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Word reading skill predicts anticipation of upcoming spoken language input: A study of children developing proficiency in reading

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ABSTRACT

Despite the efficiency with which language users typically process spoken language, a growing body of research finds substantial individual differences in both the speed and accuracy of spoken language processing potentially attributable to participants' literacy skills. Against this background, the current study took a look at the role of word reading skill in listeners' anticipation of upcoming spoken language input in children at the cusp of learning to read; if reading skills affect predictive language processing, then children at this stage of literacy acquisition should be most susceptible to the effects of reading skills on spoken language processing. We tested 8-year-olds on their prediction of upcoming spoken language input in an eye-tracking task. Although children, like in previous studies to date, were successfully able to anticipate upcoming spoken language input, there was a strong positive correlation between children's word reading skills (but not their pseudo-word reading and meta-phonological awareness or their spoken word recognition skills) and their prediction skills. We suggest that these findings are most compatible with the notion that the process of learning orthographic representations during reading acquisition sharpens pre-existing lexical representations, which in turn also supports anticipation of upcoming spoken words.

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Introduction

The speed and accuracy of spoken language processing can be explained, at least in part, by the fact that mature (e.g., Altmann & Kamide, 1999; DeLong, Urbach, & Kutas, 2005; Federmeier & Kutas, 1999; Kamide, Altmann, & Haywood, 2003; Van Berkum, Brown, Zwitserlood, Kooijman, & Hagoort, 2005; Wicha, Moreno, & Kutas, 2004) and developing (e.g., Borovsky, Elman, & Fernald, 2012; Mani & Huettig, 2012; Nation, Marshall, & Altmann, 2003) language users are able to anticipate upcoming linguistic input based on constraints set by available visual and auditory information. For instance, on hearing the verb *eat* in a sentence such as "The boy eats the big cake," listeners anticipate that the direct object is likely to be something edible and use this to fixate an image of an edible object such as cake in preference over an inedible object. Despite the evidence in favor of such efficient language processing across a variety of populations (toddlers, children, and adults), a growing body of research finds substantial individual differences in both the speed and accuracy of spoken language processing potentially attributable to participants' literacy skills (e.g., Adrian, Alegria, & Morais, 1995; Huettig, Singh, & Mishra, 2011; Kosmidis, Tsapkini, Folia, Vlahou, & Kiosseoglou, 2004; Lukatela, Carello, Shankweiler, & Liberman, 1995; Mishra, Singh, Pandey, & Huettig, 2012; Morais, Cary, Alegria, & Bertelson, 1979; Petersson, Reis, Askelof, Castro-Caldas, & Ingvar, 2000; Reis & Castro-Caldas, 1997; Reis, Petersson, Castro-Caldes, & Ingvar, 2001; Serniclaes, Ventura, Morais, & Kolinsky, 2005; Silva, Faísca, Ingvar, Petersson, & Reis, 2012). The current study examined the contributions of two potential reasons for such an effect of literacy on spoken language processing: (a) increased granularity of phonological processing through learning to decode an orthographic code and (b) sharpening of pre-existing lexical representations through acquisition of orthographic representations for words. Against this background, the study took a renewed look at the role of reading skill in listeners' anticipation of upcoming spoken language input in children at the cusp of literacy acquisition. In what follows, we first provide a brief review of previous studies examining the influence of literacy on both adult and child spoken language processing before outlining the current study.

A number of studies have compared phonological processing skills in illiterate and literate adults and found important differences between the populations in tasks involving phonological awareness, pseudoword repetition, and phonological word–object mapping. For instance, Morais and colleagues (1979) asked illiterates and late literates (who had taken part in adult literacy programs after 15 years of age) to add or delete one phoneme (e.g., /p/) of a spoken word and found poorer performance for illiterates than for literates on non-word trials. Performance on non-word trials is critical here because performance on real-word trials can be influenced by participants' retrieving pre-existing representations of these words. This is especially so because illiterates have been found to perform as well as literates in real-word repetition tasks (Reis & Castro-Caldas, 1997) while performing worse than illiterates in repeating pseudo-words (Reis & Castro-Caldas, 1997). This finding is typically explained by suggesting that illiterates have impaired processing at the level of sub-lexical phonological structure (Petersson et al., 2000).

More information yet is provided by studies employing online methods that offer an opportunity to measure phonological processing with fine temporal sensitivity. For instance, Huettig and colleagues (2011) examined low and high literates' use of phonological information in an online eye-tracking task. Here, participants listened to simple spoken sentences such as "Today he saw a crocodile" while they looked at a visual scene of four objects. The authors observed that low literates, unlike high literates, do not exploit phonological matches between spoken words and visual referents for language-mediated visual orienting in an *efficient* manner. In modeling this behavior, Smith, Monaghan, and Huettig (2013) concluded that literacy acquisition results in changes to the grain size of phonological mappings. This conclusion was supported by their findings that models containing more specified phonological representations (representation of individual phonemes) behaved similarly to the high literates, whereas models containing less specified representations (specification at the word level alone) performed similarly to the low literates.

Similarly, recent work also suggests that low literates are worse at anticipating upcoming spoken linguistic input relative to high literates (Mishra et al., 2012). Here, participants were presented with a visual display of four objects—for instance, a door (target) along with a button, a flower, and a drum