Introduction

The left anterior temporal lobe (LATL) and left angular gyrus (LAG) have been dubbed "semantic hubs" due to their reliable involvement in multi-modal semantic processing and conceptual combination. However, it is unclear which aspects of semantic composition each area subserves. Work on adjective-noun pairs demonstrates the LATL is sensitive to "feature-based" combinatorics, whereby meaning is derived by combining concepts' features (Baron et al., 2011; Berins & Pykkänen, 2011). LAG, on the other hand, has been implicated in tracking event structure and thematic relations between concepts (Graves et al., 2010). One prediction emerging from these studies is that LATL subserves "function-based" combination of predicates with other predicates, formalized as Predicate Modification (PM), while LAG is more sensitive to "function-based" thematic relations of the sort that arise when a predicate is combined with its arguments (formally Functional Application (FA)) (Heim & Kratzer, 1998).

**Hypothesis I:** LATL tracks FA (while LATL tracks PM)

**Stimuli and Design**

- 36 sets of 4 compositional phrases and 2 non-compositional phrases (noun/verb + non-pronounceable letter string, counter-balanced for word being phrase-initial or –final)
- +verb, -verb, FA, -verb_PM, and +verb_PM always had the same noun, +verb_FA and +verb_PM always had the same verb.
- Given best 100 voxels in each ROI, regressed over voxels' GLM fits (from comp-non-comp contrast) (AFNI; Cox & Jesmanowicz, 1999) for each compositional phrase vs. another, subject as random intercept (in R; Bates, 2004)

**Task:** Subject indicated by button press (yes/no) the synonymy of either a phrase to a target phrase (e.g., eats meat ~ eats quickly).

**Subjects:** 18 subjects (6 male) recruited from the University of Pennsylvania, all right-handed native speakers of English.

**Voxel Selection**

- Composition > non-composition mask: AFNI glm over whole-brain Composition (e.g., eats meat) > Non-composition (e.g., eats fghj)
- ANOVA over Fisher's z-transformed correlation values:
  - Factors: Verb (same, different, no verb); Composition (same, different); ROI (LATL, LAG)

**Methods**

- **Voxel Heat Maps**
  - Map of overlap of 18 subjects' 100 best voxels. ROI boundaries circumscribe heat map.
  - fMRI acquisition:
    - TR = 3 sec
    - Voxels: 3x2x2 mm voxel size
    - B0 unwarping
    - Oblique acquisition at +20° from AC-PC

**Similarity Analysis**

- Correlation of each pair of word pairs (e.g. eats quickly ~ eats meat) in LATL and LAG
- Post hoc t-test in each ROI: shared vs. different Composition was only significant in LATL (p<0.001)
- Summary: Suggests that LATL might be sensitive to composition type and/or that the noun (e.g. meat) is the main substrate of similarity between phrases, e.g., between "eats meat" and both "tasty meat" and "with meat" in LATL. LAG tracks similarity of verb structure rather than composition type per se.

**Conclusion**

We assessed multi-voxel pattern similarity profiles of LATL and LAG in response to compositional word pairs sharing either composition type (PM or FA) or event structure (presence or absence of a verb). We find evidence that LATL is more sensitive to verb structure similarity than composition type, while LAGL can be sensitive to composition type and/or features combining with nouns.

**References**


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