

---

## Concepts (continued)

Harry Delugach  
CS 635/796 - Computational models of cognition  
Summer 2006

---

---

---

---

---

---

---

---

---

## Saliency

- Concept is a collection of properties
- Saliency
  - Relative “importance” of each property domain
- Saliency may vary within a concept depending on the context in which it is used
  - E.g., apple’s color may not matter when eating it

---

---

---

---

---

---

---

---

---

## Natural concept

- Criterion C (concept)
- A natural concept is represented as
  - a set of regions in a number of domains
  - an assignment of saliency weights to the domains
  - Information about how the regions of different domains are correlated

---

---

---

---

---

---

---

---

## Spaces vs. frames

- Frame
  - Slots - feature or property
  - Values - symbolic representation
- Space
  - Collections of features into domains
  - Allows describing concepts that are close to each other

---

---

---

---

---

---

---

---

## Essential vs. incidental

- Essential property
  - Must be present or else the object is something else
    - E.g., employee must work for some entity
- Incidental, accidental
  - May be present
  - May help understand
- Criterion C does NOT assume this distinction
  - Uses "salience"
  - Essential has high salience
  - Incidental has lower salience
  - May vary between domains

---

---

---

---

---

---

---

---

## Similarity

- Concepts group together things that are similar
- Representations should preserve similarity and differences
- Degree of similarity is determined relative to a particular domain (dimension)
- Is similarity itself a domain?

---

---

---

---

---

---

---

---

### What is similarity?

- Similarity exists objectively in the real world, independent of cognition (realism)
- Similarity is a cognitive magnitude that can be measured (empiricism)
- Similarity is a cognitive magnitude that is used in models of cognition (theoretical)
  - Determined by choice of cognitive theory

---

---

---

---

---

---

---

---

### Alternative views of similarity

- Medin's view
  - Similarity increases as the number of shared properties increases
  - Properties are independent and additive
  - All properties are about equal level of abstraction
  - Concept is equivalent to the list of its properties

---

---

---

---

---

---

---

---

### Shared properties

- Many objects share large number of properties
- E.g., A bird is similar to a writing desk
  - Both found above ground
  - Both stand on legs
  - Both are rotating around the sun
  - Both weigh < 1000 pounds (<500 pounds, etc.)
  - Both sink in water

---

---

---

---

---

---

---

---

### Similarity in conceptual spaces

- Takes the theoretical attitude
- Similarity is modeled using distance measures in conceptual spaces

---

---

---

---

---

---

---

---

### Combining concepts

- “Pink elephant”, “student worker”
- Usually seen as conjunction of predicate
  - Pink elephant is the conjunction of all things pink with all things elephant
  - But elephants aren’t pink!
    - Non-monotonic
    - Revises concept rather than intersects it
- What about “white wine”?
- What about “red brick” vs “brick red” in English?

---

---

---

---

---

---

---

---

### Context effects

- Some properties can’t be defined independently of other properties
  - E.g., tall building, tall tree, tall jockey
  - Tall is associated with height, but not a particular region
    - Tall jockey is not a tall person
- Property is defined with respect to a contrast class
  - “tall” means in the “upper” part of the class’s height region

---

---

---

---

---

---

---

---

## Non-monotonic aspects

- Propositional
  - Default rule: “Birds fly”
  - If x is a penguin, then x is a bird
- Conceptual
  - Penguins don't fly
- Change to subordinate category (bird to penguin)
- Context affects similarity
  - E.g., Are bicycles and motorcycles similar?
  - Change in salience

---

---

---

---

---

---

---

---

## Objects

- Prototype
  - Most expected regions for most salient dimensions
- Object belongs to category for which the corresponding prototype is the closest in the conceptual space

---

---

---

---

---

---

---

---