

**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

<i>Stage</i>	<i>Main constraint</i>
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

## Limitations of Analogy

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

11

## One-minute Essay

- How is analogical problem solving different from rule-based problem solving?

12

## 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

13

## Discussion Question

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



14

## 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.

15

## One-minute essay

- What is the relation between similarity and analogy?



16

## A behavior is innate?

1. Culturally universal.
2. Specific brain area(s).
3. Adaptive during evolutionary period.
4. Not a side effect of other behaviors.

17