

ACOUSTICS2008/969

Neural correlates on Chinese speech production: an fMRI study

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The aim of this study is to use functional magnetic resonance imaging (fMRI) method to find neural correlates on Chinese speech production. Three young normal adults (mean age 24 yrs) produced four tone Chinese characters "ma1, ma2, ma3, and ma4" in four ways: (A) normal speech, (B) mouthing speech, (C) unarticulated speech, (D) internal speech, and "ma1, ma1, ma1, and ma1" for the condition (E) normal speech. The fMRI results showed that the areas associated with the control of breathing for speech, vocalization, and hearing were the sensorimotor cortex, supplementary motor area, the superior temporal gyrus, the cerebellum, parietal association area, and the lingual gyrus. The areas associated with articulation were the sensorimotor cortex, the cerebellum, the inferior frontal gyrus, anterior and posterior cingulate gyrus, and the precuneus. The areas associated with tone variation were found in bilateral basal ganglia, hippocampal formation, and parietal association area, and the left pre-motor area, middle occipital gyrus, and the right cerebellum, superior temporal gyrus, and midbrain. Neural correlates of speech production and Chinese tone were all related to the cerebellum. In summary, our preliminary results showed the cerebellum plays an important role on Chinese speech production.