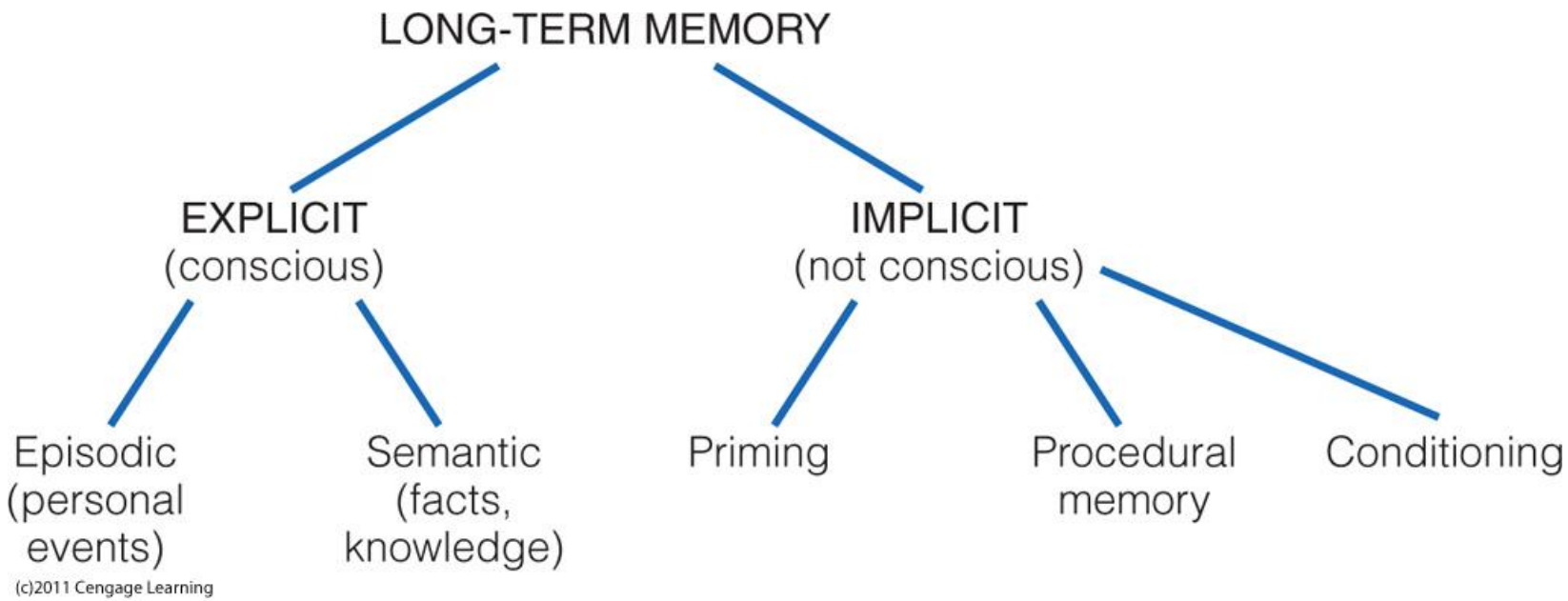
Episodic and Semantic Memory

Division of LTM



LTM distinctions

- What are the major LTM distinctions?

- STM vs. LTM
- Explicit vs. Implicit
  - Declarative vs. non-declarative
  - Conscious vs not conscious
- Episodic vs. Semantic

Semantic vs. episodic memory

Endel Tulving

- **Semantic**
- General knowledge
- Conceptual
- Less likely to be forgotten
- Less likely to be emotional
- “Is a butterfly a bird?”
- What are breakfast foods?

- **Episodic**
- Specific learned event
- Time-related
- More likely to be forgotten
- More likely to be emotional
- “butterfly” on the list?
- What did you have for breakfast?

Episodic and semantic dissociation

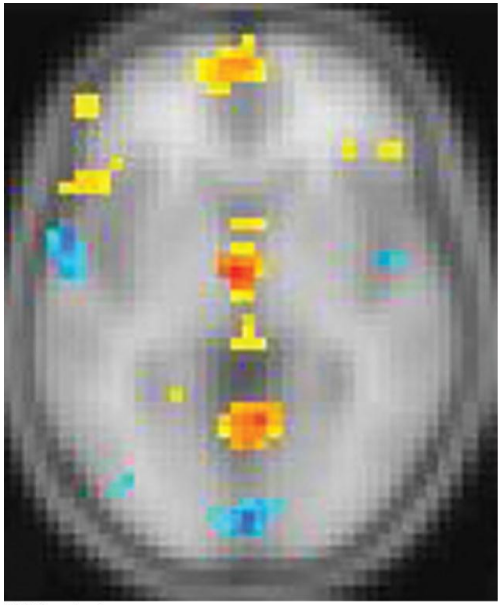
- Difference in experience of retrieval
  - Episodic: “mental time travel”; remember
  - Semantic: know
- How do episodic and semantic memory influence each other?
  - Episodic decays over time, retain semantic
    - Details fade but general fact information is retained
  - Semantic enhanced with episodic
    - Better recall of info when associated with personal experiences
  - Semantic influences attention & detail of episodic memory
    - Knowledge allows for chunking
- Is there evidence of independent systems?

Neuropsychological evidence

- K.C.
  - Motorcycle accident
  - Loss of episodic memory: no memory for events in the past nor able to create new ones
  - Retained semantic memory: able to learn new facts (e.g. brother's death)
- Italian woman
  - Encephalitis
  - Loss of semantic memory: unable to remember meaning of words, nor recognize familiar or famous people
  - Intact episodic memory: able to remember events of her life; however unable to create new episodic events
- Clive Wearing
  - Encephalitis
  - Loss of episodic memory; intact semantic memory for info before illness

Neuroscience evidence

- Levine et al. (2004)
  - Diary on audiotape; listened to recording in scanner
- fMRI data suggest different areas represented for episodic vs semantic (with some overlap)
  - Yellow = episodic; Blue = semantic; Green/red: overlap
  - Episodic: greater prefrontal cortex



Rajah & McIntosh (2005)

Found similar pattern of neural interactions within each model so "episodic and semantic retrieval may reflect variation along a <u>continuum</u> of processing during task performance within the context of a single memory system."

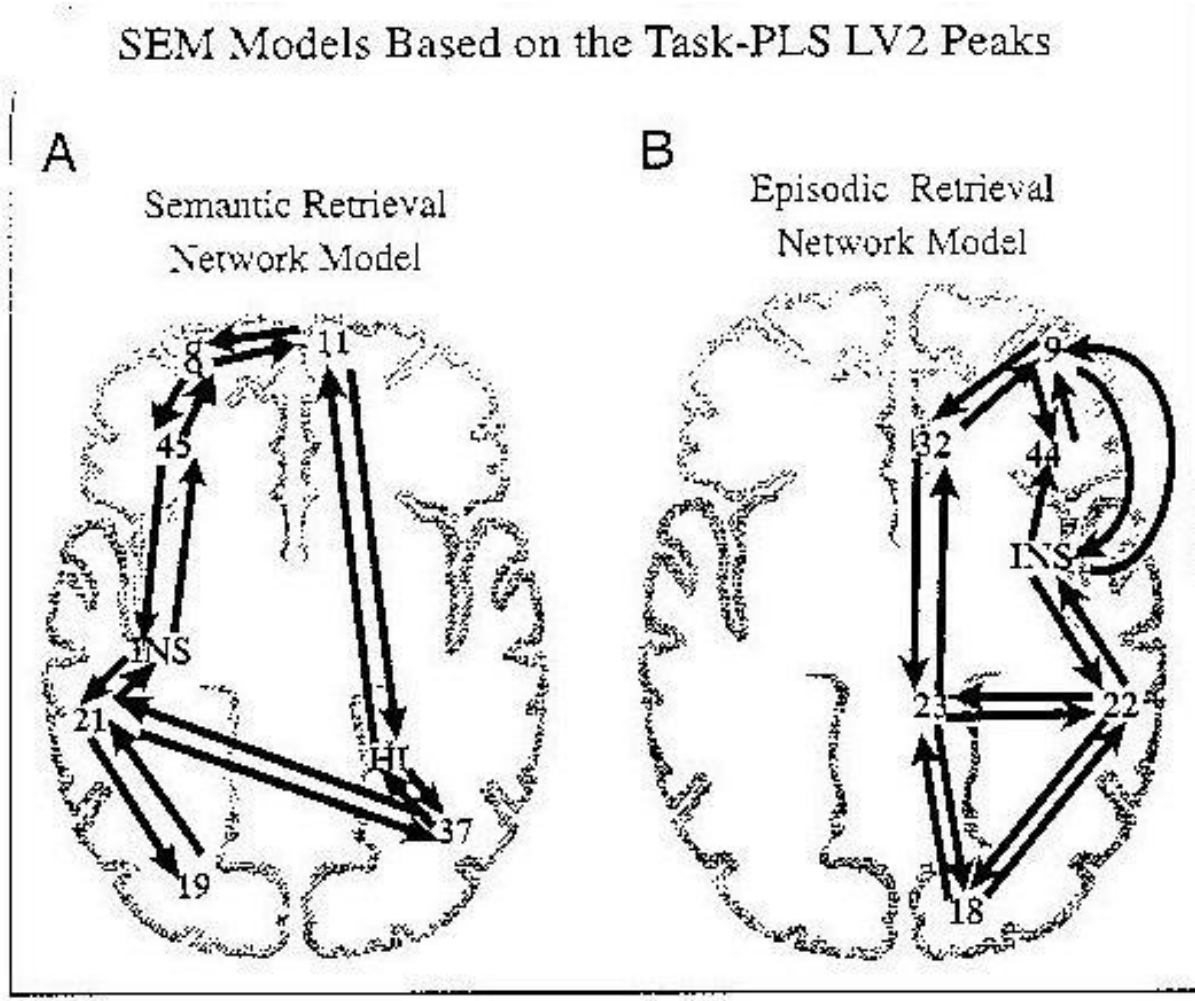


Figure 2. Anatomic model for the network analysis. The arrows

Neuroscience evidence: Episodic

- Cabeza et al (2004)

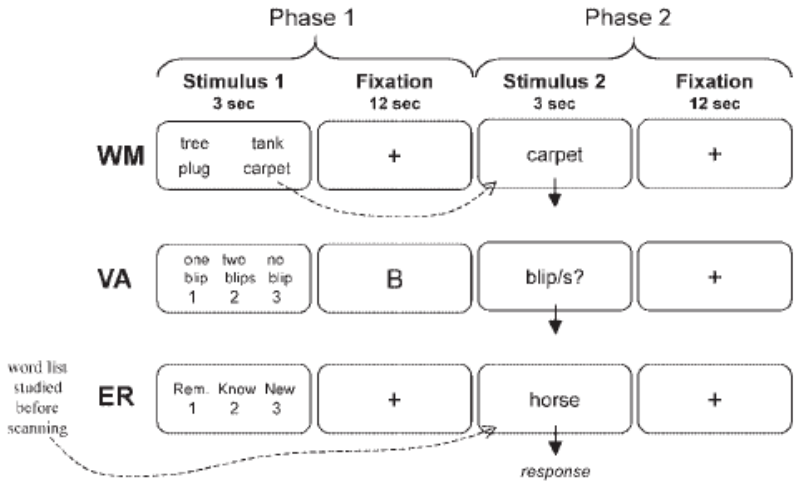


Figure 1. Behavioral paradigm. WM was investigated with a word delayed-response test, VA with a sustained attention task, and ER with a word recognition task.

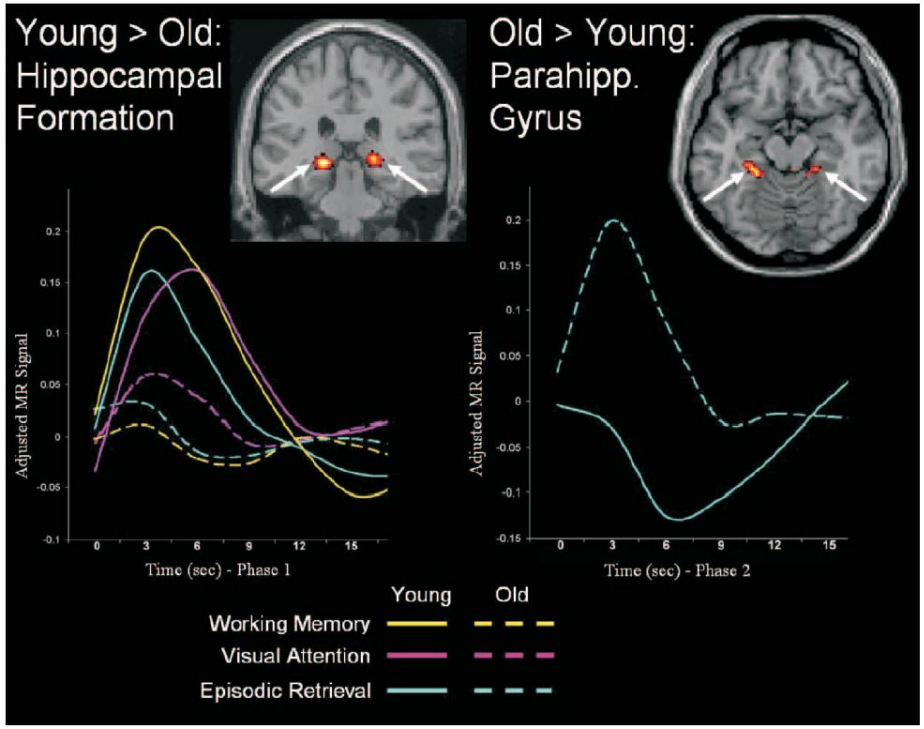
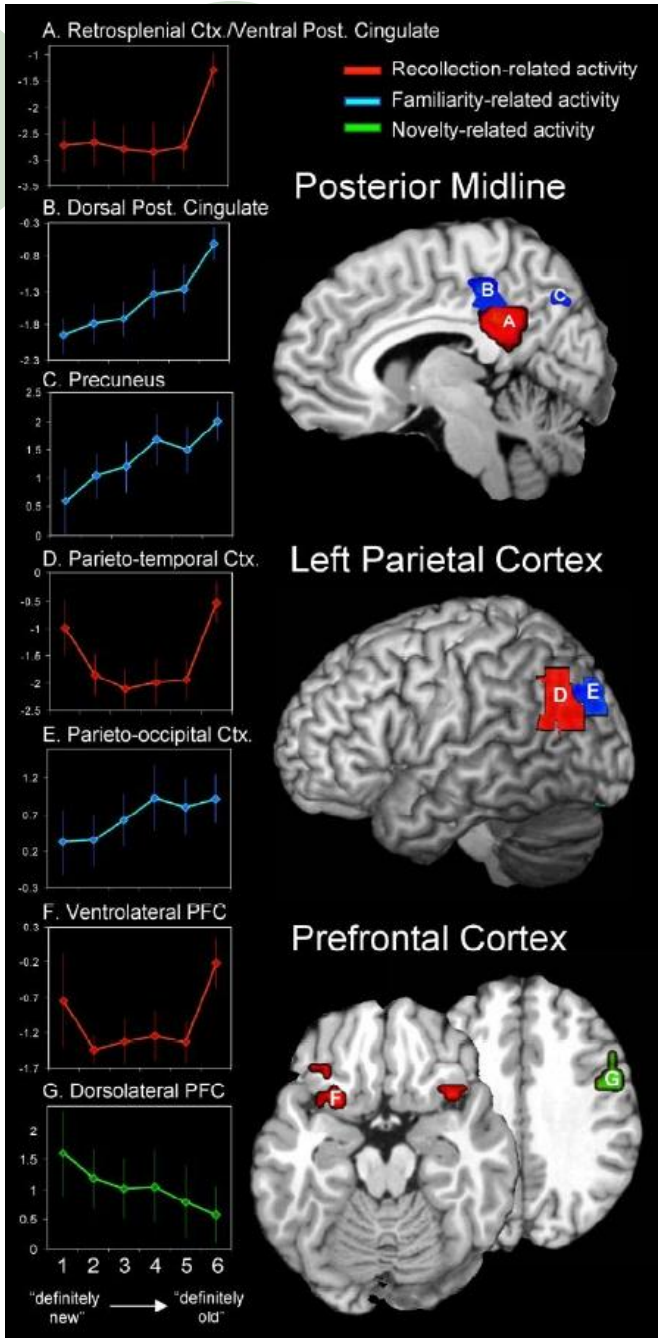


Figure 4. Dissociation between two medial temporal lobe regions. The hippocampal formation, bilaterally, was more activated in younger than in older adults during all tasks (task-independent age effect), whereas the parahippocampal gyrus, bilaterally, was more activated in older than in younger adults during the ER task (task-specific age effect). The time-course plots are from the left hippocampal formation ($x, y, z = -19, -29, -2$) and the left parahippocampal gyrus ($x, y, z = -26, -34, -11$).

Cabeza lab

http://www.cabezalab.org/projects/episodic-memory

- Functional neuroimaging studies have associated episodic memory with activations in the prefrontal cortex (PFC), the medial temporal lobes (MTL), and other brain regions (for reviews, see Cabeza, 1999; Cabeza & Nyberg, 2000b; Nyberg & Cabeza, 2000).
- However, the specific contributions of each of these regions and their sub-regions to various episodic memory processes remain unclear.
- Currently, we are trying to clarify the neural correlates of two sets of episodic memory processes: relational memory and recollection, and true vs. false memories.



Semantic memory research

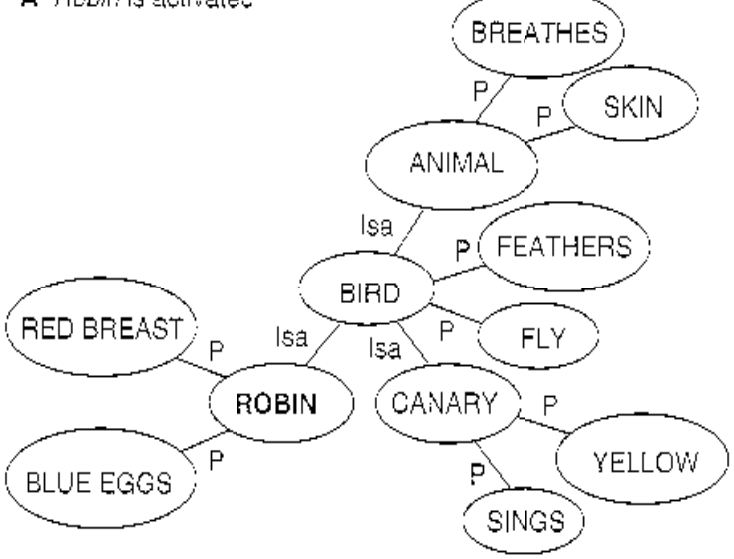
- Structure: How do we represent words and word meanings in memory?
- Process: How do we retrieve such knowledge?
- Two models:
  - Collins & Quillian (1969, 1970, 1972)
  - Smith (Smith, Rips, & Shoben 1974)
- Methodology:
  - Sentence verification task
  - True or false: “A robin is a bird”
  - Examine RT
  - Independent variables: relatedness, frequency, concreteness, repetitions

Sentence verification

Answer as quickly as possible either true or false.

- A poodle is a dog.
- A squirrel is an animal.
- A flower is a rock.
- A carrot is a vegetable.
- A mango is a fruit.
- A petunia is a tree.
- A robin is a bird.
- A plantain is a vegetable.
- Coca-cola is a soda.
- Wofford is a college.
- Spartanburg is a village.
- Psychology is a science.

Collins & Quillian Model

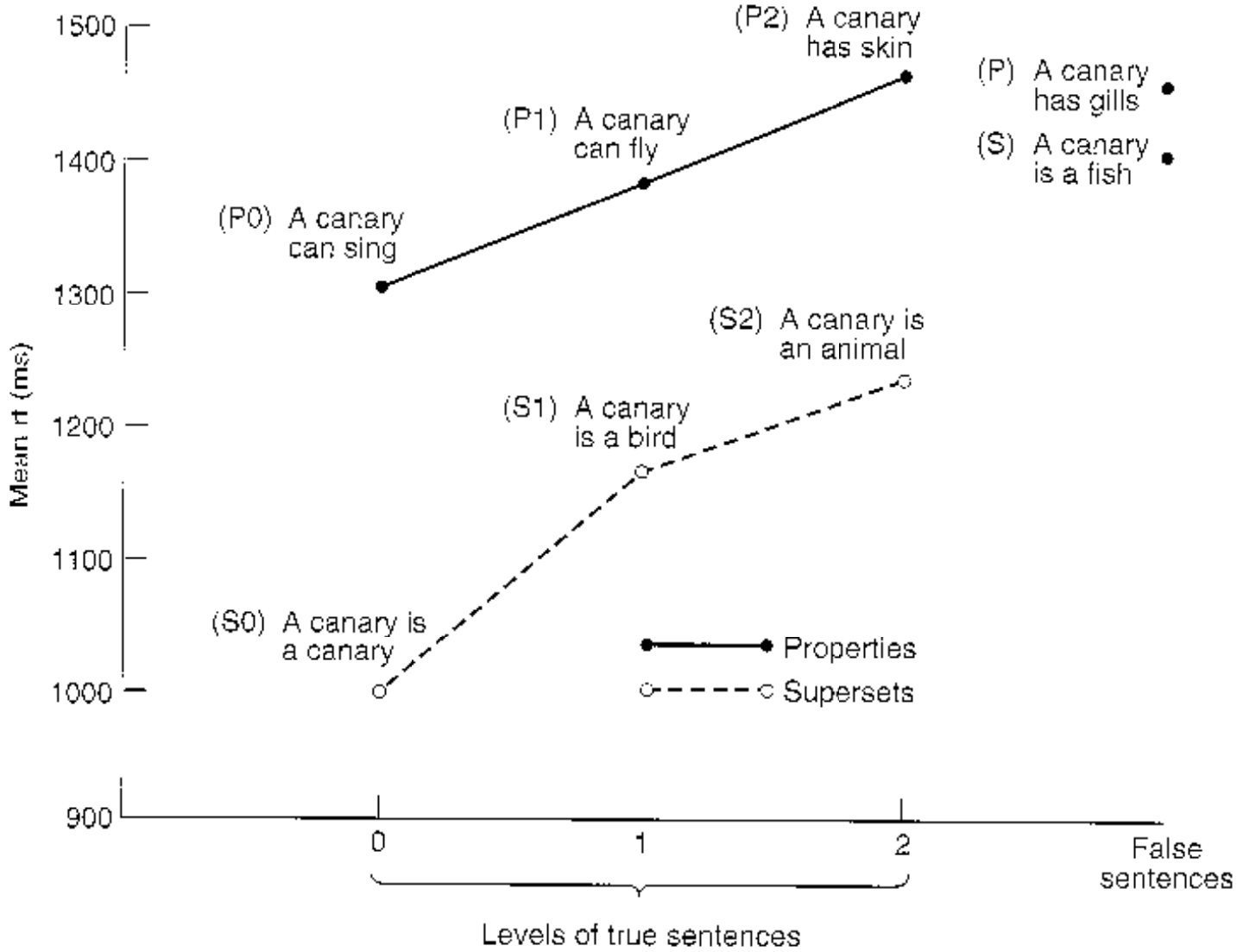


- Semantic memory network
- Structure
  - Concept *nodes* connected by *pathways*
  - Connections denote a *proposition*: directional relationship between concepts
    - Category or "*Is a*" statement: member of a category
    - *Property statement* (P): "has a"
- Process
  - *Spreading activation* (vs. inactive baseline)
    - Priming: Temporarily more accessible
  - *Intersection*: 2 spreads of activation connect
  - Decision stage

Types of sentences to be tested

- Category size:
  - A robin is a bird. vs. A robin is an animal.
  - A dog is mammal. vs. A dog is an animal.
  - Hyp: Faster if smaller category
- Typicality:
  - A robin is a bird. vs. A penguin is a bird.
  - Hyp: Faster if typical member
- False sentences:
  - A bat is a bird vs. A pencil is a bird
  - Hyp: Faster if “more” false

Collins & Quillian (1969)



Semantic memory: Methodologies

- Association tasks
  - Category association
- Category verification tasks
  - RT to word pairs (e.g. “robin-bird” vs “computer-bird”
- Lexical decision tasks
  - RT to decide if word or non-word