

## **Visual Analysis and Lexical Access of Chinese Characters by Chinese as Second Language Readers\***

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To assess the learning of word form, pronunciation, and meaning in an unfamiliar writing system, we carried out Event Related Potential (ERP) experiments with learners of Chinese at the end of their first and second terms of Chinese class at an American university. The subjects were required to recognize a target Chinese character or English word with ERP recorded. They named filler targets indicated by a signal 1000ms after the onset of the stimuli. The orthographic processing of characters and words was extracted as a 200ms component by Principle Component Analysis (PCA). The semantic processing was extracted as a 400ms component (N400). The 200ms PCA component was negative at occipital (N200) and positive at frontal electrodes (P200). It was sensitive to visual analysis and lexical access respectively. ERP results showed that the visual analysis of Chinese was more difficult than English at the first term, but not the second term. The lexical access was more difficult and the semantic processing was slower for Chinese than English at both terms. Faster lexical access was obtained for familiar characters at the first term, but not the second term. The separation of visual analysis and lexical access at the second term indicates a threshold style processing of Chinese characters for the learners with moderate reading proficiency.

Key words: Chinese as a second language, ERP, sinograms

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## 第二語言學習中漢字視覺分析 與詞彙通達的事件相關電位

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我們使用事件相關電位 (Event Related Potential) 研究了美國大學生在中文學習過程對中文形音義的加工。實驗分別在第一年中文課程的第一和第二學期期末進行，實驗任務是對單個呈現的漢字或英文單詞進行識別，然後在 1000 毫秒後出現命名信號時讀出剛剛看到的字或詞。對 ERP 信號的主成分分析 (Principle Component Analysis) 提取出了一個在 200 毫秒左右的字形加工成分，和一個在 400 毫秒左右的語義加工成分。這個字形加工成分在枕葉電極上表現為負電位，在額葉電極上表現為正電位。這兩個正負電位變化分別對視覺形狀分析和詞彙通達敏感。ERP 結果顯示在第一學期末，對中文的視覺分析比英文要更加困難，但在第二學期末就和英文很接近了。然而，對中文的詞彙通達在兩個學期末都比英文更加困難。此外，對熟悉的漢字的詞彙通達在第一學期更快速，但第二學期熟悉度差異明顯減弱。在第二學期的視覺分析與詞彙通達的分離表明在中文學習過程中漢字的加工與中文字母語者相同，是閾限形式的。

關鍵詞：中文，第二語言，事件相關電位