NEURAL SIGNATURE OF CHINESE CHARACTER AMNESIA: AN FNIRS STUDY

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The digital age has seen handwriting being marginalized as a medium of written communication, leading to much decline in handwriting literacy, especially in non-alphabetic writing scripts. Chinese for instance, the marginalized role of handwriting had attributed to an increased failure in accessing orthographic forms, known as character amnesia [1]. Despite previous neuroimaging attempts to identify the brain areas involved in handwriting [2], little insight has been gained regarding the neurocognitive underpinnings of character amnesia. To address this issue, this study made use of fNIRS (consisting of 24 sources and 24 detectors), which is relatively tolerant to motion artifacts inherent in handwriting. Twenty-three native adult Cantonese-speakers carried out a written-to-dictation task. Following a fixation period varied between 4000 to 6000ms (jitter event-related design), participants heard a dictation prompt (e.g., 粵劇嘅粵/jyut6kek6ge3jyut6/, meaning "Cantonese" from the word "Cantonese opera") and wrote down the target character on a sheet on top of a Wacom Intuos tablet. If they forgot how to write the character, they drew hash marks (i.e., #) such that the strokes in the hash marks were the same as the stroke in the target character. Then following a second fixation appeared, participants were presented the target character and reported their handwriting as a correct handwriting, character amnesia, or incorrect handwriting. A general linear model with a hemodynamic response function (HRF) was applied to Oxy-Hb started from the onset of dictation prompt to the offset of handwriting (i.e., writing latency + writing duration), beta values served as indicators of brain activity for each trial. In an LME model controlling for character frequency, regularity, context word familiarity, and number of stroke production, we found that, compared to the correct handwriting trials, character amnesia trials elicited significantly less brain activation in the right middle occipital gyrus (rMOG; t = -3.40, p = 0.026, *FDR-corrected*), right supramarginal gyrus (rSMG; t = -3.58, p = 0.026, *FDR-corrected*), and marginal significantly less brain activation in the left postcentral gyrus (lPoCG; t = -2.96, p = 0.077, *FDR-corrected*). These results indicated that rMOG, rSMG, and lPoCG are associated with character amnesia in Chinese handwriting. While rMOG and lPoCG have been shown to be involved in Chinese orthographic processing, since greater activation was observed in stroke retention [3] and stroke order processing [4]. rSMG is relevant with phonological processing [5], since the effect of TMS over rSMG disrupted people's performance in judging the number of syllables of printed words (i.e., orthography-to-phonology conversion; [6]). These findings might potentially indicate that character amnesia is relevant with incomplete activation in the graphemic buffer (i.e., rMOG and lPoCG) and phonology-to-orthography conversion (i.e., rSMG).

References
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