1 An Evolving Decision-Making Paradigm

Books, and the ideas they contain, are products of their time. As an author, it is easy to believe you are writing enduring truths for posterity. But the piece you have written, like the banana you buy at the supermarket, has a limited shelf life. Today's enduring truth is tomorrow's quaint whimsy.

You would think that a book about decision making would be enduring, since it is dealing with a timeless topic: making choices from among alternatives. Clearly, after decades of refining decision-making processes and tools, the experts have figured it out, right? Here is how it works. In making choices, smart decision-makers gather pertinent information, use this information to assess different alternatives, rank the alternatives according to their appeal, then select the alternative that rises to the top of the list. This is the refrain that decision-making books and courses preach to us. Isn't this how smart decisions are made? In this book, the answer is: "Sometimes yes, and sometimes no."

Like all other books, this one is a product of its time. It has emerged from reflections on a three-decade string of ever-growing economic disturbances, culminating in the economic crisis of 2008–2009. Yet it is not an economics or finance book. It is a book about decision making written for individuals who face choices and must decide what to do. The choices they address may entail Big Decisions—the kinds of choices department heads, chief financial and chief executive officers, and government leaders make. Or they may entail smaller decisions that managers and employees routinely face in their jobs: selecting a project, reconfiguring business operations, or hiring a new employee.

What is the link between the recent economic turmoil and the focus of this book? Answer: The economic crises we have been facing arose because a lot of people made a lot of truly awful decisions. Consider the 2008–2009 economic and financial meltdown that nearly plunged the world economy into an economic depression to rival the Great Depression of the 1930s.

Highly educated people in high-impact positions made bad decisions. Sadly for Alan Greenspan, chairman of the Federal Reserve from 1987 to 2006, this will likely be his enduring legacy.

Political power brokers made bad decisions. Beginning with Jimmy Carter in 1977 and Ronald Reagan in 1981, national political leaders were tripping over themselves to dismantle the federal government and its regulatory infrastructure in order to unleash markets to work their magic. As a result, government's regulatory efficacy dropped substantially. It is clear in retrospect that inadequate regulatory oversight contributed strongly to the economic crisis.

Business leaders made bad decisions. Taking advantage of deregulation, bankers, insurers, and Wall Street technocrats put aside their fiduciary responsibilities and began looking more like weekend gamblers in Las Vegas than guardians of depositors' and investors' funds.

And large segments of the general public made bad decisions: given a choice between saving money and spending it, they elected to spend. With an abundance of cheap debt, savings never had a chance. Personal savings plunged and debt skyrocketed.

The prevalence of bad decisions has been so substantial that thoughtful people must ask: What's going on here? Given unprecedented access to data, the existence of highly sophisticated decision support systems, steady methodological advances in the decision sciences, and guidance from highly experienced experts, how could we get things so wrong?

The economic crisis of 2008–2009 was a transformational event. It demonstrated that smart people aren't as smart as they and the public think. The elaborate economic and financial models developed with input from Nobel laureates didn't work as advertised. The long-held assumption that people make rational choices for the most part was debunked. Confidence in the value of the bell-shaped curve as a predictive tool was overshadowed by worries about fat tails and black swans—low-probability events that have devastating consequences.

Faith in free market capitalism was greatly shaken, and people turned to government as savior (a disturbing prospect to many).

The decision-making implications of the economic crisis of 2008–2009 go beyond decision making in business and public policy. They pertain to the full range of decisions people make, from the small to the grand, from social to technical. They bear as much on engineers deciding what design to implement for a technical product as on senior business managers deciding how to allocate their investment budget. Although the economic crisis of 2008–2009 highlighted decision-making inadequacies within a narrow band of economic activity, its lessons are far-reaching.

Transformational events cause people to rethink their assumptions about how things work. Thomas Kuhn wrote about transformational events in science in his classic book, *The Structure of Scientific Revolutions* (1996). He referred to them as *paradigm shifts*, where the old framework governing a world outlook is supplanted by a new one. In view of the contribution of bad decisions to the crisis of 2008–2009, now is a good time to reflect on the inadequacies of the traditional decision-making paradigm.

THE TRADITIONAL PARADIGM

In academia, the decision-making discipline goes under various titles: *decision science, management science*, and *operations research* are frequently used terms. For the most part, it focuses on quantitative techniques to help people make choices from among various alternatives. This orientation is captured in the articulated goal of the journal *Decision Sciences*: "*Decision Sciences* . . . is a quarterly, professional journal that uses the latest computer technology, mathematical and statistical techniques, and behavioral science." The awkward inclusion of ". . . and behavioral science" sounds like an afterthought, and probably it is. The journal's principal focus is on quantitative methods.

Many of these techniques are geared toward prioritizing alternatives, where the most attractive alternatives go to the top of the list and the least attractive drop to the bottom. They are covered by a plethora of names, including *multiattribute decision modeling, benefit-cost analysis,* and *analytical hierarchy process.*

The techniques associated with classical operations research deal with constrained optimization. They address questions such as: "In producing a given level of manufactured goods, what is the best arrangement of people, equipment, and materials to minimize costs?" Other techniques concentrate on generating data to help in decision making. For example, forecasting tools project future states of affairs based on past history and assumptions about evolving conditions. Their crystal ball glimpses of the future help decision-makers make informed choices today. Still other techniques simulate alternative outcomes associated with different actions: if you increase spending, the economy will go one way; if you decrease it, it will go another.

The traditional paradigm sees effective decision making as grounded in the employment of rigorous decision-making techniques. Students taking decision-making courses in universities spend much of their time studying a bevy of quantitative methods. I have firsthand experience of this because I have been teaching decision-making subjects at universities for some thirty years.

The old paradigm also views good decision making as a rational process. It holds that one way to demarcate good from bad decision making is to determine how logical and objective the decision-making process is. Good decisions require logic and objectivity. Although there is no guarantee that logic and objectivity will yield desired results owing to a range of uncontrollable factors, they are seen to be a necessary condition for establishing good decisions. Whimsical decisions rooted in emotion generally yield bad results. If satisfactory outcomes emerge from whimsy and emotion, it is by accident.

Economists capture the ideal of the rational decision-maker in their construct of *Homo economicus*, economic man. Adam Smith's invisible hand was built on the premise that individual decision-makers in the market operate on the basis of self-interest in a competitive environment. The combination of self-interest and competition ultimately yields efficient market behavior. As economists such as France's Leon Walras, England's Francis Edgeworth, and Italy's Vilfredo Pareto began employing rigorous mathematical economic models at the end of the nineteenth century, *Homo economicus* came to play a central role in economic theory. In its most robust embodiment, *Homo economicus* pictures economic decision-makers as rational players who possess perfect information to make decisions that maximize utility.

THE REAL WORLD

This book disputes three premises of the traditional paradigm. First, it takes a skeptical view of the idea that good decision making is rooted in the systematic process articulated at the outset of this chapter: gather information pertinent to the decision, use this information to assess alternatives, and so on. This is the abstract framework underlying most decision-making books and courses. It has commonsense appeal, but it places too much emphasis on employing a detached logical process, thereby addressing only a slice of what effective decision making really entails. A review of the academically oriented decision-making books published in the past three decades shows that in striving to promote objectivity, few make more than passing reference to the human and social elements of decision making, including biological constraints, and fewer still address important epistemological and metaphysical issues concerning the nature and value of the knowledge we gather for decision making and the limits of the models we use.

Second, this book rejects the idea that mastery of key techniques lies at the heart of effective decision making. The heavy emphasis on employing decision-making techniques distracts decision-makers from the real issues. At best, it can waste the time of countless men and women who spend incalculable hours studying diligently to become good decision-makers. How many great decisions owe their success to mastery of integer programming? For that matter, how many small decisions do? In spite of the fact that the value of integer programming is questionable for 99 percent of decision-makers, it is regularly taught in basic quantitative decision-making courses. And what holds for integer programming holds true for most of the other quantitative techniques that comprise the core of decision-making books and courses.

At worst, this emphasis puts the decision-making effort onto the wrong track. The old adage stands true here: to the four-year-old boy with a hammer, the world is a nail. When decision-makers define the decision-making process as centered on identifying the right tools, the decision-making effort has gone astray.

Third, this book rejects the assumption of rationality. On this point, it has plenty of good company. In 1957, Herbert Simon (1997) developed the concept of bounded rationality to challenge the notion that *Homo economicus* reflects real-world decision-makers. His well-known concept of satisficing avers that when searching for solutions, real-world decision-makers typically stop the search

when they come across solutions that are good enough; in other words, they aren't looking for optimal solutions. In the 1970s, two psychologists, Amos Tversky and Daniel Kahneman (1974), began conducting psychological experiments that tested the rationality of decision-makers. They became preeminent figures in what was dubbed behavioral economics. Not surprisingly, they found that real-world decision making is seldom a rational process, something that just about everybody but economists recognized. Simon and Kahneman received Nobel Prizes in economics for their work in 1978 and 2002, respectively.

In this book, I go further than Simon and the behavioral economists in questioning the rational basis of decision making. For his part, Simon did not devote much attention to how people really make decisions. His principal concern was to identify the impact of satisficing behaviors on economic modeling. Kahneman and Tversky present a different story. Being psychologists, they were seriously interested in the behavioral component of decision making, but they were not wide-ranging in their investigations. They focused on how decision-makers in a laboratory setting rely on decision-making heuristics and are often unable to assay risk properly. Their experimental subjects were often undergraduate students at elite universities, a disturbing fact that has implications for the external validity of their findings. (How representative are the decision-making capabilities of inexperienced though conscientious nineteen-year-old with IQs typically greater than 120?)

Kahneman and Tversky's mission was to surface and understand the nonrational aspects of human decision making in order to help people function more rationally. Their approach was hardly revolutionary. They supported the existing paradigm by extending its coverage to nonrational behavior. An underlying premise of their research is, "If people have better information, they will use it to make better decisions." Although this assertion holds true in many cases, this book argues that it does not hold true in many others—which brings us back to the economic churning of the past two or three decades. A careful examination of events in business during this time makes it clear that the damaging decisions that business leaders and government policymakers made were driven largely by forces that economists in general—including behavioral economists—have ignored, and these include forces of pride, ideology, greed, and corruption, forces that hide incompetence and promote self-dealing and disloyalty.

Interestingly, this view closely echoes the views articulated a century ago by the American economist Thorstein Veblen (2007). Veblen had a front-row seat in the economic and social drama that starred the rapacious robber barons of American industry. To him, the free market was not a finely tuned watch that miraculously yielded optimal results; rather, it was a back-alley dog-fighting pit that favored opportunistic and merciless curs. Veblen would not be surprised by how events have unfolded in recent years.

This book investigates the moral dimension of decision making. It embraces the perspective articulated by Nobel laureate Paul Krugman (2009). When looking at the many finance debacles of recent years, Krugman identifies moral hazard as a major contributor to disasters and near-disasters. Here is the essence of moral hazard: financial decision-makers assume enormous risks, knowing that if their investments go sour, government will save the day. When their risks pay off, they generate substantial wealth for themselves and their clients; when they don't, the public foots the bill. Heads I win, tails you lose. Moral hazard is a subset of the larger issue of the principal-agent problem, where you find that people hired to do a job (agents) pursue their personal interests at the expense of the interests of their clients (principals). The principal-agent problem goes a long way in explaining why decisions in organizations go awry, and I discuss it in detail later in this book.

This book explores a host of additional factors that are embedded in real-world decision making. Included here are the competence and commitment of the players, the constraints of legacy, the reality of asymmetric access to information, the influence of politics, the pervasiveness of culture—and the ever-present temptations of greed.

The bottom line is that something that is usually viewed as invariant—the basic process of making choices—has undergone significant change. The economic crises we have encountered since the 1980s support this view. Advances in computers, communications, economic and financial theory, and decision-making techniques, coupled with extraordinary access to information through the Internet, fooled us into believing that we were on the road to achieving mastery over the decision-making process. Although we did not expect to hit the target all the time owing to uncontrolled uncertainties, we should usually get things right with due diligence and the application of disciplined methodology.

The precipitous fall into an economic abyss in 2008–2009 woke us from our dream world. What an ugly awakening! We now see that the decision-making premises we had been following since World War II were questionable. What is especially frightening is the realization that high-impact decision making is not a clean, rational undertaking, as advertised by the conventional wisdom, but is buffeted by nonrational elements, including moral failings, greed, outright corruption, stupidity, politics, black swans, human whimsy, failed models, hubris, and acts of God.

RETHINKING DECISION MAKING

As we rethink decision making, our attention should focus on two realities. First, it is important to recognize that decision making is a social activity. It is rooted in people and should not be approached as an objective process detached from human factors. People have personal perspectives and agendas and possess dramatic variations in capabilities. Quite often a decision is made by one set of people, executed by another set, is beneficial to yet another set, and is resisted by still another set. The constituent members of each set of people vary in their levels of competence, commitment to a solution, knowledge of the facts, moral outlook, and opinions about how given decisions should be handled. Decisions that are reached reflect the interplay of these people. The idea of attaining objective decisions that remove human subjectivity from the equation is silly. Making decisions outside a social context can yield unpleasant surprises and curve balls.

Second, decision-makers must recognize that decisions are the end product of wrestling with constraints: constraints of knowledge, time, resources, skills, political forces, legacy, laws of nature, human laws, ethics, personalities, and more. Effective decision making requires decision-makers to surface these constraints and figure out how to craft workable decisions that accommodate them. More often than not, they find themselves fitting square pegs into round holes. The common wisdom holds: "You can't fit square pegs into round holes." Actually, you can—if you possess a sharp pocket knife and good whittling skills. In real-world decision making, people fit square pegs into round holes all the time. Certainly this can lead to bad decisions, but sometimes decision-makers have little choice and the results of the whittling yield good-enough decisions.

Just about everyone agrees that constraints can color decisions. Even strong adherents of objective decision making grudgingly agree with this. However, the constraints are often treated as nuisances that distract from the real decision-making effort. The view taken in this book is that these constraints are central to the decision-making process, not secondary forces. Rather than distract from real decision making, they often drive it. They should be examined carefully and should not be brushed aside.

Social Context

When decision making is viewed as a social activity, it is clear that to understand it, you need to comprehend its human context. For example, people make decisions to achieve both selfish and altruistic ends. Or a decision may be wise, but the people implementing it foolish and incompetent. Or a decision may be foolish, putting wise people into the difficult position of trying to make it work. In articulating needs, some people may be insightful and clear thinking, so that they capture needs effectively; others may be dull and generally clueless, promoting nonsense needs.

To make this point concrete, consider a hypothetical example. When a publicly traded company shuts down a factory, the decision to do so incorporates inputs from a broad array of people, including senior executives, members of the board of directors, labor union leaders, consultants, plant managers, market analysts (if the decision will have an impact on stock price), and possibly political leaders in the affected community. The decision will have an impact on many people, including employees (who stand to lose their jobs), shareholders (who can expect either a rise or fall of stock price), vendors (who may experience lost business), local political leaders (who may face loss of employment in their districts), and the public (whose negative views may harm the company's reputation). Each of these players constitutes a stakeholder group in the decision process. Each stakeholder group will have a different perspective on the question of shutting down the factory, and those most heavily affected by the decision may strive mightily to influence the outcome of the decision process. As Miles's law perceptively observes, "Where you stand depends on where you sit" (Miles, 1978).

When considering stakeholder views, we often unconsciously hold that the constituent members of each stakeholder group possess a monolithic perspective.

We say things like, "This is what the public wants," or "This is the implementers' interpretation of the requirements," or "Senior management has determined that this is what needs to happen." In reality, the perspectives of individual stakeholder members vary. Consider the principal decision-makers. In getting to a final decision, members of this group will argue diverse views on what should be done. Once the decision is made, there will be varying degrees of agreement with and support for it. Even after a decision has been made, it may be misleading to offer a blanket statement suggesting that the decision-makers agree on the outcome. Some may; some may not. There will be differing degrees of agreement among those who support the outcome. Some decision-makers might be so hostile to the outcome that they strive to nullify it—if not now, then later. Of course, this hostile response might be offset by fervent champions of the decision who will do all they can to make sure it is carried out properly—at any cost.

The motivations underlying their positions vary. Some will be heavily influenced by selfish concerns; for example, if a decision leads to a drop in stock price, their personal wealth will also drop. Others will function altruistically, supporting a position that will strengthen the long-term health of the organization even if it yields short-term pain. Still others will strike a position reflecting their whimsical preferences of the moment.

Consider also the people charged with executing the decision. They are usually a different set of people from the decision-makers, and they too are not a monolithic body. When they are commanded to implement the decision, some may disagree with it, in which case their commitment to doing a good job is questionable. Their degrees of competence will vary: the highly competent will help deliver the desired solution effectively, while the incompetent will thwart its achievement—not through evil intent, but through incompetence. Their interpretation of the terms of the decision may not match the intended requirements of the decision-maker. This happens all the time. It is rooted in communication failure. The decision-makers say, "Do X." The implementers hear, "Do Y." In this case, the actions carried out to implement a decision do not reflect the intent of the formulated decision.

The point is that decision making is rooted in people who have diverse values and capabilities that affect the choices they make. Even when there is a sole decision-maker and the decision entails narrow technical choices, it occurs in a

social context. The social aspect of decision making should not be considered an afterthought, something to be looked at once data have been collected and prioritization tools identified. It is in fact the launching point for crafting good decisions.

Constraints

In addressing the constraints decision-makers face, this book adopts a Stoic perspective. Stoicism as a philosophy emerged in Greece in the third century B.C.E. However, its most influential proponent was a freed Roman slave named Epictetus, born circa 50 C.E. Like Socrates, Epictetus never wrote down his ideas. However, one of his students, Arrian, took extensive notes of his discourses and compiled them in the *Enchiridion.* Our knowledge of Epictetus's teachings comes from the *Enchiridion* (Epictetus, 1991).

The principal Stoic lesson arises from a statement that appears early in the *Enchiridion*, where Epictetus notes: "In life, there are things you control, and things you do not control. Focus on the things you control." Sancho Panza showed Stoic proclivities when he cautioned Don Quixote, "Don't tilt against windmills."

To most people, the term *stoic* is associated with the ability to face adversity with a stiff upper lip. Stoics are seen to be people who accept tribulations without complaint. This interpretation, however, does not actually reflect the Stoic perspective. The interpretation arose because Stoics did not express strong grief when family or friends died. Their phlegmatic bearing was not tied to a stay-tough attitude but reflected their view that death was something over which they had no control. Since death is inevitable and uncontrollable, it doesn't make sense to wallow in grief when you lose a loved one.

This perspective has a bearing on decision making. Decisions are crafted in a context of limits. Limits constrain action. Decision-makers are like the artist who is given a No. 10 sable hair paint brush and a palette containing one color, prussian blue: there is only so much he can do with these materials. Effective decision making requires people to understand the limits constraining them.

The following sections consider some important limits.

Limited Information. This is a favorite topic among decision-making experts and is covered in many decision-making books. It has a name: *decision making*

with uncertainty. In the effort of trying to make a decision, a universal frustration facing decision-makers is the absence of crucial information on how things now stand, as well as on the consequences associated with pursuing different decision-making alternatives. For example, when thinking about developing a new product that will entail a substantial investment, senior managers may be thwarted from making an informed judgment because they lack information on the product development challenges they will face, the array of competing products that will be in the market at the time the new product is rolled out, and the future state of the economy. Conventional decision-making perspectives deal with risk and uncertainty by factoring probabilities into the decision-making process.

Limited Capabilities. A decision is no better than the capacity of people to implement it. What's the point of deciding to make an omelet if you don't have eggs, or to enter a singing contest if you are tone deaf? There is often a gap between an ideal image of how a decision will be implemented and reality. While decision X may in theory appear to be a great one, in practice it will be flawed if no one is able to implement it effectively.

Limited Commitment. Everything that pertains to limited capabilities pertains equally to commitment. If the people responsible for executing a decision have little commitment to implementing it aggressively, it is unlikely that the decision will be actionable. Commitment can be low for various reasons. As a general rule, people who are consistently indifferent to their job responsibilities are not likely to be diligent in fulfilling requirements to implement any decision. Those who are hostile to the decision may implement it grudgingly or may actually work to sabotage it. Those who are normally diligent in doing their jobs may be so overwhelmed with other chores that they do not have the time to do what needs to be done. When commitment to implement a decision is low, the fate of the decision is jeopardized.

Limited Imagination. When making decisions, decision-makers must be able to envision a wide range of scenarios, addressing a variety of questions such as these: What great things can we do? What are our adversaries doing? What crazy alternatives can we visualize, and what are their likely consequences? When we face

difficult challenges, what creative approaches can we take to execute our decisions? The answers to these and other pertinent questions will vary dramatically from person to person and group to group. Individuals and groups blessed with a rich imagination will likely generate superior decisions to those who possess limited imaginations.

Legacy-Rooted Limitations. Sometimes decision-makers find themselves in the position of mastodons trapped in a tar pit: they have a good sense of what actions they should take, but they are unable to shake free of the sticky strands of legacy that bog them down. Legacy can constrain decision making in many ways. The best known is revealed in the statement: "We've never done things this way before." This outlook forces people to follow deeply rutted paths that have been traveled many times. Legacy also may be rooted in operating rules that are obsolete, sales commission regimes that distort behavior, peer pressure that discourages risk taking, and so on. In one of the most insightful management books written in recent years, *The Innovator's Dilemma* (1997), Clayton Christensen points out that a company's customers may be the primary culprits killing initiatives that promote innovation. This is a fascinating finding in view of the universal mantra offered at business schools: "Always listen to your customer." It suggests that listening to your customer too attentively can lead to your demise. The important point here is that legacy can prevent people from deciding what needs to be decided.

Psychological Limitations. History and literature are filled with stories of people whose downfall was rooted in psychological limitations. Hitler's megalomania caused him to deny the possibility of a Normandy landing by the allies. Digital Equipment Corporation's downfall was rooted in its prideful CEO's refusal to pursue what he perceived to be the second-rate technology of personal computers. Psychologically unable to bite the bullet to deal with the Nazi threat, Neville Chamberlain's appeasement policies provided Hitler the time he needed to strengthen Germany's military might. In *Crime and Punishment*, Raskolnikov's obsession with the theory of the extraordinary man leads him to believe he can commit murder without consequence. What holds true for these specific examples applies universally in the arena of decision making. People are a product of

their psychological makeup, which limits the range of actions they are capable of envisioning and pursuing.

Biological Limitations. Ultimately all decisions trace back to electrical and chemical activity that occurs within a sponge-like organ that resides inside the skulls of humans. In the final analysis, how people perceive and respond to events is determined by the way their brain functions. The brain is the most complex thing we are aware of, and we have only a rudimentary grasp of how it works. Thanks to the brain's filtering activity, no two people perceive reality in exactly the same way. This means that even the clearest facts are subject to multiple interpretations, which has big implications for decision making.

Limited Time. Decision-makers rarely have the time they need to be thorough in reaching decisions. This situation arises for a number of reasons. For example, they often do not have enough time to collect the information needed to make an informed decision. Or if they are unable to achieve quick consensus on a decision, they may find deliberations extended indefinitely. Or if they are required to make spot decisions, they need to respond instantly, in which case there is no option to spend time reviewing alternatives carefully.

Moral Limitations. Decisions are colored by values, which vary substantially among cultures, and within a culture they vary from individual to individual. Historically, values and their moral implications have not been consciously addressed in traditional decision-making theory and practice, where it has been assumed that people obey the law and generally behave in accordance with accepted moral practice. Of course, decision scientists recognize that moral shortcomings exist in humans, but these have not been viewed as central determinants of how decisions are made and consequently have not been incorporated into decision-making theory and practice. I confess that in most of my thirty years of teaching decision making, I stuck with the party line and treated decision making as morally neutral. Today, I believe this is a naive perspective. It took the likes of Michael Milken, Ivan Boesky, Nick Leeson, Bernie Madoff, the traders at AIG's Financial Products division, and countless men and women selling subprime loans to unqualified buyers to wake me to the real impact of moral factors on

decision making. These individuals are the big players. Their questionable moral practices that have been carried out on a grand scale also exist on a microlevel among people making everyday decisions.

Limits Rooted in the Power and Political Actions of the Players. In some cases, the most significant limit constraining decision making is tied to the power status and political actions of key players. When Joseph Stalin said, "This is my decision," the search for optimal alternatives would stop. In this scenario, the decision-making process was easy: implement whatever decision Stalin dictated. When power issues are more complex, entailing two or more players, and entail influencing decisions through political action, the decision-making process becomes more difficult. However, as the players jockey to gain advantage, there is an opportunity to see to it that decision making accommodates merit as a decision criterion.

Limits Imposed by External Forces. Some constraints lie completely out of the control of decision-makers—for example, economic downturns, actions of competitors, the sudden rise and fall of new fads, force majeure (hurricanes, fires, tsunamis, and so forth), and government regulations. In the risk management arena, various strategies are employed to deal with these external sources of risk, including establishing contingency reserves (a risk-acceptance strategy), making decisions that steer you away from potentially bad events (a risk-avoidance strategy), and purchasing insurance and entering into contracts (risk-transfer strategies).

THE COGNITIVE CHALLENGE

The biggest limit of all is the cognitive limit: that is, the limit of what humans are capable of knowing. Because it is pervasive and governs all aspects of human perception, I am treating it separately from the other constraints.

The cognitive limit has two components. One is the limit of what we can know imposed on us by the structure and operation of the brain. Every sensation we experience is intermediated by the brain. Every idea we hold is a product of the brain's interpretation of the data it processes: 1,400 grams of wet meat, 100

billion neurons, trillions of neuronal pathways, 11.2 million bits of information processed per second! The role of the brain in decision making is becoming a hot topic, thanks in large measure to advances in technology that enable scientists to track brain activity, particularly fMRI (functional magnetic resonance imaging) technology. One of the most significant findings of recent brain studies is recognition that in its search for efficiency, the brain is constantly taking shortcuts to conserve energy. For example, when it experiences an event, it stores the experience in a virtual storage bin of reusable templates that define human perceptions of future experiences. What you see is not what you get—literally. What you see is the brain's best guess of what you are actually experiencing. This book dedicates two chapters to covering the emerging area of the biology of decision making.

The second component is philosophical, falling in the domains of epistemology and ontology. Epistemology is concerned with how we acquire, interpret, and disseminate knowledge. Ontology is concerned with what is real. What this second component addresses is the notion that facts are determined contextually—they are not objective truths—and do not speak for themselves. There is only so much humans can know.

ADJUSTING TO THE NEW PARADIGM

In *The Structure of Scientific Revolutions* (1996), Thomas Kuhn notes that paradigm shifts occur when the prevailing paradigm is unable to resolve troubling puzzles. For example, in the late nineteenth century, James Clerk Maxwell developed four equations that together constituted a comprehensive theory of electrodynamics. These equations treated light as an electromagnetic wave and became the mainstay of beliefs regarding electromagnetic phenomena. However, in examining what was called the photoelectric effect, where certain metals emit electrons when exposed to light, Einstein discovered that Maxwell's equations did not work. In 1905, he argued convincingly that light possessed the properties of particles, which he called photons and whose name was ultimately changed to quanta. He won the 1921 Nobel Prize for this insight (not for his theory of relativity). Thus began the quantum physics revolution that overturned the classical treatment of electromagnetic phenomena and opened the door to explaining how atoms work.

When paradigm shifts occur, the old paradigm often is not jettisoned in its entirety, though there are well-known cases where this has happened (for example, the rejection of the Ptolemaic view of an earth-centric solar system, phlogiston theory explaining how things ignite, and the concept of a pervasive ether through which electromagnetic waves travel). In its time, the old paradigm was successful because it supported workable predictions of phenomena. To the extent that components of the old paradigm still allow successful predictions, they are kept. For example, Einstein's general theory of relativity demonstrates that gravity does not really exist as a force; what appears to be the mutual attraction of objects is caused by the curvature of space-time, not a force of gravity. However, scientists continue to use equations based on Newton's theory of gravity because they work nicely for most of the phenomena we encounter. However, they cease to work effectively when dealing with super-massive and very small objects or when dealing with objects traveling at near light speed.

In this book, I maintain that we are undergoing a paradigm shift in our approach to decision making. The economic collapse of 2008–2009 cannot be adequately explained by the traditional paradigm's argument that people make bad decisions owing to uncertainty and imperfect information. Many of the players who contributed to the crisis knew exactly what they were doing. A better explanation is that owing to a host of social and moral factors, including deregulation, moral hazard, greed, hubris, and the principal-agent problem, key players in society made self-serving decisions that undermined good economic principles. This interpretation is in line with the emerging paradigm showcased in this book.

Having said this, I believe that much of the old paradigm has value, but its purview needs to be broadened. Despite my criticism of the premises of traditional approaches to decision making, I do not propose to throw out the baby with the bathwater. My principal criticism of the traditional decision-making perspective is that in its pursuit of the employment of quantitative tools and its single-minded drive to promote models based on rational behavior, it is too narrowly focused. It does not effectively deal with decision-making constraints and understates the social dimension of decision making.

Nonetheless, many of its techniques are valuable when dealing with structured, well-defined situations. Any operation built on well-defined processes can benefit mightily from the implementation of decision science tools. Manufacturing and

logistics stand out here. In manufacturing, it is impossible to conceive of a profitable player being able to maintain profitability without using standard decision science tools such as linear programming. In logistics, we see that the miraculous growth of FedEx was tied to the employment of advanced algorithms that worked out the most efficient route to get package X from Selma, Alabama, to Fort Wayne, Indiana.

For example, regardless of its underlying premises, decision making entails prioritization among alternatives, and the traditional prioritization techniques are useful. Similarly, decisions are made under conditions of uncertainty, and many traditional insights regarding uncertainty are helpful.

CONCLUSION: IT ISN'T EASY GETTING IT RIGHT

From January 2008 through midsummer 2008, crude oil prices increased by nearly 50 percent. I initially watched the price rise with curiosity, and then with alarm. At the outset of the year, the price was steady and below $100 per barrel, which was hardly a bargain considering that crude was selling in the range of $60 per barrel one year earlier. In February, the price of crude broke through the $100 per barrel mark. Then it rose steadily and peaked at $145 per barrel in July, by far the highest price in history.

As the price climbed to unprecedented levels, I expected this to be headline news in newspapers and on television broadcasts, particularly in view of the fact that this oil shock was occurring at the same time frightening stories were surfacing about horrific problems with subprime loans. Instead, while the record oil prices were nonchalantly reported as records, most commentary focused on the impacts of the price hikes on the summer driving habits of Americans! Here we faced the most massive and speediest transfer of wealth in the history of the world, chiefly from industrialized countries to oil-producing countries, and the American press and public were worried about what it would cost to run behemoth SUVs during the summer vacation.

There was something unreal about all of this.

Two months after crude oil prices peaked, the fourth largest investment bank in the United States, Lehman Brothers, went bankrupt, an event that helped trigger the onset of the world's worst recession since the Great Depression.

Fast-forward one month after the collapse of Lehman Brothers. In October 2008, I facilitated a one-week off-site executive training program directed at upper-level managers being groomed to run a large shipping company. The managers were bright young men and women from Europe, North Africa, Asia, and the United States. Some of them were destined to be the leaders of their substantial shipping enterprise. This was a high-status, high-impact management development program. The participants were smart, dedicated people who were willing to work sixty-hour weeks year after year in order to serve their company.

During the week, participants steadily produced presentations describing their perception of the greatest challenge their company faced: managing success. Participant after participant provided trend data on the growth of their business in this port and that, and talked about the challenges of managing this growth effectively. Port facilities needed to be expanded. Information systems needed to be upgraded to handle the increased scale of business. The human resource departments at different ports needed to hire more people.

As the participants described the challenges their company faced, I grew increasingly uncomfortable. Although I was no expert on international shipping, my understanding of the current unraveling of the global financial system made it clear to me that these bright men and women were living in a fantasy world. To them, the big challenge they faced was how to manage effectively the buckets of money they would continue to be making. It was common wisdom among prominent government officials, economists, and business players that international trade would grow explosively. But this isn't what I saw. If we were lucky, we were on the verge of a serious recession; if unlucky, we faced a reprise of the Great Depression. One thing was clear: given current economic trends, global trade would slow down or grind to a halt. Participants deflected all of my efforts to shift the discussion to the possibility of a business slowdown. In fact, a senior manager attending the session took me aside and told me to stick to the script and stop politicizing the event.

It was unreal.

The global economy imploded within weeks of this management development session. Two months after the managers returned to their jobs, the *Washington Post* pictured a photo of empty container ships moored in a mile-long line outside Singapore. For the next year, global shipping ground to a halt.

The fact that the key decision-makers of a large shipping company were so wrong about their business prospects at a time when there were many signs indicating an imminent global economic implosion is disturbing. But these players reflected the rule, not the exception. Few business and government leaders saw what was coming, even though the evidence that things were amiss was abundant. The most convincing explanation of the collective blindness to the impending disaster is that business and government leaders were convinced of the efficacy of finely tuned economic and financial policy. The fact that business and government working together managed to minimize economic troubles for some forty years led to a feeling that financial crises were a thing of the past. The possibility of economic Armageddon was inconceivable.

In a word, the implosion was rooted in hubris.

This experience offers a lesson for decision-makers: they need to be humble. They need to recognize the limits of their ability to fully understand and handle the challenges they face. They need to expand their perspectives and start thinking about the unthinkable, because the unthinkable occurs more often than they would suspect.