Using a Model-Based fMRI Analysis Method to Locate the Neural Correlates of a Multitasking Bottleneck

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Abstract: It has been shown that people can only maintain one problem state (a temporary mental representation, comparable to the focus of attention in working memory), at a time. When more than one problem state is required, for example in multitasking, performance decreases considerably. To locate the neural correlates of this 'problem state bottleneck' we applied a model-based fMRI analysis method. First, a computational cognitive model was fit to the behavioral data. We then regressed the activity of the model's cognitive resources against the fMRI data to identify regions that match the model's activity. The brain region responsible for the temporary representation of problem states, the inferior parietal lobule, and the brain region responsible for long-term storage of problem states, the inferior frontal gyrus were thus identified. We show that the model-based analysis method outperforms the classical cognitive subtraction method.