General Knowledge

Chapter 8

1. General knowledge is general in nature, and entails whatever (content) is held in semantic memory.
2. General knowledge is implicitly or explicitly acquired.
3. To understand general knowledge we need to understand structure of semantic memory, and schemas and scripts.

Declarative Memory

<table>
<thead>
<tr>
<th>Declarative Memory</th>
</tr>
</thead>
<tbody>
<tr>
<td>Semantic Memory</td>
</tr>
<tr>
<td>Episodic Memory</td>
</tr>
</tbody>
</table>

1. Semantic memory: Organized knowledge about the world.
2. Episodic memory: Information about events that relate to us.
Semantic Memory

<table>
<thead>
<tr>
<th>Memory</th>
<th>Knowledge</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Semantic</td>
<td>Encyclopedic</td>
<td>Paris is the Capital of France</td>
</tr>
<tr>
<td></td>
<td>Lexical</td>
<td>White mean the same as fair</td>
</tr>
<tr>
<td></td>
<td>Conceptual</td>
<td>Gravity attracts objects</td>
</tr>
</tbody>
</table>

Categories

To understand knowledge we need to know two things. 1) **Categories**: Class of objects that belong together.

- [Diagram of different boxes]

Concepts

2) **Concepts**: Mental representation of a category.

- More representative of concept of box.
- Less representative of concept of box.
- Even lesser representative of concept of box.
Objects & Categories

1. Why code objects into categories? Mainly efficiency. Categories reduce information thus facilitate encoding, storage and retrieval.

2. How do we categorize objects? We will look at four different models of explaining how we categorize objects.
   a. Feature Comparison Model
   b. Prototype Model
   c. Exemplar Model
   d. Network Models

Feature Comparison Model

Feature comparison model suggests that we code categories by comparing features and putting them together. Making decision about an object belonging to a category is faster if it contains all required features.

<table>
<thead>
<tr>
<th>Category</th>
<th>Bird</th>
<th>“Robin”</th>
<th>Decision</th>
<th>RT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Animatie</td>
<td>Animatie</td>
<td>Yes/No</td>
<td>Fast</td>
<td></td>
</tr>
<tr>
<td>Feathers</td>
<td>Feathers</td>
<td>Yes/No</td>
<td>Fast</td>
<td></td>
</tr>
<tr>
<td>Has breast</td>
<td>Red breast</td>
<td>Yes/No</td>
<td>Fast</td>
<td></td>
</tr>
<tr>
<td>...</td>
<td>...</td>
<td>Yes/No</td>
<td>Fast</td>
<td></td>
</tr>
<tr>
<td>Flies</td>
<td>Flies</td>
<td>Yes/No</td>
<td>Fast</td>
<td></td>
</tr>
</tbody>
</table>

Features

Smith and colleagues (1978) provided early feature comparison model.

<table>
<thead>
<tr>
<th>Defining Features (Essential)</th>
<th>Are animate</th>
<th>Have feathers</th>
<th>Have a beak</th>
</tr>
</thead>
<tbody>
<tr>
<td>Characteristic Features (Accidental)</td>
<td>Can sing</td>
<td>Can fly</td>
<td>Can perch</td>
</tr>
</tbody>
</table>

Distinction between defining and characteristic features is arbitrary.
Testing Features

One way to test defining and characteristic features is carry out a similarity test.

<table>
<thead>
<tr>
<th>Question</th>
<th>Feature</th>
<th>Decision</th>
<th>RT</th>
</tr>
</thead>
<tbody>
<tr>
<td>A cat is a pencil (low similarity).</td>
<td>Defining</td>
<td>False</td>
<td>Fast</td>
</tr>
<tr>
<td>A cat is a mammal (high similarity).</td>
<td>Defining</td>
<td>True</td>
<td>Fast</td>
</tr>
<tr>
<td>A cat is fluffy (intermediate similarity).</td>
<td>Characteristic</td>
<td>True or False</td>
<td>Slow</td>
</tr>
</tbody>
</table>

Model

Stage 1
Compare all features of the subject and the predicate to determine featural similarity

Stage 2
Compare defining features of the subject and the predicate to determine featural similarity

Mismatch
Match
False
True

Low Overlap
High Overlap

Testing Features

One way to test defining and characteristic features is carry out a similarity test.

<table>
<thead>
<tr>
<th>Task</th>
<th>Effect</th>
<th>Question</th>
<th>RT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sentence Verification</td>
<td>Typicality</td>
<td>Is robin a bird?</td>
<td>Fast</td>
</tr>
<tr>
<td></td>
<td>Typicality</td>
<td>Is penguin a bird?</td>
<td>Slow</td>
</tr>
<tr>
<td>Category Verification</td>
<td>Size</td>
<td>Is robin a bird?</td>
<td>Fast</td>
</tr>
<tr>
<td></td>
<td>Size</td>
<td>Is robin an animal?</td>
<td>Slow</td>
</tr>
</tbody>
</table>
**Evaluation & Criticisms**

**Feature Comparison Model**

<table>
<thead>
<tr>
<th>Explains</th>
<th>Does not explain</th>
</tr>
</thead>
<tbody>
<tr>
<td>Membership to a category may not be based on defining features.</td>
<td></td>
</tr>
<tr>
<td>Typicality effect</td>
<td>Features may be interdependent thus defining categories may be difficult.</td>
</tr>
<tr>
<td>How do individual members of a category related to each other</td>
<td></td>
</tr>
</tbody>
</table>

**Prototype Model**

1. **Prototype**: Mental image or an idealized item that is most typical of the category. Best example of a category.

2. A prototype usually is an abstract image and not an imagined picture. So the prototype of an “animal” is a four legged creature somewhere between a dog and a cow.

![Prototype of a bird]

**Prototypicality**

Category: “Bird”

More typical

Prototype of a bird

Less typical
Characteristics

1. Best examples of a category serve as prototypes. So a robin or a sparrow serve as the best prototype for the category bird.
2. Prototypes are judged faster after priming than non-prototype. Priming the Ss with the word red hastens the response speed when a prototypical bright red color is shown compared to a dark red.
3. Prototypes share attributes in a family resemblance category.

Levels of Categories

Generally there are three levels of categories as given below:

<table>
<thead>
<tr>
<th>Category</th>
<th>Feature</th>
</tr>
</thead>
<tbody>
<tr>
<td>Superordinate</td>
<td>Fruit</td>
</tr>
<tr>
<td>Basic-level</td>
<td>Apple</td>
</tr>
<tr>
<td>Subordinate</td>
<td>Granny Smith</td>
</tr>
</tbody>
</table>

Characteristics

1. Basic level categories are used to identify objects. People say pen and not writing utensil or Pilot roller ball gel ink pen.
2. Basic level names are more likely to produce priming effect than superordinate level categories.
3. Different levels of categorization activate different parts of the brain. Superordinate categories activate prefrontal cortex and subordinate categories activate visual areas of the brain.
Characteristics

4. Experts are better with subordinate categories and novices are better with basic-level categories.

Comparison

<table>
<thead>
<tr>
<th>Feature Model</th>
<th>Prototype Model</th>
</tr>
</thead>
<tbody>
<tr>
<td>Objects need to possess all essential and characteristic features to classify in a category</td>
<td>Objects may not possess all characteristics to be labeled in a category</td>
</tr>
<tr>
<td>Rigid</td>
<td>Flexible</td>
</tr>
</tbody>
</table>

Exemplar Approach

In order to form a concept the exemplar approach says that first we look at a few examples to form a category... then classify each new object based on these examples.
Exemplar Approach

<table>
<thead>
<tr>
<th>No.</th>
<th>Category</th>
<th>Example</th>
<th>Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>amphibian</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>bird</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>fish</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>insect</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>mammal</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>microorganism</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>reptile</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Heit & Barsalou (1996)

Comparison

<table>
<thead>
<tr>
<th>Exemplar Model</th>
<th>Prototype Model</th>
</tr>
</thead>
<tbody>
<tr>
<td>Concept is based on numerous representative examples.</td>
<td>Concept is based on idealized representation, not necessarily one that is seen.</td>
</tr>
</tbody>
</table>

Network Models

1. Feature comparison model, the prototype approach and the exemplar approach all emphasize that an item belongs to a category.
2. Network models suggest that related items (nodes) are connected (links) than their mere categorization.
Network: Related Words

The word “apple” is related to many other words, thus not a category to some word fruit.

Collins and Loftus Model

Collins and Loftus (1978) developed a network model that purports that items are connected based on meaningfulness.

Spreading Activation

Collins and Loftus (1978) also propose that semantic memory is organized in networks. Retrieval of information involves spreading of activation of related concepts.
How does Memory Work?

![Diagram showing nodes and connections for memory processing](image)

When we say "Is McIntosh a fruit?" The model proposes that activation spreads from node "McIntosh" and "Fruit" to "Apple". The intersection results in an affirmative answer from the subject. "Is McIntosh a mammal" leads to no interaction and thus a negative response.

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Other Network Models

Though Collins and Loftus model is appealing, it has been superseded by two other models.

a. Adaptive Control of Thought (ACT)
b. Parallel Distributed Model

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Anderson’s ACT Theory

1. ACT attempts to account for all forms of cognitive processes. So ACT accounts for perception, memory, language, decision making and other cognitive processes.
2. For our purposes we will look at declarative knowledge aspect of ACT. Declarative knowledge is knowledge about facts and things.
Models Compared

Collins and Loftus model is based on network of individual (meaningfully related) words, on the other hand ACT model is based on meaningful propositions.

Proposition

1. Proposition is the smallest unit of knowledge that is true or false e.g., Cat was white. The cat may or may not have been white.
2. Propositions combine.

Susan gave cat to Maria.
The cat was white.
Maria is the president of the club.

Susan gave a white cat to Maria, who is the president of the club.

Propositional Network

1. The node (#1 in ellipse) represents the proposition and links by arrows outward bound toward concepts.
2. The proposition is abstract (not in exact wording).
Propositions Together

Concepts as Networks

3. Concepts in a proposition can be represented by its own individual network.

Other features of ACT Model

4. Links can vary in strength.
Other features of ACT Model

- At any one moment 10 nodes occupy working memory and that activation among nodes can spread.
- The activation is limited because of limits on working memory capacity.

Criticisms of ACT Model

1. ACT model provides connection between words but not between words and their representations of objects in the world.
2. Model does not relate memories in the context of the neurobiology of the brain.

Parallel Distributed Processing

1. Parallel Distributed Processing (PDP) model represents a network model in which a large number of neuron-like units get activated. Other names include connectionism or neural networks.
2. This network model is based on physiological and structural properties of neurons.
Features of PDP

1. It is orange.
2. It inhabits barnyards.
3. It is typically yellow in color.
4. It says “Oink”.

Pig

Serial Search

If we were to unscramble these letters to form a word, using an algorithm would take 907,208 possibilities.

S P L O Y O C H Y G

Parallel Search

Try putting consonants at the beginning and Y at the end.

S P L O Y O C H Y G

B B Y O M O C H G Y
Parallel Processing

Based on our understanding of the nervous system parallel processing involves utilizing many aspects of a sense at the same time in perceiving an object. Each sense uses multiple dimensions to register and finally comprehend an object.

Memory Searches

1. Memory is more flexible.
2. Memory storage is content addressable.
3. Some attributes are better in retrieving memory than others.

McClelland Model
Characteristics

1. Cognitive process are based on parallel operations.
2. Knowledge is stored in multiple units.
3. A network contains neuron like units.
4. The connections between units is weighted.
5. When a unit reaches critical level of activation it either excites or inhibits other units.
6. Every new event changes the weight of connections among units.
7. Graceful degradation: Brain’s ability to provide partial memory.

Schemas and Scripts

General Knowledge

<table>
<thead>
<tr>
<th>Words, concepts and sentences</th>
<th>Situation, events and other “packages” called schemas</th>
</tr>
</thead>
</table>

For example, you have a schema for the interior of a hardware store, with tools, paints, lumber etc. not psychology books, opera DVDs and cakes.

Schemas

Schema theories propose that we encode generic information about a situation, and use this information to understand and remember new examples in a variety of situations. In short schemas are a top-down process.
Functions of Schemas

Schemas have at least three functions:
1. Remember (recognize).
2. Understand.
3. Predict.

So schemas have heuristic functions. General rules of interacting with new situations.

Brief History of Schemas

In the 1920s and 1930s pioneers like Piaget and Bartlett worked on schemas. Piaget worked on cognitive schemas as they developed during early years and Bartlett studied memory schemas.

Research on Schemas

1. Schema in romantic relations have been studied (Honeycutt & Cantrill, 2001).
2. Bicultural individuals may have two sets of schemas (Hong et al., 2000).
3. Schema therapy helping clients develop healthy schemas and replace older maladaptive schemas developed during childhood, adolescence and adulthood.
Scripts

1. Scripts are subcategory of schemas. A simple yet well structured sequence of events in a situation with behavioral activity associated with it. For example going to restaurant and eating.

2. Memory for scripts are better if the script-identifying event [in the script] take place early than late.

Schemas & Memory Selection

Enhanced memory for schema-consistent material (Brewer and Treyens, 1981)

Schema-inconsistent Material

Other research has shown that we remember objects, events or situation more vividly if they are inconsistent with our schema (Davidson, 1994).

<table>
<thead>
<tr>
<th>Schema-consistent</th>
<th>Schema-inconsistent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Incidental learning</td>
<td>Intentional Learning</td>
</tr>
<tr>
<td>Recognition</td>
<td>Recall</td>
</tr>
<tr>
<td>Not corrected for guessing</td>
<td>Corrected for guessing</td>
</tr>
</tbody>
</table>
Schemas & Boundary Extension

When we form image schemas based on visual perceptions, our schemas rarely depict true representations of our perceptions.

Schema & Memory Abstraction

Same is true for schemas based on verbal material. Verbal material is stored in terms of meaning and not in word-for-word format (verbatim memory). Meanings become memory abstractions and thus a schema for what is read or heard.