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Bilingual Experience Influences Different Components of Cognitive Control: Evidence from fMRI Study

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Abstract : Cognitive control plays a central role in information processing, which is comprised of various components including response suppression and inhibitory control. Response suppression is considered to inhibit the irrelevant response during the cognitive process; while inhibitory control to inhibit the irrelevant stimulus in the process of cognition. Both of them undertake distinct functions for the cognitive control, so as to enhance the performances in behavior. Among numerous factors on cognitive control, bilingual experience is a substantial and indispensible factor. It has been reported that bilingual experience can influence the neural activity of cognitive control as whole. However, it still remains unknown how the neural influences specifically present on the components of cognitive control imposed by bilingualism. In order to explore the further issue, the study applied fMRI, used anti-saccade paradigm and compared the cerebral activations between high and low proficient Chinese-English bilinguals. Meanwhile, the study provided experimental evidence for the brain plasticity of language, and offered necessary bases on the interplay between language and cognitive control. The results showed that response suppression recruited the middle frontal gyrus (MFG) in low proficient Chinese-English bilinguals, but the inferior patrietal lobe in high proficient Chinese-English bilinguals. Inhibitory control engaged the superior temporal gyrus (STG) and middle temporal gyrus (MTG) in low proficient Chinese-English bilinguals, yet the right insula cortex was more active in high proficient Chinese-English bilinguals during the process. These findings illustrate insights that bilingual experience has neural influences on different components of cognitive control. Compared with low proficient bilinguals, high proficient bilinguals turn to activate advanced neural areas for the processing of cognitive control. In addition, with the acquisition and accumulation of language, language experience takes effect on the brain plasticity and changes the neural basis of cognitive control.

Keywords : bilingual experience, cognitive control, inhibition control, response suppression
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