kees, yet they won more games

ple answer is that general man- ent Harvard economics gradu- vas limited and systematically ad been incorporated into per- ficiencies. Lewis (2003) argues mistakes. First, they overgen- vere overly influenced by play- ienced by what they saw with rovided far better data.

pert intuition in baseball sys- ghted other variables. The re- performed the experts. After r over a hundred years, teams v how to run regression equa- players was so inefficient, and it superior management could 's success, many teams tried to is learned to rely more heavily ice (Schwarz, 2005).

resting questions. Why did it n baseball? To what extent are e when better strategies exist? review of *Moneyball*, baseball ll of us, they tended to rely on ated the conventional wisdom effort, and courage for an or- efully assessing data and using

in Major League Baseball are port of baseball is full of excel- ne tendency of baseball execu- f personnel managers to base s rather than on the hard data uitive reactions to interviews, ide little predictability about onnel selection based on real any performance, etc.) rather

ave the opportunity to signifi- processes. We will not argue eball executives, most profes- al behavior and do so in spe- t we can do to correct these

deficiencies? This concluding chapter examines six concrete and complementary strategies for making better decisions: (1) use decision-analysis tools, (2) acquire expertise, (3) debias your judgment, (4) reason analogically, (5) take an outsider's view, and (6) understand biases in others.

STRATEGY 1: USE DECISION-ANALYSIS TOOLS

Since we do not make optimal decisions intuitively or automatically, when decision quality really matters, it makes sense to rely on procedures that can help direct us toward more optimal decisions. The field of study that specializes in giving this sort of prescriptive decision advice is generally called *decision analysis*, and a number of books have distilled the field's wisdom and provide useful guides for making decisions (for example, see Goodwin, 1999; Hammond, Keeney, & Raiffa, 1999). These approaches usually require you to quantify both your preferences and the value you place on each of the various decision options. Rational decision-making strategies also require you to be specific about the probabilities associated with uncertain future outcomes.

Decision analysis usually guides decision making using the logic of *expected value*. To compute an option's expected value, you must multiply its value by its probability. So, for instance, to compute the dollar value of a lottery ticket, you would need to multiply the dollar value of its payout with the probability of receiving that payout. Because the expected value of lottery tickets is almost always less than it costs to buy them, purchasing lottery tickets is usually not a good use of your money. When a decision has multiple dimensions—such as a choice between two houses, one that is expensive and newly renovated and another whose price is more reasonable but that requires more work—the decision usually requires some sort of multi-attribute utility computation. This computation forces the decision maker to weigh her willingness to spend money against her willingness to perform home improvement work.

Often, however, businesses need to make a series of similar decisions over and over. For instance, corporations need to decide which applicants to hire. Executives need to decide which employees to promote and how big each employee's bonus should be. Bank loan officers need to decide whether to extend credit to loan applicants. Venture capitalists need to decide whether to fund an entrepreneur's new venture.

What Is a Linear Model?

One excellent tool for making these sorts of decisions is a *linear model*—a formula that weights and adds up the relevant predictor variables in order to make a quantitative prediction. As an example, Don recently asked his children's pediatrician to predict how tall his five-year-old son, Josh, would grow to be. The pediatrician offered a simple linear model in response. She said that a child's adult height is best predicted with the following computation: First, average the parents' heights. Second, if the child is a boy, add two inches to the parents' average. If the child is a girl, subtract two inches from the parents' average. Innumerable linear models exist to help us make informed predictions. A linear model called PECOTA, for instance, helps baseball teams predict players' future performances using data such as their ages, heights, weights, and prior performances (Schwarz, 2005). There is even a company that uses a secretive linear model to help movie studios predict how much money their movies will earn (Gladwell, 2006).

Why Linear Models Can Lead to Superior Decisions

Researchers have found that linear models produce predictions that are superior to those of experts across an impressive array of domains. In addition, research has found that more complex models produce only marginal improvements over a simple linear framework. Dawes (1979) argues that linear models are superior because people are much better at selecting and coding information (such as what variables to put in the model) than they are at integrating the information (using the data to make a prediction). Einhorn (1972) illustrates this point in a study of physicians who coded biopsies of patients with Hodgkin's disease and then made an overall rating of disease severity. The individual ratings had no predictive power of the survival time of the patients, all of whom died of the disease. However, the variables that the physicians selected to code did predict survival time when optimal weights were determined with a multiple regression model. The doctors knew what information to consider, but they did not know how to integrate this information consistently into valid predictions.

In addition to having difficulty integrating information, we are also inconsistent. Given the same data, we will not always make the same decision. Our judgment is affected by mood, subjective interpretations, environment, deadlines, random fluctuations, and many others nonstable characteristics. In contrast, a linear model will always make the same decisions with the same inputs. Thus, the model captures the underlying policy that an expert uses while avoiding the expert's random error. Furthermore, experts are likely to be affected by certain biases triggered by specific cases. In contrast, the model includes only the actual data that are empirically known to have predictive power, not the salience or representativeness of that or any other available data. In short, linear models can be programmed to sidestep biases that are known to impair human judgment.

Such bias is common in financial decisions, corporate personnel decisions, bank loan decisions, and routine purchasing decisions. In each of these domains, the decision maker must make multiple routine decisions based on the same set of variables—a task well suited to a linear model. Such models allow an organization to identify the factors that are important in the decisions of its experts. Thus, independent of their superior predictive powers, the feedback and training opportunities provided by linear models make them a valuable managerial tool.

Why We Resist Linear Models

While evidence amply supports the power of linear models, such models have not been widely used. Why not? Resistance to them is strong. Some have raised ethical concerns, such as this one described by Dawes (1979):

> When I was at the Los Angeles Renaissance Fair last summer, I overheard a young woman complain that it was "horribly unfair" that she had been rejected by the Psychology

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physicians who coded biopsies
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he physicians selected to code
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onsider, but they did not know
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tion, we are also inconsistent.
ne decision. Our judgment is
nt, deadlines, random fluctua-
rast, a linear model will always
he model captures the under-
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cally known to have predictive
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e same set of variables—a task
nization to identify the factors
independent of their superior
ties provided by linear models

els, such models have not been
e have raised ethical concerns,

er, I overheard a young woman
n rejected by the Psychology

> Department at the University of California, Santa Barbara, on the basis of mere numbers, without even an interview. "How could they possibly tell what I'm like?" The answer is they can't. Nor could they with an interview.

Dawes argues that decision makers demonstrate unethical conceit in believing that a half-hour interview leads to better predictions than the information contained in a transcript covering three-and-a-half years of work and the carefully devised aptitude assessment of graduate board exams.

Now consider the response that Max received when he asked a well-known arbitrator to make a number of decisions as part of a study of arbitrator decision-making processes:

> You are on an illusory quest! Other arbitrators may respond to your questionnaire; but in the end you will have nothing but trumpery and a collation of responses which will leave you still asking how arbitrators decide cases. Telling you how I would decide in the scenarios provided would really tell you nothing of any value in respect of what moves arbitrators to decide as they do. As well ask a youth why he is infatuated with that particular girl when her sterling virtues are not that apparent. As well ask my grandmother how and why she picked a particular "mushmelon" from a stall of "mushmelons." Judgment, taste, experience, and a lot of other things too numerous to mention are factors in the decisions. (Bazerman, 1985)

In contrast with this arbitrator's denial of the possibility of systematically studying decision processes, research in this area actually shows that linear models are capable of capturing his decision-making model (or his grandmother's choice of mushmelon).

Another argument commonly made against decision-analysis tools such as linear models is that they rule out the inclusion of intuitions or gut feelings. In an apocryphal story, Howard Raiffa was on the faculty at Columbia and received an offer from Harvard. According to the story, he visited his dean at Columbia, who was also his friend, and asked for help with his decision. Sarcastically, the dean, borrowing from Raiffa's writings on decision analysis, told Raiffa to identify the relevant criteria, weight each criterion, rate each school on each criterion, do the arithmetic, see which school had the best overall score, and go there. Supposedly, Raiffa protested, "No, this is a serious decision!" While he enjoys this story, Raiffa says it simply isn't true. The more important the decision is, he continues to believe, the more important it is to think systematically about it.

Finally, people sometimes argue that the use of linear models will require difficult changes within organizations. What will bank loan officers or college admissions officers do when computers make the decisions? Such concerns express the fear that people are not necessary for linear models to make decisions. In fact, people play a crucial role in models. People decide which variables to put into the model and how to weight them. People also monitor the model's performance and determine when it needs to be updated. Nevertheless, resistance to change is natural, and resistance to the use of linear decision models is clearly no exception. Overcoming a bias against expert-based, computer-formulated judgments is yet another step you can take toward improving your decision-making abilities. We will now look more closely at two domains in which evidence shows that linear models can lead to better organizational outcomes: graduate-school admissions decisions and hiring decisions.

Improving Admissions Decisions

The value of using linear models in hiring, admissions, and selection decisions is highlighted by work Moore and his colleagues undertook on the interpretation of grades (Moore, Swift, Sharek, & Gino, 2007). They found substantial differences in the grading practices of colleges, even between institutions of similar quality and selectivity. The results show that students from colleges with more lenient grading are more likely to get into graduate school, even after controlling for the quality of the institution and the quality of its students. Due to a variant of the representativeness heuristic called the *correspondence bias* (Gilbert & Malone, 1995), graduate schools misinterpret the high GPAs of alumni from lenient-grading institutions as indicating high performance. The correspondence bias describes the tendency to take others at face value, assuming that their behavior (or their GPAs) corresponds to their innate traits. This bias persists even when those making the admissions decisions have full information about different institutions' grading practices. It seems that people have trouble sufficiently discounting high grades that are due to lenient grading.

By contrast, it would be easy to set up a linear program to avoid this error. Indeed, Dawes (1971) did just that in his work on graduate-school admissions decisions. Dawes used a common method for developing his linear model: he first modeled the admissions decisions of a four-person committee. In other words, he systematically analyzed how the committee made its admissions decisions relying on three factors: (1) Graduate Record Examination scores, (2) undergraduate grade point average, and (3) the quality of the undergraduate school. Dawes then used the variable weightings he obtained from modeling the experts in a linear model to predict the average rating of 384 other applicants. He found that the model could be used to rule out 55 percent of the applicant pool without ever rejecting an applicant that the selection committee had in fact accepted. In addition, the linear model was better than the committee itself in predicting future ratings of the accepted and matriculated applicants by faculty! In 1971, Dawes estimated that the use of a linear model as a screening device by the nation's graduate schools (not to mention by the larger domains of undergraduate admissions, corporate recruiting, and so on) could result in an annual savings of about $18 million in professional time. Adjusted for today's dollars and the current number of graduate-school applications, that number would easily exceed $500 million.

Improving Hiring Decisions

Hiring decisions are among the most important decisions an organization can make. Virtually every corporation in the world relies on unstructured, face-to-face employment interviews as the most important tool for selecting employees who have passed through an initial screening process. The effectiveness of employment interviews for predicting future job performance has been the subject of extensive study by industrial psychologists. This research shows that job interviews do not work well. Specifically, employment interviews predict only about 14 percent of the variability in employee

performance (Schmidt & Hunter, 19
ing job performance is difficult and f
predict performance substantially bet
stantially lower cost.

So why do people continue to bel
agers' robust faith in the value of inte
tive biases:

- **Availability:** Interviewers may
ployee performance, but their i
bother to collect useful data on th
in specific positions or within the
rely on their intuitions to determ
ities needed for success.
- **Affect heuristic:** People make
or not, based on superficial featu
mannerisms, or similarity to self (
Rosenthal, 1993). Managers rarel
employment interview (Dougher
times claim that interviews allow
the firm, but this assessment is u
candidate's qualities, and is littl
response.
- **Representativeness:** Intuition
speak coherently about her goal
form well at the job. For most jo
lated to actual job performan
ingratiating people often make
However, these traits are often l
mediately observable traits, such
- **Confirmation heuristic:** After
and hiring one of them, manage
selected (Einhorn & Hogarth, 19
forming better than the rejecte
they would need to assess wheth

What is a better alternative to face-
number of other selection tools are a
ment than interviews, including simp
conducting interviews, they ought to
dates are reviewed by the same set o
the same questions of each candida
viewers' quantitative assessments o
model, along with intelligence, years