

Automatic activation and attention regulation of phonological and semantic processes in reading of Chinese words

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Introduction

Neuroimaging studies demonstrated that phonological and semantic tasks activated different cortical regions when English words were visually presented[1]. Considering that Chinese is an ideograph, it is of interest to see if access to meaning of Chinese words also activates phonological process, or whether they activate different cortical areas as the English words do. In this study, we used fMRI to explore brain activity during homophone and synonym judgement tasks in which Chinese words were visually presented. Depending on Posner's idea that attention may regulate the activation of brain[2], the tasks of homophone and synonym judgement may activate the corresponding cortical area separately if they are processed by different part of the brain.

Methods

8 young right-handed, native Chinese speakers were instructed to perform Chinese synonym and homophone judgement tasks during scanning on a GE Signa Horizon system. 10 axial slices (124 images per slice) were acquired using single shot gradient-echo EPI pulse sequence (TR/TE = 2000ms/40ms, matrix = 64*64, FOV = 24*24, thickness/skip = 6/1 mm). Anatomic images were also collected using SE and fast SPGR pulse sequence for co-registration. A cross correlation analysis was used to statistically generate activation maps.

Results & Discussion

In both tasks, an extensive network was significantly activated including bilateral lateral prefrontal cortex, ventral temporal cortex and extrastriate area. Apparent left-side dominance was seen in the prefrontal cortex. There was no essential difference between activation during homophone and synonym judgements. The automatic activation hypothesis of word reading may account for the similar activation of homophone and synonym judgements found in the present study. Our results also indicate that attention regulation seems to depend on experimental condition. In current study, both phonological and semantic processes appeared to be automatically activated, although attention may indeed play a role in consequent operations.

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