

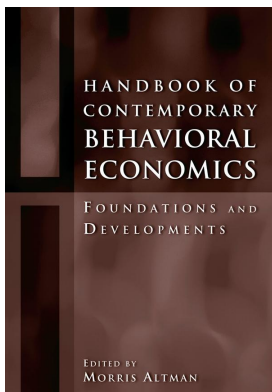
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INTUITION IN BEHAVIORAL ECONOMICS

ROGER FRANTZ

The purpose of this essay is to show the relevance of intuition in behavioral economics in the areas of knowing human nature, as a tool for decision making in general and with uncertainty in particular, and as a central component of heuristics. There is a large literature on intuition in business, the arts, and the sciences, which stands outside the scope of this chapter. A representative sample would include Agor 1984, 1989; Bastick 1982; Bergson 1946; Bishop 1967; Cobb-Stevens 1990; Comfort 1984; Davis-Floyd and Arvidson 1997; De Becker 1998; DePaul and Ramsey 1998; Dreyfus 1986; Falkenstein 1995; Fuller 1972; Hudson 1967; Levinas 1973; Noddings 1984; Parikh 1994; Piattelli-Palmarini 1994; Rehm 1990; Rowan 1986; Smyth 1978; Thomas 1999; Westcott 1968; Wilson 2000; and Yamaguchi 1969.

For purposes of discussion, intuitions may be said to be of four broad types. The first type is an insight gained by an expert in that field of inquiry after a period of study that appears to occur suddenly—the “eureka phenomenon.” The eureka phenomenon is actually the last stage of an intellectual effort by an expert in the field. It involves thinking about a problem and then allowing it to slip into the subconscious while the conscious mind is focused on something else. After some time, be it seconds, hours, weeks, or months, the insight seems to occur suddenly, without a conscious, rational, step-by-step analytical process immediately preceding it. Sometimes intuition leads to a preanalytic “vision.” The vision supplies the raw material for the subsequent analytical effort. How do we acquire our vision? Joseph Schumpeter says we acquire it “intuitively . . . This should be obvious” (Schumpeter 1954, 41).

The second type is expert judgments made on a daily or moment-by-moment basis. Intuitive diagnosis by a physician is an example of expert judgment on a daily basis. The play of chess grandmasters as discussed by Simon is an example of moment-by-moment expert judgment. Grandmasters report that chess is an intuitive activity in which they apply their professional judgment to the game at hand. Even under tournament conditions, grandmasters are said to usually decide on the best move in a matter of seconds, spending most of their time trying to verify their intuition (Simon 1982). Examples of the first two types of intuitions in the history of science are numerous and include the works of Jonas Salk (1983), Albert Einstein, August Kekulé, Henri Poincaré, and Pierre de Fermat (Hadamard 1945; Harmon and Feingold 1984; Medawar 1969; Miller 1996).

The third type is a (sudden) judgment that seems intuitive or obvious, regardless of the field and whether the person is an expert in that field. We may refer to this intuition as an axiom. These types of intuitions include a sense of danger, the intentions of others, the grammaticality of a sentence, the size of distant objects, the well-being of a friend at first glance. “We hold these truths to be self-evident” is another example of this form of intuition. John Locke was one of many seventeenth-century writers who spoke about intuition as an axiom. According to Locke,

an intuition occurs when the mind perceives a relationship (or lack of one) between two ideas immediately, directly, and with a sense of certainty such that proof is not required. For example, he held it to be an intuition that $2 + 2 = 4$ or that a triangle has three sides. Economists are speaking about intuition as an axiom when they say, “It is intuitively obvious to the casual observer that . . .” Reasoning, on the other hand, is the mind perceiving a relationship (or lack of) between two ideas indirectly, that is, using intermediate ideas in order to do so. Reasoning is thus “indirect intuition.” Locke believed that intuition is rapid reasoning (Locke 1894, 2:179) and is complementary to conscious reasoning. The fourth type includes “far-out” forms of ESP, but these will not be discussed here.

Intuition must be distinguished from *intuitionism*. Intuitionism is a philosophy that maintains that humans have an innate and infallible faculty for knowing right from wrong and, even more than that, for knowing the (self-evident) truth. I reject this in favor of intuition as a subconscious form of thinking, and allow for the fact that our intuitions may be incorrect. So U.S. Federal Reserve chair Alan Greenspan’s intuition about future trends in interest rates should be taken more seriously than the intuitions on interest rates of a waiter at his favorite New York delicatessen. And the intuitions of Linus Pauling on organic chemistry should be taken much more seriously than my intuitions on that subject.

SOME DEFINITIONS AND EXAMPLES OF INTUITION

In *Intuition and Science* (1962) Mario Bunge states that intuition is a group of intellectual mechanisms that are difficult to define or analyze. The intellectual mechanisms Bunge cites include drawing inferences so quickly that reasoning seems to be absent, imagination, synthesizing disparate elements into a grand vision, and sound judgment. More common, everyday terms include “gut feeling,” “educated hunch,” “sixth sense,” “picking up vibes,” and the “eureka moment” or “aha experience.” Peter Medawar, in *Induction and Intuition in Scientific Thought*, says that intuition means “perceiving logical implications instantly; seeing *at once* what follows from holding certain views,” “the instant apprehension of analogy,” and “thinking up or thinking out an experiment which provides a really searching test of a hypothesis . . . experimental flair or insight” (1969, 56–57). Daniel Kahneman and Amos Tversky, in their 1982 article “On the Study of Statistical Intuitions,” define intuition as “an informal and unstructured mode of reasoning” (see also Hogarth 2001, 101). Herbert Simon says that intuition is analytical thinking “frozen into habit and into the capacity for rapid response through recognition of familiar kinds of situations” (Simon 1997, 139). The common element in all these descriptions is that intuition is a form of thinking, but not a conscious analytical (logical, sequential, step-by-step, and reasoned) process of thinking. Interestingly enough, relatively recent experiments by psychologists Amos Tversky and Daniel Kahneman and others have generally shown that heuristics or intuition often mimics the results of more analytically based judgments (Gigerzner, Czerlinski, and Martignon 2002). At the same time, the experiments show that the use of intuition can also lead to biases and errors in judgment.

Major economists in the history of economic thought, including Smith, Mill, Marshall, Keynes, Hayek, Schumpeter, and Simon, have written favorably about intuition, both explicitly and implicitly arguing that logic and intuition are complementary. In *The Making of an Economist* (1990) Klammer and Colander interview graduate students in economics from various departments throughout the United States, with the interesting insight that the students consider both mathematics and intuition to be important, and express an appreciation for the intuitive elements in the work of their professors.

Still, intuition has by and large taken a backseat in the mind of economists, who have stressed logical and analytical thinking both in doing economics and as the basis for the rational behavior of *Homo economicus*. This is the case even in research on behavioral economics, which has provided a theoretical alternative to orthodox neoclassical theory. This stress on logical and analytical thinking at the expense of other possibilities has led to complaints both within and from outside the profession about excessive theorizing and the use of mathematics. Perhaps as a result, it has become almost commonplace for an economist to state during a presentation, “The intuition behind the model [and/or result] is . . .” But in this context *intuition* means that an idea is easy to comprehend in plain and simple English.

THE BRAIN

Intuition may be said to be nothing less and nothing more than one way in which the human brain processes information. The human brain has two general ways to process information, intuitively and analytically, and hence has its own division of labor. Whereas Adam Smith’s division of labor offers advantages to large firms, the brain’s division of labor offers advantages for survival and progress. This division of labor is between the left and right hemispheres of the neocortex and has existed for at least a hundred thousand years (Ornstein 1997, 33). In 1960, Roger Sperry showed that each of the two hemispheres of the neocortex specialize, with the left hemisphere processing information in a logical, reasoned, step-by-step, sequential manner, and the right hemisphere processing information in a (complementary) nonverbal and intuitive way. In 1981 Sperry won the Nobel Prize in medicine for this work. Almost twenty-five hundred years before Sperry, Hippocrates, the founder of modern medicine, stated that the brain seemed to function in two distinct ways. He also believed that the brain, not the heart, was the source of pleasure and pain and judgment. Later research (Herrmann 1989) has shown that, like the neocortex, the left hemisphere of the limbic system also processes information logically. And, similar to the neocortex, the right hemisphere of the limbic system also processes information intuitively, accomplishing this in part by housing our ability for empathy (Taggart and Valenzi 1990), a term of importance to Adam Smith. Current psychological research on “spontaneous communication” is in fact referred to as “a conversation between limbic systems” (Buck and Ginsburg 1997, 23).

The fact is, the hemispheres interact in most of our decision-making and thought processes. It is also the case that both have their comparative advantage. Steve Sloman, in his article “Two Systems of Reasoning” (2002), says that we follow our “noses” but feel compelled to justify our behaviors with reasons. Sloman distinguishes what he calls the associative system of reasoning from the rule-based system. Forms of associative reasoning include intuition, imagination, and associative memory. Forms of rule-based reasoning are deliberation, formal analysis, and strategic memory. Sloman presents evidence from several studies showing that intuition and analysis often lead to similar judgments. In addition, he points out that analytically based judgments become more intuitive (commonsensical, or intuitively obvious to the casual observer) over time. Others have classified the dual processing system as experiential and rational (Epstein 1994), intuition and analysis (Hammond 1996), narrative and logical-scientific (Bruner 1986), and mystic and savant (Bergland 1985). Michael Polanyi refers to this duality as the intuitive and the formal (Polanyi 1974, 131). Frederick von Hayek discusses our “two types of mind” as two types of scientific thinking. One is “the perfect master of the subject” (Hayek 1978, 50), a person who has at his fingertips an apparently inexhaustible amount of facts and theories. The second consists of “puzzlers” or “muddlers” (*ibid.*, 51). Puzzlers draw inspiration from “submerged” memories, process “wordless thought,” “see” things they cannot put into words, and make discoveries that

come as a “surprise” after a period of reflection (what has been referred to elsewhere as the “aha experience”) (ibid., 53–54). Hayek describes himself as a puzzler. Although he never uses the word *intuition*, Hayek seems to be describing someone who makes extensive use of it.

The left hemisphere engages in step-by-step thinking. The right hemisphere makes an overall view of the environment, including others’ intentions. The right hemisphere is also where our overall worldview or vision is generated and changed if need be to account for anomalies. The left hemisphere is more of a follower and indifferent to discrepancies. The left hemisphere assembles facts, while the right integrates the individual facts into an overall worldview. When we communicate, the left hemisphere processes the text, while the right hemisphere puts it within a context to create understanding. The right hemisphere holds various meanings of words, while the left hemisphere chooses the best. It is the right hemisphere that understands sarcasm, nonverbal communication, intentions, other people’s state of mind, humor, proverbs, and metaphors.

If you tell an individual with damage to the right hemisphere that he needs to ground himself, he is likely to place his feet on the ground. If you tell such a person to clear her mind before choosing, she may put her head under a water tap. Ask people with this damage the meaning of the proverb “People who live in glass houses shouldn’t throw stones” and they give you a literal meaning—if you throw something at a piece of glass, it may shatter. Because individuals with damage to the right hemisphere lack the ability to place things into context, they simply don’t “get it.”

The right hemisphere is essential in choosing rationally. Asked to explain a decision they’ve made, individuals with damage to their right hemisphere will rely exclusively on their left hemisphere. The left hemisphere will have an explanation that, regardless of how elaborate it may be, usually doesn’t make much sense. The left hemisphere lacks the big picture, and so “the left hemisphere alone generally makes a mess of reality, not seeing the whole picture” (Ornstein 1997, 127). From the perspective of the brain’s division of labor, arguing against intuition is arguing against the brain’s normal functioning.

WHY WOULD BEHAVIORAL ECONOMICS BE INTERESTED IN INTUITION?

We Know Human Nature Intuitively

Let’s start with *Homo economicus*. We assume that individuals are rational, calculating costs and benefits. Why do we calculate costs and benefits? We are *motivated* to do so. The concept of rationality is itself a “psychological interpretation” of observed behavior, hence the natural connection between economics and psychology. How do we know that humans are motivated, consciously or otherwise, to be rational? J.N. Keynes, in his book *The Scope and Method of Economics* (1955), says that the basic principles of economics, including the principle of rational behavior, are a priori. That is, we know them both before and independent of observing human behavior. The “facts of human nature,” according to Keynes, are not directly observed; rather they were the result of “an *introspective* survey” of human motives (Lewin 1996, 1298). Economic laws, including the law of rational behavior, are thus derived from facts about human nature that are intuitive or obvious.

Max Weber argued that because we are human beings we understand the motives behind human behavior through our own introspections: “This *verstehen*, or intuitive understanding of human motivation, is what distinguishes the human sciences from the physical sciences” (cited in Lewin 1996, 1298). *Verstehen* is nothing more than Adam Smith’s concept of sympathy. On the

other hand, the majority opinion on this subject within the economics profession is that economics as a “science” has little need for *verstehen* or intuition, or concepts such as consciousness or understanding. Understanding, in fact, is a “meaningless pursuit,” as science should limit itself to “observable empirical regularities” (*ibid.*, 1305) and hence to describing these regularities. Slutsky, Hicks, Allen, and Samuelson were among the group preaching economics as a science approach. Slutsky focused on observable utility as expressed in price and quantity. Hicks and Allen continued this by replacing marginal utility with the marginal rate of substitution. Samuelson continued with revealed preferences (Schumpeter, 1954).

Behavioral economics assumes that cognitive activity—information processing—precedes behavior, serving as an intermediary between changes in the environment and changes in behavior. Human behavior is thus not mechanical, at least in the sense that it is variable. Understanding mechanical behavior requires an owner’s manual, a calculator, a computer program, or perhaps only a well-defined production or cost function. Understanding nonmechanical behavior—unpredictable, untaught, capricious, variable—makes *verstehen*, or intuition, more important. In a changing environment, an individual must seek patterns or similarities with known environments and/or know another person’s mind to predict how that person may behave. The fact is, human behavior comes in both mechanical and nonmechanical varieties. Robin Hogarth in his book *Educating Intuition* says that “humans have a variety of different information-processing systems that vary from the innate [intuitive] to the fully conscious, [and] that most of these systems operate continuously” (2001, 179).

In addition, none of the components of nonmechanical behavior may be motivated by utility maximization or psychological hedonism. William James rejected this one-motive approach to all human behavior, referring to it as unscientific and “narrow teleological superstition” (cited in Lewin 1996, 1299). Economists such as Keynes and Marshall understood that much is left out of economists’ theory of human behavior, but that this is inescapable in our attempt to be scientific. Harvey Leibenstein’s X-efficiency theory was based in part on the hypothesis that human behavior varies in the degree to which it exhibits rationality; he called this “selective rationality” (Leibenstein 1966). Herbert Simon referred to it as “bounded rationality” (Simon 1982).

The study of intuition may also yield significant payoffs because it is an ingredient in altruism. In *The Heart of Altruism*, Kristin Monroe states, “Early discussions of what contemporary scholars refer to as empathy and altruism utilize the term sympathy, Adam Smith being but one notable example” (1996, 243 n. 47). Furthermore, she reports that the word *empathy* comes from the German *Einfühlung*, meaning “the process of intuiting one’s way into an object or event to see it from the inside” (*ibid.*). Collard (1978) and Ickes (1997) have also discussed altruism and its relationship with empathy, sympathy, and intuition.

Intuition Is a Tool for Decision Making Under Uncertainty

A classic statement about uncertainty is that of Frank Knight in *Risk, Uncertainty, and Profit* (1964). What is not well known is that in Knight’s work, intuition plays a central part in dealing with uncertainty. According to Knight, perfect competition or an “imaginary society” is a “heroic abstraction.” First, this imaginary society contains rational people. Rational people have “practical omniscience,” and hence there is a lack of ignorance. Rational people know what they want; their motives are known consciously and are stable and consistent. Their responses are deliberate, and they know the consequences of their actions. Second, there is perfect mobility and no costs of adjustment. Third, there is costless intercommunication among people. Fourth, people make decisions independent of all others. Fifth, all activity is free and voluntary. These are the necessary

conditions of perfect competition. Under perfect competition there is “general fore-knowledge of progressive changes” or knowledge of the “law of change.” Under these conditions profits will move toward zero.

In real life, perfect intercommunication and hence perfect knowledge do not exist. In real life there is uncertainty, inertia, indifference, and habit, and hence the possibility of profit. Knight reviews literature associating profits with many factors, including a reward for risking capital, bargaining power stemming mainly from “superior knowledge and foresight” about the direction of change in an ever-changing environment, “frictions” created by uncertainty hindering the competitive process, and dynamic changes that lower costs. However, it is not change as such that creates profit, but ignorance of change, unpredictable change, or error.

In order to distinguish change from ignorance, or predictable change from change that is not predictable, Knight distinguishes risk from uncertainty. Risk refers to situations in which there is measurable randomness, while uncertainty refers to unknowable randomness—ignorance. Uncertainty about human behavior stems from Knight’s belief that, unlike objects of the natural world, we are not unconscious mechanisms restricted to mechanistic behavior. We have consciousness and free will, feelings and emotions, and react to the same stimuli in various ways. We are motivated by love and hate, exhibit capriciousness, and are subject to persuasion. We are rational, deliberative, and purposive, but also emotional. Humans do not remain the same through time. We have memory and we adjust to experience. Unlike atoms, no two people are exactly the same, no two people react exactly the same to the same experience, and no two people experience the same “objective” environment exactly the same.

In Part 3 of *Risk, Uncertainty, and Profit* Knight examines the assumption of “practical omniscience.” Knowledge begins with consciousness, or awareness. Consciousness is “forward-looking”—it anticipates the future, it sees things coming *before* they materialize. Knight says that the biological purpose of the nervous system is for adapting to the environment to better one’s chances of survival, and this requires seeing ahead. Yet while Knight says that he is interested in the relationship between consciousness and knowledge and behavior, he also makes it clear that he is *not* interested in “the ultimate nature of reality or any other philosophical position.”

The process of human inference is, in short, a nonmechanical process, a “fundamental mystery,” and subject to error. Because of uncertainty we are forced to draw inferences about the meaning of a twinkle in another’s eye, lines around the mouth, tone of voice. Following Adam Smith (see Frantz 2000), Knight says that it is consciousness that allows us to make inferences through “sympathetic introspection” into what is going on in the ‘mind’ of the other person(s).” This ability is the “mysterious capacity of interpretation.” Knight’s theory of knowledge is not a theory of “*exact* knowledge” offered by logic. Knight is not sure that the world is understandable to any great extent, but if it can be understood, this is done through logical processes. Even the “ordinary decisions of life are made on the basis of ‘estimates’ of a crude and superficial character” and based on a process that is “very obscure.” Hence logicians and psychologists have paid little attention to them. The obscurity, the subconscious nature, the apparent absence of logic, and the “mental rambling” nature of the process do not imply irrationality. This mental rambling is called judgment, common sense, and intuition. Knight considers intuition to be based on memory, association, and experience, a type of “unconscious induction,” and made more valuable when combined with analysis. In these ways he is similar to other economists, notably Mill (see Frantz 2002) and Simon (see Frantz 2003). Intuitions are subject to error, but at the same time the ability to make correct judgments is the prime determinant of an individual’s value and success in business.

Ronald Heiner in his 1983 paper “The Origin of Predictable Behavior” presents an interesting hypothesis: that uncertainty (caused by cognitive limits, the inability to make correct inferences

from past experiences, and incorrect expectations) leads individuals to be cautious and follow rule-based behavior. Following rules, behavior becomes both predictable and more geared toward *satisficing* than maximizing. On the other hand, the lack of uncertainty leads individuals to “throw caution to the wind.” This leads behavior to be less predictable and more geared toward maximizing than satisficing. Hence, maximizing behavior, made possible by the lack of uncertainty, leads to unpredictable behavior.

Standard theory attempts to explain choices based on the individual’s competence (c) and the difficulty (d) of the decision, and assumes that $(c - d) \sim 0$. However, Heiner’s point is that the $(c - d)$ gap creates uncertainty that leads to rule-based behaviors. The $(c - d)$ gap is generated by two broad classes of variables: environmental and perceptual. The former determine the degree of complexity faced, while the latter determine competence for dealing with complexity. Uncertainty increases as the former increases and/or the latter decreases. Uncertainty also increases the chance of making the wrong decision or the right decision at the wrong time. Choosing right or wrong is determined by “whether some process—conscious or not—will cause (or prevent) an ‘alertness’ or ‘sensitivity’ to information that might prompt selection of an action” (Heiner 1983, 565). Being alert to information is a developed skill, and greater uncertainty and a desire for making choices require more of the being-alert-to-information skill. Heiner makes use of the word *intuition* with phrases such as “intuitively measure” (ibid., 565), “intuitively interpret” (ibid., 566), “this intuitively means” (ibid., 567), and “as intuitively suggested” (ibid., 568). He also says that it is intuitive that without uncertainty, maximum flexibility of behavior—the ability to “loosen up”—yields the largest benefit (ibid., 563).

Intuition/Emotions as Well as Reason Is an Instrument in Decision Making

Yaniv Hanoch says, “Indeed people use reason to respond to . . . motivations, but they also use emotions. What sets the stage is our emotional mechanism, while one function of reason is to explore the possible paths to get there. That is, while ends cannot be determined logically by reason, once ends are determined, it is the role of reason to take us there” (Hanoch 2002, 3). Emotions interact with reason (rational thinking) in at least two important ways: by limiting the number of options considered and by limiting the aspects of the environment considered. This is contrasted with subjective expected utility (SEU) theory, which assumes that individuals make a thorough examination of all options and aspects of the environment until a probability about the future can be constructed. Being boundedly rational means having the ability to discriminate between different pieces or sets of information, focus on a subset of available information, produce alternative scenarios, gather facts about the environment, and draw inferences from these facts (ibid., 6). Emotions serve these functions. Emotions have been designed by evolution to assist us in being boundedly rational (ibid., 7).

In his book *Descartes’ Error: Emotion, Reason, and the Human Brain* neurologist Antonio Damasio shows that intuition, emotions, and feelings play a positive role in rational decision making. A very important reason is that “the strategies of human reason probably did not develop, in either evolution or any single individual, without the guiding force of the mechanisms of biological regulation, of which emotion and feeling are notable expressions” (Damasio 1994, xii). Not all human decisions involve choosing and reasoning in the normal sense used by economists (conscious evaluation of the costs and benefits of various options). First, there are automatic bodily processes by which the body moves to a state of equilibrium. For example, a drop in blood sugar triggers physical changes in the body, leading to a state of hunger. We are neither conscious of nor have any control over these physical changes. Second, we engage in survival

strategies that are automatic or instinctive. For example, when we see an oncoming car we automatically move away from it. We know that an oncoming car is dangerous and that the appropriate response or choice is to move. While we are conscious of what is going on, the movement away from the car is automatic. Third, there are many choices we make in our life—concerning career, family, friendships, recreation, vacations, saving, voting—that require us to reason and choose in the usual sense of the terms. These choices involve short- and long-run costs and benefits, all of which are shrouded by complexity and uncertainty. Descartes referred to the first two as being part of our “animal spirit,” while the third is characteristic of our “human spirit” (ibid., 165–68). The third category of decisions are those traditionally believed to be optimized through logic or “rationality” and in the absence of emotions.

The difficulty with rational decision making is that calculating costs and benefits so as to maximize subjective expected utility will take too much time and is subject to too much error. Two reasons are offered: the human attention span is too short, and the capacity of our working memory is too small. Second, the strategy of eliminating emotion from decision making “has far more to do with the way patients with prefrontal damage go about deciding than with how normals usually operate” (ibid., 172). In other words, the economic theory of rational decision making is best illustrated by brain-damaged individuals. The real-world decision-making process of individuals with normal brain functioning involves intuition. According to Damasio, the human mind at the beginning of a decision-making process is not a “blank slate” but contains numerous images gleaned from experience. Depending upon the circumstances surrounding the decision, a subset of the available images will be automatically activated. Even before reasoning takes place, when the mind considers an option with a bad outcome, the individual experiences an unpleasant gut feeling in the body. If the option contains a positive outcome, the gut feeling is pleasant. Because the feeling is in the body, Damasio uses the term *somatic* (*soma* being the Greek word for “body”). The gut feeling in the body “marks” an image, hence the term *somatic marker*. Damasio says that somatic markers are an example of “*feelings generated from . . . emotions*. Those emotions and feelings *have been connected, by learning, to predicted future outcomes of certain scenarios*” (ibid., 174). Feelings and emotions are not identical. An emotion is a physical phenomenon with bodily correlates that are often automatic and prompted within the subconscious. For example, fear affects the heart rate and facial and/or other muscles. Emotions are often automatic and prompted by the subconscious.

The somatic marker creates a feeling in the body that “forces attention on the negative outcome to which a given action may lead, and functions as an automated *alarm signal* which says: Beware of danger ahead if you choose the option which leads to this outcome. . . . The automated signal protects you against future losses, without further ado, and then allows you *to choose from among fewer alternatives*” (ibid., 173). Somatic markers, having screened alternatives, allow any subsequent cost-benefit calculations to be more accurate, and allow the decision-making process to be more efficient. There are two important implications. First, somatic markers make use of both attention and working memory, but it is our *values* that drive the process. After all, pleasant and unpleasant gut feelings imply values or preferences. Second, there is an optimal level of emotion because emotions can be either beneficial or costly in the process of decision making. Third, emotion and logic (or intuition and analysis) are complements rather than substitutes. While Pascal said, “The heart has reasons that reason does not know at all,” Damasio says, “*The organism has some reasons that reason must utilize*” (ibid., 200). We are not always conscious of somatic markers. Somatic markers also act subconsciously, affecting those parts of the brain that control our appetites. Thus, for no apparent reason we would feel drawn to or away from some particular behavior. He says, “This covert mechanism would be the source of what we call intu-

ition, the mysterious mechanism by which we arrive at the solution of a problem *without* reasoning toward it” (ibid., 188).

Damasio reports the results of gambling experiments illustrating his somatic marker hypothesis. The experiment involves players turning over cards from four decks of cards. Some cards in decks A and B paid the player \$100 (in play money), but others required payments in excess of \$1,000. In decks C and D, some cards paid \$50, while other cards required payments of less than \$100 on average. Players without frontal lobe brain damage began by sampling cards from all four decks. Seeing high rewards from decks A and B, they showed a preference for these decks. As the game continued and they were forced to pay large sums by cards in decks A and B, they switched to decks C and D. Players with frontal lobe brain damage began by sampling cards from all four decks, then showed a preference for the high-reward decks, A and B. However, having lost large sums of money, they returned to their preference for decks A and B, lost all their money, and were forced to borrow more. Despite being attentive, risk-averse, and intelligent and possessing a preference to win, frontal-lobe-damaged individuals act “irrationally.” Damasio’s explanation is that people with frontal lobe damage lack somatic markers, thereby lacking an association between a stimulus and an appropriate somatic response. They act, therefore, as if they have an inappropriate preference for the present at the expense of the future. They have in Damasio’s terms, a “myopia for the future” (ibid., 218). It is as if they do not retain what they learned through education or experience; they do not have a theory of their own mind.

In another article on the same topic the author, Gretchen Vogel, states, “Intuition may deserve more respect than it gets these days. Although it’s often dismissed along with emotion as obscuring clear, rational thought, a new study suggests that it plays a critical role in humans’ ability to make smart decisions” (Vogel 1997, 1269). Four neuroscientists from the University of Iowa College of Medicine studied patients with damage to their ventromedial prefrontal cortex. People with damage to this part of the brain score high on IQ tests and memory tests as often as non-brain-damaged persons. However, they tend to be more indecisive and make poor choices in real-life situations. Brain-damaged patients and a control group were given four decks of cards, two “good” decks and two “bad” decks. Each person was given \$2,000, and each card listed an amount of money they won or lost. In the long run, choosing from the bad deck led to net losses, while the good deck led to net gains. The brain-damaged patients showed no emotion (measured by no physiological changes that accompany nervousness) as their net losses continued to increase and did not tend to switch to the good deck. Members of the control group showed signs of nervousness after a series of losses and switched to the good decks. They also began switching to the good decks even before they could articulate to the researchers that the good decks were a better long-term strategy. In other words, members of the control group had a hunch about which deck to choose from even before their conscious mind could formulate a reason. An explanation for the result is that the ventromedial prefrontal cortex is the part of the brain that stores memories of past rewards and punishments and creates an unconscious response to current rewards and punishments, which we call a hunch or an intuition. The brain-damaged patients lack this intuitive ability and hence make poor decisions.

Intuition as a Component of Heuristics

Intuition can be an expression or form of a heuristic because both usually bypass all conscious thinking processes. Why use a heuristic or intuition? Because in a world that contains much risk and uncertainty, objective measures of probability are not always available. Human cogni-

tion processes may be divided into two broad groups: intuition and reason. Humans use both because human cognition is a dual process. Adjectives used to describe the intuitive process include *automatic, effortless, rapid, parallel, affective, nonverbal, and experiential*. Adjectives used to describe reason include *analytical, deliberative, verbal, rational, and rule-based* (Slovic 2001, 4). Kahneman and Tversky (1982) refer to intuition as a “natural assessment,” one with some advantages over reason. First, the intuitive process produces results faster than the analytical system. Second, under conditions of uncertainty, when objective measures of probability are not available, intuition becomes the best method for subjectively evaluating the probability of events. Third, because intuition is the product of a subconscious process, the conscious mind remains free to undertake other tasks and hence is more flexible. Fourth, in a complex environment, speed and flexibility are advantageous. In some sense, therefore, our intuitive system is more efficient than reason.

Evaluating intuitively based judgments implies a standard of comparison. One standard often used is how well intuitive judgments compare to those made by analytical methods such as the rules of probability. For example, the *extension rule* is a basic rule of probability and states that if $A > B$, then $P(A) = P(B)$. The extension rule can also be stated as the *conjunction rule*, $P(A \& B) = (B)$. For example, are there more seven-letter words ending in *-ing* (A) or seven-letter words whose sixth letter is n (B)? Since $-ing > -n-$, the correct answer is B . Yet surveys show that people’s intuitions choose the former. Comparing actual intuitions to rules of probability creates a bias against intuitive judgments. In fact, rules of probability are statements of logic. Since nothing can be more logical than logic, intuitions can never be superior to the rules of probability. In any contest between intuition and logic, intuition’s best outcome is a tie. The Tversky and Kahneman research agenda on biases and errors in judgment from using heuristics (intuition) shows that intuition is at best only as good as logic. And the emphasis is on the shortcomings of intuition.

The fact is that “people do not normally analyze daily events into exhaustive lists of possibilities or evaluate compound probabilities by aggregating elementary ones. Instead, they commonly use a number of heuristics” (Tversky and Kahneman 2002, 20). Hence, intuitive judgments are not made by listing possibilities and evaluating compound probabilities. In Kahneman and Tversky’s prospect theory, intuitive judgments are shown to take many forms, including creating similarities or making associations between two or more events or people, perceptions of causality, and thinking about salient characteristics or archetypes of events or people. In each case, people are attempting to turn a difficult question into an easier one. In the example of *-ing* and *-n-* words, people can more easily remember the former, and thus they tend to believe that there are more of the former. During a hiring seminar a tenured faculty member is really trying to answer a difficult question: whether a candidate will remain intellectually active and is good enough to receive tenure. A simpler question is asked: how good is the candidate’s presentation? In attempting to answer the difficult question of whether a particular person is a librarian or a salesperson, people answer an easier question: are the known characteristics of that person more similar to those of a librarian or those of a salesperson? People make intuitive judgments by creating mental images of their environment in which relationships and rules are obvious, even if less detailed. This means that intuition is the result of mental model building.

The mental model and the form of the intuition are dependent upon the question being answered. For example, in answering the question of what percentage of men who have suffered a heart attack are over age sixty, we ask ourselves to picture the typical heart attack victim (the exemplar or archetype) from memory of stories we have seen and/or read. This is known as the availability heuristic. If we are asked to choose an occupation for someone we do not know based

only on a sketch of their personality, we look for similarities between the personality sketch and the representative personality of a person in a particular occupation. This is called the representative heuristic. If we are asked to make an assessment of something we know nothing about, such as the number of countries in the United Nations, we draw upon whatever data we are given. This is known as anchoring. Intuitions are a natural assessment or judgment mechanism of the human brain, and may be the best choice when no other means of judgment is available. No one expects models to be accurate and full of detail. In fact, the model-as-map analogy states that the power of a map or a model is that it does not have too much detail. In turning difficult questions into simpler ones and in building a generalized mental map of the environment, people would seem to be rational in using their intuition. Unfortunately, our mental images of the world and the real world are not always consistent with each other. And just as models don't always predict accurately, neither does intuition.

At the same time, when people attempt to think logically they often fail. It seems intuitive, therefore, that the true comparison should be between intuitive judgments and actual judgments when people are trying to be logical. If it's correct that "people are not accustomed to thinking hard" (Kahneman and Frederick 2002, 58), then perhaps one reason we use intuition is because we are lazy. At the very least, intuition may be a second-best way of making decisions. In their preface to *Heuristics and Biases*, Gilovich, Griffin, and Kahneman state, "The core idea of the heuristics and biases program is that judgment under uncertainty is often based on a number of simplifying heuristics rather than more formal and extensive algorithmic processing. These heuristics typically yield accurate judgments but can give rise to systematic error" (2002, xv). In other words, intuition can be accurate, often complementing analysis, but is subject to systematic error. At the same time, the series of experiments by psychologists Amos Tversky and Daniel Kahneman have been acknowledged by economists as demonstrating that human decision making deviates significantly from the predictions of economic theory. For example, in *Rethinking Intuition* (1998), Tamara Horowitz, a philosopher, argues that the results of the Tversky and Kahneman experiments demonstrates that people's intuitions produce decisions that are at odds with economic theory.

At the same time, what seems intuitively obvious to the casual observer today often turns out to be just plain wrong tomorrow. Once upon a time it was common sense that the earth was at the center of the universe. Once upon a time it was common sense that nature could not contain a vacuum. Once upon a time it was common sense that heavier objects fall faster than lighter objects. Galileo's thought experiments in his "mind's eye"—that is, his intuition—led to the new commonsense idea among physicists that all objects fall through a vacuum at the same speed. Once upon a time Newtonian physics was common sense among physicists. It was replaced by the common sense of Einstein's theory of special relativity. From Aristotle and the Greeks to Galileo, Newton, and Einstein is a movement from one commonsense idea to another (Miller 1996). In one respect, it is common sense that common sense changes as we evolve and gain understanding of the world. While it may seem counterintuitive that what we consider to be common sense changes, it actually is intuitively obvious that common sense changes!

Kahneman and Tversky emphasized the representative, availability, an anchoring heuristics. Paul Slovic introduced economists to the "affect heuristic" (Slovic 2001). While economists generally assume that decisions are the result only of cognition, Slovic argues that affect proceeds and influences cognition: affect "lubricates reason" (ibid., 3–4). Hence, the existence of "dual-process" theories of how we think, know, process information, and make decisions. These two processes are "intuitive, automatic, natural, non-verbal, narrative, and experiential," on one hand,

and “analytical, deliberative, verbal, and rational,” on the other (*ibid.*, 4). The intuitive system is affective in nature and is faster than the analytical system. The intuitive system is, therefore, also believed to be a more efficient way to interact with an uncertain, complex environment. The intuitive/affective system also relies on feeling states of which we may not be aware. In comparison, the analytical system relies on cognitions such as probabilities. There is a large body of research supporting the importance of affect in decision making. For example, we may have a positive feeling about strawberry Jell-O, but a negative feeling when hearing the name Bowl Championship Series.

While economists have focused on *anticipated* feelings such as regret and disappointment, psychologists have focused on *immediate* feelings and “visceral” or affective states occurring at the time of decisions (Lowenstein 2000; Slovic 2001). Visceral factors, or passions, include anger, fear, hunger, thirst, sexual desire, emotions, pain, and (drug) cravings. Unlike preferences, which are assumed to be stable and consistent in the short run, visceral states change quickly and are affected by the external environment and the condition of the body. Visceral states have long been assumed to be destructive of behavior, but they are essential to humans. They affect survival and reproduction and hence quality of life. They are essential in decision making, yet we tend to underestimate them, preferring instead to see our decisions as rationally formulated. Visceral factors are powerful enough to create an internal conflict in us between what we want to do and what we otherwise believe is the rational course of action. One example is that a visceral state such as fear can neutralize a rational evaluation of uncertainty (risk). Thus, utility maximization in the presence of visceral states, especially alternating “hot” and “cold” visceral states, is difficult. At high levels of visceral intensity we feel “out of control” and may be led to behave in ways contrary to what we believe to be our self-interest.

Affect affects our perception of risk. For example, the perception of risk from various hazards is positively correlated with feelings of danger about that hazard. Despite the fact that the benefits and costs of various hazards need not have any particular correlation, in laboratory studies people’s perception of benefit and cost are negatively correlated with each other. That is, if people feel that the benefits of nuclear power or pesticide use in farming are high, then they tend to judge the risks as being low. And where the risks are said to be low, the benefits are perceived to be high (Slovic et al. 2002, 410–11). Studies of toxicologists asked about the risks of exposure to very low levels of various chemicals (1/100th of the exposure level warranting regulators’ concern) show negative correlations between affect—the danger posed by the chemical—and perceived risk. Studies also show that people overpay for insurance when the object is beloved, regardless of its condition. Affective responses are part of almost every response or perception we have (Zajonc 1980). That is, we see a lovely sky, not a sky; a pretty face, not a face; an attractive house, not a house. Affect, therefore, affects preferences. In addition, the affective may be more important than is usually suggested when looking at the world through a cognitive or rational framework. Zajonc writes, “We sometimes delude ourselves that we proceed in a rational manner and weight all the pros and cons of the various alternatives. But this is probably seldom the actual case. Quite often, ‘I decided in favor of X’ is no more than ‘I liked X’” (*ibid.*, 155). The affective is considered part of our experiential system of thinking or information processing, as opposed to our analytical system. The experiential also includes intuition.

“Fast and frugal” heuristics are decision-making strategies that rely on cues. For example, are there more homeless people per million population in New York or Chicago? To answer this without researching the answer, you look for cues, such as the existence of rent control and public housing; unemployment, vacancy, and poverty rates; and average temperature. In the “minimalist” heuristic, you randomly select a cue; if you select rent control, since cities with rent control tend

to have more homeless people, and since New York has rent control and Chicago does not, then you would choose New York as probably having more homeless people. In the “take the best” heuristic, you pick the most important cue. The “choosing by default” heuristic means choosing the first option you think about. This is a classic way of making decisions intuitively. Choosing by default is known as an “automated choice heuristic” (Frederick 2002).

In a review of fast and frugal heuristics, Gigerenzer, Czerlinski, and Martignon (2002) find that their performance is comparable with multiple regression and Bayesian networks. In 1992, Spencer Johnson, coauthor of *The One Minute Manager* (Blanchard and Johnson 1982), published a book, “Yes” or “No”: *The Guide to Better Decision Making* (Johnson 1992), in which he described three questions you ask yourself when solving a problem: “Am I meeting the real need?” “Am I informing myself of options?” and “Am I thinking it through?” If your first thought about question 1 is yes, then you move on to question 2. If the answer to question 1 is no, then you begin analyzing what the real need is. When you get through with question 3, then you have made a better choice than you otherwise would.

Errors in judgment due to the use of intuition or heuristics are not limited to, say, undergraduates. Individuals of all levels of education and skill make such errors. Under- and overoptimism occur in predictions made by doctors, weather forecasters, lawyers, sports commentators, professional gamblers, economists, and stockbrokers (Koehler, Brenner, and Griffin 2002). Werner DeBondt and Richard Thaler studied the one- and two-year earnings-per-share forecasts by a group of professional forecasters. The result of their statistical analysis is that forecasters overreact and that earnings-per-share forecasts are unrealistically optimistic. The same overreaction has been reported in the literature for exchange rate and macroeconomic forecasts. DeBondt and Thaler conclude that the analysts surveyed are “decidedly human. The same pattern of overreaction found in the predictions of naïve undergraduates is replicated in the predictions of stock market professionals. Forecasted changes are simply too extreme to be considered rational. . . . When practitioners describe market crashes as panics, produced by investor overreaction, perhaps they are right” (2002, 685).

Herbert Simon’s studies of MBA students and experienced business executives asked to analyze a situation show that the two groups come to similar conclusions. However, the experienced executives came to their conclusion in much less time, “with the usual appearance of intuition” (Simon 1997, 136). The work of the MBA students, on the other hand, “was done slowly, with much conscious and explicit analysis” (ibid.). The conclusion Simon reaches is that experience allows people to make decisions intuitively, that is, to make judgments “without careful analysis and calculation” (ibid.). In a study of decision making among physicists, Simon and Simon studied the protocols of two people solving a physics problem by recording them verbalizing what they were thinking while solving the problem. One of the persons was a novice at this type of problem solving, the other an expert. The expert solved the problem in less time, did not follow the reason-only steps, required fewer steps to solve the problem, spent less time per step, did not write down as many relevant facts or equations to solve, and expressed more confidence. In essence, the skilled person took a series of appropriate shortcuts. These shortcuts imply that the expert used what Simon calls physical intuition—intuition used by physicists. That is, the expert read the problem, created a mental representation, and created a set of equations based on that mental representation to solve the problem. While the expert’s approach is more “physical” or “primitive” (Simon and Simon 1989, 224), the novice’s approach is more algebraic. The conclusion that physical intuition “accounts for the superior ability of physicists to solve physics problem should occasion no surprise. Physicists and teachers of physics have been saying that for years” (Simon and Simon 1989, 230).

CONCLUSION

Taken separately, the importance of both behavioral economics and intuition should be intuitively obvious to the casual observer. Behavioral economics developed as a response to anomalies, empirical tests at odds with standard economic models of behavior. Behavioral economics has advanced our understanding of human behavior and increased the predictive power of our models. Intuition is a normal brain function, and by operating at a subconscious level, intuition leaves our conscious mind free for other uses. In other words, intuition is an efficient form of allocating our scarce mental resources, and major economists have discussed intuition as a tool in economics (Frantz 2005). In this essay I have tried to argue that intuition is part of several topics of interest to behavioral economists: understanding human nature, decision making under uncertainty, the role of emotion in decision making, and intuition as a heuristic. The role of intuition in decision making is also highlighted in the new field of neuroeconomics (Glimcher 2004). Behavioral economics and intuition as a tool of economic decision making will continue to gain importance within our profession.

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