PHIL/PSYCH 256
INTRODUCTION TO COGNITIVE SCIENCE
Week 5: Analogy

Paul Thagard

1

Analogy

Analogy: use mental representation of one example (source, base) to solve another one (target)

Great scientific analogies:

- Sound/wave
- Lightning/electricity
- Natural selection/artificial selection
- Mind/computer

Bad analogies: Dell.

2

3

Why Use Analogies?

- Often there are no established rules and concepts available.
- Easier to adapt cases.
- Human mind is good at matching and adapting.

4

Analogy: Representation

- Source and target representation:
  - Verbal
  - Pictorial
  - Sensory
  - Emotional
- Not a full theory of mental representation: still need concepts, rules, images, etc.

5

Analogy: Procedures

1. Pursue target
2. Find source that matches target
   1. Given
   2. Retrieve from memory
   3. Construct
3. Map source to target: correspondences
4. Adapt source to generate solution
5. Learn by forming schema

6

Analogy: Constraints

1. Purpose: what is the use?
2. Similarity of elements: meaning, visual similarity
3. Structure: approximation to isomorphism: preserve relational structure

7

Constraints on Analogy

Stage	*Main constraint*
Retrieval	Similarity
Mapping	Structure
Adaptation and transfer	Purpose

8

Discussion Question

- When have you found analogies to be useful or harmful? What constraints were operating?

9

Computational Power

- Analogical problem solving useful for decisions, explanations, and other problems.
- Learning: adapt old solutions.
- Language: metaphor, e.g. poetry.

10

Key Points

- Analogies are a powerful way of creatively solving problems when established rules and concepts are not available.
- Using analogies requires attention to the constraints of purpose, structure, and similarity.

11

A behavior is innate?

1. Culturally universal.
2. Specific brain area(s).
3. May have precursors in lower animals.
4. Adaptive during evolutionary period.
5. Not a side effect of other behaviors.

12

Limitations of Analogy

- Lack of previous experience
- Hard to find relevant cases
- Adaptation may be complex
- Analogies may be misleading
  - Worst analogy ever made

13

Using Analogies Well

- Use familiar sources
- Make the mappings clear
- Use deep systematic analogies
- Describe the mismatches
- Use multiple analogies
- Perform analogy therapy to correct bad analogies

14

Discussion Question

- Can my advice for using analogies well improve your use of analogies?

15

Key Points in Gentner

- Similarity is like analogy.
- Systematicity: match connected systems of relations.
- Focus on alignable differences.
- Make inferences and extend mappings.
- Importance of similarity for categorization.

16

Key Point Overall

- Analogies can be powerful for solving problems and providing explanations, but they can be misused.

17