Do Bilinguals Need to Inhibit Their Non-Target Language? Insights from Transcranial Magnetic Stimulation and Functional Magnetic Resonance Imaging (fMRI) of the Right Inferior Frontal Gyrus

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Bilingual individuals often activate both languages simultaneously, even when speaking only one. However, there is ongoing debate about whether bilinguals need to inhibit the non-target language during word production. To address this, we conducted three studies targeting the right inferior frontal gyrus (rIFG), a region linked to inhibitory control, using transcranial magnetic stimulation (TMS) and functional magnetic resonance imaging (fMRI). In Study 1, Chinese-English bilinguals completed picture-naming tasks in single- and dual-language contexts after receiving continuous (cTBS), intermittent (iTBS), or sham theta burst stimulation over the rIFG. cTBS increased asymmetric switching costs and decreased asymmetric mixing costs, suggesting disruption to both local and global language control, while iTBS had no beneficial effects. Study 2 combined TMS and fMRI to examine neural effects. After receiving cTBS, iTBS, or sham stimulation, participants completed a language-switching task during fMRI. Only cTBS reduced asymmetric switching costs of rIFG activation, confirming its causal role in bilingual control. Study 3 applied time-resolved online TMS to the rIFG and left superior temporal gyrus (lSTG) across seven 100-ms windows during language switching. Stimulation at specific windows (rIFG: TW1, TW2, TW4, TW5; lSTG: TW2, TW5) significantly reduced switching costs, revealing a temporally specific, top-down control mechanism involving the rIFG–lSTG pathway. Together, these studies provide converging evidence that inhibitory control—particularly via the rIFG—is critical for managing bilingual language switching.

Biodata

Dr. Junjie Wu is an Assistant Professor at Tianjin Normal University and is currently visiting Dr. Xin Wang at Macquarie University. He received his PhD in Basic Psychology from Beijing Normal University in 2020. His research employs behavioral experiments, eye tracking, functional magnetic resonance imaging (fMRI), and transcranial magnetic stimulation (TMS) to examine the cognitive and neural mechanisms that support bilingual language representation and control.