

Faster performance on a visuomotor task correlates with decreased fMRI activation.

Michael LEE¹, William BRADLEY¹, Dar-Yeong CHEN¹, Peter BROTCHE²

¹Long Beach Memorial MRI, 403 East Columbia Street, Long Beach, CA USA; ²Brain Imaging Research Institute, Banksia Street, Heidelberg Weste, Victoria Australia;

Purpose

To determine if there is a correlation between speed of task performance and level of brain activation for different individuals during a simple visuomotor task.

Methods

8 neurologically normal R-handed college students viewed an LCD display via a rear-projection screen while scanned within a 1.5T GE CVi using real time fMRI. 21 contiguous EPI GRE images (TR=3000 ms, TE=42ms, flip angle= 90°, FOV 30x30, matrix 64X64) were acquired every 3 seconds for whole-brain coverage. The task involved viewing a line drawing with an accompanying description; volunteers pressed one button when the stimuli matched and another key if they did not match. A standard block paradigm with a visual fixation baseline (off, on, off, on, off, on, off) was used in a four minute acquisition. Statistical Parametric Mapping '99 (London, UK) was used to generate individual and group fixed-effect statistical parametric maps using a corrected threshold of $p=.05$, with cluster size set at 10 voxels (Friston 1994).

Results

Activation in both dorso-lateral prefrontal cortices, Broca's area (right greater than left), and primary and extrastriate visual cortex were observed in 7 of 8 subjects. See figure 1. There was a significant correlation between an individual's median reaction time and the total number of activated voxels (ANOVA $F=7.53$ $P=.03$). Task performance was 100% for all 8 subjects.

Haier RJ et al. *Brain Research* **570**: 134-143 (1992). Regional Glucose Metabolic Changes After Learning a Complex Visual-spatial/Motor Task: a PET Study.

Haier RJ, et al. *Intelligence* **12**: 199-217 (1988). Cortical Glucose Metabolic Rate Correlates of Abstract Reasoning and Attention Studied with PET.

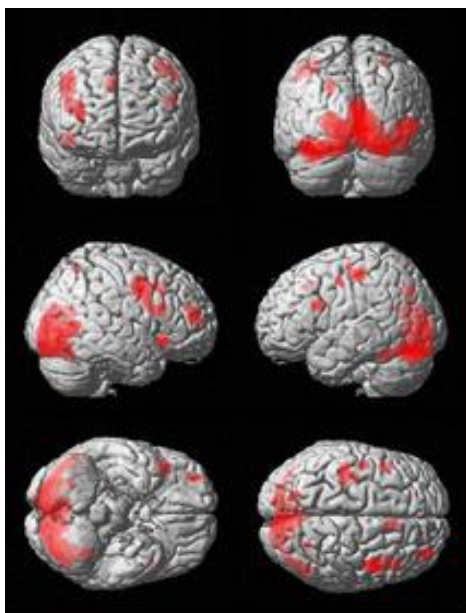


Figure 1: Group activation map

Discussion

Although research has shown global brain activity may decrease as a function of task practice (Haier 1988) or correlate with intelligence (Haier 1992), this study provides evidence that faster responses are significantly correlated with less brain activation in a visuomotor task. Further studies are needed to determine whether other cognitive processes show a similar correlation between response time and global brain activity.

References

Friston KJ, et al. *Human Brain Mapping* **1**: 214-220. (1994) Assessing the Significance of Focal Activations Using their Spatial Extent.