Multiple-Choice Questions

1. Which of the following is the best term for mental activities associated with remembering, thinking, and knowing?
   a. Cognition
   b. Concepts
   c. Prototypes
   d. Convergent thinking
   e. Divergent thinking

2. Which of the following is the best phrase for the narrowing of available problem solutions with the goal of determining the best solution?
   a. Allowing for incubation
   b. Divergent thinking
   c. Developing expertise
   d. Convergent thinking
   e. Experiencing other cultures

3. Producing valuable and novel ideas best defines which of the following?
   a. Prototyping
   b. Cognition
   c. Intrinsic motivation
   d. Venturesome personality
   e. Creativity

Practice FRQs

1. Compare the notions of concept and prototype.

Answer

1 point: A concept is a mental grouping of similar objects, events, ideas, and people.

1 point: A prototype is a mental image or best example of a category.

2. Identify and explain four of the five components of creativity mentioned in this module.

(module 35)

Problem Solving: Strategies and Obstacles

35-1 What cognitive strategies assist our problem solving, and what obstacles hinder it?

One tribute to our rationality is our problem-solving skill. What's the best route around this traffic jam? How should we handle a friend's criticism? How can we get in the house without our keys?

Some problems we solve through trial and error. Thomas Edison tried thousands of light bulb filaments before stumbling upon one that worked. For other problems we use algorithms, step-by-step procedures that guarantee a solution. But step-by-step algorithms can be laborious and exasperating. To find a word using the 10 letters in SLOUCHING, for example, you could try each letter in each of the 10 positions—907,200 permutations in all. Rather than give you a computing brain the size of a beach ball, nature resorts to heuristics, simpler thinking strategies. Thus, you might reduce the number of options in the SLOUCHING example by grouping letters that often appear together (CH and GH) and excluding rare letter combinations (such as two Y's together). By using heuristics and then applying trial and error, you may hit on the answer. Have you guessed it?

Sometimes, no problem-solving strategy seems to be at work at all, and we arrive at a solution to a problem with insight. Teams of researchers have identified brain activity associated with sudden flashes of insight (Kounios & Beeman, 2009; Sandkühler & Bhattacharya, 2008). They gave people a problem: Think of a word that will form a compound word or phrase with each of three other words in a set (such as pine, curb, and main), and press a button to sound a bell when you know the answer. (If you need a hint: The word is a fruit.) EEGs or fMRIs (functional MRIs) revealed the problem solver's brain activity.

1 Answer to SLOUCHING program: PSYCHOLOGY.

2 The word is apple: pineapple, crabapple, appearance.
Heuristic searching: To search for hot cocoa mix, you could search every supermarket aisle (an algorithmic search), or check the broadcast, beverage, and baking supplies sections (heuristics). The heuristic approach is often quicker, but an algorithmic search guarantees you will find it eventually.

In the first experiment, about half the solutions were by a sudden Ahah! insight. Before the Ahah moment, the problem solvers’ frontal lobes (which are involved in noticing) were active, and there was a burst of activity in the right temporal lobe, just above the ear (Figure 35.1).

We are not the only creatures to display insight, as psychologist Wolfgang Köhler (1925) demonstrated in an experiment with a chimpanzee. Köhler placed a piece of fruit and a long stick outside Sultan’s cage. Inside the cage, he placed a short stick, which Sultan grabbed, using it to try to reach the fruit. After several failed attempts, he dropped the stick and seemed to survey the situation. Then suddenly, as if thinking “Ahah!” Sultan jumped up and seized the short stick again. This time, he used it to pull in the longer stick—which he then used to reach the fruit.

It is more than just a fluke. More recent research has shown that people who use insight to solve problems tend to use these neural networks more efficiently (Macaluso & Call, 2006).

In their most simplified forms, insight is a new idea that suddenly makes sense, or a sudden realization that something is connected to something else. Insight is a cognitive process that enables people to solve problems in a more efficient way than if they just keep trying the same methods over and over.

In the Figure 35.2., the matchstick problem: How might you rearrange the matchsticks to form an equilateral triangle?

The problem is not to tell the difference between a deeply wise, intuitive nudge from the universe and one of my own horn-headed ideas!

The problem is not to tell the difference between a deeply wise, intuitive nudge from the universe and one of my own horn-headed ideas!

Forming Good and Bad Decisions and Judgments

What is intuition, and how can the representativeness and availability heuristics, overconfidence, belief perseverance, and framing influence our decisions and judgments?

When making each day’s hundreds of judgments and decisions (Is it worth the bother to take a jog? Can I trust this person? Should I shoot the basketball or pass to the player who’s hot?), we seldom take the time and effort to reason systematically. We just follow our intuition, our fast, automatic, unconscious, and feelings and thoughts. After interviewing policy makers in government, business, and education, sociologist Linzer Janis (1984) concluded that they often do not use a reflective problem-solving approach. How do they usually arrive at their decisions? If you ask, they are likely to tell you “. . . they do it mostly by the seat of their pants.”

When we need to act quickly, the mental shortcuts we call heuristics enable snap judgments. However, research by cognitive psychologists Amos Tversky and Daniel Kahneman (1974) on the representativeness and availability heuristics showed how these generally helpful shortcuts can lead even the smartest people into dumb decisions.

Twente and Kahneman’s joint work on decision making received a 2002 Nobel Prize; sadly, only Kahneman was alive to receive the benefit.

Kahneman and his colleagues and students have changed the way we think about the way people think. —Amos Tversky (1985)

"Intuitive thinking is a lot of the time . . . But sometimes that habit of mind gets us in trouble" —Daniel Kahneman (2011)

A minimalist approach to approach a problem in a particular way, often a way that has been successful in the past.

Intuition is effortless, immediate, automatic feeling or thought, as contrasted with explicit, conscious reasoning.

mental set: A tendency to approach a problem in a particular way, often a way that has been successful in the past.

Intuition is effortless, immediate, automatic feeling or thought, as contrasted with explicit, conscious reasoning.
The Representativeness Heuristic

To judge the likelihood of things in terms of how well they represent particular prototypical cases is to use the representativeness heuristic. To illustrate, consider:

A stranger tells you about a person who is short, slim, and likes to read poetry, and then asks you to guess whether this person is more likely to be a professor of classics at an Ivy League university or a truck driver (adapted from尼斯和Ross, 1980). Which would be the better guess?

Did you answer "professor"? Many people do, because the description seems more representative of Ivy League scholars than of truck drivers. The representativeness heuristic, however, enabled you to make a snap judgment. But it also led you to ignore other relevant information. When I help people think through this question, the conversation goes something like this:

**Question:** First, let's figure out how many professors fit this description. How many Ivy League universities do you suppose there are?

**Answer:** Oh, about 10, I suppose.

**Question:** How many classics professors would you guess there are at each?

**Answer:** Maybe 4.

**Question:** Okay, that's 40 Ivy League classics professors. What fraction of these are short and slim?

**Answer:** Let's say half.

**Question:** And, of these 20, how many like to read poetry?

**Answer:** I'd say half—10 professors.

**Question:** Okay, now let's figure how many truck drivers fit the description. How many truck drivers do you suppose there are?

**Answer:** Maybe 400,000.

**Question:** What fraction of these are short and slim?

**Answer:** Not many—perhaps 1 in 10.

**Question:** Of these 50,000, what percentage like to read poetry?

**Answer:** Truck drivers who like poetry? Maybe 1 in 100—oh, eh, I get it—that leaves 500 short, slim, poetry-reading truck drivers.

**Comment:** Yup. So, even if we accept your stereotype that the description is more representative of classics professors than of truck drivers, the odds are 50 to 1 that this person is a truck driver.

The representativeness heuristic influences many of our daily decisions. To judge the likelihood of something, we intuitively compare it with our mental representation of that category—of, say, what truck drivers are like. If the two match, that fact usually overrides other considerations of statistics or logic.

The Availability Heuristic

The availability heuristic operates when we estimate the likelihood of events based on how mentally available they are. Casino entice us to gamble by signaling even small wins with bells and lights—making them vividly memorable—while keeping big losses soundlessly invisible.

The availability heuristic can lead us astray in our judgments of other people, too. Anything that makes information "pop" into mind—its vividness, recency, or distinctiveness—can make it seem commonplace. If someone from a particular ethnic or religious group commits a terrorist act, as happened on September 11, 2001, when Islamic extremists killed nearly 3000 people in the United States in coordinated terrorist attacks, our readily available memory of the dramatic event may shape our impressions of the whole group.

Even during that horrific year, terrorist acts claimed comparatively few lives. Yet when the statistical reality of greater dangers (see Figure 35.4) was pitted against a single vivid case, the memorable case won, as emotion-laden images of terror exacerbated our fears (Sunstein, 2007).

We often fear the wrong things. We fear flying because we play in our heads some air disaster. We fear letting our children walk to school because we play in our heads tapes of abducted and brutalized children. We fear swimming in ocean waters because we replay jaws in our heads. Even just passing by a person who sneezes and coughsheightens our perceptions of various health risks (Lee et al., 2010). And so, thanks to these readily available images, we come to fear extremely rare events. (Turn the page to see "Thinking Critically About the Bear Factor—Why We Fear the Wrong Things.")

Meanwhile, the lack of comparably available images of global climate change—which some scientists regard as a future "Armageddon in slow motion"—has left most people little concerned (New, 2007). The vividness of a recent local cold day reduces their concern about long-term global warming and overwhelms less memorable scientific data (Li et al., 2011). Dramatic outcomes make us gasp; probabilities we hardly grasp. As of 2013, some 60 nations—including Canada, many in Europe, and the United States—have, however, sought to harness the positive power of vivid, memorable images by putting eye-catching warnings and graphic photos on cigarette packages (Ridslan, 2013). This campaign may work, where others have failed. As psychologist Paul Slovic (2007) points out, we reason emotionally and neglect probabilities. We overfeel and underthink. In one experiment, donations to a starving 7-year-old child were greater when her image was not accompanied by statistical information about the millions of needy African children like her (Small et al., 2007). "If I look at the mass, I will not act," Mother Teresa reportedly said. "If I look at the one, I will." "The more who die, the less we care," noted Slovic (2010).

Overconfidence

Sometimes our judgments and decisions go awry simply because we are more confident than correct. Across various tasks, people overestimate their performance (Metcalfe, 1998). If 60 percent of people correctly answer a factual question, such as "Is absinthe a liqueur or a poisonous substance?" they will typically average 75 percent confidence (Fischhoff et al., 1977). It's a licorice-flavored liqueur. This tendency to overestimate the accuracy of our knowledge and judgments is overconfidence.

It was an overconfident B3 that, before its exploded drilling platform spewed oil into the Gulf of Mexico, downplayed safety concerns, and then downplayed the spill's magnitude (Mohr et al., 2010; Urbina, 2010). It is overconfidence that drives stockbrokers and investment managers to market their ability to outperform stock market averages, despite overwhelming evidence to the contrary (Malkiel, 2004). A purchase of stock X, recommended by a broker who judges this to be the time to buy, is usually balanced by a sale made by someone who judges this to be the time to sell. Despite their confidence, buyer and seller cannot both be right.

History is full of leaders who were more confident than correct. And classrooms are full of overconfident students who expect to finish assignments and write papers ahead of schedule (Buschel et al., 1994). In fact, the projects generally take about twice the number of days predicted.

*Don't believe everything you think.*—Bob Marley
Thinking Critically About

The Fear Factor—Why We Fear the Wrong Things

After the 9/11 attacks, many people feared flying more than driving. In a 2006 Gallup survey, only 40 percent of Americans reported being “not afraid at all” to fly. Yet from 2005 to 2007, Americans were nine times more likely to die in an automobile or pickup truck crash than on a scheduled flight (National Safety Council, 2010). In 2009 alone, 33,800 Americans were killed in motor vehicle accidents—that’s 650 dead people each week. Meanwhile, in 2009 (as in 2007 and 2008), zero died from airline accidents on scheduled flights.

In a 2001 essay, I calculated that if—because of 9/11—we flew 20 percent less and instead drove half those unknown miles, about 800 more people would die in the year after 9/11 (Myers, 2001). German psychologist Gerd Gigerenzer (2004, 2006) later checked this estimate against actual accident data. (Why didn’t I think of that?) U.S. traffic deaths did indeed increase significantly in the last three months of 2001.

Figure 35.5. By the end of 2002, Gigerenzer estimated, 1900 Americans had lost their lives on the road by trying to avoid the risk of flying. Despite our greatest fear, flying’s biggest danger is, for most people, the drive to the airport.

Why do we fear the wrong things? Why do we judge terrorism to be a greater risk than accidents? Psychologists have identified four influences that feed fear and cause us to ignore higher risks.

1. We fear what our ancestral history has prepared us to fear. Human emotions were road tested in the Stone Age. Our old brain prepares us to fear yesterday’s risks: snakes, bears, and spiders (which combined now kill a tiny fraction of the number killed by modern-day threats, such as cars and cigarettes). Yesterday’s risks also prepare us to fear confinement and heights, and therefore flying.

2. We fear what we cannot control. Driving or flying, we do not.

3. We fear what is immediate. The dangers of flying are mostly telescoped into the moments of takeoff and landing. The dangers of driving are diffused across many moments to come, each tri- entreally dangerous.

4. Thanks to the availability heuristic, we are most readily aware in memory. Powerful, vivid images, like that of United Flight 175 sliding into the World Trade Center, feed our judgments of risk. Thousands of safe car trips have extinguished our anxieties about driving. Similarly, we remember (and fear) widespread disasters (hurricanes, tornadoes, earthquakes) that kill people dramatically, in bunches. But we fear too little the less dramatic threats that claim lives quietly, one by one, continuing into the distant future (Gates, 2001). Bill Gates has noted that each year a half-million children worldwide die from rotavirus. This is the equivalent of four 747’s full of children every day, and we hear nothing of it (Glass, 2004).

Figure 35.5. Scared onto deadly highways. Images of 9/11 etched a sharper image in American minds than did the millions of routinely deadly flights on U.S. airways during 2002 and after. Dramatic events are readily available to memory, and they shape our perceptions of risk. In the three months after 9/11, those few deadly perceptions led more Americans to travel, and some to die, by car. (Adapted from Gigerenzer, 2001.)

Thinking Critically About (continued)

Dramatic deaths in bunches breed concern and fear. The memorable Haitian earthquake that killed 230,000 people sits on a small piling of justified concern. Meanwhile, according to the World Health Organization, a small epidemic of poverty, an estimated 10 million, was killing about the same number of people, mostly in Africa, every four months.

The news, and our own memorable experiences, can make us disproportionately fearful of infinitesimal risks. As one risk analyst explained, "If it’s in the news, don’t worry about it. The very definition of news is ‘something that hardly ever happens!’" (Schneider, 2007). Despite people’s fear of dying in a terrorist attack on an airplane, the last decade produced one terrorist attempt for every 10.6 million flights—less than one-twentieth the chance of any one of us being struck by lightning (Silver, 2002).

The point to remember is that it is perfectly normal to fear purposeful violence from those who wish us harm. When terrorists strike again, we will all recoil in horror. But smart thinkers will check their fears against the facts and resist those who aim to create a culture of fear. By so doing, we take away the terrorists’ most efficient weapon: exaggerated fear.

Figure 35.5. Scared onto deadly highways. Images of 9/11 etched a sharper image in American minds than did the millions of routinely deadly flights on U.S. airways during 2002 and after. Dramatic events are readily available to memory, and they shape our perceptions of risk. In the three months after 9/11, those few deadly perceptions led more Americans to travel, and some to die, by car. (Adapted from Gigerenzer, 2001.)

Anticipating how much we will accomplish, we also overestimate our future leisure time (Zauberman & Lynch, 2005). Believing we will have more time next month than we do today, we happily accept invitations and assignments, only to discover we’re just as busy when the day rolls around. Failing to appreciate our potential for error and believing we will have more money next year, we take out loans or buy on credit. Despite our painful underestimates, we remain overly confident of our next prediction.

Overconfidence can have adaptive value. People who err on the side of overconfidence live more happily. They make tough decisions more easily, and they seem more credible than others (Baumeister, 1989; Taylor, 1989). Moreover, given prompt and clear feedback, at weather forecasters receive after each day’s predictions, people can learn to be more realistic about the accuracy of their judgments (Finchhoff, 1982). The wisdom to know when we know a thing and when we do not is born of experience.

Belief Perseverance

Our overconfidence in our judgments is startling; equally startling is our tendency to cling to our beliefs in the face of contrary evidence. Belief perseverance often fuels social conflict, as it did in a classic study of people with opposing views of capital punishment (Lord et al., 1979). Each side studied two supposedly new research findings, one supporting and the other refuting the death penalty. Each side was more impressed by the study supporting its own beliefs, and each readily dismissed the other study. Thus, showing the preponderance of anti-capital-punishment groups to the same mixed evidence actually increased their disagreement.

"When you know a thing, to hold that you know it; and when you do not know a thing, to allow that you do not know it: this is knowledge." — Cicero (651-470 B.C.), ANTIQUITAS

When you finish reading this module...
The Perils and Powers of Intuition

35.3 How do smart thinkers use intuition?

We have seen how our irrational thinking can plague our efforts to see problems clearly, make wise decisions, form valid judgments, and reason logically. Moreover, these perils of intuition (fear and goals and prejudices) and they persist even when people are offered extra pay for thinking smart, even when they are asked to justify their answers, and even when they are expert physicians or clinicians (Sharaf & LeBourou, 2002). So, are our heads indeed filled with wood?

Good news: Cognitive scientists are also revealing intuition's powers. Here is a summary of some of the key points:

- **Intuition is huge.** Recall from Module 16 that through selective attention, we can focus our conscious awareness on a particular aspect of all we experience. Our mind's unconscious track, however, makes good use of intuitive information. Today's cognitive science offers many examples of unconscious influences on our judgments (Custers & Aarts, 2013). Consider: Most people guess that the more complex the choice, the smarter it is to make decisions rationally rather than intuitively (Ibnar et al., 2010). Actually, Dutch psychologists have shown that in making complex decisions, we benefit by letting our brain work on a problem without thinking about it (Strick et al., 2010). In one series of experiments, they showed three groups of people complex information (about apartments or roommates or art posters or soccer football matches). They invited one group to state their preference immediately after reading information about each of four options. A second group, given several minutes to analyze the information, made slightly smarter decisions. But never all, in study after study, was the third group, whose attention was distracted for a time, enabling their minds to process the complex information unconsciously. Critics of this research remind us that deliberate, conscious thought also is part of smart thinking (González-Villegas et al., 2008; Lassiter et al., 2008; Newell et al., 2008; Byrne et al., 2008). Nevertheless, letting a problem "incubate" while we attend to other things can pay dividends (Sio & Ormerod, 2009). Facing a difficult decision involving lots of facts, we're wise to gather all the information we can, and then say, "Give me some time not to think about this." By taking time to sleep on it, we let our unconscious mental machinery work on, and await, the intuitive result of our unconscious processing.

- **Intuition is usually adaptive.** Our instant, intuitive reactions enable us to react quickly. Our fast and frugal heuristics, for example, enable us to intuitively assume that fuzzy-looking objects are far away—which they usually are, except on foggy mornings. Our normal associations surface as gut feelings, the intuitions of our two-track mind. If a stranger looks like someone who previously harmed or threatened us, we may—without consciously recalling the earlier experience—react warily. People's automatic unconscious associations with a political position can even predict their future decisions before they consciously make up their minds (Galdi et al., 2008).

- **Intuition is born from experience.** It is implicit knowledge—what we've learned but can't fully explain, such as how to ride a bike. We see this tacit expertise in chess masters playing "blitz chess," where every move is made after barely more than a glance. They can look at a board and intuitively know the right move (Burns, 2004). We see it in experienced nurses, firefighters, art critics, car mechanics, and hockey players. And you, too, for anything which you have developed a special skill. In each case, what feels like instant intuition is an acquired ability to size up a situation in an eyeline. As Nobel laureate psychologist Herbert Simon (2001) observed, intuition is analysis "frozen into habit."
The bottom line: Intuition can be perilous, especially when we overread and underestimate, as we do when judging risk. Today’s psychological science reminds us to check our intuitions against reality, but also enhances our appreciation for intuition. Our two-track mind makes sweet harmony as smart, critical thinking listens to the creative whispers of our vast unseen mind, and then evaluates evidence, tests conclusions, and plans for the future.

### Multiple-Choice Questions

1. What is another term for a methodological, logical rule that guarantees solving a particular problem?
   - a. Heuristic
   - b. Algorithm
   - c. Insight
   - d. Mental set
   - e. Confirmation bias

2. Which of the following is the tendency to search for supportive information of preconceptions while ignoring contradictory evidence?
   - a. Confirmation bias
   - b. Intuition
   - c. Mental set
   - d. Availability heuristic
   - e. Overconfidence

### Practice FRQs

1. Name and define two problem-solving strategies. Next, explain an advantage each has over the other.

   **Answer**
   1. **Algorithm:** An algorithm is a step-by-step procedure that guarantees a solution.
   2. **Heuristic:** A heuristic is a simple thinking strategy that often allows us to make quick judgments.

2. Explain how each of the following can lead to inaccurate judgments: overconfidence, mental set, and confirmation bias.

   **(3 points)**