

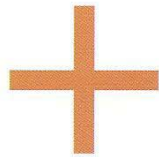
YALE ECONOMIC REVIEW

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Baseball's New Science

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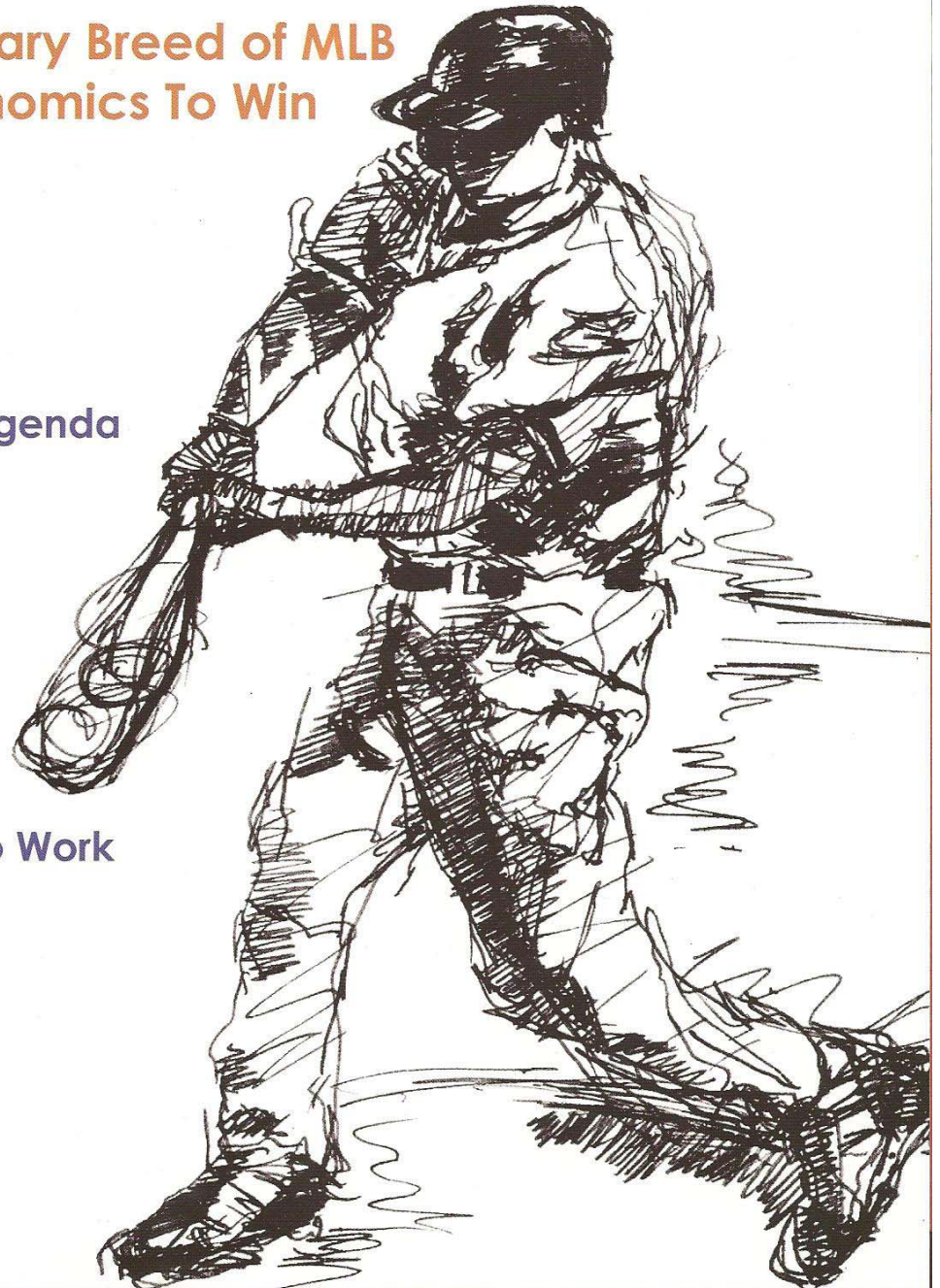
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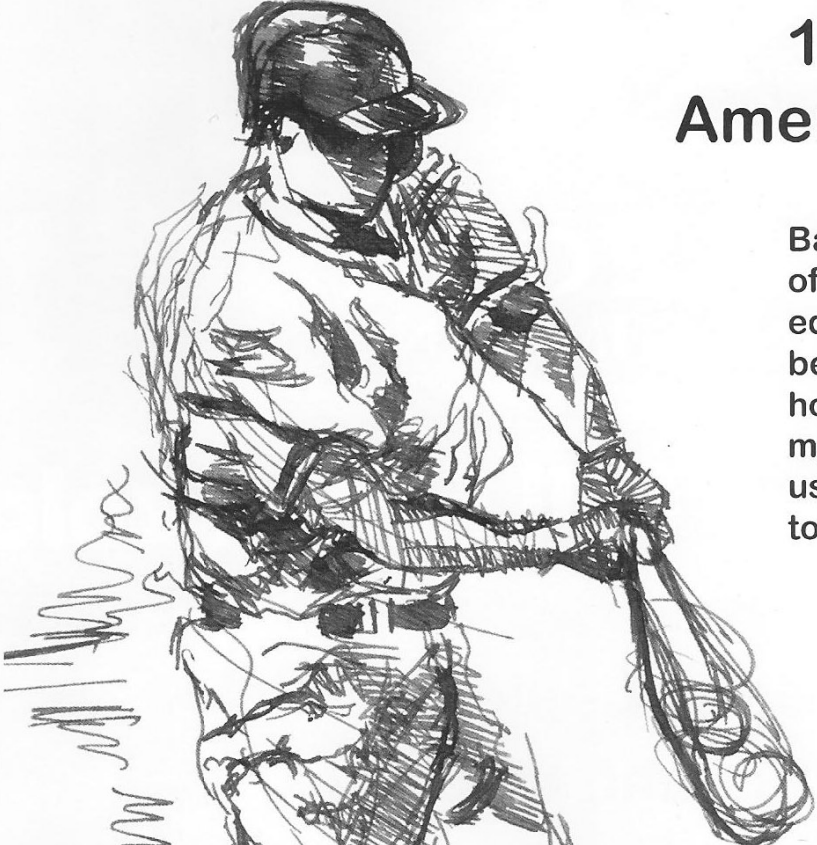
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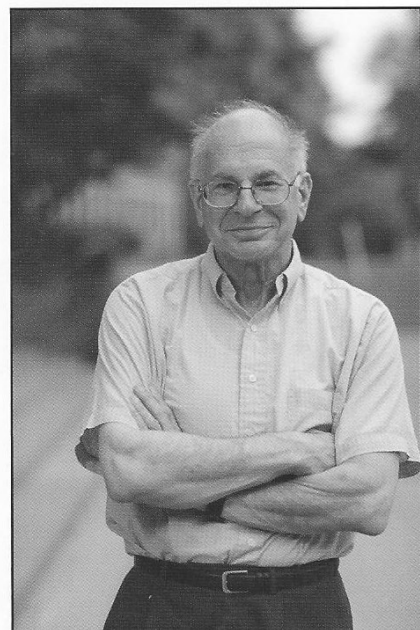


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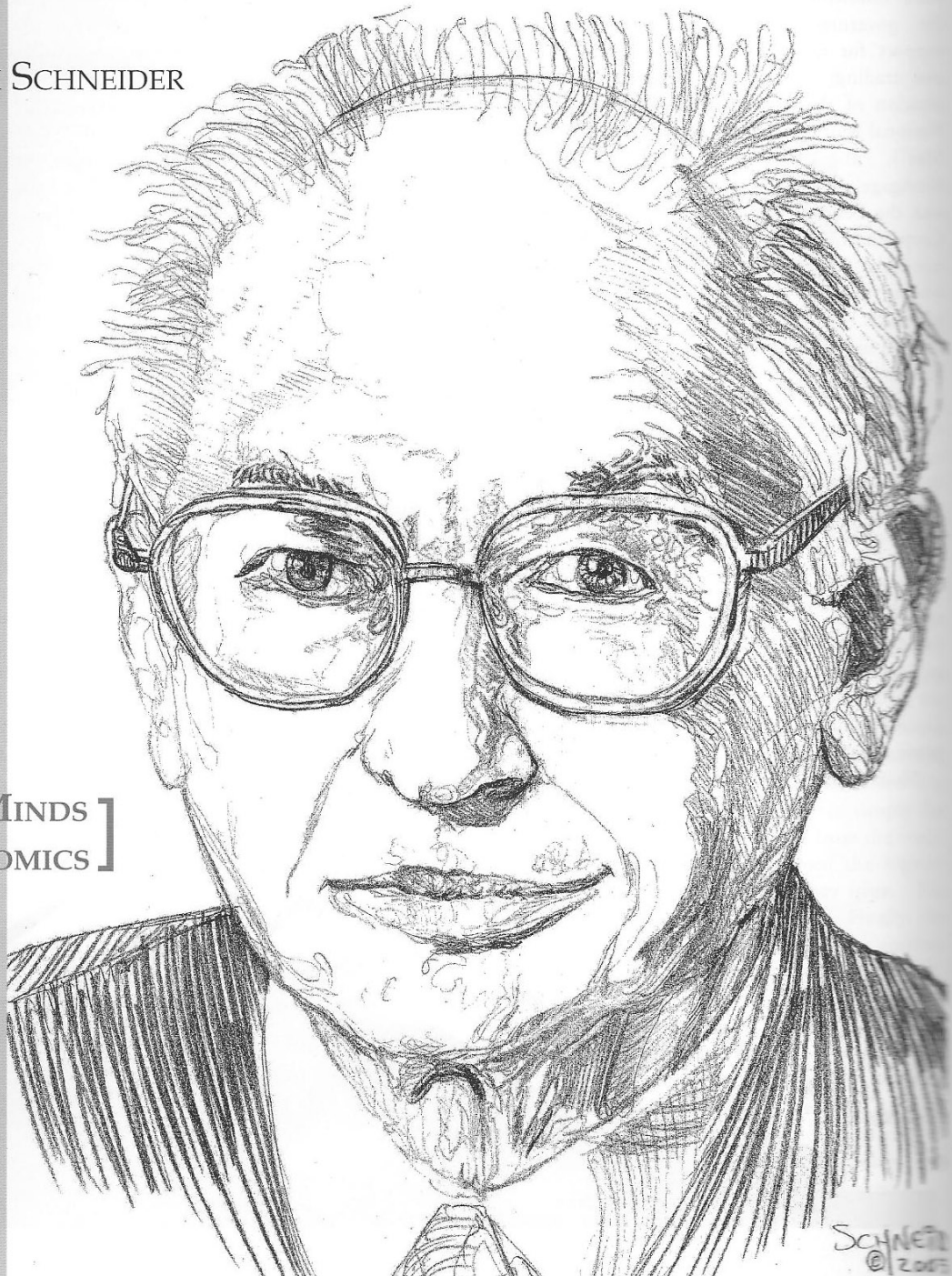
Psychologist and Nobel Laureate Daniel Kahneman discusses human rationality, the birth of behavioral economics, and the nature of multidisciplinary research.



Daniel KAHNEMAN

BY MARK SCHNEIDER

[GREAT MINDS
[IN ECONOMICS]



Daniel Kahneman has long been fascinated with people. He vividly recalls, as a terrified child in the heart of the Second World War, being baffled by the complexity of human nature. While traveling down a deserted street after a 6 p.m. curfew, Kahneman was stopped by a German SS soldier. "He beckoned me over, picked me up, and hugged me. I was terrified that he would notice the star inside my sweater," he remembers. "He was speaking to me with great emotion, in German. When he put me down, he opened his wallet, showed me a picture of a boy, and gave me some money. I went home more certain than ever that my mother was right: people were endlessly complicated and interesting."

The 73-year-old Nobel-Prize winning psychologist has since spent a lifetime expanding the intellectual platforms that define the current states of economics and psychology. A psychologist by trade, Professor Kahneman's collaboration with Amos Tversky on Prospect Theory remains the second most-cited article in all of economics. YER interviewed Professor Kahneman about his contributions to economics, his views on collaboration in academia, and some recent developments in behavioral economics.

Rationality and Prospect Theory

The debate over the extent to which people are rational—and what rationality even means—dates all the way back to Daniel Bernoulli, who in 1738 wrestled with the St. Petersburg Paradox. The paradox describes a coin-toss gamble with an infinite expected value, although any player would be only willing to pay a small amount to play. Bernoulli proposed two fundamental ideas in his explanation: expected utility theory and the principle of diminishing marginal utility. The former states that individuals make decisions based on the probability distribution of the utility they may receive over various situations; the latter states that successively higher sums of any good yield successively lower incremental utilities. Two centuries later, John Von Neumann and Oscar Morgenstern revived Bernoulli's ideas in their landmark 1944 publication, "Theory of Games and Economic Behavior," which introduced the field of game theory. Bernoulli's ideas thus formed a cornerstone of modern day expected utility theory.

Expected utility theory eventually gave rise to rational choice theory, which holds that people will maximize their utility subject to their budget constraints. This fundamental economic tenet provides a tractable means to a quick and specific result, but perhaps does so at the cost of not fully representing actual human behavior. This weakness was illustrated in a paper presented by Nobel Laureate Maurice Allais in 1953. Allais presented evidence that a person's preference for gambling depends largely on the environmental context, or the framing effect, and is not as purely mathematical as rational choice theory contends.

Nobel Laureate Herbert Simon entered the rationality debate by proposing that people are not only limited by their budget constraint when they maximize utility, but that they also face specific cognitive limitations when making choices. These notions are understood as bounded rationality. Simon coined the term "satisficing" to note that cognitive limitations lead people to make sub-optimal decisions, which they perceive as "good enough." But, according to Robert Solow, "the reason Simon lost the rationality debate is because 'satisficing' is not precise enough."

The next major contribution to the rationality debate came not from the realm of economics, but rather from a close-knit team of two psychologists studying decision making. "I learned...that the name of the game was the construction of a theory that would explain the Allais paradox parsimoniously," recalled Kahneman, referring to Allais's findings that individuals would alter their decisions over a probability distribution in a manner not predicted by expected utility theory. For Kahneman, the question "was not a difficult one because Allais's famous problems are, in effect, an elegant way to demonstrate that the subjective response to probability is not linear." The subjective non-linearity is obvious: the difference between probabilities of .10 and .11 is less impressive than the difference between 0 and .01, or between .99 and 1.00. It readily follows, then, that not all steps up in probability are created equal; we react stronger to some than to others.

These nonlinear responses to probability produce preferences that violate compelling axioms of rational choice and are therefore incompatible with standard expected utility theory. "The natural

response of a decision theorist to the Allais paradox would be to search for a new set of axioms that have normative appeal, and yet permit the non-linearity," said Kahneman. "The natural response of psychologists was to set aside the issue of rationality and to develop a descriptive theory of the preferences that people actually have, regardless of whether or not these preferences can be justified."

Kahneman recalled that one of his first insights into the representation of human economic behavior came as a result of his naïveté. "When reading a mathematical psychology textbook, I was puzzled by the fact that all the choice problems were described in terms of gains and losses—actually, almost always gains—whereas the utility functions that were supposed to explain the choices were drawn with wealth as the abscissa," he noted. "This seemed unnatural, and psychologically unlikely. We immediately decided to adopt changes and/or differences as carriers of utility. We had no inkling that this obvious move was truly fundamental, or that it would open the path to behavioral

We reasoned that if the theory ever became well-known, having a distinctive label would be an advantage.

economics. Harry Markowitz, who won the Nobel Prize in economics in 1990, had proposed changes of wealth as carriers of utility in 1952, but he did not take this idea very far."

Kahneman took the concept of changes of wealth as carriers of utility to the next level. This was significant because of a property of preferences that Kahneman labeled "loss-aversion": the response to losses is consistently much more intense than the response to corresponding gains. Loss aversion is manifest in the reluctance to accept risk. "When people are offered a gamble on the toss of a coin, most will reject a gamble in which they might lose \$20, unless they are offered more than \$40 if they win. The concept of loss aversion was, I believe, our most useful contribution to the study of decision making," said Kahneman. "The asymmetry between gains and losses solves quite a few puzzles, including the widely noted and economically irrational distinction that people draw between opportunity costs and 'real' losses." Kahneman believes that loss aversion helps explain a wide range of decision-making choices, like why real estate markets dry up for long periods when prices are down.

"Additional experiments in the area of decision making emerged when we flipped the signs of outcomes in the problems we had been considering," he said. As he noted in his autobiography, "The result was exciting. We immediately detected a remarkable pattern, which we called reflection: changing the signs of all outcomes in a pair of gambles almost always caused the preference to change from risk averse to risk seeking, or vice versa. For example, we both preferred a sure gain of \$900 over a .9 probab-

ity of gaining \$1,000 (or nothing), but we preferred a gamble with a .9 probability of losing \$1,000 over a sure loss of \$900. We were not the first to observe this pattern; Raiffa (1968) and Williams (1966) knew about the prevalence of risk-seeking in the negative domain, but ours was apparently the first serious attempt to make something of it."

After three years of soul searching and questioning the results of the studies, the work was prepared for publication. Kahneman and Tversky deliberately chose a meaningless name for their theory: prospect theory. "We reasoned that if the theory ever became well-known, having a distinctive label would be an advantage," Kahneman explained.

The Birth of Behavioral Economics

While there is no date set in stone to mark the birth of behavioral economics, the energy surrounding the field seems to have expanded rapidly in the aftermath of the introduction of "Prospect Theory" by Kahneman and Tversky in a 1979 edition of *Econometrica*. Behavioral economics is an approach to economic problems that is grounded in empirical regularities of human behavior and questions the deeper cognitive processes at play in decision making. Among the early products of behavioral economics were prospect theory, loss aversion, the endowment effect, and framing effects. Kahneman contributed significantly to each of these.

Kahneman said it was too early to speak of the shortcomings and limitations of behavioral economics because the field has just begun: "It is not entirely clear where it is going. It hasn't been applied to many domains of economics. It really is a very early field. My guess, if I have to guess, is that there are going to be many more applications than we have seen so far. I would say that labor economics is an area where behavioral economics is going to be significant. It's really significant already in forming policies, because of framing, and it is significant in finance."

Kahneman further noted that a salient area of research in behavioral economics focuses on framing effects, which are essentially the environmental structure in which information is presented. This context greatly influences our interpretation of our environment which, in turn, influences our decisions. Kahneman, noting the prevalence of framing effects in society, remarked, "Framing effects are used all the time. The estate tax is called the death tax—that's framing, and done very effectively."

The Aftermath of Prospect Theory

Many great discoveries have come about almost entirely by accident, as researchers set out to test a certain hypothesis but arrive at a completely unpredicted result. In a similar manner, Kahneman and Tversky did not anticipate the impact that prospect theory was to have in the debate surrounding human rationality. If they

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had set out to contribute to the rationality debate, it is not clear whether the fruits of their labor would have been as successful as they were. "I realized only recently how fortunate we were not to have aimed deliberately at the large target we happened to hit," Kahneman admitted. "If we had intended the article as a challenge to the rational model, we would have written it differently, and the challenge would have been less effective. An essay on rationality would have required a definition of that concept, a treatment of boundary conditions for the occurrence of biases, and a discussion of many other topics about which we had nothing of interest to say. The result would have been less crisp, less provocative, and ultimately less defensible. As it was, we offered a progress report on our study of judgment under uncertainty, which included much solid evidence. All inferences about human rationality were drawn by the readers themselves."

The interpretation of the work as a broad attack on human rationality—rather than as a critique of the rational-agent model—attracted much opposition, some quite harsh and dismissive. "The conclusions that readers drew were often too strong, mostly because existential quantifiers, as they are prone to do, disappeared in the transmission. Whereas we had shown that some, not all, judgments about uncertain events are mediated by heuristics, which some-

times, not always, produce predictable biases, we were often read as having claimed that people cannot think straight," said Kahneman. "The fact that men had walked on the moon was used more than once as an argument against our position. Because our treatment was mistakenly taken to be inclusive, our silences became significant. For example, the fact that we had written nothing about the role of social factors in judgment was taken as an indication that we thought these factors were unimportant. I suppose that we could have prevented at least some of these misunderstandings, but the cost of doing so would have been too high."

Two Cognitive Systems

In response to the criticisms raised over the years, Kahneman, in collaboration with MIT economist Shane Frederick, recently put forth a revised model.

"There is some evidence that there are multiple areas and regions in the brain which are active during decision making, and the relative balance of activity in regions sometimes predicts behavior," Kahneman said. "The configuration of the brain during impulsive choices is not going to be the same as the configuration during more reflective activity."

Kahneman believes that the empirical controversy about the re-

Expected Utility Theory vs. Prospect Theory

Expected utility theory holds that in making decisions under uncertainty, people anticipate the utility they would have in any given state, then construct a weighted average considering the probability any given state will occur. Individuals then make decisions to maximize this probability-weighted average.

Prospect theory offers an alternative, grounded in empirical support. Unlike expected utility theory, which simply views utility as a function of wealth, prospect theory assumes utility to be a function of changes in wealth from some current position. According to prospect theory, people exhibit a cognitive bias, whereby their choice depends partially on whether the choice is presented as a potential gain or as a potential loss, where gains are considered much less valuable (in absolute terms) than losses are considered painful. As such, individuals take more risks in search of gains than they do to avoid losses.

The Value Function

An essential feature of prospect theory presumes utility to be a function of changes in wealth, rather than of wealth itself. This insight provides a basis for value to be treated as a function of two variables: the initial asset position (reference point), and the magnitude of the change (positive or negative) from that reference point. Value functions are assumed to kink at this reference point. Since the change from the reference point is critical, prospect theory indicates how people can respond differently to prospective gains and losses.

The Weighting Function

Prospect theory assumes that people cognitively misrepresent probabilities in constructing a weighting function, which

assigns decision weights to stated probabilities among various states. Empirical findings indicate that people tend to overweight very low probabilities and to underweight very high probabilities. In other words, individuals clump intermediate probabilities in their minds, making the difference between 45 and 55 percent much less noticeable than that between zero and two percent or 98 and 100 percent.

Some sample questions relating to prospect theory help to illustrate this decision making pattern:

Prospects for High Probability Gains and Losses:

a) Would you prefer an 80 percent chance of gaining \$4000 or certainty of receiving \$3000?

b) Would you prefer an 80 percent chance of losing \$4000 or certainty of losing \$3000?

Prospects for Low Probability Gains and Losses

c) Would you prefer a one in a thousand chance of gaining \$5000 or certainty of receiving \$5?

d) Now, would you prefer a one in a thousand chance of losing \$5000 or certainty of losing \$5?

In the study conducted by Kahneman and Tversky, a significant majority chose the sure bets for (a) and (d) and chose the gambles for (b) and (c). That is, individuals avoid risks when seeking gains of high probability or avoiding losses of low probability but take risks to avoid losses of high probability or to seek gains of low probability.

ality of cognitive illusions dissolves when viewed in the perspective of a dual-process model. The essence of such a model is that judgments can be produced in two ways, and also in various mixtures of the two: a rapid, associative, automatic, and effortless intuitive process (System 1), and a slower, rule-governed, deliberate, and effortful process (System 2). System 2 “knows” some of the rules that intuitive reasoning is prone to violate and sometimes intervenes to correct or replace erroneous intuitive judgments. Thus, errors of intuition occur when two conditions are satisfied: System 1 generates the error and System 2 fails to correct. In this view, the experiments in which cognitive illusions were “made to disappear” accomplished that goal by facilitating the corrective operations of System 2 and tell us little about the intuitive judgments being suppressed.

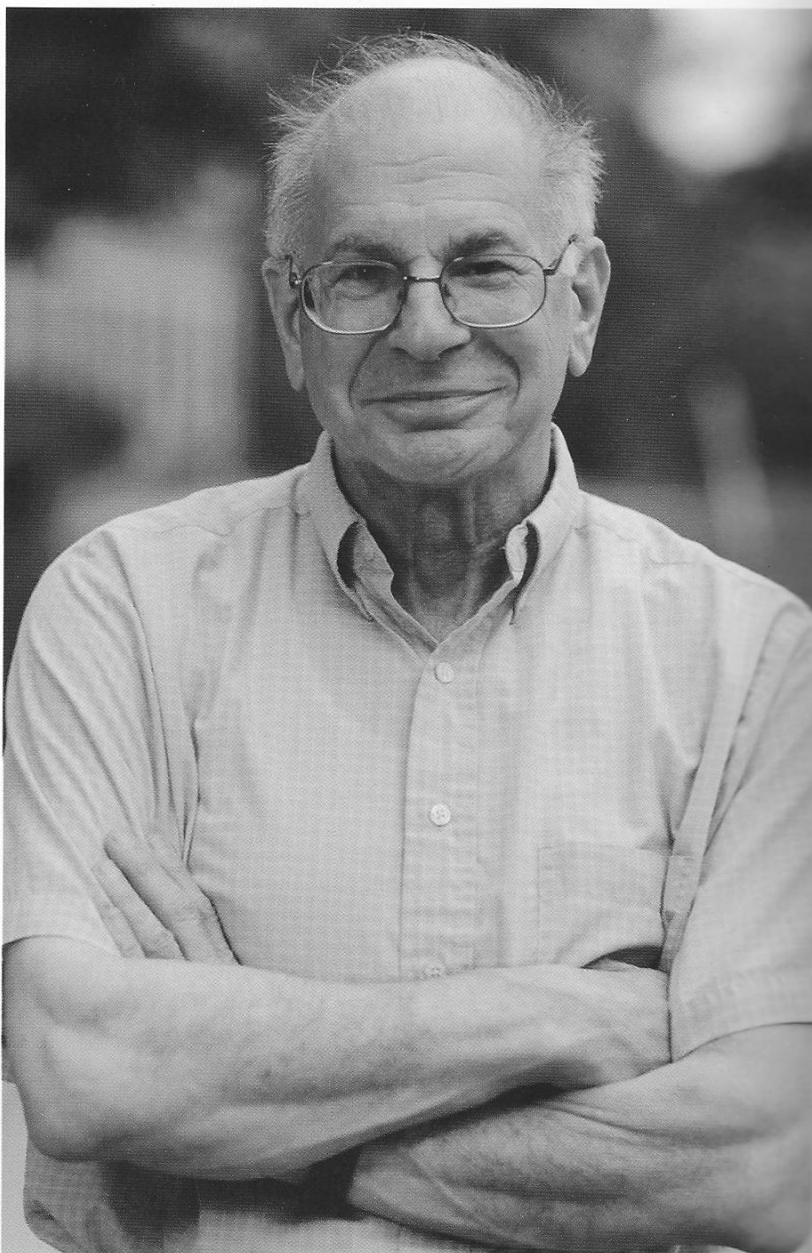
“Most decision problems engage System 1,” Kahneman explained. “We have emotions. We have intuitions. It just happens involuntarily. System 1, I assume, is always active. Now, there are many choices which are dominated by sheer reasoning. If you decide which of two routes to take from New Haven to New York, you’re doing some reasoning that doesn’t have much intuition, and it doesn’t have much emotion in it. Many important decisions, however, are loaded with emotion as well as with reasoning.”

A Beautiful Collaboration

Daniel Kahneman and Amos Tversky may be recognized for their contributions in academia as the Wright brothers were recognized for their innovations in flight or as Rodgers and Hammerstein for their musicals. Without the other, each was more of an ordinary man. Together, they were an inimitable team. Their collaboration began in 1968 when Kahneman taught a graduate seminar on the applications of psychology to real-world problems. “In what turned out to be a life-changing event, I asked my younger colleague Amos Tversky to tell the class about what was going on in his field of judgment and decision making,” Kahneman remembered. The collaboration resulted in a research team that would last for more than a decade.

When asked about his thoughts on collaborative work, Kahneman noted that “there are some fields in which people have to collaborate, such as experimental physics, because the job cannot be done by one person. And there are fields where people collaborate relatively rarely. And in the social sciences it sometimes happens when there are complementary skills. There is time lost from coordination, but if there are complementary skills, then the product that then gets out is better than either one could do alone. And in my case with Amos Tversky, that was certainly true.”

Kahneman and Tversky published eight papers, five of which



were cited more than 1000 times by 2002. Tragically, Tversky passed away in 1996 and was therefore ineligible to share in the Nobel Prize.

Transcending the Border of Disciplines

Kahneman remains a member of Princeton’s psychology department, yet he received the 2002 Nobel Prize in Economics. He does not consider behavioral economics to be drawing too much from multiple fields. “I don’t really think that behavioral economics is becoming more interdisciplinary,” he said. “I would almost say the opposite. It’s populated by economists. I’m not a behavioral economist, and I don’t think many psychologists would identify themselves as behavioral economists. It is an approach to economics. And it’s a minority approach, and they may

feel at odds, on occasion, I guess, with most of the profession. Yet the blend of theory and empirical work that characterizes the field exists in other realms of psychology such as learning theory. If behavioral economics is strictly within the domain of economics, it has nonetheless greatly expanded the scope of the discipline."

Kahneman recognizes the presence of certain disciplinary boundaries. "Prospect Theory" was published in *Econometrica*, one of the most mathematically technical journals in the field, and although the paper was submitted by two psychologists, it has become the most cited article ever published in the journal.

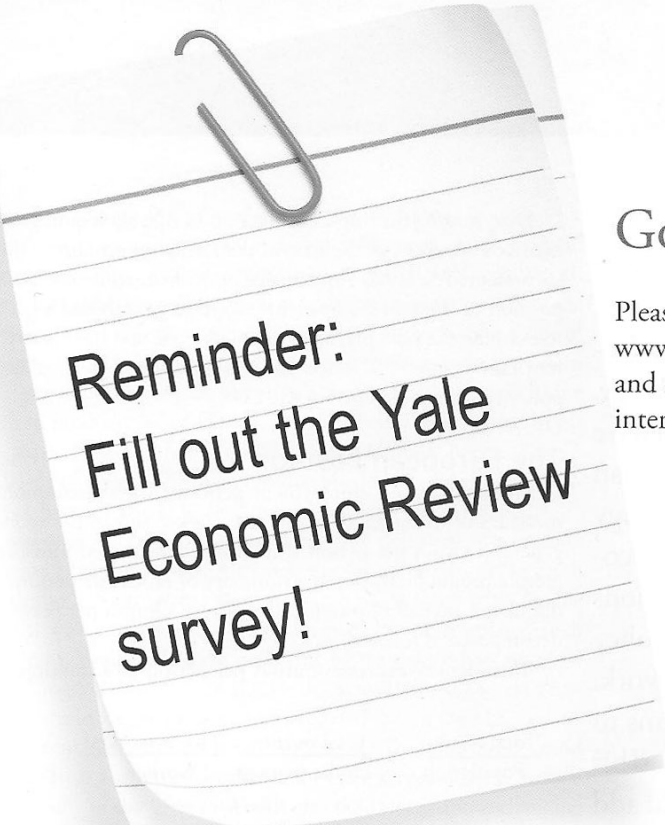
"The choice of venue turned out to be important; the identical paper, published in *Psychological Review*, would likely have had little impact on economics," Kahneman said. "But our decision was not guided by a wish to influence economics. *Econometrica* just happened to be the journal where the best papers on decision making to date had been published, and we were aspiring to be in that company." Despite the technical nature of *Econometrica*, Kahneman avoids describing his work as quantifying behavior. "Our papers are mostly qualitative—even when we do measure statistics, we are looking for qualitative information."

Even so, according to Kahneman, it was the formal na-

ture of prospect theory that paved the way for its impact on the economic discipline. "The impact of prospect theory depended crucially on the medium, as well as the message. Prospect theory was a formal theory, and its formal nature was the key to the impact it had in economics," Kahneman reflected. "Every discipline of social science, I believe, has some ritual tests of competence, which must be passed before a piece of work is considered worthy of attention. Such tests are necessary to prevent information overload. To serve

I don't think that behavioral economics is becoming more interdisciplinary. I would almost say the opposite.

this screening function efficiently, the competence tests usually focus on some aspect of form or method, and have little or nothing to do with substance. Prospect theory passed such a test in economics, and its observations became a legitimate (though optional) part of the scholarly discourse in that discipline. It is a strange and rather arbitrary process that selects some pieces of scientific writing for relatively enduring fame while committing most of what is published to almost immediate oblivion."



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