Module 34

Thinking, Concepts, and Creativity

Module Learning Objectives

34-1 Define *cognition*, and describe the functions of concepts.

34-2 Identify the factors associated with creativity, and describe ways of promoting creativity.

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In some ways, we humans are, as we will see, dim-witted. We fear the wrong things. We allow the day's hot or cold weather to color our judgments of global climate change. We tend to be overconfident in our judgments and to persevere in clinging to discredited beliefs. Yet we also display remarkable mental powers. Our intelligence, creativity, and language mark us as "little less than the angels."

cognition all the mental activities associated with thinking, knowing, remembering, and communicating.

concept a mental grouping of similar objects, events, ideas, or people.

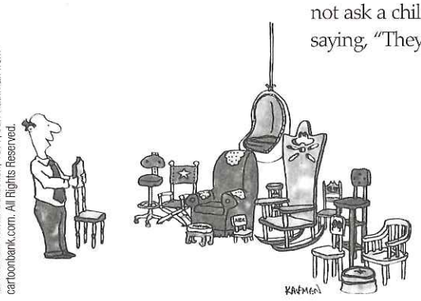
prototype a mental image or best example of a category. Matching new items to a prototype provides a quick and easy method for sorting items into categories (as when comparing feathered creatures to a prototypical bird, such as a robin).

Thinking and Concepts

34-1 What is cognition, and what are the functions of concepts?

Let's begin our study of **cognition**—the mental activities associated with thinking, knowing, remembering, and communicating information—by appreciating our human smarts.

Consider, for example, our ability to form **concepts**—mental groupings of similar objects, events, ideas, and people. The concept *chair* includes many items—a baby's high chair, a reclining chair, a dentist's chair—all of which are for sitting. Concepts simplify our thinking. Imagine life without them. We would need a different name for every person, event, object, and idea. We could not ask a child to "throw the ball" because there would be no concept of *throw* or *ball*. Instead of saying, "They were angry," we would have to describe expressions, intensities, and words. Concepts such as *ball* and *anger* give us much information with little cognitive effort.



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"Attention, everyone! I'd like to introduce the newest member of our family."

We often form our concepts by developing **prototypes**—a mental image or best example of a category (Rosch, 1978). People more quickly agree that "a robin is a bird" than that "a penguin is a bird." For most of us, the robin is the birdier bird; it more closely resembles our bird prototype. And the more closely something matches our prototype of a concept—bird or car—the more readily we recognize it as an example of the concept.

Once we place an item in a category, our memory of it later shifts toward the category prototype, as it did for Belgian students who viewed ethnically blended faces. For example, when viewing a blended face in which 70 percent of the features were Caucasian and 30 percent were Asian, the students categorized the face as Caucasian. Later, as their memory shifted toward the Caucasian prototype, they were more likely to remember an 80 percent Caucasian face than the 70 percent Caucasian they had actually seen (Corneille et al., 2004). Likewise, if shown a 70 percent Asian face, they later remembered a more prototypically Asian face. So, too, with gender: People who viewed 70 percent male faces categorized them as male (no surprise there) and then later misremembered them as even more prototypically male (Huart et al., 2005).

Move away from our prototypes, and category boundaries may blur. Is a tomato a fruit? Is a 17-year-old female a girl or a woman? Is a whale a fish or a mammal? Because a whale fails to match our "mammal" prototype, we are slower to recognize it as a mammal. Similarly, when symptoms don't fit one of our disease prototypes, we are slow to perceive an illness (Bishop, 1991). People whose heart attack symptoms (shortness of breath, exhaustion, a dull weight in the chest) don't match their heart attack prototype (sharp chest pain) may not seek help. And when behaviors don't fit our discrimination prototypes—of White against Black, male against female, young against old—we often fail to notice prejudice. People more easily detect male prejudice against females than female against males or female against females (Inman & Baron, 1996; Marti et al., 2000). Concepts speed and guide our thinking. But they don't always make us wise.

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Toying with our prototypes It takes a bit longer to conceptualize a Smart Car as an actual car, because it looks more like a toy than our mental prototype for *car*.

Creativity

34-2 What is creativity, and what fosters it?

Pierre de Fermat, a seventeenth-century mischievous genius, challenged mathematicians of his day to match his solutions to various number theory problems. His most famous challenge—*Fermat's last theorem*—baffled the greatest mathematical minds, even after a $2 million prize (in today's dollars) was offered in 1908 to whoever first created a proof.

Princeton mathematician Andrew Wiles had pondered the problem for more than 30 years and had come to the brink of a solution. One morning, out of the blue, the final "incredible revelation" struck him. "It was so indescribably beautiful; it was so simple and so elegant. I couldn't understand how I'd missed it. . . . It was the most important moment of my working life" (Singh, 1997, p. 25).

Wiles' incredible moment illustrates **creativity**—the ability to produce ideas that are both novel and valuable (Hennessey & Amabile, 2010). Studies suggest that a certain level of aptitude—a score above 120 on a standard intelligence test—supports creativity. Those who score exceptionally high in quantitative aptitude as 13-year-olds are more likely to obtain graduate science and math degrees and create published or patented work (Park et al., 2008; Robertson et al., 2010). Intelligence matters. Yet, there is more to creativity than what intelligence tests reveal. Indeed, the two kinds of thinking engage different brain areas. Intelligence tests, which typically demand a single correct answer, require **convergent thinking.** Injury to the left parietal lobe damages this ability. Creativity tests *(How many uses can you think of for a brick?)* require **divergent thinking.** Injury to certain areas of the frontal lobes can leave reading, writing, and arithmetic skills intact but destroy imagination (Kolb & Whishaw, 2006).

Although there is no agreed-upon creativity measure—there is no Creativity Quotient (CQ) corresponding to an Intelligence Quotient (IQ) score—Robert Sternberg and his colleagues have identified five components of creativity (Sternberg, 1988, 2003; Sternberg & Lubart, 1991, 1992):

1. *Expertise*—a well-developed base of knowledge—furnishes the ideas, images, and phrases we use as mental building blocks. "Chance favors only the prepared mind," observed Louis Pasteur. The more blocks we have, the more chances we have to combine them in novel ways. Wiles' well-developed base of knowledge put the needed theorems and methods at his disposal.

FYI

After picking up a Nobel Prize in Stockholm, physicist Richard Feynman stopped in Queens, New York, to look at his high school record. "My grades were not as good as I remembered," he reported, "and my IQ was [a good, though unexceptional] 124" (Faber, 1987).

creativity the ability to produce novel and valuable ideas.

convergent thinking narrows the available problem solutions to determine the single best solution.

divergent thinking expands the number of possible problem solutions (creative thinking that diverges in different directions).

2. ***Imaginative thinking skills*** provide the ability to see things in novel ways, to recognize patterns, and to make connections. Having mastered a problem's basic elements, we redefine or explore it in a new way. Copernicus first developed expertise regarding the solar system and its planets, and then creatively defined the system as revolving around the Sun, not the Earth. Wiles' imaginative solution combined two partial solutions.
3. ***A venturesome personality*** seeks new experiences, tolerates ambiguity and risk, and perseveres in overcoming obstacles. Wiles risked much of his time in pursuit of his dream and persevered in near-isolation from the mathematics community partly to stay focused and avoid distraction.
4. ***Intrinsic motivation*** is being driven more by interest, satisfaction, and challenge than by external pressures (Amabile & Hennessey, 1992). Creative people focus less on extrinsic motivators—meeting deadlines, impressing people, or making money—than on the pleasure and stimulation of the work itself. Asked how he solved such difficult scientific problems, Isaac Newton reportedly answered, "By thinking about them all the time." Wiles concurred: "I was so obsessed by this problem that . . . I was thinking about it all the time—[from] when I woke up in the morning to when I went to sleep at night" (Singh & Riber, 1997).
5. ***A creative environment*** sparks, supports, and refines creative ideas. After studying the careers of 2026 prominent scientists and inventors, Dean Keith Simonton (1992) noted that the most eminent were mentored, challenged, and supported by their colleagues. Many had the emotional intelligence needed to network effectively with peers. Even Wiles stood on the shoulders of others and wrestled his problem with the collaboration of a former student. Creativity-fostering environments support innovation, team-building, and communication (Hülsheger et al., 2009). They also support contemplation. After Jonas Salk solved a problem that led to the polio vaccine while in a monastery, he designed the Salk Institute to provide contemplative spaces where scientists could work without interruption (Sternberg, 2006). Google has estimated that nearly half its product innovations have been sparked during the 20 percent of employee time reserved for unstructured creative thinking (Mayer, 2006).

Imaginative thinking Cartoonists often display creativity as they see things in new ways or make unusual connections.

"For the love of God, is there a doctor in the house?"

For those seeking to boost the creative process, research offers some ideas:

- *Develop your expertise.* Ask yourself what you care about and most enjoy. Follow your passion and become an expert at something.
- *Allow time for incubation.* Given sufficient knowledge available for novel connections, a period of inattention to a problem ("sleeping on it") allows for unconscious processing to form associations (Zhong et al., 2008). So think hard on a problem, then set it aside and come back to it later.
- *Set aside time for the mind to roam freely.* Take time away from attention-absorbing television, social networking, and video gaming. Jog, go for a long walk, or meditate.
- *Experience other cultures and ways of thinking.* Living abroad sets the creative juices flowing. Even after controlling for other variables, students who have spent time abroad are more adept at working out creative solutions to problems (Leung et al., 2008; Maddux et al., 2009, 2010). Multicultural experiences expose us to multiple perspectives and facilitate flexible thinking.

A creative environment

Before You Move On

▶ ASK YOURSELF

Imagine patiently waiting your turn at a store, and then having some late-arriving adults served before you. The clerk also checks inside your bag as you leave the store. What is a prototype, and what sort of "teenager" prototype does the clerk seem to have in mind?

▶ TEST YOURSELF

According to Robert Sternberg, what are the five components of creativity?

Answers to the Test Yourself questions can be found in Appendix E at the end of the book.

Module 34 Review

34-1 What is cognition, and what are the functions of concepts?

- *Cognition* refers to all the mental activities associated with thinking, knowing, remembering, and communicating.
- We use *concepts*, mental groupings of similar objects, events, ideas, or people, to simplify and order the world around us.
- We form most concepts around *prototypes*, or best examples of a category.

34-2 What is creativity, and what fosters it?

- *Creativity*, the ability to produce novel and valuable ideas, correlates somewhat with intelligence, but beyond an intelligence test score of 120, that correlation dwindles.
- Sternberg has proposed that creativity has five components: expertise, imaginative thinking skills; a venturesome personality; intrinsic motivation; and a creative environment that sparks, supports, and refines creative ideas.