Thinking, Creativity, and Problem Solving

“Duh!”

The New Yorker, April 12, 2004
What is a thought?

The mental activity that is involved in the understanding, processing, and communicating of information

Draw a picture of a dog
• What type of dog is it?
• How do you know it’s a dog and not a bird?
• Why did you picture this type of dog?

You have just illustrated three units of thought: *symbols*, *concepts*, and *prototypes*
• Thinking is made possible through the use of these units of thought
Symbol

Object or act that stands for something else
• Not the actual object, but something in your mind that represents it
  • Examples
    • Image of a dog in your mind
    • American flag – stands for multiple things
    • Any others?
Concept

Grouping our mind does of similar symbols

• Organized into hierarchies
• Imagine life without concepts. How would you explain your “dog” to someone?
Pitfalls To Avoid When Creating Concepts

Give me five different groups of people

- Groupings can be based on physical qualities, age, gender, ethnic/racial background, etc.

Rate how likely an individual member of each group would have each of the qualities listed in the columns (1=Not Likely; 7=Likely)

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<th>“High” SES</th>
<th>Happiness</th>
<th>Creativity</th>
<th>Intelligence</th>
<th>Friendliness</th>
<th>Honesty</th>
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Now share your ratings with a neighbor or two. Similar? Different? Why?

How can informal concepts on how various groups are like color our attitudes toward individuals?

This is called creating a stereotype – an oversimplified concept

- Don’t let the helpful process of creating concepts make you unfairly judge someone!
Prototype

The generic example you imagine when you think of a concept

- Can be a mixture of different specific examples, but will be a single image in your mind

The picture you drew of a dog before – was it a prototype?

What’s this?

How about this?

If you had a tough time figuring out that the image on top was a chair, it was because it did not easily match the prototype you imagined

Now that I told you that it’s a chair, can you match it to your prototype better?
Problem Solving

Can anyone solve a Rubik's Cube?

How did you learn how to do that?
General Methods of Problem Solving: Algorithms and Heuristics

An *algorithm* is a specific procedure that in time will always lead to the solution of a problem

- Try every combination until you get it right
- Guaranteed
- Not always practical

A *heuristic* is a rule of thumb that often, but not always, helps us find the solution to a problem

- Eliminate combinations likely to be wrong
- Much faster, more practical
- But not as reliable
General Methods of Problem Solving: Algorithms and Heuristics (cont.)

Give us an example where using an algorithm is a better choice to solve a problem of complete a task

- Putting something together from IKEA
- A heuristic?
- Learning how to ride a bike
- How about cooking? Better to use a recipe or to wing it?
Specific Methods of Problem Solving

**Trial and error**
• Try one solution until it is proven wrong. Repeat until you try the right solution

**Difference reduction**
• Identify goal, where we are in relation to it, and what direction to go to get closer to it (reduce the difference between where we are and where we want to be)
• Sometimes this could mean a step backward in order to move forward
Specific Methods of Problem Solving

Means-end analysis

- Not “What direction should I go?”, but “What can I do to get there?”
- Break down problem into parts and solve each individually, knowing solving each part helps solve whole problem

Working backward

- Figure out final goal, what last step must be, then the next to last step, etc., until reaching first step
- Especially useful not knowing where to begin
Specific Methods of Problem Solving

**Analogy**
- Solve a problem same way you solved similar problem in past

**Insight**
- Sudden understanding
- Think about it until solution just comes to you – “A-ha!”

**Incubation**
- Take step back, let unconscious work on it a while -- helps promote an insight
Let’s Solve Some Problems!

“Six Problems to Solve”

• Solve each problem. Identify the method(s) you used to solve each.

Did any of these have you stumped? There is a reason…
Obstacles to Problem Solving

*Mental Set*
When your use of an analogy doesn’t work
• Connect 9 dots with 4 lines without lifting your pencil from the paper

*Functional Fixedness*
When you only think of using items at your disposal in traditional ways to solve your problems
• Many have this issue when trying to solve the “Scissors & String” problem
Obstacles to Problem Solving

*Mental Set*

When your use of an analogy doesn’t work

- Many have this issue when trying to solve the “Four Dot” problem
- Now that you know how to solve it, how about connecting 9 dots with 4 lines without lifting your pencil from the paper?

*Functional Fixedness*

When you only think of using items at your disposal in traditional ways to solve your problems

- Many have this issue when trying to solve the “Scissors & String” problem
Problem Solving and Creativity

*Creative thinking* – original ideas that fit the situation at hand

*Divergent thinking* (follow leads in various directions; consider multiple solutions to a problem) is more closely associated with creativity than *convergent thinking* (considering only available facts; focus on one solution)

- Divergent thinking aka “thinking outside the box” – some are more comfortable with this than others

Actually, many problems are effectively approached when using a combination of divergent and convergent thinking

- Divergent thinking produces many possible solutions at first; convergent thinking used to select the most probable solutions and reject the others

“Never, ever, think outside the box.”
Problem Identification, Root Cause Analysis, and Solution Brainstorming

• Let’s identify a problem in the school
• Determine the root cause
  • Root cause analysis – ask “Why?” until we can’t any more
• Come up with good solution(s)
  • Use divergent thinking to come up with possibilities, convergent thinking to come up with the most plausible
• Present it to Dr. Britton