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ScienceDirect
Journal of Experimental Child Psychology 97 (2007) 205–219
Journal of Experimental Child Psychology
www.elsevier.com/locate/jecp

Automatic activation of phonology in silent reading is parallel: Evidence from beginning and skilled readers

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Received 14 November 2006; revised 29 January 2007
Available online 30 March 2007

Abstract

The picture–word interference paradigm was used to shed new light on the debate concerning slow serial versus fast parallel activation of phonology in silent reading. Prereaders, beginning readers (Grades 1–4), and adults named pictures that had words printed on them. Words and pictures shared phonology either at the beginnings of words (e.g., *DOLL–DOG*) or at the ends of words (e.g., *FOG–DOG*). The results showed that phonological overlap between primes and targets facilitated picture naming. This facilitatory effect was present even in beginning readers. More important, from Grade 1 onward, end-related facilitation always was as strong as beginning-related facilitation. This result suggests that, from the beginning of reading, the implicit and automatic activation of phonological codes during silent reading is not serial but rather parallel.

Keywords: Language acquisition; Phonology; Psycholinguistics; Speech/Speech perception; Learning

Introduction

An important part of reading development has to do with learning associations between letter strings and their corresponding phoneme sequences, a process often referred to as

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doi:10.1016/j.jecp.2007.02.001

phonological decoding (Frith, Wimmer, & Landerl, 1998; Share, 1995). Phonological decoding in children typically is studied by having children read aloud words and/or pseudowords (Frith et al., 1998; Goswami, Ziegler, Dalton, & Schneider, 2003; Treiman, Goswami, & Bruck, 1990). Research using the reading aloud paradigm has shown that beginning readers initially rely on a slow and sequential process by which graphemes are mapped onto their corresponding phonemes—the so-called alphabetic stage of reading development (Frith, 1985).

Phonological decoding is at the heart of reading acquisition because it provides a self-teaching device that allows children to decode novel words (e.g., Ehri, 1992; Share, 1995; Ziegler & Goswami, 2005). As beginning readers become more skilled, phonological decoding becomes less serial (i.e., more parallel). The hallmark of this developmental change is the disappearance of the word length effect. That is, beginning readers tend to show strong length effects, for which naming latencies increase with each additional letter in a quasilinear fashion (Goswami, Ziegler, Dalton, & Schneider, 2001; Ziegler & Goswami, 2005). However, as children become more skilled readers, the length effect becomes much smaller and eventually disappears, at least for familiar words (Di Filippo, De Luca, Judica, Spinelli, & Zoccolotti, 2006; Weekes, 1997; but see Perry, Ziegler, & Zorzi, 2007).

This literature suggests that beginning readers compute phonology from print in a rather slow and serial manner. However, this conclusion is based largely on reading aloud tasks in which phonology is activated in an explicit and controlled fashion. In a recent series of experiments, Booth, Perfetti, and MacWhinney (1999) challenged this conclusion by studying automatic orthographic and phonological activation in the brief identification paradigm. In their task, children (Grades 2–6) were presented with an uppercase prime (for 30 ms) followed by a lowercase target (for 60 ms) and a pattern mask (XXXX). The instruction was to identify the target word. For a target word such as *tomb*, primes were pseudowords that shared either phonology (*tume*) or orthography (*tams*) with the target or that were unrelated to the target. Booth and colleagues showed orthographic and phonological priming effects despite the fact that primes and targets were presented so briefly that children were not fully aware of the stimuli. These findings provided strong evidence in favor of a quick, automatic, and general activation of phonological codes in beginning readers.

Contrasting these two lines of research, there seems to be a conflicting view about how beginning readers activate phonological codes from print. Naming data suggest that phonological activation initially is slow and serial, whereas perceptual identification data suggest that phonological activation can be extremely rapid and general. Unfortunately, brief perceptual identification tasks have been subject to various criticisms highlighting the influence of sophisticated control strategies on the participants' performance (Perry & Ziegler, 2002; Verstaen, Humphreys, & Olson, 1995).

Incidental reading in the picture–word paradigm

To adjudicate between these two apparently conflicting views, one would need a task that is not affected by guessing strategies and in which reading is not achieved in an explicit and controlled manner. These conditions are met by the picture–word interference paradigm (Rosinski, Michnick-Golinkoff, & Kukish, 1975). In this paradigm, participants' main task is to produce the name of a pictured object as quickly as possible. At the same time, they are asked to ignore a distractor word printed on the picture. The incidental