Semantic Memory

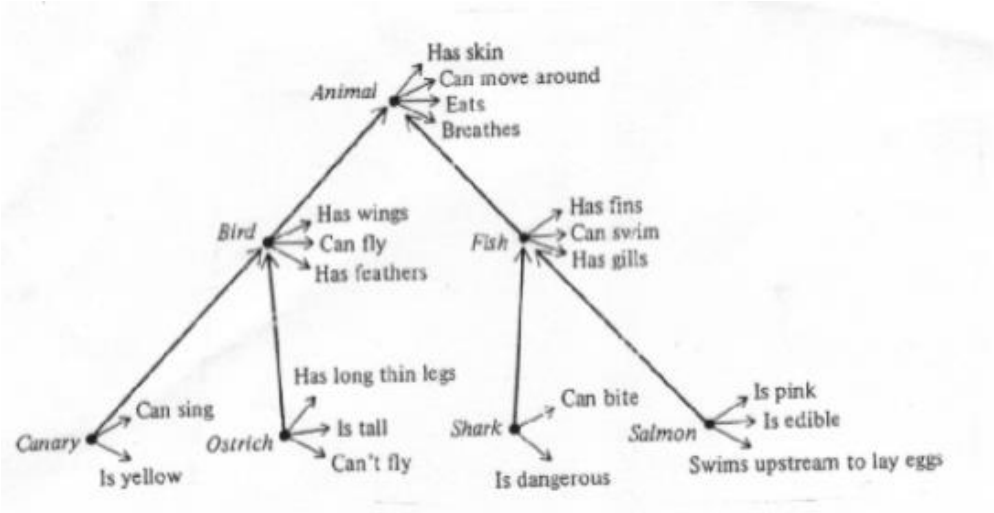
- Semantic memory: conceptual knowledge, linguistic knowledge, memories for general facts.

Theories of Semantic Memory Organisation

- Early studies used the 'sentence verification task'.
  - Indicating whether given sentences were true or false, i.e. "a canary is a bird".
  - DV → reaction time (RT).
- Sentence verification task:
  - Subject-predicate → A canary is a bird.
  - Sentence types → set inclusion (a canary is a bird), property-attribute (a canary has feathers).
- Network model (localist representation) → concepts are represented by nodes, relationships between concepts are represented by links.

Hierarchical Network Model (Collins and Quillian, 1969)

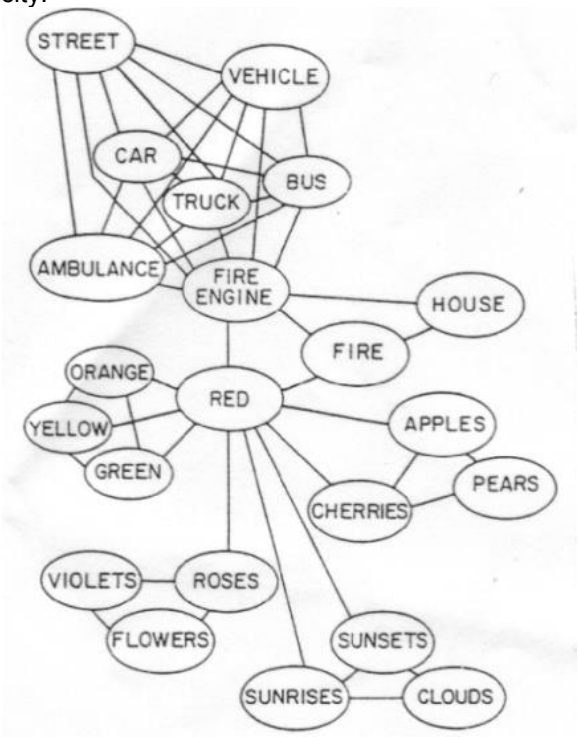
- Concepts are organised in a hierarchy of inclusiveness.
- Cognitive economy → the property attribute is stored non-redundantly at the highest (most general) level.
- Sentence verification RT is a function of levels.



- Problems with the hierarchical network model:
  1. Challenge to the cognitive economy (Conrad, 1972):
     - Argued that RT data are better explained in terms of frequency of co-occurrence of concept and property than levels.
  2. RT doesn't always mirror hierarchical relationship.
  3. Within-category typicality effect
     - E.g. a canary is a bird < an ostrich is a bird.
  4. Negative ("false") judgements are not faster for closer concepts; in fact the opposite.
     - E.g. a canary is a salmon < a canary is an ostrich.

Spreading Activation Model

- Network model, except dropped the idea of a strict hierarchy → concepts are organised non-hierarchically.
    - Explains lack of hierarchical effect.
- Links between concepts are based on associative strength linked to it
    - Explains the semantic priming effect.
    - Explains the typicality effect (bird-canary < bird-ostrich).
- Semantic priming effect → response to a word is faster following a semantically related word, e.g. “is truck a word?” where car-truck < flower-truck.
    - Used to study the organisation of semantic memory.
    - Automaticity.

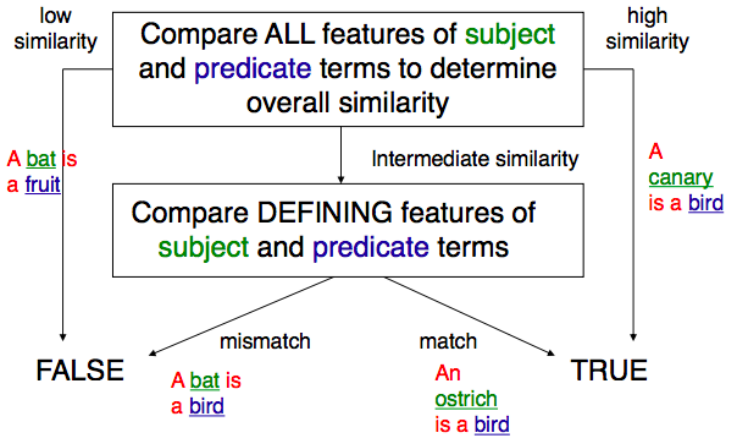


Feature Comparison Model (Distributed representation)

- Network models assume knowledge is represented with a concept node (localist).
- Feature representation assumes concept is represented as distributed features in semantic space.
    - E.g. concept of “sheep” → associated with visual features, tactile, auditory, gustatory.
    - There’s no node that puts this all together, instead it is all distributed with percept features.
- Explaining the sentence verification data with the feature comparison model:

- Two stage decision model → assumes that decisions are made by comparing the similarity of features of subject and predicate terms (e.g. canary [subject] is a bird [predicate]).
- Assumes that features can be of two types: defining (essential) features, and characteristic (less important) features.

- Two stage decision process:
  1. Compare *all* features of subject and predicate terms to determine overall similarity:
     - Low similarity → GO STRAIGHT TO FALSE.
     - High similarity → GO STRAIGHT TO TRUE.
     - Intermediate → go to step 2.
  2. Comparing *defining* features of a subject and predicate terms (and then true/false decision).



- The two stage decision process offers a natural explanation for:
  - Typicality effect (on positive decisions) → a canary is a bird < an ostrich is a bird.
  - Similarity effect (on negative decisions) → a canary is a salmon < a canary is an ostrich.
- Problems with the Feature Comparison Model → clear distinction of defining and characteristic features is lacking.

Sentence verification experiments evaluation

- Have provided important data used to develop theories of (lexical) semantic knowledge.
- Limitations:
  - Data can be explained equally well with theories with very different assumptions.
  - Do the data reflect the structure of semantic memory, or the task process?
  - Is the recognition of word meanings the same as object recognition?

<u>Neuropsychological studies of semantic memory</u>

- Studies of brain-impaired patients show:

    - Selective impairment of categories → impairments of living things are more common than of objects.
    - Even more category-specific impairment, i.e. preserved knowledge of body parts with impairment of living things, or preserved knowledge of objects with impaired knowledge of instruments.
- Patient JBR:
    - Consistent pattern of impairment across a variety of tasks to tap semantic memory, i.e. naming pictures, giving definitions of spoken words, etc.
    - Impaired knowledge of living things, with preserved knowledge of inanimate objects, and specific impairment of musical instruments.

<u>Organisation of concepts in the brain</u>

1. Perceptual-functional theory
    - Assumes distributed representation.
    - Category-specific impairments reflect different types of property.
2. Distributed-plus-hub theory
    - Assumes a hub (like a node) in addition to distributed modality-specific information.

Perceptual-functional theory:

- Living things are distinguished from each other on the basis of perceptual (visual) properties.
- Non-living things are distinguished from each other on the basis of functional properties.
- Explains more common impairments with living things in terms of visual properties being more frequent.
- Also explains category-specific impairments e.g. instruments are distinguished by visual properties.
- Problems for the perceptual-functional theory:
    - Patients don't necessarily show impairments of one type of knowledge (only perceptual, only functional).
    - Some properties are neither sensory nor functional → can be conceptual knowledge i.e. does a camel live in the desert?

Distributed-plus-hub theory

- There is a hub located in the Anterior Temporal Lobe (ATL) for each concept in addition to distributed modality-specific information.
- Predicts occurrence of item-specific and modality-independent deficit of semantic memory.
- Semantic dementia patients show this kind of impairment:
    - SD patients choose the green celery (correct colour of vegetables generally) and green pumpkin → "typical" feature is preserved because it is distributed over many members of vegetable category.
    - Delayed drawing → SD patients draw general properties of a certain animal, but may forget specific features that are unique to that animal.
- There is a hub for each concept/object in addition to distributed modality-specific information.