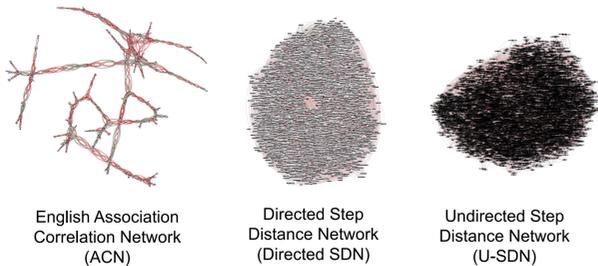


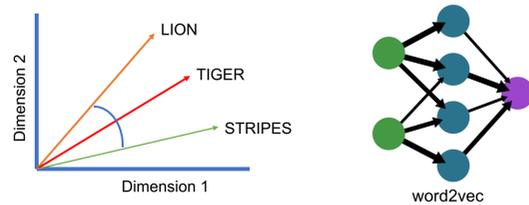
MODELS OF SEMANTIC MEMORY

- Association networks represent each word as a localized node, and words related in meaning are connected by edges. Distributional models represent words through vectors, such that words that are related in meaning are closer in a high-dimensional vector space.

ASSOCIATION NETWORK MODELS



DISTRIBUTIONAL SEMANTIC MODELS



- There is evidence that both models explain performance in priming tasks (Kenett et al., 2017; Kumar, Balota, & Steyvers, 2019)
- This project investigated the predictive power of semantic models in tasks that require accessing different semantic relationships

EVALUATING SEMANTIC MODELS IN A WORD GAME AND CONCEPTUAL ASSOCIATION TASK

- We explored the predictive power of 4 semantic models in English:
 - The Association Correlation Network (Kenett et al., 2011)
 - Undirected Step Distance Network (Steyvers & Tenenbaum, 2005)
 - Directed Step Distance Network (Steyvers & Tenenbaum, 2005)
 - word2vec (pretrained; Mikolov et al., 2013)
- Experiments 1 and 2:** Can semantic models predict performance in a complex word game that involves identifying conceptual relationships?
- Experiment 3:** Do semantic models have varying degrees of predictive power for different types of semantic relationships (perceptual, attributive etc.) identified via a conceptual task?

E1 AND E2: COOPERATIVE WORD GAME

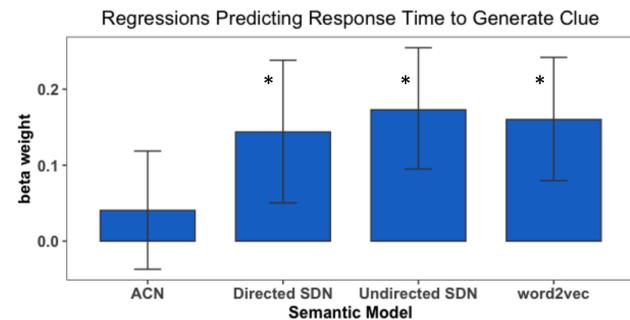
- Clue Master** was given two words (e.g., **EXAM** and **ALGEBRA**) from the board and came up with a one-word clue that was related to both words
- Word Guesser** received the one-word clue (e.g., **MATH**) and guessed the two words that the clue corresponded to on the board



ADORE	YARN	ANCHOR	BURGLAR
GIGGLE	OUTFIT	RUMOR	DEPTH
ALGEBRA	WRITE	ANGRY	EXAM
INSTRUCTION	PEN	BETTER	LEAD
COUCH	ABNORMAL	BANDANNA	VOID

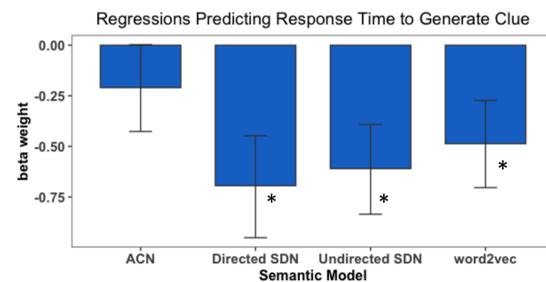
NETWORK PATH LENGTHS AND WORD2VEC COSINES PREDICTED CLUE MASTER'S RESPONSE TIMES TO GENERATE FIRST CLUE

Clue generation was fastest when the clue was closer to the word pairs in directed and undirected network space of word2vec vector space

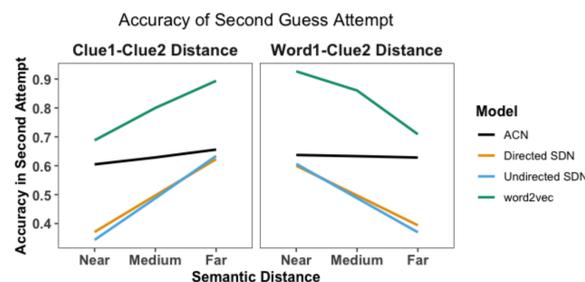


NETWORK PATH LENGTHS PREDICTED WORD GUESSER'S LIKELIHOOD OF CHOOSING THE CORRECT WORD PAIRS

Likelihood of guessing the word pairs was highest when the clue was closer to the word pairs in the directed network space (smallest distance)

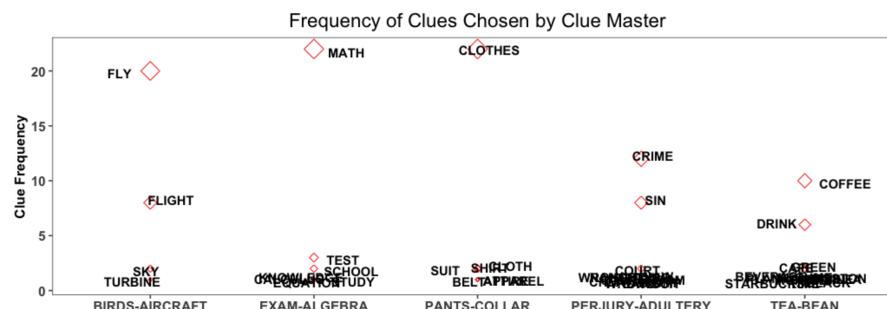


Second clues were most successful if they were farther from the first clue and closer to one of the words, suggesting a different search process based on the second clue, compared to the first clue



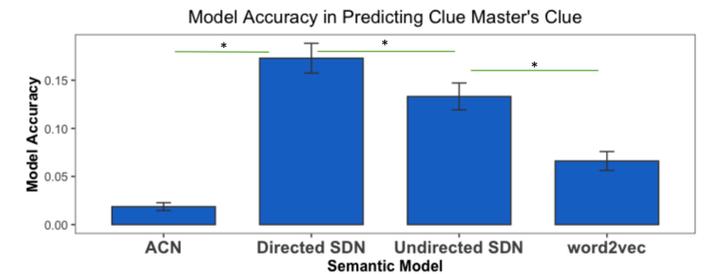
E1 AND E2: QUALITATIVE CLUE ANALYSIS

Clues generated included different types of semantic relationships between the word pairs, e.g., coordinate (pants-collar), attributive (birds-fly), etc.



NETWORK PATH LENGTHS PREDICTED WORD GUESSER'S LIKELIHOOD OF CHOOSING THE CORRECT WORD PAIRS

The likelihood of directly predicting the clue itself was strongest for the Directed SDN, when scores were based on whether the clue was in the path or among the nearest neighbors for the word pairs.



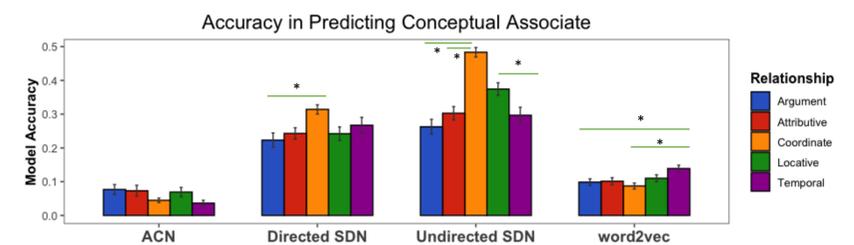
E3: PREDICTIVE POWER ACROSS DIFFERENT SEMANTIC RELATIONSHIPS

Generate a word related to both words

SCISSORS
HAIR

CUT

RELATIONSHIP	WORD PAIR	RESPONSE
Argument	SCISSORS HAIR	CUT
Attributive	BIRD WINGS	FLY
Coordinate	COFFEE TEA	DRINK
Locative	SHIP SEA	SAIL
Temporal	SANTA CHRISTMAS	HOLIDAY



- Preliminary analyses based on shortest paths and nearest neighbors show significant differences in the predictive power of semantic models across different types of semantic relationships, suggesting that different models may be emphasizing different aspects of the semantic space.
- These results are consistent with other work showing that semantic models can successfully account for patterns across only some semantic relationships (Chen, Peterson, & Griffiths, 2017; Lucy & Gauthier, 2017)

CONCLUSION

- Association networks and distributional semantic models appear to differentially emphasize different types of semantic relationships and these differences have important consequences for the extent to which they explain performance in semantic tasks
- Future research will examine the specific search processes that operate on these different models of semantic representation, and evaluate how performance in semantic tasks may be a function of both search processes as well as the underlying representation.