Chapter 7 –
Semantic Long-Term Memory

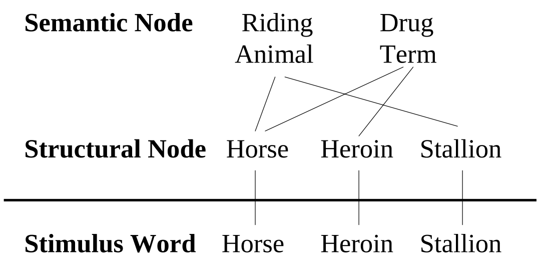
Endel Tulving

- U of T
- ***Episodic Memory***: autobiographical knowledge about personal past, unique to the individual
- ***Semantic Memory***: general knowledge about the world that all members of a culture possess

Ambiguity

side of a river ← bank → place where money is kept

Nodes in Memory



Anderson et al. (1976)

- ***Instantiation*** = encoding a particular structural node as connected to a particular semantic node
- semantic memory “intrudes” to influence episodic memory

- study: “the fish attacked the swimmer”
- best cue for recall of “attacked the swimmer” is “shark”, not “fish”

Production vs Verification

- ***Verification*** = indicating the truth of a test item
  - FRUIT-peach; ANIMAL-carnation
  - A horse is an animal; A table is a fruit
- ***Production*** = retrieving an instance from memory when given a cue
  - FRUIT-a
  - FRUIT-d
  - A rose is a ____________

Allan Collins & Ross Quillian

Ross Quillian

Allan Collins

- Quillian (1965) designed a computer model of semantic knowledge
- Collins & Quillian (1969, 1970) developed a technique to test semantic memory

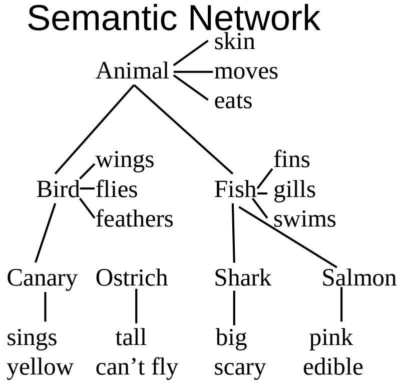
Hierarchical Network Model (Collins & Quillian, 1969)

- semantic memory consists of a network of basic elements (nodes) connected by pointers which express relations between elements
- stored with each element are a list of properties that define the features of each concept

Hierarchical Network Model (Collins & Quillian, 1969)

- organization of the information is hierarchical
- assumption of cognitive economy - features or properties are represented only once at the highest level of the hierarchy

Semantic Network



Hierarchical Network Model

Assumptions of the model:

- it takes time to move from one level of the hierarchy to a different level
- it takes additional time to retrieve features (properties) stored at a level

  >therefore, it should be faster to answer questions about category membership than about properties

Hierarchical Network Model

Tests of the model: Sentence Verification task. True? Yes or No

<u>Category Membership (supersets)</u>

S0: A canary is a canary

S1: A canary is a bird

S2: A canary is an animal

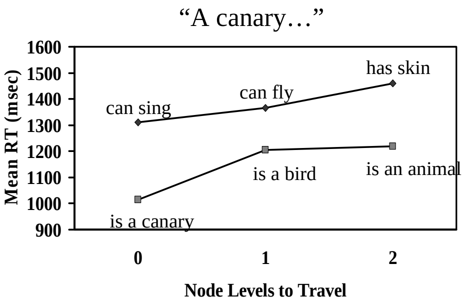
<u>Properties</u>

P0: A canary is yellow

P1: A canary can fly

P2: A canary has skin

Collins & Quillian (1970)



Priming

- *prime*: "a robin can fly"
  vs "a robin has a red breast"
- *target*: "a robin is a bird"
- faster on target when primed by "fly" rather than "red breast" because "fly" is stored with "bird" whereas "red breast" is stored with "robin"

Problems with Hierarchical Network Model

- Model does not explain the Typicality Effect: *Faster to verify typical members of category than atypical members.*
  e.g., A robin is a bird
  A chicken is a bird
- In model, typical and atypical members are at same level of hierarchy, so should take the same time

Schaeffer & Wallace (1970)

- faster to category verify HORSE-COW than HORSE-CAT
- slower to category verify WALNUT-DAISY than WALNUT-PARROT

- similarity helped "yes" but hurt "no" – contrary to Collins & Quillian semantic distance idea
- suggested the use of feature overlap

Semantic Features Model
(Ripps, Shoben & Smith, 1973)

- developed to explain results that Hierarchical Network cannot explain
- all concepts in semantic memory represented as sets or lists of features
- no cognitive economy, same features stored with different concept

Semantic Features Model
(Ripps, Shoben & Smith, 1973)

Two types of features:

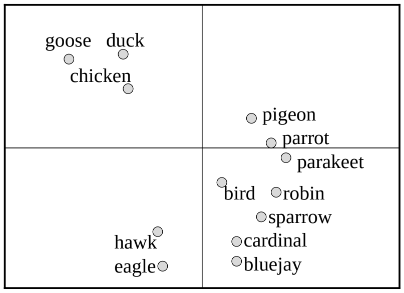
1. Defining Features - features essential to define concept

   e.g., bird - has feathers, has wings

2. Characteristic Features - features that are characteristic or common to many members of category, but not essential

   e.g., bird - able to fly

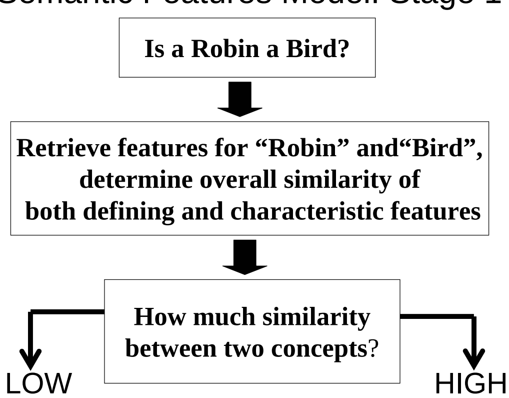
Scaling Similarity



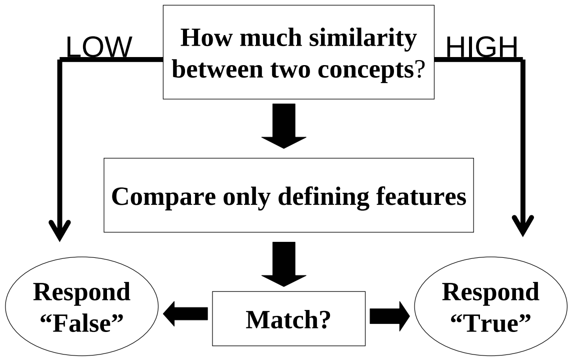
Semantic Features Model
(Ripps, Shoben & Smith, 1973)

- Relationships between concepts not stored in memory, must be computed

Semantic Features Model: Stage 1



Semantic Features Model: Stage 2



Semantic Features Model

Comparisons based only on Stage 1:

- A "robin" is a "bird"
  -high similarity between all features

- A "pencil" is a "bird"
  -very low similarity between all features

Semantic Features Model

Comparisons based on Stage 2:

- An "ostrich" is a "bird"
  -medium similarity, share defining but not characteristic features
- A "bat" is a "bird"
  -medium similarity, share some characteristic features but not defining characteristics

Semantic Features Model

Can explain Typicality Effect:

- decisions about typical exemplars can be made using only Stage 1 of model
  (e.g., a robin is a bird)
- decisions about atypical exemplars slower because must go to Stage 2
  (e.g., an ostrich is a bird)

Criticism of Semantic Features Model

Model cannot easily explain priming effects

Spreading Activation Network Model (Collins & Loftus, 1975)

Elizabeth Loftus

Allan Collins

- concepts organized in network, but organization not hierarchical
- features also stored with concepts
- length of links between concepts represents strength of associations
- assumes activation spreads between concepts

Meyer & Schvaneveldt (1971)

- lexical decision task
- RT measure

- NO trials (usually) not of interest
- are YES trials faster when preceded by a related word? Yes = priming!

Neely (1977)

- read the prime, then make a lexical decision about the target
- prime always a category name; target always an instance (member of category)
- varied the stimulus onset asynchrony (SOA) between prime and target—either short (150 msec) or long (750 msec)

Neely (1977)

- faster to verify target when it matches prime category
- faster at short SOAs, but even faster at long SOAs
- suggests automatic spreading activation at short SOAs; automatic + expectancy at long SOAs

Neely (1977)

- showed no priming for BUILDING-hand because expectancy could not operate at short SOA
- showed priming for BUILDING-neck because expectancy could operate at long SOA
- showed only automatic priming of body parts when prime was BODY PART
- showed only automatic priming of buildings when prime was BUILDING

Summary

- memory is organized into an interconnected network
- we can search through the network rapidly based on similarity
- there are automatic connections, but we can also learn to override these using conscious, controlled strategies