The Role of Action Information in Thematic Relations between Objects

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Does action information play a role in the processing of thematic relationships between objects?

Introduction

• Object concepts: organized both taxonomically (categorically) and thematically (in terms of associated roles in events)
• Thematic information: 1. Critical for determining relationships between manipulable objects; 2. Activates a bilateral tempo-parietal network including inferior parietal lobules and middle temporal gyrus
• Left tempo-parietal cortex: plays an important role in action-based object relationships
• Stroke patients with left tempo-parietal lesions less sensitive to the action element of thematically-related manipulable objects than healthy controls or patients with other lesion loci

Hypotheses

• Left Angular Gyrus: more active when thinking about event/thematic similarity compared to category/taxonomic similarity
• Left Angular Gyrus: not differentially activated for taxonomic judgments made with action compared to taxonomic judgments made without action
• Precuneus: more activation for taxonomic judgments compared to thematic judgments
• Taxonomic relationships between objects will show greater activation in anterior temporal lobe than thematic relationships

Participants

• 14 participants from the University of Pennsylvania (5 females), mean: 21.8 years, range: 18–30

Stimuli

• Task and stimuli based on Tsagkaridis et al. 2014
• 36 groups of objects, 2 trials formed from each group: 72 unique trials; 36 scrambled trials

Methods

• Both kinds of judgments made on all 36 Ref- Tax-ThA trials and all 36 Ref- Tax-ThNoA Triads.

Design

• Event-related, 4 runs of 45 trials each (7 min 39 sec total per run), 3 second TRs
• Data collected on a 3-T Siemens Trio system and 32-channel array head coil; echo-planar fMRI performed in 42 axial slices and 3 mm isotropic voxels
• Correct trials only, RT regressed as no interest in fMRI analysis

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Results

• Whole brain analyses: thinking about event similarity activates bilateral temporoparietal areas
• ROI analyses: stronger activation for Event vs. Category in left AG, but not strongly active for either task
• Contrary to hypothesis; left precuneus was more active for Event vs. Category
• Whole brain analyses showed Event > Category in left anterior temporal cortex
• No areas more active for Category > Event judgments

Events Based on Common Action (Th+A) vs. Co-occurrence in Space and Time (Th-A)

• Whole-brain analyses showed more activation in right AG for Th-A, among other areas
• ROI analysis in left pMTG showed not just Th-A > Th-A, but also that Event or Category (Th+A) activates pMTG
• Areas predicted to be more active for Th-A during Event trials were actually more active for Th-A

Future Analyses

1. Collected motor imagery localizer; can use to create functional ROIs in which to examine Th-A/Th-A differences
2. Have continuous ratings of similarity between target and correct answer, e.g., action similarity, thematic similarity, taxonomic similarity. Can use to find regions whose activations vary with similarities.

Conclusions

• Mean Parameter Estimate

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References


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