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Introduction

Acquired dyslexia and dysgraphia across scripts

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Many studies have investigated the cognitive processes used to read and to spell in English. Much of our kowledge about these processes comes from reports of patients with acquired dyslexia and dysgraphia, first identified in the behavioral neurology clinic. As in all clinical studies, the detail in these reports includes description of preserved and impaired abilities of the patient, usually with reference to a cognitive neuropsychological model of reading and spelling [6,12,13,26, 28,29]. The beauty of these reports is the insight provided to the clinician and to theorist about the topography of cognitive processing, allowing science to 'carve nature at its joints'.

One criticism of this research is the emphasis on European languages. However, a review of acquired dyslexia and dysgraphia in languages other than English reveals an interesting fact. Many cases are reported in Behavioral Neurology – a revelation that reflects the global reach and sophistication of this readership. It is therefore a great privilege to present this Special Issue on the topic of Reading and Writing Disorders Across Scripts.

The question posed to the authors (and readers) of the papers in this Special Issue is whether the processes identified for reading and spelling in cognitive neuropsychological models developed for English, extend to other languages. This is not a trivial question that is limited to the armchair. Language processing in bilingual speakers is moving towards the front of cognitive neuropsychological enquiry simply because bilingual speakers are the majority of speakers in many language environments. Thus, it is of interest to know about dyslexia and dysgraphia in Chinese, Korean and Urdu for theoretical reasons but also because it is necessary to know if the cognitive processes used to read and to spell in one language have any effects on reading and spelling in another language [see 8, 9, 16 for interesting answers]. If the cognitive mechanisms used to read and to spell in one language impact on reading and spelling in another language then several clinical implications follow, specifically for the treatment of acquired dyslexia and dysgraphia in bilingual speakers [23,26, 40].

The contributors to this Special Issue report on patterns of acquired dyslexia and dysgraphia in Arabic, Chinese, Greek, Hebrew, Hungarian, Italian, Japanese, Russian, Slovak and Spanish. One unique feature is reports of multilingual speakers with reading and spelling disorders in different languages (Druks et al.; Friedmann and Haddad; Kambanaros et al.; Senaha and Parente). These cases not only highlight the striking similarities in the patterns of dyslexia and dysgraphia across languages, they converge on the view that cognitive processes used to read and to spell are independent of linguistic differences. Such reports have implications for theoretical models of bilingual language processing because they suggest language 'non-selective' access to the reading system. For example, the Bilingual Interac-

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tive Activation (BIA) model developed by Dijkstra and colleagues [8,9] assumes an integrated system for oral reading across languages with language non-selective access to the oral reading system [see also 28, 29].

Wilson, Kahlaoui and Weekes [40] reviewed extant reports of acquired disorders of reading and spelling in bilingual speakers. Their review found that the error patterns of surface, phonological and deep dyslexia in monolingual speakers in different languages are observed in bilingual speakers [1,2,11,14,15,19,20,24, 30,39]. That is not to say that all cases of acquired dyslexia in bilingual speakers show the same pattern of oral reading impairment in both languages. Weekes et al. [38] report Mongolian-Chinese bilingual speakers with different reading errors in two types of script. The Mongolian language has an alphabetic script with a set of sublexical mappings from orthography to phonology. Weekes et al. observed semantic oral reading errors in Mongolian but semantically-related translation errors in Chinese i.e. reading a Chinese character using a semantically-related Mongolian syllable. One patient produced within-language semantic oral reading errors in Mongolian e.g. table read as "stool", but did not produce these errors in Chinese. Language selective reading errors are a challenge for the BIA+ model.

Language selective reading errors are observed in other bilingual speakers. Laine et al. [36] reported a Swedish-Finnish speaker who had acquired dyslexia in both alphabetic scripts but was more likely to make phonological errors when reading Swedish than Finnish. García-Caballero et al. [25] reported a Galician-Spanish patient who had reading difficulties only for Galician – a transparent orthography that shares morphology and vocabulary with Portuguese. Raman and Weekes [30] reported a Turkish-English speaker who was surface dyslexic in English but deep dysgraphic in Turkish. Such reports suggest that oral reading problems manifest themselves differently across languages, according to the unique properties of a script.

It is of interest that language selective oral reading errors are not limited to bilingual speakers. The most striking cases are reports of selective reading impairments in biscriptal patients showing that the type of script used within a language can have an impact on acquired dyslexia. Korean uses two different scripts: an ideographic writing system Hanja and syllabic writing system Hangul. Disorders of reading and writing for ideographic and syllabic characters in Korean can be script specific [18]. These reports are difficult to reconcile with non-selective models of bilingual oral reading [8]. Indeed, Caramelli et al. [4] observed a within language dissociation in reading errors across script in a Brazilian Portuguese-Japanese (Nisei) bilingual speaker who produced more oral reading errors in Japanese (ideographic) than Portuguese (alphabetic) even though he acquired both languages at an early age. Of even more interest was the differential pattern of reading impairment within the Japanese language for Kanji and Kana script. Japanese script uses an ideographic writing system (Kanji) adopted from Chinese characters and a syllabic system (Kana). Reports of monolingual Japanese speakers with acquired dyslexia who read well in one script and not the other i.e. biscriptal dyslexia are plentiful [7,32–34]. However, Caramelli's report was the first to show that acquired dyslexia within Japanese transfers to irregularly spelled Portuguese words (see also Senaha and Parente, this volume).

A review of the cases reported with acquired dyslexia and dysgraphia in bilingual speakers is summarized in Table 1 (biscriptal cases are omitted). Each case is described in terms of the language status i.e. the first acquired (L1) and the second acquired (L2) language, the cerebral pathology (if reported), the pattern of reading impairment and the characterisation of acquired dyslexia stated in the case report. The summary shows a mixed pattern. For some cases there are no differences in quantity or quality of oral reading errors across languages, even if the languages use very different scripts (e.g., Arabic-Hebrew). However for the majority of cases there is some effect of language status on performance with different patterns of reading errors across languages. Two features that emerge from the summary are that 1) effects of language status do not necessarily favour the first acquired language and 2) effects of language status do not depend on similarity between scripts. For example, there are reports of Chinese-English speakers who produce more errors in Chinese (L1) than English (L2) but another report shows the opposite pattern. Reports of acquired dyslexia and dysgraphia in bilingual and biscript patients will continue to challenge and inform cognitive neuropsychological models of reading as will cases of reading and writing disorders in monolingual speakers such as those reported here by Crepaldi et al., Hricova et al., Mondini et al., Semenza et al., and Wilson et al.

In closing, I would very much like to thank Argye Hillis and Naama Friedmann for encouragement and help in editing this Special Issue. Thanks also to the contributors for their insights into acquired disorders of reading and writing across scripts.

Table 1

Reported cases of dyslexia in bilingual speakers (1938–2011)

Citation	Language pairs	Neuropathology	Errors	Characterisation
Lyman et al. (1938)	Chinese-English	Left TBA	More reading errors in English (L2) than Chinese (L1)	None
Eng (1998)	Chinese-English	Left TBA	More reading errors in Chinese (L1) than English (L2)	Semantic errors in both languages including translation errors
Eng and Obler (2002)	Chinese-English	Left TBA	More reading errors in Chinese (L1) than English (L2)	Semantic and surface errors in both languages (stress and tonal)
Byng et al. (1984)	Devanagari-English	Left TBA	More reading errors in Devanagari (L1) than Engish (L2)	None
Kambanaros et al. (2012)	Greek-English	Left temporal CVA	More writing errors in English (L2) than Greek	Phonological dysgraphia
*Chengappa et al. (2004)	Hindi-English	None reported	More reading errors in English (L2) than in Kannada (L1).	Surface dyslexia in English.
Druks et al. (2012)	Hungarian-English	Dementia (nfPPA)	More reading errors in English (L2) than Hungarian (L1).	Progressive dyslexia in both languages
Ohno et al. (2002)	Japanese-English	Left hemisphere CVA	More reading errors in Japanese than English (including translation of kana words). Writing spared	Pure alexia for Japanese Kana and Kanji.
*Karanth (2002)	Kannada-English	None reported	More reading errors in English (L2) than in Kannada (L1).	Surface dysgraphia in both languages
Ratnavalli et al. (2000)	Kannada-English	Left occipital lobe	No differences between languages; writing preserved	Pure alexia in both languages (writing intact)
Ratnavalli et al. (2000)	Kannada-English	Left parietal lobe	More reading errors in Kannada (L1); writing difficulties for both languages	None
Kim, Na and Park (2007)	Korean-English	Left hemisphere CVA	Dysgraphia in both languages transposition errors between consonants and vowels occurred in English	Graphemic buffer impairment.
Masterson et al. (1985)	Spanish-English	Left temporal CVA	More reading errors in English (L2) than Spanish (L1)	None
Laganaro & Venet (2001)	Spanish-English	Large left TBA	No differences between languages: more difficulty reading nonwords compared to words.	A mixture of pure and phonological alexia.
Raman & Weekes (2005)	Turkish-English	Left temporal CVA	More reading errors in English (L2) than Turkish (L1)	Surface dyslexia in English/deep dysgraphia in Turkish
Beaton & Davies (2007)	Welsh-English	Left CVA	More reading errors in English (L2) than Welsh (L1)	Deep dyslexia in both languages
Tainturier et al. (2012)	Welsh-English	Left CVA (x7)	No difference between languages	Phonological dyslexia in both languages
García-Caballero (2007)	Galician-Spanish	Basal ganglia	Reading errors in Galician (L1) only	None
Laine et al. (1994)	Finnish-Swedish	Left anterior CVA	No differences between languages: more difficulty reading nonwords compared to words.	A mixture of pure and phonological alexia.
Béland & Mimouni (2001)	Arabic-French	Left temporal CVA	More reading errors in French (L2) than Arabic (L1)	Deep dyslexia in both languages
Ibrahim (2008)	Arabic-Hebrew	Left hemisphere tumour	More reading errors in Arabic (L1). Could only spell single words in Arabic	Letter-by-letter reading
Ibrahim (2009)	Arabic-Hebrew	Herpes encephalitis	More reading errors in Hebrew (L2). In spelling to dictation, Arabic better preserved than Hebrew	Letter-by-letter reading
Friedmann & Haddad	Arabic Hebrew	Left TBA	No difference between languages	Letter position dyslexia
Weekes et al. (2007)	Mongolian-Chinese	Left temporal CVA	More reading errors in Chinese (L2) than Mongolian (L1). Translation reading errors	Deep dyslexia in Mongolian and Chinese,
Meguro et al. (2003)	Portuguese-Japanese	Dementia (DAT)	More reading errors in Kanji than kana (L2) and irregularly spelled words than nonwords in Portuguese (L1)	Surface dyslexia
Senaha & Parente (2012)	Portuguese-Japanese	Left traumatic brain injury	More reading errors in Kanji than kana (L2) and irregularly spelled words than nonwords in Portuguese (L1)	Surface dyslexia
Caramelli et al. (1994)	Portuguese-Japanese	Left traumatic brain injury	More reading errors in Japanese (L2) than Portuguese (L1). More reading impairment for Kanji than Kana	None
Meguro et al. (2003)	Portuguese-Japanese	Dementia (Alzheimer)	Kana, Portuguese and Japanese nonwords > Portuguese irregular words (L1) > Kanji characters (L2)	None
*Wydell & Butterworth	English-Japanese	None reported	More reading errors in English (L1) than Japanese (Kanji and Kana)	Developmental phonological dyslexia in English

*These are cases of developmental dyslexia where no neuropathology is reported.

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