LIFG resolves competition between representations of an object before and after an event

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INTRODUCTION

• Events often entail changes in state of individual objects.
• How do we maintain distinct representations corresponding to the 'before' and 'after' of a described event?
• Do multiple object instantiations compete when an object is changed from its original state?
• Left inferior frontal gyrus (LIFG) has previously been demonstrated to be central in resolving competition amongst incompatible representations of a stimulus, as produced by an ambiguous word or a garden-path sentence (e.g., Hindy et al., 2009; January et al., 2009).
• We examined fMRI activity within LIFG across three tasks: (i) an event comprehension task; (ii) a Stroop interference functional localizer; and (iii) a sentence comprehension functional localizer.

EXPERIMENT 2 PRELIMINARY RESULTS

Clusters of at least 15 contiguous voxels that reliably predict degree-of-change stimulus ratings. Maps threshold at t=3.

METHODS

RATED STIMULUS DIMENSIONS

1. Sentence of each item rated on degree of change (extent to which the object is changed by the event) & imageability (extent to which the action elicits a clear mental image)

EXPERIMENT 1

2 (object change) × 2 (temporal order) within-subjects factorial design

N = 16 (9 female)

135 trials (60 'change' trials, 60 'no change' trials, & 15 catch trials)

Each trial lasted 6 sec: first sentence presented for 3 sec, followed by second sentence for 3 sec.

Ss responded when the second sentence was implausible given the first sentence.

EXPERIMENT 2

2 conditions; temporal order always the same

N = 15 (7 female)

115 trials (50 'change' trials, 50 'no change' trials, & 15 catch trials)

Task identical to Experiment 1

FUNCTIONAL LOCALIZERS

Stroop Interference

Task Conflict trials interspersed with neutral trials (e.g., *farm*). Ss pressed button to indicate font color of each word.

fROI 15 most responsive LIFG voxels for conflict trials vs. neutral trials

Sentence Comprehension

Task 12 sentence & 12 nonword blocks. Ss responded when consecutive trials had related sentences or identical nonwords.

fROI 15 most responsive LIFG voxels for sentence blocks vs. nonword blocks

EXPERIMENT 1 RESULTS

Overlap of task-responsive voxels with functional localizers

Stroop Interference fROI

Sentence Comp fROI

CATEGORICAL EFFECTS

• Change & Imageability as continuous variables (based on Experiment 1 stimulus ratings)

 SUBJECT-WISE ANALYSIS BASED ON STIM RATINGS

Stroop Interference fROI: r(14) = .27 (p = .04)
Sentence Comprehension fROI: r(14) = .04 (p = .97)

ITEM-WISE ANALYSIS BASED ON STIM RATINGS

Stroop Interference fROI: r = 0.27 (.001) r = 0.08 (.24)
Sentence Comprehension fROI: r = 0.15 (.03) r = 0.01 (.85)

DISCUSSION

• Tracking objects across events requires maintaining multiple representations of the same object in different states (Altmann & Kanade, 2009).
• Results suggest that, when representing change, multiple representational instantiations of an object do compete; and the greater the change, the greater the conflict.
• Imageability effect in the sentence comprehension fROI in Experiment 1 converges with recent evidence for increased LIFG activation for words with low imageability ratings (Bedny & Thompson-Schill, 2006).
• Because imageability ratings were correlated with degree of change in Experiment 1 (r = 0.50), a possible degree-of-change effect in the sentence comprehension fROI may have been mitigated by the imageability of the stimuli. In Experiment 2, degree-of-change and imageability are much less correlated in Experiment 2 (p = .16).
• Unlike similarity-based interference often observed for representations of similar but distinct objects, we observe contrast-based interference for representations of the same object but in distinct states.

REFERENCES


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