Book of Readings

Creative & Critical Thinking

AIPC Upskill

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A Note on The Texts

These readings are a collection of texts and extracts from various books, articles, and other publications. They have been replicated from their original source, meaning that errors in the original document will be transferred into this Book of Readings. In addition, readings retain their spelling and terminology.

Creative Approaches to Problem Solving

Whether it is considered from the viewpoint of its effect on society, or as one of the expressions of the human spirit, creativity stands out as an activity to be studied, cherished, and cultivated.

—Silvano Arieti



Source: Isaksen, S., Dorval, B., & Treffinger, D. (2011). Creative approaches to problem solving: A framework for innovation and change. Thousand Oaks, CA: SAGE Publications. (p. 1-24)

A

B

C

D

E

F

The purpose of this chapter is to describe what we mean by "creative approaches to problem solving." As a result of reading this chapter, you will be able to do the following:

1. Describe the four basic elements of the system for understanding creativity.
2. Explain what the terms creativity, problem solving, and creative problem solving mean and their implications for managing change.
3. Describe how creativity and problem solving relate to making change happen.

> *The person who follows the crowd will usually get no further than the crowd. The person who walks alone is likely to discover places no one has ever been before.*
>
> *Creativity in living is not without its attendant difficulties. For peculiarity breeds contempt. And the unfortunate thing about being ahead of your time is that when people finally realize you were right, they'll say it was obvious all along.*
>
> *You have two choices in life: You can dissolve into the mainstream, or you can be distinct. To be distinct, you must be different. To be different, you must be what no one else but you can be. ...*
>
> *—Anonymous*

The purpose of this chapter is to prepare you for using the information in this book to help you make decisions, solve problems, and use your creativity to change your world in the direction of your greatest aspirations. Let's examine the core concepts behind *Creative Approaches to Problem Solving: A Framework for Innovation and Change.*

One of our intentions in writing this book is to explore with you a creativity method you can use to productively and proactively manage change and produce innovation. However, one of our assumptions is that you already have experience with managing change. Therefore, let's start with you and your own thoughts about the main concepts in this book.

Activity 1.1

Defining Creativity and Problem Solving

Take a minute and write down a few of your first impressions when you see or hear the word Creativity. Now write down a few of the first impressions when you see or hear the words Problem Solving.

The purpose of Activity 1.1 is to help set the stage for understanding what we mean by creative approaches to problem solving. It asks you to identify and list your perceptions of the key words in our book title. Take a minute to complete the activity before continuing to read the chapter.

What do you notice about the two lists you created? When we do this exercise in our training courses and workshops, we get plenty of different responses for each word. However, we also find strong themes in people's responses, even when we involve people from several different cultures. Let's examine how people have responded to the activity and use these responses to examine each topic.

What Is Creativity?

> *Creativity is a distinguishing characteristic of human excellence in every area of behavior.*
> *—E. Paul Torrance*

Most people can readily come up with informal definitions of creativity. They often associate creativity with words such as *new, unusual, ideas, out of the ordinary, imagination, unique, exciting, wacky, open, fuzzy,* or *something radically different*. It is common for them to relate creativity to the arts: composing or performing plays, making great sculpture, the paintings of the masters, writing great literature, composing and performing music, and the like. It's a word that often has a great deal of positive power and energy associated with it, within and across cultures.

On the other hand, it is unusual for people to associate creativity with words such as usefulness, value, and purposeful. When we probe further, we find that some people often perceive creativity as something not very worthwhile, and in some cases, even as something quite negative. We have identified three principal myths people hold about creativity. We call them the myths of mystery, magic, and madness.

Some people believe that creativity is something so mysterious it cannot be studied productively. They believe creativity comes from an external source over which the individual has no control. This becomes a problem when it inhibits or interferes with their desire or ability to make sense of their own creativity and how they might use it. Other people believe that creativity is something that is magical, which only a few gifted people really have. This suggests that creativity is a trick that certain people know and if you talk about how the trick is done you will take away the "magic." If you hold this belief, you separate people into two groups: those who have it and those who do not. This myth also discourages people from discussing how they use their creativity or how they can nurture it in others.

A third common myth is that creativity is linked with madness. In other words, to be creative, you must be weird, strange, or abnormal. This suggests that creativity is unhealthy behavior, which should be avoided (Figure 1.1).

Figure 1.1 A Common Perception of Creativity



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In the face of so many common myths and misconceptions, it is a wonder that creativity has been studied seriously at all. However, there is an alternative set of assumptions and beliefs that allow us to be more productive in learning about and developing creativity. Creativity is natural (present in everyone), healthy, enjoyable, important, and complex but understandable.

Although creativity is a complex and challenging concept, with no universally accepted definition, it is understandable. For more than 50 years, people have been studying, reading and writing about, theorizing about, and researching creativity. Many theories have been developed to help us understand and organize the complex nature of creativity. Many research studies have established a body of evidence to guide us in understanding, recognizing, and nurturing creativity. Rothenberg and Hausman (1976) support the importance of studying creativity. They stated,

> *The investigation of creativity is at the forefront of contemporary inquiry because it potentially sheds light on crucial areas in the specific fields of behavioral science and philosophy and, more deeply, because it concerns an issue related to our survival: our understanding and improvement of ourselves and the world at a time when conventional means of understanding and betterment seem outmoded and ineffective. (p. 5)*

Creativity is a natural part of being human. It is not reserved for those people with some sort of special gift. This suggests that creativity exists in all people (at different levels and various styles). The challenge arises from learning how to understand and use the creativity you have. This belief is fundamental for those who are interested in identifying what creativity is and understanding how it can be developed.

Accessing and using creativity can release tension and help people lead healthy and more productive lives. Much of the popular creativity literature tends to focus on those stories of unusual artists or scientists who were highly creative and known for rather exotic or strange behavior. We often overlook creative individuals who lead "normal" lives. It can be easy to fall into the trap of believing that people need to display unusual behaviors in order to be creative. In the research conducted on creativity, there is no

evidence to suggest that in order to be creative one must be sick, abnormal, or unhealthy. To the contrary, there is some evidence to suggest that learning how to understand and use creativity can be mentally and physically healthy.

Creativity is enjoyable in that using it brings about a sense of satisfaction, accomplishment, and reward. When you learn about and apply your creativity, it can provide you with a sense of peacefulness and joy. Creativity is also important in that the outcomes and consequences of using creativity have benefits for individuals, groups, and organizations. Creativity provides important benefits for all people in their personal life, as well as in their work, and enhances the quality of life for society as a whole.

We are not the first authors to attempt to define creativity. Previous scholars have collected and synthesized dozens, and even hundreds, of different definitions offered by various writers and thinkers (e.g., Treffinger, 1996). For example, Gryskiewicz (1987) defined creativity as novel associations that are useful. This definition came as a result of interviews and analysis of stories of creative performance with approximately 400 managers in organizations. What we like about this definition is that it is simple and has a builtin tension between something being novel and useful. The novelty part of the definition appears to fit well with most people's perceptions of creativity. However, the usefulness part of the definition often stimulates questions in people's minds about whether something needs to be useful in order to be creative. It also raises questions in general about who determines if something is novel or useful, and therefore, who determines if creativity is present or not.

Figure 1.2 Noller's Symbolic Formula for Understanding Creativity

$$C = f_a(K,I,E)$$

Creativity is a function of Knowledge, Imagination, and Evaluation, reflecting an interpersonal attitude toward the beneficial and positive use of creativity.

Ruth Noller, Distinguished Service Professor Emeritus of Creative Studies at Buffalo State College, developed a symbolic equation for creativity. She suggested that creativity is a function of an interpersonal attitude toward the beneficial and positive use of creativity in combination with three factors: knowledge, imagination, and evaluation (see Figure 1.2). Children are often viewed as naturally strong in imagination. They often need help in acquiring knowledge and expertise, as well as in understanding appropriate criteria for evaluating ideas or behavior. In comparison, practicing professionals often are seen as having a great deal of knowledge and evaluative strength but as needing help with imagination.

You might learn a number of lessons from Noller's equation. One is that creativity is a dynamic concept. It changes through our experience. Also, creativity always occurs in some context or domain of knowledge. But, while expertise is important and necessary, it is not sufficient for determining creativity. Finally, creativity involves a dynamic balance between imagination and evaluation.

Despite the many different definitions of creativity, you can make some sense out of them. Just look back to what you wrote down during the first activity in this chapter. As Welsch (1980) indicated,

> *The definitions of creativity are numerous, with variations not only in concept, but in the meaning of subconcepts and of terminology referring to similar ideas. There appears to be, however, a significant level of agreement of key attributes among those persons most closely associated with work in this field.... On the basis of the survey of the literature, the following definition is proposed: Creativity is the process of generating unique products by transformation of existing products. These products must be unique only to the creator, and must meet the criteria of purpose and value established by the creator. (p. 107)*

Rather than trying to subscribe to one single definition of creativity, we use a broad framework originally offered by Rhodes (1961) to organize the diverse and large numbers of definitions. Rhodes collected 56 definitions of creativity and reported,

> *As I inspected my collection I observed that the definitions are not mutually exclusive. They overlap and intertwine. When analyzed, as through a prism, the content of the definitions form four strands. Each strand has unique identity academically, but only in unity do the four strands operate functionally.*

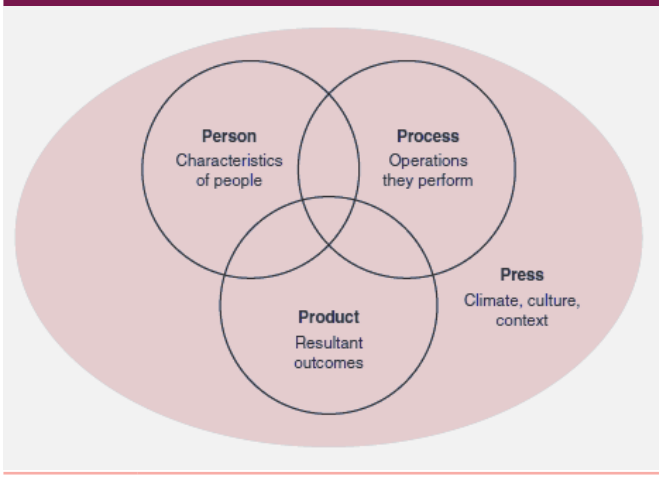
Rhodes (like many other scholars) found it more productive to describe creativity within four overlapping themes. These themes include definitions of the characteristics of creative people, the operations within the creative process, the creative results and outcomes, and the context or place for creativity. Isaksen (1984) put these four themes into a Venn diagram (see Figure 1.3) to represent the interaction that occurs among the four elements and the need to consider the whole system to obtain the best picture of creativity.

There are some in the creativity field who feel that this framework is old and tired and that it should be retired or broadened. Unfortunately, most do not offer an alternative. We know of two alternatives that have been offered as general models for outlining inquiry for the broad field of creativity research. One is specifically focused on formulating research (Isaksen, Stein, Hills, & Gryskiewicz, 1984). The other is designed to provide a framework and name for the entire emerging discipline of creativity (Magyari-Beck, 1993).

Those who complain about the "4P's" (person, process, product, and press) model seen in Figure 1.3 present an argument that is similar to complaining about the periodic

table of elements. These four broad themes are simply the way creativity has been defined and how it is found in the literature. We see value in this general way to classify our understanding of creativity because it provides a comprehensive model that embraces a number of different and important perspectives on this subject. It also provides a view of the entire system of creativity. We refer to it as a system because each of the four elements is a necessary and interrelated part of the whole concept of creativity. Each element influences the other elements. It is difficult to get a complete or true picture of creativity when one part of the system is left out.

Figure 1.3 Systematic Approaches to Creativity



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The following four subsections will provide you with a short summary of each of the four P's.

Characteristics of Creative People

> *Creative personality is . . . a matter of those patterns of traits that are characteristic of creative persons. A creative pattern is manifest in creative behavior which includes such activities as inventing, designing, contriving, composing, and planning.*
>
> *—J. P. Guilford*

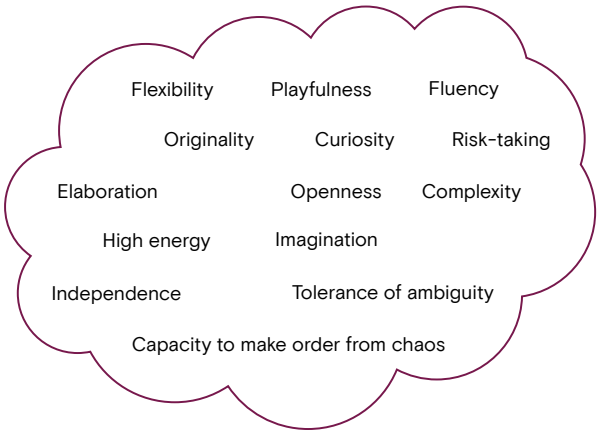
Much of the initial interest in creativity among psychologists and others working in applied settings started with curiosity about how highly creative people were able to demonstrate their creativity. Some of the initial approaches to understanding the characteristics of creativity in people involved finding and describing individuals who were generally agreed on as being highly creative. The major challenge facing investigators who followed this approach was in determining how much creativity the individuals had. As a result of this approach, we had a great deal of information regarding the cognitive and affective characteristics of highly creative people.

Early writers in this area often focused on describing creative geniuses, those people who have special and significant talents and gifts. More recently, scholars have taken a more inclusive approach and looked for extraordinary creativity in ordinary people. Most researchers and educators have emphasized the level aspect to creativity in people. The major question for them is "How creative are you?" It was easy with the

historical geniuses, but much more difficult if we look at everyday creativity. For example, MacKinnon (1978) indicated that there were many different paths along which people travel toward the full development and expression of their creative potential. Rather than trying to put creative people into a single mold, he said, "the full and complete picturing of the creative person will require many images" (p. 186).

A great deal of this research led to the identification of a large number of characteristics associated with highly creative people (Puccio & Murdock, 1999; Treffinger, Young, Selby, & Shepardson, 2002). However, as you read the sample list in Figure 1.4, you will probably begin asking yourself some important questions such as:

Figure 1.4 Some Characteristics of Being Creative



- To be creative, is it necessary to demonstrate all the characteristics in the list? If not, how many?
- Does anyone really demonstrate all those characteristics? All the time? Isn't that a little unlikely?
- Are these "traits" (aspects of your personality that are "with you" all the time) or patterns of behavior that might describe how someone acts once in a while?
- Wouldn't many of the characteristics vary, depending on what task the person might be working on and how she or he feels about and reacts to that task? Might they not also change over time, or in different situations?

These are not easy questions to answer. The traditional view of traits in highly creative people fosters the belief that those characteristics are only held by those at the very top of the spectrum—geniuses and those who are famous for their productions. Clearly, these characteristics may be held by everyone, at all levels, to some degree.

Some people might also believe that these characteristics are fixed and cannot be modified or enhanced. Our experience and research indicate quite clearly that creativity characteristics are dynamic and changeable (see Isaksen, 1987; Isaksen, Murdock, Firestien, & Treffinger, 1993). Although many writers emphasize identifying high or low creativity, the challenge might be more appropriately posed as nurturing and developing creative characteristics within everyone.

A more recent approach to the study of creativity in people concerns how people show the creativity they have. Rather than asking the question, "How creative am I?" it asks the question, "How am I creative?" This question deals more specifically with the form, kind, or style of creativity, rather than the level, degree, or amount.

We believe that it is important to recognize, understand, and access the full spectrum of creative talent in people. This includes the natural diversity in orientation that people have toward creativity, as well as the full range of knowledge, abilities, and skills people bring to the table when solving problems creatively. Understanding your personal creativity, and the creativity of those around you, will help you be more successful in deliberately using your creativity.

You will read more about this area of creativity and its relationship to Creative Problem Solving (CPS) in Chapter 7.

Operations Within the Creative Process

> *The art of thought, like the art of running, or the actor's art of significant gesture, is an attempt to improve by conscious effort an already existing form of human behavior.*
>
> *—Graham Wallas*

The creative process is also one of our four essential aspects of creativity. It is concerned with how creativity takes place. It examines the mental or cognitive processing, or the thinking that occurs, as people use their creativity. Much of our early research on the creative process involved reports of how highly creative people described the processes they went through to develop their products. This type of investigation is based on the assumption that we can

> *take a single achievement or thought—the making of a new generalization or invention, or the potential expressions of a new idea—and ask how it was brought about. We can then roughly dissect out a continuous process, with a beginning and a middle and an end of its own. (Wallas, 1926, p. 79)*

One of the challenges to studying the creative process was developing an accurate description of a person's internal thought processes. The goal was to help make the creative process more visible and understandable in order to improve creative thinking. Many different artists, scientists, composers, poets, and inventors made attempts to describe their creative moments. A variety of scholars during the 20th century became interested in productive or reflective thinking and the art of thought (Dewey, 1933; Ghiselin, 1952; Koestler, 1969; Spearman, 1931; Wallas, 1926; Wertheimer, 1945), resulting in many different attempts to describe the best thinking that humans could accomplish.

Wallas (1926) developed one of the early descriptions of the creative process (see Figure 1.5) based on numerous descriptions of famous artists and scientists. He suggested that the art of thought included four stages: (1) preparation (investigating the problem in all directions), (2) incubation (thinking about the problem in a "not conscious" manner), (3) illumination (the appearance of the "happy idea"), and (4) verification (validity testing and reducing the idea to an exact form). This demonstrated that you could deliberately identify the creative process. In the 1930s, Alex Osborn (1942, 1953) pursued his interest in the human imagination and began reading the research on and experimenting with practical procedures for encouraging creative thinking by the people with whom he worked. His initial description of CPS built on the work of Wallas, Spearman, and others, and helped change the perception that the creative process could only happen intuitively or implicitly. He also worked to develop deliberate strategies for its use in groups.

Figure 1.5 Wallas' Creative Process



Another outcome from pursuing an improved understanding has been a diversity of strategies and methods that can be helpful to anyone who is attempting to be deliberately creative. These strategies can include deliberately shifting your perception about a problem by using analogies or metaphors, setting aside the problem to allow for incubation and insight, or seeking inspiration from great works of music or art. There are as many strategies as there are stories from highly creative people about their creativity.

Figure 1.6 Blocks of Creative Thinking



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Removing Blocks and Barriers. Many of the strategies for increasing your

personal creativity come from an understanding and removal of your personal barriers or blocks to creative thinking. You may notice that in some situations you feel confident about yourself and your ability to succeed in a particular task, while in other situations you do not. As depicted in Figure 1.6, one aspect of your approach to creativity is your awareness of blocks to creative thinking and behavior.

It is only natural to have some resistance to novelty. Novelty requires you to change the approach, behavior, or way of thinking. It requires new learning and may increase the possibility of failure. Your internal climate is most likely formed as a result of some interaction between who you are and the environment or situation in which you operate. One of the ways to reduce the effects of blocks and barriers is to increase the likelihood of developing your strengths. Another way to overcome barriers is to know what they are and whether or not they are keeping you from productively making use of your strengths. You will overcome obstacles more effectively when you are conscious of their presence and impact.

There are three broad, overlapping categories of blocks: personal, problem solving, and environmental (situational). Examples of personal blocks include lack of self-confidence or self-image; a tendency to conform; a need for the familiar, habit-bound thinking; emotional numbness; saturation; excessive enthusiasm; various values and cultural influences; and lack of imaginative control.

As an example of personal blocks, Jones (1987) discovered four major categories of barriers in the literature. These included strategic, value, perceptual, and self-image barriers. Strategic barriers relate to the inability to see and use a variety of possibilities for problem solving. Examples of strategic barriers include resistance to using imagination, an inability to tolerate uncertainty, and the inability to keep an open viewpoint to new ideas.

Value barriers reflect the lack of flexibility displayed in applying personal values, beliefs, and attitudes. Examples of this kind of barrier include being rigidly custom bound, having a strong desire to conform to pre-existing patterns, and having dogmatically negative attitudes toward creative thinking.

Perceptual barriers relate to seeing things in rigidly familiar ways and usually involve aspects of sensual acuity and awareness of the environment. Having difficulty in seeing a problem from a variety of viewpoints, imposing unnecessary constraints, failing to use all the senses, and stereotyping are examples of this kind of barrier.

Self-image barriers describe conditions where people do not assert themselves or make use of available resources. Sometimes, people have an extreme fear of failure, have a reluctance to exert influence, or simply fail to take advantage of resources around them. These barriers are easily related to other problem-solving and situational blocks.

Problem-solving blocks are strategies, skills, or behaviors that inhibit your ability to focus and direct problem-solving activities, generate and identify options and alternatives, or turn ideas into action. Some problem-solving blocks include solution fixedness, premature judgments, habit transfer, using poor problem-solving approaches, lack of disciplined effort, poor language skills, various perceptual patterns that limit intake, and rigidity.

Environmental blocks are those factors in your context, situation, or setting that interfere with your problem-solving efforts. Environmental (situational) blocks to creativity include the belief that only one type of thinking is required for creative outcomes, resistance to new ideas, isolation, a negative attitude toward creative thinking, autocratic decision making, reliance on experts, various strategic blocks that limit the use of resources, and an overemphasis on competition or cooperation. We will look more deeply into these barriers and the conditions necessary for their removal in the section on the context for creativity.

We believe that most creativity methods today share common core foundations and relate to the creative process outlined by Wallas and Osborn. Although these methods may appear distinct on the surface, they are likely to be guided by solid foundational principles associated with how highly creative people naturally use their creativity.

Work on understanding the creative process continues today. Beyond the work of those who follow the tradition established by Osborn, there are practical books such as *Creating Minds* (Gardner, 1993) and *The Mind's Best Work* (Perkins, 1981). In addition, there have been advances in cognition and neuroscience that can provide even further insight into the nature of the creative process (Boden, 1991; Carroll, 1993; Dietrich, 2007; Kaufmann, Helstrup, & Teigen, 1995; Ward, 2004, 2007).

This book is mainly about a particular approach to understanding the creative process, called Creative Problem Solving. An overview of this approach is more fully described in Chapter 2.

Creative Results and Outcomes

> *Creativity may be defined, quite simply, as the ability to bring something new into existence.*
>
> *—Frank Barron*

Creative products or outcomes come in a variety of sizes and shapes and from many different contexts. Many people think of an outstanding play or novel, an inspiring painting or song, or a significant invention or discovery when they think about creative products. They are not limited to either the arts or the sciences. Creative products can

be found in the arts, the sciences, the humanities, or any other discipline or domain of human endeavor. They can be the result of the efforts of individuals or groups. They may have varying degrees of novelty and usefulness.

Figure 1.7 Creativity Versus Innovation

Creativity	Innovation
Imagination	Implementation
Process	Product
Generating	Developing
Novelty	Usefulness
Soft	Hard

Creative products can be both tangible and intangible. They may be concrete or "touchable," such as an invention or marketable product. Other creative outcomes can be intangible, such as learning and personal development, the development of a new service or improvement of an existing one, social technology, or the design of a new process or methodology.

For many people, this area of study has been called "innovation" rather than "creativity" because of the focus on product rather than process (see Figure 1.7 for other distinctions). Since innovation is often considered to be the commercialization of a new idea, we see it as a part of the creativity system outlined above. The reasons some prefer to use the term innovation over creativity include the need to focus on obtaining concrete results, preferring to stay focused on what is useful and easier to understand, and the need to avoid such fuzzy concepts as people and process. Our position is simple. You can have creativity without innovation, but you cannot have innovation without creativity (see Isaksen & Tidd, 2006).

MacKinnon (1975) pointed out the importance of studying creative products. He stated:

> *In a very real sense . . . the study of creative products is the basis on which all research on creativity rests and, until this foundation is more solidly built than it is at present, all creativity research will leave something to be desired. . . . In short, it would appear that the explicit determination of the qualities which identify creative products has been largely neglected just because we implicitly know—or feel we know—a creative product when we see it. (pp. 69–71)*

Figure 1.8 Besemer's Characteristics of Creative Products



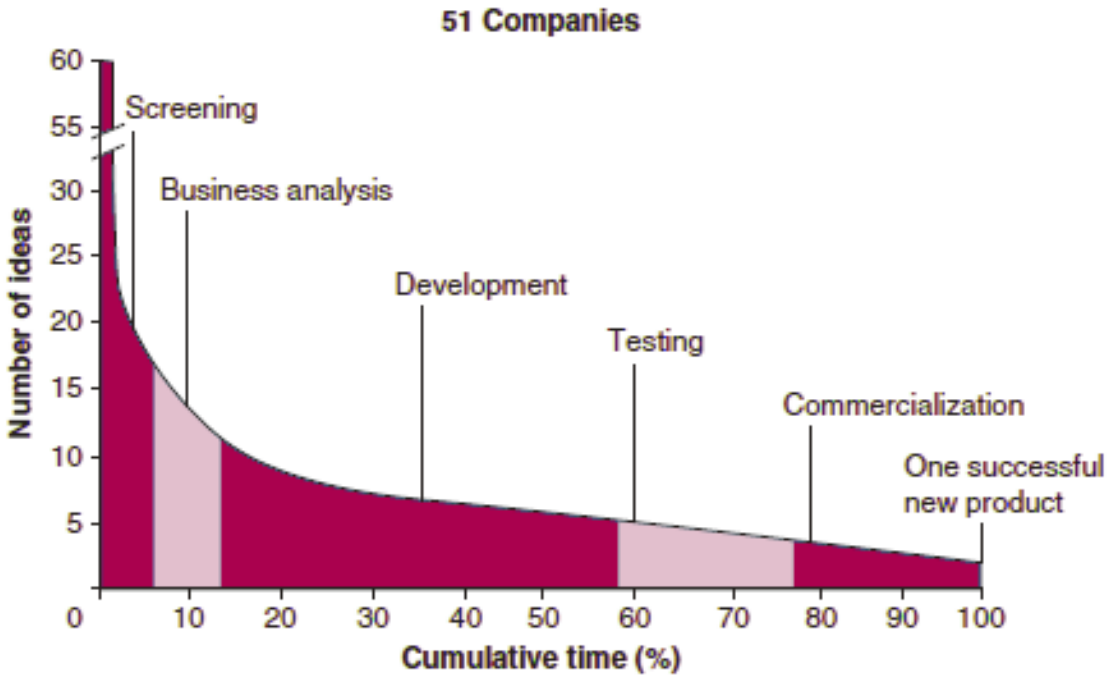
An interesting approach to examining the characteristics of creative products or outcomes has been developed by Besemer (Besemer, 1997; Besemer & O'Quin, 1987, 1993, 1999; Besemer & Treffinger, 1981). She and her colleagues developed ways to assess the creativity in a particular product or outcome, using a paper-and-pencil

rating scale. Their assessment, initially called the Creative Product Analysis Matrix, and subsequently changed to the Creative Product Semantic Scale (Besemer, 2006; O'Quin & Besemer, 1989), is based on asking people to identify the characteristics required in a product for it to be considered creative.

As shown in Figure 1.8, creative products and outcomes can be evaluated on the three dimensions of novelty, resolution, and style. The novelty dimension examines the amount of newness or originality contained in a product. The resolution dimension examines how well the product solves the problem for which it is developed. The third dimension, style, focuses on the extent that a product extends beyond the basic requirements needed to solve a problem. The style factor examines the kind of elaboration or synthesis that has gone into creating an outcome with simple elegance. It considers, for example, factors such as packaging and presentation, how well crafted or attractive it is.

Many organizations involved in new product development have a similar process for analyzing and developing new concepts. One of the Dun and Bradstreet companies conducted a study of 51 U.S. companies. Figure 1.9 shows the results of the study. Note that, on average, it took more than 50 ideas to get one successful new product. These were ideas that were screened or selected for further business analysis. More

Figure 1.9 Creative Product Decay Curve Identified in Dun and Bradstreet Study



recent research from the private sector indicates that those organizations that are very successful in commercializing new ideas generate and nurture more than 100 ideas per day (Davis, 2000). Still others have found that it depends on when you start to count

the ideas. For example, Stevens and Burley (1997) found that it can take as many as 3,000 raw, unwritten ideas to result in about 300 ideas submitted to a more formal idea-screening process. Evidently, it takes an idea-rich environment to produce creative products.

Current trends in many of the organizations within which we work point to some interesting implications for new concept and product development. Many organizations are trying to shorten the amount of time it takes to come up with successful new products. They are also trying to push more ideas through the entire process so that more than one successful new product will result.

This is having an effect on the kinds of new products being developed. Decreasing time, increasing throughput, and other demands on the new product development process appear to be reducing the occurrence of highly novel products. Instead, this trend seems to promote an increase in the frequency of useful and stylistically modified products. For example, Tide was a very new product for Procter & Gamble when it was first produced. Tide with Bleach is a new product, which is lower in novelty but emphasizes usefulness. The net result of the trend is that we are able to see more and more modifications and improvements on existing product lines (within many markets). Examining product and services lines, as well as examining customer demands, can be fruitful applications of the measure developed by Besemer. Inventors and companies can target the kind of new development they desire to meet market needs.

The development and nature of creative products and outcomes offers a fruitful and important aspect within various conceptions of creativity. Inventions, discoveries, innovations, and the development of new and improved services and products offer both tangible and intangible evidence of the significance and value of understanding creativity and its many applications. Recent developments in this area of creativity help to go beyond the traditional emphasis on products being new and useful. The third dimension of stylistic elaboration and synthesis, made evident through recent research, has expanded and extended our view of creative outcomes. The development of creative products and inventions is increasingly seen as a collaborative effort. Many organizations are attempting to shorten the product development cycle by involving all the relevant areas in cross-functional teams. This illustrates how creative people can work together to create products or outcomes in particular places using a certain kind of creative method. This serves as just one example of how the four areas of the system are related.

The Context for Creativity

> *Be brave enough to live creatively. The creative place is where no one else has been. You have to leave the city of your comfort and go into the wilderness of your intuition. You can't get there by bus, only by hard work, risking and by not quite knowing what you're doing. What you'll discover will be wonderful—yourself.*
>
> *—Alan Alda*

Figure 1.10 Barriers to Innovation



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The creative context concerns the environment, place, situation, or climate in which creativity takes place. It examines those factors that promote or inhibit creative behavior. Those conducting inquiry into the creative climate ask questions such as, "What stops people from using their creativity?" "What is the environment, context, or situation that is most conducive to creativity?" "How can someone establish a climate that encourages the release and development of creativity?"

Press was the early word used to describe this broad area because it meant the interaction between the person and the situation. Factors in the environment pushed or pulled the person, while factors, actions, and qualities within the person pushed and pulled on the environment. When you consider the kind of blocks and barriers listed earlier that come from the situation (such as those identified in Figure 1.10), you can see how the climate can exert pressure on the individual. The entire interaction was labeled "press."

What is the environment like in which creativity can flourish? Research on organizational obstacles to creativity done by the Center for Creative Learning, Inc. (Burnside, Amabile, & Gryskiewicz, 1988) yielded a variety of barriers to innovation, including various organizational characteristics (inappropriate reward systems being overly bureaucratic, lack of cooperation across functions, etc.), lack of freedom in deciding what to do or how to approach a task or problem, perceived apathy toward task accomplishment, poor project management, perceived inappropriate evaluation systems, insufficient resources, insufficient time, and emphasis on the status quo.

The same research approach identified a variety of organizational stimulants to creativity. These include freedom in deciding what to do or how to accomplish the task, good project management, sufficient resources, management exhibiting enthusiasm for ideas—

creating a generally nonthreatening and open environment, a collaborative atmosphere across levels and divisions, a general sense that creative work will receive appropriate feedback, recognition, and reward, sufficient time, challenge due to theintriguing nature of the problem, its importance to the organization, or the context of the problem, and a sense of urgency that is internally generated.

Our research on the environment supporting creativity is built on the dimensions of the climate for innovation and creativity studied by Ekvall of the Swedish Employment Security Council and the University of Lund (Isaksen & Ekvall, 2007). We will provide more information regarding the context for creativity and how it affects CPS in Chapter 8.

The following list of suggestions for creating or maintaining a climate for creativity draws on the research of many scholars. It is not a totally comprehensive or conclusive list. In short, these suggestions provide recommendations to help you shape an atmosphere conducive to creativity and innovation. The items on this list are necessary for creativity to take place, although other factors may need to be present as well.

1. Provide freedom to try new ways of performing tasks; allow and encourage each individual to achieve success in an area and in a way possible for him or her; encourage divergent approaches by providing resources and room rather than controls and limitations.
2. Point out the value of individual differences, styles, and points of view by permitting the activities, tasks, or other means to be different for various individuals.
3. Establish an open, safe atmosphere by supporting and reinforcing unusual ideas and responses of individuals when engaged in both creative/exploratory and critical/developmental thinking.
4. Build a feeling of individual control over what is to be done and how it might best be done by encouraging individuals to have choices and involving them in goalsetting and decision-making processes.
5. Support the learning and application of specific CPS tools and skills in the workplace and on tasks that are appropriate.
6. Provide an appropriate amount of time for the accomplishment of tasks; provide the right amount of work in a realistic time frame.
7. Provide a nonpunitive environment by communicating that you have confidence in the individuals with whom you work. Reduce concern of failure by using mistakes as positives to help individuals realize errors and meet acceptable standards and provide affirmative feedback and judgment.
8. Recognize some previously unrecognized and unused potential. Challenge individuals to solve problems and work on new tasks in new ways. Ask provocative questions.

9. Respect an individual's need to work alone or in groups. Encourage self-initiated projects.
10. Tolerate complexity and disorder, at least for a period. Even the best organization and planning requires clear goals and some degree of flexibility.
11. Create a climate of mutual respect and acceptance among individuals so that they will share, develop, and learn cooperatively. Encourage a feeling of interpersonal trust and teamwork.
12. Encourage a high quality of interpersonal relationships and be aware of factors such as a spirit of cooperation, open confrontation and resolution of conflicts, and the encouragement of expression of ideas.

The four themes for understanding creativity (people, context, method, and outcome) will be examined throughout the book. We will keep these four perspectives in mind to help ensure that we take a comprehensive and holistic perspective to providing you with creative approaches to problem solving. As Rhodes (1961) concluded, the themes overlap and intertwine. The best and most comprehensive picturing of creativity will require the interaction of all four themes. In short, creativity is not a simple thing—it is multidimensional. Although we have made some progress in introducing some science to the field, we will never reduce the wonder inherent in human creativity. We believe that taking a holistic approach will increase your chances of successfully solving problems. However, what is problem solving and how does it relate to creativity?

What Is Problem Solving?

> *Nothing is more interesting for humans than human activity and the most characteristically human activity is solving problems; thinking for a purpose, devising means to some desired end.*
> *—George Polya*

In the Creativity and Problem Solving word listing activity, we often get a wide variety of words associated with problem solving. In some situations, people associate problem solving with overcoming a difficulty or avoiding some sort of pain. They focus their attention on the word *problem* and perceive it as a bad thing or something to be removed. However, in other situations, people associate problem solving with words such as logic, analysis, structure, closing a gap, meeting a need, overcoming difficulties, making something work better, mathematics, and science.

We take the stance that problem solving is a process of closing the gap between what is and what is desired. It is the act of answering questions, clearing up uncertainties, or explaining something that was not previously understood. You engage in problem solving

while conducting day-to-day activities such as adding up grocery totals or figuring out how to find a particular building, office, or product. You may try to remember important birthdays, figure out what to do for someone special in your life, or try to find information to help you with a school project. You may also face more important or significant issues that require problem solving. For example, you may need to replace your car or home, make decisions about family holidays, determine the best courses to take at a university, or give tough feedback to an employee.

Problem solving generally involves devising ways to answer questions and to meet or satisfy a situation which presents a challenge, offers an opportunity, or is a concern. It involves closing the gap between what you have and what you want. The search for answers is often based on your expertise or existing knowledge. Many times, the area of the challenge is well-defined, with clear pathways and methods for solution. The opportunity may also offer clear-cut boundaries, priorities, roles, and directions for effective or even "correct" answers. There are a number of highly effective approaches you can use for problem solving in situations with these characteristics. Here are some examples:

- Check the literature (Has someone else already provided a perfectly appropriate and useful solution to this problem, or to one very similar to it?)
- Use existing or previous solutions from history (What has been successful for other people in similar circumstances?)
- Hire a consultant (Can an outsider bring a new perspective that will reveal a good option that was too obvious for you to see yourself? Will a consultant's past experience save you time, effort, and money?)
- Delegate the task (Should this situation be handled by someone else? Even though it seems like it's just "passing the buck," might that be the best response?)
- Just do it (If you really know what you ought to be doing, but you have been procrastinating or avoiding it, why not just get it over with?)
- Research it (Might the situation be handled effectively by conducting an experiment, a field study, or a pilot project?)
- Form a committee or task force (Might a few key people come up with a productive strategy efficiently and promptly?)
- Read the manual (As the sign says, "When all else fails, try reading the directions.")
- Use existing algorithms (Is there a formula or existing set of procedures that has been designed specifically for situations just like this?)

These approaches can be powerful in a variety of situations. However, when might you need a creative approach to problem solving?

What Is a Creative Approach?

We say that this book is about a creative approach to problem solving. What does that mean? An approach is simply the way you move toward, advance, or come closer to something. In the context of this book, an approach is a way of making change happen. There are at least two different kinds of approaches to making change happen; creative and non-creative. A creative approach implies that you are attempting to advance toward an outcome that is new, unstructured, and open ended. These situations often involve an ill-structured problem and unknown solutions. Although you need to use your knowledge and skills for evaluation, a creative approach requires you to engage your imagination, as well as your intelligence, during your approach because no ready-made answer exists. It also requires you to take a more comprehensive view and use the entire system of people, method, content, and context in the approach.

Using a creative approach also implies that you have a courageous attitude; one that

Table 1.1 Examples of Creative Approaches to Problem Solving

Actively constructing many and varied opportunities and identifying the more promising ones to explore and examine more fully. Being open to many different possibilities and maintaining a positive attitude. Solving future-focused problems that do not even exist today.
Examining facts, impressions, feeling, and opinions from many different points of view. Being willing to dig deeper under assumptions.
Seeing the problem or challenge from many different viewpoints. Being able to play with possibilities.
Generating many, varied, and unusual ideas that have high potential to address the problem or meet the challenge in a fresh and valuable way. Being able to think up and suspend judgment when needed. Having idea power.
Investing energy and talent in taking a wild or highly unusual idea and shaping, refining and developing the idea into a workable solution. Being persistent.
Considering aspects of the situation surrounding the solution to enable agreement of your solutions by others. Being sensitive to the context and the people who may be involved with your solution and working to obtain support and acceptance.
Having a variety of possible approaches to take for any given situation, challenge, or problem. Being aware of the power of process.
Reflecting on many different factors in determining your approach.

includes being open to new experiences, embracing ambiguity, and venturing into new and unfamiliar territory. This attitude is often necessary because creative approaches are about helping you move from a place with which you are familiar to one that is different and potentially unknown, and the results of your efforts are potentially uncertain. To demonstrate what we mean by creative approaches to problem solving, consider the

Table 1.2 Examples of Non-Creative Approaches to Problem Solving
Mindlessly defending the status quo. Being resistant to exploring new opportunities.
Making and acting on faulty assumptions or incorrect data.
Seeing the problem or challenge in only one way.
Applying worn-out or habitual responses that don't have the desired effect or fail to solve the real problem.
Overlooking the need to improve, develop, or refine a tentative solution.
Moving on before ensuring agreement and acceptance by others (premature completion or conclusion)
Using an approach uncritically, just because it may have provided relief or results before.
Reacting to a situation before reflecting on alternative ways of responding.

approaches identified in Table 1.1.

Let's also illustrate what we mean by a noncreative approach to problem solving. Table 1.2 contains specific examples of what we would judge to be noncreative approaches to problem solving.

Creative approaches to problem solving enable you to better use the knowledge and skills you already have. They deliberately link creativity and problem solving.

Linking Creativity and Problem Solving

When we present our approach, some people become concerned about the relationship between the concepts of creativity and problem solving. They often ask, "Are you saying that creativity is the same as problem solving?" This idea of linking creativity and problem solving seems to create some tension for some people. One of the challenges we faced in writing this book was to demonstrate the productive links between creativity and problem solving that will help you get the best from both forms of thinking.

Researchers have explored links between creativity and problem solving before and have come up with a variety of answers (Isaksen, 1995). For example, Guilford (1977) suggested that problem solving and creative thinking were closely related. Creative thinking produced new outcomes, and problem solving involved producing novel responses and outcomes to new situations. Problem solving often has creative aspects, but creativity is not always problem solving. Newell, Shaw, and Simon (1962) suggested that "creative activity appears . . . simply to be a special class of problem-solving activity characterized by novelty, unconventionality, persistence, and difficulty in problem formulation" (p. 63).

Rather than keeping creativity separate from problem solving, our approach has been to deliberately link the two. Our approach is designed to apply both your imagination and your intelligence, to generate as well as focus, to use logic and memory as well as

emotion and synthesis. The opportunity created by linking these two concepts is that you have a very diverse collection of strategies, tools, and approaches, enabling you to handle a wide variety of challenges and opportunities.

Linking creativity and problem solving is an example of Janusian thinking. This kind of thinking is named after the Roman god Janus. The reason Janus was chosen as the inspiration behind Janusian thinking is that he had to look in two opposing directions at the same time. As the god of doorways, he looked outside and inside at the same time. Rothenberg (1971) used this attribute to coin the phrase Janusian thinking. He (Rothenberg, 1999) described the Janusian process as

> *actively conceiving multiple opposites or antitheses simultaneously. . . . During the course of the creative process, opposite or antithetical ideas, concepts, or propositions are consciously conceptualized as simultaneously coexisting. Although seemingly illogical and self-contradictory, these formulations are constructed in clearly logical and rational states of mind to produce creative effects. They occur as early conceptions in the development of scientific theories and artworks and at critical junctures at middle and later stages of the creative process; these simultaneous antitheses or simultaneous opposites usually undergo transformation and modification and are seldom directly discernable in final creative products. (p. 103)*

Rothenberg (1979, 1996) provided evidence that this kind of process exists in both the arts and sciences, and in most creative endeavors. He has collected historical and anecdotal evidence, as well as a large amount of data from his psychiatric practice, to support his theory (Rothenberg, 1998).

Active and simultaneous consideration of opposites appears to be a key aspect of creating new and useful responses across a variety of fields. We find support for this idea from a number of key creativity researchers and writers, particularly those who are interested in the creative process. At the core, Janusian thinking is an attempt to describe an aspect of the creative process, a process that is in motion and is dynamic. Deliberately linking creativity and problem solving allows you to take a Janusian stance when you face challenges and opportunities.

A Framework for Change

We often hear the expression, “Change is inevitable, growth is optional.” Unfortunately, we do not know who originally said it. However, it fits nicely when talking about a framework for change. This book provides our current description of CPS, a system that organizes creative approaches to problem solving. The system contains an explicit, yet flexible, framework, language, and suite of tools you can use to productively guide the changes you want throughout your life—at home, at school, and at work.

Change will happen. That is a given. CPS is designed to help you address change in a way that enables you to grow and prosper. Whether you are stimulating changes yourself, or responding to changes brought on by others, the CPS framework provides you with a flexible structure you can use to enhance your effectiveness at using your creativity to make change productive. You can use the framework to address your need for change on a personal level. You can use it to work more effectively with others in a group or team to make change happen. The framework can also be used to change and improve the quality of life and work within organizational settings, and indeed, for society as a whole.

Part of the CPS system is an explicit framework containing components and stages. The components will help you gain clarity about the change you need to make, help you create ideas for what the change might look like, and help you develop powerful solutions and plans for making the change happen. They will also help you take into consideration the whole picture surrounding a desired change to help you be more effective at making the change happen. Whether it takes 10 minutes to complete or multiple years to plan and initiate the change, the CPS framework is flexible enough to support your efforts.

You will find that the CPS framework serves as a menu from which you can choose specific components, stages, tools, and language. You only need to use the part of the framework that suits your needs for a given change you want to create. You can use the elements of the framework in any order or sequence, depending on your specific needs at the time. Therefore, we will show you the items on the menu in the initial chapters of the book, and then demonstrate how you can put the elements of the menu together in the later chapters of the book. Now let's look more closely at the framework of CPS.

Putting This Chapter to Work

This chapter has been focused on defining what we mean by CPS. We examined some of the conceptions of creativity and problem solving, and then linked the two to better understand creative approaches to problem solving.

Activities to Guide Reflection and Action

Work on one or more of the following activities to review your understanding of the material in this chapter and to practice applying the content in real situations. If you are using this book as part of a course or study group, you may wish to work individually and then compare your responses or to work collaboratively as a team.

1. Become a myth spotter. Be on the lookout for when people use the term creative or creativity, and see if they are holding on to any of the nonproductive conceptions of creativity.

2. Try generating a list of things that might benefit from a more creative approach to problem solving versus a more traditional approach. Try keeping a journal or create a blog to record or share these creative challenges.
3. Think about someone who strikes you as a creative person. Then list those characteristics that support your impressions. Compare those you listed against some of those included in this chapter.
4. Think about a time or place in which you felt particularly creative. List the characteristics of that occasion—what supported your creativity? Compare your answers with the description of the creative environment included in this chapter.

Creative Leadership

Leadership is the art of giving people a platform for spreading ideas that work.

– Seth Godin, American Author and Former Dot Com Business Executive



Source: Griffiths, C., & Costi, M. Creative Leadership. (2019). In The creative thinking handbook: Your step-by-step guide to problem solving in business. Kogan Page. New York

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Innovation is a Core Leadership Skill

Big or small, young or old, all companies must find a way to inspire creativity and nurture it within their ranks. Without a healthy and consistent supply of ideas, most organizations will pass their sell-by date for usefulness. It's no joke; the pressure to stay current is always on, making innovation a top priority for leaders. The creative approach can be different for every business, but ultimately the goal is to get people working together to deliver new ideas and solve problems. People make change happen, and so your success as a firstrate leader hinges on building a culture where innovation is everybody's job, from Sam in HR to Louise in Accounting.

Innovation isn't only about new paradigm-shifting products, services or technologies, it's about any new idea that can help you do things better, whether it's cutting costs through more efficient production methods, dreaming up ways to increase brand value or deciding what jobs need to be done within each department. Kaizen (continuous improvement) is just as relevant as disruption. Creative leadership means empowering people to take on playful, daring, idea-hungry and solution-finding behaviours in their day-to-day work so the company can move fast towards a shared purpose. Having the right tools and processes, such as the Solution Finder, is super-important, but innovation won't blossom to its full potential without an overall culture or environment that supports it. Are you a team of one? Not the CEO? No matter, you can still lead creatively in your department, with your co-workers in other functional units or within your sphere of influence. In practical terms, 'flying the flag' for innovation means:

- **Championing a grand mission and vision.** The ability to set a meaningful direction for the business that excites others, rather than bland statements that are long on puffed-up platitudes and short on inspiration.
- **Pulling insights from failures as well as successes.** Creativity is given the space it deserves through risk taking and experimentation. Any failure is a learning opportunity to create better results for future choices.
- **Making play a corporate priority.** Injecting fun into workplace practices is a key way to help creativity flow. The more you play, the more it is accepted as a cultural norm.
- **Being a source of optimism.** Shifting attitudes to change from antagonism to anticipation. Maintaining a can-do spirit. A consistently positive leader sees the good in everything and overcomes moods to keep the team moving forward.
- **Ushering in support systems to enable experimentation.** Supplementing the formal organizational structure with informal systems and networks that allow information sharing and cross-fertilization of ideas across work units.

The End Game

The biggest challenge in creative leadership is motivating people to want to be involved in innovation. Many people don't see themselves as creative, or they feel it's not their job to have new ideas; and to be honest, organizational systems are often designed in a way that stifles creativity rather than making it happen. One of the most powerful ways to inspire and focus people towards positive change is to connect to your higher meaning – the purposeful mission and big-picture vision you hold for the company or a specific innovation project. Your mission is what you are doing today; your vision is your ambition for the future.

Work That Matters (Mission)

Why do you do what you do? What is the overriding purpose of your business? This should be about more than money; your business must have a meaning that people can embrace, share and believe in. According to a survey by American Express (2017), 62 per cent of millennials in the United States, UK, France and Germany want to make a positive difference in the world, and 74 per cent believe that the successful businesses of the future will have a genuine sense of purpose that resonates with people. This offers valuable insight for creative leaders in how to engage their workers for the long term. Leadership needs to make a convincing case that working for the organization will provide meaning and value to each person, and that they have a cause worth pursuing over and above the extrinsic rewards they get from the job.

A well-defined mission represents the soul of the organization/team and generates power. For example, LEGO's (2012) mission is 'to inspire and develop the builders of tomorrow', while Google (nd) promises to 'organize the world's information and make it universally accessible and useful'. Your own mission acts as an anchor for workers to dedicate their creative efforts to tasks and activities that align with the goals and values of the company. As a team, explore your strengths, values and passions to get to the crux of why you exist (Mühlfeit and Costi, 2017):

- **Strengths.** What are your strengths as a team/company? Does anything stand out as your unique superpower? Think of your strengths in terms of the product offerings or services you provide, the level of talent you have and the resources at your disposal. Are you masters of engineering excellence? Can you boast a whip-smart sales team? Or, like British retail giant Tesco, is creating value for customers your thing?
- **Values.** What are your team/company values? These are the principles, philosophies and positive intentions that you stand for and that help you connect to your customers and workers at a deeper level. To get a sense of

your core values, ask your team, 'What's important to us?' and pay attention to the language they use. Are you all about 'having fun' or are you more interested in speed, diversity, integrity, teamwork or entrepreneurial spirit? Also think about the image you present to the public. When people look at your business, what would you like them to see? For Ford, 'quality is job one' (Petersen, 2007), as emphasized in former ad campaigns, while Virgin (nd) has insatiable curiosity, heartfelt service and smart disruption as part of its underlying philosophy.

- **Passions.** What are you passionate about as a team/company? Consider why you are in this business in the first place. What ignited your interest in starting or working for the company? Your passion tells people why they should do business with you; it's the infectious energy that makes the brand come alive and which others can see and feel. Are you passionate about building an empire, sustainability, innovation, people or entertainment? Find out what drives your company and embrace it.

'Move' People (Vision)

What does success look like? Where do you want to be in three, five or ten years' time? You cannot expect your team to be innovative if they don't know where they are headed. With a clear understanding of the past and present, a creative leader paints an inspiring and distinctive picture of the future vision that excites others to follow. There is a sense that you are all embarking on a journey or adventure together. Your chosen horizon should be grounded on more than maximizing shareholder value, profits or any other financial target. That's not going to get people leaping out of bed to seize the day. Make it memorable. Make it bold. 3M's (2018) vision is 'to advance every company, enhance every home and improve every life'. And Amazon (nd) aims 'to be the Earth's most customer-centric company, where customers can find and discover anything they might want to buy online'. Ask 'What if?' questions to bring to light what you really want innovation to do for your company. For instance, 'What if we had a million pounds to spend on our solution?' or 'What if we scrapped our current business model?'

Striving for a better future will always involve change – people are more willing to accept the challenges ahead when you empower them to use their own creativity to forge a path forward. This participation can't come about if your vision is not clear or transparent. It's up to leaders to demonstrate that there is a bigger risk in standing still and that organizations with no vision for the future are the ones destined to stagnate.

Be Strategic

The mission and vision are the starting point for strategic plans and objectives. You have your internal mission that defines your work and *'why'* you exist; and then you

have the external vision that represents '*where*' you are going and what you intend to do. Together, these help you to set priorities and devise strategies to reach your goals. Engage others in coinventing the detail of the end game and a roadmap of how to get there. Once you have strategies in place, you and your team can focus your energy on delivering the vision and mission without constantly trying to figure out what comes next.

CASE STUDY The Living Company

Why do so many companies die young? Arie de Geus (1999), a business executive at Royal Dutch Shell, studied companies that lived longer than most, ranging from 100 to 700 years, including names such as DuPont, Mitsui and Siemens. His team observed that prosperous, long-standing organizations tend to operate as a living community of people held together by clear values and a strong sense of identity, rather than merely focusing on the bottom line. Even in the most widely diversified companies, workers feel like parts of a whole. On top of this, companies that last are very good at 'management for change' (de Geus, 1997). There is a high level of tolerance for experimentation, which creates the space for more innovation and learning. The opposite of the 'living company' is the 'economy company', which exists only to make money. Are profits or people your purpose? If it's the former, then you might not make it to the next decade.

Freedom to Fail... and Learn

We all know that in the business world there are hits and misses; if you're aiming for a hit, you're bound to miss some of the time. That's just the way it goes – any innovator will tell you. Creativity thrives in a climate of adventure and experimentation; a climate fed by risk. It's not easy to embrace risk and take chances that could potentially lead to error. Not only is implementing new ideas nerve-wracking, but the process of innovation can distract people from their day-to-day work and the 'normal' activities of the business.

> *If you're not failing every now and again, it's a sign that you're not trying anything very innovative.*
> *– ATTRIBUTED TO WOODY ALLEN, American Screenwriter and director*

The Big, Bad Unknown

At a corporate level, fear of the unknown is blatantly widespread. Big companies thrive on predictable outcomes; they need to be able to forecast the future to make optimal strategic decisions. And this is where the problem lies. CEOs can very quickly shoot down new and fresh ideas that might lead the organization to places it's never been before. There's a reluctance to play around with the business model or aspects of strategy that have worked well for them since the 90s: 'If it ain't broke, don't fix it'. Most companies are

still on some illusory search for the 'holy grail' of ideas – a brand spanking new idea that also brings the reassurance of having been tried and proven in the past. That's never going to happen. New ideas are risky. They take you into uncharted territory. Oddly enough, fear of the unknown usually gets worse the *more* successful you become. The more accomplishments you've achieved, the higher your footing, and the more you stand to lose by making a mistake.

Learning from Failure

Although we hate failure, it's our mistakes that often teach us the most. Some of the most venerated people and organizations are the ones that take chances, get things wrong and bounce back to try again. Pixar is flying high right now, but it acknowledges that there was a 16-year journey of experiments and mess-ups – including a major corporate shift from making computers to creating commercial animations – before the company got around to successfully releasing its first full-length movie, Toy Story. When Pfizer first tested a new drug to treat high blood pressure and angina, the results turned out to be far less effective than researchers predicted. In an interesting twist, however, male subjects in the clinical trials reported that it had one particular side effect. Instead of binning the drug, Pfizer flipped their strategy and the so-called 'potency pill' Viagra was born. Bill Gates' first venture with Microsoft co-founder Paul Allen was Traf-O-Data 8008 – a device that could take a look at traffic tapes and then process them into useful data. It never took off. However, Allen (2014) looked back at the experience with a positive mind-set: 'Even though Traf-O-Data wasn't a roaring success, it was seminal in preparing us to make Microsoft's first product a couple of years later.'

For these innovators, failure was a stepping stone instead of a stumbling block and helped them forge their own unique path. We could all benefit by seeing it in the same way. If we're more concerned about getting it right first time, we'll bypass the playful, imaginative phase of the creative process. We won't spend time reframing the problem to find more answers, challenging assumptions, changing perspectives or testing different ideas. All of these techniques can bring up errors, but these errors might also take our thinking somewhere completely new. The best thing we can do is learn from our blunders; but to do this we have to free ourselves to make them in the first place. Do you allow yourself to make mistakes? How tolerant are you of your team making mistakes? As a leader you need to learn to see the positive side of failure:

1. Failure is a sign that you're diverging from the well-trodden route. You're pushing the boundaries; and that's a good thing.
2. Failing at one thing means that you learn what doesn't work. We all learn by trial and error, not trial and rightness! The important thing is to reflect on the lessons learnt from failure so that you don't make the same mistakes again.
3. Each failure gives you an opportunity to try a new approach.

How to Manage Mistakes

Errors are inevitable and necessary to make creative progress, but how can we manage them? To make it easier to stomach, try calling failure something different in your organization. For example, Four Sea-sons Hotels & Resorts chose to stop labelling something as a failure or a mistake, preferring to use the term 'glitch' instead (Gower, 2015). Each department holds a daily 'Glitch Report' meeting, in which team members discuss the previous day's mishaps, looking at how to correct course and achieve the best possible outcomes. A failure or mistake can sound final, as if it can't be recovered from, but a glitch is an opportunity to identify areas to improve.

Aim for a 'no blame' culture and empower your team. Obviously in some industries, such as medicine, there is less room for error, but empowerment can still be a powerful tool for finding unconventional approaches. Acceptance of failure is a key cultural element of enlightened brands such as Pixar, Amazon, Dyson and Google. The leadership at animation company Pixar prizes an environment where employees know they can fail without fear of dismissal or embarrassment. Co-founder and president Ed Catmull talks pragmatically about the subject: 'We will fail, and we need to make it safe for you to do that. If you get over the embarrassment, you become more creative because it frees you up' (Graham, 2015). Give your co-workers the time and space to grow their skills, bring more ingenuity to their work and 'be all they can be'. Encourage them to take managed risks. To get the best out of your team – especially the highly creative types – set aside rigid, uncompromising job descriptions and focus on broad guidelines that can be adapted to each person and the context they're working in. Specify goals, not methods, so people can go ahead and raise their game. By all means, set the boundaries for your empowered workers ('This is as far as you can go'), but understand that you can't control every variable and eventuality of every decision or task.

Yes, they *will* make mistakes. Maybe lots of them. But that's something that you will have to learn to cope with. Mistakes can occur for all sorts of reasons, such as poor prioritization, conflict with other projects/within teams, negligence, not collecting enough data, and so on. Many times these can be traced back to the common thinking biases (selective, reactive and assumptive thinking), such as misdirected confidence in a certain solution. Let's say the worst happens – you annoy shareholders, waste funds or damage the company's reputation. What then? A major loss can be devastating for individuals and teams alike. These times call for leaders who can see the positive side of failure, take stock of the situation and get everyone back on track and moving again. If your people are worried about getting it right first time, they'll steer clear of any exploration or testing of different ideas. Following the steps in this book will go some way in helping to minimize the possibility of failure, but please understand that there will always be uncertainty involved when leaving your comfort zone. Use these strategies to manage risk:

- **Make small bets.** Consider your personal attitude to risk. How comfortable are you with getting things wrong? You don't have to bet the whole company. Place the odd bet on a small idea every now and then and see what comes of it.
- **Reframe failure.** Call it a 'glitch' or something else less painful-sounding.
- **Risk vs reward.** For each big idea, ask yourself: What might happen if you take a chance on it? What might happen if you don't?
- **No such thing as a 'fail'.** What would you do if you knew you could not fail? Take steps towards it. If you knew you couldn't get things wrong, would that change your attitude to experimentation?
- **What could go wrong?** Use force field evaluation and the court challenge (Chapter 9) to find the blind spots and consider all the things that could go awry with a project at the start. Build mitigating strategies into your plan to prevent them happening.
- **Share learning.** Get together with your team to talk about past 'failed' projects and what you can learn from them for the future. What were the silver linings? Reflect on the risks you took and whether it was worth the experience in hindsight. This helps to make the topic of failure less awkward for the team.
- **Worst-case scenario.** What's the worst that can happen? Prepare yourself for any losses by making contingency plans. Often this helps you realize that the anticipated failure is ultimately 'not that bad' and can be managed.
- **Don't blame.** If a project fails, find out what went wrong and why, but don't reproach the people involved. Nonetheless, if the same mistakes keep recurring, make it clear that ongoing poor performance will need to be dealt with.
- **Fess up.** Everyone makes mistakes, including leaders. When you can acknowledge your slipups as well as your successes, people will admire your honesty and forgive you for them. Owning up to your mistakes makes you more human and encourages others to be open about sharing their bloopers too, rather than trying to mask them.
- **Learn fast.** Check progress at each stage of an innovation project as well as at the end. Celebrate the things that are working and fix the parts that can be done better as you go along. If you monitor projects closely, problems can be quickly spotted and taken care of before things spiral out of control.

Make Play a Priority

Like daydreaming, most people look down on play in the workplace. They see it as childish, time-wasting and frivolous. There's a general attitude that if you're playing then

you're not getting down to the real business of working. This is a real shame because play is synonymous with fun – and fun is one of the most powerful idea generators around. It's by fooling about that you get to try out different options, figure out what works and what doesn't. Through play you can rearrange things, turn them inside out and upside down; you can look for hidden analogies and challenge your assumptions. People who are enjoying themselves will always come up with more ideas than those who take themselves too seriously.

I'm not saying you shouldn't ever be serious during the creative process. Being level-headed has its value when you're ready to take your ideas and lessons, evaluate them and make them workable in reality. Play and practicality aren't mutually exclusive concepts – they both have a role to play when you're innovating; but play comes first! In the early stages of creativity, it's vital for ideas to flourish. You're not really creating when you're carrying out a preset strategy, hammering through your to-do list or worrying about the cost of this or that, are you?

Letting go of a serious-minded attitude and having fun isn't always as easy as it sounds. It's something that I see people really struggle with during my workshops on creative thinking and applied innovation. Sometimes the problem isn't necessarily with you as an individual, it's with your environment. In a profit-driven workplace (and most are), there's usually little time for random experiential processes that may or may not benefit the bottom line. A study by staffing firm Robert Half International (2012) revealed that a surplus of red tape is holding businesses back from being more innovative. Of the 1,400 chief financial officers interviewed, 24 per cent blamed excessive bureaucracy as the top creativity killer, and 20 per cent said being bogged down with daily tasks and putting out fires is holding them back from coming up with new concepts. Yet creativity thrives in an atmosphere that's free from such pressure. If you're a business owner or manager, you're in an excellent position to look at ways of establishing a more creativity-friendly work environment.

The Fun Factor

A psychological study at the University of Western Ontario found that upbeat work environments can spur creativity (Nadler, Rabi and Minda, 2010). The researchers manipulated happy and sad moods with help from music and video clips. They discovered that those in a positive frame of mind were more flexible in their thinking and had wider perspectives, fuelling their ability to tackle tricky problems creatively. Researcher Ruby Nadler says, 'Generally, a positive mood has been found to enhance creative problem-solving and flexible, yet careful thinking'. So, people who watch funny videos on the internet at work aren't necessarily wasting time. This is great news for employers who want to stimulate non-stop creativity in their workplace.

Be honest with yourself – do you go out of your way to encourage fun, humour and play within your team, or do you crush it? To have fun with your team, you'll need to relax and lower your guard a bit. Many leaders find this difficult, preferring to keep a distance. However, you won't lose respect by introducing a bit of play into the creative process; if anything, your team will respect you more and the brilliant ideas that come of it will be well worth it. Take inspiration from leaders such as Anita Roddick, who in 2003 announced to her Body Shop financial investors, 'Well, I think we're not going to grow next year. We just want to have more fun' (Csikszentmihalyi, 2003). It's not about being childish but 'childlike'. The most highly creative people are children after all.

CASE STUDY 'Serious fun' at Virgin

Fun is a key vehicle through which the imagination can be geared up and explored. When you're inspired and happy, your brain is free from the temporary niggly concerns that hold back fresh ideas, and it becomes easier to take risks. No one is more aware of this than Richard Branson, founder of the Virgin Group and acclaimed business magnate. He rarely wears the conventional suit and tie, he organizes outrageous launch events, and even goes as far as to perform risky stunts for the media. As *Time Magazine* wrote, 'Branson seems hellbent on making sure that everybody, but everybody, is having as much fun as he is' (Branson, 2011). Branson goes to great lengths to make sure his colleagues are enjoying themselves. He regularly writes people letters to tell them what's going on and encourages them to send him their own ideas. He also builds fun into things such as product launches, celebrations and meetings. On Virgin Atlantic's first flight, the plane was filled with conjurors and entertainers, and champagne flowed abundantly. People danced in the aisles to the latest hits. The film *Airplane* was shown and the cabin crew started a ritual of handing out choc ices during the film. This has become a fun tradition whenever a new route is opened up, and Virgin workers clamour to be part of it (Armstrong, 2008). The Virgin Group's passion for play is how they set their parameters for working together and giving great customer service, and they've successfully carried it into a jumble of radically unrelated industries.

Practical Play

People love to work hard when they get to play hard too. This may especially be the case with younger workers; the results from a survey of 2,000 UK employees carried out by online HR specialists BrightHR in collaboration with psychological wellbeing consultants Robertson Cooper indicate that more millennials expect fun to be an integral part of their lives at work than any other demographic (BrightHR and Robertson Cooper, 2015). In addition, people who took part in fun workplace activities had much higher mean scores for creativity (55) than those who had not taken part in a fun activity in the past six months (33), regardless of their age. The following tactics are great for injecting more fun into your work environment.

Have a Laugh Together

Humour bolsters creative output. Why? First, getting into a humorous frame of mind loosens you up so you can widen your thinking. The release of tension triggered by humour produces enkephalin flow in the brain, and this sets you up to be open to new and sudden mental shifts and ideas. Second, it allows you to take things less seriously. This is key. If you can poke fun at something, you're much more likely to test assumptions and break the rules that uphold it. And by doing this, you can find more and better alternatives. Lastly, it triggers the brain's associative capability so you can make new and unexpected connections between existing ideas. This leads to those 'Aha' moments that you get when you suddenly see things from a new and surprising perspective.

One exercise you can use to loosen and stir up people's thinking at the beginning of a brainstorming session is to have them make up funny or cheeky mottos for their products and organizations. This is an exercise that creativity author Roger von Oech (2008) likes to do to start his seminars and conferences. Some of the examples he quotes in his book *A Whack on the Side of the Head: How You Can Be More Creative* include:

- 'Where you're not alone until you want a loan.' – For an international bank
- 'We put the "cuss" in customer.' – For a large retailer
- 'Good people, good medicine, good luck.' – For a health insurance company
- 'A leader in technology whether the customer needs it or not.' – For a large computer company
- 'Customer service is our number one priority: please leave your complaint at the beep.' – For a major airline

Try this as a warm-up exercise next time you have an ideation meeting and see what bold and humorous lines your team come up with. It's just the trick to get everyone's creative juices flowing. Other ways to think humorously:

- Break up the intensity of your creative sessions with funny five-minute video clips.
- Attend a comedy club with your team or watch slapstick films.
- Make a note of the funny things that happen to people in the office and share them for laughs (with people's permission, of course!).

Invite Play into the Office

The physical space where people work can be a powerful instigator of creativity. Children feel most free to play and create when they are in a comfortable and stimulating environment, and so do adults. It's important to create spaces where workers can take

time away from the seriousness of the day and have full permission to play without being judged. Creative companies get this and offer breakout zones, fun outings and recreational activities to help people feel young at heart and foster playful creativity. Google has led the way with its bright, sunny offices around the globe being likened to play parks. There are scavenger hunts, gaming rooms, in-office slides, aquariums, beach volleyball courts, tropical jungle huts, climbing walls, massive dinosaur skeletons, free all-you-can-eat cafeterias and more. Facebook has its arcade games, free bikes, DJ mixing facilities, pool tables, hackathons and woodworking shops, while Groupon boasts an enchanted forest for people to chill out and create in.



Figure 12.1: Dinosaur speak

The challenge for companies is to encourage play without seeming insincere. Don't just copy Google – the funky office-as-playground approach works for them, but you need to do what fits with your own culture and physical infrastructure. Put out a few feelers to determine what kinds of playful solutions would be appreciated by your team. Ping pong tables and bean bags are mainstream when it comes to playful design and help to get people away from their desks. But you can take it a notch further by installing swings, putting greens, hammocks, dartboards, ball pits or any other activity station where people can go to break the monotony of the daily routine. Cultivating creativity isn't just about manipulating the office layout or décor, however; you can introduce play through, for example, karaoke competitions, nerf gun wars, silly dress-up days, laughter workshops, spy-themed adventure games, clown hire, ginger-bread-house decorating contests or fun exercise classes such as trampolining.

Innovate with Optimism

One of the biggest reasons that innovation efforts fail is that they are often killed by corporate dinosaurs who are pessimistic and resist the challenges being made to the status quo.

As a change architect, you will undoubtedly run into opposition and misgivings about the new ideas being implemented. This is sometimes known as the status quo bias, which inclines people to (James, 2009):

- Keep things the way they are, even if they didn't originally choose their current position.
- Avoid the risks generated by change, even when the risks are far less than if they were to make no change.

If you want to make enemies, try to change something.

> *WOODROW WILSON, 28th President of the United States, Address to the World's Salesmanship Congress, Detroit (July 1916)*

The best way to combat negative dinosaur speak and the status quo bias is optimism. Optimism is massively underrated in business, and yet study after study has found it to be an indispensable quality in leaders that others want to follow. It is important in a general sense, but it is even more vital when attempting to drive real innovative growth. Making any type of change requires marshalling a great deal of energy, and optimism is the fuel that powers us along with the hope that we are making things better.

Positive Growth

Optimism begets positive action and mental resilience, which are necessary for growth and flourishing. Linked to this is research undertaken by Stanford psychology professor Carol Dweck (2006) on the differences between people with fixed and growth mindsets. Looking at her findings from a leadership perspective, we learn that bosses with a fixed mindset operate from a philosophy that people's basic qualities (such as personality, intelligence and talents) are carved in stone. They're of the mind that you make do with what you're born with and have little belief that they or others can change. Unsurprisingly, developing people's creativity and inventiveness is not a priority for these immutable types. However, leaders with a growth mindset assume people's basic qualities can be developed with work and determination. They place great value on learning, are open to feedback, and are confident in their ability to cultivate their own and others' creative talents. These bosses seek out constructive ways to praise, empower and motivate their

workers and are resilient in the face of setbacks. There's no way around it. If you want to be a leader who helps people 'grow' their creativity and fulfil their potential, you have to be optimistic about it.

Cheerfulness is a Creative Choice

Optimism feeds positive emotions and engagement, which are antecedents of creativity (Emerald Group, 2015). Barbara Frederickson's (2004) work on the study of positive emotions led her to develop the Broaden and Build Theory, the substance of which is that positive emotions, such as joy, interest and gratitude, do much more than cause happiness and contentment in the moments we experience them. They also broaden behaviours such as play, awareness, discovery and inquisitiveness. When we experience positive emotions, our minds open up to new possibilities, actions and ideas, and we become more flexible and creative in the way we work. As you apply optimism as a leader and allow people to enjoy what they're doing, you will find that in time they will be more inclined to experiment and show initiative. How can you be a more optimistic influence to your team? Here are some quick pointers you can put to the test:

- **Be positive, no matter what.** First off, practise being positive and upbeat every day. Don't fall into the trap of only being positive when something good or momentous happens; it's easier to maintain a positive attitude on an ongoing basis than it is to regain it once you've succumbed to negativity.
- **Embrace newness.** When a new idea is introduced, get behind it fully and make sure you encourage everyone to 'give it their best shot'. Be positive about changes to new products, processes or procedures. Lukewarm initiatives are unlikely to become roaring successes. Some failure is OK, but if teams see innovations flop time and time again, they won't be inspired to keep creating.
- **Master your strengths.** Focus on what you and others do well and build from there. Commit to your professional development. Your journey to mastery will bring confidence and a growing capability to succeed. Be on the lookout for victories and celebrate them along the way. By ritually fuelling the growth of your team, you'll be hardwiring yourself to be a more optimistic and innovative leader.
- **Take in inspirational material on a daily basis.** I like to watch TED videos on entrepreneurship and innovation and read about the latest cognitive research. Others might prefer daily quotations, motivational tapes or reading biographies of successful people. What can you read/watch/listen to/play to get a jolt of optimism and good feeling each day?
- **See the silver lining.** We can all learn to reframe our thoughts to look for the hidden positives in any negative situation – the 90 per cent we still have rather than the 10 per cent we have lost. That bit of bad news or bad luck

won't last for ever. Shift your attitude to being helpful, not helpless. What can you do right now to alleviate the situation? Is there an opportunity hidden here somewhere? If there's nothing you can do, don't dwell on it.

- **Expect people to succeed.** One of the most powerful gifts you can give someone is to believe in their potential. This is the key to helping them accomplish more and more. Even when a member of your team fails to achieve what they set out to do, don't wallow with them. Give them encouragement instead so that they feel energized to tackle the next challenge: 'Never mind. I know you'll do better next time.'

Supportive Systems

What if you were to put creativity at the heart of each and every process and project? Innovation in organizations doesn't just happen – it needs some support. First off, it begins with leadership. If you're an entrepreneur or manager, you're in the best place to commit to and capitalize on this extraordinary resource through the systems and structure of your organization. How can you make creative exploration easy for everyone? Can you adapt current systems to include innovation? Small organizations are usually better at innovating collectively than large ones because they have fewer barriers and more flexible conditions. Decision-making processes in larger organizations can be painfully slow and people are less likely to see their ideas being considered seriously. Leaders who focus on innovation and remove obstacles can bring about fast changes with effective initiatives, such as letting people make decisions, investing in their growth, sharing information and data, trusting them to do the right thing, giving them opportunities to collaborate and be socially active, and allowing them to take risks without fearing a backlash if they make a mistake.

If your role is less leader and more 'small cog', you can still make an impact in your immediate team or work section. Initially, try concentrating on the areas that you can directly influence and that don't require authorization, such as improving your personal creativity, collecting insights for the department and making incremental changes to processes. For bigger initiatives, find managers or mentors who can support you in making change happen. Or get a group of like-minded innovators together to extend your clout. Have patience and stick with it because it won't happen overnight – it's best to take small steps to get others on board bit by bit.

Collaboration Station

For innovation to occur you need an atmosphere of trust and collaboration. In what's fast becoming a virtual world where people are tied to their desks and devices, consider

how you can set up your offices in ways that encourage real face-to-face conversations. Create 'water cooler opportunities' where people can bump into colleagues from different areas of the business or visitors from outside. These serendipitous encounters facilitate the exchange of ideas and information that can help a company progress. They are also a great way to form trusted partnerships of people who can challenge and support each other.

Think about how you can design greater movement into your environment, so people feel free to roam – strategic coffee machines, flexible seating, printers in the middle of the office, moveable walls, a central atrium/lobby. Assemble social spaces for people to mingle and hold meetings in unforced circumstances, such as lounges, cafeterias, huddle spots and breakout areas. At its new US headquarters, Samsung introduced huge outdoor areas sandwiched between floors to entice engineers and salespeople to mix with each other. Install idea boards or interactive touch screens in common areas. LinkedIn has 'white-board walls' everywhere to provide a canvas for capturing ideas as they come, keeping them visible for others to see and expand on. But before you go tearing down all cubicles and closed spaces, spare a thought for the introverts in your organization who might be intimidated by so many accidental interactions. Give them their private space with walled-off workstations, which can also double up as bases for one-on-one discussions.

Inclusive Innovation

Other than formal brainstorming, there are innumerable ways to encourage ideas from workers, customers or the wider community. For instance, by running competitions, hosting workshops/events or through collaborative web platforms (crowdsourcing). Three times a year, former Disney CEO Michael Eisner would hold a Gong Show for his workers to keep fresh ideas coming in. Eisner and a few of his executives would devote a day listening to anyone who wanted to pitch an idea, from set designers to secretaries to theme park attendants (Tucker, nd). Usually up to 40 people were allowed to present their ideas, no matter how outrageous. Although most ideas were gonged, the process succeeded in creating an atmosphere where people felt safe to speak up. Most of Disney's animated feature movies began life in these sessions, such as *The Little Mermaid* and *Pocahontas*, as did the idea for Disney's retail stores.

Some companies keep the pipeline of innovation going by making it easy for workers to make suggestions for improvement and development on a routine basis – and benefit tremendously from it. Leading Japanese car manufacturer Toyota implements over one million employee ideas every year, 95 per cent of them within 10 days of being submitted (Lindegaard, 2011). On average, each Toyota employee submits 100 ideas per year, quickly adding up to several million suggestions. Most of them are incremental ideas that help the company improve piece by piece, rather than radical, far-reaching ones;

but the important thing is the culture in which this innovative mindset is nurtured. Ideas and suggestions made by team members are part of the Toyota Way and a cornerstone of its success in the global market. Thanks to collaborative technologies, it's never been easier to enable your team to come forward with ideas. Even though you won't implement every idea, the innovative spirit you'll create will be priceless.

Other companies choose to look outside for new options in order to break free from company-centric perspectives. For instance, Cisco runs an annual global innovation competition to help identify new business ideas, with a $250,000 grand prize for the winning team. In some cases, Cisco goes on to invest in the winning idea, but the main goal is to build innovative relationships and partnerships. Take note: the opportunities for promoting innovation in your business are as endless as innovation itself.

Key Takeaways

For creativity to flow through an organization, it has to be led enthusiastically from the top. Leaders must learn to think of innovation as a core capability. This chapter offers practical insights to make creativity and innovation part of your company DNA.

- **Focus on the end game.** Creative leadership is essentially about creating, having and sharing a purposeful mission and vision – providing the passionate 'why' and 'where' that mobilizes teams into action.
- **Don't be afraid to fail.** Fear causes us to shy away from the unknown and hold back from taking chances in case we fail. To become better innovators, we need to fight the kneejerk emotional reaction of fear, focus on the opportunities available, and take calculated risks. Of course, no one likes to make mistakes, but if you do, welcome them as a form of learning – heed the lesson, change your direction and move on.
- **Engage in play.** Not being able to have fun at work dulls your creative instincts and causes the whole work environment to suffer too. You can play and still be practical. Play can take many forms – bring more fun (and less seriousness) into the workplace with humour to engage the happy side of people's brains. Consider how you can set up the work environment to provide fun stimuli for unconventional ideas, and the free time to find them.
- **Optimism.** Be a source of positive energy. Avoid pessimistic thinking and see the good in everything – even bad situations or solutions. Communicate in ways that lift people up and help them overcome feelings of self-doubt. Seek out positives everywhere! Good vibes keep the place buzzing.

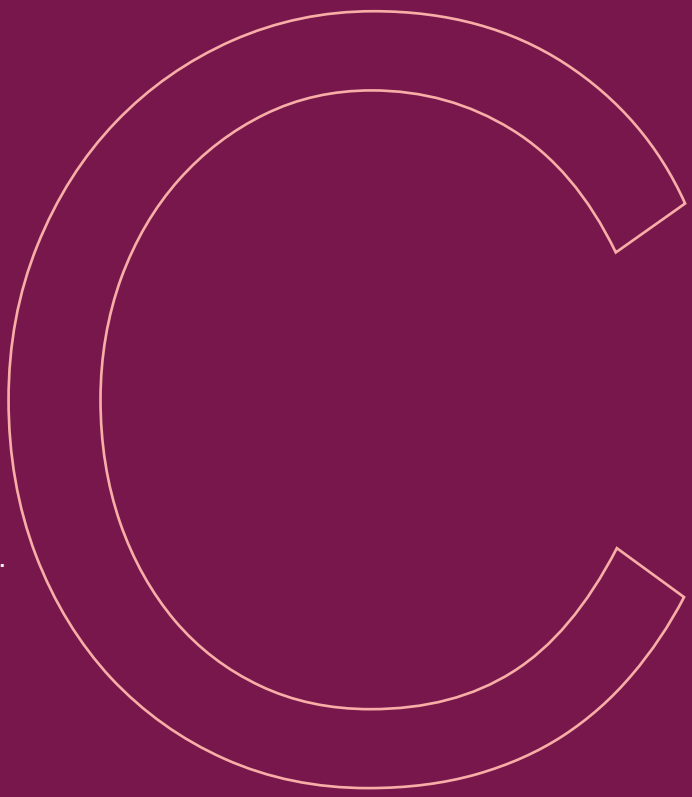
- **Set up supportive systems.** Innovate from the bottom up through deliberative practices and open networks that allow people to share ideas and information wherever they are in the hierarchy. Structuring the office environment for collaboration and movement helps to increase the creative connections between teams, while suggestion schemes and competitions can elicit new ideas from people inside and outside the organization.

Seven Steps to a More Creative Life

About the author

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In these turbulent times, creativity is at a premium. Successful individuals, teams and businesses will flourish not because they work harder (although diligence and persistence are of course laudable) but because they are smarter about what they do.

This article presents seven steps to leading a more creative life, based on tried and tested methods. 'How to' lists have a long and honourable history, but it might surprise some to learn that this one is based on tips written some 500 years ago by one of the most creative individuals of all time – Leonardo da Vinci. He wrote extensively in daily journals, and some 3,000 pages of his observations survive, providing a comprehensive insight into the workings of his unique mind.

These are his recommendations.

Being Insatiably Curious

In one of his journals, Leonardo wrote about having "an insatiably curious attitude to life and unrelenting quest for continuous learning". This characteristic marks out many great creative minds: they constantly ask questions, wondering how things work or how things could be done differently. Like small children, they're not afraid to ask questions that might embarrass or mystify adults: *Why is the sky blue? Why can't we fly? How do birds find their way home?* The general principle at work here is simply keeping an open mind and noticing.

To emulate Leonardo's approach, it helps to take some simple steps, the first of which is keeping a journal, as he did. He used his journals as a means of monitoring his curiosity, recording anything and everything that caught his attention, from major projects to everyday chores (some of the journals even have shopping lists cheek by jowl with designs for weapons and flying machines). This process of continual recording acts both as a way of tracking the evolution of ideas and as an ongoing stimulus for your creative imagination.

My personal recommendation for developing the journal habit is to take these steps:

- choose a high quality A5 or A6 journal with a sturdy cover and either plain or grid paper, rather than lines. Writing on lined paper encourages left to right linear thinking. Grid or plain paper gets you away from subconscious reminders of linear thinking – and you might want to draw as well as write
- get a decent pen and preferably a small set of coloured pencils or pens, as colour adds another dimension to even the most rudimentary sketch
- rather than using your journal from left to right (another linear habit), turn it sideways. This simple action generates a different mindset, as you'll discover if you try it

- following Leonardo, it's good practice to use your journal every day, and to write your thoughts as they arise, along with some statements such as 'I wonder how/why...'

These actions also help personalise your journal, making it truly unique to you. Interestingly, after adopting this practice for a while, it will feel slightly odd if you revert to the conventional view. This is a small example of the ways you can retrain your thinking processes.

In these days of sophisticated technology, would it not be simpler to rely on a tablet rather than a journal? For me, the answer is both/and, rather than either/or. An electronic tablet is incredibly useful for all sorts of creative activity, but it's hard to beat the experience of expressing your personal thoughts directly on to paper.

Another route is to generate a stream of consciousness, just letting your thoughts tumble out randomly without trying to structure them. Begin by selecting a topic or issue that interests you, then record your thoughts and associations without censoring or editing them (you may need to try this several times to break old habits).

Testing Knowledge through Experience

Leonardo was very practically-minded, and he accumulated his wisdom through direct experience. Begin by checking your belief systems. What beliefs do you hold that you can verify by experience?

Play the Three Points of View game with yourself to test your beliefs through experience:

- make a strong case against a belief you hold *of this belief?* and argue from his perspective
- take a distant view about this belief as if you came from a different culture or world. Ask yourself what would a visitor from Mars make
- get friends to give you different contributions from their own viewpoint.

Be prepared for some surprises as you adopt these different views on beliefs you might never have questioned before.

Another way of demonstrating experience to yourself is to consider the opposite of what you'd normally do. As an exercise, find yourself some 'antirole models'. These are individuals you don't want to resemble, whose mistakes you want to avoid, the opposite of what you'd normally think of as role models (people you'd like to emulate). Observe the traps they fell into so that you can avoid them.

Refining the Senses

Leonardo emphasised the importance he attached to “the continual refinement of the senses, especially sight, as the means to enliven experience”. This is why one of Leonardo’s mottoes translates as “knowing how to see” – one of his foundations in both the arts and science.

Following Leonardo, try this exercise:

- write a detailed description of an experience. For example, select an experience full of meaning for you, such as watching a sunrise, and immediately write about the event in your journal
- note where you were, what mood you were in and how that changed as the event unfolded
- record what colours stood out
- what did you hear?
- how did you feel at the end?

Make your account as vivid and real as possible. At a later date, reread your account and see what effect it has on you.

Smell is one of our most evocative senses, and it permeates our lives as much as sight. However, it’s easy to relegate smell to a background role, only using it consciously when an odour is particularly good or bad.

So, as an exercise, try to describe a smell in as much detail as possible:

- capture the smallest element and the biggest impression
- did it remind you of an event or experience?
- did it generate a special emotion?
- did you recall the first time you experienced it?
- what else comes up as you immerse yourself in this review process?
- can you find words to capture the essence of this smell?

Once again, write everything in your journal and illustrate it. You can also try this exercise with taste and touch.

And hearing is another primary sense that deserves special treatment. Normally, you hear in a passive way – sounds come to you and form much of the daily backdrop to your life. Because sound is there all the time, it goes largely unnoticed unless something disrupts the

pattern, like a loud bang or a scream. However, you can learn to sharpen your hearing skills through a process called active listening. This involves you consciously paying attention to the different kinds of auditory experiences all around you, and this can be a major stimulus for your creative imagination.

These exercises are further material for your journal and, as with the other experiences, it's always worth revisiting your journal at a later date to review your responses and make further notes on them. In any discussion involving Leonardo da Vinci, drawing is an essential component. Learn to draw, even if you believe you can't. You can find many resources available to help here; Betty Edwards' books, notably *Drawing on the Right Side of the Brain*, remain outstanding and should convince even the most self-deprecating non-drawer of his innate ability.

Embracing Ambiguity

Most of us instinctively avoid ambiguity and gravitate towards certainty. Most of us instinctively avoid ambiguity and gravitate towards certainty. However, a willingness to befriend ambiguity can lead to a whole new way of seeing. Ambiguity is essentially to know something, though its meaning may be indeterminate. Leonardo called it "a willingness to embrace ambiguity, paradox and uncertainty".

As an exercise, try holding two different emotions at the same time. Picture a time when you were really sad, and a time when you were equally happy. Now put them together and see if you can experience both at the same time. (Don't be discouraged, it can be done: country and western artists are experts at bittersweet!)

Balancing Art and Science

Here, the emphasis is on "the development of the balance between science and art, logic and imagination". In essence, this refers to what we now call whole-brain thinking. The Western world has a history of separating art and science, treating them as though they' re independent of each other. However, modern educational thinking is now moving to a more integrated approach, recognising that both have a role to play and that each can benefit from the other.

One very powerful technique you can use to blend art and science is mind-mapping. This technique is now well-established and is widely used in many fields from business to education. Its strength is that it combines logic and imagination in a unique evolving process - the signature spider-web pattern - using words, shapes and colour in a way thought to be analogous to how the brain itself works.

Mind-mapping is based on a simple set of guidelines designed to help everyone attain rapid mastery of the process.

Some of the most interesting art now being created is based on the latest scientific developments. Several artists are exploring the visual beauty of, for example, the patterns created in genetics and quantum physics, and the mathematics of fractals. And scientists are using drawing and sculpture to help them grasp some complex and abstract issues.

Cultivating the Finer Aspects of Life

Leonardo described this as the "cultivation of grace, ambidexterity, fitness and poise". Today we would call it 'dressing for success'.

Contemporary accounts suggest that Leonardo was something of a dandy, with long flowing locks and the most fashionable and expensive clothes (in contrast to his rival Michelangelo, who dressed in peasant garb and rarely washed, and whom Leonardo enjoyed teasing). The mirror-writing in his journals has fascinated generations and is just one example of his extraordinary physical dexterity.

How do we achieve this? Creativity is, of course, cerebral but it helps to house it in a fit body. Develop a personal programme to cultivate your physical fitness, focusing on these key elements. The benefits of these activities become apparent relatively quickly and can easily be incorporated into your daily routine:

- develop your body awareness. As you improve your overall physical fitness, consciously become more aware of your body. Whichever techniques you use as part of your fitness regime, try a variety of others that coordinate mind and body skills, such as yoga, tai chi or qi gong, juggling or dance - whatever takes your fancy. They're all great fun once you get the hang of them, and you stay fit almost without noticing.
- become ambidextrous. To become ambidextrous, start by performing simple routine tasks such as cleaning your teeth or eating with a spoon with your non-dominant hand. As you gain confidence (and your brain creates new neural pathways to help you), you can graduate to writing. Begin with capitals, then single letters and finally joined-up writing.

As a bonus you might want to teach yourself to write upside down, which can be very impressive across a desk in meetings!

Connecting Everything

The final step, which draws all the others together, is recognising how everything is connected. Leonardo described this as “a recognition of and appreciation for the interconnectedness of all things and phenomena”. Today we would recognise this concept as systems thinking, or what some experts call ‘interdependence’.

Much of Leonardo’s output is based on his ability to form new patterns through connections and combinations of different elements. Ways to follow his example include:

- find ways to link things that seem to be unrelated. The more unlikely they are, the better. Find similarities between a bear and a diamond; a ship and a brain; a shoe and a palace.
- play the Dinner Party Game. Imagine you’ve invited some of your real life and fictional heroes (and villains if you want to enrich the mix!) to your dinner party and imagine the conversation. Feed them a topic and enjoy the spectacle. What does Gandhi say to Hitler about quantum physics? What do Margaret Thatcher and Steve Jobs discuss about modern art?
- think about how things originate. What has to happen for certain things to exist? Take examples from nature (how do plants repopulate after a forest fire?) and from the man-made world (what do you need to make a motorbike?).

So there you have it. We can’t all be Leonardos, but we can all benefit from his wisdom in the form of these tips for a more creative life.

Just for the Sake of Argument

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Source: Zeggerelli, M. (2007). Chapter 3: Just for the sake of argument. In *Logic for Dummies* (pp. 33–48). Hoboken, NJ: Wiley.

Simply put, logic is the study of how to tell a good argument from a bad one.

In daily life, most people use the word *argument* to describe anything from a tense disagreement to a shouting match. An argument, however, doesn't have to be heated or angry. The idea behind *logical argument* is simple: I want to convince you of something, so I point out some facts that you already agree with. Then, I show you how what I'm trying to prove follows naturally from these facts.

In this chapter, I explain what logic is and walk you through the elements of a logical argument. I also provide you with lots of examples, show you what logic *isn't*, and run through the various fields that use logic. When you're done, you may still find yourself on the wrong end of an argument, but at least you won't be accused of being illogical!

Defining Logic

Here's what you need to know about logic:

- Logic is the study of *argument validity*, which is whether a logical argument is *valid* (good) or *in-valid* (bad).
- An argument, in logic, is a set of one or more *premises* followed by a *conclusion*, which are often connected by one or more *intermediate statements.*
- The premises and the conclusion are always *statements* — sentences that give information and that are either true or false.
- In a valid *argument*, if all of the premises are true, the conclusion must also be true.

When you put it all together, then, here's what you get:

Logic is the study of how to decide the circumstances in which a set of true premises leads to a conclusion that is also true.

That's it! As you go through this book, keep this definition in mind. Write it down on an index card and paste it to the mirror in your bathroom. Every topic in logic relates to this central idea in some way.

Examining Argument Structure

A *logical argument* must have one or more premises followed by a conclusion. Here's an example of a logical argument:

Nick: I love you.
Mabel: Yes, I know.
Nick: And you love me.
Mabel: True.

Nick: And people who love each other should get married.
Mabel: OK.
Nick: So we should get married.

This may not be the most romantic marriage proposal you've ever heard, but you get the idea. If Mabel really does agree with all three of Nick's statements, his argument should convince her to marry him.

Take a closer look at the structure of Nick's argument and you can see that it contains three premises and one conclusion. Boiling it down to its most basic form, Nick is saying:

Premises:

I love you.

You love me.

People who love each other should get married.

Conclusion:

We should get married.

The premises and the conclusion of an argument all have one thing in common: They are statements. A *statement* is simply a sentence that gives information.

For example, the following are all statements, though none yet fit into the premise or conclusion category:

- The capital of Mississippi is Jackson.
- Two plus two equals five.
- Your red dress is prettier than your blue one.
- Men are just like dogs.

In contrast, the following are *not statements:*

- A big blue Cadillac (not a complete sentence)
- Do you come here often? (a question)
- Clean your room right now. (a command)
- Golly! (an exclamation)

In logic, the information that a statement provides, and therefore the statement itself, may be either true or false. (This rule applies whether the statement you're talking about is being used as one of an argument's premises or as its conclusion.) This is called the *truth value* of that statement.

Because logicians deal with truth values all the time, they save on the everrising cost of ink by referring to the truth value as just the *value* of the statement. In this book, I use both terms, but they mean the same thing.

Sometimes you can easily verify the truth value of a statement. The value of a statement that says "The capital of Mississippi is Jackson" is *true* because Mississippi's capital is, in fact, Jackson. And two plus two is four, not five, so the value of the statement "Two plus two equals five" is *false*.

In other cases, the truth value of a statement is more difficult to verify. For example, how do you decide whether one dress really is prettier than another, or whether men really are just like dogs?

For the moment, don't worry about *how* you figure out whether a statement is true or false, or even *if* you can figure it out. I touch on this in the "The sound of soundness" section later in the chapter.

Looking for Validation

In a good argument — or a *valid argument*, as logicians say — when all the premises are true, the conclusion must also be true.

Valid arguments are at the very heart of logic. Remember, in a logical argument, I want to convince you of something, so I point out facts that you already agree with (*premises*), then show you that what I'm trying to prove (the *conclusion*) follows from these facts. If the argument is valid, it's airtight, so the conclusion inevitably follows from the premises.

For example, suppose your professor says to you, "Everyone who studied did well on my midterm. And you studied, so you did well." Break this statement down into premises and a conclusion to see what you get:

Premises:

If a student studied, then he or she did well on the midterm.

You studied.

Conclusion:

You did well on the midterm.

The preceding argument is an example of a valid argument. You can see that if both premises are true, then the conclusion must be true as well.

Now you can see why I also state in the preceding section that validity rests upon the structure of the argument. When this structure is missing, an argument is invalid even if all of its statements are true. For example, here is an invalid argument:

Premises:

George Washington was the first U.S. president.

Albert Einstein proposed the Theory of Relativity.

Conclusion:

Bill Gates is the richest man in the world.

All of these statements happen to be true. But that doesn't mean the argument is valid. In this case, the argument is invalid because no structure is in place to ensure that the conclusion must follow from the premises. If Microsoft stock suddenly crashed and Bill Gates was penniless tomorrow, the premises would be true and the conclusion false.

Studying Examples of Arguments

Because arguments are so important to logic, I include in this section a few more examples so you can get a sense of how they work.

Some of these examples have arguments in which the first premise is in the form "*If . . . then . . . .*" *If* something happens, *then* something else will happen. You can think of this type of sentence as a slippery slide: Just step onto the *if* at the top of the slide and you end up sliding down into the *then* at the bottom.

Aristotle was the first person to study the form of arguments. For example:

Premises:

All men are mortal.

Socrates is a man.

Conclusion:

Socrates is mortal.

He called this form of argument a *syllogism*. (See Chapter 2 for a closer look at early forms of logic by Aristotle and other thinkers.)

After you get the hang of how logical arguments work, the variations are endless. In Parts II through V of this book, you discover even more precise and useful ways to create, understand, and prove logical arguments. For now, though, these examples give you a taste of what valid arguments are all about.

Ice cream Sunday

Suppose that on Sunday, your son, Andrew, reminds you: "You said that if we go to the park on Sunday, we can get ice cream. And now we're going to the park, so that means we can get ice cream." His logic is impeccable. To show why this is so, here is Andrew's argument separated into premises and a con clusion:

Premises:

If we go to the park, then we can get ice cream.

We're going to the park.

Conclusion:

We can get ice cream.

The first premise sets up the if-then slope, and the second is where you step onto it. As a result, you land inevitably in the conclusion.

Fifi's Lament

Suppose one afternoon, you arrive home from school to hear your mother make the following argument: "If you cared about your dog, Fifi, you would take her for a walk every day after school. But you don't do that, so you don't care about her." Here's what you get when you break this argument down into its premises and a conclusion:

Premises:

If you cared about Fifi, then you would walk her every day.

You don't walk Fifi every day.

Conclusion:

You don't care about Fifi.

The first premise here sets up an if-then slope. The second premise, however, tells you that you don't end up at the bottom of the slope. The only way this could happen is if you *didn't* step onto the slope in the first place. So, your mother's conclusion is valid — poor Fifi!

Escape from New York

Suppose that your friend Amy, describing where she lives, makes the following argument: "Manhattan is in New York. And Hell's Kitchen is in Manhattan. My apartment is in Hell's Kitchen, and I live there, so I live in New York." This argument also relies on the if-then slope, but doesn't contain the words "if" and "then." They're implied in the argument but not stated specifically. I make this clear below:

Premises:

If something is in my apartment, then it's in Hell's Kitchen.

If something is in Hell's Kitchen, then it's in Manhattan.

If something is in Manhattan, then it's in New York.

I live in my apartment.

Conclusion:

I live in New York.

The if-then slope makes a conclusion apparent in this case. In this example, though, one slope leads to another, which leads to another. After you know that Amy lives in her apartment, you have no choice but to slide down the next three slopes to conclude that she lives in New York.

The Case of the Disgruntled Employee

Suppose your wife, Madge, arrives home from work in a huff and says: "You can find three kinds of bosses in this world: the ones who pay you on time, the ones who apologize when they pay you late, and the ones who just don't value you as an employee. Well, my paycheck is late and my boss hasn't apologized, so I know that he doesn't value me."

Here's her argument:

Premises:

A boss pays his employees on time or apologizes when he pays late or doesn't value you.

My boss didn't pay me on time.

My boss didn't apologize for the delay.

Conclusion:

My boss doesn't value me.

This argument relies not on an if-then slope, but on a set of alternatives set up using the word "or." The first premise sets up the choice, while the second and third each eliminate an alternative. The conclusion is the only alternative that remains.

What Logic Isn't

Because it has been around for about 2,000 years, logic has had a chance to weave itself into the fabric of much of our culture. And *Star Trek's* Mr. Spock is only the tip of the iceberg.

Consider a few cultural stereotypes that involve logic: If you meet someone who's quiet and thoughtful, you may think that she is a *logical* person. When someone makes a rash or hasty decision — or one that you just don't agree with — you may accuse him of being *illogical* and advise him to *think logically* about what he's doing. On the other hand, if you find someone cold or detached, you may decide that he's *ruled by logic*.

Because logic is so loosely defined in common speech, people have all sorts of misconceptions about it. In some circles, logic is revered as the greatest human endeavor. In others, it's despised and looked at as an exercise for the ivory tower, which is remote from the challenges that face ordinary people in their daily lives.

Logic may have both a good and a bad reputation because people think it's something that it isn't. In this section, I pull out all the stops and show you exactly what logic is — and what it isn't.

You can use Table 3-1 as handy reference to compare what logic can and can't do.

Table 3-1	The Cans and Cannots of Logic
Logic Can't	***Logic Can***
Create a valid argument.	Critique a given argument for validity.
Tell you what is true or false in reality.	Tell you how to work with true and false statements.
Tell you if an argument is sound.	Tell you if an argument is valid.
Justify conclusions arrived at by induction.	Justify conclusions arrived at by deduction.
Make an argument rhetorically stronger (more convincing).	Provide the basis for rhetorical improvement.

Thinking versus Logic

Reasoning, or even just plain thinking, is a hugely complex process that is only barely understood. And — to part company with Mr. Spock and his clan — logic is one piece of that reasoning process, but it doesn't make up the whole thing.

Think about the type of reasoning you might use to resolve a dispute between two children. You'd need to observe what is happening, relate this experience to past experiences, and try to figure out what might happen in the future. You might choose to act harshly by threatening to punish them. You might act kindly and reassure them. You might remain impartial and listen to both sides of the story. Or you might take a little from all of these approaches.

In short, you would have a lot of options and would somehow find a way to keep the peace (or maybe none of them would work, but that's a subject for *Parenting For Dummies*, not *Logic For Dummies*). All of these options involve thinking. Even sending both kids to their rooms without any attempt to understand what's going on requires the kind of thinking that humans do best (but that even the smartest dog can-not do).

However, if you limited yourself to logic when keeping the peace with your kids, you wouldn't get anywhere. Logic doesn't tell you what to do or how to act — it's not that kind of a tool. So when you respond to a situation by observing, thinking, and not letting emotion sway your actions, realize that you're calling on a whole host of abilities that are far more sophisticated (and also far less certain!) than logic.

Don't get logic and thinking confused. Logic is just one aspect of thinking, but it's an aspect that has been studied so rigorously that it's understood very well. In this way, logic is a lot more — and also a lot less — than just clear thinking unclouded by emotion.

Reality — What a Concept!

Because with logic you're constantly working with true and false statements, you may think that the point of it is to tell you what is true and what is false — in other words, you may think that logic is supposed to tell you the nature of reality in objective terms. But, in fact, logic can't tell you what's objectively true or false — it can only tell you what's true or false relative to other statements that you already know (or believe) to be true or false.

For example, look at these two statements:

New Jersey is a U.S. state.

Stealing is always wrong.

The first statement seems simple to verify as true, but the second seems difficult to verify at all. But, in either case, logic doesn't tell you right from wrong or even whether New Jersey is a state — you have to find other sources for those things. What logic *does* tell you is whether an argument is valid — that is, whether a set of true premises produces a true conclusion.

The only exception to this rule involves statements that are true in only a very limited and trivial sense. For example:

All blue things are blue.

Either Toonsis is a dog or he isn't a dog.

If you're a salesman living in Denver, then you're a salesman.

Statements like these are called *tautologies*. Tautologies have an important role to play in logic, and you find out about that role in Chapter 6. For now, though, just understand that the main reason they're so reliably true is because they don't really convey any information about the world. As far as figuring out what in this crazy, complex world is true or false — you're on your own.

The Sound of Soundness

A *sound argument* is simply a valid argument plus the fact that the premises are true, making the conclusion true as well.

Soundness goes hand in hand with reality. But, because logic doesn't tell whether a statement is true or false, it also doesn't tell whether an argument is sound. Even a valid argument will produce a lousy conclusion if you give it a bunch of rotten premises. For example:

Premises:

Jennifer Lopez is on earth.

When the Messiah is on earth, the end times have arrived.

Jennifer Lopez is the Messiah.

Conclusion:

The end times have arrived.

Here you have a logically valid argument. However, is it sound or unsound? I personally have a hard time accepting the third premise as true, so I would have to say it's an unsound argument. And you may well agree. The point is this: Because logic won't take a side about whether that statement is true in reality, logic also won't help you decide whether the argument is sound.

Make sure you see the difference between a valid argument and a sound argument. A valid argument contains a big if: *If* all of the premises are true, then the conclusion must also be true. A sound argument is a valid argument with one further condition: The premises *really are true*, so, of course, the conclusion really is true as well.

Note that when you start off with an invalid argument, logic has a lot to say: If an argument is invalid it's always unsound as well. Figure 3-1 shows a little tree structure that may help you understand arguments better.

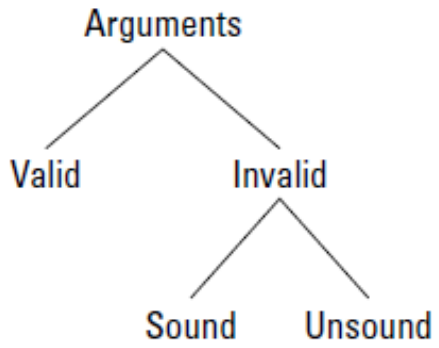


Figure 3.1
A look at a logic tree can help you tell where your arguments fall

Deduction and Induction

Because *deduction* rhymes with *reduction*, you can easily remember that in deduction, you start with a set of possibilities and reduce it until a smaller subset remains.

For example, a murder mystery is an exercise in deduction. Typically, the detective begins with a set of possible suspects — for example, the butler, the maid, the business partner, and the widow. By the end of the story, he or she has reduced this set to only one person — for example, "The victim died in the bathtub but was moved to the bed. But, neither woman could have lifted the body, nor could the butler with his war wound. Therefore, the business partner must have committed the crime."

Induction begins with the same two letters as the word *increase*, which can help you remember that in induction, you start with a limited number of observations and *increase* that number by generalizing.

For example, suppose you spend the weekend in a small town and the first five people you meet are friendly, so you inductively conclude the following: "Everybody here is so nice." In other words, you started with a small set of examples and you increased it to include a larger set.

Logic allows you to reason deductively with confidence. In fact, it's tailormade for sifting through a body of factual statements (*premises*), ruling out plausible but inaccurate statements (*invalid conclusions*), and getting to the truth (*valid conclusions*). For this reason, logic and deduction are intimately connected.

Deduction works especially well in math, where the objects of study are clearly defined and where little or no gray area exists. For example, each of the counting numbers is either even or odd. So, if you want to prove that a number is odd, you can do so by ruling out that the number is divisible by 2. See the "Whose Logic Is It, Anyway?" section for more examples of how and where logic is applied.

On the other hand, as apparently useful as induction is, it's logically flawed. Meeting 5 friendly people — or 10 or 10,000 — is no guarantee that the next one you meet won't be

nasty. Meeting 10,000 people doesn't even guarantee that most people in the town are friendly — you may have just met all the nice ones.

Logic, however, is more than just a good strong hunch that a conclusion is correct. The definition of logical validity demands that if your premises are true, the conclusion is also true. Because induction falls short of this standard, it's considered the great white elephant of both science and philosophy: It looks like it may work, but in the end it just takes up a lot of space in the living room.

Rhetorical Questions

Rhetoric is the study of what makes an argument cogent and convincing. Take a look at the following argument:

Premises:

Science can't explain everything in nature.

Anything in nature can be explained by either science or by the existence of God.

Conclusion:

God exists.

Even though this may or may not be a sound argument, it's a valid argument. However, it may not be a *cogent* argument.

What makes an argument cogent is close to what makes it sound (see the "The sound of soundness" section earlier in the chapter). In a sound argument, the premises are true beyond all doubt. In a cogent argument, the premises are true beyond a reasonable doubt.

The phrase "reasonable doubt" may remind you of a courtroom. This connection makes sense because lawyers make logical arguments that are intended to convince a judge or a jury of a certain conclusion. In order to be cogent, the lawyer's arguments must be valid and the premises of these arguments must be believable. (See the section "Tell it to the judge (law)" where I talk about the relevance of logic in a legal context.)

The Science of Induction

Induction is reasoning from a limited number of observations toward a general conclusion. A classic example: After observing that 2 or 10 or 1,000 ravens are black, you may decide that all ravens are black.

Inductive arguments, while they may be convincing, are not logically valid. (You never

know, a white or pink raven may be out there somewhere.) But, although induction is logically unreliable, scientists seem to use it all the time with great success to explain all sorts of events in the universe. The philosopher Karl Popper took on the apparent contradiction, showing that induction isn't necessary for scientific discovery.

Popper's answer, in a nutshell, is that science doesn't really use induction to prove anything — it just looks that way. Instead, Popper says that scientists develop theories that fit their observations and then they *disprove* alternative theories. So, the last theory left standing becomes the accepted explanation until a better theory is found. (This may sound cavalier, as if any halfwit could come up with a crackpot theory and have it accepted. But, scientists are extremely adept at disproving plausible theories, so don't quit your day job.)

Even though some thinkers still question Popper's explanation, many find it a good explanation that resolves a centuries-old philosophical problem.

Considering that logic is concerned with validity rather than soundness, how does logic enter into the process of making an argument cogent? It does so by drawing a clear distinction between the underlying form of an argument and its content.

The form of an argument is what logic is all about. If the form doesn't function correctly, your argument falls apart. However, when it does function correctly, you can move on with confidence to the content of your argument.

Go back and take a look at the argument at the beginning of this section. I said that it's a valid argument but that it may not be cogent. Why? For one thing, the second premise is full of holes. Consider the following:

- What if science can't currently explain everything in nature but someday is able to?
- What happens if something other than science or the existence of God can explain some things?
- What if there is simply no explanation for everything we see in nature?

Each of these questions is a plausible exception to the argument. You need to address these exceptions if you want your argument to convince intelligent, clear-thinking people that your thinking is correct. In other words, you need to address the rhetorical issues within your argument.

In reality, however, appealing to the intelligence of an audience may be less effective than an appeal to powerful emotions and irrational beliefs. In such cases, a simple, flawed argument may be more convincing than a sound argument that the audience has trouble understanding. A shaky argument from a speaker whom the audience likes can be convincing where a brilliant but obnoxious display of intellect may be only alienating.

The study of what makes an argument cogent or convincing is useful and provocative, but it's also outside the scope of this book. From a purely logical standpoint, once an argument is valid, no further improvement is possible.

Whose Logic Is It, Anyway?

With all the restrictions placed upon it, you may think that logic is too narrow to be of much use. But this narrowness is logic's great strength. Logic is like a laser — a tool whose best use is not illumination, but rather focus. A laser may not provide light for your home, but, like logic, its great power resides in its precision. The following sections describe just a few areas in which logic is commonly used.

Pick a Number (Math)

Mathematics is tailor-made to use logic in all its power. In fact, logic is one of the three theoretical legs that math stands on. (The other two are set theory and number theory, if you're wondering.)

Logic and math work so well together because they're both independent from reality and because they're tools that are used to help people make sense of the world. For example, reality may contain three apples or four bananas, but the ideas of *three* and *four* are abstractions, even though they're abstractions that most people take for granted.

Math is made completely of such abstractions. When these abstractions get complicated — at the level of algebra, calculus, and beyond — logic can be called on to help bring order to their complexities. Mathematical ideas such as number, sum, fraction, and so on are clearly defined without exceptions. That's why statements about these ideas are much easier to verify than a statement about reality, such as "People are generally good at heart" or even "All ravens are black."

Fly Me to the Moon (Science)

Science uses logic to a great advantage. Like math, science uses abstractions to make sense of reality and then applies logic to these abstractions

The sciences attempt to understand reality by:

1. Reducing reality to a set of abstractions, called a model.
2. Working within this model to reach a conclusion.
3. Applying this conclusion back to reality again.

Logic is instrumental during the second step, and the conclusions that science attains are, not surprisingly, logical conclusions. This process is most successful when a good correlation exists between the model and reality and when the model lends itself well to the type of calculations that logic handles comfortably.

The areas of science that rely most heavily on logic and math are the *quantifiable sciences*, such as physics, engineering, and chemistry. The *qualitative sciences* — biology, physiology, and medicine — use logic but with a bit less certainty. Finally, the *social sciences* — such as psychology, sociology, and economics — are the sciences whose models bear the least direct correlation to reality, which means they tend to rely less on pure logic.

Switch On or Off (Computer science)

Medicine used to be called the youngest science, but now that title has been handed over to computer science. A huge part of the success of the computer revolution rests firmly on logic.

Every action your computer completes happens because of a complex structure of logical instructions. At the hardware level — the physical structure of the machine — logic is instrumental in the design of complex circuits that make the computer possible. And, at the software level — the programs that make computers useful — computer languages based on logic provide for the endless versatility that sets the computer apart from all other machines.

See Chapter 20 for an in-depth discussion of logic as it relates to computers.

Tell it to the Judge (Law)

As with mathematics, laws exist primarily as sets of definitions: *contracts, torts, felonies, intent to cause bodily harm*, and so on. These concepts all come into being on paper and then are applied to specific cases and interpreted in the courts. A legal definition provides the basis for a legal argument, which is similar to a logical argument.

For example, to demonstrate copyright infringement, a plaintiff may need to show that the defendant published a certain quantity of material under his own name, for monetary or other compensation, when this writing was protected by a preexisting copyright.

These criteria are similar to the premises in a logical argument: If the premises are found to be true, the conclusion — that the defendant has committed copyright infringement — must also be true.

Find the Meaning of Life (Philosophy)

Logic had its birth in philosophy and is often still taught as an offshoot of philosophy rather than math. Aristotle invented logic as a method for comprehending the underlying structure

of reason, which he saw as the motor that propelled human attempts to understand the universe in the widest possible terms.

As with science, philosophy relies on models of reality to help provide explanations for what we see. Because the models are rarely mathematical, however, philosophy tends to lean more toward rhetorical logic than mathematical logic.

What Are Cognitive Biases?

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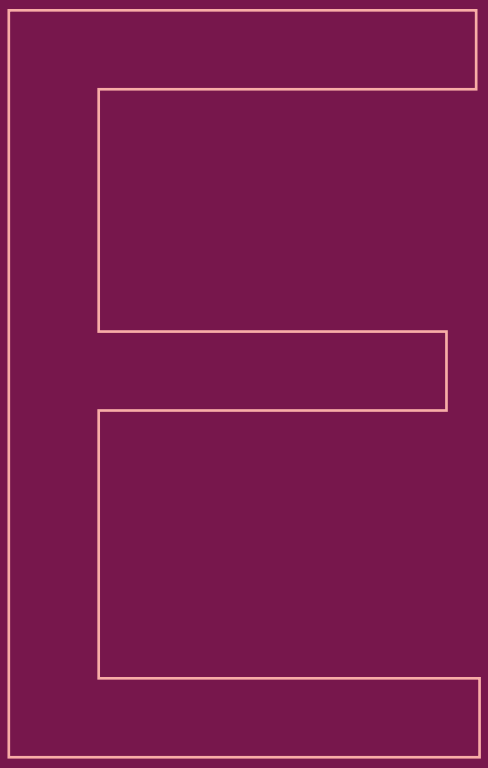
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Source: Ellis, G. (2018). Cognitive Biases in Visualisations. Konstanz, Germany: Springer (p. 1–7)

1.1 Introduction

Decisions, decisions, decisions, we make them all the time, probably thousands each day. Most are part of daily living, such as moving about our environment, others need more thought, but are not particularly critical, such as what coffee to buy. However, some decisions are important, even with life implications, from deciding if it's safe to cross the road, to a doctor deciding what cancer treatment to suggest for a patient. We might imagine that all of these decisions, whether trivial or not, are based on sound reasoning using our senses and our experience stored in our memory. However, it is generally, agreed that the majority of decisions are made unconsciously using heuristics – strategies that use only a fraction of the available information. This makes sense in evolutionary terms, as to survive approaching danger, for instance, decisions had to be made rapidly. Humans do not have the time or brain processing power to do much else than use heuristics, and are, in fact, inherently lazy in order to conserve precious energy resources. Fortunately, most of the time the result of using the very fast and automatic heuristic strategies are "good enough", however in certain situations they are not good enough, leading to poor judgments. It is these "errors in judgment" or "irrational behavior" that are commonly referred to as *cognitive biases*.

During this decade, interest in cognitive biases has increased markedly, with several large research projects starting in 2012, as well as a few mentions in popular online publications and even in the press. In addition to an increase in scholarly articles, the biggest change has been in media interest, especially in the business world. A recent Google search for "cognitive bias" presents many business orientated items which are either aimed at selling (e.g. *Cognitive Biases How to Use Them to Sell More*) or as a warning (*e.g. Hidden Cognitive Biases That Cost You Big Money*). Other search results are generally pessimistic regarding cognitive biases such as *The 17 Worst Cognitive Biases Ruining Your Life!*

More recently, *implicit* or *unconscious bias* has been in the media, in the context of equality and anti-discrimination. This is often the result of stereotyping which is influenced by our background, culture and experience. In this sense "unconscious" means that humans make this judgment without realizing it, as with heuristic processing. And, if we think that cognitive biases only affect humans, then there are studies on rats, sheep, bees, chicken and many other animals which use cognitive bias as an indicator of animal emotion. However, these uses of the term "cognitive bias" differ from the more traditional one which we are discussing in this book.

Before considering cognitive biases (in humans) in the context of visualization and visual analytics tools, the next sections, provide some examples of common cognitive biases and a brief history of their 'discovery' and subsequent research.

1.1.1 Examples

A recent classification of cognitive biases, the Cognitive Bias Codex by Benson lists 187 biases. These have been added to since the 1970s and the trend seems to be continuing, although sometimes just a bias by another name. There are of course, similarities which various classification schemes over the years have attempted to tease out although most of the work has been in the area of decision support. In Chap. 2, Calera Valdez et al. propose a framework, specifically for the study of cognitive biases in visualization, and contrast this with the aforementioned Cognitive Bias Codex.

For those readers, not familiar with cognitive biases, here are four examples of common biases:

Familiarity/availability bias is where people tend to estimate the likelihood of something to happen by how easy it is to recall similar events. For instance, people will generally think that travel by airplane is significantly more dangerous in the aftermath of a plane crash being reported in the media (see Chap.6).

Confirmation bias is where people tend to search for confirming rather than for disconfirming evidence with regard to their own previous assumptions. For example, if you think that eating chocolate makes you loose weight then a Google search "loose weight by eating chocolate" will confirm this if you ignore article to the contrary (see Chap. 5).

Representational bias in visualization involves constraints and salience. For example, a matrix representation is not good at showing network data (a constraint) but can highlight missing relationships in its table view (salience) (see Chap.10).

Overconfidence bias is where people tend to assess the accuracy of their answers or performance as greater than it actually is. There are many related cognitive biases such as illusion of control and planning fallacy (see Chap.9).

1.2 A Brief History of Cognitive Biases

Early research on decision-making was founded on the theory of rational choice, where a person carefully assess all the alternatives and if they make errors these would not be systematic. However, in the 1950s and 60s, experiments found that people are generally poor at applying even basic probability rules and often make suboptimal judgments when measured against an 'ideal' standard derived from Bayesian analysis. Even experts, such as physicians, were found to make biased judgments. Simon proposed bounded rationality, suggesting that humans are too limited in their data processing abilities to make truly rational decisions but employ simplifying heuristics or rules to cope with the limitations.

In the early 70s, Tversky and Kahneman developed this idea with their *heuristics-biases* program, with particular attention on judgments involving uncertainty. Systematic deviations from 'normative' behavior were referred to as cognitive biases and this was backed up by a series of experiments which illustrated 15 biases. Heuer also promoted the idea of cognitive bias errors being due to irrationality in human judgment with his work amongst intelligence analysts. Over the years many more cognitive biases were proposed, based mostly on laboratory experiments. However in the 80s, researchers began to question the notion that people are error prone and a lively debate has ensued over the years typified by the communication between Gigerenzer, and Kahneman and Tversky. One of the opposing arguments poses the question "Are humans really so bad at making decisions, especially where it involves uncertainty?". Gigerenzer suggests that the use of heuristics can in fact make accurate judgments rather than producing cognitive biases and describes such heuristics as "fast and frugal" (see Chap. 13).

It is suggested that the success of heuristics-biases program is partly due to the persuasive nature of the experimental scenarios, often in the laboratory, which can easily be imagined by the reader. However, many of the studies have clearly involved domain experts in the workplace. Another criticism of the heuristics-and-biases approach is the resultant long list of biases and heuristics, with no unifying concepts other than the methods used to discover them. So the focus of later work has been to propose decision making mechanisms rather than just looking for departures from normative (ideal) models. To this end, dual process models have been put forward, for example the two system theories of reasoning which feature System I: involuntary/rapid/rule-based +System 2: conscious/slower/reasoning decision making. Kahneman's book "Thinking, Fast and Slow" also adopts this dual process model and gives a very readable account of heuristic and biases.

Other developments include the *Swiss Army Knife* approach that proposes that there are discrete modules in the brain performing specific functions, and deviations occur when an inappropriate module is chosen or where no such module exists, so the next best one is used. Formalizing heuristics and modeling cognitive biases are other approaches to understanding what is going on in our heads when we make decisions. A useful discussion of the impact of Tversky and Kahnemans work can be found in [see footnote] But as research continues in this area, Norman provides a word of warning, especially in medical diagnosis, that there is bias in researching cognitive bias.

1.3 Impact of Biases

Not withstanding the debate amongst researchers as to the underlying cognitive processes, there is little doubt that in particular circumstances, systematic behavior patterns can lead to worse decisions. Making a poor decision when buying a car by overrating the opinion of a person you have recently met *(vividness bias*), is often not a major problem, but in other realms such as medical judgments and intelligence analysis, the implications can be

damaging. For instance, a number of reports and studies have implicated cognitive biases as having played a significant role in a number of highprofile intelligence failures (see Chap. 9). Although uncertainty is a factor, a person's lack of knowledge or expertise is not the overriding consideration. Cognitive biases such as overconfidence and confirmation are often associated with poor judgments among people in senior roles, as in a realistic study where all the twelve experienced intelligence analysts were led astray by confirmation bias, leaving only the inexperienced analyst with the correct answer.

In addition to Chap.9, which focuses on intelligence analysis, many of the chapters in this book describe the impact of various cognitive biases, especially in relation to interpreting visualizations or when using visualization tools. For instance, Chap.6 details the impact of familiarity related biases, especially with experts from the physical sciences and Chap. 10 discusses potential problems with representational biases when viewing visualizations. The case study described in Chap. 12 reveals the likelihood of numerous cognitive biases which can seriously affect decision making in a college admissions process. Chapters 3 and 4 discuss the notion that various aspects of computer systems, as well as humans, can also exhibit biases.

1.4 Cognitive Biases in Visualization

Interest in cognitive bias research has grown considerably at both the cognitive science level and also in relation to the visual analytics and decision-making tools that we build. The DECISIVe workshops have focused on two main issues related to visualization: (i) is the interpretation of visualizations subject to cognitive biases and (ii) can we adapt visualization tools to reduce the impact of cognitive biases?

1.4.1 Interpretation of Visualizations

There is evidence from peoples' susceptibility to optical illusions that systematic errors can occur due to simplifying heuristics, such as grouping graphic items together, as set out in the Gestalt principles. It has also been demonstrated that different visual representation of common abstract forms or appearance of the visualization itself can affect the interpretation of the data. In relation to the comprehension of images, Fendley discusses cognitive biases in detail and proposes a decision support system to mitigate a selection of biases. Ellis and Dix proposed that cognitive biases can occur in the process of viewing visualizations and present examples of situations where particular cognitive biases could affect the user's decision making. Recent studies into priming and anchoring, the curse of knowledge and the attraction effect demonstrate these cognitive bias effects when interpreting visualizations, but as their authors point out, much more work needs to be done in this area.

1.4.2 Visualization Tools

In visual analytics, user interaction plays a significant role in providing insightful visual representations of data. As such, people interact with the systems to steer and modify parameters of the visualization and the underlying analytical model. While such human-in-the-loop systems have proven advantages over automated approaches, there exists the potential that the innate biases of people could propagate through the analytic tools. However, if the system is able to monitor the actions of the user and their use of the data resources, then it may be possible to guide them and reduce the impact of particular cognitive biases. This requires ways to effectively detect and measure the occurrence of a range of cognitive biases in users. Work towards this is the subject of Chaps. 5, 7 and 9 in particular. Researchers point out that novel corrective actions, ideally tailored to the user, are then required.

1.5 Debiasing

Reducing the negative impact of cognitive biases is a challenge due to the inherent nature of biases and the indirect ways in which they must be observed. Early work generally focused on developing user training, typically scenario-based, in an attempt to mitigate the effect of a small number of cognitive biases. However, this approach has met with little convincing generalizable and lasting success. Research shows that even if users are made aware of a particular cognitive bias, they are often unwilling to accept that their decisions could be affected by it, which itself constitutes bias blind spot. Structured analytical techniques (SATs) (as discussed in [see footnote] , such as 'argument mapping' and Analysis of Competing Hypotheses (ACH) have been used in intelligence analysis to reduce the impact of cognitive biases. Few of these techniques have been evaluated in empirical studies, apart from ACH, which, for realistic complex problems, has proved unsatisfactory, often due to the time pressures (see Chap. 9).

There has been appreciable effort in the medical field to identify cognitive bias effects and reduce prevalent diagnostic errors with interventions (checklists) to increase clinicians knowledge, improve clinical reasoning and decision-making skills or assist clinicians with selected tools. According to Croskerry, progress is being made, but this is hindered by the general lack of education in critical thinking amongst clinicians.

Bias-Reducing Analytic Techniques (BRATS) are another way of investigating bias mitigation. They benefit from minimally intrusive cognitive interventions based on prior work on cognitive disfluency. While results were mixed, opportunities for further research show promise. Another method involves the application of serious games to improve critical thinking as in the MACBETH and HEURISTICA, games developed as part of IARPA's Sirius program.

A common challenge across all these methods is the difficulty to shape an individual's cognitive behavior. Therefore, research is shifting toward modifying and improving the decision environment (i.e. tools, etc.). Recent works investigate how visualizations can reduce base-rate bias in probabilistic reasoning. Other visualization research focuses on the cognitive biases that affect judgments under uncertainty: for example in finance, helping investors to overcome uncertainty aversion and diversification bias or loss aversion and conservatism; assisting Fantasy baseball experts to mitigate the regression bias in their predictions; or countering the anchoring and adjustment bias in decision support systems.

Researchers further propose frameworks, integrated into visual analytic systems, that provide support for mitigating some cognitive biases through measures such as the use of appropriate visualization types, uncertainty awareness, the use of statistical information and feedback from evidence-based reasoning. Other approaches attempt to "externalize the thinking" of the decision-maker or improve hypothesis generation, in this case to avoid confirmation bias.

1.6 Conclusion

Cognitive biases are still somewhat intriguing. How humans actually make decisions is still largely a mystery, but we do know that most of this goes on at an unconscious level. Indeed, neuroscience experiments suggest that human decisions for physical movement are made well before the person is consciously aware of them. From a survival of the species point of view, the evolutionary argument is compelling for very quick decisions and we often cannot say how we arrived at a particular judgement other than say it was a 'gut feeling'. The popular classification of cognitive biases as errors brought about by heuristics - the unconscious decision-making processes in the brain - is more a matter of academic than practical interest. The important point is that better decisions can be made if we are more aware of the circumstances in which cognitive biases can occur and devise ways of countering this unhelpful behaviour. Both of these factors, bias detection and mitigation, pose serious challenges to the research community, as apparent from the limited progress so far on both accounts. However, the DECISIVe workshops have stimulated research into dealing with cognitive biases in visualization, and I hope that readers of this book will find help and inspiration in its chapters.

Footnotes

[i]Fiedler K. von Sydow M (2015) Heuristics and biases: beyond Tversky and Kahnemans (1974) judgment under uncertainty. In: Cognitive psychology: Revisiting the classical studies, pp 146-161

[ii]Heuer RJ, Pherson RH (2010) Structured analytic techniques for intelligence analysis. Cq Press, Washington, D.O

Group Decision Making

A

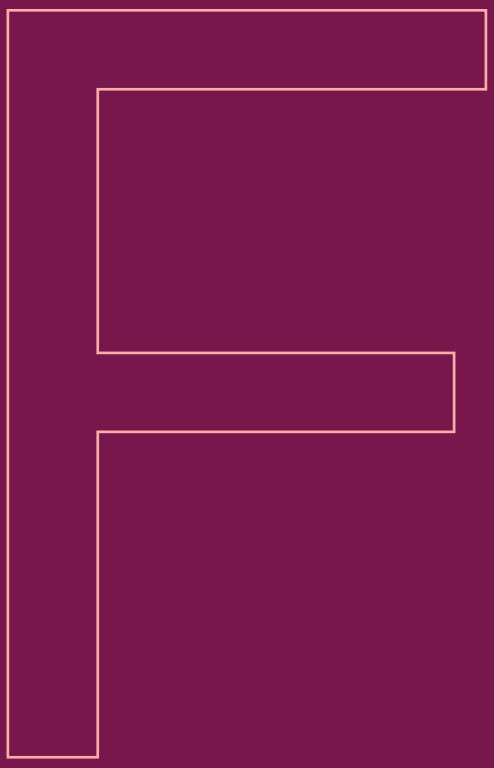
B

C

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Source: Kalkstein, Y. (2019). Group decision making: How to be effective and efficient. Retrieved from https://thedecisionlab.com/insights/business/group-decision-making-how-to-be-effective-and-efficient/

Undoubtedly, if you have ever read about group decision making, you have come across a concept known as "groupthink". The term "groupthink" was coined by Irving Janis in his 1972 book *Victims of Groupthink: A Psychological Study of Foreign-Policy Decisions and Fiascoes*. He used events in foreign policy to examine our tendency to arrive at less than ideal group decisions.

The main cause? A failure to think critically in a group setting is fueled by our desire to conform to a majority and our hesitation to reevaluate initially rejected solutions. Decisions, in this case, happen too quickly without proper analysis. The anecdote? Encourage every member to critically evaluate and voice concerns, encourage dissension, and as a leader, remain humble and open to criticism.

Yet, as many higher education professionals can surely attest to, I have also witnessed the other challenge in group decision making. In academia, engaging in critical dissent is encouraged (reviewed by Jetten & Hornsey, 2014), and while this is a fine attribute, practically, this can mean that we sometimes spend so much time expressing our thoughts, opinions, and concerns trying to reach consensus and we somehow never arrive at decisions in a timely manner.

Groups can thus hinder the ability to make decisions efficiently and effectively. But the reality is, we are often working in groups in today's world. Interestingly, the research suggests that as employees, our time in meetings has increased over the years, and that ineffective meetings are associated with reduced wellbeing (Rogelberg et al., 2006). In other words, in 2019, we are spending more time in meetings that we used to, and ineffective meetings can make us miserable at work and waste our time.

So, how can we balance both the desire to avoid groupthink, but also a desire for effective group decision-making in meetings?

Here a few principles that may help:

1. What is the point of this meeting?

I recently went to a meeting where we debated the food menu for an event. Was my opinion really needed? Truth be told, you put ten professors in a room and debate what napkins to use, and that could take an hour. Not every decision requires a meeting. Figure out first why you need a meeting. Is this meeting to brainstorm, is it to narrow down options, to share data, or to create a solution? Are you looking for advice? Feedback? Or a group decision? Make these expectations clear to those attending.

For example, let's say you *do* want to figure out what color napkins to use at the event. Maybe you, as the leader, remain the decision-maker and you say "I'm looking for your thoughts on

napkin color". Allow everyone to talk and respect all answers. And then say "thank you for your feedback. I will take it under advisement."

If alternatively, you would like to decide collectively on the napkin color, you could see if you can arrive at a consensus, and if not, narrow choices down and vote.

2. What is the problem?

To make decisions as a group, the problems must first be clarified. In a meeting focused on problem-solving, be sure to agree on a definition of the problem before talking about potential solutions (Rogel-berg, Scott, & Kello, 2007).

For example, "People have formally complained in the past that our napkin colors drastically detract from the event. Therefore, we are meeting to determine how to improve this situation."

3. Avoid groupthink.

Groupthink suppresses dissent. One area where the importance of dissent has been highlighted is in healthcare, a field where interpersonal communication has been labeled as the cause for over 60% of medical errors and 12 billion dollars wasted in U.S. hospitals (Agarwal, Sands, Díaz, Schneider & Smaltz, 2010). Maxfield, Grenny, McMillan, Patterson, and Switzler (2005) reported that less than 1 in 10 healthcare providers spoke up when they saw something potentially harmful. Why did both the majority of physicians and nurses not speak up when they witness incompetence? Maxfield et al. (2005) reported the following prototypical responses: "There wasn't a time or opportunity," "It's not my role," "I've seen them get angry," and "I thought they would retaliate."

As a leader, in any organization, how do we avoid a tendency for others not to speak up? Make sure everyone is heard. Allow the time without repercussions for dissent. Ask open-ended questions that encourage critical thinking such as, "what would be the downsides of Option X that Dr. Michael just suggested?" "Are there any implications we haven't thought of if we switch napkin color?" "Are there any other possibilities we could consider?" "Can anyone play devil's advocate for a moment on this issue?" and finally "Does everyone feel comfortable if we move in this direction?"

And here's some good news–encouraging participation in a meeting is significantly and positively correlated with both attendee satisfaction and attendee perception of meeting productivity (Malouff, Calic, McGrory, Murrell & Schutte, 2012)

4. Have a leader who leads.

While everyone should feel comfortable talking, someone must lead. Too often I have watched meetings end with "okay, well...we are out of time, so let's continue this next time." Or "let's chew on this" or "let's table this" or "well, there's a lot here, so....." (the sentence doesn't even get completed as they look to the others for a direction).

A leader needs to watch the time and not waste the point of the meeting. Satisfaction with a meeting and perception of meeting productivity are significantly and positively related to leaders being able to move a meeting along and encourage decision making (Malouff et al., 2012).

Leave time to review accomplishments and make a decision. The decisions might be "we need more information, so Dr. Kay and Dr. Hu have agreed to send us the reports" or "let's make a draft based on our ideas to review for next meeting" or "Jamie will take care of X while Morgan will do Y" or even "now that we have considered the consequences of using napkins, let's focus on entirely new ideas like personal air dryers". One way or the other, be proactive at the end of a meeting. Summarize the accomplishments or views, make decisions, and delegate tasks clearly. In one study, leaders taking the time to summarize decisions led to greater participant satisfaction and perception of meeting effectiveness (Malouff et al., 2012).

Group decision-making, when poorly led, can amplify individual decision-making mistakes. In other words, we can become *stupider* in groups. On the other hand, if a leader wisely leads by creating an environment where different perspectives are heard and valued, a group can become wiser than any of its individuals (Sunstein & Hastie, 2015). The individual must understand their role is to add new information, and not to please anyone. The leader must understand that their role is to create an environment where problems are clarified, dissent is valued, and tasks and future directions are clearly distributed.

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