Simple Minds, Smart Choices

For sweet decisions, mix a dash of knowledge with a cup of ignorance

By BRUCE BOWER

During a Major League baseball game, nobody needs a seventh-inning stretch more than the catcher. Not only does he play in an uncomfortable crouch swathed in protective gear, but he makes critical decisions at the frenzied pace of an air-traffic controller.

Before each delivery, the catcher flashes a hand signal to the pitcher indicating the best pitch to throw. Imagine that a strong batter faces a count of three balls and two strikes, with runners on first and third. What should the hurler serve up, a fastball high and inside, a slider low and away, or a change-up over the heart of the plate? By the way, Mark McGwire's up next.

Former Major League catcher Tim McCarver didn't wrack his brain over such quandaries. "You have to put down a sign quickly," he told an interviewer in the March 28 NEW YORK TIMES MAGAZINE. "[T]he first one is going to be the right one." For most baseball decisions, he adds, "I think you can train yourself to be right quicker than in five seconds."

It's unclear whether McCarver's pared-down approach to decision making is always a hit. However, a growing number of behavioral scientists in a variety of disciplines now embrace a similar perspective, often called bounded rationality. Here, bounded refers to inherent limits on rational thought, depending on the organism and its environment. Decision strategies that hinge on mere bits of well-chosen information about one's surroundings pack a surprisingly powerful wallop, especially when time and knowledge are in short supply, according to the bounded-rationality view.

In fact, new evidence suggests that for choosing one's actions in many real-world contexts, these bare-bones tactics work at least as well as complex statistical formulas that consider voluminous data. Studies also suggest that simple strategies wring insight out of shifting environments with much greater ease than fancy probability equations do.

This is good news for animals trying to survive on an often unforgiving planet. Harried decision makers throughout the animal kingdom lack the mental tools to zip through intricate probability calculations but boast enough brain power to discover and exploit simple guides.

Models of what is called rational judgment in cognitive science, economics, biology, and other fields have traditionally held that animals strive to reach the best possible, or optimal, judgments by statistically weighing and comparing all information relevant to a task. This scenario largely ignores time pressures. Even if the full solution eludes their grasp, this view states, creatures look for ways to edge closer to optimality.

As an alternative to optimality, bounded rationality has lurked in the academic background since its description 40 years ago by psychologist Herbert Simon of Carnegie Mellon University in Pittsburgh. Simon argued that it's usually too difficult for a person to calculate an optimal strategy. Moreover, he held, in many situations no single best solution exists. Instead, the mind's limitations dictate that people use heuristics, or simple rules of thumb derived from experience, to exploit consistent information patterns in their surroundings.

"There's now a convergence of thinking across a number of fields on the importance of heuristics and bounded rationality," says Thomas D. Seeley, a behavioral ecologist at Cornell University. "All sorts of animals take advantage of the structure of the environments that they live in to simplify their decisions."

Seeley participated in a scientific workshop on bounded rationality held in March at the Free University in Berlin.

Researchers at the Berlin meeting agreed that animals often reach critical decisions by relying on uncomplicated shortcuts. In joint position papers written at the end of the workshop, they concluded that bounded rationality may help clarify how emotions, consensus-building cues in small groups, and cultural norms simplify human reasoning—for better and for worse.

The Center for Adaptive Behavior and Cognition at the Max Planck Institute for Human Development in Berlin has launched one of the most ambitious projects yet to explore the impact of bounded rationality on human judgment. Scientists at the German facility, headed by psychologist Gerd Gigerenzer, discuss their latest findings in *Simple Heuristics That Make Us Smart* (1999, Oxford University Press).

Gigerenzer's group focuses on what it calls "fast and frugal" formulas for decision making. These guidelines not only work with limited knowledge about the task and environment at hand but actually benefit from partial ignorance.

In a previous study, Gigerenzer and coworker Daniel G. Goldstein asked a computer program to choose the more populous German city in each of many pairs. The program selected correctly more often when it was equipped with a fast-and-frugal strategy for evaluating cues to city size than when it used statistical methods that analyzed all available information (SN: 7/13/96, p. 24).

The simple heuristic, dubbed "take the best," first noted whether the computer program recognized one city but not the other. If so, the recognized city was treated as larger. If both or neither city was recognized, the program then considered a list of other cues one at a time. It began with strong cues to size, such as the city being a state capital, and ended with weaker ones, such as the city having a university. The first cue on which a pair of cities differed triggered a size verdict.

Accuracy peaked when the computer program recognized about half the cities. In that situation, pairs often consisted of one recognized and one unfamiliar city. Knowledge and ignorance thus worked together to quicken and improve size determinations.

Gigerenzer and his coworkers have now applied recognition-based judgments to a much wilder realm—the stock market. Their humble strategy again showed its muscle, at least during a rising, or bull, market.

The researchers surveyed 480 people on their recognition of some companies on the New York Stock Exchange (the 500 firms indexed by Standard and Poor's) and 298 companies on several German stock exchanges. Volunteers fell into one of four groups: pedestrians in downtown Chicago, pedestrians in Munich, finance or economics graduate students at the University of Chicago, and comparable graduate students at the University of Munich.

Two primary investment portfolios were constructed for each group based on companies in its home country recognized by at least 90 percent of the group's members and the 10 most-recognized firms in the country foreign to the group. Portfolio performance was monitored for 6 months, beginning on Dec. 13, 1996.

Portfolios of highly recognized stocks performed far better than portfolios of unrecognized stocks that were also assembled for each group. Investment

portfolios based on recognition in most cases also yielded higher returns than common measures of overall market performance in both countries.

Ignorance seemed to work in a portfolio's favor, the researchers say. People making international picks did better than the graduate student or pedestrians choosing native companies. Furthermore, while the pedestrian groups recognized only a small proportion of the international stocks, their top-10 international portfolios outperformed both portfolios of randomly selected stocks and the markets.

Putting his money where his heuristic is, Gigerenzer invested the equivalent of more than $30,000 in the German stocks most familiar to German pedestrians. He raked in a 47 percent return over the course of the study, beating the market index by about 13 percent.

Gigerenzer also asked the German graduate students simply to recommend a portfolio of stocks. They tended to pick less-recognized German stocks, and their choices usually lost money.

In further research, Gigerenzer plans to examine whether recognition-based portfolios outperform managed funds and other tactics in a declining, or bear, market. It's possible that the recognition heuristic simply picks the biggest firms, which may feed disproportionately off market upswings and suffer the biggest hits during economic downturns.

Beyond a blind reliance on recognition, the take-the-best heuristic and a pair of even plainer tactics squeeze a surprising amount of predictive accuracy out of available decision-making cues, according to Gigerenzer's group. The two simpler strategies consist of relying on the first randomly chosen cue that discriminates between a pair of choices or beginning with the cue that yielded the previous correct choice and then, if necessary, picking cues at random.

In computer simulations, these fast-and-frugal strategies jousted with several sophisticated mathematical formulas in making predictions about 20 real-world situations. Competing approaches estimated, for example, which of two Chicago public high schools—presented in a series of pairs from a total of 57 schools—had a higher drop-out rate based on a set of cues of varying usefulness. Each computerized tactic learned to make choices using a partial set of these cues and then rendered further verdicts using the remaining cues.

Statistical formulas such as multiple regression often outperformed the fast-and-frugal competitors during the training period. In the later trials, the two simplest heuristics did about as well as multiple regression. But the take-the-best heuristic, showing its greater flexibility, triumphed over multiple regression. Also, that heuristic came within one percentage point of the accuracy of so-called Bayesian models, which even more slowly and exhaustively compute an event's probability.

The take-the-best method works particularly well in information-scarce environments where a few cues, each on its own, act as reliable decision guides, Gigerenzer theorizes.

Another simple heuristic, studied by Max Planck Institute psychologist Peter M. Todd and several colleagues, shows promise as a framework for categorizing objects. The researchers call it "categorization by elimination."

Simple decision strategies make a killing in the stock market, according to a German researcher.

This strategy puts in order a limited number of categorization cues according to how well they work. It then uses these cues one by one to narrow down a set of choices, stopping as soon as only one remains.

In one study, categorization by elimination worked about as well as two information-crunching approaches. The researchers instructed pairs of volunteers, each in a separate room, to manipulate virtual bugs that interact on a computer screen. Each person was told to make his or her bug display pursuit or evasion, fighting together, courting or being courted, and play.

The computer was then used to categorize the volunteers' intentions by consulting up to seven bug-motion cues—including forward speed of each bug and relative distance between bugs. It considered the cues one at a time, beginning with those deemed most informative by the investigators. They compared this simulation with one that employed a pair of statistical methods that combined information from all seven motion cues.

The simple heuristic usually considered only three or four motion cues before ruling on bugs' behavioral aims. Yet its 57 percent accuracy rate nearly matched the 60 percent rate achieved by the statistical approaches.

Psychologist Ward Edwards of the University of Southern California in Los Angeles, an advocate of Bayesian tools to assist judgment, calls the latest findings "impressive and remarkable." Still, Edwards expresses uncertainty over the applicability of such simple tactics to many of life's thorny problems.

The extent to which fast-and-frugal tactics work in various environments is unknown, cautions Baruch Fischhoff, a Carnegie Mellon psychologist who studies decision making. "It's hard to tell how people naturally frame their decisions," he remarks.

While bounded rationality struggles for respect in fields such as psychology, artificial intelligence, and economics, it has largely replaced the optimality assessments long favored by investigators of animal behavior in natural habitats, Seeley says.

The Cornell scientist's own work on collective decisions by honeybees offers a case in point. Up to several hundred scouts in a honeybee hive visit prospective new nest sites and then return to perform a group dance that culminates in the selection of a superior site.

Rather than hashing out the pros and cons of each piece of real estate, the scouts abide by a few dancing rules to reach a consensus that sends the swarm to a suitable new home, Seeley holds.

In research described at the Berlin workshop, Seeley finds that individual scouts dance longer and in a more frenzied manner after visiting better sites (such as a large, thick-walled tree cavity situated high above the ground). Scouts who visit mediocre and poor sites quit dancing sooner. Hours later, some of the quitters resume gyrating, this time copying the dance of scouts who visited the site that the group eventually chooses.

"It seems that the cognitive tools used by individual bees are surprisingly simple, especially compared with the complex information processing performed by the swarm as a whole," Seeley says. "In this case, collective wisdom arises from the poorly informed masses."

Seeley plans to investigate how honeybee scouts determine the dance-worthiness of prospective sites.

In the meantime, baseball catchers and honeybees are not the only ones who like to keep their decision-making tactics short and sweet. Gigerenzer recounts an anecdote about two eminent philosophers, one of whom was vacillating over whether to accept a job at a rival university. His comrade advised him to do what he always wrote about—optimize his choice by using every bit of potentially useful information to weigh the pluses and minuses of the new position.

The first philosopher responded acidly, "Come on, this is serious." □