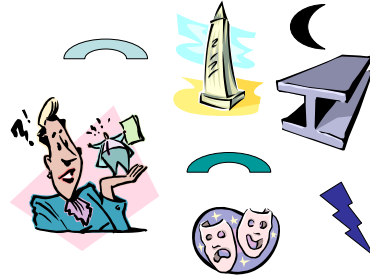## Frames, Scripts, and Schemas
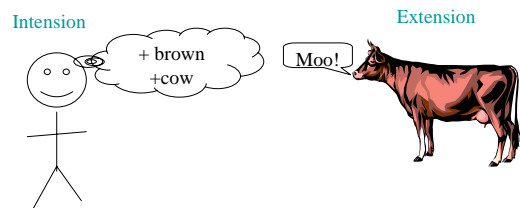
The Categorization Game

Concepts & Categories

- **Defining Attribute Theories**
  - Classic Approach
  - Semantic Networks (a.k.a. Associative Networks)
  - Spreading Activation Models
- Defining and Characteristic Attribute Theories
  - Feature Set Theory
- **Prototype Models**
- **Exemplar Models**
- **Schemas, Scripts, Frames**

Defining Attribute View

- Categories defined by sets of attributes each of which is necessary and all of which are jointly sufficient to determine category membership.

Summary: Defining Attribute Theories

- Key Points
  - Meaning captured by conjunctive list of attributes
  - Attributes building blocks of concepts
  - Attributes necessary & sufficient to define category membership
- Predictions
  - Clear boundaries between members and nonmembers
  - All members equally representative of category
  - In hierarchical organization, all defining attributes are inherited

Problem with Defining Attribute Theories

- Concepts are often NOT defined by conjunction of necessary features
  - Wittgenstein
    - What makes a game a game?
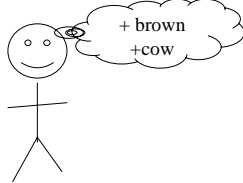
Typicality

Problem with Defining Attribute Theories

- Not consistent w/empirical observations
  - Rosch (1973)
    - All category members not equally representative
      - Robins better birds than canaries
    - Typicality has cognitive consequences
      - Verification time for 'A canary is a bird' longer than 'A robin is a bird'

Problems with Classical Picture

Intension

+ brown
+ cow

- Very few concepts have defining features
- Categorization behavior not all-or-none
  - Some category members better than others
  - Fuzzy boundaries

Prototype Theory

- Categories are represented by prototypes that represent the average of exemplars of that category
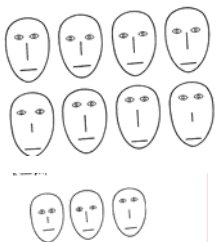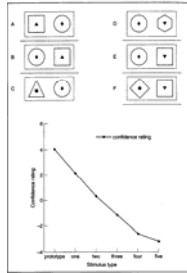
Evidence for Prototype Theory

Figure 8.4 Examples of novel faces for Figure 8.5. The middle face is the category 1 prototype, and the right face is the category 2 prototype.
From "Pattern recognition and categorization," by S. K. Reed, 1972, Cognitive Psychology, 3, 382–407. Copyright © 1972 by Academic Press, Inc. Reprinted by permission.

- Show people examples of a category
- Show them novel stimulus and ask if they've ever seen it
- People wrongly say yes to the prototype (average of the faces they have seen)

Prototype Theories

- Concepts have prototype structure
- No delimiting set of necessary and sufficient conditions
- Category boundaries fuzzy
- Category instances fall on a typicality gradient
- Category membership determined by similarity of object's attributes to the prototype

Evidence for Prototype Theories

- Confidence that you have or haven't seen a stimulus before related to distance from the prototype

Evidence for Prototype Theory

- Typicality gradients exist
- Typicality gradients predict categorization times
- Typical items mentioned first on category listing task
- Typical items sketched when people asked to draw an example of Category X
- Children learn typical examples first
- Typical members more likely to serve as cognitive reference points
- Typicality correlates with family resemblance

Criticisms of Prototype View

- Not all concepts have prototype characteristics
  - Hampton (1981) claims 'rule' and 'belief' don't exhibit prototype structure
- Incomplete account of conceptual knowledge
- Doesn't explain why categories cohere

Alternatives
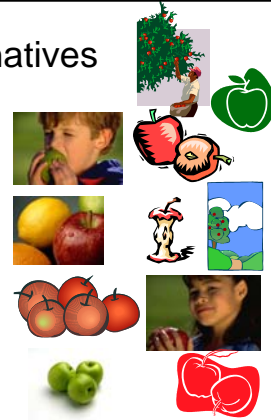
Exemplar Models of Concepts

- Categories made up of a collection of instances or exemplars
- Instances grouped relative to one another via similarity metric
- Categorization involves retrieving instances from memory given particular cue
- When exact matches not found, nearest neighbor is retrieved

Nosofsky's ALCOVE Model

- Features of all exemplars stored in large multi-dimensional space
- Similarity function of distance in hyperspace
- Some features more important than others (alpha)
- Exemplars associated w/multiple categories
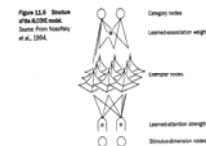
Can exemplar models account for standard categorization effects?

- Typicality Effects
  - Is a robin/ostrich a bird?
  - Typicality ratings
- "False Alarms" to Prototype

Problems with Exemplar Models

- Unrealistic storage assumptions
- How do exemplars get associated w/categories?
  - Still need to explain how information gets grouped into categories…

Prototype Theories (a.k.a.) Characteristic Attribute Theories

- Categories organized around central properties
- 2 Classes of Prototype Theories
  - Classic Approach
    - Prototype represented by characteristic attributes
      - Abstract
      - Average
  - Alternative Approach: Exemplar Models
    - Prototype represented by examples
      - Best Member

Exemplar Models vs. Prototypes

- Both explain typicality effects
  - But what about variability within a concept?
- Neither explains fact that correlation between features of category members is not random
  - Flightless birds tend to be large
- Neither explains why *ad hoc categories* show typicality gradients
  - For example
    - Change your identity and move to South America
    - Stay in Las Vegas
    - "Ways to avoid being killed by the Mafia"