



Book reviews

Simple Heuristics That Make Us Smart

G. Gigerenzer, P.M. Todd, and the ABC (Center for Adaptive Behavior and Cognition) Research Group; Oxford University Press, New York, 1999, 416 pages, ISBN 0-19-512156-2 Hardcover, \$24.50.

How can we be rational in a world of risks and uncertainties?

Recently, the Center for Cognitive Sciences at the University of Minnesota announced the results of its Millennium Project: a list of the 100 most influential works in cognitive science from the 20th century. Not surprisingly, this very recent volume by Gigerenzer and colleagues did not make the list. Of course, it is much too soon to judge which works *from* the 20th century will prove to be most influential, and I hope and expect that when such a tally can eventually be made, this volume will be high on the list.

In their beginning remarks, the authors tell us: “This book is an invitation to participate in a journey into largely unknown territory. The journey ventures into a land of rationality that is different from the familiar one we know from many stories in cognitive science and economics — tales in which humans live in a world with unlimited time and knowledge, where the sun of enlightenment shines down in beams of logic and probability. The new land of rationality we set out to explore is, in contrast, shrouded in a mist of dim uncertainty.”

The contents of the book

This book is a result of teamwork, ingeniously crafted to examine three design features of human rationality: bounded rationality, ecological rationality, and social rationality. The central argument of the book is that the environments in which we evolved and in which we now live have certain regularities and that decision-making mechanisms take advantage of these environmental regularities. The ecological and social regularities have been largely ignored in contemporary models of decision making, which often assume generalized all-purpose mechanisms based on the laws of logic and probability. In contrast, when taking environmental regularities and limited mental capacities into account, the mechanisms and heuristics that we actually use may be both surprisingly fast and frugal and remarkably accurate at the same time.

The first chapter of this volume lays down the theoretical foundation for the use of fast-and-frugal heuristics. These heuristics are fast because they use only part of the potential available information in the environment, and they are frugal because they are

guided by stopping rules for information search and use only a few cues or even a single piece of information for making a decision (one-reason decision making). These heuristics are fast and frugal also because they are specially designed mental tools for solving specific problems in specific task environments.

Most of the book illustrates this argument by showing that in many circumstances these simple heuristics can even outperform well-known statistical benchmark models (such as multiple regression and Bayes's theorem) when uncertainty is high and knowledge about the world is incomplete.

The first and the simplest heuristic put to test (chapter 2) is the *recognition heuristic*, which exploits information implicit in the failure to recognize something, and thus can be considered to be an ignorance-based heuristic. One example from the book is that cities whose names are familiar are likely to be larger than cities unfamiliar names. The recognition heuristic can also be generalized to the task of choosing a subset of objects from a larger set, as in selecting a set of stocks based on recognition alone (chapter 3). By analyzing and simulating the performance of the recognition heuristic, the authors arrive at a counter-intuitive prediction: Using this heuristic, a person who knows less than another can make systematically more accurate inferences. For example, stocks whose names are known to relatively uninformed individuals are likely to outperform unknown stocks.

Another class of simple heuristics (e.g., *Minimalist*, *Take the Last*, and *Take the Best*) for one-reason decision-making is systematically examined in chapters 3 through 8. The *Take-the-Best* heuristic knows not only the signs of cues but also which cues are better than others, and terminates the search if one object has a positive cue value and the other does not. In comparison, the *Take-the-Last* heuristic only needs to know what cues to use, not what order in which to use them. A tournament between the proposed simple heuristics and some well-known linear strategies (e.g., Dawes's rule and multiple regression) is conducted in 20 real task environments. The tasks range from predicting the attractiveness of famous men and women based on cues such as name recognition and nationality of the selected men and women, to predicting high school dropout rate based on cues such as the percentage of low income students and their SAT scores, to predicting mortality rates in 20 U.S. cities, house prices, car accident rates, and degrees of environmental pollution (chapter 5). The performance of these one-reason decision-making heuristics is remarkable and comes within a few percentage points of the accuracy of computationally complex Bayesian models (chapter 8).

Chapters 9 through 11 examine another set of simple heuristics, namely, elimination heuristics in categorization tasks, where one category must be chosen from several possible ones. *QuickEst* (chapter 10), for instance, can be seen as taking an elimination approach to estimation by taking advantage of ecological regularities of the environment. The trade-off between being fast and frugal and being accurate is discussed in chapter 9. In light of this discussion, a well-known cognitive phenomenon in estimating event probability, called hindsight bias, is viewed as a price worth paying for fast-and-frugal memory.

The next three chapters explore the use of simple heuristics in the domain of social intelligence. In chapter 12, the authors explore how categorization by elimination can be used to make rapid decisions about the intentions of other organisms from their motion

cues alone. Intriguing simulations are conducted to investigate satisficing heuristics for sequential mate search in chapter 13 and in parental investment in chapter 14. Chapter 13 takes up the problems typified by selecting the best secretary or a mate from a somewhat unknown pool of alternatives, where one cannot return to individuals previously passed over. The optimal rule requires examining the first 37% of the candidates and then choosing the first candidate who is superior to any of those in the original sample. If the chance of actually finding the optimal person is also to be just 37% on average, then 74% of the people would have to be interviewed. Clearly, this is a costly and unreliable procedure. Simulations show that a criterion based on the first 14% of candidates has an 83% chance of finding someone in the top 10% of the pool. In many environments, a simple “try a dozen” rule works even better under many criteria than does the 37% rule. As the authors noticed, in mate search, both parties are choosing. Future work should take this important feature of mate search into account.

The last part (chapters 15 and 16) summarizes the book and looks toward the future. In sum, the book provides stimulating ideas and intellectually challenging discussions. In addition, it is fun to read.

The fast-and-frugal heuristics approach

The research program reported in the book takes a synthetic approach that combines the Brunswikian tradition of vicarious functioning and Simon’s bounded rationality and satisficing (i.e., satisfying and sufficing as opposed to optimizing) heuristics. According to Brunswik (1940), cues used in decision making are selected with priority and substituted for each other. Individual decision cues are incomplete predictors of uncertain outcomes, but are collectively sufficient for making accurate judgments and decisions. The main tool used by Brunswik to model vicarious functioning was multiple regression. In a world of risks and uncertainties, however, vicarious cues may not be equally reliable in different environments. Moreover, to survive and thrive in the face of risks and uncertainties, one is obliged to settle for less than the optimal. Simon’s concept of bounded rationality (1956, 1990) calls for research attention to the behavioral implications of the two shaping forces of human decision rationality, namely, the structure of task environments and the limited computational capacities of the decision maker.

The simple heuristics approach has replaced multiple regression with a rich set of faster and more frugal heuristics. In this book, these fast-and-frugal heuristics are viewed as a new branch of adaptive mental tools parallel to the satisficing heuristics. Thus, there are two forms of bounded rationality: satisficing heuristics for searching through available alternatives and fast-and-frugal heuristics that use little information and computation to make a variety of decisions.

All the proposed simple heuristics are specified with precise steps for actions and clear stopping rules for search. The simple heuristics approach is a major advance in breaking narrow norms in studying human rationality. According to Gigerenzer (1996), the effectiveness of a heuristic is determined by its fit to the task environment; that is, its ecological validity. Research on reasoning and decision making should begin by

investigating the content and context of a problem to clarify the antecedent conditions that elicit various heuristics and to work out the relationship between heuristics. The laws of logic and probability play little role in the performance of these mental tools and thus should not be imposed as universally applicable norms of sound reasoning.

Many issues discussed in the book should be of interest to the readership of *Evolution and Human Behavior*. The authors argue that evolutionary rationality can be found in the use of fast-and-frugal heuristics and inference mechanisms that can be simple and smart.

The issues raised in the book

In the following I focus on the areas where I see a need for further research and great possibilities of progress.

When do we need fast-and-frugal heuristics?

The working realm of fast-and-frugal heuristics needs to be clearly defined. There may be multiple ways to distinguish the situations where being fast and frugal is critical from those where speed and efficiency are built-in components of intuitive heuristics. Cosmides and Tooby (1996) have provided relevant discussion on mechanism complexity. According to them, it may be complex to determine whether and how a statistical rule, such as Bayes's theorem, should be applied to a given problem, but statistical rules are not themselves complex. In their words, "natural selection has produced computational mechanisms in the visual system that are vastly more complex than those that would be required to apply the calculus of Bayes' rule. There is no 'natural limit' on evolved complexity that would prevent the evolution of computational mechanisms that embody Bayes' rule" (p. 12). The notion of mental limitations is "empirically vacuous unless one specifies what those limitations are" (p.13).

It appears that Gigerenzer et al.'s fast-and-frugal heuristics may be particularly useful for dealing with evolutionarily novel problems. Another useful distinction may be between tasks in which the information to be used is available to the decision maker in parallel versus tasks where information must be sought explicitly through a search either in memory or in the environment.

Cue selection and cue ranking

Some simple heuristics proposed in the book require the decision maker to know the ranking of cues while others do not. The effectiveness of fast-and-frugal heuristics that do not need a ranking of cues, such as Take the Last and Minimalist, has not been tested in social domains against cue-ranking dependent heuristics, such as Take the Best and QuickEst.

In social situations where some cues may be irrelevant or negatively correlated with judgment criteria, random selection of a cue may lead to fitness-reducing behavior. In some situations, cues may even be presented falsely for the purpose of social manipulations. What

would and should people do in such situations, particularly when making survival-related decisions in complex social environments?

The simple heuristics themselves say little about cue selection and cue ranking, and thus provide no guidance here. Evolutionary models such as Hamilton's inclusive fitness rule (1964) provide testable predictions about cue selection and cue ranking. For instance, Burnstein et al. (1994) tested social implications of Hamilton's inclusive fitness model in hypothetical contexts where subjects had to decide how to use their resources to help others. The social information or cues about the recipients of the help varied in kinship, age, health, wealth conditions, and fecundity status. The results showed that these cues were given different priorities depending on the risk level of the problem. When making high-stake, survival-related decisions, cues were used clearly in a way to enhance the donors' inclusive fitness. However, when decisions involved trivial everyday favors and bore little biological significance, cues were integrated into decisions contingent upon social or cultural norms, such that more resources were allocated to the elderly than to young adults whose genetic relatedness to the decision maker was the same.

Cue conflict and goal conflict

How important are cue ranking and cue selection in making survival-related judgments and decisions under uncertainty, particularly when available cues are not all usable or positively correlated with an inference criterion? Our studies of risky choice in social contexts (Wang, 1996; Wang et al., in press) suggest that, other than kinship, group size is another evolutionarily reliable cue about social relationships and is in fact used with a high priority in making risky decisions. When cues about kinship, group size, and group composition (group homogeneity) are unambiguously presented, subjects pay little attention to verbal framing cues that present the same choice outcomes in terms of either lives-saved or lives-lost. However, when evolutionarily valid cues are absent or in conflict, decision makers become sensitive and susceptible to the verbal frames of choice outcome. Such social context-dependent susceptibility to verbal/communicational cues can lead to an irrational reversal in risk preference simply due to the way of presenting expected outcomes. Thus, in cases of cue-conflict or goal-conflict (Simon, 1956, 1990), unreliable low-ranking cues may be selected in making risky choices.

Evolutionary psychology can provide insights into questions concerning how people select a fast-and-frugal heuristic or combinations of heuristics from the adaptive toolbox. Some other questions that may be of interest to the readers of this journal include: Where do heuristics come from? How are heuristics selected from the adaptive toolbox? How does environmental structure interact with heuristic use? What are the differences in the use of adaptive heuristics to solve evolutionarily recurrent problems as opposed to evolutionarily novel problems? How do we use fast-and-frugal heuristics in estimating social risks and making risky decisions?

In short, there are many intriguing ideas and stimulating issues raised in the discussions of this book. As the ideas grow, the fast-and-frugal heuristics program will undoubtedly continue to be developed and expanded in various areas of human behavior (e.g., psychology,

economics, management science, and biology). This book has opened a new mine of literature in the field of judgment and decision making. Evolutionary thinking has helped the authors identify problems and construct investigations and should continue to guide future research on bounded rationality, social rationality, and ecological rationality.

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Death Hope and Sex: Steps to an Evolutionary Ecology of Mind and Morality

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Evolutionary ecology embraces early experience

One of the most seductive beliefs in human development is that early experience fundamentally molds personality traits and intellectual capacities. The reasons that this idea hold strong sway would require a book in itself to explore fully. Freudian theory made a