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Localizing damage in the functional architecture: The distinction between implicit and explicit processing in deep dyslexia

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Abstract

Deep dyslexia is an acquired reading disorder in which a previously literate adult produces semantic errors during reading and demonstrates impaired nonword reading. Most models of the syndrome account for the reading errors observed in deep dyslexia in terms of multiple loci of damage. In contrast, Buchanan, McEwen, Westbury, and Libben [(2003). Semantic and semantic error: Implicit access to semantic information from words and nonwords in deep dyslexia. *Brain & Language. Special Issue: Meaning in language*, 84, 65–83] proposed in their Failure of Inhibition Theory (FIT) that reading errors result from damage in the phonological output lexicon alone. According to this formulation, semantic errors result from impaired explicit access and production due to failure of inhibition. In contrast, implicit processing is assumed to be intact in deep dyslexia. In the current manuscript, we tested several predictions that develop from the FIT in order to localize damage in the functional architecture of the language system.

Keywords: Deep dyslexia; Reading disorder; Failure of inhibition theory (FIT)

1. Introduction

The adequacy of explanations for neuropsychological phenomena hinges upon the theoretical sufficiency of the models from which they are derived. In order to refine accounts of various disorders, the assumptions upon which these models are predicated

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must be rigorously tested and revised to accommodate novel research findings. With respect to language disorders, the basic assumption underlying cognitive models of different acquired dyslexias is that impairments reflect the operation of remaining linguistic components after damage to the functional architecture. How this breakdown is conceptualized depends on the manner by which lexical information is assumed to be represented in the language system.

1.1. Language representation and information processing in a normal reading system

Although conceptualized differently depending on the model, most accounts assume normal visual word recognition is a multi-step process that is mediated by the spread of neuronal activation from one level of word (lexical) representation to the next: the processing of words involves visual analysis of the printed form, which results in *access* to some type of stored representations of orthographic (print) information. Subsequently, the word's meaning is accessed in the semantic system and its pronunciation accessed in the phonological system. Within this framework for lexical processing, access at each level of representation can be understood as the point at which entries associated with presented information are activated (e.g., for the semantic system, at the point that the definition for a printed word is activated).

1.2. Models of skilled reading

Theories of normal reading are similar insofar as they posit different storage systems for linguistic information (e.g., orthographic, semantic, and phonological information). However, conceptualization of the representation and access within those storage systems differ. Although hybrid models exist, current theories of skilled reading can generally be divided into two broad categories: single and dual route models.

The most influential of the former models is the Seidenberg and McClelland (1989) model proposing that visual word recognition is accomplished via a single route involving interactions between orthography, semantics, and phonology. Each unit in the system contributes activation to many different representations that are accessed simultaneously via a network of interconnections and back propagation. Thus, according to parallel-distributed progressing (PDP) models or "connectionist" networks, word knowledge is not represented in discrete entries that are serially accessed. Instead, information is distributed throughout the network, accessed in parallel, and is stored as a pattern of activation across units resulting from "experience with the spelling-sound correspondences implicit in the set of words from which it learns" (p. 525).

In dual-route accounts (e.g., Coltheart, Curtis, Atkins, & Haller, 1993; Patterson & Morton, 1985), the conversion from orthography to phonology can occur by either of two possible routes: the assembled and addressed routines (see Fig. 1). The rule-based assembled route (pathway A) develops pronuciations for printed words by piecing together the sounds of individual letters or letter sequences (i.e., phonemes) This procedure is successful for regular words (e.g., *save* and *wave*) but not for exception words (e.g., *have*) because these exception words violate standard spelling-sound correspondence rules. This assembled pathway can read both regular words and non-words but it does not read exception words and does not directly access meaning prior to pronunciation.