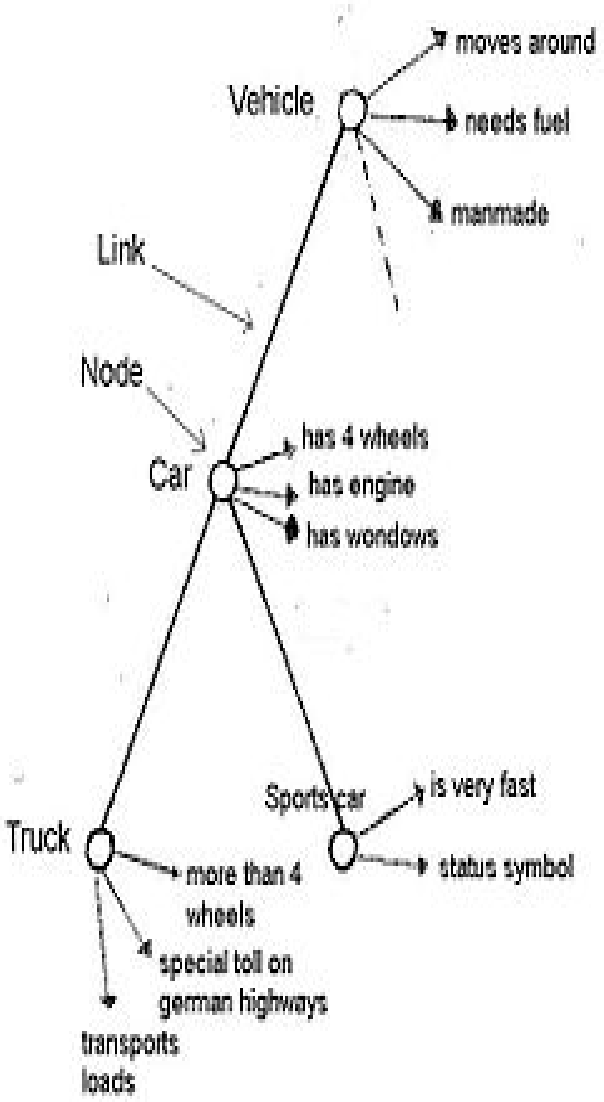
Semantic memory models

The Hierarchical Semantic Model

The model was proposed by Collins & Quillinan (1969). They tested the idea that semantic memory is analogous to a network of connected ideas.



The Model consists of nodes (in this case words/concepts). Each node is connected to related nodes by means of pointers.

Thus the node that corresponds to a given word/concept together with the pointers to other nodes to which the first node is connected , constitutes the semantic memory for that word/concept. The collection of nodes associated with all the words & concepts is called Semantic Network

Collins & Quillian (1969) tested the principle of cognitive economy with their model of semantic memory. They reasoned that the closer a fact is stored to a particular node, the less time it should take to verify the fact and property.

> *They reported that people took less time to respond to sentences whose representations should span two levels (A canary is a bird) than for those whose representation should span three (A canary is an animal)*

This model was called the ***hierarchical semantic network model of semantic memory.*** The nodes in this model are organized in hierarchy and most nodes have super ordinate and subordinate nodes. Super ordinate nodes correspond to the category name for which the thing corresponds to the subordinate node was a member.

Meyer & Schvaneveldt (1971) reasoned that if related words are stored close by one another and are connected to one another in a semantic network, then when ever one node is activated or energized, energy spreads to the related nodes. One reason for such a fact could be the concept of ***spreading activation***, the idea that excitation spreads along the connection of nodes in a semantic network

Limitations of HMSM

1) *Cognitive Economy*: Conrad (1972) found that people respond no faster to sentences such as “A shark can move” than to “A fish can move” or “An animal can move”.

2) *Hierarchical Structure*: Rips, Shoben & Smith (1973) showed participants were faster to verify “A pig is an animal ” than to verify “A pig is a mammal” thus violating the hierarchical structure (animal-mammal-pig)

3) *Typicality Effect*: Rips (1973) found that responses to sentences such as “A robin is a bird” were faster than responses to “A turkey is a bird”. In general typical instances of a concept is responded to more quickly than atypical instances.

The Feature Comparison Model

Smith, Shoben & Rips (1974) proposed an alternative to the HMSM called the *feature comparison model of semantic memory.*

Assumption: The meaning of any word or concept consists of a set of elements called features. Features come in two types

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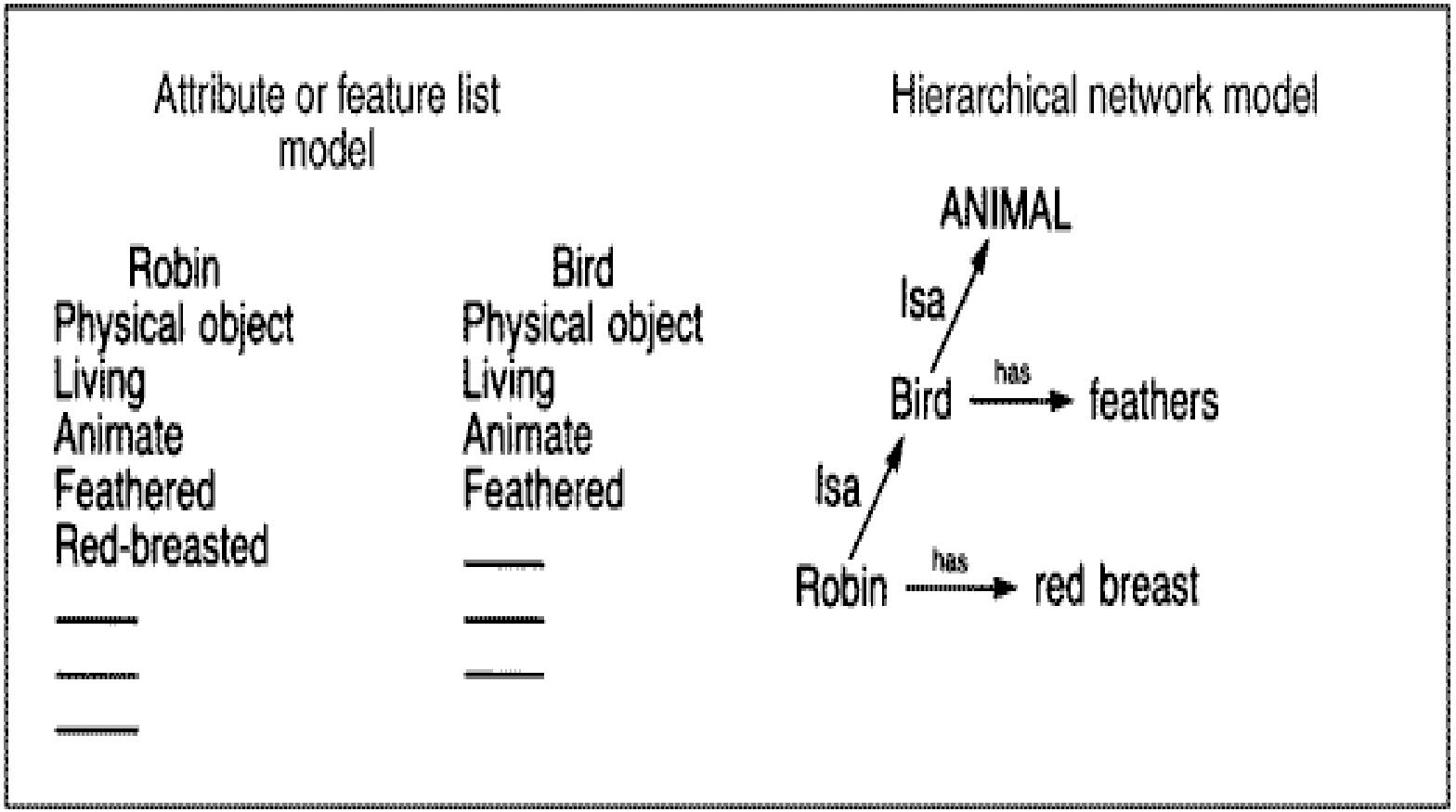
1) *Defining – meaning that the features must be present in every example of the concept and*

2) *Characteristic – meaning the features is usually but not necessarily present.*



Feature Comparison model can explain shortcomings of the HMSM

1) *Typicality Effect*: Sentences like “A robin is a bird” are verified more quickly than “A turkey is a bird” because robin being more typical examples of birds are thought to share more characteristics feature with “bird” than do turkeys

2) *Category Size Effect*: The feature comparison model assumes that as categories grow larger they also become more abstract which lead to lesser defining features.

Criticisms:

1) There is no existence of defining features (suppose a bird has clipped wings. Will it no longer be a bird?)

Other Network Models

Collins & Loftus (1975) presented an elaboration of the Collins & Quillian (1969) Hierarchical model that was the ***spreading activation model***

This model conceives of semantic memory as a network, with nodes in the network corresponding to concepts. They also saw related concepts as connected by paths in the network

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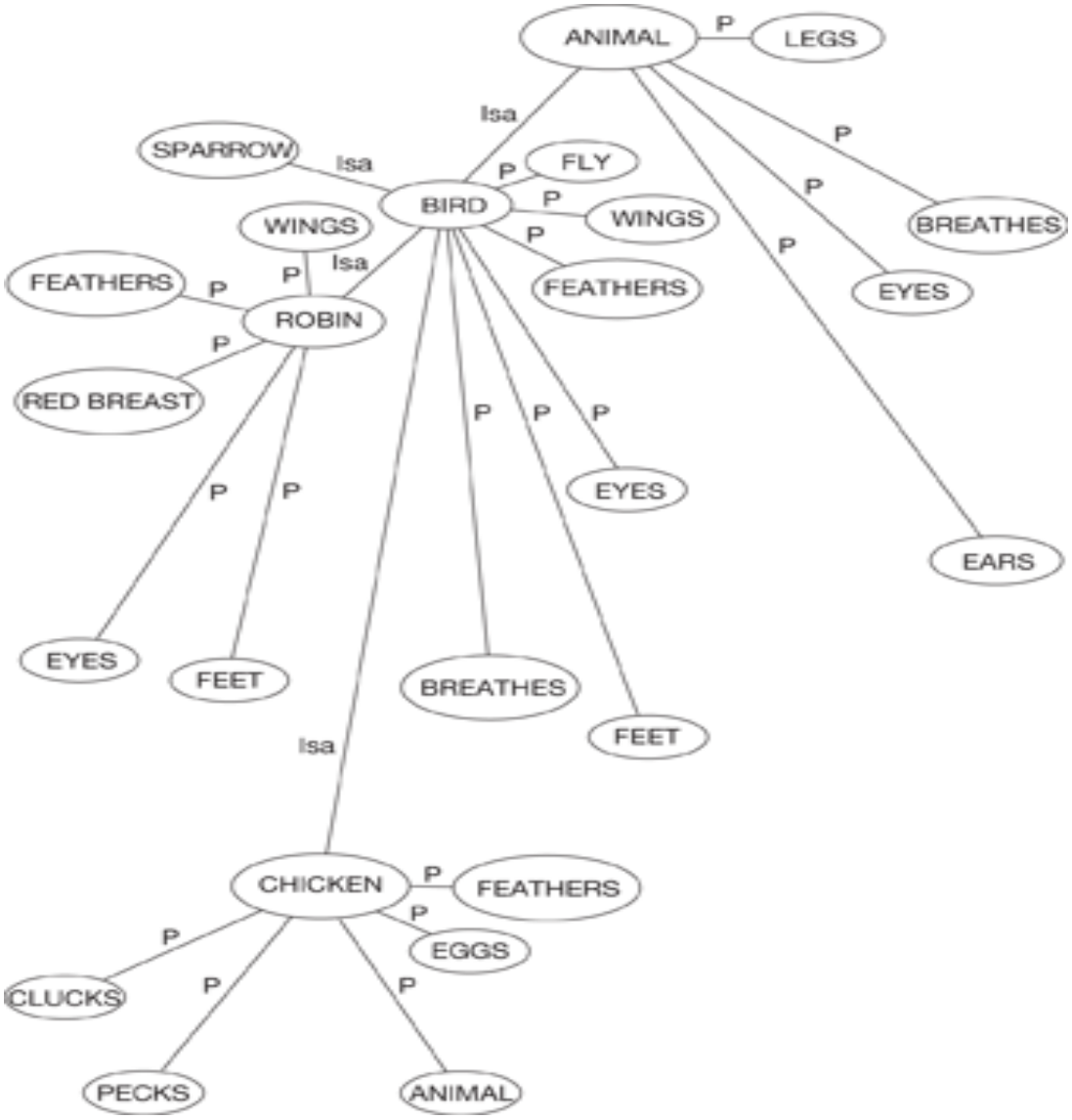
They further asserted that when one node is activated the excitation of the node spreads down the paths or links to related nodes. They believed that as activation spreads down the paths or links to related nodes. When activation spreads outwards, it decreases in strength, activating very related concepts a great deal but activating distantly related nodes only a little bit.



In this model very similar concepts have many connecting links and are placed close to each other. Each link/connection between two concepts is thought to have a certain weight or set of weights associated with it.

Criticism: The breadth of the model makes it difficult to make clear and strong predictions from the model regarding empirical findings.

Anderson's ACT model

Proposed by John Anderson (1976, 83, 93) and called the ***adaptive control of thought*** model of memory (ACT, ACT-*, ACT-R). Based on analogies to computers, ACT gives rise to several computer simulations of cognitive processing of different tasks.

Anderson (1983) believed declarative memory stores information in networks that contain nodes.

There are different types of nodes, including those corresponding to spatial images or to abstract propositions.

ACT model allows both for activation of any node and for spreading activation to connected nodes

Procedural memory store information in production rules

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Production rules specify a *goal* to achieve, one or more *conditions* that must be true for the rule to apply, and one or more *actions* that result from applying the rule