

The dynamic nature of concepts: A semantic network analysis

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Introduction

Current theories of semantic memory posit it as dynamically changing, contingent on context and individual differences.

We apply computational network science methodologies to examine the dynamic nature of semantic memory, by examining the effects of combining concepts on the properties of semantic networks.

We characterized the semantic network of participants using their free association responses obtained twice, before and after either a baseline condition (no manipulation) or after a conceptual combination task that was biased to elicit either attributive (property-based) or relational (relation-based) interpretations.

What is a Robin Hawk?



Attributive



Relational

Methods

The Conceptual Combination (CC) manipulation task

Instruction Manipulation

Instructions emphasizing either attributive or relational strategies.

Practice with feedback

Instruction manipulation check.

Priming

Strengthening manipulation effect by a conceptual combination priming paradigm.

Task

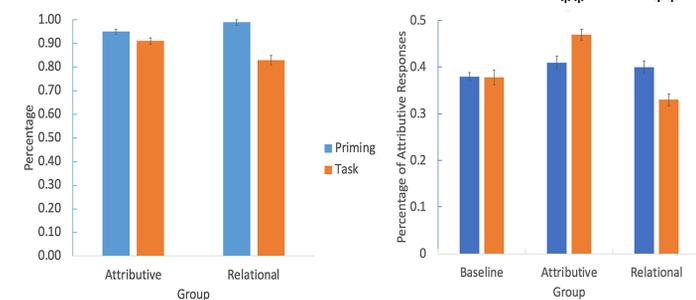
Conceptual combination task of ambiguous noun-noun combinations.

Participants completed a continuous free association task (in one minute generate all responses you can think of to x) to 50 cue words (25 CC manipulated, 25 unmanipulated). The semantic networks estimated the organization of these cue words as **nodes**. **Edges** between nodes are defined based on their association correlations (overlap in associative responses generated to any pair of nodes).

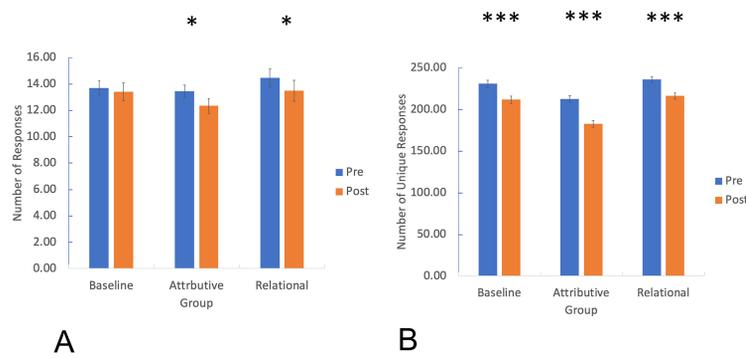
Animals	Fruits and vegetables	Nature
Robin	Tomato	Pine
Octopus	Olive	Mountain
Shrimp	Carrot	Cactus
Snake	Pineapple	Wood
Cheetah	Melon	Tree
Snail	Lemon	Garden
Alligator	Strawberry	Peach
Elephant	Onion	Mushroom
Whale	Bulldog	Rose
		Flower
Food	Home	
Cracker	Cookie	Oven
Cake	Popcorn	Refrigerator
Honey	Candy	Sink
Pretzel	Yogurt	Microwave
Chocolate	Syrup	Trash
		Knife
		Kitchen
		Broom
		Table
		Room

150 participants were recruited from the University of Pennsylvania, randomly assigned to the baseline condition (70% Female, mean age = 21.7 y, SD = 2.8 y), attributive condition (70% Female, mean age = 21.8 y, SD = 3 y), or relational condition (70% Female, mean age = 21.3 y, SD = 2.6 y).

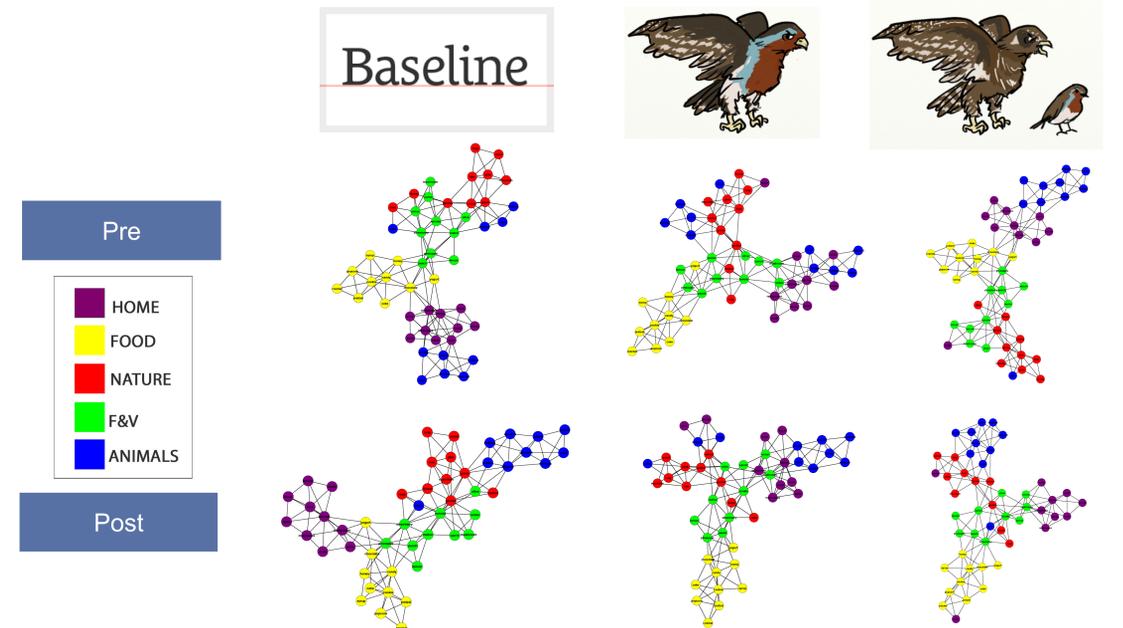
Results



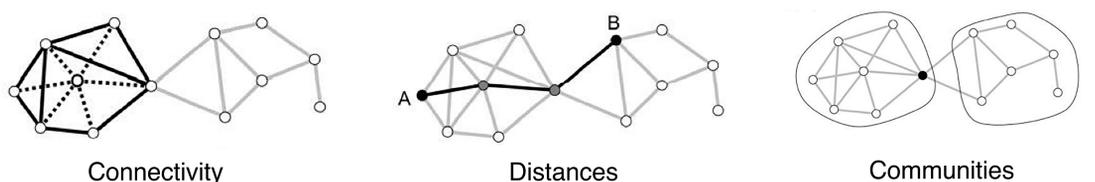
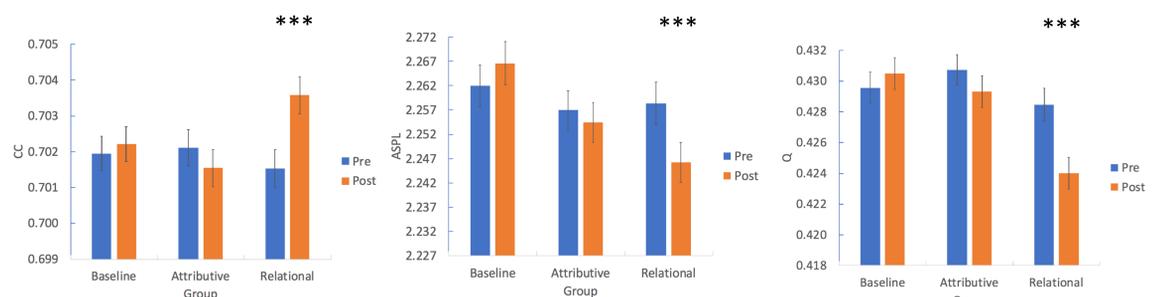
Manipulation task: A) Biased interpretations towards attributive/relational interpretations; B) increased/decreased property-based associations for the attributive/relational condition.



A) Manipulation task similarly reduces number of generated associations. B) Post session similarly reduces number of idiosyncratic associations.



2D visualization of the networks for all three conditions at the two time points. Colors correspond to category. Edges denote symmetrical relation between nodes.



Bootstrapping analysis finds that only the relational condition groups' post-network globally exhibits higher connectivity, lower overall distances, and lower overall sub-communities structure.

Conclusions

- We quantitatively investigate the dynamic nature of semantic memory, in line with current theories.
- Despite a similar effect of the CC manipulation task on performance in generating free associations, we find significant changes of the network properties only for the relational condition network (connectivity, distances, community structure).

