

Lecture 20

Semantic ROIs from a functional localizer

- Subtract non-word from word activation

Human semantic brain areas

- People have worked on semantics for the 100 years
- Prefrontal cortex (dorsal and ventral)
- Temporal lobe

Representation of phonemic, syntactic & semantic features

- Problem: too much data
- Data compression: Principal components analysis
 - Simplex method of doing dimensionality reduction
 - Take eigenvalues and eigenvectors of a matrix
 - Reconstruct lower-rank matrix from eigenvalues
 - Trick: gives you a bunch of eigenvectors that are orthogonal to each other
 - Orthonormal space
 - Some matrices are not compressible at all

Subjects share ~5 semantic dimensions

- Y: amount of variance
- X: principle component number

Words projected onto group PCs

- Low-dimensional component space
- Space that mediates between feature space (huge) and voxels across all of the brains
- Space that your brain uses to organize the world

The first PC. concepts that increase BOLD

- Red: high loading of this word
- Neutral (Blue) activity: less activation
- Animacy vs. inanimacy

Voxels projected onto group semantic PCs

- Red: PC1
 - Green: PC2
 - Blue: PC3
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Semantic areas in individual brains

- Looking at multiple subjects is a problem because brains vary
- Minor sulci are variable among individuals
- Some gyri only exists in 10% of the people
- Brain size correlates to body size

Semantic areas in individual brains

- Localizer task: words and non-words

- Subtract them
- Temporal cortex

Cross-subject volumetric alignment

- MNI: averaged brain created by averaging a fuckload of brains
 - Sheer, scale, rotate
- One brain
- Reference brain to MNI brain
- Data loss!

Cross-subject surface alignment

- Extract grey matter
- Inflate brain: brain-shaped ball

PrAGMATiC

- Probabilistic and Generative Model of Areas Tiling Cortex
- Ball and spring model
- Pin springs to anatomy
 - Major anatomical landmarks (optimal)
 - Functional localizers (the one Jack used)
- Algorithm choose areas to maximize predictions
- Remove functional areas that have no significant relationship to semantic information
- 77 individual semantically functional areas on the left size and 64 on the right