Modeling the Remote Associates Test

Jule Schatz, Steven J. Jones, John E. Laird

Motivation

Codenames (last year)

How do humans do this task?

The Remote Associates Test (RAT)

Simple word association task that has been researched with humans

Mednick, S. (1962). The associative basis of the creative process. *Psychological Review*, 69(3), 220-232.

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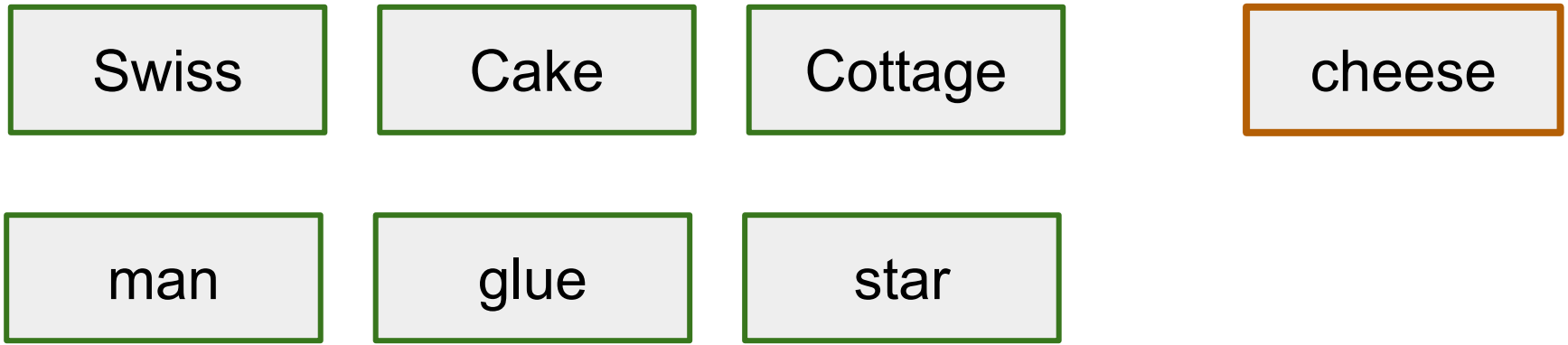

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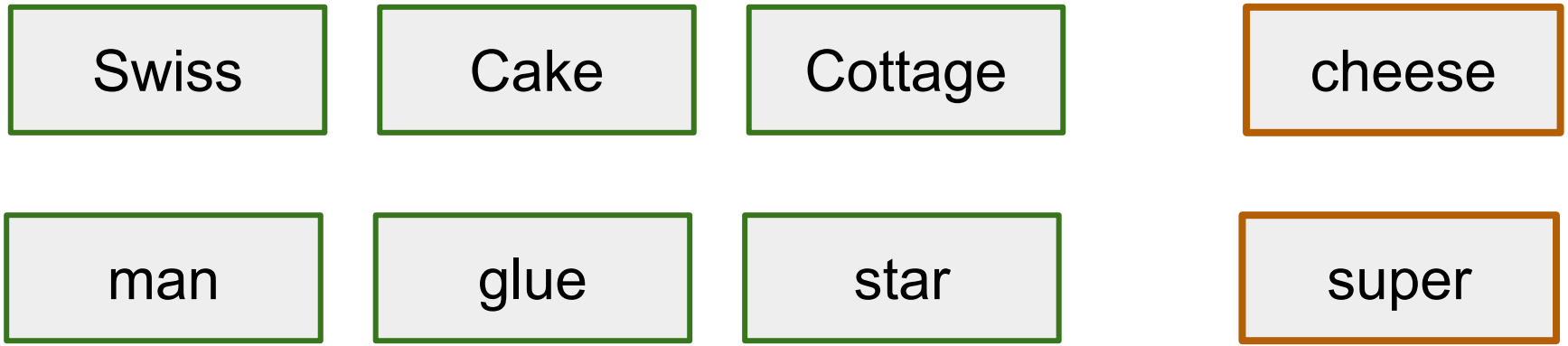

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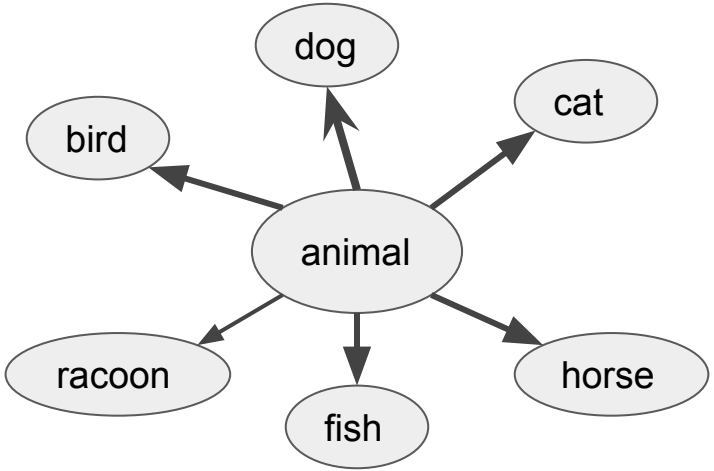
Related Work

Olteţeanu and Schultheis explanation of RAT difficulty for humans

- Fan
- Association strength



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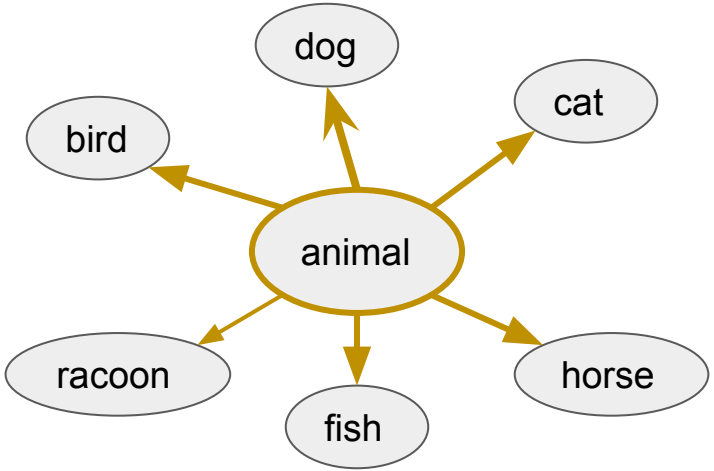

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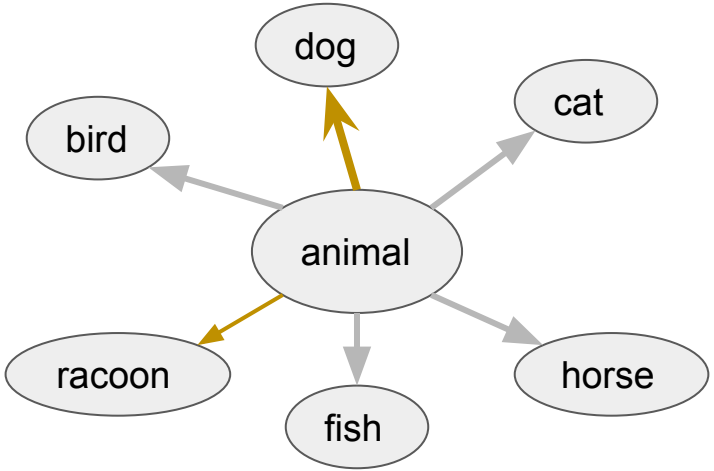

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Related Work

Olteţeanu and Falomir created comRAT-C

- Used Bowden and Beeman's 144 compound RAT problems
- Created a database of 2-grams and compound words
- Showed results in terms of correlation between human data and English corpora data

Oltet¸eanu, A.-M., & Falomir, Z. (2015). Comrat-c - a computational compound remote associates test solver based on language data and its comparison to human performance. Pattern Recognition Letters, 67, 81–90.

Human Brain Cloud (HBC) Knowledge Base

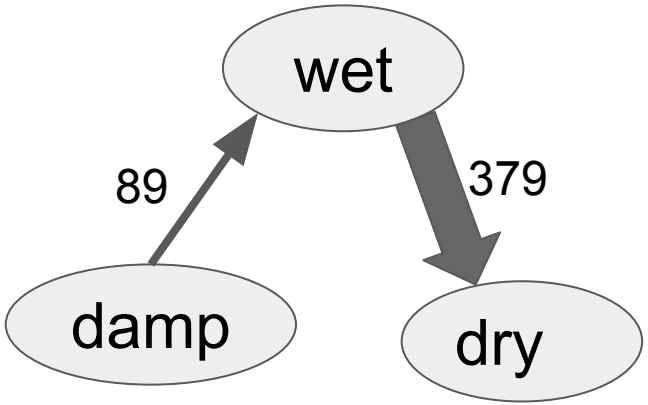
Number of words: 40,652

Number of Associations: 1,298,831

Data from HBC

word1	word2	Association count
wet	dry	379
damp	wet	89

Semantic Memory



Gabler, K. (2013). Human brain cloud. Retrieved from https://humanbraincloud.com/

Soar Models

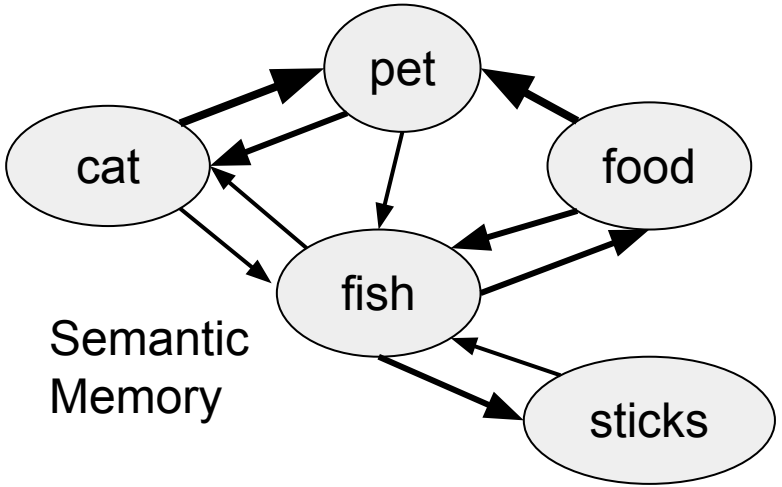
Non-Cued Retrieval Model

Relies on spreading activation

Cued Retrieval Model

Relies on data available in semantic memory

Non-Cued Retrieval Model



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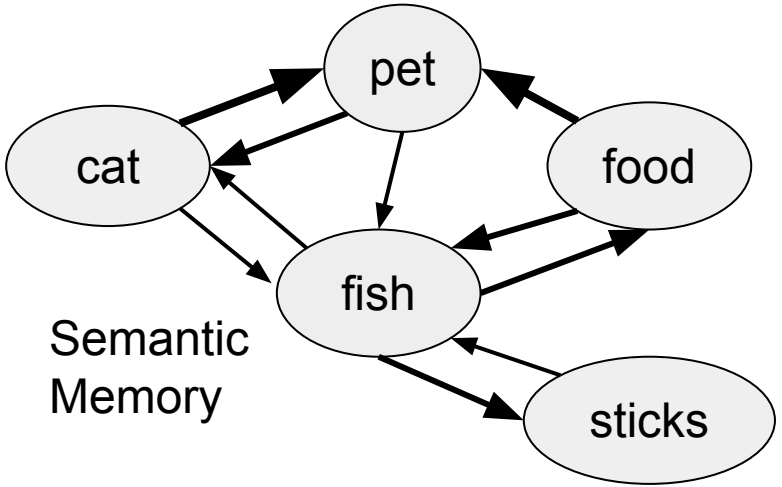

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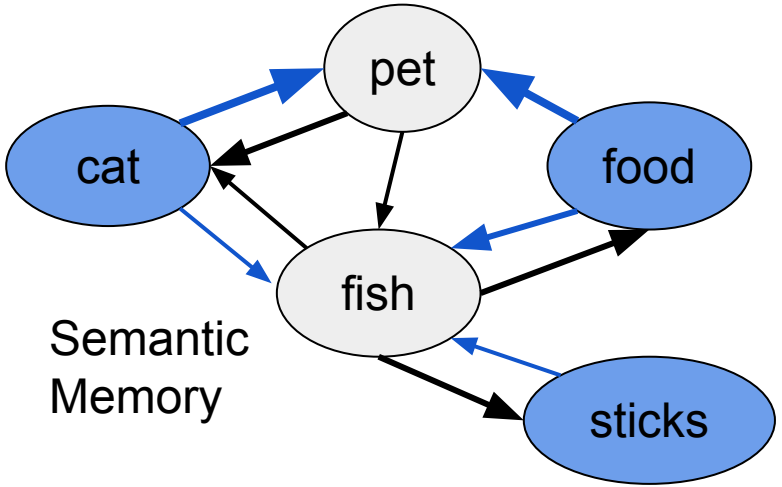

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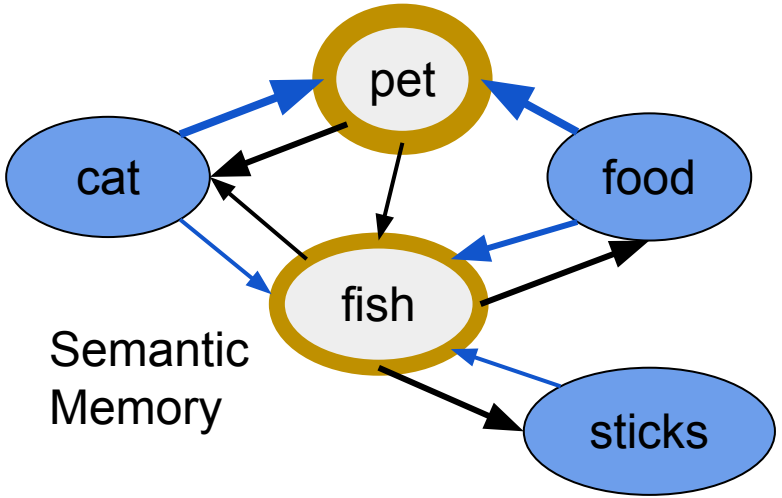
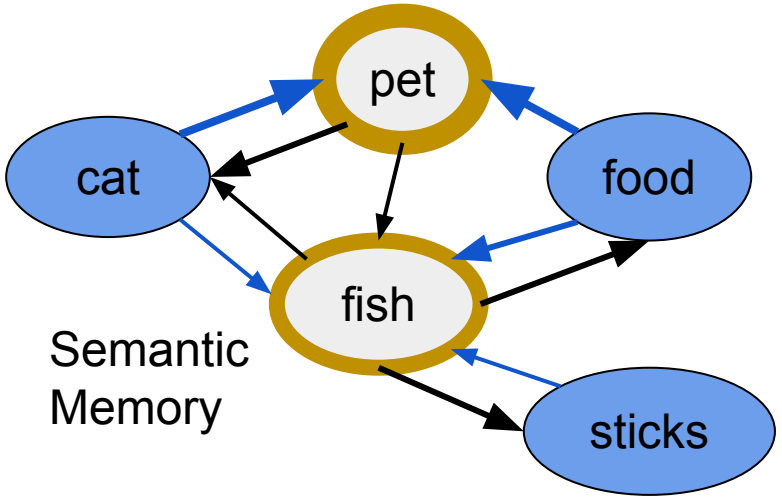


Non-Cued Retrieval Model

1. Model is given RAT items “cat”, “food”, “sticks”
2. Model retrieves the words from semantic memory
3. Model asks for a word
    a. Receives “Pet”



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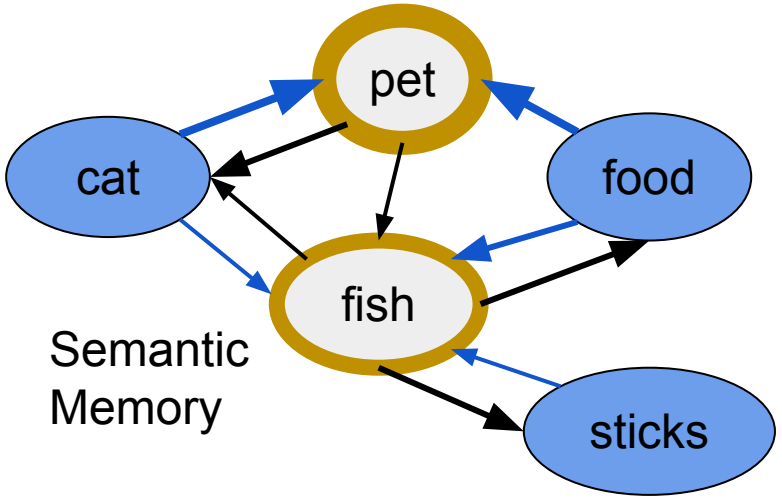
4. Evaluates “Pet” as relating to 2 words



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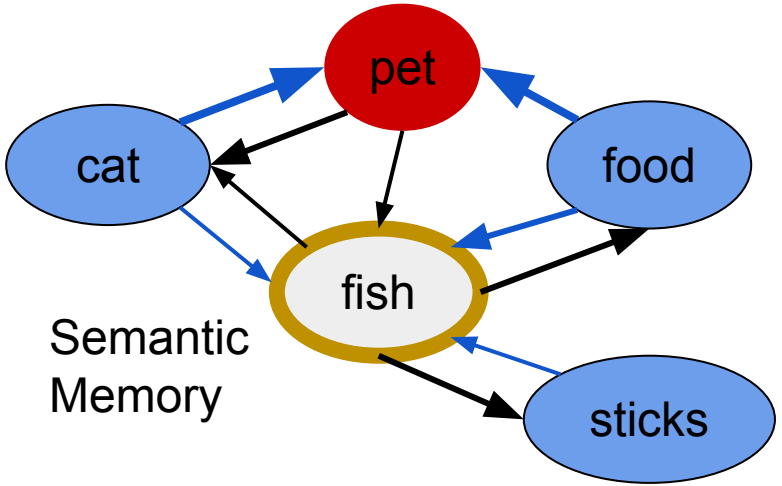

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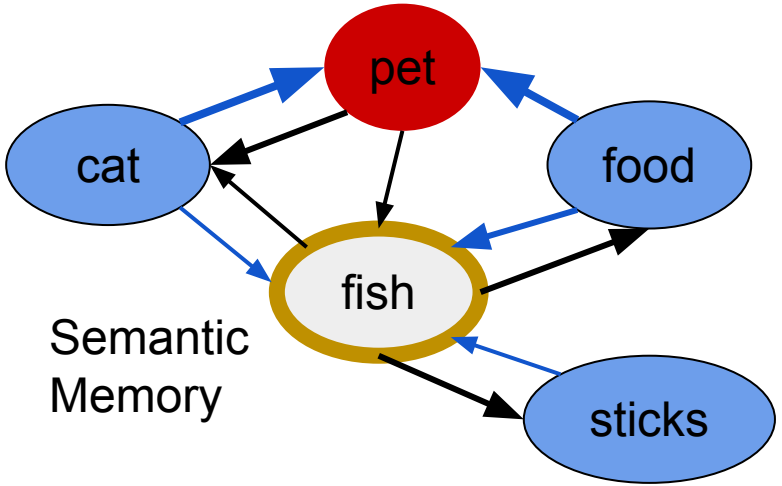
6. Evaluates “fish” as relating to 3 words



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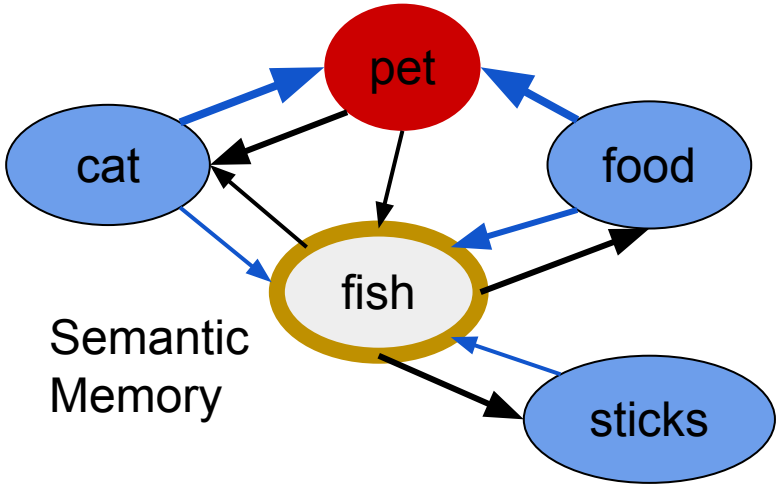
6. Evaluates “fish” as relating to 3 words
7. Returns fish



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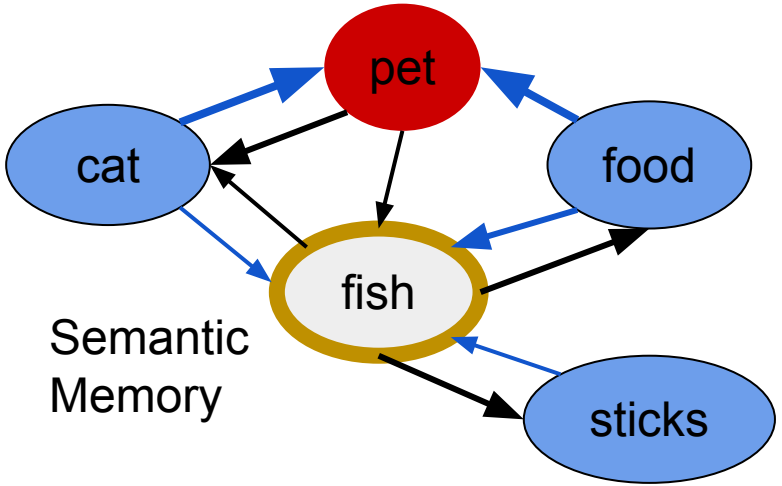

Attempt 1

Attempt 2

Non-Cued Retrieval Model

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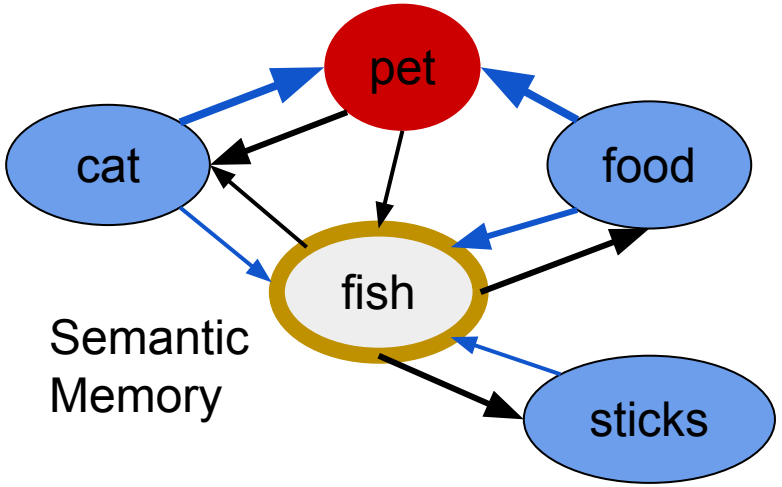
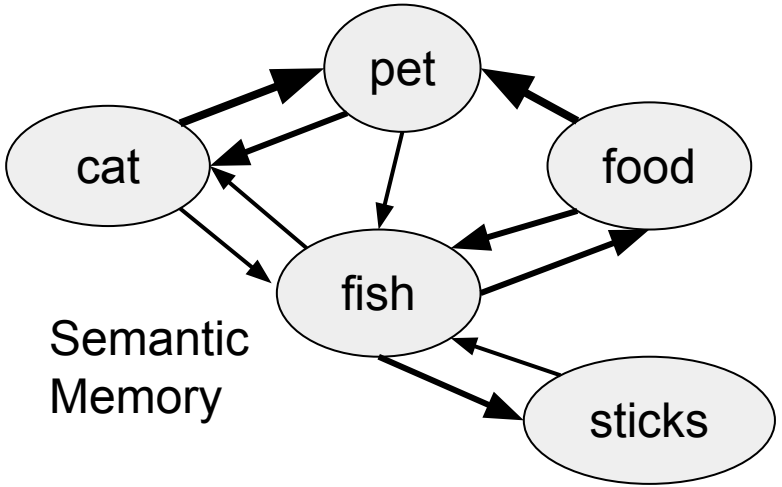


Relies on association strength and fan!

Cued Retrieval Model



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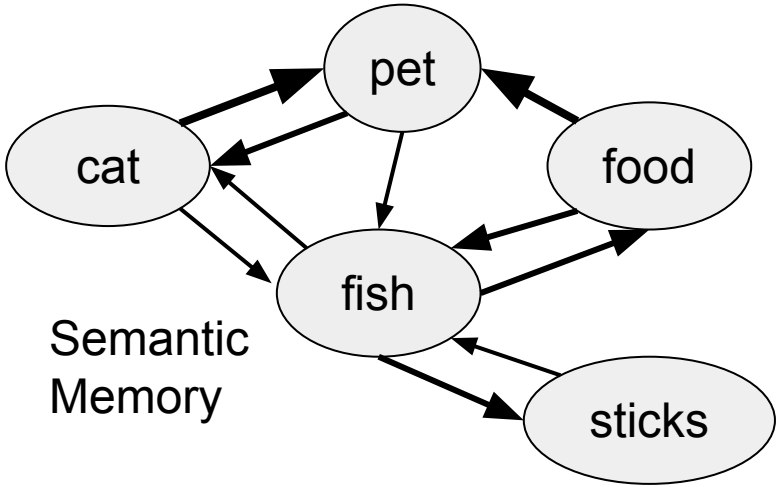

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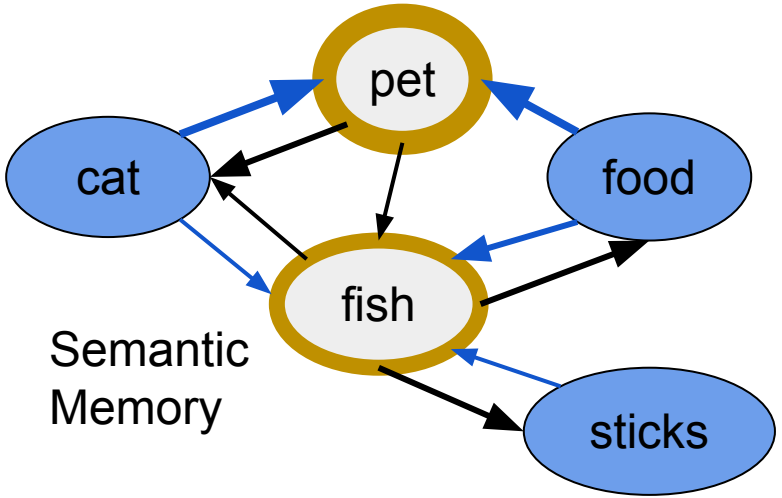

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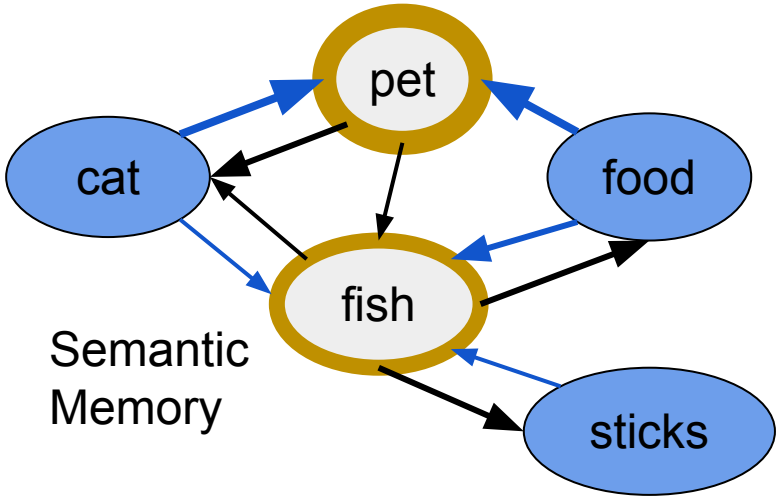
3. Model asks for a word that is associated with all 3 given RAT items



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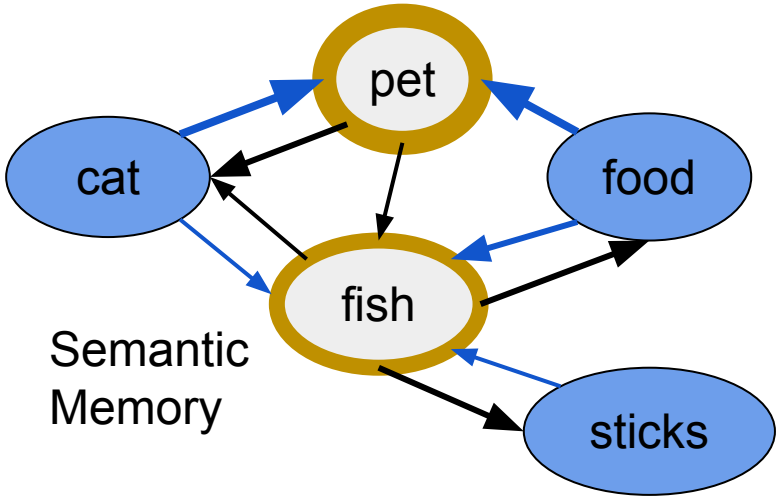

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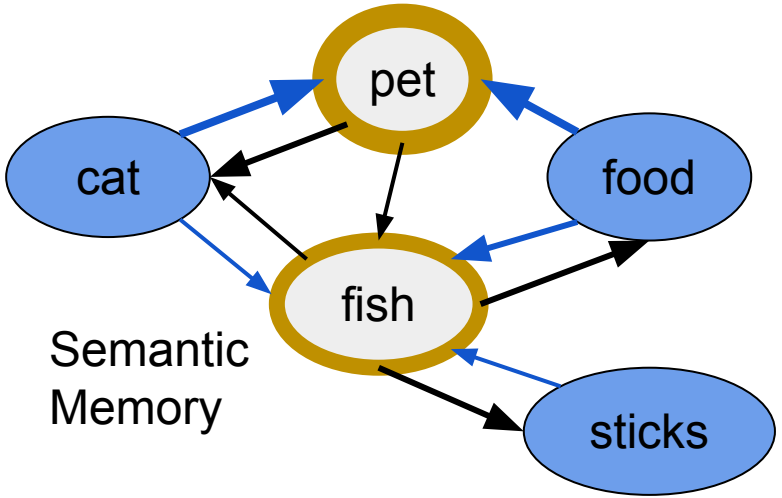

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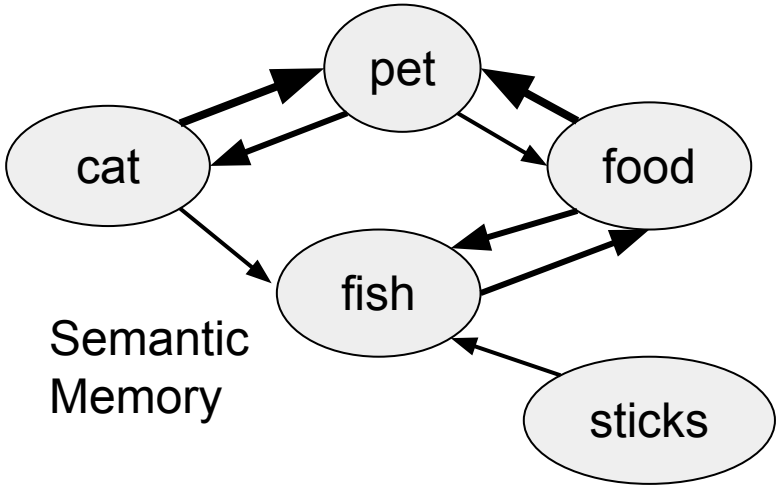

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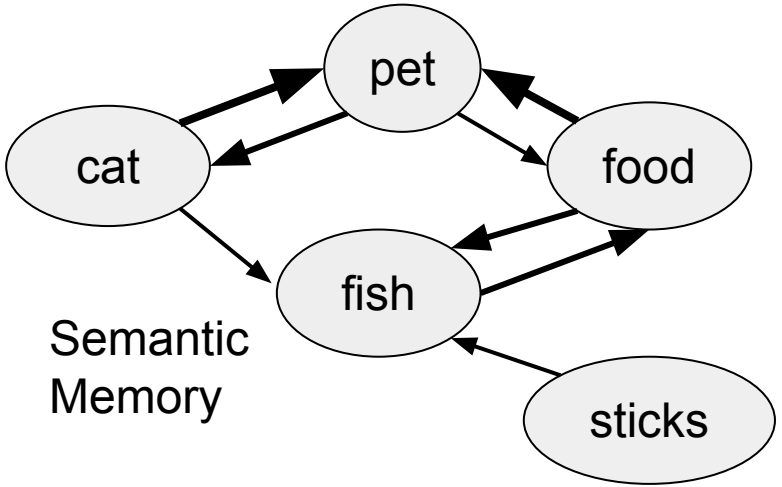

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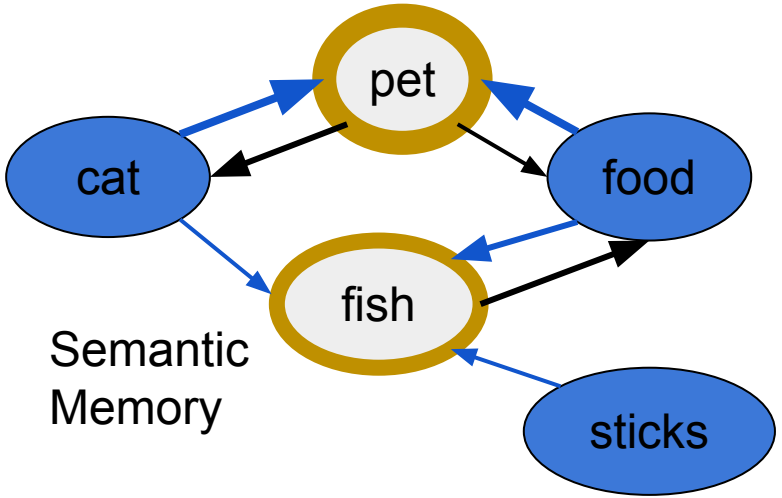

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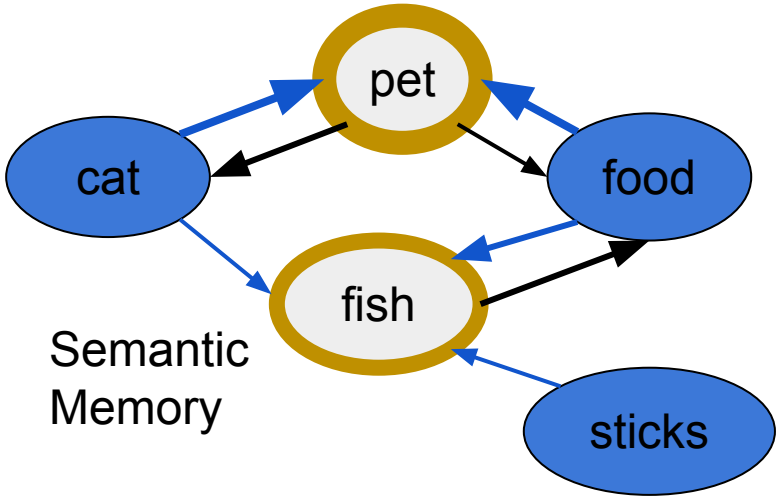

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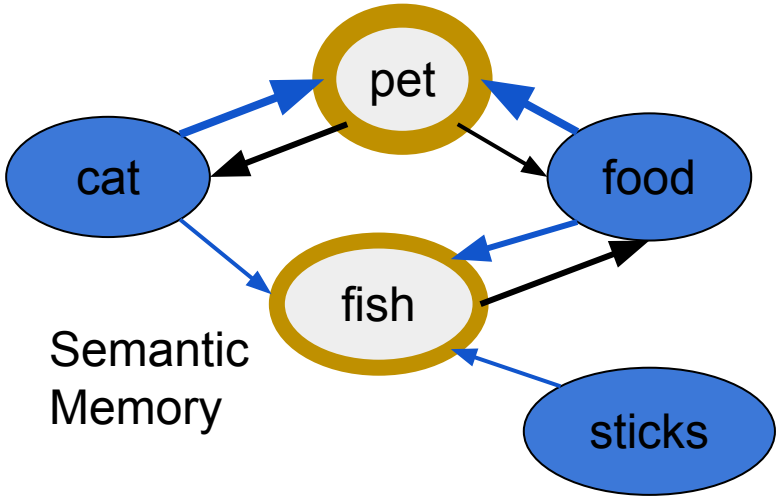

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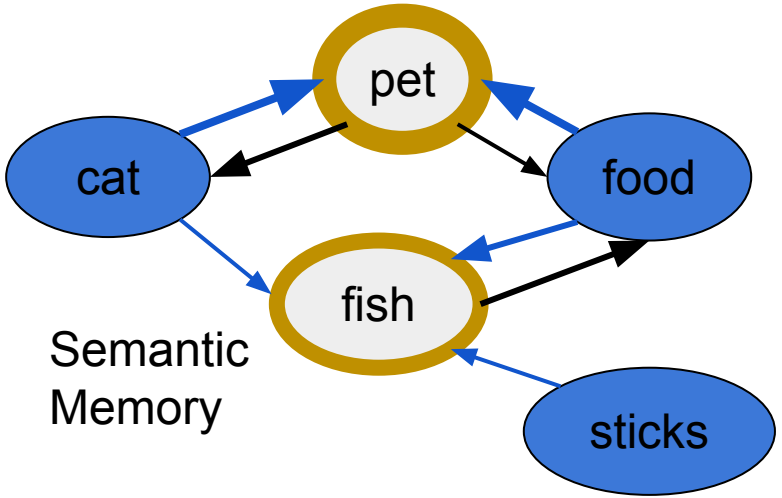

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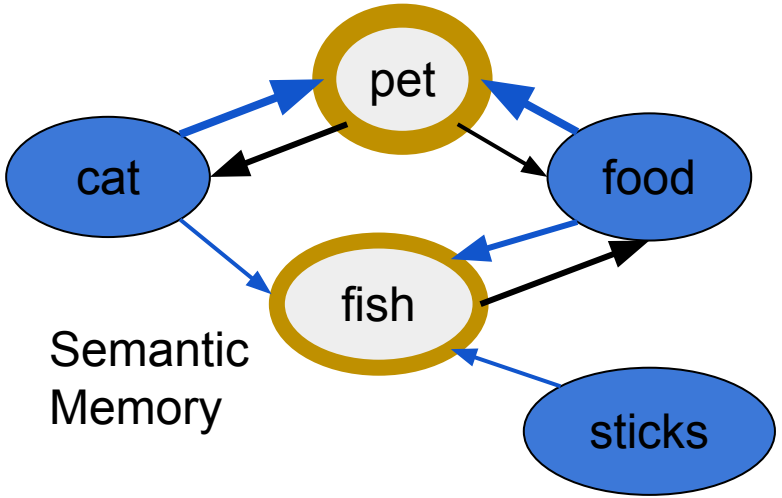

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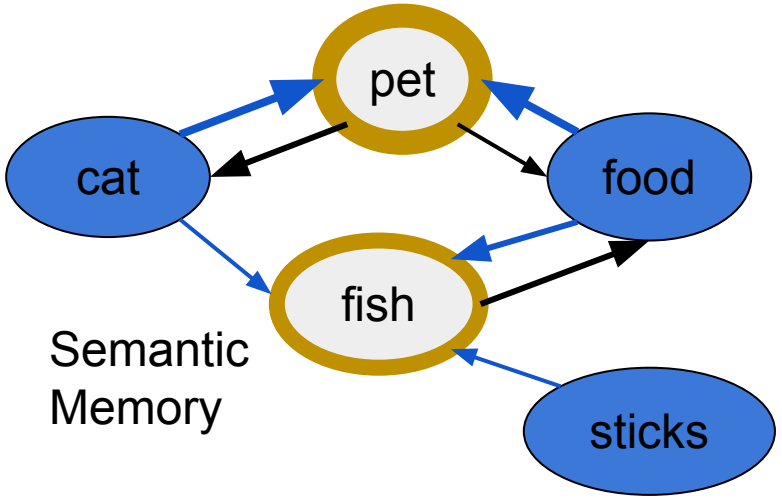

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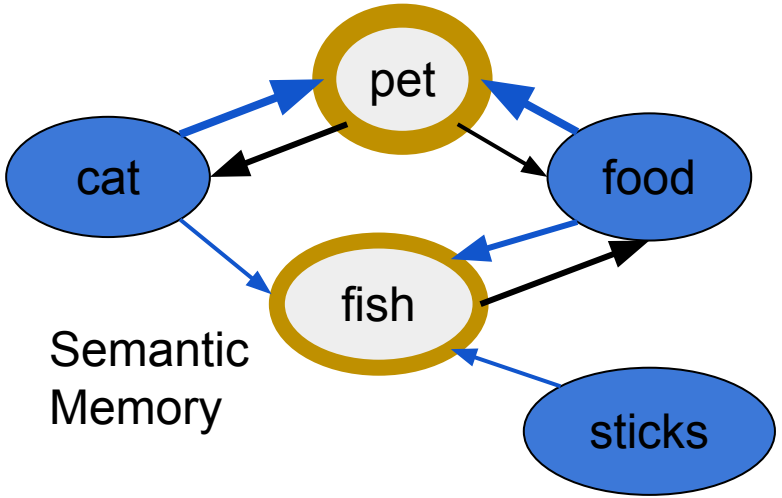


Relies on data in semantic Memory

Hypothesis

Non-Cued Retrieval Model

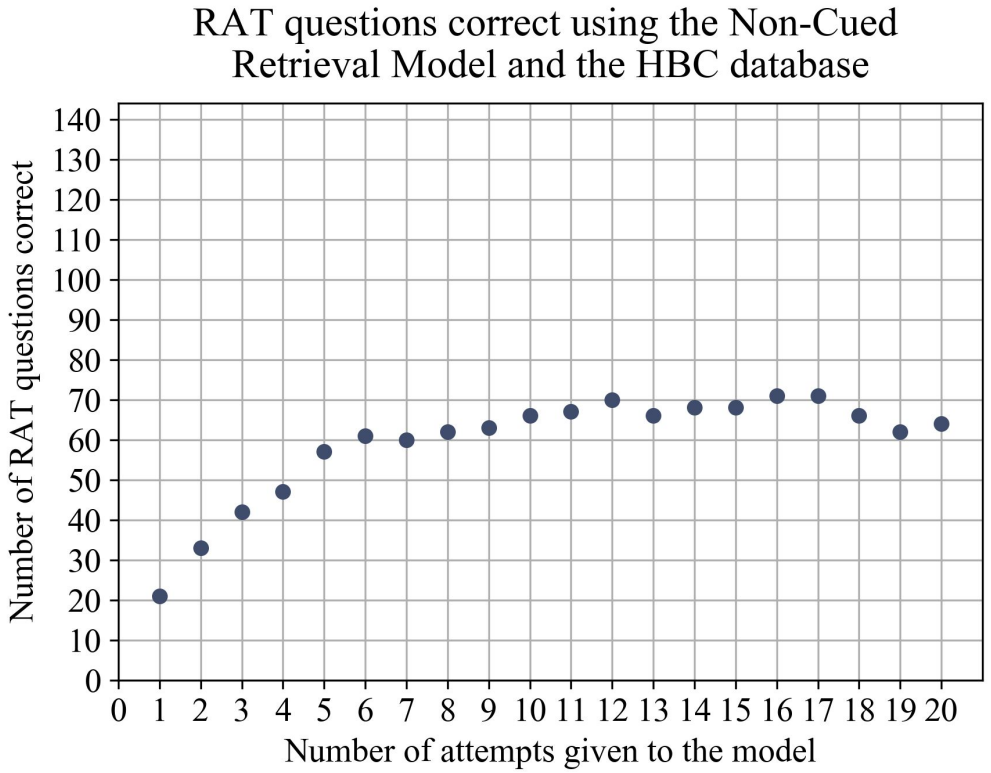
Correlate better with human data

Cued Retrieval Model

Get more RAT questions correct

Results Using HBC Knowledge Base

	RAT questions correct (out of 144)
Non-Cued Retrieval model	21-71
Cued Retrieval model	70
Humans given 15 seconds	44



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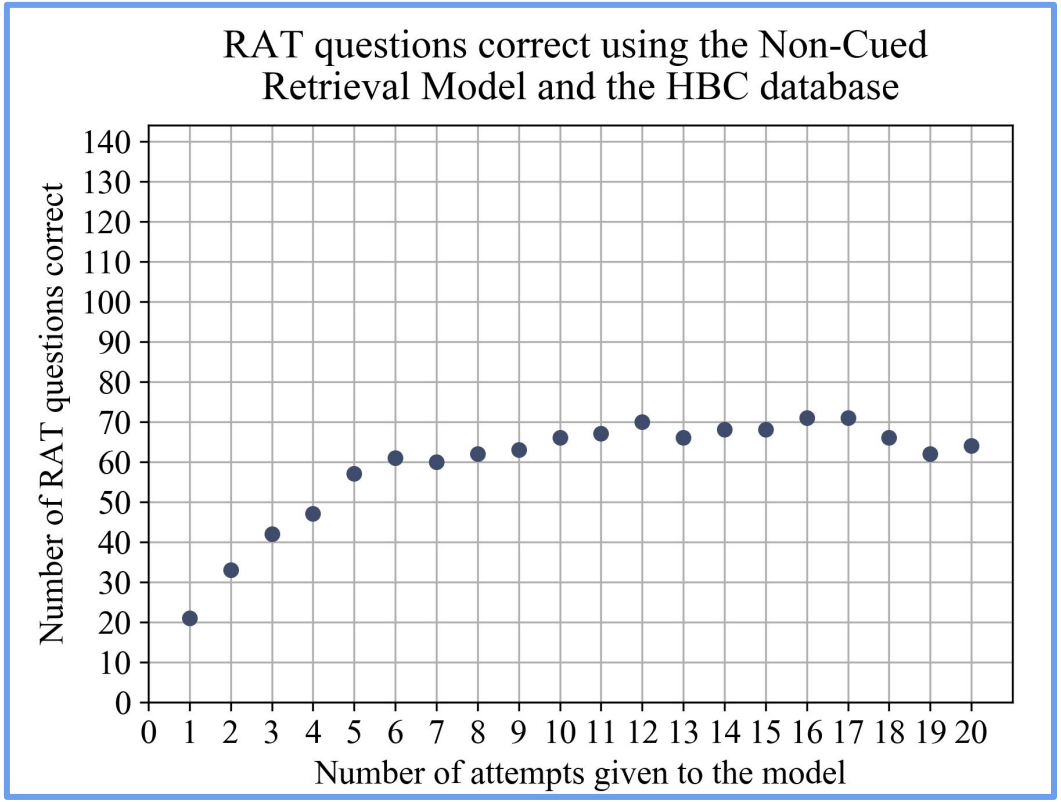

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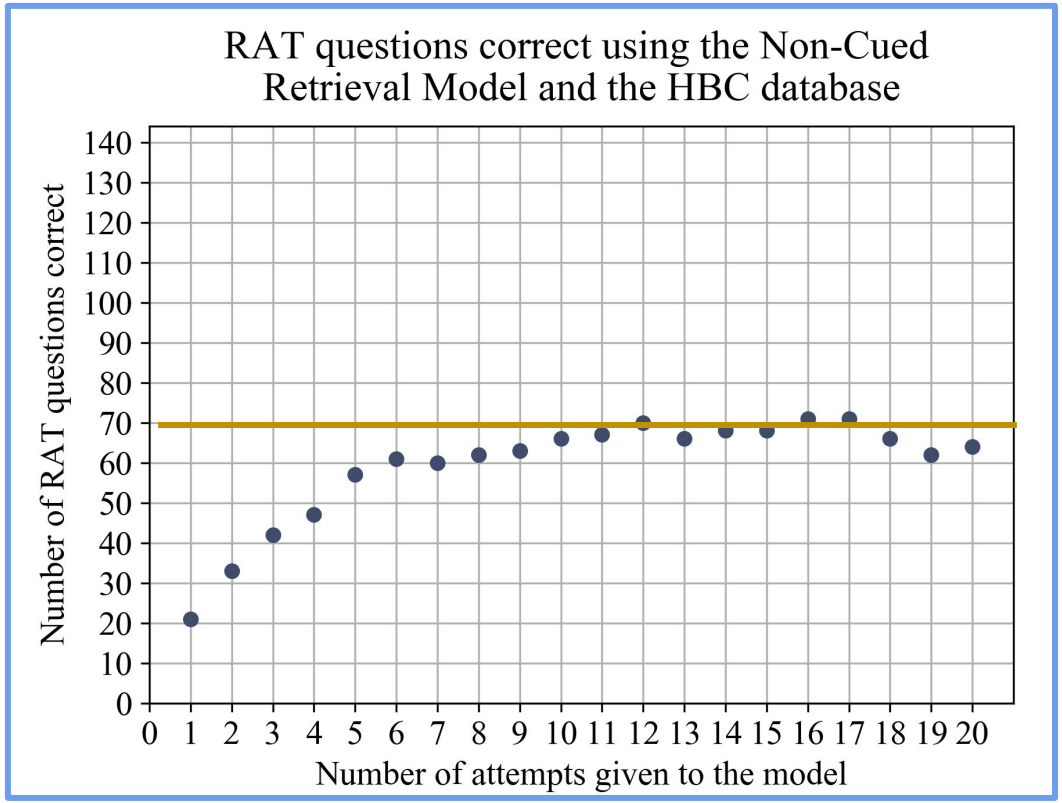

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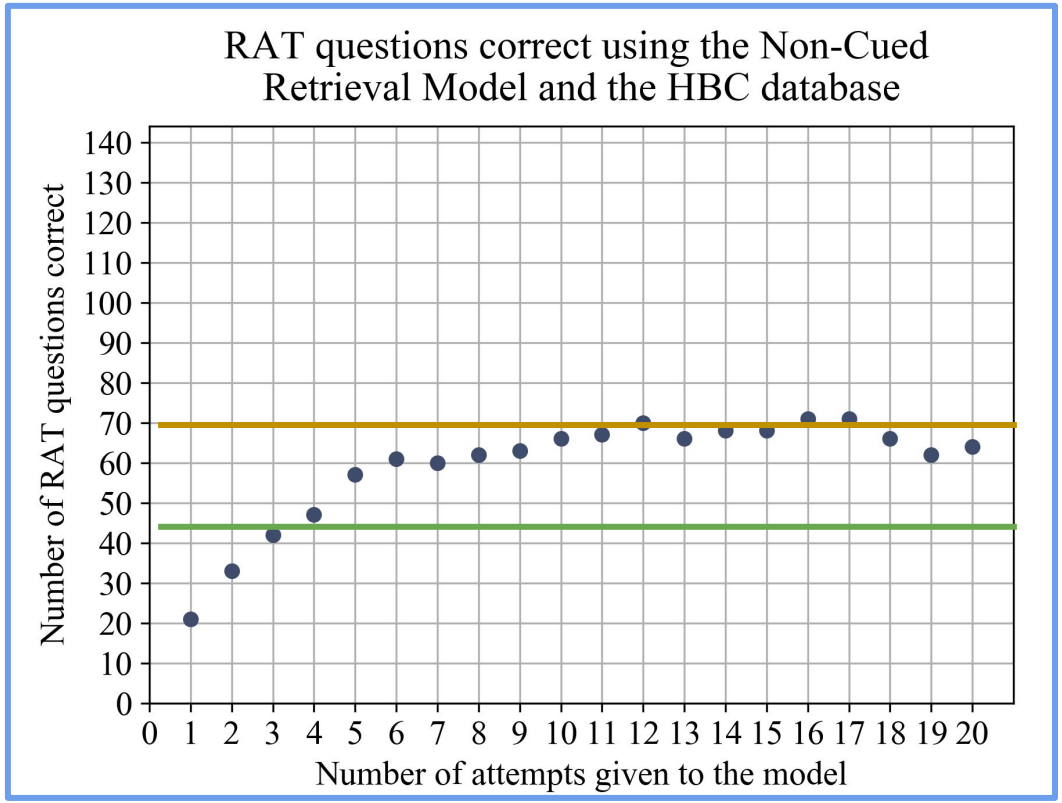

Difficulty Comparison

- 144 questions into 12 bins based on human % correct
- Compared each bin with model correctness

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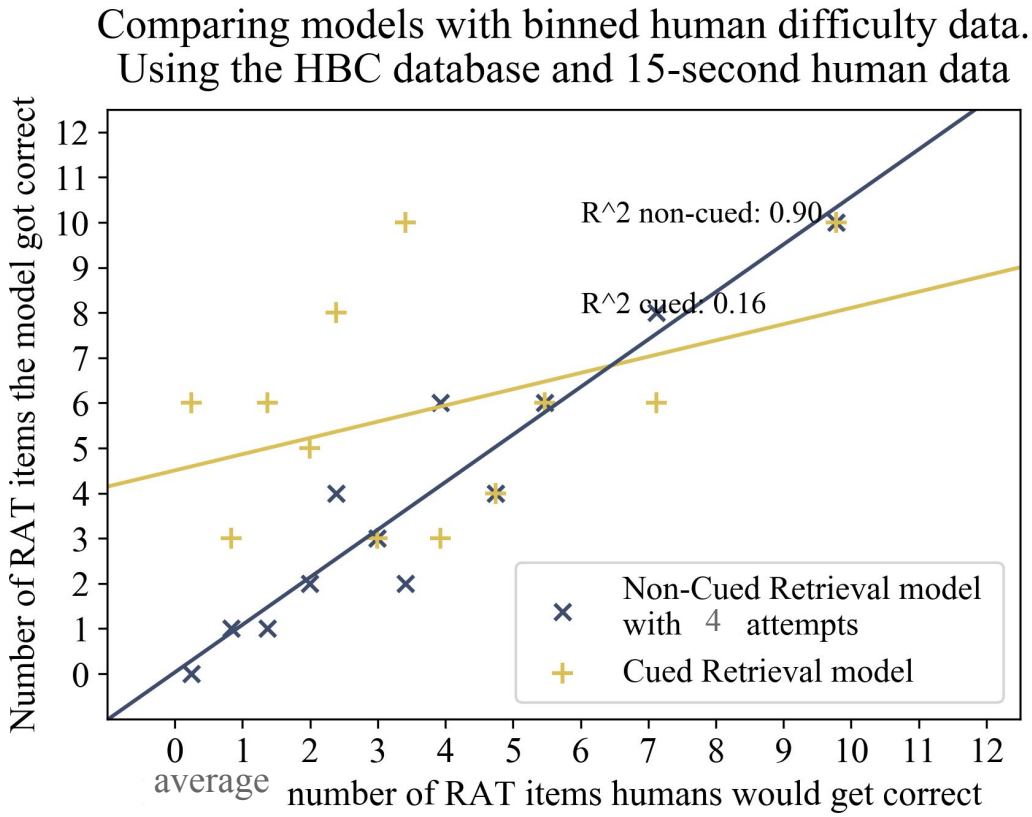
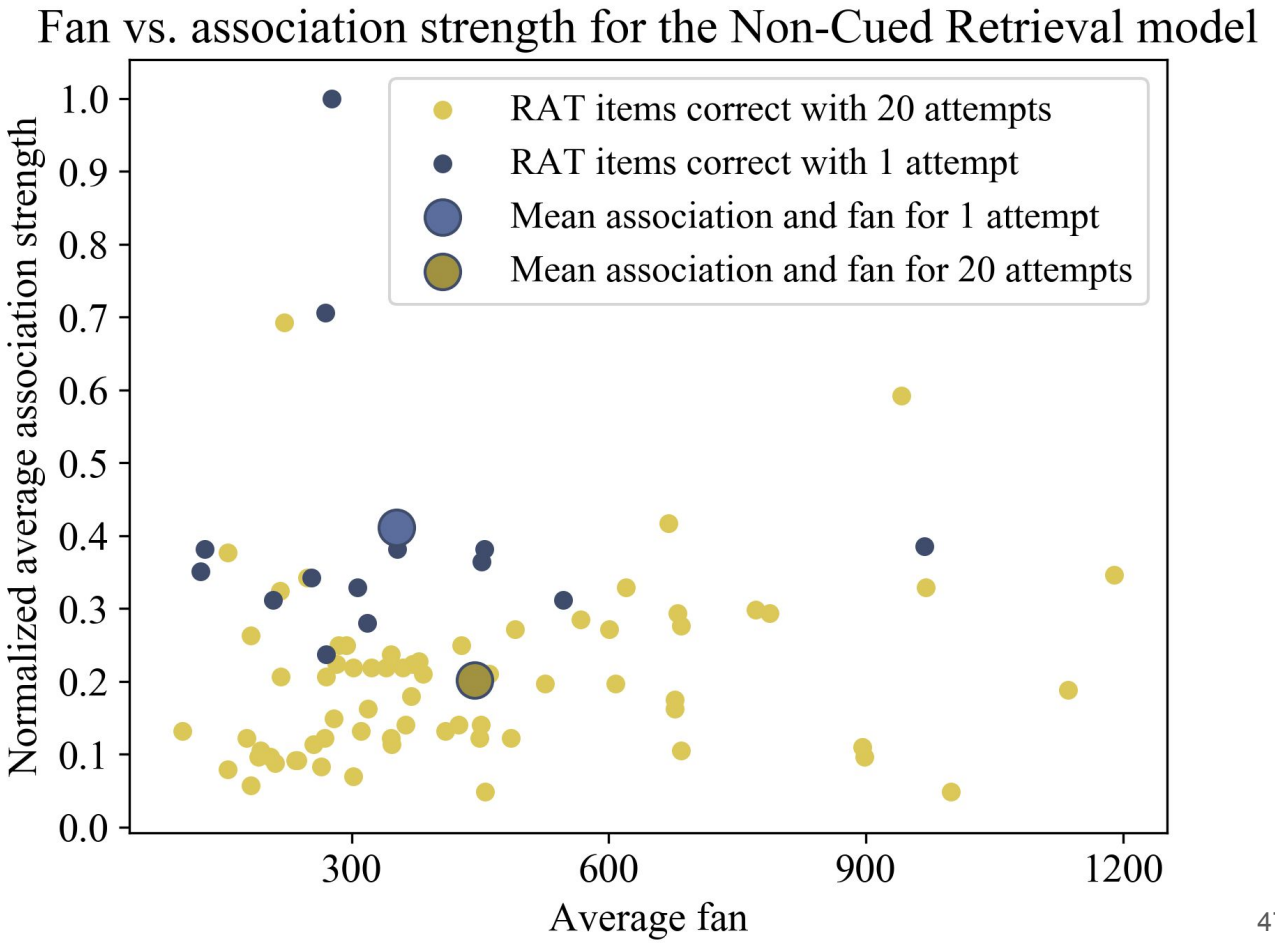


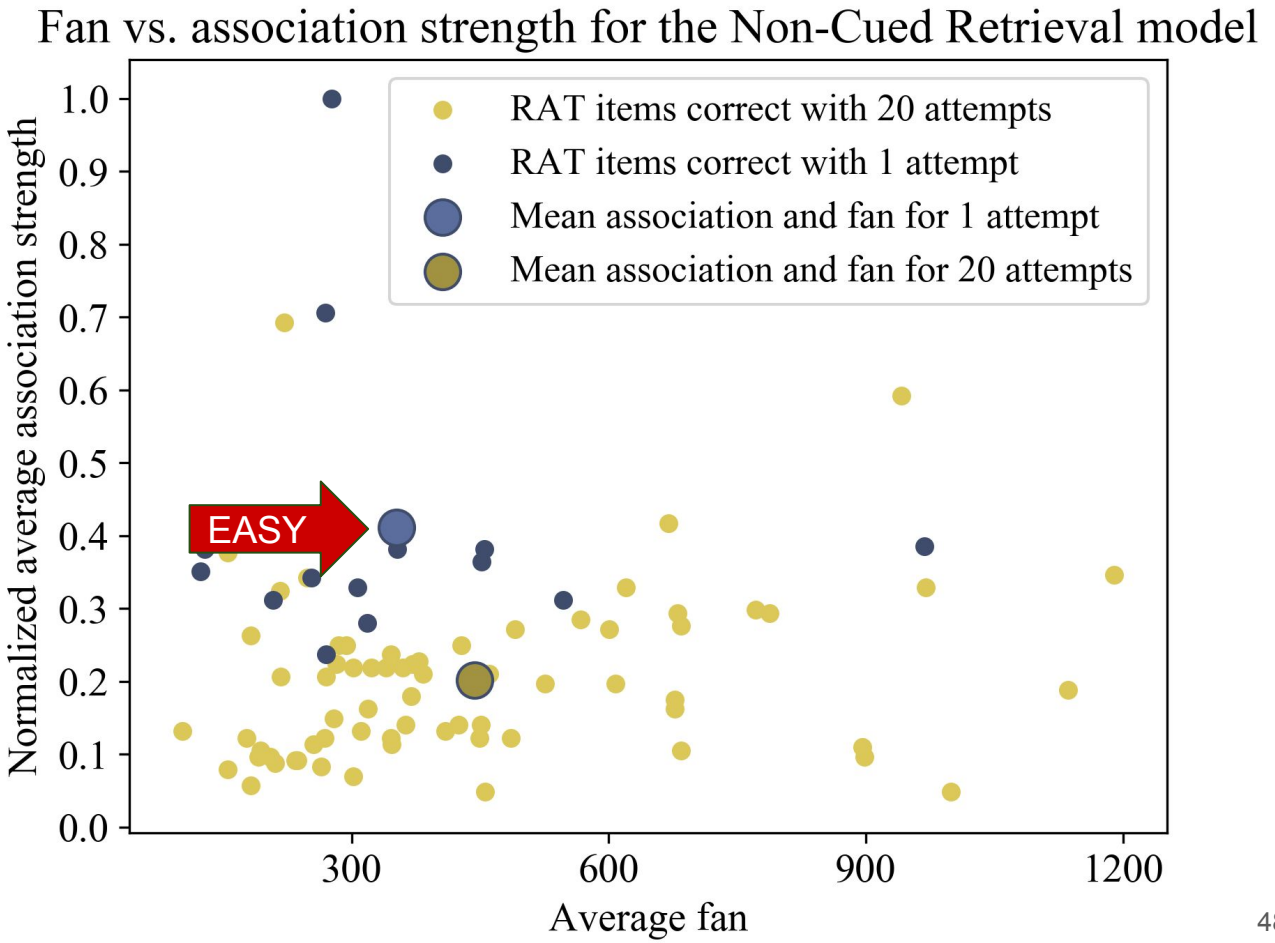
Fan and Association Strength

- Focused on questions that the model could answer correctly
  - 20 attempts (hard)
  - 1 attempt (easy)



Fan and Association Strength

- Focused on questions that the model could answer correctly
  - 20 attempts (hard)
  - 1 attempt (easy)



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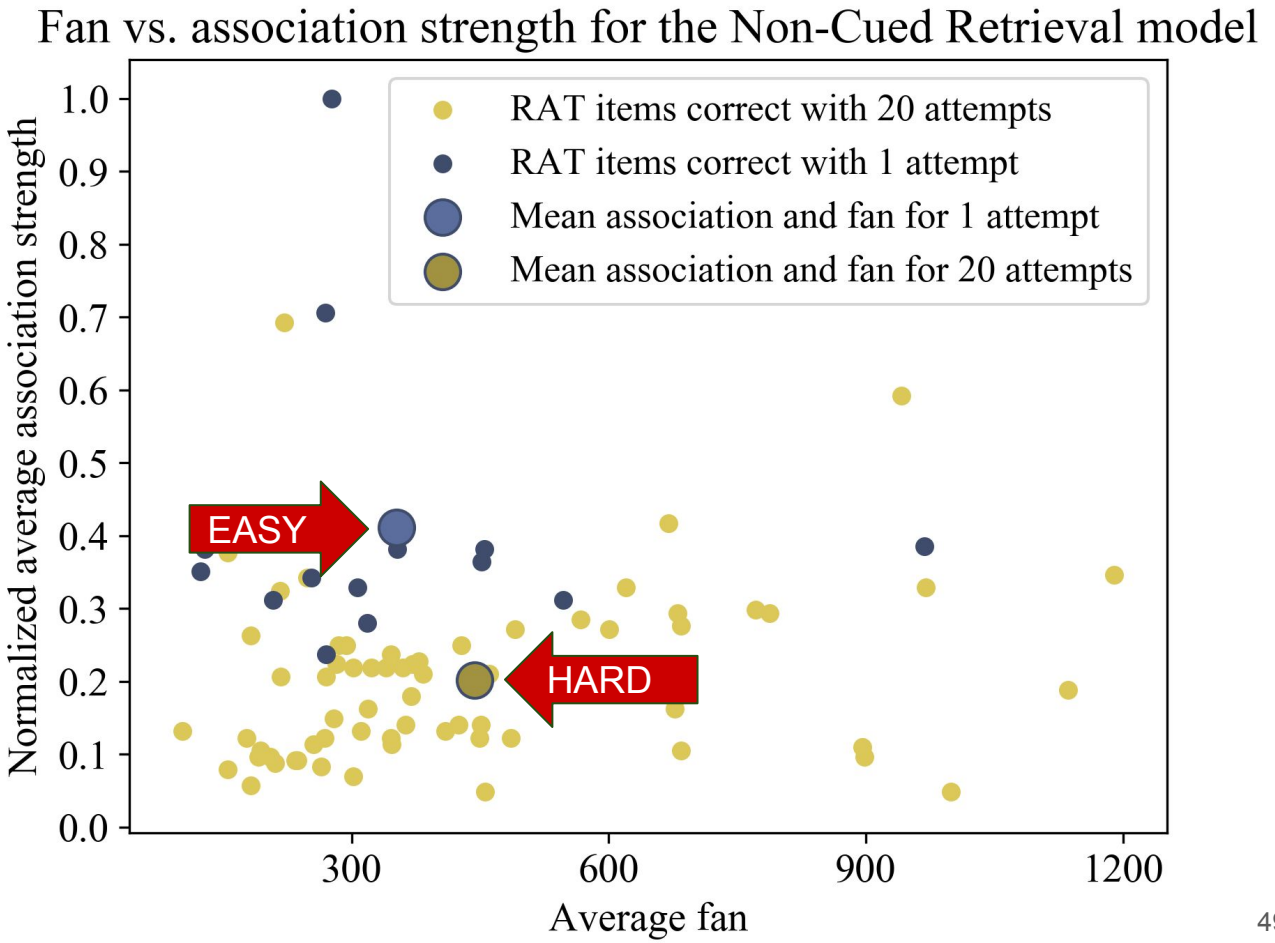


Summary

- Created a database of word associations, HBC
- Created two models in Soar
  - Non-Cued Retrieval model
  - Cued Retrieval model
- Compared models to human performance

- Knowledge base needs to be tweaked
- New knowledge bases
- More analysis on fan and association strength influences

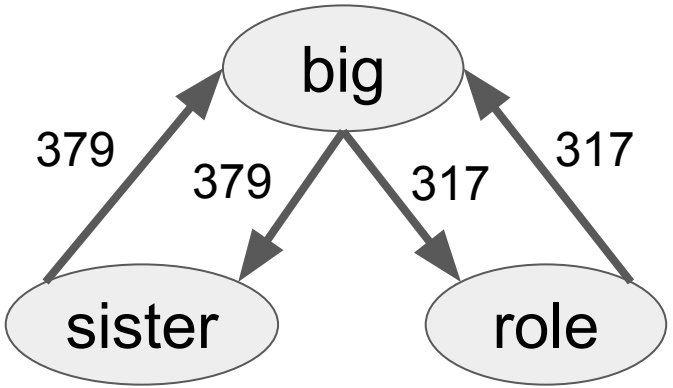
COCA-TG Knowledge Base

- Recreated from Olteţeanu and Falmoir's work
- Only compound words and bigrams, taken from COCA*

Data from *COCA

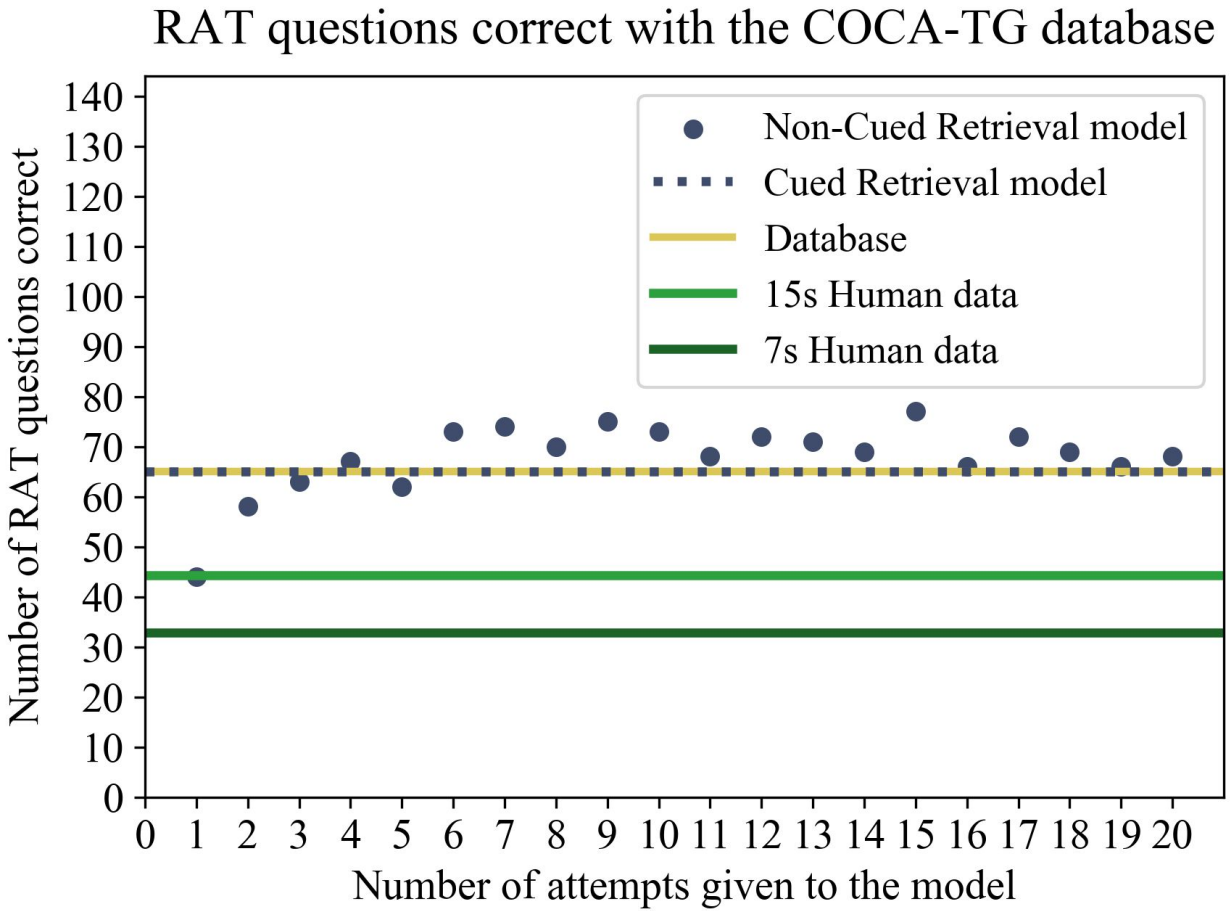
word1	word2	frequency
big	sister	379
big	role	317

Semantic Memory



*COCA- Corpus of Contemporary American English

	HBC	COCA-TG
Number of Words	40,652	20,809
Number of Associations	1,298,831	349,196


RAT questions correct with the COCA-TG database
Number of RAT questions correct
Number of attempts given to the model
Non-Cued Retrieval model
Cued Retrieval model
Database
15s Human data
7s Human data
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20