MRI Makes Itself Useful

Adjusting functional activations using anatomical information

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General Linear Model

\[ Y = \beta x + \varepsilon \]

- Observed data
- Coefficient(s)
- Regressor variables
- Error term (unmodeled variance)

**statistical parametric map**

\[ t = \frac{\text{effect}}{\text{variance}} \sim \frac{x}{\varepsilon} \]

Does NOT ask, “Where is the effect large?”, but rather “Where is the effect statistically reliable?”
Functional Activations

1. Difference in a specific metabolic process which influences measured signal.
2. Difference in tissue composition within a supposedly homogenous structure.
3. Misregistration of a structure to the target template.
4. Partial volume effect (PVE), a special case of spatial blurring.

VBM Activations

1. Differences in the tissue component of a structure (e.g. more WM in the thalamus).
2. Misregistration: underlying differences in structure shape not removed by the coregistration process.
Gray Matter Probability Maps

PET: Quantitative

MRI: Not

GMP: Semi-quantitative

A comparable scale from 0.0-1.0 for all subjects.
Human fMRI

Functional activation increases In both size and magnitude.

Functional activation decreases (falls below statistical threshold).