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## Consolidating new words from repetitive versus multiple stories: Prior knowledge matters



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### ABSTRACT

Prior knowledge is proposed to support the consolidation of newly acquired material. The current study examined whether children with superior vocabulary knowledge show enhanced overnight consolidation, particularly when new words are encountered in varying stories. Children aged 10 and 11 years ( $N = 42$ ) were exposed to two sets of eight spoken novel words (e.g., “crocodol”), with one set embedded in the same story presented twice and the other presented in two different stories. Children with superior vocabulary knowledge showed larger overnight gains in explicit phonological and semantic knowledge when novel words had been encountered in multiple stories. However, when novel words had been encountered in repetitive stories, existing knowledge exerted no influence on the consolidation of explicit phonological knowledge and had a negative impact on the consolidation of semantic knowledge. One full day (24 h) after story exposure, only very weak evidence of lexical integration (i.e., slower animacy decisions toward the basewords [e.g., “crocodile”] than toward the control words) was observed for novel words learned via repetitive (but not multiple) stories. These data suggest that although the consolidation of explicit new word knowledge learned through multiple contexts is supported by prior knowledge, lexical integration might benefit more from repetition.

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## Introduction

Oral storytelling throughout childhood is important for socioemotional development (Baker, 2013) and confers significant educational advantages (Scarborough & Dobrich, 1994), particularly for literacy (Ardoin, Eckert, & Cole, 2008; Lonigan, Shanahan, & Cunningham, 2008; Whitehurst & Lonigan, 1998). However, the most commonly reported effect of early storybook exposure is on children's vocabulary knowledge (Farrant & Zubrick, 2013; Hammer, Farkas, & Maczuga, 2010; Hepburn, Egan, & Flynn, 2010; Sénéchal, 1997; Sénéchal, Pagan, Lever, & Ouellette, 2008). It has even been argued that rich home literacy experiences may mitigate the risk posed by low socioeconomic status for children's vocabulary development (Payne, Whitehurst, & Angell, 1994). Nonetheless, children's ability to garner new words from listening to stories is highly variable (Biemiller & Boote, 2006; Mol, Bus, & de Jong, 2009) and is associated with children's existing vocabulary knowledge (Henderson, Devine, Weighall, & Gaskell, 2015; Karweit & Wasik, 1996; Wilkinson & Houston-Price, 2013). For pedagogical reasons, it is important that we understand how best to use stories to promote vocabulary learning and examine how individual differences in the existing knowledge base may affect optimal conditions for word learning.

Studies of spoken word learning that use explicit training regimes have consistently demonstrated that word learning is a long-winded process both in developing and adult learners (see James, Gaskell, Weighall, & Henderson, 2017, for a review). A distinction has been made between "lexical configuration" (i.e., the rapid acquisition of explicit word knowledge, e.g., as measured by recall tasks) and "lexical engagement" (i.e., the slower emergence of a novel word becoming "integrated" and interacting with existing lexical knowledge) (Leach & Samuel, 2007). This protracted process can be explained by a complementary learning systems (CLS) account (Davis & Gaskell, 2009; McClelland, McNaughton, & O'Reilly, 1995), whereby initial exposure to novel words gives rise to sparse representations in the short-term hippocampal system, with consolidation required for a long-term representation to be strengthened in neocortical memory. Studies of children and adults have shown that novel word forms can be more accurately recalled and begin to compete for recognition with existing words after a period of offline consolidation (Brown, Weighall, Henderson, & Gaskell, 2012; Gaskell & Dumay, 2003; Henderson, Weighall, Brown, & Gaskell, 2013a) over and above the effects of repeat testing (Henderson, Weighall, & Gaskell, 2013b). Consistent with a substantial body of evidence suggesting an active role for sleep in supporting memory consolidation (see Spencer, Walker, & Stickgold, 2017, for a review), improvements in novel word knowledge are particularly apparent after sleep in adults (Dumay & Gaskell, 2007) and throughout childhood (Axelsson, Williams, & Horst, 2016; Gais, Lucas, & Born, 2006; Henderson, Weighall, Brown, & Gareth Gaskell, 2012; Huang et al., 2016; James et al., 2017). Furthermore, specific parameters of slow-wave sleep (e.g., slow oscillations <1 Hz and sleep spindles 12–15 Hz) are associated with overnight changes in lexical competition and explicit phonological memory for novel words in adults (Tamminen, Payne, Stickgold, Wamsley, & Gaskell, 2010; Weighall, Henderson, Barr, Cairney, & Gaskell, 2017) and children (Smith et al., *in press*). These electroencephalogram (EEG) events are temporally synchronized with hippocampal ripples (Staresina et al., 2015) and together have been proposed to coordinate the reactivation of newly learned information stored in hippocampal networks and its subsequent integration into neocortical systems (Rasch & Born, 2013).

Although the importance of offline consolidation is well established for phonological aspects of word learning, there is less consistency within the literature on semantic aspects of learning. For example, Henderson et al. (2013b) found overnight improvements in children's ability to recall definitions of previously unfamiliar science words. However, Weighall et al. (2017) reported no consolidation advantage for children's ability to make true/false judgments on newly learned novel word-object pairs, and Tamminen and Gaskell (2013) reported a decline in adults' ability to recall nonword meanings on the day after learning.

Offline consolidation also appears to support vocabulary learning when words are encountered incidentally via listening to stories. For example, Henderson et al. (2015) exposed children to novel competitor words (e.g., "daffodat" derived from "daffodil") that were embedded in a spoken fictional story. Consistent with the CLS account, children's ability to recall the phonological forms of the novel

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