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Short report

Opposing effects of age and reading ability on pseudoword priming

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ABSTRACT

Repetition priming refers to the facilitation of stimulus processing due to prior processing of the same or similar stimulus, and is one of the most primitive ways in which experience and practice can affect performance. Previous studies have produced contradictory results regarding the stability of repetition priming across development. Drawing on models of word priming that suggest decreased priming with increased reading ability, the present experiment investigated the possibility that null effects of age in priming are due to opposing effects of age and reading ability on priming magnitude. Forty-eight participants between 7 and 22 years old read aloud primed and unprimed pseudowords, after completing a reading ability assessment. In line with predictions, the magnitude of priming for pseudowords increased with increased age when reading ability was controlled, and decreased with increased reading ability when age was controlled. Moreover, neither the age nor ability effect was significant when tested without the other. Results were not influenced by explicit memory for primed pseudowords. Thus, the present experiment provides evidence for developmental increases in word priming, as well as a potential explanation for the lack of developmental effects in previous studies.

Central to most theories of learning is the idea that experience and practice improve performance. One type of learning, referred to as repetition priming, occurs when prior processing facilitates subsequent processing of the same or similar stimuli (for reviews, see Roediger & McDermott, 1993; Schacter & Tulving, 1994). Unlike other forms of learning priming occurs automatically, often without awareness or intention, and does not require explicit practice or encoding/retrieval strategies. Some have argued

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that priming reflects a primitive type of learning that, once established, is relatively stable throughout development (Schacter & Moscovitch, 1984; Squire, 1987; Tulving & Schacter, 1990). Supporting this perspective, several researchers have observed little or no change in priming magnitude in participants from 5-year-olds to young adults (Billingsley, Smith, & McAndrews, 2002; DiGiulio, Seidenberg, O'Leary, & Raz, 1994; Drummey & Newcombe, 1995; Hayes & Hennessy, 1996; Naito, 1990; Perez, Peynircioglu, & Blaxton, 1998; Russo, Nichelli, Gibertoni, & Cornia, 1995). Contrary to this perspective, however, others have observed increased priming with increased age across similar age groups (Alario, De Cara, & Ziegler, 2007; Booth, Perfetti, & MacWhinney, 1999; Cycowicz, Friedman, Snodgrass, & Rothstein, 2000; Kang & Simpson, 1996; Komatsu, Naito, & Fuke, 1996). Thus, the view that repetition priming is unaffected by development is not without controversy.

Several hypotheses have been proposed to explain these discrepant findings. Some researchers have argued that increased priming with age is due to influences from explicit memory (Parkin & Streete, 1988; Russo et al., 1995). For example, during a picture fragment completion task, Russo et al. (1995) observed increased priming with increased age in an initial analysis including all of their stimuli. However, after removing the stimuli that participants explicitly recalled from the analysis, the increase in priming with age disappeared, leading them to conclude that priming is stable across development when explicit retrieval strategies cannot be employed. The influence of explicit memory on priming cannot explain all developmental effects, however, because others have observed increased priming with age, even after removing explicitly recalled items from the analysis (Cycowicz et al., 2000).

Other researchers have suggested that developmental effects in priming may be obscured by different levels of baseline performance in different aged participants (Cycowicz et al., 2000; Komatsu et al., 1996). That is, high levels of baseline performance may restrict the amount of facilitation observable as a consequence of priming, while lower levels may enhance it. Increased priming with age thus may be concealed by higher levels of baseline performance in older participants. Direct support for this idea comes from a study of word fragment completion priming in which increased priming with age was observed when baseline differences were corrected, but equivalent priming with age was observed when they were not (Komatsu et al., 1996). Critically however, correcting for baseline differences only revealed increased priming with age when words were generated during the encoding phase. When words were read during the encoding phase, priming did not vary with age even when baseline differences were corrected (Komatsu et al., 1996). Thus, baseline differences cannot account for all instances of equivalent priming across age groups.

Models of word priming that highlight the role of reading ability provide another possible explanation for inconsistent developmental effects in priming studies (Booth et al., 1999; Plaut & Booth, 2000; Plaut, McClelland, Seidenberg, & Patterson, 1996; Stark & McClelland, 2000). In particular, these models emphasize the compression of priming effects at high levels of reading ability. That is, due to limits on the system's processing efficiency, high-ability readers, who are maximally efficient at word processing, do not benefit from priming to the same extent as lower-ability readers, who have not achieved maximum efficiency (Plaut & Booth, 2000; Stark & McClelland, 2000). This idea is similar to the aforementioned baseline-differences perspective in that it is based on underlying performance differences. However it suggests that priming is a non-linear function of reading ability, which cannot be removed through any corrective formula. It is thus possible that negative effects of reading ability on word priming cancel out positive effects of age in studies including expert readers, such as college undergraduates. Indeed, developmental studies of word priming that include college undergraduates have observed equivalent priming across age groups (Castles, Davis, & Letcher, 1999; Naito, 1990), whereas studies confined to children have observed increased priming with age (Booth et al., 1999; Kang & Simpson, 1996). Nonetheless, few word priming studies have measured reading ability directly, and those that have measured reading ability have not obtained measurements from expert readers (Alario et al., 2007; Booth et al., 1999). Thus, the relationship between priming, age, and reading ability is unclear.

To test these relationships, the present study examined the effects of age and reading ability on priming magnitude during a pseudoword reading task in a group of 7–22-year-old participants. Pseudowords, rather than real words, were used in order to increase task difficulty and hence priming magnitude for the high-ability readers (Stark & McClelland, 2000). In addition, explicit memory for primed pseudowords was measured in a forced-choice, recognition-memory paradigm, to control for