

Where are the ACT-R modules in the brain?

Jelmer Borst & John Anderson

> ACT-R Workshop July 27, 2012



courtesy of Andrea Stocco

Methods

- Model-based fMRI analysis
- Five previously published studies
- Meta-analysis







Model-based fMRI Analysis



Logothetis & Wandell 2004, Ann. Rev. Physiol.

Hemodynamic Response Function



Classical fMRI analysis



Classical fMRI analysis



which voxels correspond to the stimulus function?

Model-Based Analysis



Model Predictions



Line up Model and Data



Model-Based Analysis





The Five Studies

Paired Associates

(Anderson, Byrne, Fincham, & Gunn, 2008)



Figure 1. A comparison of the procedures in the Paired and Generated conditions.

Visual & Aural Fan

(Sohn, Goode, Stenger, Jung, Carter, & Anderson, 2005)

(a) Visual Trial



(b) Auditory Trial





Figure 1. Design of our experiment. The two series of panels represent two possible trial types. Equations could be numeric or parametric (not depicted).

Information Processing

(Anderson, Qin, Jung, & Carter, 2007)



Fig. 1. The 28.5-s structure of an fMRI trial. In this instance, it shows that the instruction can either be a word (e.g., AT) or a number (e.g., 23).

Multitasking

(Borst, Taatgen, & Van Rijn, 2011)



Visual & Aural Fan



Correlations in Predictions





Results

Aural



Manual

p < .001



Visual

p < .05



Problem State

p < .00∣



Declarative Memory p < .05



Meta Overview



Meta Overview



Fronto-Parietal Control Network

(e.g., Cabeza et al., 2003; Cole & Schneider, 2007; Dosenbach et al., 2007;

Spreng et al., 2010; Vincent et al., 2008)





Aural

Manual

Visual















Problem State

Retrieval





Thank you!