

Problem Solving

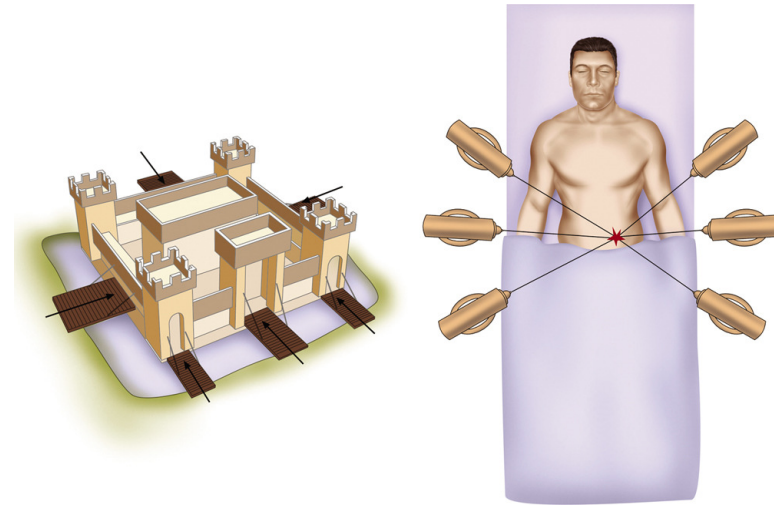
Problem solving: Using knowledge to find a way around obstacles to reach goals (page 318).

TABLE 8.2 Problem-Solving Strategies

| Strategy | Characteristics | Sample Problem | Solution |
|-------------------------|--|---|---|
| Subgoals | Identify the goal state and several subgoals to be achieved. | You want to repair your car muffler, but you do not have enough money to pay for repairs. | To reach the goal of having enough money for repairs, you research the best price, cut spending for a month, and work more hours to earn more money. |
| Working backward | Begin from the goal state and work backward to the current state. | You want to graduate in two years, but you are not sure what courses you need to take. | You identify the credits needed to graduate, then the credits needed per term, then the credits needed this term, and finally the classes that provide the needed credits for this term. |
| Analogy | Identify a previously solved problem that is similar to the current problem. | You cook beef with broccoli, but the broccoli ends up soggy. | You think about how, when you put an iced coffee in your lunch bag, your sandwich got damp. Similarly, moisture from the beef ruins the broccoli. Next time, you cook the beef and broccoli separately and then combine them. |
| Insight | Take a break from actively thinking about the problem, and the answer may spontaneously become apparent. | You have a hard time solving a difficult calculus homework problem. | You put the problem away. After a while, the correct way to solve the problem pops into your mind, and you are able to complete your homework. |

Analogical Problem Solving

To solve a problem by analogy, we look for similar problems that have a known solution and apply that solution to the current problem.



- Only 10% of research participants spontaneously came up with the correct solution.
- 30% of the participants came up with the solution if they read the island fortress problem or one similar to it.
- 75% of the participants came up with the solution if they read more than one analogous problem or were given a specific hint to use the fortress story.

Analogous Problem Solving

The more experience you have with solving problems and identifying the underlying structure of the problem (compared to the surface structure), you are more likely to spontaneously solve problems in front of you. In addition, if you are exposed to a wide variety of problems and their solutions, you are more likely to solve problems.

Other real examples of analogous problem solving (the following come from the Connections I series by James Burke),

- Metal smiths needed to get their ovens hotter to make better quality steel. They learned how to get their ovens hotter by seeing glass makers throw in shards of glass to make their glass ovens hotter.
- To get a fine spray of gasoline in an automobile engine, engineers used a perfume atomizer.

Other examples of analogous problem solving comes from the Marvel Cinematic Universe.

- Spider-man and Iron Man needed a way to rescue Dr. Strange from Ebony Maw in Infinity War--see Aliens.
- Spider-man suggesting how to deal with Ant-man in Captain America: Civil War--see Empire Strikes Back.

You Overcome Obstacles to Solve Problems

Good problem solvers know what strategies are effective AND obstacles that occur when solving problems. In addition, being able to determine what information is relevant and what information is irrelevant is important.

Restructuring Thinking about a problem in a new way in order to solve it ([page 321](#)).

Your mental representation can help or hinder your ability to solve a problem. A different mental representation or frame of a problem can make it easier, or more difficult to see “a solution”.

Restructuring changes how you think about a problem that may aid or hinder gaining insight into a solution.

Overcoming mental sets A mental set is an established way of thinking that has worked in the past but might not be the best way to solve a problem ([page 321](#)).

Using a way of thinking that has been successful in the past might keep you from noticing problems, novel ways of solving problems, or looking at the problem from a different perspective.

Overcoming functional fixedness Functional fixedness is the tendency to think of things based on their usual functions, which may make it harder to solve a problem ([page 322](#)).

| | |
|---------------------|---|
| Selective exposure | The tendency to selectively associate with people who are similar to you. This makes it less likely you will be able to have different points of view and have different possible solutions to solve the problem. |
| Normative influence | The desire to be accepted by the group makes it difficult to express different ideas. A norm needs to be established that constructive disagreement is acceptable to spark creativity. |

Restructuring

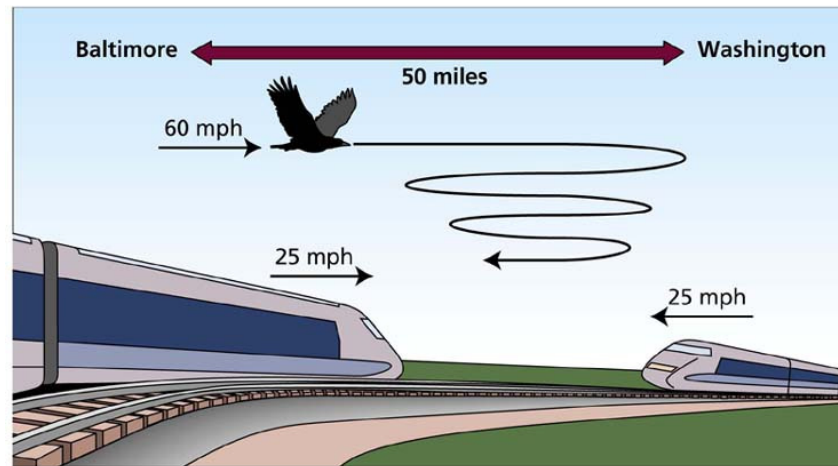
Thinking about a problem in a new way in order to solve it ([page 321](#)).

How you mentally structure, organize or think about a problem can influence your ability to solve the problem. If you are having difficulties solving a problem, you may need to find a different way of structuring the problem to identify key elements of the problem.

Restructuring a Problem: How Far Did the Crow Fly?

Train A leaves Baltimore for its 50-mile trip to Washington D.C. at a constant speed of 25 mph. At the same time, train B leaves Washington D.C. bound for Baltimore at the same speed of 25 mph.

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A crow that happened on a methamphetamine lab and sampled its product leaves Baltimore at the same time as train A, flying above the tracks toward Washington D.C. at a speed of 60 mph. When the crow encounters train B, it turns and flies toward train A, then instantly reverses its direction and flies back to train B. This supercharged bird continues this sequence until Train A and Train B meet midway between Baltimore and Washington D.C.

How far has the crow flown?

Drawing a picture helps visualize what is going on. In physics we tell students to sketch a picture.

Restructuring a Problem: Horse problem

A man bought a horse for \$60 and sold it for \$70. Then he bought the same horse for \$80 and sold it again for \$90.

- Write down how much money was made in both transactions combined.

Restructuring a Problem: Horse problem

If you try to do this in your head without writing things down, it makes it more challenging due to the limits of working memory. When you tax your limits of working memory, you are relying on a lot of mental shortcuts and intuition

A man bought a horse for \$60 and sold it for \$70. Then he bought the same horse for \$80 and sold it again for \$90.

- Write down how much money was made in both transactions combined.

| | |
|-------------------------------|------------------|
| <u>Bought:</u> Horse for \$60 | - \$\$\$\$\$ \$ |
| <u>Sold:</u> Horse for \$70 | +\$\$\$\$\$ \$\$ |

| | |
|------------------------------------|----------------------|
| <u>Bought:</u> Same Horse for \$80 | - \$\$\$\$\$ \$\$\$ |
| <u>Sold:</u> Same Horse for \$90 | +\$\$\$\$\$ \$\$\$\$ |

Techniques to solve the problem:

- Carry out a simulation with money to see what the actual results are.
- Add up the total amount of money paid out and compare it with the total amount of money paid in.
- Change the mental representation of the problem (see below).

The method you use should all lead to the same answer. When in doubt about an answer to a problem, try different techniques. If they come to different answers, there is a problem with one of your methods that need to be examined.

A man bought a horse for \$60 and sold it for \$70. Then he bought firewood for \$80 and sold it for \$90. How much money did he make in both transactions combined?

Mental Sets

A mental set is an established way of thinking that has worked in the past but might not be the best way to solve a problem ([page 321](#)).

Mental sets can be useful because they may save time and effort of searching for new types of solutions. Using a way of thinking that has been successful in the past might keep you from noticing problems, novel ways of solving problems, or looking at the problem from a different perspective.

Mental Sets

The task is to measure out specified amounts of water using the three jars.



| | Desired water | Jar A | Jar B | Jar C |
|---------|---------------|-------|-------|-------|
| Trial 1 | 100 | 21 | 127 | 3 |
| Trial 2 | 8 | 18 | 48 | 11 |
| Trial 3 | 62 | 10 | 80 | 4 |
| Trial 4 | 31 | 20 | 59 | 4 |
| Trial 5 | 29 | 20 | 57 | 4 |
| Trial 6 | 20 | 23 | 49 | 3 |
| Trial 7 | 25 | 28 | 76 | 3 |

Psychological Science, 4/e Figure 8.24
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$$\begin{aligned}
 B - A - C - C &= 127 - 21 - 3 - 3 = 100 \\
 B - A - C - C &= 48 - 18 - 11 - 11 = 8 \\
 B - A - C - C &= 80 - 10 - 4 - 4 = 62 \\
 B - A - C - C &= 59 - 20 - 4 - 4 = 8 \\
 B - A - C - C &= 57 - 20 - 4 - 4 = 29 \\
 B - A - C - C &= 49 - 23 - 3 - 3 = 20 \\
 B - A - C - C &= 76 - 28 - 3 - 3 = \mathbf{25}
 \end{aligned}$$

Mental Sets



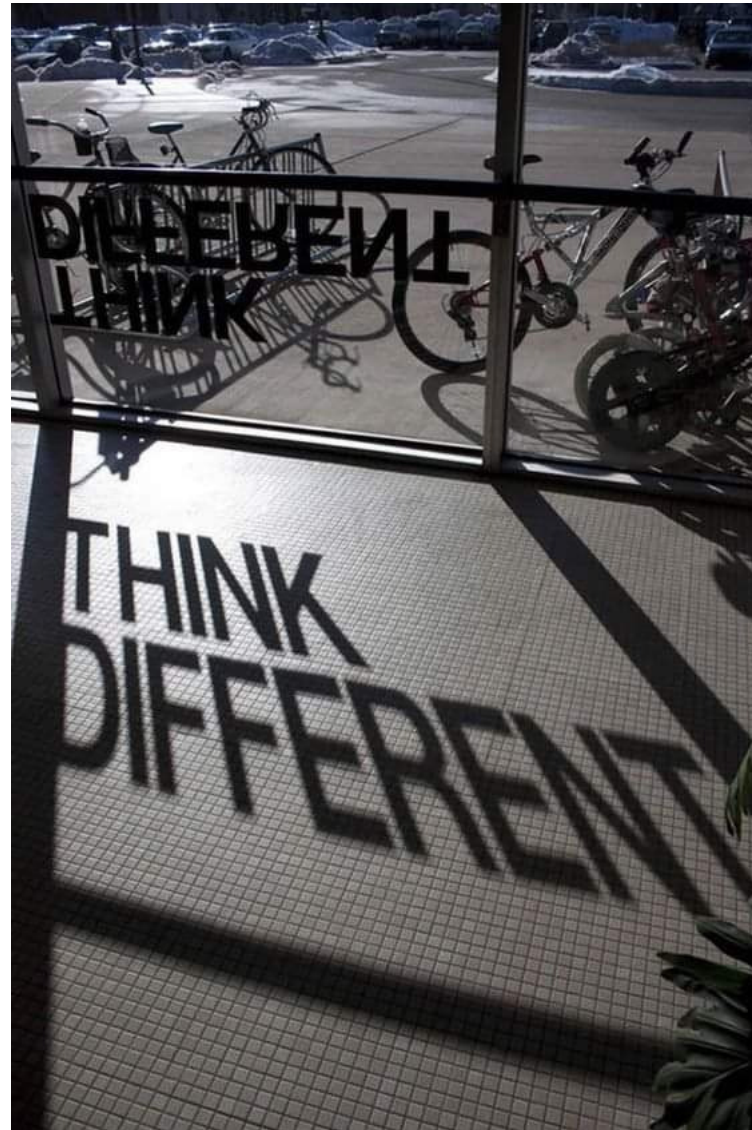
When there is a social problem, we tend to think of a technological solution instead of changing our behavior.

Overcoming Mental Sets

Instead of placing garbage cans around this beach, the city made a giant see-through fish with the words “Goby loves plastic, please feed him”. Kids enjoyed feeding him so much, that he’s usually full by the end of the day



Overcoming Mental Sets



Overcoming Mental Sets

Other Examples

- Current oil change service have a pit that you drive over. We used to raise the car on a lift.
- In the 1980s movie Raising Arizona with Nicholas Cage and Holly Hunt, a speeding car stops right in front of an infant. Instead of using CGI (which was not available at the time, or camera angle, they _____).
- “When something breaks, throw it away and buy a new one versus fixing it”
- Fischer-Price and “action-heroes”: The action hero toy is a lucrative market, however, Fischer-Price has a strong prohibition against creating violent toys. How could they pursue this important market without creating a “shoot-‘em-up Rambo style toy (such as G.I. Joe, X-men, Star Wars, etc.)? They created action figures such as a fireman, construction worker, ambulance driver, etc.

Overcoming Mental Sets

Mental sets is the tendency to solve problems with the strategies that have been used in the past. Overcoming mental sets can come up with creative solutions such as with reverse graffiti. Instead of spraying paint to create art, you clean dirty surfaces to create art.

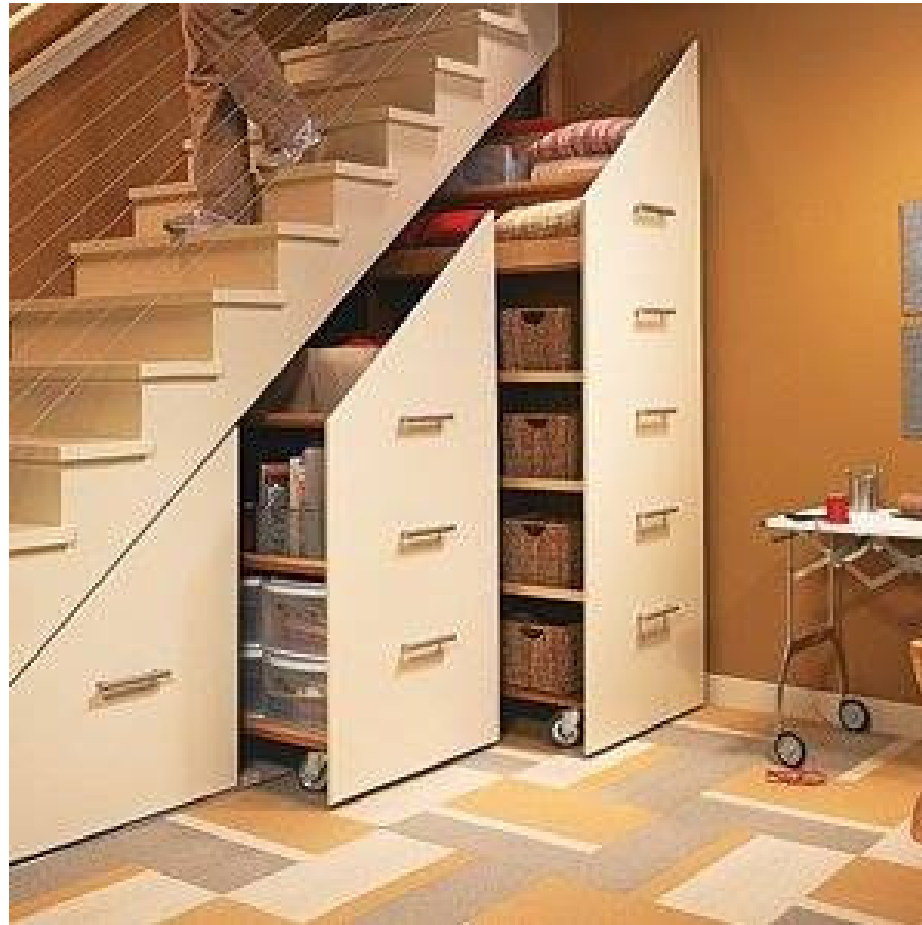


Overcoming Mental Sets



Artists created art that can be viewed on the water by painting images upside down on buildings.

Overcoming Mental Sets



This design uses the space under the stairways in a different way.

Overcoming Mental Sets

Instead of hiding cables:



Instead of normally hiding cables, make it into works of art.

Overcoming Mental Sets

This kid's parents built his Halloween costume around his wheelchair...



Instead of trying to make a Halloween costume for a child in a wheelchair, make the wheelchair part of the costume.

Overcoming Mental Sets



Crafty Fun Group · [Join](#)

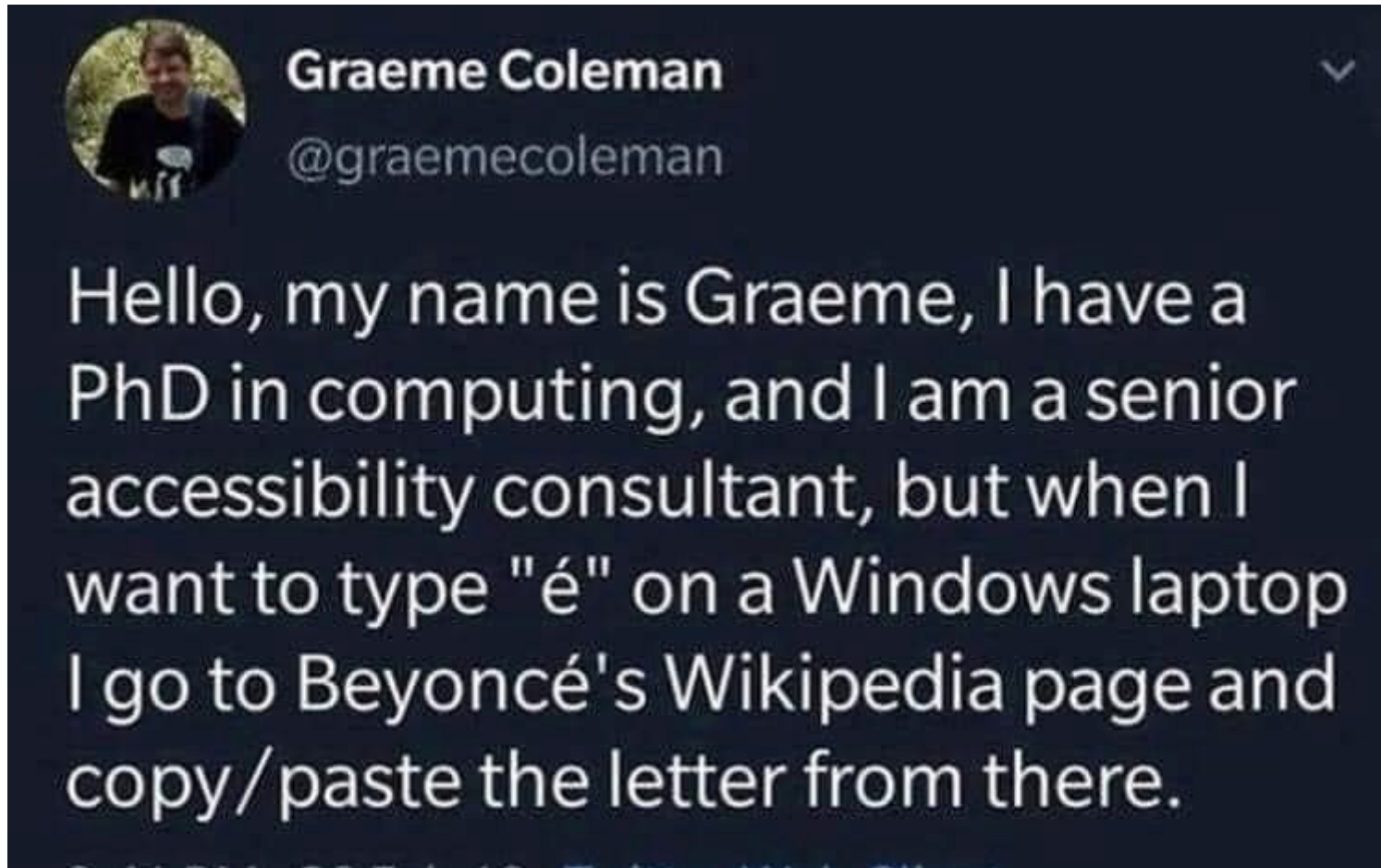
Kelly Mules · 5 d ·

I made this costume for my son out of lots of cardboard and Styrofoam it even had a little lights lit up at night. This was the first time he went trick-or-treating in a wheelchair after getting sick from Guillain Barre Syndrome. [#KellyMulesArt](#)



Instead of trying to make a Halloween costume for a child in a wheelchair, make the wheelchair part of the costume.

Overcoming Mental Sets



Instead of going to "key caps" to find the accent over the e, copy it from a well-known source.

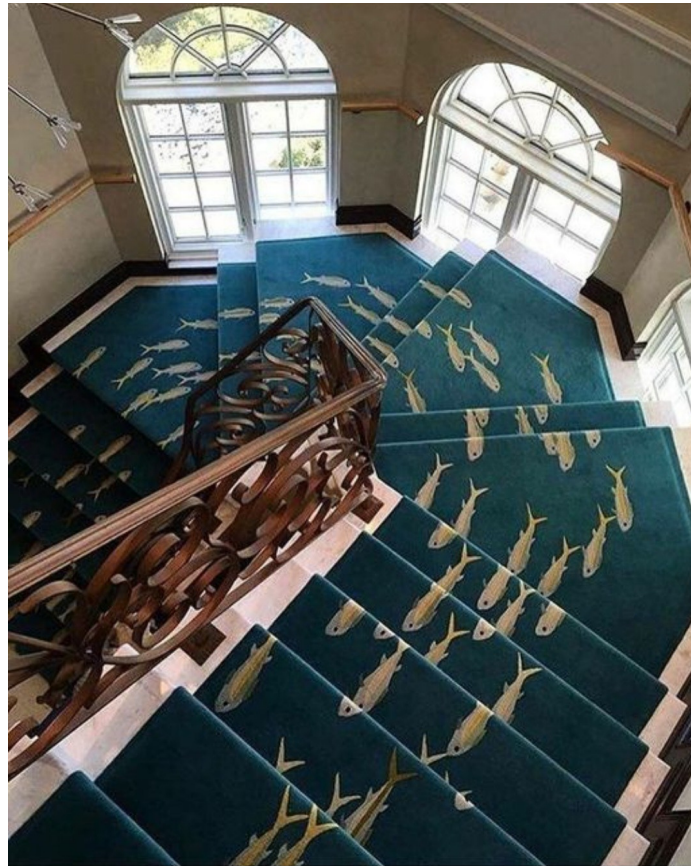
This parking garage in America put lines on the wall to make parking easier



...
@homo_zai

I personally know about 10 bad drivers who need these lines. I vote for it to be mandatory in every parking lot

Overcoming Mental Sets



'River of Fish' stair runner by The Rug Company. Designed by Barber & Osgerby.

We might not consider the floor as a place for art.

Related to Mental Sets--thinking about things differently



While this isn't exactly overcoming a mental set (you aren't really solving a problem, but answering a question). You can apply your knowledge broadly and look at non-standard ways of answering a question in a creative way that might be more poignant.

For example, "What do you want to be when you grow up?"



In Japan, a sink is built above the toilet tank for hand washing. The water drains into the toilet tank to be used for the next flush, and saves millions of gallons of water each year.

How to measure sticky ingredients when baking. Press your measurement cups into the flour, then pour the sticky ingredient in



Functional Fixedness

Functional fixedness Functional fixedness is the tendency to think of things based on their usual functions, which may make it harder to solve a problem ([page 322](#)).

Figure 8.20, [page 322](#):

How can you use these objects—a box of matches, thumbtacks, and a candle—to mount the candle on the wall so that it illuminates the room.

(a) The Problem

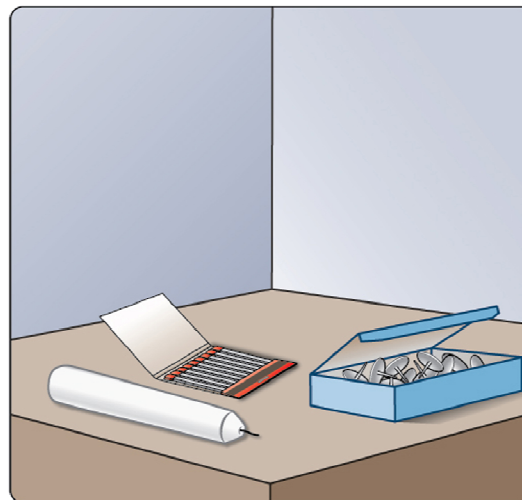


FIGURE 8.20

Functional Fixedness

We can experience functional fixedness by only viewing the box for the tacks to hold tacks and not as a stand for the candle.

(b) The Solution

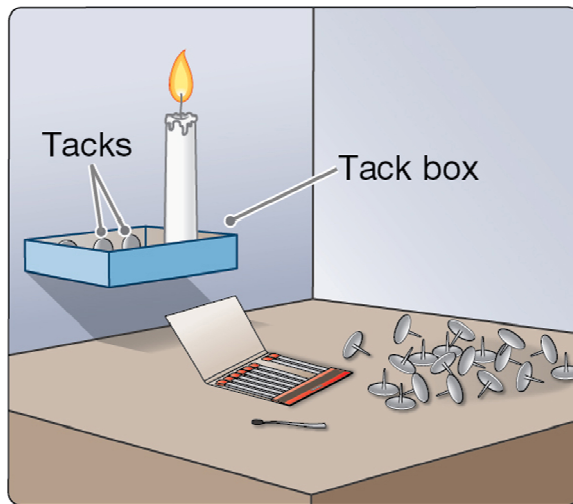


FIGURE 8.20

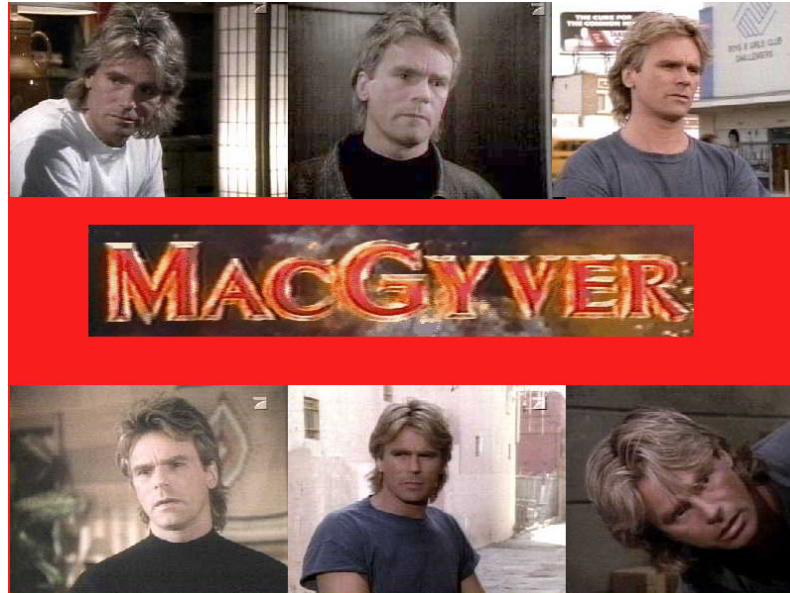
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By overcoming functional fixedness, we can be creative and solve the problem. In general, people who have excellent thinking skills can demonstrate the ability to create, change, and manipulate internal representations to make decisions and solve problems ([page 322](#)).

Examples of Overcoming Functional Fixedness

- In high school I stayed at a friend's house the night before a class trip. Our bus left very early in the morning and we were running late. It was time to go and she still had wet hair. She said, "No problem, I'll dry it in the car." I didn't understand but rushed around to get ready. Once in the car, she turned the heater on high and dried her hair as I drove us to catch the bus. I would have never thought of using the car heater as a hair dryer.
- I bought frozen orange juice. When I got home, Nicole told me we didn't have a pitcher to put it in. I simply went over and grabbed an empty 2-liter bottle from ginger ale and used that.
- Have you ever spent a lot of time looking for a flat-headed screwdriver when a dime would have worked just as well?
- I have a kitchen hammer that I saw kitchen chefs use to crush garlic with (observational learning). However, it is packed away somewhere, and I don't want to take the effort to go find it. Instead, I take a can of chili (the glass jars are too risky) and use it to crush the garlic.
- When a friend was overseas on a tour group, he needed some thread to fix his backpack. How about dental floss instead?

- An archaeological team went into the desert (Gobi?) in China looking for fossils. Several hundred miles into the remote desert, a gasket in one of their vehicles needed replacing. Unfortunately, the nearest shop was hundreds of miles away and they didn't have a spare.
- Large size “binder clips” are used to hold large stacks of papers. What else can they be used for?
- Richard Dean Anderson often displayed overcoming functional fixedness as the star of the television show



- In the movie _____, Tom Hanks was shipwrecked with several items that appeared to be useless, but later found a use for them.



Overcoming Functional Fixedness



Overcoming Functional Fixedness

Carpet Alarm Clock. Forces you to get up and stand on it to turn it off. I need this in my life.



Overcoming Functional Fixedness



Overcoming Functional Fixedness



Travel photos are always better with
dinosaur toys



**EVERY YEAR, MY WIFE AND I DEVOTE
THE MONTH OF NOVEMBER TO
CONVINCING OUR CHILDREN THAT,
WHILE THEY SLEEP, THEIR PLASTIC
DINOSAUR FIGURES COME TO LIFE.**

It began modestly enough. The kids woke up to discover that the dinosaurs had gotten into a box of cereal and made a mess on the kitchen table.



The next morning, the dinos had climbed onto the kitchen counter to raid the fruit bowl.



To everyone who said we hung our door upside down - we did it so our puppies could look out.



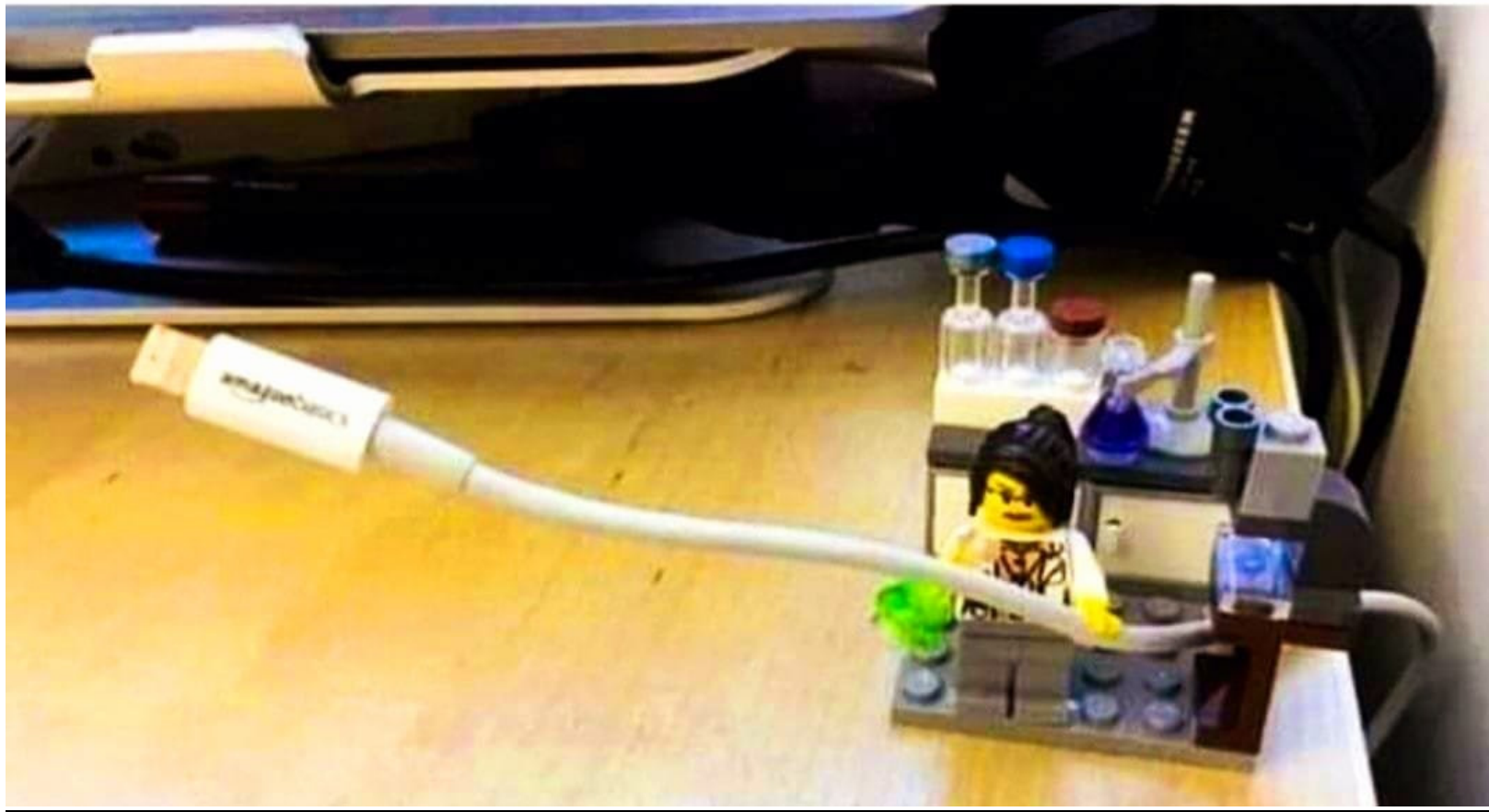








Just discovered that LEGO hands are the perfect size for making sure your phone charger doesn't fall off your desk



Mental Sets versus Functional Fixedness

A simplified description of mental sets versus functional fixedness is that

- Mental sets = This is how we have always done it.
- Functional fixedness = This is how we have always used it.