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Cognitive neuropsychological analysis of isolated agraphia: Review and report of a new case

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ABSTRACT

The present study offers a brief review of the literature about isolated agraphia (IA) and discusses a new case in the context of contemporary neuropsychological models of reading and spelling. The studies of IA, within the cognitive neuropsychological framework, have dealt with issues related to the universality of cognitive models, the autonomy of orthographic lexicon/phonological mediation of writing/spelling, the multiplicity of patterns of symptoms associated with IA, and the neural bases of IA. CBH, a 59-year-old female, freelance journalist with a history of stroke-induced bilateral parietal lobe lesion displayed symptoms of IA. CBH's performance on experimental tasks related to reading and writing suggests that IA may not be restricted to one or the other syndrome of dysgraphia, access to the orthographic lexicon does not require phonological mediation, hence, it is autonomous, and the left parietal lobe plays a crucial role in spelling.

1. Introduction

Pitres (1884) reported a case of pure motor agraphia associated with a lesion of the foot of the second frontal convolution of the left hemisphere. His patient was not able to write with the right hand in spite of the absence of right hemiplegia. However, this patient was able to read, spell, and write with the left hand. The conceptualization of 'pure motor agraphia' and the localization of its lesion had drawn much criticism at that time from contemporary researchers. Dejerine (1914), the most vocal of all, had argued that agraphias will always be accompanied by alexias. In Dejerine's hierarchical conceptual model of language,

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spoken modality mediated written expression, hence, there can be no pure agraphia. Dejerines's argument against pure motor agraphia was based on his observation of the loss of abilities to retrieve spoken word and the related deficits in written word retrieval in Broca'a aphasia. Wernicke (1903) had held similar views regarding the dependency of written language on spoken language. He also has rejected the occurrence of pure agraphia on the basis of his "assumption of the bilateral representation of optic letter images on which letter writing was based" (De Bleser, 1996, p. 22). However, Wernicke's (1903) case study represents one of the earliest attempts to verify the nature of pure agraphia, although it turned out to be an enigma for his own model of language representation (De Bleser, 1996). Although, Pitres' conceptualization of isolated agraphia was judged, in retrospect, to be a 'premature thought' during his time (Barriere & Lorch, 2004, Lorch & Barriere, 2002), in the subsequent decades the concept was redefined to include a motor type, and a linguistic type (Roeltgen, 1994). Since Pitres' (1884) contribution, several cases had been reported attesting to the existence of both types of isolated agraphia.

The case reports of isolated agraphia can be grouped into three categories. In the first, we find studies that have reported on isolated motor agraphia impacting only on the peripheral processes of writing, such as cursive writing, typing, or motor processes of formulating letters (Aimard, Devick, Lebel, Trouillas, & Boisson, 1975; Pitres, 1884; Popescu & Vaidya, 2007). In the second, we find studies describing isolated agraphias that are related to central cognitive/linguistic processes of reading and writing (Kinsbourne & Rosenfeld, 1974; Paolino, De Bastiani, Monetti, Boldrini, & Rosati, 1983; Vernea & Merory, 1975; Zangwill, 1954). Studies explicitly driven by contemporary cognitive models accounting for impairments of central processes of writing or spelling make up the third category (e.g., Gonzalez Rothi, Roeltgen, & Kooistra, 1987; Hillis, Chang, Breese, & Heidler, 2004; Luzzi & Piccirilli, 2003; Marien, Pickut, Engelborghs, Martin, & De Deyn, 2001; Miceli, Silveri, & Caramazza, 1985; Piccirilli, Petrillo, & Poli, 1992). A brief summary of all such studies of isolated agraphia is presented in Table 1.

The current study is about a case with isolated linguistic agraphia from the perspective of contemporary cognitive neuropsychological model of written word production.

Word-centric contemporary cognitive neuropsychological models of oral reading and writing are mostly about mental representations and cognitive processes that underlie reading and writing (Coltheart & Funnell, 1987, Monsell, 1987, Patterson & Shewel, 1987; Rapp, 2002). A few of these models have specifically addressed the issue of common cognitive processes underlying reading and writing. Hillis and Rapp (2004) discuss two alternative models that address the issue whether a phonological mediation is obligatory or not in spelling/writing. In the first model, the independent component account suggests that reading and writing share only the semantic system. Visual analysis for perception of letters, access to lexical orthographic representations, access to lexical phonological representations, and sub-lexical orthography-to-phonology conversions are unique only to oral reading, whereas, writing to dictation involves the use of phonological input lexicon, orthographic output lexicon, phonologic-orthographic conversion rules, graphemic buffer, and the actual conversion into letter shape. In the second model, the shared-component account argues that "spelling to dictation is simply the reverse of oral reading" in the following order (Hillis & Rapp, 2004, p. 777): access to lexical phonological representations of the word, access to its semantic representation, which in turn is followed by access to orthographic lexicon, accessed orthographic representation of a word will be retained in a graphemic buffer and from then on to grapheme-letter shape conversion. Writing unfamiliar words and nonwords will require the use of phonology-to orthography conversion rules. Reading follows these steps in the opposite direction. Both accounts appear to receive support from lesion data. For instance, Hanley and McDonnell (1997) argued that there was no obligatory phonological mediation in accessing meaning in a case with phonological impairment in naming, and repetition, with intact comprehension and writing/spelling. Piras and Marangola (2004) further reinforce the view that access to orthographic representations can be achieved without the mediation of phonology. Earlier studies (Miceli, Benvegnu, Capasso, & Caramazza, 1997, Rapp, Benzing, & Caramazza, 1997; Shelton & Weinrich, 1997, Tainturier, Schiemenz, & Leek, 2006) also offered clinical data from aphasic clients to support the view that the orthographic lexicon is autonomous and the output phonological and orthographic lexicons can show dissociation in the context of brain lesions. In contrast, a few researchers continue to argue in favor of the phonological mediation for the access of orthographic representation in writing (Rapczak, Beeson, Henry, Leyden, Kim, Rising, Anderson, & Cho, 2008).Hence, isolated agraphia with relatively spared oral reading will have implications for this issue.