PSYC 5303: Theories of Learning

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Week 15: Knowledge structures

Semantic Memory

"When Lisa was on her way back from the shop with the balloon, she fell and the balloon floated away."

- Lisa is a child
- She bought the balloon in the shop
- She got a fright and was hurt
- The balloon was on a string
- This was not the outcome she wanted

Semantic Memory

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Semantic memory is made up of *concepts*.

- How are these concepts accessed, stored, and manipulated?

Models of semantic memory

How is semantic information stored/organized?

- Network models
  - propositions
  - hierarchical networks
  - spreading activation
- Exemplar and prototype models
- List models
  - Smith's "Feature overlap model"
- Compound cue models
- Scripts and schemas

Propositions

Representation of meaning

- proposition = verifiable statement (T/F)
- two or more concepts with a relationship between them

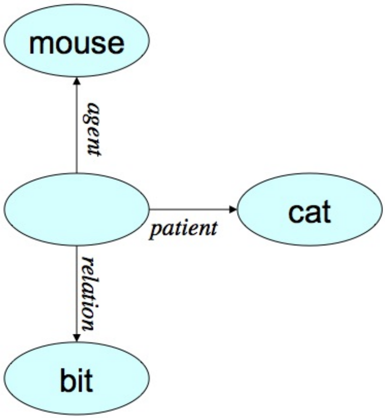
A mouse bit a cat

bit (mouse, cat)

Propositions

Representation of meaning

- proposition = verifiable statement (T/F)
- two or more concepts with a relationship between them
- networks – propositions represented as concept nodes linked by relations



Propositions

Complex example: "Children who are slow eat bread that is cold"

- slow children
- children eat bread
- bread is cold

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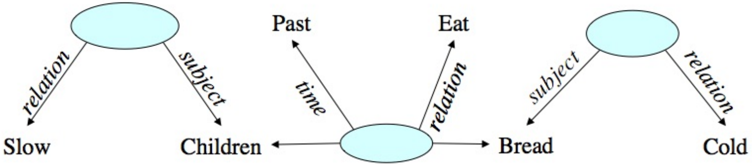

Propositions – evidence

Kintsch (1974) – memory is better for sentences that have fewer propositions

"The crowded passengers squirmed uncomfortably"

- *passengers crowded*
- *passengers squirmed*
- *passengers uncomfortable*

Three propositions

"The horse stumbled and broke a leg"

- *horse stumbled*
- *horse broke leg*

Two propositions

Propositions – evidence

Bransford & Franks (1971) – constructed four-fact sentences and broke them down into smaller sentences:

- 4 – The ants in the kitchen ate the sweet jelly that was on the table.
- 3 – The ants in the kitchen ate the sweet jelly.
- 2 – The ants in the kitchen ate the jelly.
- 1 – The jelly was sweet.

Propositions – evidence

Bransford & Franks (1971) – sentence recognition task

- Study: heard 1-, 2-, and 3-fact sentences only
- Test: heard 1-, 2-, 3-, and 4- fact sentences (most of which were never presented)

Propositions – evidence

Bransford & Franks (1971)

- Results – the more facts in the sentences, the more likely Ss would judge them as “old” (and with higher confidence), even if they hadn’t actually seen the sentence at study

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- Results – the more facts in the sentences, the more likely Ss would judge them as "old" (and with higher confidence), even if they hadn't actually seen the sentence at study
- Constructive model – we integrate information from individual sentences in order to construct larger ideas

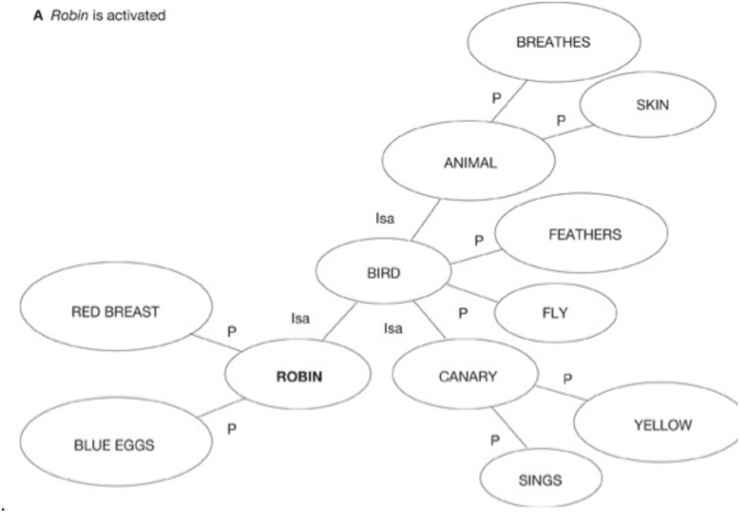
Semantic network model

Collins & Quillian (1969)

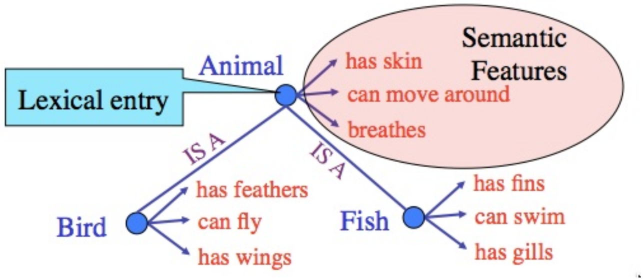
- Words/concepts represented as an interconnected network of propositional relations
  - Each word/concept is a particular node
  - Connections among nodes represent semantic relationships
  - Words/concepts triggered via spreading activation

Semantic network model

Collins & Quillian (1969)



Semantic network model



Hierarchical network model (Collins & Qullian, 1969)

- Lexical entries represented/stored in a hierarchy
- Representation permits cognitive economy
  - reduces redundancy of semantic features

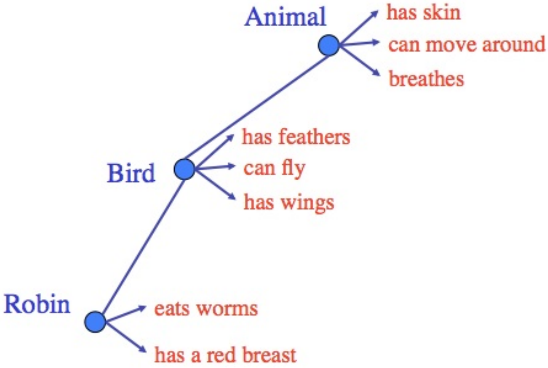
Semantic network model

Collins & Quillian (1969)

- Testing the model: semantic verification task
  - An A is a B – True/False

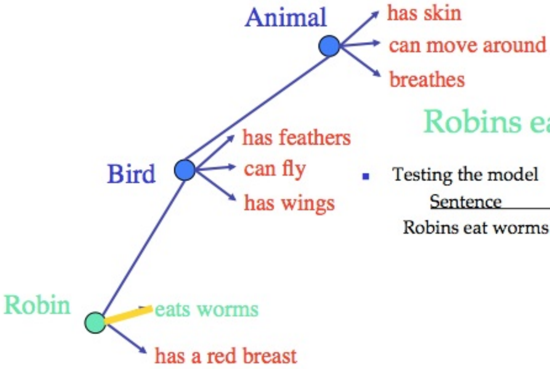
Semantic network model

Collins & Quillian (1969) – semantic verification task



Semantic network model

Collins & Quillian (1969) – semantic verification task



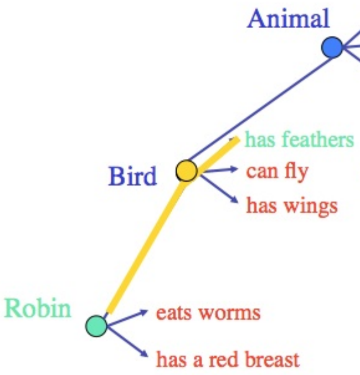
Robins eat worms

- Testing the model

Sentence	Verification time
Robins eat worms	1310 ms

Semantic network model

Collins & Quillian (1969) – semantic verification task



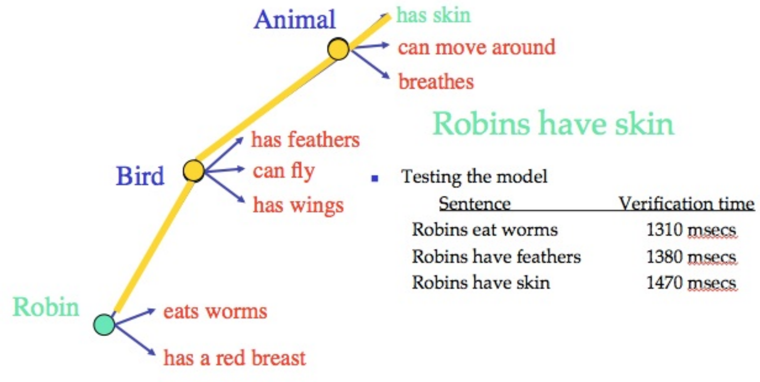
Robins have feathers

- Testing the model

Sentence	Verification time
Robins eat worms	1310 msecs
Robins have feathers	1380 msecs

Semantic network model

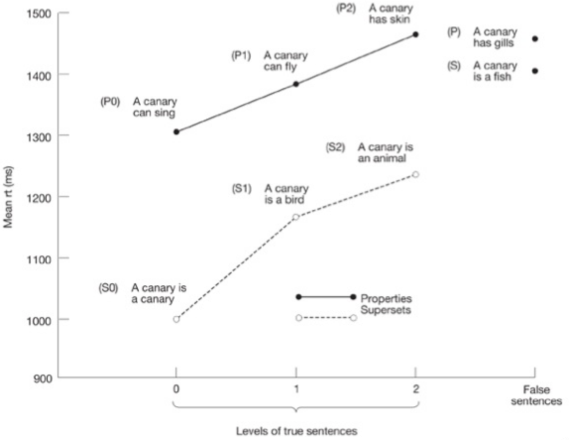
Collins & Quillian (1969) – semantic verification task



Sentence	Verification time
Robins eat worms	1310 msecs
Robins have feathers	1380 msecs
Robins have skin	1470 msecs

Semantic network model

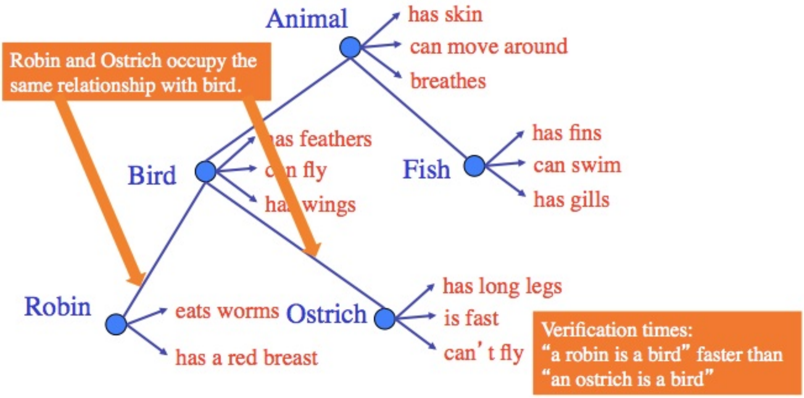
Collins & Quillian (1969) – semantic verification task



Each step up the hierarchy costs around 75-80 ms...

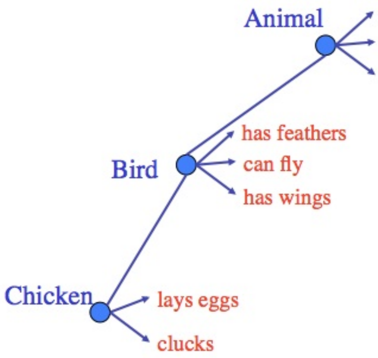
Semantic network model

Collins & Quillian (1969) – problems



Semantic network model

Collins & Quillian (1969) – problems

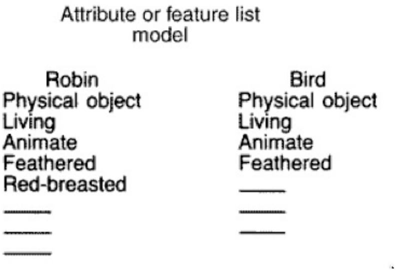


Smith et al. (1974) showed that there are some hierarchies where more distant categories can be faster to categorize than closer ones.

- A chicken is a bird is slower than A chicken is an animal!

Feature comparison model

Smith, Rips, & Shoben (1974)



- Concepts represented in terms of defining features and characteristic features
- Two-stage feature comparison process

Feature comparison model

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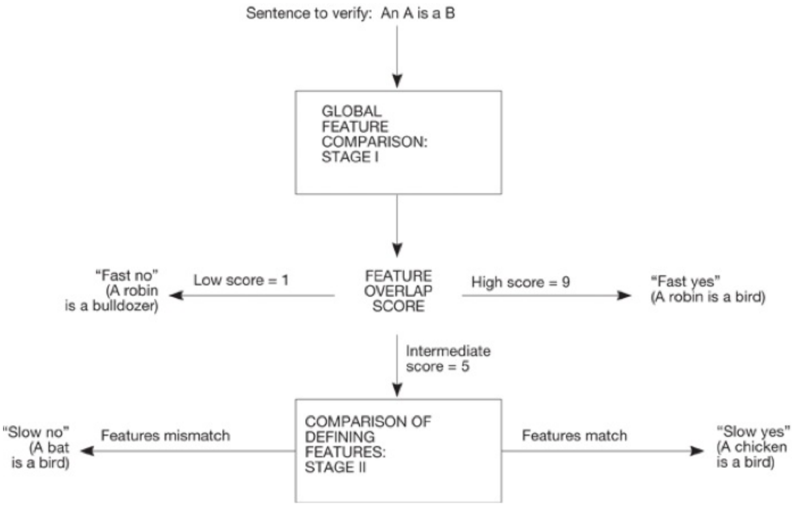
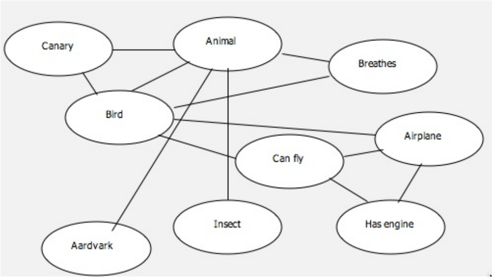


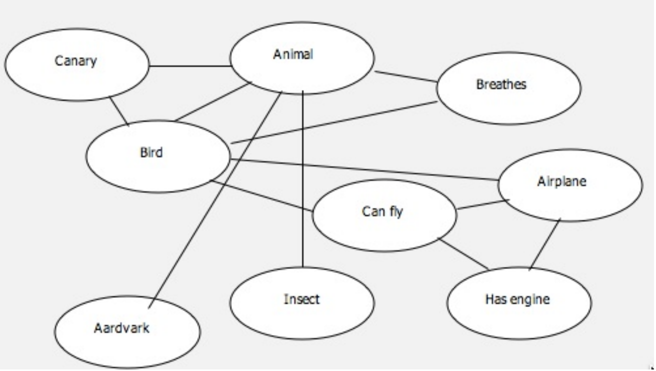
Spreading activation model

Collins & Loftus (1975)

- Extends Collins & Quillian in the following ways:
  - Concepts and properties are treated equally, and each can be directly accessed
  - Links between units of information vary in length according to associative strength



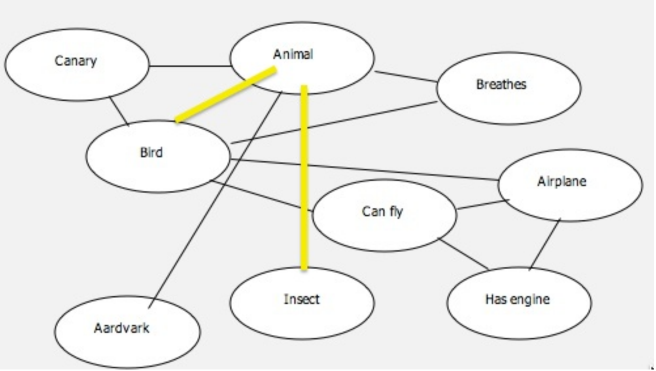
Spreading activation model



Typicality effect – which is faster to verify?

- A bird is an animal
- An insect is an animal

Spreading activation model



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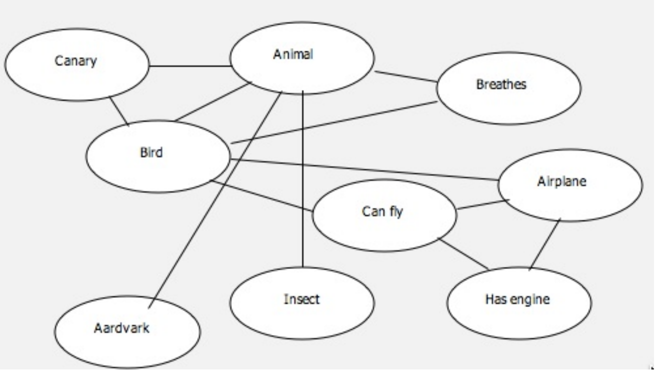
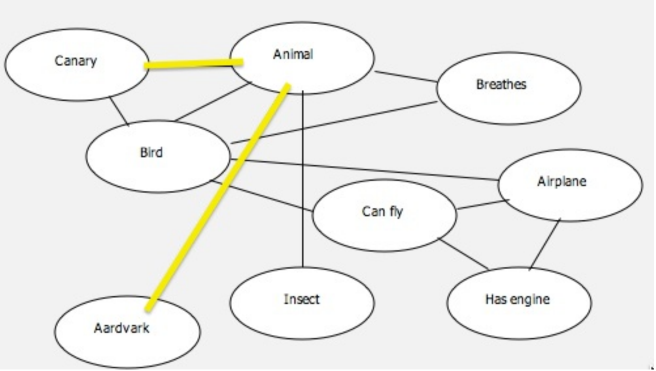


Familiarity effect – which is faster to verify?

- A canary is an animal
- An aardvark is an animal

Spreading activation model



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