We all make decisions every day, but few of us think about how we do it. Psychological research has shown that people make decisions that after reflection they regard as wrong. Our purpose in this book is to provide a systematic process that enables quality decision making.

To begin, it is important to distinguish between descriptive and normative pursuits. Descriptive fields do what the name implies; namely, describe reality and actions as they are, while normative fields identify how they should be. For example, it sometimes happens that when we add a column of numbers from the bottom up using pencil and paper, we obtain a different sum than when we add the same column of numbers from the top down. When this occurs, we say that we have made a mistake because we have an arithmetic norm requiring that the sum of numbers be the same regardless of the order in which we add them. If we have no norm for what we are doing, we cannot say descriptively that we have made a mistake. The rules of arithmetic provide norms for arithmetical computations. Similarly, the foundations of decision analysis provide the norms for decision making.

Consider the various fields of study at the University. Is physics a descriptive or a normative field? Although many results in physics have the names of laws, in fact, these findings are models of reality that aim to describe what is so. To confirm their descriptive ability, they must be tested by experiment. Even today, scientists still perform expensive, sophisticated experiments to see whether Einstein’s model describes the physical behavior of the universe. While
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Newton’s model has been used for centuries and continues to be used today, Einstein’s model is more descriptive of physical behavior at velocities approaching the speed of light.

In this book, our primary focus will be on normative decision making—how we should make decisions, rather than how we actually make them. Yet for three important reasons, we shall also address descriptive decision making. The first reason is motivational: If we do not learn through demonstration that we are faulty decision makers, we will not see the point of learning a powerful normative process. The second reason is practical: Descriptive models of human behavior may allow us to predict the natural conduct of the people affected by our decisions. Just as the results of a normative process like addition are no better than the numbers entered, the results of our normative decision process will be no better than its inputs. We need to understand that these inputs come from humans displaying various biases and distortions, and we must learn to control for such factors. Finally, our descriptive knowledge of how people receive information will enable us to present our results and have them understood.

You might wonder about the difference between what we naturally do in making decisions and what we would like to do upon reflection. In other words, why is there a difference between descriptive and normative behavior? One possible explanation is that in evolutionary terms, we still have the bodies and brains of our caveman ancestors. Even in the business district of a major city, hearing the roar of a lion will alarm us. For millions of years, this instinctual sense of alarm was critical for survival, but today it is of little value.

One consequence of our origins is that in many cases, our natural capabilities are better suited to the challenges of our ancestors than to the challenges of modern life. Examples abound:

- We cannot sense a highly radioactive environment, even though it could kill us in a matter of hours.
- If we lose visual reference while flying an airplane in bad weather, without instruments, we crash.
- If we are scuba diving and we lose our air supply at depth, our natural instinct to hold our breath and dash for the surface might end up killing us.

Though we do not have these capabilities, we have developed compensations for them all:

- We use Geiger counters to sense radiation.
- We use instruments to fly in bad weather.
- We learn through instruction that the unnatural act of releasing air gradually as you surface is the proper procedure when scuba diving.

Another consequence of our origins is that we have capabilities that once helped us to survive, but now may even lead us to harm.

- Millions of years ago if you had food before you, you ate it before it could spoil or be taken from you by another creature. Now this instinctive behavior at the buffet table can be ultimately harmful if it leads to diabetes or heart disease.
- Millions of years ago if someone challenged you, aggressive behavior toward him could save your life. Now, road rage can lead to injury and death.

Figure 1.1 presents a way to visualize the effects of our nature on decision making. Here we picture our choice of action as determined by the interaction between two decision systems: One deliberative, or reasoned; the other affective, or emotional. The affective decision system is the “hot emotional system.” This system existed within the 6+ million year old brain, and was motivated by sex, fear, and hunger stimuli that were directly related to survival. It focused on stimuli that are here and now: proximate and immediate.
In contrast, the deliberative decision system, or the realm of reason, is the “cool cognitive system.” The final evolution of the human brain some 150,000 years ago resulted in the development of the prefrontal cortex, and along with that, the deliberative decision system. The prefrontal cortex enhanced, but did not replace, our “old” brains: As a result, the two systems coexist, often creating considerable internal conflict.

The pull of each system in determining action is influenced consciously, by willpower, and unconsciously, by factors such as stress and cognitive effort. We usually think of hard work as some kind of physical activity that will leave you exhausted. However, another kind of work, the cognitive effort involved in thinking, can end up exhausting your deliberative decision system, thereby increasing the influence of the affective decision system.

You might use willpower to avoid the tempting high calorie dessert by remembering that eating it will not serve your desire to lose weight. However, the jet lag you experience by flying through several time zones may create stress that will tip the scale toward the “hot” emotional system, resulting in poor reasoning during the next day’s business conference.

Perhaps the simplest example of the struggle between the systems is to observe someone at a party eating handful after handful of peanuts and saying “I know I am going to regret this tomorrow.”

We were not evolutionarily equipped to make many of the decisions we face in modern life. For example:

• Choosing among medical treatments that have uncertain and long run consequences.
• Making financial decisions, as individuals or companies, that will produce uncertain futures of long duration.

Making such decisions by “gut feel” is to hand them over to the affective decision system. As we proceed, we shall see many examples of affective decision making gone wrong. The purpose of this book is to develop our deliberative decision system and to increase its role in our decision making.

Learning normative decision making poses special challenges. We have all made thousands of decisions in our lives, and most of us think we are good at making them. If we offered
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a course in breathing, a prospective student might say, “Why do I need a course in breathing? I breathe quite well already. I suppose you are going to tell me that if I am lying on the couch watching TV I can breathe at a slower rate than if I am running upstairs.” Yet many people do have coaches for breathing: Singers, competitive swimmers, and even meditators.

While some of us may not need breathing coaches because we are not singers or competitive swimmers, none of us can escape making decisions. We know we have made decision mistakes, and that we may have developed flawed decision making habits. Increasing our ability to think clearly about decisions will benefit us throughout our lives and the lives of those we affect.

Since we are examining a human faculty in which most of us feel very competent, demonstrating the inadequacy of our present decision behavior may be discomfiting. If you take a course in calculus or Chinese history, you will rarely have to make a major change in how you think about yourself. You have a general idea of the subject, and you are going to learn much more about it. However, the content of the course will only occasionally challenge the way you are thinking about all the choices you make, major and minor, in your everyday life. In our subject, the challenge is continual. The benefit of grappling with that challenge is learning a powerful way to make decisions.

We sometimes describe the result of mastering this subject as installing a new operating system in your brain. You can now run powerful programs you could not run before, and you can no longer run the old programs. Do not embark lightly on this journey. There is an Eastern saying, “Better not to begin, but if you begin better to finish.”

As Samuel Butler put it, “A little knowledge is a dangerous thing, but a little want of knowledge is also a dangerous thing.” This book is not about making decisions only in a specific field, such as business or medicine. The concepts apply everywhere and are useful in all fields, as our examples will show.

1.3 DECLARING A DECISION

Decisions do not arise in nature. No one walks through a forest and says, “I have just spotted a wonderful decision.” Decisions are declared by human beings. Sometimes they arise when we have what philosophers call a break in our existence—some change in our circumstances—that impels us to declare a decision. We can consider these decisions as reactive to the change. Whether we experience a change for the worse, like losing a job or falling ill to a disease, or a change for the better, like inheriting money, we face declaring a decision.

We can also declare decisions proactively, without any external stimulus. You can declare a decision about quitting your job or about taking up skydiving just because you want to. Figure 1.2 illustrates the different types of declarations.

Some of the most important decisions you can make are those you declare proactively. When Warren Buffett1 was asked about the worst decision he ever made, he said, “The things I could have done and didn’t do have cost us billions of dollars…” He viewed his worst investment failures as errors of omission, rather than commission—errors arising from a lack of proactivity.

Whether the decision is reactive or proactive, it is yours. The alternatives you have belong to you. You have total power over the alternative you select, but seldom over the consequences of selecting that alternative. We are using the word “alternative” in the American sense, rather than in the European sense. Saying, “We have one alternative” is understandable to an American, but a European might ask, “Alternative to what?” So when we say you have only one alternative,

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1Warren Edward Buffett (born August 30, 1930) is an American investor, businessman and philanthropist. Buffett has been one of the richest men in the world and has given most of his fortune to charity.
we mean that you have no choice. A cartoon showed a chaplain offering comfort to a convict about to be executed in an electric chair. The caption was, “My advice is to pray to a saint who helps the wrong people by mistake.”

Doing nothing is always an alternative. Suppose you go to a restaurant for dinner. The waiter presents the menu and then awaits your order. You say, “I will need a few more minutes.” Shortly thereafter, he returns and you again request more time. Whenever the waiter returns, you repeat your request. What happens? The last time you see the waiter, he tells you that the kitchen is closed and that no more food will be served. You have chosen the “do nothing” alternative, and you have suffered the consequences.

To truly have alternatives in making a decision means that they are completely under your control. For example, you may say you have the alternative of getting a job with company ABC, but you do not. You have the alternative of applying for a job with company ABC. You may say you have the alternative of going to graduate school, but your real alternative is to apply to graduate school. Taking care in understanding alternatives is an important step in thinking clearly about decisions.
Once a decision is declared, knowing what to do may require little effort or extensive analysis. Most everyday decisions, such as what to have for breakfast or what clothes to wear, seldom require analysis. Other decisions, such as the purchase of a new home or car, may require more analysis, but are also less frequent. Figure 1.3 shows the number of decisions we face and the analysis effort they require.

Decision analysis works for all types of decisions. However, you can deal with simple decisions in a few minutes using common sense or some rules of thumb. You do not need an extensive analysis to decide what to have for breakfast.

More complicated decisions, however, are worthy of more thought. Using a simple checklist to remind us of things to consider and to help us identify common decision making errors might make the process easier. Examples of more complicated decisions are where to spend a vacation, or whether to buy a new television set.

The most important decisions we face deserve a much more refined analysis. They may involve elements of complexity, dynamics, and far-reaching consequences. They are worthy of, but frequently do not receive, the structured, rigorous decision process we will describe in later chapters.

Figure 1.4 shows the types of decisions we may face and methods to approaching them.
1.4 Thought vs. Action

The mere idea of thinking about something does not mean we have made a decision. To better understand our decisions, we first make a distinction between “thought” and “action.” Figure 1.5 illustrates all possible combinations of actions and thoughts. The diagram identifies four different regions.

**Figure 1.5 Regions of Thought and Action**

**Region 1: Thought Without Action** Consider what you do in your daily life. Are there times when you have thought without action? A little reflection shows that the answer is “Yes.” For example, we can think “What a beautiful cloud!,” or “I should quit this job!,” or “I am bored.” This region also includes feelings you may have towards someone or something. Much of our self-talk is thought without action, and perhaps that is a good thing.

**Reflection**
Think of other situations where you may have thought but not acted.

**Region 2: Action Without Thought** Is there action without thought? Once again, the answer is “Yes.” A simple example is a reflex response to a stimulus, like crying after cutting an onion. A more thought provoking example is riding a bicycle. Can you imagine trying to use an instruction manual for riding a bicycle? The manual would describe things like steering head angles, tire contact areas, and the center of gravity of the combined human-bicycle system. We learn to ride a bicycle automatically without thinking, so a manual like this would be of little use.

Walking is another great example of an inborn ability or a trained skill. No explanation involving muscle contraction will help.

**Reflection**
To illustrate the advantage of coaching even when a skill has been learned and performed automatically without thinking, consider the following question:

Suppose you are riding fast on your bicycle and wish to turn to the left around a curve as quickly as possible. In what direction do you turn the handlebar?

The common answer is that you turn the handlebar to the left. Very experienced bicycle and motorcycle riders know that the correct answer is to turn the handlebar to the right. This is clear if you observe motorcycles racing counter clockwise around a circular dirt track. They all have their handlebars turned to the right, away from the center of the circle.

For this to be the correct answer, what must be true of cycle design?
Even without instincts or training, you can take appropriate action in new situations, without thought, by acting on your inner knowledge. Buddha would call it “right action:” Just do it. However, it is often difficult to make spontaneous and correct decisions in our personal or professional lives. Complexity, uncertainty, or conflicting values may confuse us.

**Reflection**

Think of other situations where there is action but no thought.

**REGION 3: NO THOUGHT-NO ACTION**  Are there situations where there is no thought and no action? One example is being in a coma. The state of consciousness produced by proper meditation might be another.

**Reflection**

Think of other situations where there is no action and no thought.

**REGION 4: THOUGHT AND ACTION—“ACTIONAL THOUGHT”**  Finally, we may want to think about what to do, which we call **actional thought**. When we think about a decision, we are practicing actional thought. But what constitutes high quality actional thought? One answer is decision analysis, our present endeavor.

### 1.5 WHAT IS A DECISION?

We now need to ask a fundamental question, “What is a decision?” A frequent answer is that it is a choice, or a choice among alternatives. But we want more precision in our understanding. The following is our definition of a **decision**:

*A decision is a choice between two or more alternatives that involves an irrevocable allocation of resources.*

Suppose a friend tells you that he has decided to buy a new Rolls-Royce. How will you know when he has actually made the decision? Is it when he has visited the dealer to look at Rolls-Royces, or when he has made an appointment to return to buy the car? You will know he has bought a Rolls-Royce when he gives the dealer his cashier’s check for the purchase price and the dealer has given him the registration and the keys. If your friend drives around the block in his new car and decides that he does not like it after all, can he just ask the dealer for his money back? The dealer may well say, “I see, you want to sell us a pre-owned Rolls-Royce in excellent condition. Here is our offer.” His offer will typically be less than the number on the cashier’s check he recently received. The difference is the monetary resource that your friend has committed in making the purchase.

A resource deserves its name if it is something that is scarce and valuable. Money is a resource; the time in our lives is a resource. Thinking about a decision takes time: The decision to think about a decision is an irrevocable use of that time. The decision to buy the Rolls-Royce by handing over the cashier’s check represents an irrevocable loss of resources—the difference between what you pay for it and what you could sell it for after accepting ownership. Every decision, then, is irrevocable in the sense that the resources committed to it will be at least partially lost.
1.5 • What is a Decision?

1.5.1 A Mental Commitment or Intention is Not a Decision

You can say that you have decided to diet, but you will not have made a decision until you do not order your customary dessert at a meal. Even if you abandon your diet tomorrow, today’s meals are different.

The roots of the word “decision” are consistent with this interpretation. The Latin word corresponding to decide means “to cut off.” As long as you are just thinking about the decision, you are not cutting off anything except the time you might have spent doing something else. As soon as you sign the contract, choose not to fasten your seatbelt before driving, or start down the expert-rated ski trail, you have cut off some possible futures and created the possibility of others. As a radio commentator once said, “The past is a canceled check and you have no claim on the future.”

As we have seen, the resource allocation of a decision can be irrevocable in whole or in part. For example, if you are merely thinking about where to spend your vacation, you have not yet made a decision. Time spent is irrevocable at the current level of science, so while thinking about your vacation you have indeed decided to spend some time, you have not yet committed monetary resources. You make a decision when you book the tickets, make the hotel reservations, and thereby commit some resources that are at least partially irrevocable due to fees for cancellation or change.

The moment of decision is the moment when changing your mind costs something. If, in anger, you write an email to your boss saying you quit, your moment of decision is when you hit “send.” Up until that moment, you can change your mind with little consequence. Once you hit “send,” however, you begin a chain of events that will be difficult, if not impossible, to reverse.

Resources are scarce, and we use our methods to allocate them. Love is not a resource because it is not finite. We do not recommend using the methodology of decision analysis when allocating love. This is more a matter of wisdom than engineering.

Reflection

Which of the following represents a decision?

- a. I have decided that I do not like vanilla ice cream.
- b. I have decided that the stock market will go up.
- c. I have decided that the stock market will go up, so I will invest right away. Here is a check for my purchase.
- d. I have decided to ace the test.
- e. I have decided to diet, and I have thrown away the ice cream in the freezer.

1.5.2 What Makes Decision Making Difficult?

Now let us look back at some of the decisions we have made and think about why they were difficult. Sometimes decisions are difficult because they require making trade-offs among several factors. They may be difficult because of other people who are involved. We call such people stakeholders. We define a stakeholder as someone who can affect, or will be affected by, the decision. In personal decisions, stakeholders may be friends or family. For example, suppose you are interested in buying a motorcycle, but you know this will worry your mother. Your mother is a stakeholder in this decision. You will have to balance upsetting her and your personal enjoyment of the motorcycle. Stakeholders in business decisions can be shareholders, employees, and customers. Stakeholders in medical decisions can be the patient, doctors, nurses, and the patient’s family.
Sometimes decisions are difficult because of fear of a bad outcome, or fear of regret, or even fear of blame. In all these cases, the difficulty is our uncertainty about the outcome. Suppose no matter what alternative you chose, there was no resulting uncertainty about the future. Imagine you could magically and instantly play a movie to illustrate your future, based on each potential alternative. After seeing the movie, you choose the best alternative. This opportunity to foresee the future would make decision making easy and free of any regrets or worries. By viewing the movie, you would learn more about your preferences and the types of tradeoffs you would be willing to make to substitute one vision of the future for another. Sometimes people say decision making is difficult because of time pressure or constraints, but even those situations would be simple if you saw the movie of your future lives resulting from each alternative.

Unfortunately, these movies of our future lives do not exist. Consequently, we can only choose the best course of action at a certain moment in time. Our futures are always uncertain, but we do have preferences. What we want to do is choose the best alternative given our preferences by properly considering uncertainty, as depicted in Figure 1.6. Creating the normative process for doing this is the subject of this book.

### 1.6 DECISION VS. OUTCOME

Suppose you had a choice between two deals.

- Deal A gives you $100 if a tossed coin lands on heads and $0 otherwise;
- Deal B gives you $100 if a rolled die lands on 5 and $0 otherwise.

Which deal would you choose? Most people would choose deal A.

Suppose you choose deal A and your friend chooses deal B. The coin is tossed and it lands tails, and the die is rolled and it lands on 5. You do not get the $100 but your friend does. Did you make a bad decision? The answer is no. If you faced this decision situation again, would you still choose deal A? Most people would say yes.

This example, shown in Figure 1.7, illustrates the most fundamental distinction in decision analysis, the difference between the quality of a decision and the quality of its outcome. The distinction implies that we can make good decisions but still get a bad outcome due to uncertainty. Observing the outcome tells us nothing about the quality of the decision—just about the quality of the result.
Using the distinction between a decision and its outcome, we can think of four eventualities:

- Making a good decision and getting a good outcome.
- Making a good decision and getting a bad outcome.
- Making a bad decision and getting a good outcome.
- Making a bad decision and getting a bad outcome.

To illustrate using Figure 1.8, imagine you are at a party and you have had a few alcoholic drinks. At the end of the party, you are drunk and must decide whether to drive home in this state. A good decision would be not to drive and to stay at your friend’s house until the morning when you can drive home sober. A bad decision would be to drive while drunk.

We consider possible outcomes following each decision. If you decide to stay and drive sober, you could have a car accident on your way home the next morning. A bad outcome has followed a good decision. If you decide to stay and drive sober, and arrive home safely, a good outcome has followed a good decision. On the other hand, if you decide to drive drunk and arrive home safely, a good outcome has followed a bad decision. Finally, if you decide to drive drunk and have an accident, a bad outcome has followed a bad decision.

Ambrose Bierce\(^2\) uses a poem to describe this idea of not judging a decision by its outcome:

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“You acted unwisely” I cried, “as you see
By the outcome”… He calmly eyed me:
“When choosing the course of my action,” said he,
“ I had not the outcome to guide me.”
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\(^2\)Ambrose Gwinnett Bierce (June 24, 1842–1914) was an American satirist, critic, poet, short story (horror) writer, editor, and journalist.
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Ambrose rushes to tell a person that he acted unwisely “made a bad decision” based on the outcome he received. The response highlights the distinction between a decision and an outcome: the person did not have the outcome available at the time of making the decision to guide his decision making.

Some people may live their lives feeling guilt or regret about something they did when, in fact, they had made a good decision at the time. We often hear statements like, “This did not work last time, so we cannot do it again” or, “This project turned out to be a bad investment, it was a very bad decision.” Careful thinking about this statement shows that they are judging the quality of the decision by the past outcome.

On the other hand, people may also make a bad decision, receive a good outcome, and live thinking that they did the right thing. When this happens, we may hear, “We tried this last time and it worked, so it was a good decision and we should just do it again.”

Reflection

Reflect on the distinction between a decision and an outcome.

Do you confuse the two in your own decision making? Have you judged the quality of a decision you made based only on the outcome? Have you been judged by the quality of a decision you made based on its outcome?

We see the need for the distinction between a decision and an outcome in understanding the daily news. The following piece aired April 12, 2004 on CNN.

Gambler: Roulette Play “Just a Mad Thing to Do”³

(CNN)—Ashley Revell, a 32-year-old man from London, England, sold everything he owned, even his clothes, to try his luck Sunday on one spin of a roulette wheel in Las Vegas, Nevada. He put $135,300 on red, and with friends and family watching, the ball hit the mark, giving Revell $270,600. The event was filmed by Britain’s Sky One television as a short reality series called “Double or Nothing.” CNN’s Anderson Cooper asked Revell what was going through his mind when the wheel was spinning.

REVELL: I was just…pleading that I’d pick[ed] it and that it would come in red. Before I actually walked up to the wheel, I was thinking about putting it on black, and then suddenly the guy was spinning the ball around and all the Sky viewers said…they [had] voted that I should put it on red. So suddenly I just put it all on red. But… I was just pleading that it would come in and I’d get lucky this time. What I was really worried about was that I’d lose and my parents would be upset and my family would, you know, all my friends would be upset. So… I was obviously just so happy when it came in.

COOPER: So you were going to put it on black, but people back in England were voting, and they said you should put it on red? You decided to do that?

REVELL: Yeah, that’s right. I mean, with all those people sort of hoping that it would be red, I thought I’ve got to go red, so that’s what I did.

COOPER: Your father was opposed to this whole concept all along. This is what he had to say. He was quoted in an interview as saying: “I told him he was a naughty boy, he was a bad boy, he shouldn’t do it. He should work like all other kids do.” How does he feel now? I mean, has he changed his mind?

³Permission Pending.
Clarity of Action

Revell: Yeah, I think so. I mean, I obviously went and shook his hand before I did it, and after he was just hugging me and jumping up and down. So, you know, I think most all dads are just concerned, and he’s seeing all my friends being married off and having kids and stuff, and he’s like any father, he just wants me to settle down and make sure I’m secure.

Cooper: Now, why did you do this? I mean, is it true that you sold all your possessions, even underwear, everything you had, and then put all the money on this? Why? Was it all just to be on TV?

Revell: Looking back on it now, I mean, at no point before I did the bet did I think about losing. I just felt positive and thought about just going ahead and winning. But now I’ve actually won, I can think about what would have happened if I’d lost. And to be honest, I was crazy to do this bet. It was the maddest thing. I mean, this is really about all I’ve got left, the tuxedo, which I’m not allowed to keep. So it was just a mad thing to do. And I’m thinking back now about what would have happened if I lost. I’d have nothing to go back to, nothing to wear. But I’d still have my friends, my family, and they’d always be there for me. So they gave me the security to be able to do this. But you know, never again. I mean, that’s – it was mad.

Reflection

Keeping in mind the roulette player’s decision, consider the following questions:

- Did Revell make a good decision by playing this game?
- Did he have a good outcome?
- Does the outcome he received change the quality of the decision he made?
- Should his father have a different view of the situation because the outcome was good?
- If you were in Revell’s place, would you have made the same decision?
- Do you think Revell would be willing to repeat the same gamble again with his current wealth of $270,600?

1.7 CLARITY OF ACTION

We have discussed the difference between a decision and an outcome, and determined that a good decision does not guarantee a good outcome. What, then, is the role of decision analysis?

The purpose of decision analysis is to enable a decision maker to achieve clarity of action in his decision and, even more fundamentally, to achieve clarity of thought. Furthermore, knowing that we have made the best decision provides peace of mind, since that is all we can do to influence the future.

We can make an analogy between decision making and flying a plane. When the weather is clear, we do not need to rely on all available instruments. However, when the weather is cloudy, we need to rely on our instruments. In a similar manner, when decisions are simple, we can make decisions using our own judgment. When decisions are more complicated, however, our judgment may fail, and we need to rely on rules to help us identify the best course of action.

Continuing the analogy, relying on instruments when flying in bad visibility is necessary not just for beginning pilots, but for the most experienced ones. When deprived of the familiar cues provided by seeing the ground, even an experienced pilot will soon believe, incorrectly, that
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he is, in fact, upside down, and will make the wrong corrective adjustments to the controls. The same is true for decision makers acting in an uncertain world. Unless they use the instruments we will build, they may also make grievous errors.

A Story by Ron Howard

Many years ago, I had a medical condition that caused occasional debilitating flareups. By taking some medications continually and other medications during flareups, I could control the condition. However, the medications had long run serious negative effects. My doctor recommended a major operation that, if successful, would cure the condition. Yet success was uncertain, and I could die in the operation. I demurred; my doctor thought I was indecisive.

Since this was a major important decision with great uncertainty and with implications for the rest of my life, I did an extensive six-month long analysis with the help of two medical doctors who were in my class. We did dynamic probabilistic modeling of the future. The doctors sent my x-rays to a specialist across the country for advice. We found that my best alternative was to see whether I had another flareup. If I did, then I should have the operation. If I did not, then I should keep postponing it. A flareup occurred and I called my doctor to schedule the operation. He asked when, and I replied “right away.” He had difficulty understanding why his indecisive patient was now so decisive. On the day of the operation, just before going under anesthesia, a kind nurse assured me that everything would be fine. I thanked her, told her I had a 2% chance of dying on the operating table, and that I was ready to go.

This story makes three points. First, that I had clarity of action in having the operation in the face of uncertainty about the consequences. Second, that the most irrevocable part of the decision was to allow myself to be anesthetized rather than to get up and leave the hospital. Third, I had a good outcome.

1.8 WHAT IS A GOOD DECISION?

We have probably used this term “good decision” in many of our daily conversations. But what is a good decision? And how do we know that we have made one?

1.8.1 Common Misconceptions about What Makes a Good Decision

There are many common misconceptions about what constitutes a good decision. In graduate classes or in executive seminars, people often answer,

“A good decision is one that produces a desired outcome.”

As we have seen, there is a clear distinction between a decision and its outcome, so this cannot be the correct definition.

Another common response is,

“A good decision is one that has the highest chance of getting the best outcome.”

Once again, this answer has a problem since this definition takes into account neither the absolute desirability of the best outcome nor the chances of very bad outcomes. Consider a deal with an 80% chance of gaining you $1,000,000 and a 20% chance of costing you $10. Another deal may provide you with a 90% chance of gaining $100 and zero otherwise. Most people would agree that the first deal is more attractive than the second, yet it has a lower chance of the best possible outcome, and a higher chance of the worst outcome. The example also illustrates the problem with the response,

“A good decision is one that has the lowest chance of getting the worst outcome.”
Arno Penzias, a Nobel Laureate, was asked how he knew a good project when he saw one. His response was,

“Simple, imagine that what you’re going to do will be 100% successful; find out how much money it’s going to be worth; multiply by the probability of success, divide by the cost, and look at the figure of merit.”

While this approach may sound like a reasonable criterion for project selection, closer examination reveals that it focuses only on the monetary outcome of 100% success and ignores other levels. In some cases, this answer would correspond to the best project, but in others, it may not. Using a ratio does not take into account the actual monetary values involved.

For example, consider two projects that will either succeed or fail. They each have a 90% chance of success. The first project will either cost $10, and, if successful, will yield $100. The Penzias figure of merit is 0.9 times 100 divided by 10, or 9. The second project will either cost $150,000, and, if successful, will yield $1,000,000. Its Penzias figure of merit is 6. Choosing based on the figure of merit would lead us to choose the first project, yet most companies would prefer the second project to the first.

There are still more ways of looking at this same example. Does the company have only two available projects? Can the company do both? Are there other considerations besides monetary reward, such as legal or ethical issues?

1.8.2 The Six Elements of Decision Quality

To answer the question of what constitutes a good decision, we first need to understand the main elements of a decision:

1. the decision-maker;
2. a frame;
3. alternatives from which to choose;
4. preferences;
5. information; and
6. the logic by which the decision is made.

First, every decision requires a decision-maker, the person who will act. As we have discussed, decisions are never found in nature: A person speaks them into existence. For example, anyone who says “I am going to decide whether to make this investment…have the operation…set the research budget at $200 million…” must be committed not only to thinking about acting, and but also to deciding. Otherwise, the analysis is useless. Commitment to actional thought is the first element of good decision-making.

Next, the person must provide a way of viewing the decision. We call this view a frame. For example, a person’s frame may be deciding which car to buy from a certain category of cars. The frame could also be whether to buy or lease a car, whether to own a car in the first place or to use public transportation, or even whether to commute to a job or work at home. Each frame presents a different view of the decision problem to be addressed.

The choice of a particular frame will lead to the creation of alternatives appropriate to that frame. These alternatives are available courses of action that the person believes would lead to different futures. Making a high quality decision will involve consideration of several

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4Arno Penzias joined Bell Labs in 1961. He conducted research in radio communication and won the Nobel Prize in 1978 for research that enabled a better knowledge of the origins of the universe. He later became Chief Scientist, and continued to search for innovative and new product ideas by visiting small companies around the country.
substantially different alternatives. Note that by an alternative, we mean a choice that is actually available and is under the decision maker’s control. You can choose to apply for many different jobs; however, your alternative cannot be to accept a job offer unless you have a job offer available. If you have no alternatives, or, in the American sense, only one alternative, then you have no choice in what to do and you have no decision to make.

Can you have too many alternatives? While a new alternative can sometimes be better than any that you recognize, finding alternatives takes time and effort. For example, suppose you had gone to a carpet store and spent two hours selecting a carpet for your living area. You have found one that is very attractive and reasonably priced, so you are about to buy it. The salesperson then says, “I should mention that we have a warehouse of carpets just behind the store with 10,000 other carpets you could look at.” Many of us would say we had made our choice and would rather spend our time in another way.

A decision maker will also have preferences on the futures that arise from different alternatives. The preferences describe what the person wants. If the decision maker were indifferent to the possible futures, there would be no need to make a decision, but merely to live in acceptance of what will be. A wise saying from the east is, “The great road is not difficult for he who has no preference.” However, many of us prefer pleasure to pain; success to failure; health to illness; wealth to poverty; youth to old age; chocolate to vanilla; and so we have preferences. A high quality decision will have clear, carefully specified preferences.

The linking of what we can do to what we want to do is provided by what we know, also known as our information. This information may leave us uncertain about what the future will follow; we must often make the decision in the face of uncertainty. We are always tempted to get more information, but information costs resources. A high quality decision process ensures that information acquisition is neither overdone nor underdone.

Finally, we must use some process to derive the action we should take, from what we can do, what we want, and what we know. If we desire to use a systematic process, such as logical reasoning, then we will want to use the best rules we know for this reasoning. We shall soon present such a set of rules for your consideration.

We can depict the six essential elements of decision quality using the metaphor of a three-legged stool, as shown in Figure 1.9. The stool metaphor is useful because it makes clear to anyone working on a decision precisely which aspect of the decision is currently under consideration. The three legs of this stool represent the three essential elements of any decision. One leg is what

![FIGURE 1.9 The Decision Quality Stool](image-url)
you can do: Your alternatives. The second leg is what you know: The knowledge that relates your alternatives to possible consequences. The third leg is what you want: Your preferences on consequences. The three legs constitute the **decision basis**: The complete description of the decision problem you face. A seat, the logic that will determine your best action for this decision basis, holds the legs together. We shall have much to say about the nature of this logic in what is to come.

One important thing to understand about the stool metaphor is that the stool will collapse if you remove any of its legs. You have no decision to make if you have only one alternative, if you see no connection between any of your alternatives and the future, or if you are indifferent to the possible consequences.

The location of the stool represents your decision frame, which determines the alternatives, information, and preferences that will be germane to your decision. For example, if you need a place to live, you could frame the problem as one of finding a new rental apartment or house. You could also use a larger frame that includes buying a home as an additional alternative. The choice of a frame, then, determines the decision basis and is the most fundamental aspect of making a decision. Later in this book, we will have a much more complete discussion on the subject of framing.

Finally, the most essential element is the person sitting on the stool. There is no decision without the person who constructs the other elements of the stool and is committed to using it for support in making the decision. The person making the decision establishes the frame, seeks and creates alternatives, assembles pertinent information, states preferences, and uses proper reasoning to select the most desirable alternative. That person is, therefore, responsible for placing the stool, fashioning its legs, constructing the seat that connects them, and, finally, sitting on the stool—following the clear course of action.

Another metaphor that contains the six elements of a decision is the chain shown in Figure 1.10. The notion here is that the chain is only as strong as its weakest link. To achieve decision quality, you must assure the quality of each link.
### 1.8.3 Graphically Representing Decision Quality

The decision quality spider web shown in Figure 1.11 graphically represents the qualitative attainment of decision quality. It can be a useful tool for individuals and for groups engaged in decision process assessment.

The distance from the inner hexagon to the outer one represents the degree of achievement for each element. The outer hexagon represents the proper balancing of elements for this particular decision. If the line for an element extends beyond the outer hexagon, that element is requiring too much effort. Figure 1.12 depicts an unbalanced analysis because too many alternatives are being considered and too little valuable information of reasonable cost is being gathered. The resulting picture displays the deficiencies or excesses in any of the elements of decision quality.

### 1.9 SUMMARY

If you decide not to read further in this book, then take away its most important message.

*The most fundamental distinction in decision making is that between the quality of the decision and the quality of the outcome.*

Once you understand this, you know how to deal properly with two useless concerns: Regret and worry.
If you make good decisions, there is no place for regret in your thinking. Just continue to make good decisions. Why regret if you made a good decision and the outcome was out of your control?

If you find you are worrying about a decision before making it, transfer your energy to making sure it is the best decision you can make.

Annie Duke, a very successful professional poker player, described how she exhibits this wisdom in her playing. She uses all her abilities to make good decisions and pays no attention to whether they actually yield good outcomes or bad outcomes. This behavior often confuses opponents who expect her game to change when she has had a very bad outcome or a very good outcome. In future sections, we will develop the structure of thought necessary for making good decisions.

Chapter 1 introduced the following keyterms:

**KEY TERMS**

- Normative vs. descriptive
- Recognizing a decision as an essential first step to good decision making
- Declaring a decision
- Thought vs. action
- The importance of actional thought
- The definition of a decision as an irrevocable allocation of resources
- The need to deal with uncertainty in decision making
- The difference between a decision and its outcome
- The role of decision analysis in helping the decision maker achieve clarity of action
- The six elements of decision quality
- The decision basis
- The stool metaphor
- The decision chain
- The spider web diagram
Chapter 1 • Introduction to Quality Decision Making

PROBLEMS

Problems marked with an asterisk (*) are considered more challenging.

1. From your readings of this chapter, explain the following terms in decision analysis:
   a. Actional thought
   b. Clarity of action
   c. Decision
   d. Outcome
   e. Normative versus descriptive

2. Which of the following situations represents a decision?
   a. I am thinking of going to Tahoe during the break.
   b. This is a beautiful star.
   c. I need to buy an umbrella.
   d. I have decided to become President.
   e. I have decided that breathing is good from me.

3. What is a decision? What makes decision-making difficult? What goal do we pursue in decision analysis? Is decision analysis a normative or descriptive discipline? Explain.

4. Name the six elements of decision quality.

5. Select a newspaper article describing someone facing a decision. Who is (are) the decision makers and what is (are) the decision(s)? What are the uncertainties present? What does (do) the decision maker(s) like or dislike? If you were a consultant hired to help the decision maker(s), what kind of warranty could you give them?

6. Write a brief answer to each of the following.
   a. What is the difference between a decision and its outcome?
   b. Give an example of a good decision followed by a good outcome.
   c. Give an example of a good decision followed by a bad outcome.
   d. Give an example of a bad decision followed by a good outcome.
   e. Give an example of a bad decision followed by a bad outcome.

7. Take some time to think about an important decision situation you are currently facing or will be facing in the near future. Describe your decision situation.
   a. What makes this decision hard? List some of the issues involved in your decision.
   b. Which of these issues describe something that you can control?
   c. Which of these issues describe something over which you have no control?

8. Write a page on a decision that most changed your life. In looking back, how did your decision-making fair on each of the six elements of decision quality?

9. Write a short paper on what you did today—how you spent your time, what did you eat, etc. Do you feel like today was well spent? Did you get the things done that you wanted to? Did you make good choices about how you spent your time? Why or why not? If you had $10 million dollars in the bank, what would you do differently with your time? What is preventing you from doing this right now—is it really the money or is something else holding you back?

*10. Consider the following quote from Ghandi talking about the British occupation: “They cannot take away our self-respect if we do not give it to them.”
    Explain this phrase and show how it relates to Decision Analysis.

*11. Give other examples of normative and descriptive fields.
Problems

*12. Mohammad is considering whether to go to college for a PhD in decision analysis and is figuring out which schools he should consider. Which of the following considerations should be a part of his decision elements?
   a. Mohammad believes that decision analysis will give him the opportunity to find a good job after graduation.
   b. Mohammad has a preference for schools which have historically successful football teams.
   c. Mohammad will choose among the top three US universities that accept him.
   d. All of the above should be considerations for his decision basis.

*13. You are considering buying stock in a burgeoning Silicon Valley startup. Which of the following statements should not be a part of the decision of whether or not to invest in the company?
   a. You examine the balance sheet for the company, and are encouraged by the slow rate at which they are spending their venture capital.
   b. You attend a presentation by the CEO and CTO, and are greatly impressed by their exciting vision for the future of the company.
   c. You decide that you would rather invest in a conservative mutual fund which pays regular quarterly dividends than take a large risk of losing all of your investment in the company.
   d. All of the above should be parts of the decision basis.