Deciding Our Futures

Futurists offer a toolbox for improving decision making.

As the world becomes more complex, the likelihood of making poor decisions about our future increases, as does the cost of bad outcomes.

Psychologists refer to two types of decision-making strategies: intuition and reason. Intuition is faster and often emotional, while reason is slower and logical. As the pace of our world accelerates, intuition may increasingly trump reason; "going with the gut" can be an efficient way to decide, but it can also lead to more errors.

It is becoming harder to make good decisions because it has become risky to simply rely on expert advice: Expertise has become fractured into smaller and smaller areas, leaving a gap in areas in which we may be unknowledgeable. Experience leaves us ill-prepared for judgments about wild-card events. And intuition is often based on biases that may lead us in the wrong direction.

This special section offers insights from futurists on ways that we can come to grips with the flaws in our decision-making processes and improve our strategies for making critical decisions about the future.

—*Editors*

CHRISTIAN WEIBELL / ISTOCKPHOTO

By Stan Shapiro

Decision Making Under Pressure

From emergency rooms to space missions, many decision-making situations allow no room for error. An ER physician reflects on what went wrong as flight managers assessed the potential damage on the space shuttle *Columbia.*

I was working a late night shift as an emergency-room physician in February 2003, shortly after the space shuttle *Columbia* disaster that resulted in the death of seven astronauts. As I reflected on the disaster, one persistent thought troubled me: If the best and brightest of NASA management could not avoid such disastrous outcomes from their decision making, what hope was there for me and my decision skills in the emergency room? What could I learn from this disaster?

My "Shuttle Thinking" model resulted from those rare, quiet moments when I would put my feet up on my desk and try to analyze my own decision-making process, searching for ways to improve it. I studied the *Columbia* disaster and compared it to my own style of making decisions. If the *Columbia* had been a patient, what would I have done differently? How could I improve my own decision process and then share it with others? "Shuttle Thinking" is what I now call a set of five common pitfalls that I believe undermine our critical decision-making process.

Five Pitfalls in Critical Decision Making

To improve my decision-making process, I now consciously examine the impact of Shuttle Thinking on every high-level decision I make, using the *Columbia* disaster as an example. Other examples could also serve to illustrate common decision-making pitfalls — the meltdown of large financial institutions, government decisions involving Hurricane Katrina, or the sinking of the *Titanic* also follow the same path of poor decision making that doomed *Columbia*.

As you recall, shortly after *Columbia*'s launch, a piece of insulating foam about the size of a large briefcase apparently broke off from the external fuel tank, hitting the shuttle's left wing. The extent of the damage to the left wing was not known. NASA managers felt that no action was needed, and the *Columbia* was allowed to return to Earth. A normal, uncomplicated reentry was expected. However, after the loss of the *Columbia* and crew, the Columbia Accident Investigation Board (CAIB) found fault with the decisions of NASA management.

Pitfall One: Unique Situation

Unique situations, by definition, have no learning curve. NASA management had no training-manual solution for the space shuttle *Columbia* incident. Instead, NASA management evaluated the situation as it unfolded; they became the learning curve. As is often the case with bad decisions in unique situations, the eventual horrific outcome was never even an initial consideration.

Key lesson: Unique situations must be approached cautiously, considered inherently risky and dangerous, and should be considered invitations to poor decision making. Scenario planning may be helpful in identifying potential sources of trouble, but unique situations require extra attention.

Pitfall Two: Data Deficit

Sometimes, not enough data exists to help you make wise decisions. Important decisions are sometimes made on little or no information. In the case of *Columbia*, there was no available information to determine if the left wing of the craft had been damaged. There were limited structural sensors in the wing, and no direct visualization of the wing from the shuttle was attempted.

So, not only was minimal data available, but there were few options for obtaining any additional data. Extravehicular activity (space walk) or launching another shuttle to "fly by" the *Columbia* to take a "visual" and check for damage were not simple options, even if they had been considered. The option recommended by engineers was to use Defense Department technologies to attain high-resolution images of the wing; however, NASA management did not exercise this option, believing that the damage was likely too minor. The CAIB investigators later concluded that the decision-making process itself contributed to the disaster.

Key lesson: Data deficits, with inadequate information for a critical decision, make it mandatory to obtain additional data.

Pitfall Three: Emotional Denial

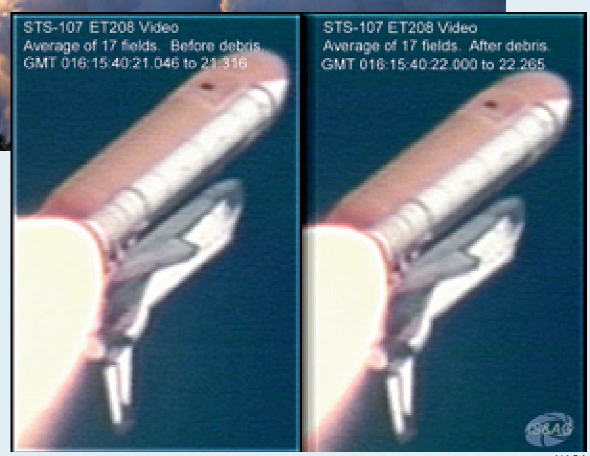
Given the variable-outcome choices in our daily lives, we may naturally tend to gravitate toward the positive potential outcomes while ignoring or even denying the fact that painful, negative outcomes are possible. If we did not have this propensity toward optimism, we might become paralyzed in our daily

continued on page 44

The 2003 Shuttle Disaster

Space shuttle *Columbia,* on mission STS-107, accomplishes a seemingly flawless launch, January 16, 2003.

NASA



NASA

Composite images before (left) and after debris strikes *Columbia* during launch. The imagery of the strike was of too low resolution to be used in engineering analysis during *Columbia*'s flight.

NASA

On February 1, 2003, at Houston's Mission Control Center, the shuttle flight controllers lose contact with *Columbia* as it makes its descent.

BILL INGALLS / NASA

In August 2003, retired U.S. Navy Admiral Harold Gehman (right), chairman of the Columbia Accident Investigation Board, presents his panel's findings to NASA Administrator Sean O'Keefe.

NASA

Lessons learned: In September 2003, Astronaut Scott E. Parazynski (right) participates in a tile-repair briefing at Johnson Space Center's Space Environment Simulation Laboratory.

continued from page 42

activities, even avoiding that "risky" commute to work, for instance. Some outcomes, such as the *Columbia* breaking up on reentry, are so uncomfortable that we often choose to not give them the full consideration they deserve. Many times, denial of the difficult or threatening components of our decisions allows us to choose the easier, more comfortable options. In the case of the *Columbia*, the easiest decision was to simply deny that there was a serious problem and to do nothing.

Key lesson: Emotional denial frequently shifts our decision making toward the easier, more comfortable solutions. Negative scenarios may be dismissed, but often at our peril.

Pitfall Four: Gambling on Probabilities

This is the pivotal point in our decision-making process. I certainly was not in the NASA conference room during their risk assessment of the *Columbia*. However, I can imagine that NASA management struggled with their unique situation, used the limited available data, and finally opted not to obtain any additional data. This initial problem analysis, coupled with a degree of denial of the seriousness of the situation, likely allowed them to conclude, "There is probably no damage caused by the foam piece, and nothing further needs to be done."

Would the outcome have been different if the NASA team restructured their conclusion by thinking of "probability" more critically as "risk assessment"? When lives are at stake, gambling on probabilities can be fatal.

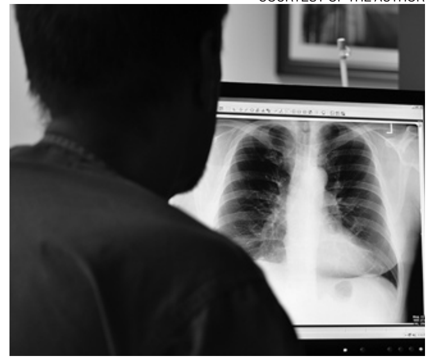
Key lesson: Relying uncritically on one probable outcome should be considered synonymous with gambling. The full extent of the gamble and its consequences then needs to be considered.

Pitfall Five: Positive Reinforcement

Long before *Columbia*, NASA management had noted smaller pieces of foam breaking off during multiple previous shuttle missions. Because no problems resulted from these foam events in the past, they knowingly accepted the fact that small pieces of foam break off. These foam events were subsequently considered to be a normal mission variant. In other words, NASA management had gambled in the past—and won. This winning mind-set unfortunately minimized their perceived risks and reinforced their willingness to continue to gamble.

Key lesson: Gambling and winning tends to reinforce the option of taking additional risks.

COURTESY OF THE AUTHOR



Author Shapiro studies X ray in emergency room. Decision making requires data, even when we're under pressure.

Decision Making in the Emergency Room

ER physicians are faced with life-or-death decisions on every shift. Early in my career I learned that, once you have made the diagnosis of "probable heartburn or indigestion" in 100 patients, you then expose yourself to the risk of one of those 100 patients returning to the ER with an actual heart attack instead of heartburn. Ninety-nine patients were correctly diagnosed with indigestion, but one patient returns with a true myocardial infarction (heart attack). Do you continue to gamble with your "probable" diagnosis style knowing that the one case in 100 will eventually return?

The practice of medicine is replete with similar examples, and physicians eventually learn by trial and error that, unless you completely verify the diagnosis by searching out additional data—such as an electrocardiogram (EKG) and heart blood tests—the laws of probability will eventually catch up with you. Because physicians are faced with these reoccurring decision scenarios in statistically large enough numbers, they rapidly learn the consequences of making a diagnosis based on probability.

Patients often misinterpret this need for additional testing (acquiring data) as the physician practicing "defensive medicine," but in reality, the physician is trying to protect the patient from the rare event (unique situation) and from the laws of probability.

NASA management faced a unique situation, used the limited available data, opted not to obtain additional information, and likely had a degree of denial of the severity of the situation. All of this resulted in a critical decision—a gamble—that lost. The remote possibility of a *Columbia* disaster, which eventually became a reality, was not given the full consideration it deserved by the key decision makers.

We are all constantly surprised when very smart people and their teams make seriously flawed decisions. No person, company, or government agency is immune. If your decisions are based on poor data and probability, eventually your luck will run out. Whether it is the financial system, space missions, or Hurricane Katrina, many of our most flawed decisions share the same common process. Sometimes when you gamble big, you lose big.

The most important step toward better decision making is early recognition of this "shuttle thinking" pattern and the role of "probability" in your decisions. To improve my decision-making process, I now consciously examine the impact of shuttle thinking on every high-level decision I make.

About the Author

Stan Shapiro is a licensed Idaho physician with 20 years of experience practicing as an emergency-room physician. His seminar, ERThink, is designed to train people in the unique critical thinking skills that he learned from the emergency room. E-mail mail@stanshapiro.com; Web site www.ERthink.com.

The Pursuit of Better Decisions

The latest edition of the comprehensive *Futures Research Methodology* CD-ROM by the Millennium Project features 37 detailed chapters on techniques ranging from environmental scanning to chaos and nonlinear scanning (ADD), as well as a chapter introducing futures methodology and a concluding chapter on Integration, Comparisons, and Frontiers of Futures Research Methods.

Among these vital tools are two specifically devoted to aiding those involved with making policy decisions in complex situations or in an environment of uncertainty: "Decision Modeling" by The Futures Group International and "Robust Decisionmaking" by Robert Lempert, Steven Popper, and Steve Bankes of the RAND Corporation.

This article is adapted from these two chapters. For more information about *Futures Research Methodology Version 3.0,* edited by Jerome C. Glenn and Theodore J. Gordon, contact The Millennium Project, 4421 Garrison Street, N.W., Washington, D.C. 20016; www.millennium-project.org. The CD-ROM may also be ordered for $49.50 ($44.50 for members) from the World Future Society at www.wfs.org/wfsbooks.htm. —*Editors*

By The Futures Group International

Decision Modeling

A systematic approach to evaluating key factors in the choices we make.

Decision modeling attempts to replicate the actual behavior of decision making. A model first identifies specific criteria to be used in making a decision, then allows the decision makers to assess how well competing options meet those criteria. For example, when purchasing a product, such as an automobile, a consumer might consider price, quality, service, and options. In decision modeling, each attribute is weighted by its relative importance, and each car model is judged on how well it matches each criterion.

Decision modeling can also explore the market potential of new technologies by assessing how well the new technology meets criteria already established by the marketplace. In these applications, decision modeling quantifies the potential of a product or technology to gain share from products already on the market.

The behavior of a large number of systems is determined, to a great extent, by decisions made by people or groups within those systems. In population systems, the behavior of couples of childbearing age determines the dynamics of the system; in market systems, the collective decisions of consumers constitute market behavior; in industries, such as the electric utility industry, decisions by corporate executives on generation expansion determine many characteristics of that system. Thus, in order to understand the behavior of systems, we must understand the nature of decision making within the system.

Strategic-management professor Michel Godet has also made some interesting additions to the technique of decision modeling. His MULTIPOL method assumes an alternative future environment rather than the single-valued future of most decisions. Godet implements that view by adjusting the weights involved in the decision according to the environment that is being forecast. In buying a car, for instance, the criterion of fuel efficiency would receive a higher weight in a low-energy future than in a high-energy one. This flexibility makes possible the discussion of relative advantages of different policies or strategies across a spectrum of alternative futures.

Methodology and Applications

Decision modeling is related to utility theory in systems analysis. In utility theory, a rational decision maker selects an alternative product, policy, or action that best meets his or her criteria for success. As an example, consider a young person deciding which college to attend. When asked what's important in a college, the factors mentioned might include: excels in my field, has good football, is co-ed. The parent might add price to the set of criteria. These four criteria would be weighted according to their relative importance. Then, using this method, a matrix could be constructed in which possible colleges would be compared on the basis of these criteria. See Table 1.

The column labeled "score" is the weighted sum for each college. All other things being equal, the most rational choice in this example is college 2. If, when such an analysis is performed, the results seem subjectively wrong, it is appropriate to ask if a criterion has been omitted (e.g., location—what about urban versus rural setting or distance from home?), or the weights are improper (the cost could be less of a factor if the student wins a scholarship).

Although a decision maker may not actually list these decision factors or consciously weigh them, they are implicit in the perceived value of alternatives. To choose the "best" alternative, the decision maker must make a judgment about what constitutes high value and low value. A choice that has a low cost may be

Table 1: School Choice Decision Matrix

Criteria →	Teaches what I want	Good football	Co-ed	Cost	Score
Weights →	**8**	**4**	**4**	**9**	
College 1: University of Big State	3	5	3	3	83
College 2: State Tech A&M	4	4	4	4	100
College 3: Little School of Liberal Arts	5	3	5	3	99

considered more valuable than one with higher cost, while one with higher benefits may be more valuable than one with lower benefits. How does a high-cost, high-benefit technology compare with a low-cost, low-benefit alternative? To answer this question, the decision maker must specify how important cost and benefits are. The low-cost, low-benefit alternative may be perceived to be the "better" alternative, if cost is much more important than benefits—i.e., "It's the best I can get for the money."

Various methods of decision analysis have also been incorporated into strategic planning as exemplified by the Strategy Analysis Grid developed by Jerome Glenn. This grid is designed to illustrate the range of general strategic choice. Glenn asserts that strategies fitting in the upper-left box are easier to implement but are possibly less effective than those in the lower-right boxes. Strategies in the lower-right box tend to be more difficult to implement (see Table 2).

Through this grid, one can examine which strategic approaches were used in the past and identify tradeoffs between more effective strategies and the degree of difficulty.

There are many other similar grid analyses of policy options. For example, Jerome C. Glenn has created a matrix that helps analyze the humanizing or dehumanizing effects of policy options by building on Maslow's hierarchy of human needs: physical, safety, esteem, love and belongingness, self-actualizing, and aesthetic. Each cell is completed by asking how the minimum condition of each policy option might satisfy or frustrate a human need.

Decision Modeling in The Real World

In practice, the alternative receiving the highest ratings should be chosen in more decisions than any other alternative, but it may not be chosen in all decisions. Because of differences in regional or individual perceptions, an alternative may have the highest value for an individual, but not for the group as a whole, when average weights and ratings are used.

Another problem is that decision makers are often reluctant to choose a new alternative with which they have no experience. They may be uncertain of its costs, for instance. As experience with the new alternative accumulates, these problems disappear, but a learning-curve adjustment should be accommodated in the decision models.

In summary, decision modeling describes the decision process as a choice among competing alternatives made on the basis of how well each alternative meets several different criteria of varying importance. These perceptions are by no means static. The importance weights and alternative ratings usually do change with time and can be influenced by marketing, advertising, and external circumstances. (Remember how automobile choice changed as a result of the increase in gasoline prices.) By incorporating this type of decision model into a description of the entire system surrounding the decision (possibly a simulation model of the entire system), a better understanding of the behavior of the system should result.

Decision modeling is quite useful in analyzing past or pending decisions as well as capturing the essential aspects involved by consumers in making decisions.

The many applications of decision modeling all share common problems:

1. Identifying the criteria. Just how can the elements of a decision be known, either for an individual or a group? Many psychological impediments can distort any assessment of what's important.

2. Collecting information to establish decision criteria and their weights. Market research is often difficult, inaccurate, and costly.

3. Perceptions shift with time and circumstances. To return to the college-selection example, once enrolled, our young student may find other things important, and the original criteria inadequate.

However, one of these weaknesses is also a strength: the ability to accept market research data as an input. In a poll, for example, consumers might be asked what other products they considered when they made their purchase, what factors led to their choice, and how important the factors were in their selection process. With this kind of data in hand, a decision matrix can be completed. Once

Table 2: Strategy Analysis Grid—How to Make Libraries Quieter

Degree of Difficulty →	Change within System	Change from Outside System	Create New Systems
Approach 1: Provide Information	Post "Be Quiet" signs	Visit schools to instruct students on library manners	Webinars on how to use community libraries
Approach 2: Provide Positive/Negative Reinforcement	Ask noisy people to leave	Student interns as Quiet Patrols	Niche reading-only libraries; fees for research use
Approach 3: Provide Environmental Change	Move readers' chairs farther apart	Use school classrooms off-hours for discussion or study groups	Provide online research functions to remove noisier activities from library

a good model is established, marketers can identify which attributes to stress or improve in order to increase market share.

For complex decisions that may affect many people for long periods of time, the simple utility matrix provides a great deal of clarity, since it requires answers to the question of what's important. It also promotes thinking about what can go wrong.

About the Authors
The original version of this article was written for earlier versions of the Millennium Project's *Futures Research Methodology* CD-ROM by several contributors at The Futures Group, a multinational strategy consulting firm founded by Theodore J. Gordon (now senior fellow of the Millennium Project). The Futures Group International, can be reached at www.futuresgroup.com.

By Robert J. Lempert, Steven W. Popper, and Steven C. Bankes

Robust Decision Making: Coping with Uncertainty

Predicting the future and then acting on our predictions leaves us vulnerable to surprises. So we need decisions that will work in a variety of potential situations.

Robust decision making (RDM) is a framework for making decisions with a large number of highly imperfect forecasts of the future. Rather than relying on improved point forecasts or probabilistic predictions, RDM embraces many plausible futures, then helps analysts and decision makers identify near-term actions that are robust across a very wide range of futures—that is, actions that promise to do a reasonable job of achieving the decision makers' goals compared to the alternative options, no matter what future comes to pass. Rather than asking what the future will bring, this methodology focuses on what we can do today to better shape the future to our liking.

RDM emerged from work at RAND beginning in the early 1990s, when we, analysts Robert Lempert and Steven Popper, were separately grappling with policy problems characterized by deep uncertainty and potentially non-equilibrium dynamics—in particular, climate change and the transition of east European communist societies to market economies. Meanwhile, RAND computer scientist Steve Bankes was grappling with the question of how one can use imperfect computer models to inform policy decisions, particularly to deal with the next wars rather than previous ones.

In brief, RDM uses the computer to support an iterative process in which humans propose strategies as potentially robust across a wide range of futures. The computer then challenges these strategies (stress tests) using simulations and data extrapolations to suggest futures where these strategies may perform poorly. The alternatives can then be revised to hedge against these stressing futures, and the process is repeated for the new strategies.

Rather than first predicting the future in order to act upon it, decision makers may now gain a systematic understanding of their best near-term options for shaping a long-term future while fully considering many plausible futures. The result is near-term policy options that are robust—i.e., that, compared to the alternatives choices, perform reasonably well across a wide range of those futures.

The strength of robust decision making is its flexibility. In this iterative process, the computer retains the full range of uncertainties, multiple interpretations, and other ambiguities and can bring key bits of information to decision makers' attention at any point where it might help distinguish among the merits of alternative decision options. This process can help break down institutional barriers to considering multiple futures, because it provides systematic criteria for determining which futures ought to be considered. It can help decision makers avoid "over-arguing," which occurs when decision makers pretend they are more certain than they actually are to avoid losing credibility in policy debates—by allowing them to acknowledge multiple plausible futures and to make strong arguments about the best policies for hedging against a wide range of contingencies.

Computer-supported RDM at its root combines the best capabilities of humans and machines. Humans have unparalleled ability to recognize potential patterns, draw inferences, formulate new hypotheses, and intuit potential solutions to seemingly intractable problems. Humans also possess various sources of knowledge—tacit, qualitative, experiential, and pragmatic—that are not easily represented in traditional quantitative formalisms. Working without computers, humans can often successfully reason their way through problems of deep uncertainty, provided that their intuition about the system in question works tolerably well.

Using their talent for storytelling, humans can challenge each other with "what if" scenarios to probe for weaknesses in proposed plans. These processes succeed because the best response to deep uncertainty is often a strategy that, rather than being optimized for a particular predicted future, is well hedged against a variety of different futures and evolves over time as new information becomes available.

These time-tested processes can break down, however, when humans are faced with complex futures for which past experience and intuition provide an unreliable guide. Their ability to trace the "what-if" implications of proposed plans fails. When operating within organizations where individual intuition may not be easily employed or shared, people can find it even more difficult to explore mental simulations as a group effort, even in the rare cases where many individuals share values and expectations about the future. Thus, among organizations with varying agendas or within communities that have wide-ranging interests, it becomes nearly impossible to engage in a formal commerce of ideas using these means.

People have limited capability to process and retain information, but computers excel at handling huge amounts of quantitative data. They can project without error or bias the implications of assumptions no matter how long or complex the causal chains, and search without prejudice for counterexamples to cherished hypotheses.

RDM begins with an initial set of alternative strategies, then uses the available information to suggest which strategies are most robust—i.e., would work best in the most plausible future scenarios. In other words, RDM begins at the opposite end from other analytical approaches, asking what are the alternative decisions we seek to choose among? RDM next identifies each strategy's vulnerabilities (the scenarios under which it would perform poorly), and then suggests new or modified strategies that might better hedge against these vulnerabilities.

Why not just base decisions on a most-probable scenario of the future? "Predict-then-act" approaches have proved extraordinarily useful for a wide range of decision problems, but can run into problems under the conditions of deep uncertainty — an almost universal characteristic of long-term policy problems. The predict-then-act approach can lead to overconfidence in decision makers' estimates of uncertainty, and make it more difficult for those with different expectations and values to reach agreement. Predict-then-plan strategies are also vulnerable to surprises that might have been countered had the available information been used differently.

RDM counters these problems by providing a framework for identifying a wide range of vulnerabilities of proposed strategies, designing counters to these vulnerabilities, and assessing the resulting tradeoffs. It reduces the problem of overconfidence by challenging analysts and decision makers to explore a wide range of plausible futures. And it facilitates agreement by providing an analytic framework where parties can agree on actions that are robust across many expectations and values.

How to Do It

The four basic steps in robust decision making are as follows.

1. Consider ensembles of large numbers of scenarios. Such ensembles should contain a set of plausible futures that is as diverse as possible in order to provide a challenge set against which to test alternative near-term policies.

2. Seek robust, rather than optimal, strategies that do "well enough" across a broad range of plausible futures. Robustness provides a useful criterion for long-term policy analysis because it reflects both the normative (ideal) choice and the criterion that many decision makers actually use in complex, uncertain conditions.

3. Employ adaptive strategies to achieve robustness. Adaptive strategies evolve over time in response to new information. Near-term adaptive strategies seek to influence the long-term future by shaping the options available to future decision makers. That is, the near-term strategies are explicitly designed with the expectation that they will be revisited in the future.

4. Use computer tools designed for interactively exploring multiple plausible futures. Humans cannot track all the relevant details of the long term, but working interactively with computers, they can discover and test hypotheses that prove to be true over a vast range of possibilities. Thus, computer-guided exploration of scenario and decision spaces can help humans, working individually or in groups, discover adaptive near-term strategies that are robust over large ensembles of plausible futures.

Robust decision making often requires significant investment in the development of suitable simulation models, as well as significant computer time and memory. Thus it is not always the best approach for every application. It is most appropriate for supporting decisions in situations characterized by deep uncertainty, and where experience and intuition are insufficient guides through the complexity of alternative policy decisions and impacts.

Finally, the method is appealing in the sense that if offers to provide decisions that perform well across a very wide range of plausible futures. RDM also seeks to characterize uncertainties not by often difficult-to-determine probabilities but rather by their effect on the central question: What factors are most important in choosing between Strategy B and Strategy A? While no method can guarantee a strategy immune to all future surprises, robust decision making does provide an approach that encourages analysts and decision makers to think systematically about such surprises and ways in which they might turn them to best advantage.

About the Authors



Lempert **Popper** **Bankes**

Robert J. Lempert is a physicist and serves as director of RAND's Frederick S. Pardee Center for Longer Range Global Policy and the Future Human Condition. E-mail lempert@rand.org.

Steven W. Popper is an economist at RAND and teaches at the Pardee RAND Graduate School.

Steven C. Bankes is chief architect at BAE Systems Advanced Information Technologies, www.baesystems.com, and an associate professor at Carnegie Mellon University.

The authors are the founders of Evolving Logic, www.evolvinglogic.com, a firm developing software to aid robust decision making.

By Michael J. Mauboussin

Managing Your Mind

A top investment strategist points out three decision-making danger zones.

The ability to make good decisions may be the most valuable skill you can acquire in your life—both personally and professionally. No one wakes up in the morning thinking, "I'm going to make some bad decisions today," yet we make them all the time. Even objectively smart people are not immune to bad decisions. In fact, some of the largest and most consequential mistakes were made by the most objectively intelligent people. Good decisions are not about smarts alone.

Here are three examples of decision-making danger zones.

The first is an inappropriate reliance on the inside view when the outside view provides more information. You are using the inside view when you make forecasts based on the information that is close at hand. The outside view asks if there are similar situations that can provide a statistical basis for making a decision.

One example of this mistake relates to Big Brown, the racehorse who had a chance to win the prestigious Triple Crown of horse racing in 2008. He had won the first two legs in impressive fashion, and his trainer gushed that winning the Triple Crown was a "foregone conclusion." The odds makers suggested a probability of victory of more than 75%. For the final race, the grandstand was packed as fans gathered to see Big Brown make history. He made history, all right. It just wasn't the history everyone expected. Big Brown was the first Triple Crown contender to finish dead last.

There was another way to look at Big Brown's chances, one that was not as optimistic as the trainer and tote board. Of the 20 horses in Big Brown's position since 1950, only three had succeeded. And Big Brown was the slowest, by a notable margin, of the last seven Triple Crown aspirants. The inside view focused on a beautiful horse that had won the first two legs with ease. The outside view considered how tall the task was. In fields as diverse as business, medicine, and sports, people rely too much on the inside view when planning for the future.

The second mistake is an undue reliance on experts, whom we tend to hold in high esteem and whose advice we slavishly follow. But the fact is, experts are getting squeezed from two directions. On the one side are computers and algorithms that perform some tasks quicker, cheaper, and more reliably than experts. On the other side are crowds, which provide better predictions than the pundits when certain conditions are met.

Best Buy, the large consumer electronics retailer, has been tapping the wisdom of crowds for the last five years. It even developed its own internal prediction market, called *TagTrade*. Forecasts for retailers are important, and are especially crucial for electronics sellers that face large obsolescence costs. Best Buy has found that their prediction markets, while not perfect, have performed well when compared to their internal experts.

The final mistake is a belief in the ability to manage a complex adaptive system, where lots of agents interact to create a whole that's greater than the sum of the parts. While complex adaptive systems are all around us in nature—ant colonies and human consciousness are but two examples—you can find them with increasing frequency in social systems as well. The problem with trying to manage a complex system, even if one has the best of intentions, is that a perturbation in one part of the system can lead to unintended consequences.

Management of the Yellowstone National Park around the turn of the twentieth century is a classic illustration. Concerned that there was insufficient game in the park, the rangers set out to increase the elk population. But as their numbers grew, the elk consumed all of the aspen trees, which ended up harming the beaver population and, in turn, the ability of trout to spawn. While the park managers were trying to help the park, their initial actions led to a cascade of adverse events that they could not have foreseen.

There are some actions you can take to mitigate these mistakes. The best place to start is to learn about them and work on recognizing them in their varied guises. For example, consider the outside view before you finalize your estimates for how long and how much it will cost to renovate your kitchen. People who rely on the inside view are almost always too optimistic.

You can also keep a decision journal. When you face decisions you deem to be tricky and consequential, write down what you decided and why. If you are so inclined, note your mood that day. By keeping track of your decisions, you will be able to reflect on the outcomes with an accurate record of your process. Proper feedback is central to the goal of constantly improving the decision-making process.

An increasingly complex world taxes our decision making like never before. In many cases, your mind naturally wants to take you down one path when another path is preferable. So it is crucial to learn when you need to think twice, to recognize those situations in context, and to apply appropriate methods to make effective decisions. ❑

About the Author

Michael J. Mauboussin is the chief investment strategist at Legg Mason Capital Management and the author of *Think Twice: Harnessing the Power of Counterintuition* (Harvard Business Press, 2009). He is also an adjunct professor of finance at Columbia Business School in New York City.