

## Think

### How to Improve Your Fundamental Capacity to Think in Creative Ways

#### Learning Goals

After reading this chapter, you will be able to do the following:

- Describe the role judgment plays in the creative process and the consequence this has on organizational creativity
- Summarize the four fundamental steps of the universal creative process—creative problem solving and design thinking mash-up
- Discuss how creative behavior results from the interplay among knowledge, imagination, and evaluation, combined with a playful attitude
- Develop a more creative mindset by adopting the principles of divergent thinking
- Generate a broader range of alternatives through the application of divergent thinking

#### Knowing—Understanding the Creative Mind

##### A Story About Managing Judgment

We start Chapter 5 with a short story, a story gleaned from Buddhist teachings.<sup>1</sup> Two monks were returning to their monastery. One of the monks was older and much more practiced in Zen philosophy, the other his younger pupil. Due to the heavy rain that had fallen earlier that day, the streets were filled with deep puddles. As they walked along, they came upon a young woman standing on the side of the street. From the forlorn expression on her face, it was obvious that she was greatly concerned about crossing the street for fear of soaking her new dress. Upon witnessing this dilemma, the older monk approached the young woman and, with her permission, carried her across the street, placing her safely on the other side.

The younger monk was aghast, for he had been taught that monks were not supposed to touch women. This obvious indiscretion so plagued his mind he was unable to meditate that evening and had great difficulty sleeping. The next morning he confronted his master by saying, “You know that monks are not allowed to touch women, yet yesterday you carried that young woman across the street.” The older monk smiled and replied, “I dropped her on the other side, but you are still carrying her.”

In this chapter we explore the basic thinking involved in the creative process, that is, the foundational thinking necessary to leverage your creative mind. Of particular importance is the way in which we manage our judgment. To be sure, judgment and evaluation play an important role in the creative process, but when misapplied, judgment and evaluation place blinders on

creative thinking. In the opening story, the older monk was able to set aside his judgment and as a result recognized an opportunity to assist the young woman. In contrast, the younger monk, unable to suspend his judgment, not only missed an opportunity but became overly preoccupied with the situation. When you hold too tightly to a thought or idea, it becomes difficult to entertain other thoughts and ideas. Learning to manage your judgment opens your mind to new possibilities.

You might think that the lessons from this story do not apply to organizations, but organizations are merely a collection of people who may or may not be adept at spotting and leveraging new opportunities. In the business world, this could make the difference between continuous growth and survival versus stagnation and death. This inability to spot new opportunities can easily be witnessed in a few classic examples, and in both cases these ideas originated from the brains inside of the company. Xerox, a U.S.-based company founded in 1906, was a pioneer in the duplication and document management business. As a company with a penchant for innovation, Xerox initially developed and demonstrated computers that featured a graphical user interface in the 1970s. Reports have it that the then board of directors did not see the value in such technology and ordered Xerox engineers to share these inventions with Apple technicians. The upstart computer company hired away some of the Xerox employees, refined the technology, and went on to feature the mouse-driven graphical user interface in one of the first successful personal computers—the Apple Macintosh.<sup>2</sup>

An innovative pioneer in the photography industry, Kodak filed for bankruptcy in January 2012. This former longtime industry leader found itself in financial ruin as a consequence of its very slow transition from film photography to digital photography. The irony in this story is that one of Kodak's very own engineering teams, led by Steve Sasson, is credited with building the first working digital camera in 1975.<sup>3</sup> Unfortunately, due to the long development cycle for this new idea, in conjunction with Kodak's existing business models based on film photography, this once highly innovative company was initially skeptical of this opportunity and then was exceedingly slow in joining the digital world. In 1976 Kodak possessed 90% of film sales in the United States and 85% of camera sales. It has been reported that Kodak's market dominance led to an unimaginative and complacent corporate culture.<sup>4</sup>

Like the young monk in the story, Xerox and Kodak both overlooked the opportunity in front of them. Both companies were unable to relax their judgment, which had become fixated on the past and current business practices. According to Collins and Porras, authors of *Built to Last: Successful Habits of Visionary Companies*, those organizations that are best able to stand the test of time are those that do not get wedded to ideas and actions embedded in their strategic plans.<sup>5</sup> Instead, strategic plans are approached much more flexibly, just like the older monk who was able to deviate from the prescribed teachings of his faith. When opportunities come along, successful organizations are able to manage their judgment to adapt to emerging situations.



**Thought Starter**  
**Judgment**

## Creative Thinking and the Creative Process

An open and flexible mind is better prepared to receive creative opportunities when they present themselves; however, individuals do not have to wait passively for creativity to arrive. Rather, it is possible to coax creativity along. Creativity does not need to be left up to chance; instead, people can be taught to create ideas and resolve challenges in a way that leads to new opportunities. That is to say, creative thinking is a trainable skill. Solid empirical evidence demonstrates that educational and training programs can significantly enhance individuals' creativity.<sup>6</sup> It is definitely possible to learn to be a better creative thinker. In the chapters in Part I of this book we referred several times to a specific set of creative-thinking skills called divergent thinking. As a reminder, divergent thinking is the ability to generate many diverse and original thoughts; the degree to which you can engage in divergent thinking is a strong predictor of the level of creative behavior you are likely to achieve. Earlier we noted that longitudinal research with nearly 300,000 school-age children highlighted the fact that the ability to engage in divergent thinking rises until about sixth grade and then drops sharply, never to regain its former level.<sup>7</sup> We would argue that if divergent thinking can be drummed out of us, the inverse is also true, that divergent thinking can be improved through training and education.

Creativity training programs have proved effective at not only increasing divergent-thinking skills but also improving problem-solving skills, creative performance, and creative attitude. A rigorous selection and analysis of 70 scientific studies of creativity programs shows that creativity training is effective.<sup>8</sup> Let's examine these outcomes more closely. Regarding divergent thinking, creativity training has been shown to significantly increase such skills as fluency (ability to generate many responses), originality (ability to generate novel responses), flexibility (ability to generate a diverse range of responses), and elaboration (ability to expound on a concept or response). Furthermore, creativity training programs have demonstrated a positive effect on improving individuals' ability to produce original solutions to complex problems. Creativity programs have been shown to significantly improve overall creative performance, that is, the ability to generate creative products. Finally, creativity training has been shown to enhance creative attitudes and behaviors, such as modifying how people react to novel ideas. Creativity training does not favor any particular type of learner, for the authors of this meta-analysis of creativity programs concluded that

creativity training contributed to divergent thinking, problem solving, performance, and attitudes and behavior for younger and older students and working adults, and for high achieving and more "run of the mill" students. . . . Taken as a whole, these observations lead to a relatively unambiguous conclusion. Creativity training works.<sup>9</sup>

This research team also evaluated key factors contributing to the effectiveness of the most successful creativity training programs. Here the researchers found that

programs based on cognitive models, that is, a focus on teaching ways of thinking, were by far the most effective. Programs based on cognitive models explicitly focus on teaching creative-thinking principles and skills that make up the creative process and then engage individuals in learning deliberate strategies that allow creativity to happen on demand. Specifically, this research team's analysis pointed to creative problem solving as the most successful creative process for the purposes of creativity training (one of the main models taught at the International Center for Studies in Creativity at Buffalo State).

In its most basic form, creative problem solving includes four steps. To begin, the mind must first clarify the nature of the problem to be resolved. Once the problem is identified and understood, then the mind can generate ideas to address the problem. These ideas represent tentative solutions, and in the next stage of thinking, the mind develops these initial concepts into workable solutions. In the final step of the creative process, the mind must work out the plan for moving the proposed solution into reality. At this point, the mind must identify the action steps necessary to launch the new creative solution and, to ensure success, must monitor and adjust as needed to guide the fragile fresh concept through to its full realization. For shorthand we refer to these four steps as Clarify, Ideate, Develop, and Implement.<sup>10</sup> Although there is a natural progression through these steps, the mind is able to jump back and forth among them.

These four areas of the creative process are universal; all human minds use these forms of thinking. As noted in Chapter 1, the ability to apply imagination to solve problems gave humans a competitive edge; you evolved to think creatively. No matter your level of intelligence, your gender, or your nationality, because of evolution, you came into the world wired to innovate. And the creative process is universal in that it cuts across all areas of human endeavor. The same thinking process is equally valuable in business, art, science, human service, music, technology, and more.

To this universal creative process we wish to add concepts associated with design thinking. Over the last several decades, design thinking, a deliberate creative process specifically focused on generating products and services with the consumer in mind, has attained great popularity in organizations and business schools.<sup>11</sup> The strength of design thinking is its clear focus on creating solutions that are human centered—making something new that is driven by the person or people for whom the solution is intended. This human-centered approach is central to design thinking; it's not about engineers creating solutions for other engineers but is focused on creating solutions that really work for the user. As Steve Jobs said, "Design is not just what it looks like and feels like. Design is how it works."<sup>12</sup> Not surprisingly, as a deliberate creative process, the stages associated with design thinking closely parallel the universal steps of the creative process outlined earlier (i.e., Clarify, Ideate, Develop, and Implement). Boiling it down to its simplest form, design thinking can be outlined in the following way: first, empathize with users by understanding their needs and issues; second, define the specific opportunities and challenges that emerge through an understanding of users; third, generate solutions that respond to these opportunities and challenges;

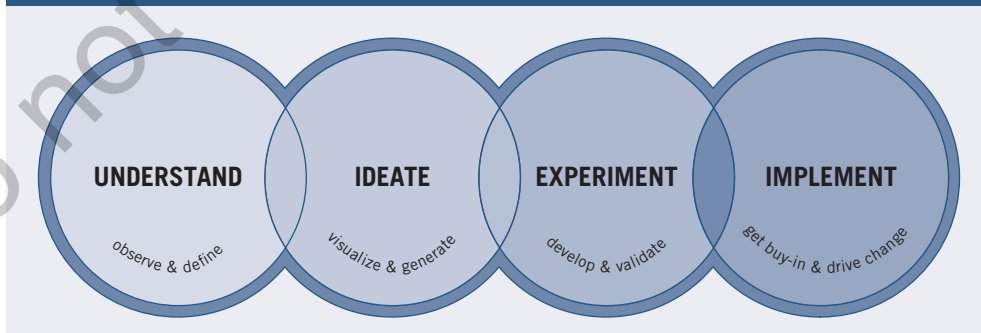
and fourth, create prototypes of the best solutions and refine them by soliciting feedback from user groups.

To best promote the creative-thinking skills of our readers, we have created a mash-up of the creative process. That is, we took the best of the cognitive models proven to enhance creative thinking (i.e., Clarify, Ideate, Develop, Implement) and married this to some of the most powerful features of design thinking (i.e., Empathize, Define, Ideate, Prototype). Our creative process mash-up merges the strengths of these two powerful models—creative problem solving’s flexible application to a wide range of organizational challenges with design thinking’s focus on the development of new product concepts and services. Through this mash-up, our goal is to help you maximize your creative-thinking skills in a way that positions you as an innovative asset to your organization, either as an intrapreneur or entrepreneur. This mash-up is presented in Figure 5.1.

For our purposes, the four steps of the creative process mash-up are Understand, Ideate, Experiment, and Implement. In the first step, the goal is to closely observe a situation to define the most important opportunities and challenges to be addressed. In the second step, Ideate, the insights gained from this understanding are used to visualize and generate a range of creative ideas. These creative ideas must be refined into great solutions. The purpose of the third step, Experiment, is to develop the best ideas and to validate their appropriateness. For innovation to occur, creative ideas must be put into action. The final step, Implement, is aimed at getting buy-in for the proposed solution and making this proposed change stick.

With the goal of helping you to enhance your creative prowess, we use this creative process mash-up as a framework to explore and develop some specific creative-thinking skills. In the next four chapters, we use this model to explore and practice two skills associated with each step. For Understand, we examine the power of observation and how it influences the ability to define interesting problems (see Chapter 6). With Ideate, we discuss the role of visualization, the ability to see ideas in the mind’s eye, and ways to generate a wide range of ideas (see Chapter 7). In the Experiment step, we discuss ways to develop good ideas into great solutions and

Figure 5.1 Creative Process Mash-up



then how to validate them (see Chapter 8). Finally, with Implement, we examine approaches for gaining buy-in for a novel solution and then how to manage the change that naturally occurs when a new solution is adopted (see Chapter 9). To be clear, we could explore many other creativity skills, but we feel that highlighting a few crucial skills is likely to maximize learning and application. And both our knowledge and experience tell us these combined eight skills are absolutely fundamental to creativity. Therefore, we are confident that the information (the knowing) and practices (the doing) we present relative to these eight skill areas will do much to enhance your natural creative-thinking skills (the being).

### Developing the Mindset for Improved Imagination

The International Center for Studies in Creativity at Buffalo State (the State University of New York) has been studying and teaching creativity for 50 years. One of the founding faculty members and a pioneer in the field of creativity education, Dr. Ruth Noller, devised an elegant description of creative behavior.<sup>13</sup> As a mathematician, she saw creativity as a formula that can be summarized as follows:  $C = f_a(K, I, E)$ . In this formula, the degree to which an individual will achieve creative outcomes (C) is a direct function of three factors: (1) the amount of knowledge (K) the individual possesses regarding the task, situation, or problem; (2) the extent to which the individual is able to apply imagination (I) to generate novel approaches; and (3) the level of effective critical evaluation (E) the individual can apply to select and develop the most promising creative idea in light of the situation.

This formula has stood the test of time and provides an excellent framework for thinking about how to nurture higher levels of creative behavior. To begin, as many models and theories hold, the foundation to most creative breakthroughs is a sufficient level of knowledge and expertise. If you are going to contribute creative breakthroughs, for example, in business, physics, art, music, cuisine, computer technology, or literature, it is necessary to possess some basic knowledge relative to that domain. Knowledge alone, however, is insufficient to cause a creative insight. To the contrary, knowledge can sometimes get in the way of creative thinking, and thus, imagination is necessary to ensure you are not trapped by your knowledge—the belief that what you now know represents the full range of what is possible. Imagination, the ability to see new possibilities, has always been the springboard to the creation of new knowledge. Finally, imaginative possibilities need to be refined and made real through good critical thinking.

Noller's definition reflects the thinking process that some believe led to the creative explosion in human civilization that we described in Chapter 1. In Noller's formula, knowledge serves as the input into the creative process, and at a broad level the creative process is represented as the balance between imagination and evaluation. Recall that some experts believe that the ability of humans to shift and direct their thinking among defocused thought, imagination, and focused thought (evaluation) contributed to the creative explosion. However, whereas the



**Thought Starter**  
**Creativity Formula**

physiological components, the ability to engage in defocused and focused thinking, were in place approximately 100,000 years ago, it wasn't until *Homo sapiens* learned to suspend judgment—what Carruthers called pretense—that the creative explosion occurred. Returning to Noller's definition, note the small *a* at the beginning of her formula. According to Noller, it is this small *a* that makes all the difference, that is, whether someone fully uses his or her knowledge, imagination, or evaluation. This part of the formula refers to attitude. For *Homo sapiens* to truly take advantage of their creative thinking, they had to adopt a more open-minded attitude toward possibilities. It is one thing to be able to think of imaginative possibilities and quite another to have the right attitude that allows your mind to entertain and play with such possibilities. Remember that the two monks in the story at the beginning of this chapter both had the physical capability of carrying the young woman across the street, but it was the older monk who was able to suspend his judgment and come to her aid.

A crucial component of the creative attitude is an ability to manage judgment, especially the ability to postpone judgment in order to see new and interesting possibilities. For your own creative explosion to occur, you too must learn how to unleash your creative thinking by properly managing your judgment. In the Doing section of this chapter, we describe four principles that, when employed by an individual, have been proven to enhance creative thinking.

## Learning Activity

### Draw Your Process

Think back to a time when you solved a problem creatively. Once identified, sketch the process you went through to resolve this situation. Use images and icons to make your creative process visible. Upon completion, review your work to identify links between the creative process mash-up presented in this chapter and your own experience. Additionally, examine your drawing

for connections to Noller's formula for creativity. In the Experiment step of the process we describe the importance of taking time to explore an idea and improve it. Tools such as sketching can be helpful (more elaboration on this point is found in Chapter 8). What insights do you get for improving your own creative process by looking at your sketch?

## Doing—Training the Creative Mind

### Improving Imagination by Applying Principles for Divergent Thinking

As discussed, creative thinking balances both imagination and evaluation. Just as some physical abilities are useful across a range of athletic endeavors, such as

strength, speed, and agility, imagination and evaluation make positive contributions to each of the four fundamental steps of the creative process. And like physical abilities, thinking skills can be learned and applied, resulting in improved imagination and evaluation. Just as you can learn to be physically flexible, as depicted in the Dalí sketch titled *Hysterical Arch*, so too can you learn to be a flexible and creative thinker. Practice the principles and strategies in this book, and through this mental exercise you can become a more flexible and creative thinker.

In this chapter we indicated that divergent thinking was a skill shown to be directly and positively impacted by training. Divergent thinking fuels imagination as it allows the mind to actively search for novel alternatives. Research into creativity training has highlighted a set of principles that when learned and internalized significantly enhance one's ability to engage in divergent thinking. Next we briefly describe four principles, two of which focus on cognitive strategies for improving divergent thinking and two reflecting attitudes that support divergent thinking. Learn to follow these principles, and you will immediately improve your capacity to engage in divergent thinking and, as a consequence, your ability to generate creative breakthroughs on demand. We begin with the two principles that help to set the right attitude for creative thinking, and then we describe two principles designed to guide good thinking.

### Defer Judgment: The Key Attitude to Open the Creative Mind

We began this chapter with a story about two monks. The older one was able to suspend his beliefs in order to assist a stranded young woman. But the younger monk's judgment was so fixed he not only missed the opportunity to help but also became so preoccupied with the older monk's behavior that he was unable to meditate or sleep that evening. This story highlights the key principle to divergent thinking: The extent to which a person is open to new possibilities is directly impacted by a willingness to temporarily withhold evaluation. Judgment focuses the mind. When an individual begins to employ judgment, the range of thought narrows mainly to the item under consideration, and consequently, it becomes difficult to perceive other possibilities. Fixation, then, results in stagnation.

When seeking new possibilities, premature evaluation and the application of judgment block the imagination. This has been demonstrated by research.<sup>14</sup> In one of the earliest investigations into creativity training, two groups of students were



**Salvador Dalí, *L'Arc Hystérique* (Hysterical Arch), 1937 ink on paper, image: 22 in × 30 in.**

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compared in their ability to generate ideas. In one case, students were presented with a problem and told to follow the defer judgment principle; that is, they were taught to withhold their judgment and to record all ideas that came to mind. The second group of students was presented with the same problem; however, they were instructed to generate only good ideas. In other words, the researchers prompted these students to apply judgment as they were simultaneously generating ideas. When the ideas generated by students under the two different sets of instructions were compared, the group that withheld judgment was found to have produced nearly twice as many good solutions for the problem.

Why does this happen? When an individual is able to let go of judgment, the mind is encouraged to defocus. The benefit of a defocused mind is that the brain is able to freely search through memory for answers and is likely to be much more open to new stimuli and unique combinations of thought. Gabora and Kaufman, in their description of the evolution of the human brain, provide an eloquent reflection on the neurological mechanisms at play when evaluation is suspended: “When the individual is fixated or stuck, and progress is not forthcoming, defocusing attention enables the individual to enter a more divergent mode of thought, and working memory expands to include peripherally related elements of the situation.”<sup>15</sup>

Whereas the defer judgment principle reflects a creative attitude, it seems to have a physiological basis in terms of brain function. When the mind is defocused, activation within the brain’s neural net is flat, meaning that thought is more diffuse, intuitive, and associative. In contrast, when humans engage in evaluation, the shape of the activation function is spiky, reflecting analytical thought. Gabora and Kaufman observe that the defocused brain “is conducive to divergent thought; it enables obscure (but potentially relevant) aspects of the situation to come into play.”<sup>16</sup>

When you come upon a situation that requires imagination, don’t leave a breakthrough up to chance. Instead, use your ability to reflect on your own thinking, a skill called metacognition, to direct your mind in such a way as to relax your judgment. Allow your mind to explore all options and alternatives in an unfettered manner. Do not judge your own or others’ thinking while simultaneously searching for imaginative ideas and solutions. Instead, apply evaluation only after you have exhausted the search for possibilities.

### Seek Novelty: An Attitude to Ensure Original Thinking

The defer judgment principle opens up the mind, but this does not ensure that imaginative options will be generated. To further bolster a creative mindset, we encourage individuals to intentionally seek out novelty. Creative breakthroughs are both novel and valuable. Whereas the defer judgment principle is designed to create a friendly forum in which individuals entertain all possibilities, it does not necessarily facilitate new thinking. By following the principle of seek novelty you are intentionally generating and examining options that are original. Recall that

you engage in divergent thinking when there is a need for imagination; to ensure original thinking, we encourage you to include ideas that at first glance may even seem outlandish.

The well-known design firm IDEO follows these same principles when engaging clients in divergent thinking.<sup>17</sup> (By the way, the person who originated these principles was Alex Osborn, developer of brainstorming.<sup>18</sup>) While working with Air New Zealand to reinvent their customer service experience for long-haul flights, IDEO encouraged the client team to seek novel possibilities. This led to the generation of such outlandish ideas as harnesses that hold people upright while flying, installing hammocks on flights, and using bunk beds. Such wild concepts ensured a forum in which all options were considered, which led to another outlandish idea, or at least one that seemed crazy at first. The idea was a seat that would allow passengers to lie flat in economy class. At first this might seem ridiculous because such seats in first class take up much more room, thus reducing capacity. However, experimentation with the idea led to a workable concept called the Skycouch. The design features a heavily padded section that swings up like a footrest, enabling a couple to lie down together. The Skycouch has been installed in Air New Zealand's international flights, and the company has won industry awards for this new concept.

The defer judgment principle opens the door for possibilities, but by seeking novelty you usher original ideas through the door. The brain is like a muscle; if you want more imaginative responses to problems at work and to life's persistent challenges, practice seeking novelty.

## Go for Quantity: A Universal Cognitive Strategy

Whereas the first two principles are aimed at forming a creative mindset, the next two principles describe cognitive strategies that feed divergent thinking. The go-for-quantity strategy is straightforward; perhaps the best way to have breakthrough ideas and thoughts is to have lots of ideas and thoughts. We refer to this as a universal cognitive strategy because it turns out that no matter the field of creative endeavor, those who produce and play with more ideas tend to generate more creative breakthroughs. Steve Jobs, Dean Kamen, Thomas Edison, Pablo Picasso, Ernest Hemingway, Maya Angelou, the Beatles, and other eminent creators didn't simply produce a small number of ideas that eventually became breakthroughs. Rather, great creators tend to generate and examine many ideas, of which a small percentage achieve the status of creative breakthrough. Alex Osborn, originator of these divergent-thinking principles, said it well when he argued that a quantity of ideas tends to breed quality. Think about it—quantity allows you to leverage probability. When you face a challenge, isn't it better to have an array of options instead of just one option? The more options you create for yourself, the more likely you are to find an answer that will work.

James Dyson, inventor and entrepreneur, is a living example of the go-for-quantity principle. For example, he created 5,127 prototypes before striking on his

first successful bagless vacuum cleaner. In a recent interview, he was asked to provide advice to those interested in innovation and invention. One of the major points he offered was to try many ideas and to fail often. As Dyson observed, “Failures are interesting . . . if you welcome them and try to understand them and watch them. I think that’s the most important thing, . . . actually building and watching your own prototype fail. That’s what gives you the idea of how to improve or change it.”<sup>19</sup>

The rule of quantity leading to quality works for not only individual success but for organizations as well. According to the research they conducted into companies that have stood the test of time (defined as 100-plus years), Collins and Porras found that the most successful organizations “try a lot of stuff, and keep what works.”<sup>20</sup> The go-for-quantity principle means that from many options some will emerge as successful breakthroughs, and as a consequence many options will emerge as failures. Think of it in these terms: Just as experimenting with many variations is fundamental to biological evolution, experimentation with many alternatives is vital to the creative process. As Collins and Porras concluded about successful companies,

It might be far more satisfactory to look at well-adapted visionary companies not primarily as the result of brilliant foresight and strategic planning, but largely as a consequence of a basic process—namely, try a lot of experiments, seize opportunities, keep those that work well (consistent with the core ideology), and fix and discard those that don’t.<sup>21</sup>

Companies are not living things; they do not generate and experiment with new ideas. Rather, it is the people within organizations who generate and experiment with new possibilities. Therefore, to enhance your success and to make yourself an even more attractive asset for your organization, we encourage you to practice the principle of go for quantity. For those mainly interested in entrepreneurial ventures, the go-for-quantity principle will help you generate many start-up ideas, as well as provide you with the mental horsepower to more skillfully respond to the abundant challenges associated with starting a new enterprise.

By training your brain to generate lots of options, you will immediately improve the number of creative breakthroughs you generate both at work and in your personal life.

### Make Connections: The Cognitive Ability to Form New Combinations

Creative breakthroughs rarely emerge from a vacuum. They are not gifts from some mysterious muse. Instead, most new ideas evolve from past ideas or emerge from the combination of previous ideas. As Albert Einstein once said, “The secret to creativity is to hide your sources.” And research into creativity training has shown that one of the most successful cognitive strategies is conceptual combination, which is the ability to link two or more concepts into a new idea.<sup>22</sup>



#### Thought Starter Go for Quantity

For instance, Julie Corbett received her first iPhone in 2007, and she was greatly inspired—not by the phone, but by its packaging. It came nestled in a biodegradable smooth fiber tray. Despite the lack of a design background, Corbett, who worked in investment management, began toying with ideas for new kinds of packaging. Corbett synthesized a number of past ideas into a new form of environmentally friendly packaging that could be used to replace plastic bottles. The exterior of her bottles are made from old cardboard boxes and newspaper, and the interior, inspired by the milk bags she used growing up in Montreal, Canada, is made from thin plastic. The shell provides a sturdy exterior, and the thin plastic interior holds the liquid. In 2008 Corbett filed a patent for this design and started a company called Ecologic Brands. This design uses 70% less plastic than conventional bottles, and it can be broken up for recycling. Ecologic has sold more than 2 million bottles and is building a new factory that is expected to turn out 9 million bottles per year.<sup>23</sup>

Julie Corbett's story is not unusual. Her creative breakthrough was sparked by another idea. In fact, she found a way to synthesize two ideas into one new idea—the iPhone packaging and milk bags led to an eco-friendly bottle. Great creators recognize that others' ideas are a springboard for new thinking. Picasso borrowed and built on many art forms. Hemingway said he got his ideas not only from other writers but from musicians and artists as well. And as we noted earlier in this chapter, Steve Jobs, the poster child for technical innovation, borrowed the idea of the graphical user interface to develop the mouse-driven personal computer from a visit to Xerox.

One of the best ways to stoke your creativity is to use others' ideas as catalysts to your own thinking. Scan your environment, look for analogous situations, and borrow ideas from fields outside of your own. Be alert to the insights you can gain into your own challenges by paying attention to the stimuli in your surroundings. As screenwriter Wilson Mizner once said, "When you take stuff from one writer it's plagiarism, but when you take from many writers it's called research."<sup>24</sup>

## Learning Activity

### Exercising Your Creative Mind

Pull out your smartphone and set the timer for 5 minutes. On your computer, tablet, or notebook, capture all the good ideas you can think of for alternative uses for a brick. When the timer goes off, stop. Now try it again. This time, review the principles of divergent thinking to be sure you understand these guidelines. Once again, set your timer. Keeping these guidelines

in mind, now generate all the alternative uses you can think of for a wire coat hanger. After the timer goes off, compare your two lists. How are they different? Which set has more creative responses? How did the guidelines help you to be more divergent in your thinking? What might you work on to improve your capacity for divergent thinking?

## Being—Internalizing the Divergent Thinking Principles

Creativity is an ability. And like all abilities, the best way to improve it is to practice, practice, practice. You now have four principles, two attitudinal and two cognitive, that you need to practice in order to make them second nature. Try the following activities to help you internalize the four divergent-thinking principles. When someone looks like a natural in some activity, it is generally because that person has engaged in many hours of deliberate practice. You can transform your ability to engage in creative thinking by committing to practice these two cognitive abilities and two attitudes. Once they are internalized, you will carry the power of creative thinking wherever you go, applying your imagination in such a way as to render yourself an invaluable organizational asset. As the title of this chapter notes, we believe these skills are fundamental to creative thinking. And as research shows, divergent thinking is a very strong predictor (stronger than IQ) of adult creative achievement, problem-solving performance, and effective leadership. As such, we conclude this section not with a single learning activity but with one for each divergent-thinking principle. Practice fosters mastery, and the goal of these activities is to help you open your mind and to think more flexibly, fluently, and originally.

### Learning Activities

#### Mastering Divergent Thinking

##### Defer Judgment

For many, this is the hardest principle to internalize. Far too often, the natural reaction to our own and others' thinking is to immediately criticize. Begin by practicing self-awareness; notice your reaction to your own and others' thinking. Do you tend to move quickly to criticism? If so, practice suspending your judgment. For assistance, you can use a tool learned earlier in this book, shifting from Yes-But thinking to Yes-And. When presented with a new idea, avoid the tendency to put it down, and instead begin by saying "Yes, and . . ." Then complete this statement starter by inserting a thought that helps to build the idea up rather than tear it down. The next

time you encounter a challenge, begin generating initial solutions by withholding your judgment. Whether alone or with others, first make a list of possible solutions, then go back and evaluate the options generated by selecting those that seem to hold the greatest promise. Perhaps the most difficult aspect of the defer judgment principle is to master the ability to suspend judgment of yourself. Learning to do so will unshackle your thinking, reduce anxiety and self-doubt, and clearly indicate that this principle has been internalized.

##### Seek Novelty

Make it a goal to try at least three new things over the next several days. These can be small

adjustments to your routine or completely new activities. Some examples might include finding a new restaurant (perhaps a cuisine that you have never tried), watching a film from a genre that is new to you, speaking with a stranger, visiting a museum or gallery, reading a magazine that is new to you, taking in an event that you've always wanted to try, or experimenting with a new sport or recreational activity. When you have completed the assignment, ask yourself what new insights, learning, or feelings resulted from your experiment with novelty. These can be insights about yourself or the world. Perhaps you might capture these thoughts in a journal. Continue to challenge yourself to try out new activities in your life.

### Go for Quantity

Make a list of your personal and professional strengths. Count the number of strengths you identified and draw a line below the last strength. Now add to this original list by generating at least twice the number of strengths found in your original list. For example, if your original list had a total of nine strengths, now add at least 18 more strengths for a grand total of 27. Use the two attitudes of defer judgment and seek novelty to add to the original list. Do not scrutinize each and every item as it comes to mind; instead, simply add it to your list, focusing on hitting your target number without evaluating the items you add to the new list. As you go, be sure to seek novel strengths, items you feel are unique to you. When you are satisfied with your list, go back and identify the strengths that really capture you. If you had to highlight your strengths to someone else, what would you share with that person? If the principle of go for quantity worked for you, we suspect that there will be some core strengths that came up in the extended list. Had you not

continued to diverge, you might have overlooked these important personal qualities. Next time you have a challenge or an assignment that requires some new thinking, employ the same strategy. Generate your initial list of ideas, then generate a second list, going for twice the quantity and remembering to use the attitudes of deferring judgment and seeking novelty to assist your divergence.

### Make Connections

Identify a current challenge you face in your life. Sit down with a magazine, looking through the headlines of the articles, the photographs, and the advertisements. Make a list of ideas that come to mind as you review the content of the magazine. Pose the following question to yourself: What new ideas do I get for solving my challenge by looking at the articles, photos, and advertisements in this magazine? Employ the principles of defer judgment and go for quantity to help you amass a long list of connections. Go completely through the magazine from front cover to back cover. When you are done, go over your list to see if there are any ideas that hold promise; if so, select some to pursue. In your life, continue to feed your ability to make new connections by learning about new subjects, attending courses outside your area of expertise, visiting new places, interacting with a wide range of people, and being trapped by specialization. The more diverse the range of ideas and thoughts you feed your mind, the more likely you are to create interesting new combinations.

With more practice, the more you will be able to internalize the skills of divergent thinking, foundational to an innovative and entrepreneurial mindset. If you have a résumé that includes skills, how might you describe these skills in your résumé?

## Case Study

### Dr. Dominic D'Agostino: Navy Seals, Seizures, and Starving Cancer

#### Introduction

A great deal of fanfare is often attributed to the birth of a new idea—the celebrated *aha* or *eureka* moment. It's important to remember that creativity is as much a process as it is a singular moment or event. Yes, the creative *process* can be designed and facilitated, deliberately, with the intention to solve a specific problem in a short amount of time (e.g., a half-day or full-day workshop). It may also unfold over time by individuals (and organizations). The following case involving Dr. Dominic D'Agostino and his research lab at the University of South Florida, Morsani College of Medicine, is a compelling example of the latter.<sup>25</sup>

Dominic D'Agostino has a gift. He has developed an ability to be more committed to things than you and me. He doesn't own a television, choosing instead to spend his evenings reading research papers and studying the newest ideas in his field. In addition to staying abreast of the latest research, he is also an accomplished scuba diver, and he has logged hundreds (and perhaps thousands) of hours of dive time. He's an athlete too. In 2010, D'Agostino set the record for most weight squat lifted in 24 hours—crushing the previous record with hours to spare!<sup>26</sup>

This ability to both be maniacally focused while also being open to new ideas from his parallel interests would play an important role in a series of breakthroughs that have gone on to save lives and influence the cutting edge of multiple fields of medical and high-performance human physiology research.

#### Background

Navy Seal divers have a bubbles problem. It stems from a tool they use called an oxygen rebreather. The rebreather is important because it allows divers to go to depth without releasing bubbles (thereby eliminating noise and removing a visual signal of their presence).

The rebreather itself works fine, but a potentially deadly side effect may occur because its usage results in increased oxygenation levels in the diver's blood. This, plus the high-pressure environments experienced by divers as they go deeper and deeper, puts them at an increased risk of a seizure. These seizures come without warning and are untreatable with medication. For a Navy Seal, this represents a life-or-death scenario.

D'Agostino, an avid diver, had recently completed a postdoctoral fellowship (after earning his PhD in neuroscience and physiology) and needed to establish a research lab in his first full-time faculty research position at the University of South Florida. His initial goal: Tackle the Navy Seal rebreather/seizure problem, and to support this investigation he was awarded a research grant from the Office of Naval Research. The grant focused on two questions: Why do these mysterious, untreatable seizures occur? And how might they be prevented?

This research had unique observation and measurement needs. In order to simulate the functioning of a human brain in an undersea environment, D'Agostino had to build a high-powered microscope *inside* of a hyperbaric oxygen chamber. Once the chamber was built and calibrated,

D'Agostino began studying cell behavior in these high-pressure and high-oxygen environments and realized that neurons in the brain were becoming overstimulated when oxygenation levels and pressure were increased—and that these factors were producing a decrease in brain energy metabolism and perhaps triggering the seizure potential.

These insights led him back to the library (recall that he owns no television and spends his evenings immersed in scientific literature), where D'Agostino discovered that these seizures were similar to those experienced by epilepsy patients.

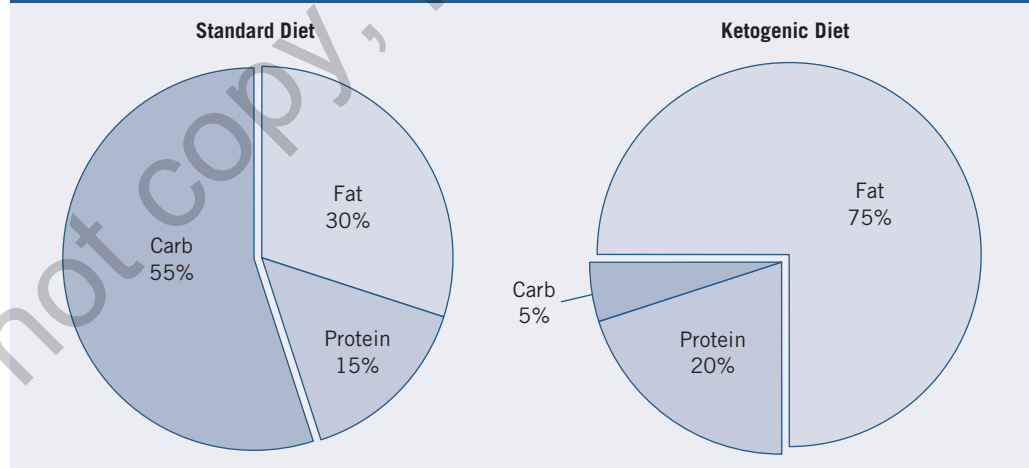
For D'Agostino, a new path had presented itself: If the seizures facing the Navy Seal divers were similar to drug-resistant, epileptic seizures, perhaps some of the tools and strategies developed to address those epileptic seizures might be useful for the divers? This idea led him down an entirely new path—food.

## The Ketogenic Diet

D'Agostino discovered that there was a diet-based strategy for mitigating the impact of medication-resistant, epileptic seizures. This diet—known as the ketogenic diet—consists almost entirely of fats and proteins, compared to a traditional Western diet high in carbohydrates and low in fats.

Investigating this food-based strategy, D'Agostino learned that the ketogenic diet was not only effective at reducing seizure rates for epileptics, but it had also been used to treat other types of neurological disorders too. He also learned that the human brain is like a hybrid engine in that it uses glucose (sugar) as the primary fuel, but during periods of limited glucose availability (e.g., fasting, starvation, extreme exercise), the body will enlist the liver to convert fatty acids into ketone bodies, which then serve as an alternative fuel source for the brain.

Figure 5.2 Contrasting Diets



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We are hard-wired for this back-up plan, says D'Agostino, because we didn't always have access to three carbohydrate-based meals per day. It makes sense that the brain would have evolved a mechanism to tap into this secondary fuel; after all, grocery stores and refrigeration are both modern-day luxuries, only available to us during the most recent sliver of human history.

Armed with this new insight, D'Agostino returned to the oxygen rebreather bubbles problem and postulated that Navy Seal divers could consume ketone supplements before diving, thereby tricking their brains into switching from one fuel source to another (from glucose to ketones), and that this metabolic strategy could be an effective tool to reduce the instances of underwater seizures. He was right.

## Cancer

During the course of tackling the seizure problem, D'Agostino also learned that a specific kind of cell needs glucose more than the rest: cancerous ones. In fact, they can't live without it. "Cancer cells are a little bit like damaged hybrid engines," says D'Agostino. "They lack the ability to transition to an alternative fuel source." Furthermore, he adds, "We can say that sugar addiction is their Achilles heel."<sup>27</sup>

This insight presented a new opportunity for Dominic and his team. They wondered why such little attention was being paid to nutrition as a mechanism for exploiting this profound weakness of cancer cells.

Diving back into the research literature, D'Agostino discovered that precedent for this approach had already been established via the work of a man named Otto Warburg, who, in

1931, was awarded the Nobel Prize for developing a very important concept: that cancer cells are damaged cells, that these damaged cells require high uptake of sugar (glucose) in order to multiply, and that they can live in low- and no-oxygen environments.<sup>28</sup> In doing so, Warburg hypothesized that cancer is a metabolic problem and that you might be able to kill it if you removed sugar from the equation.

Energized by the pioneering work of Warburg, D'Agostino took to the Internet and discovered that a researcher at Boston College, Dr. Thomas Seyfried, had dedicated his career to extending the thinking of Warburg into the current era of cancer research.<sup>29</sup>

With a new thought partner and a new mission to tackle cancer, D'Agostino and his team began investigating the unique behaviors of cancer cells and their addiction to sugar. Thanks to Warburg and Seyfried, they already knew that cancer cells were glucose dependent and that they were capable of living and thriving in low-oxygen environments.

Equipped with his DIY microscope inside of a hyperbaric oxygen chamber, he wondered if that formula could be reversed. His research team subjected these glucose-dependent cancer cells to a high-pressure, high-oxygenation environment within his microscopy chamber and discovered a shocking result. Referred to as blebbing, the cell membranes of cancer cells starting to bubble and some even began exploding! Even more exciting, the team observed that the same levels of oxygen that were causing the cancer cells to self-destruct were nontoxic for the healthy, normal cells around them. "Because we built the tool, we were in a position to make breakthrough observations with the tool," D'Agostino said. The academic journal

Neuroscience agreed and published their groundbreaking results.<sup>30</sup>

“These observations inspired us to test the combination of the ketogenic diet and hyperbaric oxygen treatment in a mouse-model of metastatic cancer,” reported D’Agostino. It worked. Mice with an aggressive form of metastatic cancer were treated with the ketogenic diet and high-oxygen environments, and the results, according to D’Agostino, “demonstrated the therapeutic efficacy of a new, nontoxic approach to cancer management.”

D’Agostino believes that nontoxic strategies (such as diet and oxygenation treatment) can be effective at managing cancer—especially for patients with difficult-to-treat brain and metastatic cancers (the ones that move rapidly in the body, jumping from organ to organ) that do not respond well to existing approaches of chemotherapy and radiation.

### Closing

The notion that creativity is as much a *process* as it is an *event* is summed up by D’Agostino: “What

started out as a Navy Seal project and then led to a promising mitigation strategy for oxygen seizures in the form of ketone supplements, ultimately led us down a path to this unexpected discovery. We now know that oxygen can kill cancer cells and that ketones can a) reduce cancer cell proliferation and b) cause cancer cells to die in a petri dish.”<sup>31</sup>

International Center for Studies in Creativity (Buffalo State) instructor Michael Fox often reminds students that good research will generate more questions than answers, and this rings true for D’Agostino and his lab mates. For these pioneering researchers, new questions are always on the horizon, and cancer is just one of the medical nightmares upon which they’ve set their sights. In the near future they intend to expand their research program from the neuroscience of seizures and cancer to ALS (amyotrophic lateral sclerosis, also known as Lou Gehrig’s disease), wound treatment, glucose transporter deficiency syndrome, and other promising areas of treatment opportunity.<sup>32</sup>

### Discussion Questions: Knowing

1. Reflecting on the case study featuring Dr. D’Agostino, what factors do you think helped him and his team to unlock such breakthrough ideas? What helped them see what no one else could see? Identify and describe

the advantages of their approach. Can you list and describe any potential disadvantages?

2. There are many scientists and researchers attempting to tackle the same health-related challenges as Dr. D’Agostino and his colleagues. Why do you

think they have been so successful in a such a short time period relative to their peers?

### Application Questions: Doing

1. Consider the chapter and the creative process mash-up model presented.

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On a sheet of paper, map the evolution of Dr. D'Agostino's work to the process stages identified in the chapter. Where can you imagine the researchers tapping into their problem-solving skills of understanding (observation and problem definition), ideation (visualization and idea generation), experimentation (solution development and validation), and implementation (getting buy-in and driving change)? Draw connections between the efforts undertaken by the researchers and the creative process stages.

2. Reflecting on the chapter, recall the formula for creativity presented by Dr. Ruth B. Noller,  $C = f_a(K, I, E)$ , where *creativity* is the result of the interaction among knowledge, imagination, and evaluation—all driven by attitude. Can you make connections between

the creative process Dr. D'Agostino went through and the key categories of creativity identified by Noller? Identify as many connections as you can and describe their role or significance.

### Thinking Ahead: Being

1. Recall the introduction of the case study, which describes D'Agostino's level of commitment and dedication to his craft. Not only did he read about the ketogenic diet and begin to apply it in his research laboratory, he also subjected himself to it! Dr. D'Agostino changed his personal diet and has been measuring the amount of ketone bodies in his blood levels for almost a decade to ensure that he stays in ketosis (low glucose, high fat). You may wonder what this has done to his body. Consider researching his articles and videos online to observe the impact it has

had on him. Hint: He once starved himself (fasting) for 7 days and then executed 10 repetitions of a 500-pound deadlift!

2. Dr. D'Agostino demonstrates an incredible work ethic inspired by the nature of problem solving itself. There are grand challenges facing humanity, and considering this case study, this chapter on the creative process, and the book thus far, what grand challenges can you see yourself getting involved in? What might it take to catalyze your imagination and work ethic in a similar manner to D'Agostino's? What do you care about so much, or love so intensely, that you would be willing to push yourself to the boundaries of your comfort zone (and potentially beyond) in order to achieve breakthrough success? What do you want, and what are you willing to give up for it?