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Contents lists available at ScienceDirect

Journal of Experimental Child Psychology

journal homepage: www.elsevier.com/locate/jecp



Enhanced semantic involvement during word recognition in children with dyslexia



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ARTICLE INFO

Article history:

Received 21 March 2018

Revised 12 September 2018

Keywords:

Semantic priming

Phonological priming

Individual differences

Reading

Dyslexia

Semantic compensation

ABSTRACT

We investigated whether children with dyslexia show enhanced semantic involvement as compensation for deficient phonological processing during reading. Phonological and semantic processing during reading and moderating effects of word frequency and word length in children with and without dyslexia were examined using a picture–word priming paradigm. Participants were 61 children with dyslexia and 50 typical readers in Grade 6 of primary school. Primes were either semantically or phonologically (shared onset and rime) related or unrelated to their target word. Results showed that priming effects were stronger in children with dyslexia than in typical readers in the semantic condition but did not differ between groups in the phonological condition. Overall, word length and word frequency effects were stronger for children with dyslexia than for typical readers, but word length and word frequency did not affect priming effects differently for the two groups. In both groups, only semantic priming effects were stronger for low-frequency longer words. Finally, individual word and pseudoword reading efficiency correlated with priming effects only in the semantic condition and only in children with dyslexia. It can be concluded that children with dyslexia, compared with typical readers, rely more on semantic information in word reading but do not show deficient phonological activation during reading compared with typical readers.

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Introduction

Single words can be read by translating graphemes into phonemes or by directly accessing meaning from the written form (see Coltheart, Rastle, Perry, Langdon, & Ziegler, 2001; Harm & Seidenberg, 2004; Plaut, McClelland, Seidenberg, & Patterson, 1996). Whereas beginning readers are assumed to read by serially translating graphemes into phonemes, more skilled readers can directly access whole-word meaning from their built-up orthographic lexicon (Ehri, 2005). Children with dyslexia have serious difficulties with forming detailed orthographic representations necessary for fluent reading (Share, 1995; Ziegler, Perry, Ma-Wyatt, Ladner, & Schulte-Körne, 2003). As a compensatory mechanism, they tend to rely more on semantic processing for reading than their typically reading peers (Hennessey, Deadman, & Williams, 2012; Nation & Snowling, 1998; Vellutino, Fletcher, Snowling, & Scanlon, 2004). That is, stronger influences of semantics on word reading can be expected in this group compared with typical readers (Plaut & Booth, 2000). Previous research has used word priming to study such effects, but the studies carried out so far have not addressed phonological and semantic effects on word reading processes independently from orthographic effects (see Sauval, Casalis, & Perre, 2017). Therefore, in the current study, we investigated semantic and phonological involvement in word reading in children with dyslexia and in typical readers in a picture–word priming paradigm.

Two influential frameworks modeling reading processes are the dual route cascaded model of reading aloud and the parallel distributed processing model. Within the DRC framework, word reading may involve a sublexical or lexical route (Coltheart et al., 2001). Via the sublexical route, graphemes are translated into phonemes according to orthography-specific grapheme-to-phoneme conversion rules. Via the lexical route, whole-word orthographic representations are directly accessed from the lexicon. Within the parallel distributed processing framework, three levels of representations are distinguished that interact during written word processing: orthographic, semantic, and phonological representations (Harm & Seidenberg, 2004; Plaut et al., 1996). Readers can access word meaning by orthography-to-phonology-to-semantic translations, or directly by orthography-to-semantic translations, without first making the translation from orthography to phonology. Both models predict that skilled readers will mostly rely on direct lexical or orthography-to-semantic reading strategies. As reading becomes a more automatic process and skilled readers rely more on direct lexical retrieval, the impact of phonological processing on reading decreases (Yap, Hutchison, & Tan, 2016; Ziegler et al., 2014). It has also been argued that when fast word reading via the lexical route is more difficult in, for instance, exception word reading, or when reading is more difficult due to underlying phonological problems as found in dyslexia, readers rely more on the direct lexical or orthography-to-semantic strategy (Betjemann & Keenan, 2008; Nobre & Salles, 2016).

A frequently used paradigm to examine word reading processes in both beginning and skilled readers is priming. Priming paradigms have been used extensively to measure how representations in the mental lexicon are activated and interact during reading (Shao & Meyer, 2017). Exposure to primes can either facilitate subsequent word reading, resulting in shorter response latencies from prime to target response, or have an inhibitory effect, resulting in longer response latencies from prime to target response, both compared with response latencies in a neutral condition (Plaut & Booth, 2000). Previous studies have found that semantically related word primes facilitate word reading or lexical decision in adults (Neely, 1991; Plaut & Booth, 2000; Yap et al., 2016). A prime (e.g., *cat*) activates related representations (e.g., *dog*) and, hence, facilitates reading of this latter semantically related target word. Next to word primes and written targets, cross-modal prime–target relations, such as picture–word priming, have been investigated. In this case, the advantage of a picture prime is that no orthographic processing of the prime is required. Although cross-modal priming effects were smaller than same-modality priming effects, semantically related picture primes have been found to facilitate subsequent word reading in adult readers (Carr, McCauley, Sperber, & Parmelee, 1982). These previous studies with adults including written word or picture primes provided evidence that semantic information is activated during single word reading, as is predicted by both the dual route and parallel distributed processing models.

Phonological priming, such as priming of onsets, pseudohomophones, or rhymes, has been used in several studies to examine activation of phonological representations during reading (Castles, Davis,

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