

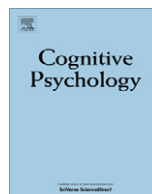


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Old and new ways to study characteristics of reading disability: The case of the nonword-reading deficit

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ABSTRACT

Theoretical and computational models of reading have traditionally been informed by specific characteristics of disabled readers. One of the most frequently studied marker effects of developmental dyslexia is the nonword-reading deficit. Disabled readers are generally believed to show a specific problem in reading nonwords. This study presents a survey of frequently cited methods used to examine this effect by controlling general reading ability in various ways. An extensive analysis, however, shows that the majority of these methods (grade equivalents scores, the reading-level match design, and interactions in a chronological-age match design) actually fail to account for confounding variables such as age and general slowing, potentially affecting the conclusions reached. To alleviate this problem, an alternative method is presented: i.e. state trace analysis. Applying this method in a sample of Dutch disabled and typical readers, the results revealed an absence of a nonword-reading deficit in the disabled readers. Furthermore, after controlling for their decoding ability, disabled readers showed inferior word reading performance, which strongly suggests that the fundamental problem of disabled readers does not relate to the reading of nonwords but concerns their (dis)ability to acquire orthographic (word-specific) knowledge. Further, predictions for disabled readers in an inconsistent orthography like English are formulated. Finally, based on a review of neurobiological studies, implications for theories of reading disability are discussed.

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1. Introduction

One of the most frequently investigated marker effects of developmental dyslexia is the nonword-reading deficit (for reviews see Herrmann, Matyas, & Pratt, 2006; Rack, Snowling, & Olson, 1992; Van den Broeck, Geudens, & van den Bos, 2010; van Ijzendoorn & Bus, 1994). Dyslexic readers would experience a specific problem in reading nonwords (these are wordlike nonsense words such as *nup*, *trel*, *futpil*). As nonwords have no lexical representation in long-term memory, and can only be read by transposing letters or letter clusters into phonemes or larger phonological units, many researchers interpret dyslexic readers' relative disability in reading nonwords as an unambiguous indication of a phonological disorder, in line with the currently dominant phonological deficit hypothesis of developmental dyslexia (cf. Liberman, 1992; Vellutino, Fletcher, Snowling, & Scanlon, 2004; Ziegler & Goswami, 2005). The reported nonword-reading deficit in dyslexic readers has been considered to be one of the core phenomena impacting on the construction of theoretical and computational models of reading (for dual route accounts of reading, see Coltheart, Rastle, Perry, Langdon, & Ziegler, 2001; Perry, Ziegler, & Zorzi, 2007, 2010; and for single process connectionist accounts, see Harm & Seidenberg, 1999; Manis, Seidenberg, Doi, McBride-Chang, & Petersen, 1996; Plaut, McClelland, Seidenberg, & Patterson, 1996).

Evidently, basic effects that motivate theories of reading, such as the nonword-reading deficit, should be established unambiguously. This is a prerequisite in order to avoid the problem of "mutual confirmation...(of)... method, data and theory" (Van Orden, Pennington, & Stone, 1990, p. 497). So far, it remains unclear, however, whether the reported nonword-reading deficit in disabled readers is indeed an unequivocal finding. In this paper, we search for unconfounded demonstrations of the nonword reading deficit and analyze frequently cited methods used to examine this effect by controlling general reading ability in various ways. Subsequently, we propose an alternative method, state trace analysis, to effectively control for confounding variables. In the following, we set out with a discussion of the most frequently adopted method in NRD studies, i.e. the reading-level match design (RLM). We will argue that the interpretation of NRD findings in these RLM studies is not without problems.

A key element in the demonstration of the nonword-reading deficit (NRD) is the finding that disabled readers show a specific problem in reading nonwords, implying that these difficulties exist over and beyond their general reading difficulties. Hence, general reading level is a key factor that should be taken into account while studying the NRD. To satisfy this condition, researchers have generally used the reading-level match design as a method to control for general reading level (Backman, Mamen, & Ferguson, 1984; Bryant & Goswami, 1986). In a RLM design, individuals with reading disabilities are matched with younger typical readers on a measure of reading ability with a real-word reading test. After this match on real-word reading, both groups are compared on their nonword-reading. The RLM design is usually preferred to the traditional chronological-age match design as many information processing differences between disabled readers and typical readers of the same age could as well be the result of both groups' different reading experiences (cf. Geudens, Sandra, & Van den Broeck, 2004). Given the experimental control on reading level, the RLM design is generally considered a more selective device in isolating critical processing differences between disabled and typical readers (cf. Stanovich & Siegel, 1994).

Despite the popularity of the RLM design, this design is, however, not without methodological problems and interpretational ambiguities (Goswami & Bryant, 1989; Jackson & Butterfield, 1989). The central problem is that the RLM design inevitably confounds reading level with age: the disabled readers necessarily being older than the control subjects. This observation has recently given rise to a new, developmental interpretation of nonword-reading deficit findings in the context of the RLM design as reported in our previous paper (Van den Broeck et al., 2010). In that paper, we provided empirical evidence for the hypothesis that the observed NRD in a RLM design does not reflect a genuine deficit, but is an artifact of normal developmental differences in word-specific knowledge between both reading groups. We hypothesized that the group of older disabled readers reached the same reading score in the word reading task (used to match both groups) as the younger typical readers as a result of their superior experience with the words to be read in this task, simply because they are older. Alternatively, we suggested that the younger typical readers needed to rely more on their decoding

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