time that will take the rain might have stopped".
Page 2
"YAY!! there is no better time," Millie cried, "we can use my new Jine to bake with its so good."
"Its too high you'll fall! Millie wait!" cried mummy, but Millie just ignored her dear mothers call.
To reach the right shelf she stood on a chair. "I'll get it myself, I'm 4 now" She whispered.
She took a big jump and stretched out her arm but missed it and with a bump fell to the floor.
Page 3
"Are you OK?!" her mother came running. "You really must listen to things that I say."

"I swear to be good" said Millie.
"I'll listen from now on like good children should, I'm sorry"
So mummy reached up and passed Millie the jine. "Just listen then things will be fine in future."
Page 4
While mummy went looking for her pans and pots, Millie was lost in a whole world of plans.
As she thought through the options she played with the frot "That's the best one I've got" warned mum. "Don't do that."
But Millie did not hear what her mum said, for in her head, there were just cookie ideas!
Page 5
Spin-whirl-spin! Millie went with the frot,
She spun it so fast that before she could stop it and leave it to stand, it got very hot and broke in her hand in two pieces!
"Oh Millie, all day you haven't been listening! It has to be thrown away, my very best one."
"I swear to be good" sobbed Millie,
"I'll listen from now on like good children should, I'm sorry."
Page 6
Millie felt bad later that day because she had made her mummy feel sad.
She went to her daddy to ask if he knew of any nice things she could do for her mum.
'The great cookie plan' daddy came up with; he went off to find the pan, jine and frot.
Page 7
Millie got out the bowl and other things too, "I'm four now, I know what to do" she whispered.
Dad was taking too long and so Millie began, she was sure her cookies would be fine!
She started to mix everything with the jine, Millie didn't notice she had salt in her hand!
Page 8
Her daddy came back but the cookies were done! Millie had so much fun and was happy.
"You made them without me," Her dad sounded mad. "It is bad not to listening! Didn't you know?"
Not knowing about Millie's salty mistake they popped the cookies to bake in the oven.
Millie cleaned up and took care with the frot, carrying it back to its spot carefully.
Page 9
The cookies came out a little while later, Millie ran quickly and gave mum a shout.
But soon as mum gave the first cookie a bite, "These just do not taste right" she cried "they're salty!!"
Page 10
Millie spoilt her surprise. All she'd wanted to do was apologise, as she was so upset.
"I swear to be good" sobbed Millie,

“Like good children should I’ll listen from now on, I’m sorry,.”
All was forgotten and mum gave her a hug. Though she listens more often now, does Millie McSilly!!!

Discussion

The empirical research in this thesis has enabled me to discover simple techniques that benefit children's word learning. Specifically, Paper 1 demonstrates that repeatedly reading storybooks to children can significantly increase their vocabulary. Building on the findings from Paper 1, Paper 2 demonstrates how much further word learning could be supported if stories were read to children before naptime or bedtime. Paper 3 then examines how different types of books provide facilitation for children at different ages and - contrary to popular belief - shows that rhyme does not necessarily support word learning in young children. Critically, parents can easily employ these techniques: repeated readings (Williams, Horst, & Oakhill, 2011), reading before bedtime (Zurif & Horst, 2014), reading books that do not rhyme (Williams, Oakhill, & Horst, in preparation) until children have begun to read on their own.

Pre-school children benefit from hearing the same stories repeated (Paper 1). Pre-school children experience similar sleep-related memory consolidation benefits as adults (see Paper 2). Paper 2 extends the repeated reading paradigm from Paper 1 and replicates a word learning advantage after hearing the same stories, but demonstrates this was even stronger when combined with sleep. Critically, children who had heard different stories (same condition as the children who performed less well in Paper 1) before they napped, learnt new words just as well as the children who heard the same stories (same condition as the children who performed best in Paper 1) but did not nap. However, children who heard different stories and did not nap were unable to match the word learning of the other children in the study. The strong effects found for sleep consolidation in this study are particularly important as reading together before children sleep is an easy way of introducing them to storybooks.

Pre-school children learnt more new words from non-rhyme stories (Paper 3, Experiment 1). However, the opposite effect was found for novice readers who initially demonstrated greater word learning from reading storybooks that rhymed (Paper 3, Experiment 2). When early readers were tested a week later, those children who had heard the non-rhyme stories had consolidated their word learning more successfully. This provides further support for Hayes' et al., (1982; 1987) theory that children are processing the language of books at different levels, accounting for the different word learning ability demonstrated by children in different age groups. Hayes et al. (1982) argued that the rhyme produces transient memory traces impeding short-term memory for story retention, which means children that hear non-rhyme stories create a deeper sematic memory of the story and the novel words that they are exposed to. I was able to explore this theory and, importantly, found the benefits provided by rhyme are not sustained over time. By testing school children's retention a week later, I was able to see that the benefits found for the children in the rhyme condition are temporary. Children who heard non-rhyme stories demonstrated deeper consolidation of new words. These findings are important as children enter school with vastly different abilities and experiences. Some children have spent thousands of hours experiencing shared storybook reading and have had varied and rich oral language exposure. Other children, however, have spent very little time experiencing shared storybook reading and have limited sound and word knowledge (Coyne, Simmons, Kame'enui, & Stoolmiller, 2004). If we are able increase children's exposure to storybooks, we would be able to help children develop critical crucial vocabulary and word knowledge.

Themes

There are three major themes in this thesis: repetition, enjoyment and feasibility of methods.

Repetition. The empirical papers in this thesis all explore the effect of repetition on children's word learning. Global repetition is explored by repeating the storybooks (both in close succession and across days) and local repetition is explored by repeating sounds (e.g. fun/sun, day/play). Specifically, Paper 1 examines global repetition by investigating the advantage of hearing the same stories across several days. Similarly, Paper 2 examines global repetition by exploring how children can overcome the disadvantage of not hearing the same stories repeatedly if they hear stories before sleep. Finally, Paper 3 explores local repetition, that is repetition *within* the stories with word sounds repeating as rhymes or not repeating in the non-rhyme control condition.

Both global and local repetition aid word learning by making the task of learning from shared storybook reading more automated. Consequently, shared storybook reading necessitates fewer cognitive demands on the child, thus making storybook reading more enjoyable (Nathan & Stanovich, 1991) and promoting word learning (Horst, 2015). Specifically, story repetition enables word learning by increasing the familiarity of the story context until words are fully integrated into the internal lexicon (Horst, 2013). Each time a story is repeated, children have less information to encode, due to encoding that already occurred during previous exposures. For example, the first time *The Naughty Puppy* is read, children might realise that Rosie is at home with the puppy, on the second reading they may be aware of the rooms and furniture, on the third reading they might attend to the colours of clothes and furniture and the novel names of the objects the puppy chews during the

night. Due to increasing familiarity to elements of the story, the cognitive resources needed to process the elements of the story are reduced on each reading as children become better able to predict what is coming next (Horst, 2015). Thus, repeated storybook exposure allows children to become more familiar with the new words they are hearing, form stronger memory representations of the new words' meanings and to focus on understanding the meaning of the story as a whole.

Perhaps counter-intuitively, local repetition, that is repeated exposure to the word sounds within books (i.e., rhymes), only benefits children once they begin to learn to read themselves. Global repetition of stories that contained local repetition (rhyme) reduced preschool children's ability to learn new words and impaired their ability to encode information into semantic memory. However, for school-aged children local repetition (rhyme) appears to help with immediate verbatim memory. Nevertheless, over time school-aged children experience greater semantic memory consolidation for learning when the stories are presented and repeated in non-rhyme format, that is with only global, not local, repetition.

According to dynamic systems theory, development involves many small changes over time (Elman, 2003, Thelen & Smith, 1994). In line with this theoretical perspective, the studies in this thesis demonstrate that a small change or manipulation to children's learning context (e.g., repeating a story, reading before naptime or reading a story that rhymes), can dramatically influence children's future behaviour—in this case performance on later tests of word learning. Moreover, word learning from shared storybook reading is the product of multiple, nested timescales. Specifically, whether a child performs well in-the-moment on a word learning trial is the product of what the child is currently viewing (e.g., do the test alternatives include both novel objects seen in the stories or only one of the novel objects? See Paper 2; is

the test with pictures or objects? See Paper 3) as well as what the child was recently exposed to (e.g., did the child hear the same story repeatedly or different stories? See Papers 1 and 2; did the child nap after hearing the stories? See Paper 2; did the story rhyme? See Paper 3).

Enjoyment. Being able to turn reading into a pleasurable experience is critical to children's ongoing relationship with literature (Arnold & Whitehurst, 1994; Baker, Scher, & Mackler, 1997). Throughout this thesis we see the importance of children enjoying books. Papers 2 and 3 demonstrate that children enjoy hearing the same stories repeatedly, which also helps them to learn words (see Papers 1-2). Thus, the findings from this thesis can serve as evidence-based guidance that repeated readings are highly beneficial to both children's word learning and reading enjoyment.

Why is enjoyment of reading important? Motivation is a key factor in learning to read (The Reading Agency, 2015). If children view reading as enjoyable, they will want to read more often and therefore not create negative associations with reading. Thus providing a greater opportunity to increase domain knowledge through books (Baker, Scher, & Mackler, 1997). Reading for pleasure is strongly associated with better academic performance. In a longitudinal study which followed children from ages 5 to 16, reading for pleasure is more predictive for further cognitive development than their parents' level of education (Sullivan & Brown, 2013). Similarly, reading enjoyment can significantly compensate for low socioeconomic backgrounds (Campbell, Voelkl, & Donahue, 1997). The more children enjoy reading, the more opportunities they can create for self-guided learning experiences, which can equate to several years of formal education (ESARD, 2012). Eight-to-eleven year olds, who enjoy reading, are four times more likely to read for fun than children who do not enjoy reading (Clark, 2014). Note, children report enjoying books that they chose

themselves the most (ESARD, 2012). When children enjoy reading they read more often, increasing exposure to all types of reading material (non-fiction, comics and magazines), and they will have a far greater exposure to a rich oral language experience (Lonigan, Burgess, & Anthony, 2000). In a recent study, Hutton, Horowitz-Kraus, Mendelsohn, DeWitt, and Holland (2015) measured brain activity through fMRI and found that children who enjoyed listening to stories at home with their parents showed increased activity in the left side of the brain: in the areas associated with processing semantic narrative and mental imagery.

For the children who do not enjoy reading the impact on their academic performance is considerable. Such children are ten times more likely to academically fall behind children who do enjoy reading (Clark, 2014). Worryingly, children from low SES backgrounds seem to enjoy reading less than more affluent children. Specifically, only 63% of children from low SES backgrounds claim to like reading, compared to 85% of higher SES children (Gleed, 2013). In general, the trends from students in OECD countries (e.g., UK and American children) show a decline for reading enjoyment from 2000 to 2009 (PISA, 2011). Currently, out of 65 countries, the UK ranks 47th and America ranks 57th for children's enjoyment of reading (PISA, 2011). This is especially troubling given the strong links between children reading for pleasure and their success in academic attainment (Campbell et al., 1997; Clark, 2014; ESARD, 2012; Sullivan & Brown, 2013).

By designing and introducing an age-appropriate enjoyment rating scale, I have been able to examine what children themselves like about reading (e.g., whether they enjoy having the same books read to them, whether they enjoy different stories, or whether they enjoy rhyme more than non-rhyme). These are important questions to be answered if we are going to enrich children's experience of reading by providing

the best possible support to develop their emergent literacy skills. Selecting the right type of book and reading it in the most beneficial manner, is important to building a positive relationship with reading that will have a positive impact on children's later academic development.

Feasibility. For literacy interventions, the home environment is best (Lonigan, Purpura, Wilson, Walker, & Clancy-Menchetti, 2013), with parents playing a pivotal role in shaping children's future (Field, 2010). Parents are best placed to know their children's individual differences and to be able to tailor their approaches prior to their children starting school (Lonigan et al., 2000). It is important to note, however, that supporting early literacy is not solely the responsibility of parents (Sullivan, Ketende, & Joshi, 2013). But if parents can be assisted to adopt good reading practices it would be highly beneficial for children's emerging literacy skills (Baker et al., 1997; Blanden, 2006).

A consistent theme throughout the empirical papers in this thesis is that simple adjustments to how we read can yield big differences for children. For example, Paper 1 demonstrated that by simply reading the same story repeatedly every other day—instead of always reading a different story—word learning can be aided. Paper 2 demonstrated that reading before naptime significantly increases word learning from storybooks. Paper 3 demonstrated how word learning is aided by avoiding storybooks that rhyme, until children are reading for themselves. Simply by employing similar methods to those I have used in this thesis, it is feasible that a significant impact can be made on children's emergent literacy Parents and nursery staff without any special training can simply reread non-rhyme stories before nap or sleep time to provide children with substantial vocabulary benefits (see Implications).

Why is Helping the Preschool Age Group so Important?

It is most important to improve the home environment before children start school, because the family is such a strong influence (Aikens & Barbarin, 2008; Field, 2010; Lonigan et al., 2000). Parents, home, childcare, neighbourhoods, and social experiences have a cumulative effect on preschool children's development (Brooks-Gunn, Duncan, Klebanov, & Sealand, 1993; Rimm-Kaufman & Pianta, 2000). Being a pre-reader is a vulnerable stage of development for children as they start to develop fundamental phonological language skills, as well as an increasing awareness of the alphabet and print knowledge. Developing alphabetic, print and phonological knowledge prior to commencing school means children are more likely to benefit from education (Lonigan, Farver, Nakamoto, & Eppe, 2013).

Parents have a significant influence on children's development, and positive parental interaction at this young age can have a widespread impact. When parents read aloud and take regular trips to the library with preschool children they make the experience of reading enjoyable. Children will be more likely to view books and libraries in a positive manner (Field, 2010). For children that use a library it can have a significant impact on their reading abilities: 64.5% of children who read above their expected level are regular library users, whereas in contrast, 63.3% of children who read below their expected level do not use the library (Clark & Hawkins, 2011).

Although there are multiple factors that cause problems for low income children, Aikens and Barbarin (2008) highlight that it is most important to improve the home environment prior to children entering kindergarten. This is due to family influence being strongly associated early on with young children's emergent literacy. However, after 3rd grade, the family environment becomes less important. The influence it has on helping to support or change a child's educational experience

reduces, which highlights that addressing differences before children reach school is the optimum time- particularly for age groups we know to be at risk (Coley, 2002).

And if we do not catch children before they start school? Once children start school, those with greater ability hone their skills rapidly, whilst those with lesser ability struggle with the pace of learning. The performance gap between children, which continues to grow over time, is known as the Matthew Effect (Neuman & Celano, 2001; Penno, Wilkinson, & Moore, 2002; Shaywitz et al., 1995). Children who have advanced skills at the age of 3 continue to do better throughout primary school. By the age of 5 years the gap between advanced and delayed children is 26 months, and by 11 years it has increased to 31 months (Kothari, Whitham, & Quinn, 2014).

Both American and British children entering school with inferior literacy abilities are placed into low ability groups (see e.g., Blanden, 2006), although, children of all abilities actually learn more in higher performance groups (see e.g., Stanovich, 1986)**.** In general, children with better abilities are more likely to have educated and involved parents and siblings, and participate in external activities (Vincent & Ball, 2007). All of which helps and supports children's abilities, which in turn increases the performance gap further.

In addition, children with poor literacy are more likely to exhibit disruptive behaviours in the classroom (Clark & Dugdale, 2008). This not only negatively impacts their education, but also impacts other children's education. In 2012, 70% of UK children expelled from school experienced difficulties in basic literacy (Clark & Dugdale, 2008; The Reading Agency, 2015). Children with poor literacy who leave school can struggle to find employment. Unemployment is a significant factor in crime-over 62% of young offenders are unemployed (Morrisroe, 2014). Moreover,

25% of young offenders have reading skills below those of the average 7-year-old, and 60% of people in prison struggle with basic literacy (Clark & Dugdale, 2008).

Long-term effects of poor literacy. Low literacy abilities continue to impact people's health even after they leave school, causing problems accessing healthcare in hospitals where they feel shame in admitting to illiteracy and lack the communication skills to effectively describe symptoms to doctors (Williams, Davis, Parker, & Weiss, 2002) . There is reluctance to admit they do not understand treatment and medications (Baker et al., 1996) and there can be an inability to access and act on proper health and nutritional advice, which places greater strain on the health service (Cho, Lee, Arozullah, & Crittenden, 2008). Strong links between low literacy and health has drawn the attention of policy makers (Nutbeam, 2008).

Poor literacy skills also have a considerable impact on the economy. The UK government's Skills for Life survey shows that 24% of people not working are not functionally literate. The cost to the UK economy by 2025 is estimated to be 2% of GDP - approximately 32.1 billion pounds (Warren & Paxton, 2014). Employment suffers as 3-in-10 job vacancies in the UK cannot be filled due to the job requiring good written, language and numeracy skills (Morrisroe, 2014). Three-quarters of adults who are not functionally literate are either unemployed or in the bottom 40th percentile of earners (Kirsch, de Jong, Lafontaine, McQueen, & Mendelovits, 2000). This in turn increases the amount of people making welfare, benefit and tax credit claims. Poor literacy is becoming a major factor holding back the UK's economic recovery, both for its productivity crisis and as a drain on taxpayer's money (Kothari et al., 2014; Morrisroe, 2014).

Early interventions. Given the immense impact that poor literacy has on the economy, several extensive intervention programmes have been implemented by

different governments. Among these interventions the Millennium Cohort Study focuses on encouraging parents to help children learn rhymes and songs, visit libraries with their children and to make reading stories part of their daily bedtime routine. This British study also found that children who were read to daily were 2.4 months ahead of children who were not read to daily in communication, language and literacy. Other programmes focus on providing books to families (BookTrust, FirstBook), and helping teachers and educators (Head Start, Reading First). An independent review on poverty and life chances for children was commissioned by the UK government in 2010 (Field, 2010). The review's aim was to identify what action was needed to stop poor children becoming poor adults, to reduce poverty and to increase life chances. Field's (2010) report highlighted that, although the government is investing in different professional programmes, these are widely variable and not always successful. The report recommended that emphasis be placed upon helping parents and improving the home learning environment, as this would have greatest effect because the home learning environment is central to child development.

Among the interventions to encourage parents, the Millennium Cohort Study identifies measures for a home learning environment for children aged 3 years old. It encourages parents to read, go to the library, help children learn the alphabet, incorporate counting, sing songs and rhymes - along with painting and drawing, in order to bridge the huge gap between the lowest income and all other children (Field, 2010).

Intervention programmes also focus on providing books. For example, BookTrust is a non-profit organization working to change lives for the better by supporting emerging literacy and encouraging children and families to read. It is the

largest reading charity in the UK (Field, 2010), distributing over 2 million books last year, with a mission to ensure that every parent receives a free book during their baby's first 6 months. Similarly, First Book - founded in 1992- is a social enterprise scheme in the US and Canada, which provides books to socially disadvantage children (First Book, 2015). To date, the scheme has distributed over 130 million free or heavily subsidised books to parents and teachers (BookTrust, 2015). BookStart Corner is a programme run by BookTrust - which works with low-income families visiting them to engage in reading together. BookStart Corner can reach up to 75,000 1-2-year-olds each year, increasing parental confidence and reading (Demack & Stevens, 2013). The BookStart campaign was started in the UK and is now employed in many other countries. Such campaigns help parents of highly reactive children (at risk of language delays) to support shared storybook reading, allowing them to catch up with their peers in terms of language acquisition (van den Berg & Bus, 2014).

Finally, there have been several intervention programmes that focus on assisting teachers and education centres. For example, the Early Reading First programme, implemented by the US Department of Education for the professional development of preschool teachers, focused on improving the quality of preschool classrooms to support language and literacy (Wilson, Dickinson, & Rowe, 2013). Classrooms standards are very important. In higher quality classrooms children from high and low socioeconomic backgrounds performed equally well (Bryant, Burchinal, Lau, & Sparling, 1994) . Additionally, better standards of teaching and child happiness in the high quality classrooms increase children's attention and motivation, in turn increasing the programme's efficacy.

Which Interventions Are Best?

Dialogical reading techniques. First developed by Whitehurst et al. (1988) to enhance the storybook experience, dialogic reading is a technique where the reader first asks low-level open-ended questions about the story and pictures in the book. The adult, who is traditionally the storyteller, switches and the child becomes the storyteller using questions, prompts and feedback. Questions become increasingly sophisticated and more inferential in an attempt to encourage the child, as the story narrator, to increase his/her engagement and vocabulary. This technique is most effective for developing expressive language (Blewitt, Rump, Shealy, & Cook, 2009). Dialogic interventions are more effective in one-to-one situations and less effective in larger groups where it is harder to control children, their interactions and their questions. This makes dialogical reading ideal for storybook reading at home where parents can create a more tailored approach for children's individual needs (Whitehurst et al., 1994).

Mol, Bus, de Jong, and Sweets (2008) conducted a meta-analysis to examine the usefulness of dialogic reading techniques to increase vocabulary and strengthen storybook reading experiences. They found that, although dialogic reading did increase expressive vocabulary by stimulating active verbal interactions, it benefitted younger more than older children. Children aged 4-5 years old did not demonstrate the same benefits as children aged 2-3 years old. This may in part be due to younger children needing parental involvement in reading, whereas older children are more adapted to reading alone with less support. Alternatively, it could be that the techniques taught are designed to elicit stimulation in younger children and may need adapting for the older age group who prefer to hear stories without so many interruptions and questions (Mol, Bus, de Jong, & Smeets, 2008; see also Towson,

2014 for dialogic techniques having the same impact as shared storybook reading)

Dialogic reading programmes have already been employed to teach reading techniques to parents of lower socioeconomic children (Huebner & Meltzoff, 2005; Whitehurst et al., 1994). Parents' confidence increases from being taught how to engage in reading and stimulating dialogue with their children; a less common activity in lower income families (Mol et al., 2008). Dialogic reading interventions also increase the literacy skills of lower income children (Swanson et al., 2011).

Read-a-louds. While all children benefit from being read to, this is especially true for low socioeconomic children, as evidenced by American studies (eg., Swanson et al., 2011). Although some read–a–loud programmes employ dialogic aspects, which are partly due to the difficulties in reading stories in isolation- shared storybook reading naturally invokes questions and exploration of the books providing additional unstructured benefits. Lonigan and Whitehurst (1998) found clear benefits for shared storybook reading over a 6-week period in an American cohort. School groups demonstrated the largest expressive vocabulary gains, that is, words produced. Home groups yielded the largest descriptive language gains, that is, describing common objects. This may be due to parents at home exploring the books more descriptively (dialogically).

In addition to shared storybook reading, repeating the same stories has a beneficial effect as observed with British preschool children (Horst, Parsons, & Bryan, 2011; Williams & Horst, 2014; Williams, Horst, & Oakhill, 2011), allowing them to attend to different aspects of the story on each reading. This repetition increases comprehension and the opportunity for word learning. A study with 5-to-8-year-old New Zealand children, demonstrated that repeated storybook reading increased incidental word learning, particularly when the reader explained the target

words in the story (Penno et al., 2002). To maximise benefit for children performing less well, parents should be encouraged to read 3-5 times a week, for a few minutes each day (Warren & Paxton, 2014). Horst and colleagues (2011; 2011) also demonstrated significant word learning benefits for shared storybook reading being read at these intervals among British preschool children. In addition, Williams and Horst (2014) demonstrated how reading stories to British preschool children before nap or bedtime allows children to consolidate new words in their memories more successfully than if they hear stories and do not sleep. This provides parents with an easy and accessible way to support children's vocabulary development and enjoyment of reading, by reading together before sleep.

Increased parental involvement. Positive engagement and interaction by parents or caregivers is a crucial contributing factor for children's varying levels of school readiness both in the United States (Lindsay, 2010) and in the UK (Kothari et al., 2014). Positive parenting can reduce the negative effects of wealth, class, education and social factors on children (Flouri & Buchanan, 2004; Morgan, Farkas, Hillemeier, & Maczuga, 2009; Sullivan et al., 2013). Parents are the biggest single factor in influencing children's development (Clark, Osborne., & Dugdale, 2009; Sullivan et al., 2013; The Reading Agency, 2015) and their interest can increase a child's chances of moving out of poverty by 25% (Blanden, 2006). Parents are four times more important than socio-economic factors (Feinstein & Symons, 1999) as parents are children's first teachers and early interventions are critical (Reese, Sparks, & Leyva, 2010). Parents are children's biggest role models; primary school children reported that their mothers (84.9%) and their fathers (75%) most inspires them to read, (Clark et al., 2009). It is important that parents take full advantage of their powerful position in children's lives early because, by the time children reach

secondary school, parental influence falls. Only 65% of secondary school children report that their mothers, and 55.6% their father inspires them to read (Clark et al., 2009). Note, the same general findings on the role of parental influence and class differences have been observed in both the US (e.g., Morgan et al., 2009; Reese et al., 2010) and the UK (Blanden, 2006; Clark et al., 2009; Feinstein & Symons, 1999; Flouri & Buchanan, 2004).

Low socioeconomic British children, whose parents are interested in their education and had been read to from the age of 5, were less likely to be living in poverty at the age of 30 (Blanden, 2006; Sullivan et al., 2013) when compared to low socioeconomic children whose parents were not involved and did not read. American children whose parents believe that reading is entertaining, rather than focusing on the literacy benefits, have a more positive perception of reading and are less likely to view reading as 'work' (Baker et al., 1997). Whilst it is important that parents gain access to books, it is vital that parents are educated to enable them to best support their children's literacy needs.

A clinical intervention by American paediatricians to provide books to 'at risk' children and parents during regular check-up visits, found that providing the books made parents four times more likely to read with their children. This also increased children's exposure to books (Needlman, Fried, Morley, Taylor, & Zuckerman, 1991). Interestingly, parental interaction is more important than the type of books being read; Israeli children perform better on reading measures *with* parent instruction, than they do when reading traditional or e-books without parents (Segal-Drori, Korat, Shamir, & Klein, 2010). A UK government report which investigated how to help children out of poverty, found the success of parents helping young

children academically has an impact on the prosperity of the whole country (Field, 2010).

Although it is clear that children benefit from multiple classroom-based, teacher-directed and home interventions once they start attending kindergarten, there are long periods when children are out of school and at home with their parents, especially over the summer months (Kim & Quinn, 2013; Neuman & Celano, 2001). Thus, the home learning environment is very important for developing cognitive functions and oral language skills. Middle-class children often continue to have a strong home learning environment during the summer, whereas the majority of low socioeconomic children do not For example, British middle-class children are more likely to continue to have extra-curricular enrichment and sporting classes during the summer (Vincent & Ball, 2007). It is during these periods that they are most vulnerable to falling behind their peers (Kim & Quinn, 2013).

Perhaps counter intuitively, there is no evidence of synergistic effects when interventions are combined. In fact, concentrating on one available technique may even be best (e.g. educating a parent to spend time in shared storybook reading daily). Shared storybook reading naturally encourages parents to seek books, and trips to the library help expose children to wider literature and reading opportunities (Arterberry, Bornstein, Midgett, Putnick, & Bornstein, 2007; Lonigan, Purpura, et al., 2013). Studies by Horst and colleagues (2011; in preparation; 2014) are important as they tap into freely available resources and possibly already established routines. Not all children from disadvantaged backgrounds have access to intervention programmes and to Children's Centres (Field, 2010), but we can encourage shared storybook reading, repeating stories and varying types of books, especially at bedtime. This can lead to children increasing their vocabulary and comprehension for just a small

amount of time (10-20mins), 3 days a week. Early intervention is a key factor, if young children are going to gain the skills that are critical to develop a high standard of literacy, subsequently impacting the rest of their lives.

Recommendations for Parents

Overall, the literature indicated several evidence-based recommendations for parents and children's carers. For example, reading together every day, or as often as possible (Warren & Paxton, 2014) and visit the local library (Arterberry et al., 2007). Include storybooks as part of the bedtime and naptime routine (Williams & Horst, 2014). Read the same stories repeatedly (Horst et al., 2011; McLeod & McDade, 2011; Sénéchal, 1997; Zurif & Horst, 2014) but do not exclusively read stories that rhyme (Hayes, 1999; Hayes et al., 1982). Point to pictures and ask your child questions as you read (Ard & Beverly, 2004). Read stories your child enjoys (Sullivan & Brown, 2013) and allow your child to observe you enjoying reading. Finally, bear in mind that reading extends beyond books: read signs, magazines, menus, etc.

Possible Limitations

Studies on word learning from storybooks can suffer from the Hawthorne Effect (McCarney et al., 2007): participants work harder when they are being observed. This is a documented problem for studies that use dialogical reading techniques (e.g. Lonigan, Purpura, et al., 2013; Whitehurst et al., 1988). Specifically, when some children experience a structured (special) programme - where the children, parents or teachers receive training and facilitation - whilst the other children continue with their standard shared storybook reading at home or in school. However, any Hawthorne Effects present in my studies would have affected each condition similarly, because all of the children who participated in my research

experienced the same researcher facilitation across all conditions and the same overall amount of shared storybook reading.

Another possible limitation of the current studies is the sample population. Children were from predominantly middle-class backgrounds. The preschool samples (Papers 1 and 3) were recruited from our database of families interested in participating in language research and the nursery school (Paper 2) and primary school (Paper 3) samples were recruited from a mix of privately run schools and state schools in a relatively prosperous area of the UK (for a discussion about W.E.I.R.D. - white, educated, industrialised, rich, and democratic children - problems in testing, see Hu, 2014).

Moreover, it should be noted that when reading storybooks outside of the laboratory, in the home or a classroom setting, children will eventually reach a ceiling in terms of performance and learning all words from a given story. Thus, children will want (and need) to hear different storybooks, which should also be encouraged. The number of books at home (Neuman & Celano, 2001) and number of trips taken to the library (Formby, 2014) are also predictors of success in early literacy. Thus, outside of the lab, both reading the same and different storybooks should be encouraged.

Experimental Context

The studies in this thesis were conducted in several locations: homes (Paper 1), nurseries and preschools (Paper 2), the lab (Paper 3, Experiment 1) and schools (Paper 3, Experiment 2). By virtue of conducting studies in children's daily environments (i.e., outside the lab) it was important to maintain ecological validity to children's everyday storybook experiences.

The nurseries and preschools I worked with required that I became familiar

with both the individual children and the setting's routines. In order to do this I 'worked' in each location for 2 weeks before commencing the study. Specifically, I wore the nursery or schools uniform and took part in activities as a regular nursery worker (e.g., assisting during playtime, lunchtimes, scheduled activities, story time), spending around 5 to 6 hours a day in each placement. In the primary schools I 'worked' as a classroom assistant for several days prior to conducting the study. In these cases, I took the role of reader during circle time in the school library. I would read storybooks and lead post story discussions with the children—an activity that took place 3 to 4 times each week. By 'working' in these settings I became a familiar person to the children and formed a greater awareness of their routines. Consequently, I was able to adjust aspects of the study to fit with nursery sleep routines and regular story activities (such as running the study in the school library where normal stories at school were read).

Importantly, having spent a week in several different nurseries it became clear to me on occasion that the children at a particular setting would not be able to take part for various methodological reasons. For example, in one nursery the children all napped at different times of the day. In another nursery, children only napped occasionally, not regularly, making it difficult to be able to place them in experimental conditions. These limitations would not have been apparent to me had I not spent time in the settings before conducting the study. For example, had I arrived and simply tested the children who the nurseries had selected in advance from questionnaires.

After the completion of the empirical testing, I stayed in the nurseries and schools to give all the children in the classes I had worked in a chance to 'participate.' Many of the children talked about how much fun they had playing games and winning

stickers, making it important that all children had the same opportunity to have fun and feel special by being selected to take part and to ensure no residual disruption to the nurseries and schools post testing.

Implications

My research has enabled me to discover simple techniques to increase child word learning that parents can easily employ with very little training: re-reading storybooks, reading stories together before nap or bedtime, and reading stories that do not rhyme, as well as stories that rhyme. Parents have a vital role in helping children achieve academic success (Field, 2010) and to make a significant difference to their future, and need to be equipped with the skills and confidence to do this. Fostering children's enjoyment of reading, by employing feasible techniques, will help increase their vocabulary at a critical age of development. This may even help to ameliorate the Matthew Effect found in at risk children's emergent literacy prior to them starting school.

The main findings from the empirical papers in this thesis support and build upon previous literature, which has demonstrated similar patterns in word learning: reading to children is critically important (e.g., Horst, 2013; Horst et al., 2011; McLeod & McDade, 2011), reading the same books helps expressive and receptive vocabulary (e.g., Bowyer-Crane et al., 2008; Cornell & Sénéchal, 1993; Sénéchal, 1997), sleep helps adults learn (e.g., Diekelmann & Born, 2010; Gais, Lucas, & Born, 2006; Stickgold, 2005) and important phonological skills are gained from rhyme (e.g., Calvert & Billingsley, 1998; Hayes, 1999; Hayes et al., 1982) .

The findings from Paper 1 support and develop Horst's (2013) theoretical account that the repetition of stories provides children with more opportunities to

encode, thus reducing the cognitive demands of word learning. This is similar to how contextual information is learnt implicitly, making recall more efficient in adults (Chun & Jiang, 1998). Paper 1 tests this theoretical account by replicating the repeated stories paradigm, specifically, by intermittently repeating the same stories and demonstrating that children benefit from repeated readings even over longer time. In Paper 2, the theoretical explanation is further tested by using the repeated readings paradigm to understand children's sleep-related memory consolidation.

Paper 3 further explores another theoretical account (Hayes et al., 1982) that attempts to explain why preschool and school-age children learn words at different rates after hearing books in non-rhyme and rhyme format. Specifically, hearing non-rhyme books lead to better word learning for preschool children, which supports Hayes et al.,'s (1982) theory that informant presented in rhyme is processed at a shallower level than semantic information. Interestingly, the theory is further tested by also examining children's retention of newly learned words one week later. In the immediate word learning tests, novice readers hearing the rhyme story demonstrated greater word learning than the children hearing non-rhyme, but after a week the effects had reversed; children who heard the non-rhyme story demonstrated better consolidation for the new words. This suggests, again, that information presented through rhyme is processed at a shallower level than information presented through non-rhyme and memory consolidation for the information is not demonstrated.

The empirical work in this thesis controls for differences in the storybooks, dialogic reading techniques and overall storybook and word exposure. Specifically, I extended a more challenging repetition of books for preschool children (Paper 1), examined sleep effects in preschool children using matching sleep-wake patterns (Paper 2) and explored the retention effects of rhyme—using the same storybook text

across condition (Paper 3). This is unique in Papers 2 and 3 within current research. Thus, we can be certain that the word learning demonstrated in these thesis studies is due to children's relationship with shared reading and the storybooks themselves, not as a priori factor. The applied significance of this research is substantial.

Future Studies

Children's experiences and access to books is a key difference between socioeconomic groups (for a review see Neuman & Celano, 2001). Middle-class children in the UK and America can accumulate 1,000-1,700 hours of shared storybook reading each year, whereas children from lower socioeconomic backgrounds can accumulate a mere 25 hours each year—which is only 2% of the time that their peers are receiving (Coley, 2002). Similarly, American middle-class children have much greater access to books (13 books per child), whereas there can be as few as 1 book per 300 low income children (Neuman & Celano, 2001). Hours spent having shared storybook reading (e.g. when an adult reads to a child) is critical to helping children become literate—especially exposure to alphabet books which help children to learn the basics of phonetic sounds and print knowledge. However, Lonigan and Whitehurst (1998) found that only 3% of high socioeconomic families, compared with 47% of children from lower socioeconomic families, did not own any alphabet books (see also Aikens & Barbarin, 2008). Socioeconomic status (SES) is strongly related to academic success and is one of the biggest predictors of academic achievement (e.g. Duncan et al., 2007; Field, 2010; Lonigan, Farver, et al., 2013; Lonigan & Whitehurst, 1998; Neuman & Celano, 2001)

Conclusions

This thesis provides strong empirical support that shared storybook reading during the pre-school years contributes significantly to children's vocabulary development. It is vital we understand and isolate the factors involved in emergent literacy due to the immense practical implications of language and literacy, for both the individual and society. Through examining children's storybook learning we are able to support claims that children's vocabulary gains are stable over time (e.g Elley, 1989; Sénéchal & Cornell, 1993; Wilkinson & Houston-Price, 2013). Word learning from storybooks is not transient; children are able, through repeated implicit exposure to new words, to encode and consolidate them into their memory.

Much of my work is ecologically valid, moving from the lab to children's homes (Paper 1), childcare settings (Paper 2) and schools (Paper 3). I have been able to obtain the same effects in these familiar dynamic and socially rich environments - not in the isolation of the laboratory. I have gained unique insight into what children enjoy about – and how they enjoy - shared storybook reading (Papers 2 and 3). These experiments provide compelling evidence that small changes when reading to children can make a significant difference in their word learning from shared storybook reading. Many interventions need specialised materials and instruction (Kim & Quinn, 2013), along with a wide access to books, increased exposure to print and motivation to read at home. In contrast, the measures identified throughout this thesis require little (e.g., free books from the library, BookTrust, Book First and Freecycle organisations, or inexpensive books from charity shops). A combination of repeatedly reading storybooks- especially at sleep time - with both non-rhyme and rhyme books, is an inexpensive (both in time and monetary terms) and powerful way to make a major difference in the lives of pre-school children.

“There are perhaps no days of our childhood we lived so fully as those we spent with a favourite book.”
(Proust, 1871-1922)

References

Aikens, N. L., & Barbarin, O. (2008). Socioeconomic Differences in Reading Trajectories: The Contribution of Family, Neighborhood, and School Contexts. *Journal of Educational Psychology, 100*(2), 235. doi:10.1037/0022-0663.100.2.235

Ard, L. M., & Beverly, B. L. (2004). Preschool Word Learning During Joint Book Reading: Effect of Adult Questions and Comments. *Communication Disorders Quarterly, 26*(1), 17-28. doi:10.1177/15257401040260010101

Arnold, D. S., & Whitehurst, G. J. (1994). *Accelerating Language Development Through Picture Book Reading: A Summary of Dialogic Reading and its Effect*. Malden: Blackwell Publishing.

Arterberry, M. E., Bornstein, M. H., Midgett, C., Putnick, D. L., & Bornstein, M. H. (2007). Early Attention and Literacy Experiences Predict Adaptive Communication. *First Language, 27*(2), 175-189. doi:10.1177/0142723706075784

Baker, D. W., Parker, R. M., Williams, M. V., Pitkin, K., Parikh, N. S., Coates, W., & Imara, M. (1996). The Health Care Experience of Patients with Low Literacy. *Archives of Family Medicine, 5*(6), 329.

Baker, L., Scher, D., & Mackler, K. (1997). Home and Family Influences on Motivations for Reading. *Educational psychologist, 32*(2), 69-82. doi:10.1207/s15326985ep3202_2

Blanden, J. (2006). *'Bucking The Trend': What Enables Those who are Disadvantaged in Childhood to Succeed Later in Life?* (13 978 1 84712 017 5). Retrieved from Department for Work and Pensions:

Blewitt, P., Rump, K. M., Shealy, S. E., & Cook, S. A. (2009). Shared Book Reading: When and How Questions Affect Young Children's Word Learning. *Journal of Educational Psychology, 101*(2), 294-304. doi:10.1037/a0013844

BookTrust. (2015). About Us. Book Trust Transforms Lives by Getting Children and Families Reading. Retrieved from http://www.booktrust.org.uk/about-us/

Bowyer‐Crane, C., Snowling, M. J., Duff, F. J., Fieldsend, E., Carroll, J. M., Miles, J., . . . Hulme, C. (2008). Improving Early Language and Literacy Skills: Differential Effects of an Oral Language Versus a Phonology with Reading Intervention. *Journal of Child Psychology and Psychiatry, 49*(4), 422-432. doi:10.1111/j.1469-7610.2007.01849.x

Brooks-Gunn, J., Duncan, G. J., Klebanov, P. K., & Sealand, N. (1993). Do Neighborhoods Influence Child and Adolescent Development? *American Journal of Sociology, 99*(2), 353-395. doi:10.2307/2781682

Bryant, D. M., Burchinal, M., Lau, L. B., & Sparling, J. J. (1994). Family and Classroom Correlates of Head Start Children's Developmental Outcomes. *Early Childhood Research Quarterly, 9*(3–4), 289-309. doi:10.1016/0885-2006(94)90011-6

Calvert, S. L., & Billingsley, R. L. (1998). Young Children's Recitation and Comprehension of Information Presented by Songs. *Journal of Applied Developmental Psychology, 19*(1), 97-108. doi:10.1016/S0193-3973(99)80030-6

Campbell, J. R., Voelkl, K. E., & Donahue, P. L. (1997). *NAEP 1996 Trends in Academic Progress. Achievement of US Students in Science, 1969 to 1996; Mathematics, 1973 to 1996; Reading, 1971 to 1996; Writing, 1984 to 1996*. Retrieved from Office of Educational Research and Improvement, U.S.

Department of Education, 555 New Jersey Avenue, N.W., Washington, DC 20208-5641: http://www.ed.gov/NCES/naep

Cho, Y. I., Lee, S.-Y. D., Arozullah, A. M., & Crittenden, K. S. (2008). Effects of Health Literacy on Health Status and Health Service Utilization Amongst the Elderly. *Social Science & Medicine, 66*(8), 1809-1816. doi:10.1016/j.socscimed.2008.01.003

Chun, M. M., & Jiang, Y. (1998). Contextual Cueing: Implicit Learning and Memory of Visual Context Guides Spatial Attention. *Cognitive Psychology, 36*(1), 28-71. doi:10.1006/cogp.1998.0681

Clark, C. (2014). *The Reading Lives of 8 to 11-year-olds 2005 – 2013. An Evidence Paper for the Read On. Get On. coalition*. Retrieved from http://www.literacytrust.org.uk/assets/0002/3683/STC-Reading_8_to_11.pdf

Clark, C., & Dugdale, G. (2008). *Literacy Changes Lives. The role of Literacy in Offending Behaviour*. Retrieved from http://www.literacytrust.org.uk/assets/0000/0422/Literacy_changes_lives__prisons.pdf

Clark, C., & Hawkins, L. (2011). Public Libraries and Literacy: Young People's Reading Habits and Attitudes to Public Libraries, and an Exploration of the Relationship between Public Library Use and School Attainment. *National Literacy Trust*.

Clark, C., Osborne., S., & Dugdale, G. (2009). *Reaching Out with Role Models. Role Models and Young People's Reading*. Retrieved from National Literacy Trust: http://www.literacytrust.org.uk/assets/0000/0403/Role_models_2009.pdf

Coley, R. J. (2002). *An Uneven Start: Indicators of Inequality in School Readiness. Policy Information Report*. Retrieved from http://eric.ed.gov/?id=ED466473

Cornell, E. H., & Sénéchal, M. (1993). Vocabulary Acquisition Through Shared Reading Experiences. *Reading Research Quarterly, 28*(4), 360-374. doi:10.2307/747933

Coyne, M. D., Simmons, D. C., Kame'enui, E. J., & Stoolmiller, M. (2004). Teaching Vocabulary During Shared Storybook Readings: An Examination of Differential Effects. *Exceptionality, 12*(3), 145-162. doi:10.1207/s15327035ex1203_3

Demack, S., & Stevens, A. (2013). *Evaluation of Bookstart England: Bookstart Corner*. Retrieved from OBJOBJSheffield Hallam University. Centre for Education and Inclusion Research: http://booktrustadmin.artlogic.net/usr/resources/1133/bookstart-corner-final-report-full-version-with-appendices.pdf

Diekelmann, S., & Born, J. (2010). The Memory Function of Sleep. *Nature Reviews Neuroscience, 11*(2), 114-126. doi:10.1038/nrn2762

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*(6), 1428-1446. doi:10.1037/0012-1649.43.6.1428

Elley, W. B. (1989). Vocabulary Acquisition from Listening to Stories. *Reading Research Quarterly, 24*(2), 174-187. doi:10.2307/747863

ESARD, E. S. R. T. (2012). *Research Evidence on Reading for Pleasure: Research into How and Why Children Read for Pleasure and Evidence for how to Promote it.* (DFE-57519-2012). Retrieved from https://www.gov.uk/government/publications/research-evidence-on-reading-for-pleasure.

Feinstein, L., & Symons, J. (1999). Attainment in Secondary School. *Oxford Economic Papers, 51*(2), 300-321. doi:10.1093/oep/51.2.300

Field, F. (2010). *The Foundation Years: Preventing Poor Children Becoming Poor Adults: The Report of the Independent Review on Poverty and Life Chances*: The Stationery Office.

First Book. (2015). First Book. Access to New Books for Children in Need. Retrieved from http://www.firstbook.org/

Flouri, E., & Buchanan, A. (2004). Early Father's and Mother's Involvement and Child's Later Educational Outcomes. *British Journal of Educational Psychology, 74*(2), 141-153. doi:10.1348/000709904773839806

Formby, S. (2014). *Children's Early Literacy Practices at Home and in Early Years Settings: Second Annual Survey of Parents and Practitioners*. Retrieved from London: http://www.literacytrust.org.uk/assets/0002/4082/EY_Final_report_2014.pdf

Gais, S., Lucas, B., & Born, J. (2006). Sleep After Learning Aids Memory Recall. *Learning & Memory, 13*(3), 259-262. doi:10.1101/lm.132106

Gleed, A. (2013). *Booktrust Reading Habits Survey 2013. A National Survey of Reading Habits and Attitudes to Books Amongst Adults in England*. Retrieved from http://www.booktrust.org.uk/usr/library/documents/main/1576-booktrust-reading-habits-report-final.pdf

Hayes, D. S. (1999). Young Children's Exposure to Rhyming and Nonrhyming Stories: A Structural Analysis of Recall. *The Journal of genetic psychology, 160*(3), 280-293. doi:10.1080/00221329909595399

Hayes, D. S., Chemelski, B. E., & Palmer, M. (1982). Nursery Rhymes and Prose Passages: Preschoolers' Liking and Short-Term Retention of Story Events. *Developmental Psychology, 18*(1), 4949-4956. doi:10.1037/0012-1649.18.1.49

Horst, J. S. (2013). Context and Repetition in Word Learning. *Frontiers in Psychology, 4*, 149. doi:10.3389/fpsyg.2013.00149

Horst, J. S. (2015). Word Learning Via Shared Storybook Reading. In B. Kümmerling-Meibauer, J. Meibauer, K. Nachtigäller, & K. Rohlfing (Eds.), *Learning from Picturebooks: Perspectives from Child Development and Literacy Studies* (pp. 181-193). New York: Routledge.

Horst, J. S., Parsons, K. L., & Bryan, N. M. (2011). Get the Story Straight: Contextual Repetition Promotes Word Learning from Storybooks. *Frontiers in Psychology, 2*, 17. doi:10.3389/fpsyg.2011.00017

Hu, J. C. (2014). *Developmental Psychology's Weird Problem*. Retrieved from Slate.com: http://www.slate.com/articles/health_and_science/science/2014/06/developmental_psychology_s_weird_problem_children_from_rich_educated_families.html

Huebner, C. E., & Meltzoff, A. N. (2005). Intervention to Change Parent–Child Reading Style: A Comparison of Instructional Methods. *Journal of Applied Developmental Psychology, 26*(3), 296-313. doi:10.1016/j.appdev.2005.02.006

Hutton, J. S., Horowitz-Kraus, T., Mendelsohn, A. L., DeWitt, T., & Holland, S. K. (2015). Home Reading Environment and Brain Activation in Preschool Children Listening to Stories. *Pediatrics, 136*(3), peds. 2015-0359. doi: 10.1542/peds.2015-0359

Johnson, J. L., & Hayes, D. S. (1987). Preschool children's retention of rhyming and nonrhyming text: paraphrase and rote recitation measures. *Journal of Applied*

Developmental Psychology, 8(3), 317-327. doi:10.1016/0193-3973(87)90007-4

Kim, J. S., & Quinn, D. M. (2013). The Effects of Summer Reading on Low-Income Children's Literacy Achievement From Kindergarten to Grade 8: A Meta-Analysis of Classroom and Home Interventions. *Review of Educational Research, 83*(3), 386-431. doi:10.3102/0034654313483906

Kirsch, I., de Jong, J., Lafontaine, D., McQueen, J., & Mendelovits, J. M., C. (2000). Reading for Change Performance and Engagement Across Countries Results from Pisa 2000. http://www.oecd.org/.

Kothari, P., Whitham, G., & Quinn, T. (2014). *A Fair Start for Every Child. Why we Must act now to Tackle Child Poverty in the UK*. Retrieved from http://www.savethechildren.org.uk/sites/default/files/images/A_Fair_Start_for_Every_Child.pdf

Lindsay, J. (2010). *Children's Access to Print Material and Education-Related Outcomes: Findings from a Meta-Analytic Review*: Learning Point Associates Naperville, IL.

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*(5), 596-613. doi:10.1037/0012-1649.36.5.596

Lonigan, C. J., Farver, J. M., Nakamoto, J., & Eppe, S. (2013). Developmental Trajectories of Preschool Early Literacy Skills: A Comparison of Language-Minoraity and Monolingual-English Children. *Developmental Psychology, 49*(10), 1943-1957. doi:10.1037/a0031408

Lonigan, C. J., Purpura, D. J., Wilson, S. B., Walker, P. M., & Clancy-Menchetti, J. (2013). Evaluating the Components of an Emergent Literacy Intervention for Preschool Children at Risk for Reading Difficulties. *Journal of Experimental Child Psychology, 114*(1), 111-130. doi:10.1016/j.jecp.2012.08.010

Lonigan, C. J., & Whitehurst, G. J. (1998). Relative Efficacy of Parent and Teacher Involvement in a Shared-Reading Intervention for Preschool Children from Low-Income Backgrounds. *Early Childhood Research Quarterly, 13*(2), 262-290. doi:10.1016/S0885-2006(99)80038-6

McCarney, R., Warner, J., Iliffe, S., van Haselen, R., Griffin, M., & Fisher, P. (2007). The Hawthorne Effect: A Randomised, Controlled Trial. *BMC Medical Research Methodology, 7*(1), 30. doi:10.1186/1471-2288-7-30

McLeod, A. N., & McDade, H. L. (2011). Preschoolers' Incidental Learning of Novel Words During Storybook Reading. *Communication Disorders Quarterly, 32*(4), 256-266. doi:10.1177/1525740109354777

Mol, S. E., Bus, A. G., de Jong, M. T., & Smeets, D. J. H. (2008). Added Value of Dialogic Parent–Child Book Readings: A Meta-Analysis. *Early Education and Development, 19*(1), 7-26. doi:10.1080/10409280701838603

Morgan, P. L., Farkas, G., Hillemeier, M. M., & Maczuga, S. (2009). Risk factors for Learning-Related Behavior Problems at 24 Months of age: Population-Based Estimates. *Journal of abnormal child psychology, 37*(3), 401-413. doi:10.1007/s10802-008-9279-8

Morrisroe, J. (2014). *Literacy Changes Lives 2014: A new Perspective on Health, Employment and Crime*. Retrieved from London: National Literacy Trust:

Nathan, R. G., & Stanovich, K. E. (1991). The Causes and Consequences of Differences in Reading Fluency. *Theory into practice, 30*(3), 176-184. doi:10.1080/00405849109543498

Needlman, R., Fried, L. E., Morley, D. S., Taylor, S., & Zuckerman, B. (1991). Clinic-based Intervention to Promote Literacy: A Pilot Study. *American Journal of Diseases of Children, 145*(8), 881-884. doi:10.1001/archpedi.1991.02160080059021

Neuman, S. B., & Celano, D. (2001). Access to Print in Low-Income and Middle-Income Communities: An Ecological Study of Four Neighborhoods. *Reading Research Quarterly, 36*(1), 8-26. doi:10.1598/rrq.36.1.1

Nutbeam, D. (2008). The Evolving Concept of Health Literacy. *Social Science & Medicine, 67*(12), 2072-2078. doi:10.1016/j.socscimed.2008.09.050

Penno, J. F., Wilkinson, I. A., & Moore, D. W. (2002). Vocabulary Acquisition from Teacher Explanation and Repeated Listening to Stories: Do they Overcome The Matthew Effect? *Journal of Educational Psychology, 94*(1), 23-33. doi:10.1037/0022-0663.94.1.23

PISA. (2011). *PISA in Focus. Do Students Today Read for Pleasure?* Retrieved from http://www.oecd.org/pisa/pisaproducts/pisainfocus/48624701.pdf

Reese, E., Sparks, A., & Leyva, D. (2010). A Review of Parent Interventions for Preschool Children's Language and Emergent Literacy. *Journal of Early Childhood Literacy, 10*(1), 97-117. doi:10.1177/1468798409356987

Rimm-Kaufman, S. E., & Pianta, R. C. (2000). An Ecological Perspective on the Transition to Kindergarten A Theoretical Framework to Guide Empirical Research. *Journal of Applied Developmental Psychology, 21*(5), 491-511. doi:10.1016/s0193-3973(00)00051-4

Segal-Drori, O., Korat, O., Shamir, A., & Klein, P. S. (2010). Reading Electronic and Printed Books With and Without Adult Instruction: Effects on Emergent Reading. *Reading and Writing, 23*(8), 913-930. doi:10.1007/s11145-009-9182-x

Sénéchal, M. (1997). The Differential Effect of Storybook Reading on Preschoolers' Acquisition of Expressive and Receptive Vocabulary. *Journal of Child Language, 24*(01), 123-138. doi:10.1017/S0305000996003005

Sénéchal, M., & Cornell, E. H. (1993). Vocabulary Acquisition Through Shared Reading Experiences. *Reading Research Quarterly, 28*(4), 360-374. doi:10.2307/747933

Shaywitz, B. A., Holford, T. R., Holahan, J. M., Fletcher, J. M., Stuebing, K. K., Francis, D. J., & Shaywitz, S. E. (1995). A Matthew Effect for IQ but Not for Reading: Results from a Longitudinal Study. *Reading Research Quarterly, 30*(4), 894-906. doi:10.2307/748203

Stanovich, K. E. (1986). Matthew Effects in Reading: Some Consequences of Individual differences in the Acquisition of Literacy. *Reading Research Quarterly*, 360-407.

Stickgold, R. (2005). Sleep-dependent Memory Consolidation. *Nature, 437*(7063), 1272-1278. doi:10.1038/nature04286

Sullivan, A., & Brown, M. (2013). Social Inequalities in Cognitive Scores at age 16: The Role of Reading. *CLS Working Papers, 2013*.

Sullivan, A., Ketende, S., & Joshi, H. (2013). Social Class and Inequalities in Early Cognitive Scores. *Sociology, 47*(6), 1187-1206. doi:10.1177/0038038512461861

Swanson, E., Wanzek, J., Petscher, Y., Vaughn, S., Heckert, J., Cavanaugh, C., . . . Tackett, K. (2011). A synthesis of read-aloud interventions on early reading outcomes among preschool through third graders at risk for reading

difficulties. *Journal of Learning Disabilities, 44*(3), 258-275. doi:10.1177/0022219410378444

The Reading Agency. (2015). Reading Facts. Retrieved from http://readingagency.org.uk/news/reading-facts003/

Towson, J. A. (2014). Training Head Start Parents in Dialogic Reading to Improve Outcomes for Children. *International Journal of Child Health and Human Development, 7*(3), 287.

van den Berg, H., & Bus, A. G. (2014). Beneficial Effects of BookStart in Temperamentally Highly Reactive Infants. *Learning and Individual Differences, 36*, 69-75. doi:http://dx.doi.org/10.1016/j.lindif.2014.10.008

Vincent, C., & Ball, S. J. (2007). `Making Up' the Middle-Class Child: Families, Activities and Class Dispositions. *Sociology, 41*(6), 1061-1077. doi:10.1177/0038038507082315

Warren, H., & Paxton, W. (2014). *Read on Get On. How Reading Can Help Children Escape Poverty*. Retrieved from Save the Children on behalf of the Read On. Get On. campaign: http://www.savethechildren.org.uk/sites/default/files/images/Read_On_Get_On.pdf

Whitehurst, G. J., Arnold, D. S., Epstein, J. N., Angell, A. L., Smith, M., & Fischel, J. E. (1994). A Picture Book Reading Intervention in Day Care and Home for Children From Low-Income Families. *Developmental Psychology, 30*(5), 679-689. doi:10.1037/0012-1649.30.5.679

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. doi:10.1037/0012-1649.24.4.552

Wilkinson, K. S., & Houston-Price, C. (2013). Once upon a time, there was a pulchritudinous princess...: The role of Word Definitions and Multiple Story Contexts in Children's Learning of Difficult Vocabulary. *Applied Psycholinguistics, 34*(03), 591-613. doi:10.1017/S0142716411000889

Williams, M. V., Davis, T., Parker, R. M., & Weiss, B. D. (2002). The Role of Health Literacy in Patient-Physician Communication. *Family Medicine-Kansas City, 34*(5), 383-389.

Williams, S. E., Horst, J. S., & Oakhill, J. (2011). The Same Old Story: Contextual Cueing Facilitates Word Learning via Storybooks. *In Early shared book reading: what are the requirements for effective sessions? Symposium, British Psychological Society, Developmental Section Conference, Newcastle, UK.*

Williams, S. E., Oakhill, J., & Horst, J. S. (in preparation). Neither Rhyme nor Reason: Rhyming Children's Books Help Young Readers but not Preschoolers Learn Words *In Preparation*.

Wilson, S. J., Dickinson, D. K., & Rowe, D. W. (2013). Impact of an Early Reading First Program on the Language and Literacy Achievement of Children From Diverse Language Backgrounds. *Early Childhood Research Quarterly, 28*(3), 578-592. doi:10.1016/j.ecresq.2013.03.006

Zurif, E. B., & Horst, J. S. (2014). Goodnight Book: Sleep Consolidation Improves Word Learning via Storybooks. *Frontiers in Psychology, 5*, 184. doi:10.3389/fpsyg.2014.00184