Proceedings of the 3rd Annual Hawaii International Conference on Arts & Humanities, January 2005. Full paper available upon request to sung0015@umn.edu.

The Cerebral Basis for Chinese Word Recognition and Mandarin Tone Identification

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The hemispheric specializations for human cognitive functions have attracted researchers' interest for decades. In this paper, we described the different hemispheric specializations between Chinese word recognition and Mandarin Tone Identification. The Chinese written system is considered logographic rather than phonographic such as alphabetic written systems (i.e., English). Therefore, Chinese characters carry relatively more semantic meanings and less phonological information than English words. In addition, Chinese languages are tonal languages but English is not. That is, segments with different tones carry different semantic meanings and in fact are different words. There are many different dialects of Chinese languages, within them Mandarin is the most popular one. There are four distinct tones in Mandarin Chinese: high level, high rising, low falling rising, and high falling. Speakers of Chinese need to identify the tones for each word in order to understand the meaning, particularly in a conversation. For instance, "fish" pronounced as [ju] plus a mid rising tone and "taro" pronounced as [ju] plus a high falling tone. A divided-visual-field paradigm was used to examine whether different information is processed for Chinese word recognition and Mandarin tone identification in terms of phonological access in reading. Thirty-seven participants were asked to identify if they know the Chinese characters presented on the computer screen or if the characters are indicative tones by pressing a "Yes" or "No" bottom. Reaction time results indicate a right-visual-field (left hemisphere) advantage for both word recognition and tone identification with different observed power: $p < .001$ for both tasks, observed power is 0.934 for word recognition and 0.671 for tone identification. This indicates a relatively stronger left hemispheric specialization for Chinese word recognition than for Mandarin tone identification. Moreover, a significant main effect of word tone was found for tone identification but not for word recognition, given that an equal number of characters (with four different tones) were used in both tasks. This further indicates different processes when participants saw the same types of stimuli but with different task requirements. Specifically, this indicates that phonological accessing (at least for tones) may be absent in Chinese word recognition but is observed in Mandarin tone identification. Moreover, the ability to process information differently based on the task requirements is consistent with the concept of brain plasticity. Finally, this paper proposed a color naming task and a color decision task for both native speakers and second language learners to further examine if phonological access is optional in reading depending on different task requirements and different developmental processes.

Key words: divided-visual field paradigm; Mandarin tones; hemispheric lateralization, brain plasticity