

## EARLY ENCODING OF RADICAL POSITION LEGALITY IN CHINESE CHARACTER READING: AN ERP STUDY

**INTRODUCTION:** In the alphabetic writing system, the identity and order of letters in a word have long been studied as important factors in reading. An analogous question in Chinese is how readers identify sublexical orthographic components called radicals and represent their positional information. Taft, Zhu, and Peng (1999) addressed this question by studying characters containing transposable radicals. Since transposable radicals can form multiple characters based on their spatial placements, if radicals are position-general they would activate multiple lexical representations and be harder to process. No difference was found in readers' performance for characters with transposable radicals and those with non-transposable radicals, which supported a position-specific account. Nevertheless, contending claims of position-general radical representations have also been put forward, based on interference effects of radical primes regardless of priming position (Tsang & Chen, 2009; Yeh & Li, 2002). A recent ERP study by Su et al. (2012) manipulated radical position dominance, defined as the proportion and frequency of characters containing a radical in a particular position relative to all characters containing the radical. In a masked priming paradigm, they found that target characters containing a primed radical in a dominant position showed smaller N170 but enhanced N400 components compared to characters with radicals in a subordinate position. However, the use of real character stimuli may inadvertently introduce phonological and semantic factors that would complicate interpretations.

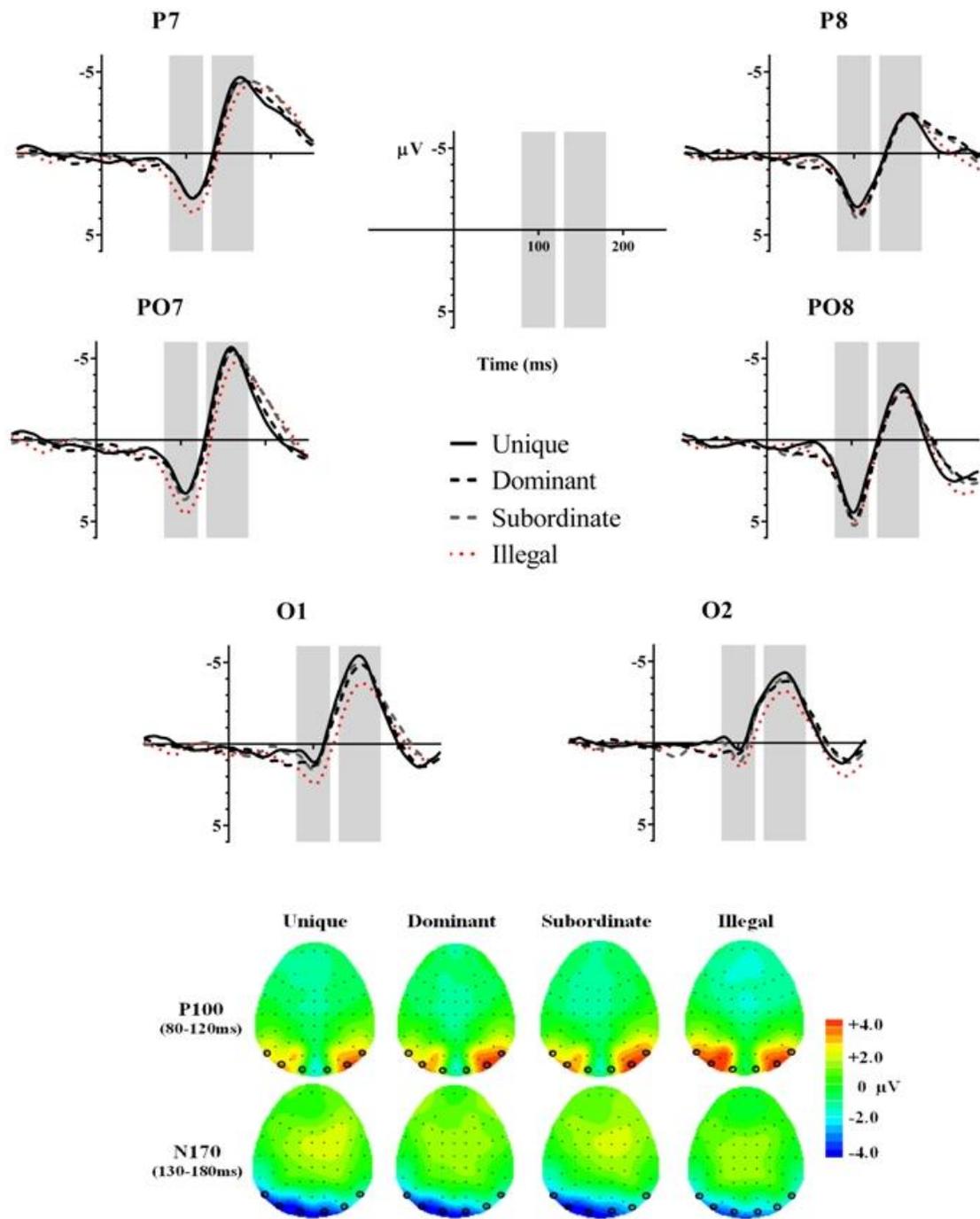
**METHODS:** In this study, we isolated effects of radical position dominance by creating four types of pseudo-characters varying in the constituent radicals' legality and degree of position dominance (Unique, Dominant, Subordinate, and Illegal; Fig. 1). Twenty native Chinese readers performed a character detection task where real characters (17% of trials) were identified among pseudo-characters, with concurrent ERP recording.



Fig. 1 Examples of stimuli with the range of radical position dominance in each condition

**RESULTS:** Pseudo-characters with radicals in dominant positions (Unique and Dominant) elicited significantly more errors than pseudo-characters with radicals in subordinate or

illegal positions (Subordinate and Illegal). This might be attributed to the higher visual familiarity for radicals appearing in dominant positions, which lowered the threshold for false alarms. For ERP data, Illegal items were reliably distinguished from other pseudo-character items within 100ms, with larger P100 amplitudes at left posterior electrodes. The difference was largest between Unique and Illegal items, and no statistical difference was found among the other pseudo-character conditions (Fig. 2). At the N170, Illegal items elicited a significantly smaller negativity than Unique items at occipital sites. Again, the pseudo-character conditions in legal radical positions did not differ among themselves (Fig. 2). No effect was found in the N400 time window.



**Fig. 2** Grand average ERPs at the P100 and N170 with analysis time windows shaded in grey and topographic plots with circles around the electrodes used in the analyses.

CONCLUSIONS: The early P100 effect suggested that radical position legality was detected at the initial stage of visual processing and might be similar to the orthographic

typicality effects reported for English stimuli where atypical pseudowords like amyss elicited a larger P100 than typical pseudowords like abiss (Hauk et al., 2006). The N170 has been associated with radical-level orthographic processing in Chinese (Lin et al., 2011) and our findings converged with previous reports in showing that radical position legality was reflected in this component. While there were stronger effects for Unique than Dominant and Subordinate items, in general our pattern of finding indicated that radical position dominance did not have a large impact in character processing, provided that they appeared in a legal position. Together, these findings revealed the early ERP components that underpinned radical position coding and further specified that its representation appeared to be "all or none" in nature.

**KEYWORDS:** ADULTS ; Electroencephalography (EEG) ; Language ; Other - Chinese; character reading

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