

VISUALIZING CROSS-LINGUISTIC READING BRAINS:
UNIVERSALITY AND INTERACTIVE SPECIFICITIES

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ABSTRACT

The universality and specificity of cross-linguistic reading have always been a topic of interest to researchers. The earliest controversies started with the issue of whether speech recoding is required for reading non-alphabetic scripts, for example, Chinese and Kanji, whether it is possible to directly access the semantic meaning of a word from orthography without speech recoding, and whether reading non-alphabetic scripts relies on the right rather than the left brain. The abatement of these controversies began with a series of experiments by Ovid Tzeng and William Wang which raised the possibility of universality across different languages. To study how humans read, two kinds of operation must be considered: the human cognitive system and the structure of language. In this paper, we will take

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the original controversy of non-alphabetic scripts being different from alphabetic scripts in the 1970s as the starting point, and use the current research results of cognitive neuroscience to explain what kind of consensus has been reached right now. In addition, we will use tone as an important feature in the study of Chinese reading, and describe the current research results on tone to highlight the special characteristics of Chinese. Finally, we will propose future research directions.

KEYWORDS

Brain Cross-linguistic Comparison Phonological Processing
Universality and Specificity

1. THE STARTING POINT

From the perspective of human evolution, speech precedes the invention of the writing system, and the development of writing systems is based on speech code (Liberman 1996). From the human developmental viewpoint, speech development precedes reading development in young children, and the ability of speech is highly correlated to reading abilities. Human speech is limited by time and space, but the writing system has broken through such limitations, which is one of the greatest intellectual inventions of human civilization. The relationship between speech and the writing system in different languages has determined the core developmental trajectory of reading research. Different languages have their complexity of orthography, phonology, morphology, semantics, and syntax (Chang et al. 2018; Chang et al. 2022; Wang 1973). The dynamic of those language components decides how human beings process reading. For example, the correspondence between grapheme and phoneme is extremely simple in Finnish, one-to-one correspondence, but the correspondence is much more complex in English; on the other hand, the morphology is more complex in Finnish than in English.

The linguistic differences between writing systems create differences in temporal activation and weighting of their linguistic components, rather than in the components themselves (Li et al. 2022; McBride and Wang 2015; Ruan et al. 2018; Verhoeven and Perfetti 2022). This has been supported by research on brain activity during reading, which has shown that reading networks are similar across different scripts but

跨語言大腦功能運作的共通性以及特殊性

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摘要

跨語言大腦功能運作的共通性以及特殊性最早期的爭議，起始於非拼音文字的閱讀，如中文，是否需要語音轉錄，以及非拼音文字的閱讀是否依靠右腦，而非左腦。這些當年爭議的消滅，起始於曾志朗先生以及王士元先生一系列實驗，提出了語言共通性的可能性。研究人類如何閱讀，必須考慮兩種系統運作，一個是人類的認知系統，另一個是語言的結構特性。雖然不同語言間的組字規則、語音結構、字形跟語音的對應關係不同，但人的認知系統是一致的。整個討論的架構已經從當年的「求異」，後來的「求同」，到現在的「從同中求異」。在這一篇論文裡，我們將以當年的爭議為起點，以現在的認知神經科學的研究成果，闡述當年的爭議，現在取得何種共識，並以聲調做為中文研究裡的重要項目，說明現在聲調研究成果，藉以突出中文的特殊性。最後，提出未來的研究建議。

關鍵詞

大腦功能運作 共通性與特殊性 跨語言比較 聲韻處理