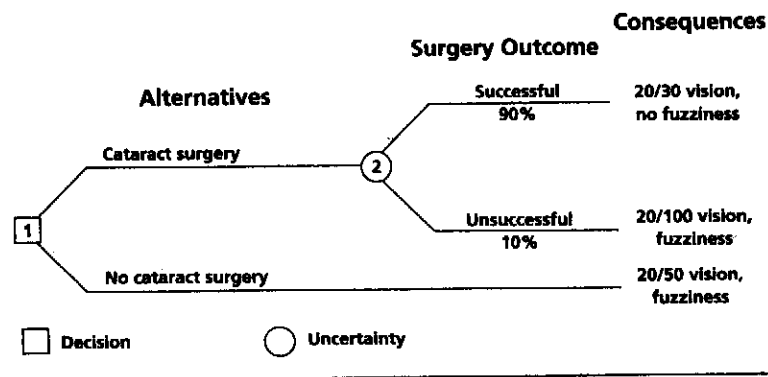


Goldman, now 68, lost the vision in his left eye. His vision in his right eye has deteriorated in recent years due to a cataract. Now, even with his glasses, his corrected vision is only about 20/50, and anything he looks at is fuzzy, particularly at night. As a result, he has been advised to stop driving his car after dark.

Recently, Rob had his eyes examined, and his doctor, Joycelynn Eddy, raised the possibility of cataract surgery. For his particular case, the chances are 90 percent that cataract surgery would be successful, "success" meaning that his vision would be restored to 20/30, corrected, with no fuzziness. An unsuccessful outcome, which Dr. Eddy estimates as having a 10 percent likelihood, would erode his vision to no better than 20/100, corrected, with persisting fuzziness.

Rob quickly draws a decision tree (below), documenting the two alternatives (surgery or no surgery) and the two possible outcomes (successful or unsuccessful). The consequences of each

Rob's Cataract Surgery Decision Tree



outcome are described in terms of two fundamental objectives: acuity and clarity.

The tree clearly shows the risk profiles of the choices, yet Rob finds that the decision remains quite difficult. He would love to eliminate the fuzziness and once again have near-normal vision—and the chances of this are very good. But if the surgery failed, Rob would be worse off than he is now. He would have to quit driving altogether, give up some of his everyday physical activities, and curtail his reading or invest in expensive enlargers and other aids.

The essence of Rob's decision is that the surgery alternative offers him a 90 percent chance of restoring his vision, but a 10 percent chance of permanently worsening it. Clear enough? Yes. And yet so difficult. Should he take his chances on the surgery or play it safe with the status quo?

What would you decide? The smart choice for one person may not be the smart choice for another. You might decide not to have the surgery, but your next-door neighbor might opt for it. It all depends on one's attitude toward risk.

Understand Your Willingness to Take Risks

Your risk tolerance expresses your willingness to take risk in your quest for better consequences—in Rob's case, better vision. It depends primarily on how significant you consider the downside—the poorer consequences of any decision—compared to the upside. If, like most people, you are risk averse, the poorer consequences will weigh more heavily in your mind than the better ones. The more heavily they weigh, the more risk averse you are.

Thus, to reflect your risk tolerance in a decision you need to think carefully about how desirable you consider the possible consequences relative to one another.

To see this, consider how two people, one moderately risk averse (Ms. Wary) and one very risk averse (Mr. Cautious), would evaluate a simple risky choice. Both are offered the opportunity to accept or reject a 50-50 chance of either making \$10,000 or losing \$5,000. A coin will be flipped. If it lands heads, they will receive \$10,000 in cash. If it lands tails, they will lose \$5,000.

How should they decide? They must weigh the chances of the upside and the downside and the desirability of each. In this case, because the upside and the downside are equally likely, the decision should hinge on how desirable they believe the upside is relative to the downside.

Mr. Cautious is very concerned about the impact of losing, fearing he'd have to borrow money or forgo important purchases to pay the penalty. He decides that the good fortune of receiving \$10,000 doesn't compensate for the equally likely \$5,000 loss. Ms. Wary would also hate to lose \$5,000, knowing it would mean delaying her long-cherished plans to remodel her condo, but she likes the potential offered by a \$10,000 windfall. With the extra cash, she could take her remodeling to the next level. The upside is desirable enough that she is willing to take the risk.

The same logic applies to all risk profiles, not just this simple one with two outcomes and consequences described in terms of a single objective, money. The basic principle is this: *the more desirable the better consequences of a risk profile relative to the poorer consequences, the more willing you will be to take the risks necessary to get them.*

But making the smart choice also requires balancing the desirabilities of the possible consequences with the probabilities that

they will occur. If the chances in the decision above were changed to 90 percent in favor of gaining \$10,000, even Mr. Cautious might be tempted. The downside remains just as undesirable relative to the upside, but because it is now much less likely, the improved chance of success will, for many people, more than compensate for the imbalance in desirability.

Once again, this logic applies to all risk profiles. *The more likely the outcomes with better consequences and the less likely the outcomes with poorer consequences, the more desirable the risk profile to you.*

Incorporate Your Risk Tolerance into Your Decisions

To take your risk tolerance into account in comparing risk profiles, follow three simple steps:

- First, think hard about the relative desirability of the consequences of the alternatives you're considering.
- Second, balance the desirability of the consequences with their chances of occurring.
- Third, choose the most attractive alternative.

Taking these three steps enables Rob Goldman to reach a final decision about cataract surgery:

1. **Think hard about the desirabilities of the consequences.** Rob believes that restoring 20/30 vision without fuzziness would make a huge difference to him. He could resume driving at night, and tennis and traveling—two of his favorite pastimes—would become much easier. And although dropping to 20/100 would be bad—no question about it—he feels he has already made so many adjust-

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ments to weakened vision that it wouldn't be the end of the world. He therefore decides that, in terms of desirability, the negative consequence of deteriorated vision only slightly outweighs the positive consequence of improved vision.

2. **Weight desirabilities by chances.** More fully stated: weight the desirabilities of the consequences by the chances of their associated outcomes. If the odds of success were only 50-50, Rob wouldn't undergo the surgery. But the odds aren't even. Rob concludes that the fact that the upside is nine times more likely than the downside more than compensates for the fact that the undesirability of failure slightly outweighs the desirability of success.
3. **Compare and choose.** When Rob now compares the surgery risk profile with the no-surgery alternative, his choice becomes abundantly clear: he calls Dr. Eddy's office to schedule the surgery.

Quantify Risk Tolerance with Desirability Scoring

Suppose that, after having developed risk profiles and thought hard about the desirabilities of the consequences and the probabilities of the outcomes, you still can't decide. At this point, you need to be more precise about the relative desirability of each consequence. You need to move from a qualitative analysis, like Rob Goldman's, to a quantitative analysis. You follow the same general steps Rob did—determining desirabilities, weighting desirabilities by chances, comparing and choosing—but you use

numbers to express the desirability of each consequence and, in turn, each alternative. Let's walk through the process.

1. **Assign desirability scores to all consequences.** You begin by comparing the consequences and ranking them from best to worst. You assign the score of 100 to the best and 0 to the worst consequence. Then you assign a score to each of the remaining consequences that reflects its relative desirability. If, for example, you conclude that the desirability of a consequence is exactly halfway between that of the best and worst consequences, you'd assign it a score of 50. Check to be sure that all your scores are consistent, and adjust them as needed to reflect your true feelings about their respective consequences.
2. **Calculate each consequence's contribution to the overall desirability of the alternative.** Outcomes with a low chance of occurring should have less influence on an alternative's overall desirability than outcomes with a high chance of occurring. Hence, you need to account for each outcome's chance of occurring—its probability. Now, to determine a consequence's contribution to the alternative's desirability, multiply its associated outcome's probability by its desirability score assigned in the first step. If your best consequence (desirability score of 100) had an outcome probability of 30 percent (0.3), its contribution would be 30 (i.e., $100 \times 0.3 = 30$). When an alternative results in a sure thing, its outcome has a probability of 1.0, and the contribution of its consequence will equal its desirability score.
3. **Calculate each alternative's overall desirability score.** Now, add the individual consequence contributions to arrive at an overall desirability score for each alternative.

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(Note that the overall desirability score of an alternative is the average of the desirability scores of its consequences, weighted by the chances of their associated outcomes.)

4. **Compare the overall desirability scores associated with the alternatives and choose.** Now you have a solid, quantified basis for making a decision. Compare the overall desirability scores of each alternative, and choose the alternative with the highest score.

Use Desirability Scoring to Make a Tough Decision

Going through the process of assigning desirability scores to consequences and calculating overall desirability scores for alternatives won't be necessary for most decisions. But for resolving some of life's most important and most complex decisions, it can be invaluable. Consider the situation facing Marisa Reyes, a graduate student in business administration who must decide within a matter of days between two attractive job offers, each involving a major uncertainty. One job is with the global accounting firm where Marisa worked for three years before leaving for graduate school. The other is with an international management consulting firm.

The career prospects and financial rewards at both firms are essentially equivalent. Marisa's decision therefore hinges on the nature and location of her initial job assignment. She has identified a number of objectives relating to the job assignment: good living conditions, including cultural and social attractions, quality housing, and interesting places to vacation; a challenging job

with substantial responsibilities; and an opportunity to contribute to society by helping people.

The actual assignment she'll receive, however, is uncertain. Because she won't start for six months, neither of the companies will commit beforehand to a specific assignment, but each has narrowed the possible postings down to two. The consulting firm might initially post her to London—her dream—but it might also post her to Buenos Aires. The accounting firm would start her either in New York or in Santiago. Each alternative, in other words, leads to an uncertainty with two possible outcomes.

Risk Profiles for Marisa's Job Decision

ALTERNATIVE: ACCOUNTING FIRM

Uncertainty: Office Assignment

Outcome	Chance	Consequences		
		Living	Job	Society
New York	90%	Very good	Excellent	Fair
Santiago	10%	Poor	Fair	Excellent
	100%			

ALTERNATIVE: CONSULTING FIRM

Uncertainty: Office Assignment

Outcome	Chance	Consequences		
		Living	Job	Society
Buenos Aires	75%	Good	Good	Very good
London	25%	Excellent	Excellent	Good
	100%			

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Marisa carefully evaluates the possible assignments at each firm, and using the techniques outlined in Chapter 7, she creates the risk profiles shown on page 139. To judge the chances of each job posting, she talks in depth with the manager of human resources at each firm.

Marisa is unable to decide by simply comparing the risk profiles. The qualitative descriptions don't provide her with enough information. Therefore, she decides to compare the choices quantitatively. Before assigning desirability scores, she ranks the four possible consequences from best to worst, a good practice. As shown in the table below, she ranks the consequences associated with London first, New York second, Buenos Aires third, and Santiago last. She assigns a desirability score of 100 to the London consequences and 0 to the Santiago consequences, the best and worst of the locations. She then assigns to the Buenos Aires consequences a score of 50, judging its desirability to be halfway between that of Santiago and that of London. She then decides that the desir-

Ranking and Scoring the Consequences of Marisa's Job Decision

Alternative	Outcome	Consequences				Rank	Desirability Score
		Living	Job	Society	Rank		
Consulting firm	London	Excellent	Excellent	Good	1	100	
Accounting firm	New York	Very good	Excellent	Fair	2	80	
Consulting firm	Buenos Aires	Good	Good	Very good	3	50	
Accounting firm	Santiago	Poor	Fair	Excellent	4	0	

Determining the Overall Desirability for Marisa's Risk Profiles

Accounting Firm

Outcome	Chance	Desirability Score	Contribution to Overall Desirability
New York	90%	80	72
Santiago	10	0	0
	100%		
Alternative's overall desirability score:			72

Consulting Firm

Outcome	Chance	Desirability Score	Contribution to Overall Desirability
Buenos Aires	75%	50	37.5
London	25	100	25.0
	100%		
Alternative's overall desirability score:			62.5

ability of New York's consequences lies 60 percent of the way from the Buenos Aires consequences to London's, and so she assigns a score of 80 (80 is 60 percent of the way between 50 and 100). As a consistency check, Marisa asks herself whether all four of the scores reflect her true feelings, and she decides that they do.

Marisa then calculates the overall desirability score for the alternatives. She first multiplies the desirability score of each of the consequences by its associated outcome probability, which yields its contribution, as shown in the table above. She then adds the contributions of New York (72) and Santiago (0) to arrive at an

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overall desirability score for the accounting firm (72). Likewise, she adds the contributions of Buenos Aires (37.5) and London (25.0) to calculate the overall desirability score for the consulting firm (62.5). Relying on her calculations and the careful thought that preceded them, Marisa makes her choice. She accepts the accounting job, and six months later she is posted to New York.

The Desirability Curve: A Scoring Shortcut

Marisa had only four consequences to consider, so assigning the initial desirability scores was fairly easy. When you have many possible consequences, however, the assignment of desirability scores can become difficult and time consuming. Fortunately, there is a shortcut: the desirability curve. After plotting the desirability scores of a few representative consequences—five, typically—you connect them on a graph to form a curve. You can then use this curve to determine the desirability scores of all other possible consequences.

There's one important limitation to the use of desirability curves: you can use them only when each of the consequences can be expressed using a single, numerical variable, such as dollars, acres, years, or lives saved. They can be used, for example, to chart the payoffs of investments in terms of dollars made or lost, the potential environmental impact of a proposed development in terms of square miles affected, or the possible consequences of open-heart surgery in terms of years added to the patient's life.

Desirability curves can be so useful, however, that it will often be worthwhile to use the even swap method to convert consequences described by multiple variables into a single, numerical

term. (Remember that Karen, the accident victim, did this in the Application at the end of Chapter 7. She converted the time and psychological impacts of a trial into equivalent dollar amounts, enabling her to describe her consequences using a single variable: money.)

An Investment Example. To see how desirability curves work, consider the decision problem facing Jim Nance. Jim makes his family's investments, guided by the dual objectives of growth and preservation of capital. Through an investment club, he now has the opportunity to make a one-year investment of \$10,000 in a private venture, unrelated to the securities markets, on which he can make as much as 87.5 percent or lose as much as 37.5 percent. In other words, over the year, his \$10,000 could grow to \$18,750 or shrink to \$6,250. Before learning of this opportunity, Jim had planned to buy an insured one-year certificate of deposit (CD) paying 6 percent interest, which would deliver a sure \$10,600 in a year.

While the potential payoffs of \$18,750 and \$6,250 represent the extremes for the private-venture investment, Jim knows that there are a multitude of other possible payoffs between the extremes, and that each will have its own probability of occurring. Using a simple software program and drawing on publicly available industry data, Jim and some of his fellow investment clubbers develop a risk profile for the investment, showing a range of possible payoffs (which can be used to describe both the outcomes and consequences in this case) and their chances. The risk profile is represented by the first two columns of the table on page 144. Analyzing the risk profile, Jim sees that each of the first three payoffs in the list would all lose money, making the overall

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**Risk Profile for Jim Nance's
Potential Investment**

Chance	Outcome and Consequence: Monetary Payoff	Contribution to Average Monetary Payoff
2%	\$ 6,250	\$ 125.00
6	7,500	450.00
13	8,750	1,137.50
15	10,000	1,500.00
18	11,250	2,025.00
17	12,500	2,125.00
11	13,750	1,512.50
9	15,000	1,350.00
4	16,250	650.00
3	17,500	525.00
2	18,750	375.00
100%	Average monetary payoff:	\$11,775.00

chance of suffering a loss 21 percent (2 + 6 + 13). On the other hand, the last seven payoffs earn more than the CD, making the chance of beating the CD's return 64 percent (18 + 17 + 11 + 9 + 4 + 3 + 2).

The risk profile for this decision is clear and unambiguous (numbers usually are), but the decision isn't. Should Jim invest in the risky venture, or should he go for the safe CD?

To answer that question, most financial analysts would first compute the "average monetary payoff" of the private-venture investment. To do this, they'd simply multiply the dollar amount of each payoff by its chances, as shown in the last column of the table, and then they'd add up all the resulting figures to arrive at the average payoff. In Jim's case, the average monetary payoff of

the venture investment is \$11,775. Because this amount is only \$1,125 higher than the \$10,600 that would be delivered by the CD, many financial analysts would advise Jim to take the CD. They would reason that a sure 6 percent return is too good to turn down given the high risk of the private venture.

There's a big problem with this approach, however. It doesn't take into account the risk tolerance of Jim and his family. It may be that the potential gain of the private venture is worth the risk to Jim. This may be so even if, like most people, he is risk averse and the loss of a given amount of money may have a far greater impact on his family than the gain of that same amount.

The desirability curve can deal with this. What you do is:

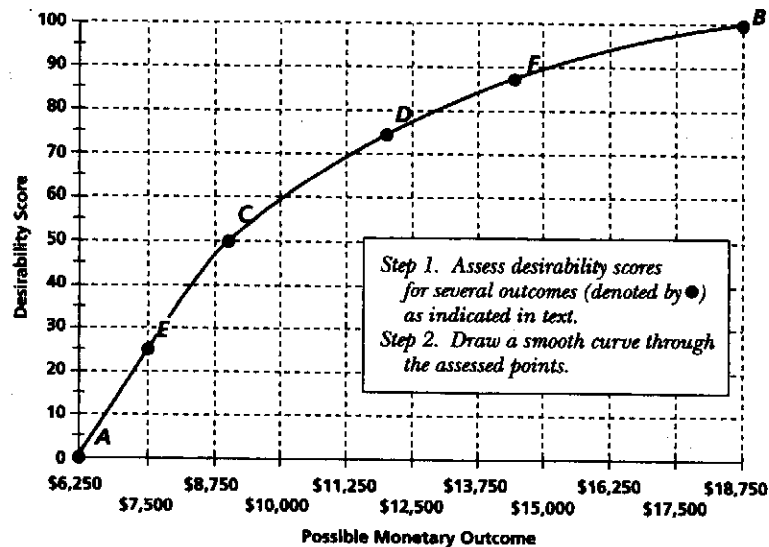
- Construct a desirability curve (often referred to in the literature as a utility curve) that assigns a desirability score to each payoff that reflects the subjective desirability of money to you.
- Use the desirability scores of the possible payoffs and their chances to calculate an overall desirability score for each alternative.
- Choose by comparing the overall desirability scores of the alternatives.

We'll show you how this is done for Jim Nance's investment.

Create a Desirability Curve. Because Jim is working with numbers, ranking the consequences is easy. When it comes to money, more is better, so he just assigns 100 to the highest payoff, \$18,750, and 0 to the lowest, \$6,250. Now, to avoid having to figure out the desirability scores for such a large number of consequences, Jim plots a desirability curve.

He uses a simple graph, illustrated below, with the horizontal axis showing the range of possible payoffs (the consequences) and the vertical axis showing the desirability score associated with each payoff. He first plots the two extreme points: point *A* represents the score of 0, assigned to \$6,250, and point *B* represents 100, assigned to \$18,750. These mark, respectively, the beginning and the end of the curve. He then uses his judgment to establish a midpoint for the curve corresponding to a desirability score of 50. Since preservation of capital is a prime objective, Jim decides that going from \$6,250 to \$9,000 is as desirable as going from

Creating Jim Nance's Desirability Curve for Money



\$9,000 to \$18,750. He thus assigns a desirability score of 50 to \$9,000 (point *C*).

Jim uses similar thinking to divide the ranges above and below \$9,000 into equally desirable ranges to establish payoffs for the 25 and 75 scores. He assigns 75 to \$12,000 (point *D*), which he decides is the midway desirability point between \$9,000 and \$18,750. He assigns 25 to \$7,500 (point *E*), his midway desirability point between \$6,250 and \$10,000.

Usually, connecting just five points will produce a smooth, easy-to-read curve. If more points are needed, however, the ranges can be divided into new equally desirable ranges. To better define his curve, Jim adds a sixth point by establishing the desirability midpoint, point *F*, between points *D* and *B*, at \$14,500. Its desirability score is 87.5, halfway between 75 and 100. He then connects the six points, producing the desirability curve (page 146).

The curve represents the desirability scores of all the potential payoffs falling between \$6,250 and \$18,750. Reading from the curve, the desirability score assigned to the certificate of deposit alternative, which has a monetary value of \$10,600, is 65, for example. Before using the curve, though, Jim decides it would be wise to test some of its implications and, if necessary, adjust it. The curve implies that, for Jim, the following increases, representing desirability increments of 25, are equivalent: \$6,250 to \$7,500; \$7,500 to \$9,000; \$9,000 to \$12,000; and \$12,000 to \$18,750. Asking himself whether these increments reflect his true feelings about desirability and risk, Jim concludes that they do.

Use the Desirability Curve to Make a Decision. Jim is now ready to evaluate the proposed investment, taking into account his risk tolerance. First, he reads from the curve the desirability scores

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that correspond to the 11 payoffs, and he writes the scores on his risk profile, as shown in the table below. He then multiplies each payoff's chances by its desirability score, as in the last column. Finally, he adds up the resulting figures to calculate an overall desirability score for the investment.

The resulting overall desirability score is 68.35. Since this exceeds the desirability of 65 from the certificate of deposit, Jim should choose the private-venture investment.

Get Additional Insights by Converting Desirability Scores Back to Money. Converting the overall desirability score back into

**Computing the Overall
Desirability Score for
Jim Nance's Potential Investment**

Consequence: Payoff in a Year	Chance	Desirability Score	Contribution to Average Desirability
\$ 6,250	.02	0	0
7,500	.06	25	1.50
8,750	.13	46	5.98
10,000	.15	60	9.00
11,250	.18	70	12.60
12,500	.17	78	13.26
13,750	.11	84	9.24
15,000	.09	90	8.10
16,250	.04	94	3.76
17,500	.03	97	2.91
18,750	.02	100	2.00
	1.00	Overall desirability score:	68.35

money yields new insights and another way to think about making risky decisions involving a single objective. Take Jim's risk profile for the venture as an example.

- Its 68.35 desirability score corresponds to a monetary value of \$11,000 from Jim's desirability curve. This says that the value of the venture to Jim is \$11,000.
- Having a monetary value gives Jim an intuitive feeling for how much better the private venture is. Namely, it is worth \$400 more to him than the certificate of deposit, worth \$10,600.
- The values assigned to risk profiles can be used for decision making. A more risk averse member of Jim's investment club might value the private venture at \$10,000 and, as a result, choose the certificate of deposit.
- Someone who had no risk aversion at all would value the private venture as its average monetary payoff, \$11,775 (see table on page 144). Jim's value is less because he is risk averse. The difference between the average monetary payoff and Jim's value, \$775, is called his *risk adjustment* for the risk profile.
- For a given risk profile, the risk adjustment is an indicator of your risk aversion. The larger the risk adjustment for any given risk profile, the more risk averse you are and vice versa.

It may be tempting to assign a value directly to a risk profile without introducing desirabilities in a formal way. Using your intuition, you could directly assess a risk adjustment, then subtract it from the average monetary value to obtain the value of the risk profile to you. This might seem simple and direct, but you need incredibly good intuition to do it well. To arrive at an appropriate figure, somehow you would have to keep in mind all the payoffs

and how desirable you consider each of them to be, as well as how likely each is. This is mind boggling.

The desirability curve approach breaks this thought process into manageable bites, allowing you first to carefully think about your desirabilities, then to blend them with probabilities to calculate an appropriate value.

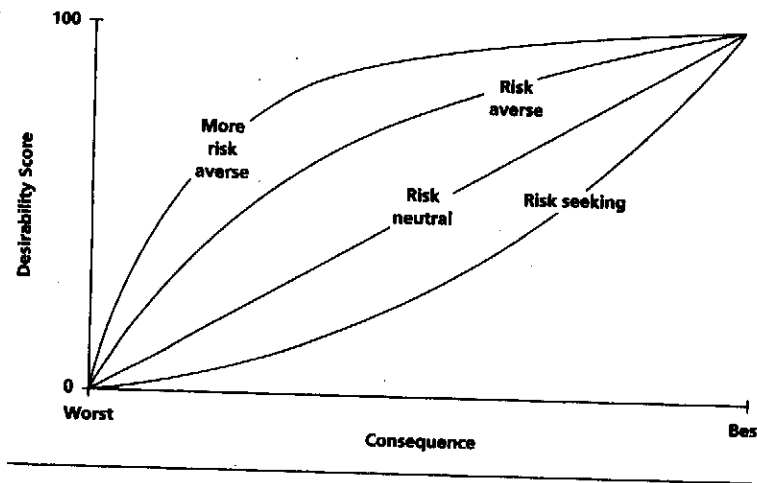
Interpret Desirability Curves. Jim's curve not only helps him make a specific decision, it also provides him with considerable insight into his attitude toward financial decision making in general. It shows, for instance, that avoiding the largest possible loss (that is, the loss from \$10,000 to \$6,250), with its desirability score of 60, outweighs obtaining the maximum gain (going from \$10,000 to \$18,750), which represents a 40-point score. Avoiding losses, it is clear, weighs more heavily in Jim's decision making than achieving equivalent gains, indicating that he is risk averse.

In fact, the shape of your desirability curve is a very good indicator of your overall risk tolerance, as the figure on page 151 illustrates. An upwardly bowed curve indicates a risk-averse attitude with a greater risk aversion indicated by a greater curvature. A straight line represents a risk-neutral attitude, and a downwardly bowed curve connotes a risk-seeking attitude.

Watch Out for These Pitfalls

We've shown you some reliable, logical ways to account for your risk tolerance in making decisions. By using them, you can avoid being tripped up by old habits and other common pitfalls. Here are a few to watch out for:

Interpreting Risk Attitude from a Desirability Curve



- **Don't overfocus on the negative.** To avoid bad consequences (and the resulting regrets), some people give disproportionate attention to the downsides of their alternatives. They focus on avoiding trouble, even if it's unlikely to occur. In many cases, however, the upside potential will far outweigh the downside risk. *Lesson:* Consider the full range of consequences, not just the bad ones.
- **Don't fudge the probabilities to account for risk.** Some people, consciously or unconsciously, account for their risk tolerance by raising the probabilities of outcomes with bad consequences and lowering the probabilities with good ones—just to be safe. Every risk profile is thereby shaded toward a pessimistic view, and the resulting decision is likely to be overly cautious. *Lesson:* Judge chances on their own

merits, without regard for your risk tolerance. Account for your risk tolerance separately.

- **Don't ignore significant uncertainty.** Some people make their decisions based on the most likely scenario, attempting to eliminate complexity by ignoring uncertainty altogether. Without bothering to make a risk profile, they just assume that the most likely chain of events will occur, determine their best choice under those circumstances, and pursue it. If something else occurs, well, that's just good or bad luck. The problem is that something else *can* and likely *will* occur. Effective decision making takes all viable possibilities into account. *Lesson:* When uncertainty is significant, develop a risk profile for each alternative which captures the essence of the uncertainty.
- **Avoid foolish optimism.** While some people assume that the most likely chain of events will happen, others assume that a very positive chain of events will happen. They see decisions through rose-colored glasses. Their wishful thinking may be a personality trait—we all have friends and associates who are perennially optimistic—but often it is simply due to a lack of thoroughness in thinking about what could occur. They might project the completion date for a project, for example, without thinking through all the possible delays. *Lesson:* Think hard and realistically about what can go wrong as well as what can go right.
- **Don't avoid making risky decisions because they are complex.** Overwhelmed by complexity, some people throw up their hands. They may do nothing and live with the status quo, they may make a random or arbitrary decision, or they may get someone else to decide for them. Such “decisions,” unfortunately, will rarely be consistent with their objectives. *Lesson:* Don't despair; you *can* deal sensibly with complexity and reach a smart choice.

- **Make sure your subordinates reflect your organization's risk tolerance in their decisions.** Government agencies, businesses, civic groups, families, and other organizations all have institutional risk tolerances. Without guidance and the proper incentives, people in an organization may, by their decisions, either expose the organization to too much risk or forfeit attractive opportunities by acting too conservatively. *Lesson:* An organization's leaders should take three simple steps to guide subordinates in dealing successfully with risk. First, sketch desirability curves that reflect the risk-taking attitude of the organization. Second, communicate the appropriate risk tolerance by issuing guidelines that include examples of how typical risky decisions should be handled. Third, examine the organization's incentives to ensure they are consistent with the desired risk-taking behavior.

Open Up New Opportunities by Managing Risk

In making decisions at home and at work—especially financial ones—you may frequently find yourself facing a risk that exceeds your comfort level. If so, there may be ways to manage this risk to make it acceptable to you. Consider the situation of Harry Healy, a small business owner who makes a good living in the very risky business of drilling and producing shallow natural gas wells near Zanesville, Ohio. Harry faces enormous risks each time he drills a well. If it produces no gas, he can lose all of the \$125,000 cost of drilling. Furthermore, the price of natural gas can fluctuate by as much as 300 percent in a single year.

Fortunately, Harry has learned to apply various techniques, used regularly by people dealing in the financial markets, to man-

age his risks. Like Harry, you should consider adding these techniques to your risk management repertoire.

Share the risk. When a good opportunity feels too risky, share the risk with others.

In Harry's case, the risk profile for drilling a typical well shows a substantial downside risk, including a 10 percent chance of finding no gas, a 30 percent chance of recovering only a small percentage of the drilling costs, and a 20 percent chance of losing a modest amount. He breaks even about 10 percent of the time and thus actually makes money only about 30 percent of the time—though the profits in these cases can be substantial.

With a net worth of under \$750,000, Harry is unwilling to risk \$125,000 at a time, when the chances are 40 percent that he will lose all or most of his investment. He manages the risk, therefore, by sharing it with a group of investors, each of whom takes a proportional share of the costs and any earnings. Harry himself invests \$25,000, a sum he is comfortable with, to keep 20 percent of each well.

Seek risk-reducing information. Try to temper risk by seeking information that can reduce uncertainty.

To reduce his risk, Harry targets drilling sites with better-than-average risk profiles. He routinely studies surface geology, information on gas production at nearby wells, and, for borderline sites, he orders a seismic test, costing about \$12,000, which can reduce some of the uncertainty about whether and how much natural gas might be present.

Diversify the risk. Avoid placing all your eggs in just a few baskets. Look for ways to diversify.

Harry diversifies his assets, investing some in stocks and bonds, rather than subjecting them all to the vagaries of the gas business. In addition, by buying mutual funds rather than individual securities, he lowers his risk further, because mutual funds hold a number of securities, and the ups of some cancel the downs of others. Even on vacation, Harry diversifies. When he goes white-water rafting through wilderness areas, his party divides the food among each raft.

Hedge the risk. When fluctuations in market prices or rates (interest rates, exchange rates, and the like) expose you to discomforting risk, look for ways to hedge.

Fluctuations in the price of natural gas can result in large swings in Harry's monthly income, and a few successive months of low prices can have serious repercussions. By buying contracts on the commodities exchange that put a floor on future prices, he can—at a cost—manage this risk. Alternatively, he can sign annual fixed-price contracts with the utilities that buy his gas. Harry typically sells over half of his gas at fixed prices and risks leaving the rest subject to market fluctuations.

Insure against risk. Whenever a risk consists of a significant but rare downside, with no upside, try to insure against it. But don't overinsure.

Harry would be liable for substantial damage and injuries from a well blowout or other accident. Although the chances of such an occurrence are extremely low, a serious accident could wipe him out. Harry manages this risk by insuring against it. He doesn't, on the other hand, insure his \$18,000 pickup truck against collision or theft. Because he can afford such a loss, he figures the insurance isn't worth its cost.

All of these techniques help to manage risk by enlisting others in transactions that reshape the original risk profile, making it more compatible with the decision maker's risk tolerance. So, when you face an uncomfortable risk, ask yourself, "What transactions can I make with others that will improve my risk profiles?"

APPLICATION

To Settle or Not to Settle?

Karen and her advisor, Jane, have come down to the final element of Karen's decision: her need for money, which determines her attitude toward risk. Starting with the assumption that Karen, otherwise broke and in debt, has at a minimum assets equal to \$210,000 (the settlement offer minus her lawyer's fees), Jane begins to examine how Karen would use the money. How would it change her life? Karen is ready with answers.

"I've thought about that a lot. First I'd pay off my debts: a \$50,000 student loan, \$25,000 for the surgery my health insurance didn't cover, and \$8,000 in taxes. Then I'd have some purely cosmetic surgery to make these facial scars less visible, and with any money left over, I'd get a used car and maybe pay more rent somewhere to get out of my dreadful apartment."

"How's your job? How much do you make?"

"It's a dead-end job, you know that. I hate sales, and I only earn about \$25,000 a year. I'd like to go back to school and learn something that would help me get a better job. I'd have to take time off, anyway, for the surgery."

Jane summarizes. "If you go to trial and lose—not the most likely outcome, but it has a chance of 30 percent—your life would be pretty bad. You'd be in debt; you couldn't afford some of the things that

would make you happier; you'd have to remain in your present job and keep your present apartment."

Karen interrupts. "Not to mention the humiliation of losing and my regret over not accepting the sure thing of \$210,000. I'm in pretty bad shape now, but I'd be far worse off if I lost the trial."

"But who says you're going to lose the trial?" Sam barks.

Jane continues: "If you netted a lot more money from the trial, what would you do with it? How would it change your life? How much happier would you be?"

"If I had a lot more money, I'd still do all the things I said I'd do if I had the \$210,000. But I'd get a condo rather than go on renting, I'd buy a new car instead of a used one, and maybe I'd buy some clothes and take a few trips to Europe and other places. And I'd definitely go to graduate school. But those things aren't nearly as important to me as what that initial \$210,000 would bring."

"How much more money above the first \$210,000 would give you roughly the same satisfaction it would?"

"Close to a million! At least \$800,000."

Sam couldn't contain himself. "You can't be serious, Karen! You can't equate having only about \$200,000 with having another \$800,000!"

"Yes, I am serious. Without the \$210,000, I'm ruined. More would make me richer, but that's not as important to me as getting an even start.

"This has really helped me," Karen says, turning to Jane. "When you force me to think about my attitude toward risk and the probabilities involved, not only do I see clearly that I should accept the \$210,000 offer, but I have firm conviction in that decision. When I think about how I'd use the money, the peace of mind I'd get, I know that the possibility of gaining more in court isn't worth the gamble of losing it all."

On the courthouse steps, before Sam could accept the \$300,000 offer, the other side increased it to \$325,000. Despite his strongly differing opinion on what she should do, Sam accepted on Karen's behalf.

FOOTNOTES

Lessons from the Application

Karen couldn't identify the smart choice until she had examined her risk tolerance. But once she had thought hard about the relative desirability to her of various possible consequences, she was able to make a decision without further analysis. This is the case for most of the uncertainty decisions that most of us face. Using a little careful, qualitative thinking about the significance of the consequences almost always makes the smart choice obvious.

If Karen had been unable to decide after thinking through the risks and benefits qualitatively, she could use the desirability scoring method. She would assign scores to the possible consequences, compute the overall desirability of going to court and of settling, and base her decision on what the scores revealed.

Sam's sharp disagreement with Karen about whether to accept the \$300,000 offer reflected a correspondingly sharp difference in risk tolerance. (They agree on probabilities; after all, Sam was the source of these judgments.) With Karen's risk tolerance, settling was the smart choice, but with Sam's, settling was foolishly conservative.

It is good to have our advisors challenge our thinking on risk tolerance (as Sam did), but in the final analysis, it's our own (or, in this case, Karen's) risk attitude that matters in making a decision. You should certainly seek out information and guidance from informed advisors, but you should never let them make a decision for you. Sam's recommendation to go to court was incompatible with Karen's risk tolerance.

CHAPTER 9

Linked Decisions

MANY IMPORTANT DECISION PROBLEMS REQUIRE you to select now among alternatives that will greatly influence your decisions in the future. Your choice of a college major, for example, may strongly influence your future career options. Such decisions are *linked decisions*—to make the smartest choice about what to do now, you need to think about what you might decide to do in the future.

All decisions affect the future, of course. Karen's decision, at the end of the last chapter, to take the settlement offer in her lawsuit will obviously affect her future options and opportunities. But those will be essentially new decision situations. The kinds of decisions we want to talk about here involve a *necessary* connection between the current decision and one or more later ones. A doctor initiating treatment on a critically ill patient, for example, has to think about how to respond to possible complications and how the current treatment may open or foreclose alternative treatments in the future.

In such linked decisions, the alternative selected today creates

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