

COGNITION

Scientists Probe Feelings Behind Decision-Making

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 crucial role in humans' ability to make smart decisions.

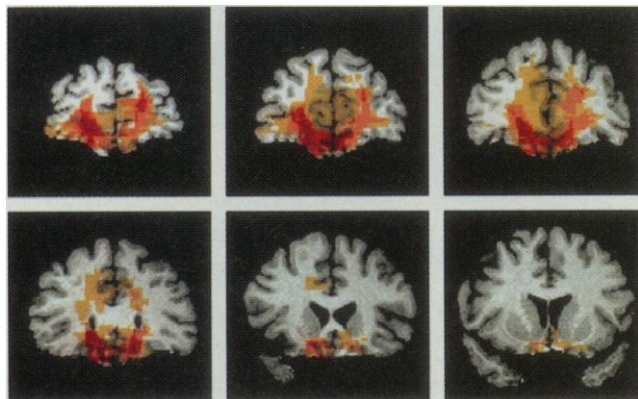
Neuroscientists Antoine Bechara, Hanna Damasio, Daniel Tranel, and Antonio Damasio of the University of Iowa College of Medicine in Iowa City set out to shed light on the role of intuition and emotion in normal decision-making by studying a group of brain-damaged individuals who seem unable to make good decisions. Some drift in and out of marriages; others squander money or often offend co-workers inadvertently. On page 1293, the researchers unveil what seems to be the missing element in their decision-making. The patients lack intuition—that ability to know something without conscious reasoning—which many cognitive psychologists think may be based on memories of past emotions. “These findings are really exciting,” says psychologist Stephen Kosslyn of Harvard University. “Emotion apparently is not something that necessarily clouds reasoning, but rather seems to provide an essential foundation for at least some kinds of reasoning.”

Psychologists have long known that when people make decisions, whether it's choosing whom to marry or which breakfast cereal to buy, they draw on more than just rational thought. Indeed, says Harvard psychologist and author Howard Gardner, the new work “fits in with an impressive heap of individual studies” showing that people rely on a variety of emotional cues—ranging from a general sense of déjà vu to specific feelings like fear—when making decisions.

The Damasios are well known for their registry of more than 2000 brain-damaged patients who participate in experiments designed to unravel how the brain works by determining what goes wrong when parts are missing (*Science*, 18 May 1990, p. 821). For several years, they have been trying to discover why patients with lesions of the ventromedial prefrontal cortex—the area of the brain right above the eyes—can perform well on intelligence-quotient and memory tests, but when faced with real-life decisions, they at first waffle, then make unwise choices. The same patients also display little emotion, and the team wondered if emotional—rather than factual—memories might be missing.

To figure out what is going wrong with

these patients, and, by extension, what goes right in uninjured brains, the researchers asked patients and a group of normal controls to perform a gambling task. Each subject was given \$2000 and four decks of cards. They were told to turn over cards from any deck and to try to win as much money as possible. Although the subjects didn't know it, there were two types of decks. Most cards in the two “bad” decks gave the subjects a reward of \$100, although a few told subjects to hand over large sums of money. Most cards in the two “good” decks, by contrast, carried rewards of only \$50, but the penalty cards were less severe, too. In the long run, choosing cards from the bad decks resulted in an overall loss, while the good decks gave an overall gain. The task was “designed to resemble life,” in its uncertainty, risks, and rewards, says Antonio Damasio. The players did not know when a money-



Impaired intuition. People who have lesions in the ventromedial prefrontal cortex often make poor choices in life.

losing card would arise in a deck and had no way to know when the task would end.

Previous work had shown that the brain-damaged patients were just as bad at choosing between good and bad decks as they were at life decisions. While normal subjects tended to pick from the good decks as soon as they had turned over a large penalty card, the patients kept opting for cards from the bad decks. The earlier work further hinted that emotion played a role. During the task, the patients didn't exhibit much stress or nervousness, as measured by skin conductance response (SCR)—a sort of micro-sweating that accompanies changes in emotion—even after they'd turned over several big penalty cards. By contrast, once normal players had encountered penalties, they began showing large SCRs just before choosing from a bad deck.

In the current study, the team tried to determine whether the emotional response and the card choices were based on conscious reasoning by introducing a new element into the task: They interrupted the game periodically to ask players what they thought was going on. Interestingly, the normal players began picking more often from the good decks and showing high SCRs well before they could articulate to the researchers that picking from the good decks seemed to be a better long-term strategy. And although three of the 10 normal subjects never had more than a hunch that some decks were good and some bad, they still picked more cards from the good decks and showed high SCRs before turning over bad-deck cards.

The brain-damaged patients, on the other hand, never expressed a hunch that some decks seemed to be riskier. Further, even after they had a theory as to which decks were bad, they continued to choose from them part of the time. (When asked to explain their choices, Damasio says, the patients said they thought it was more exciting to play from the risky decks, or that one could never tell when the rules might change.)

Although not all the results were statistically significant, the authors say the overall findings suggest that in normal people, nonconscious emotional signals may well factor into decision-making before conscious processes do. Antonio Damasio believes the ventromedial prefrontal cortex is part of a system that stores information about past rewards and punishments, and triggers the nonconscious emotional responses that normal people may register as intuition or a “hunch.” Read Montague, a neuroscientist at Baylor College of Medicine in Houston, agrees: “Something has collected the statistics ... and starts nudging behavior all before [the subjects] know what is happening.” But when that ability is gone, says Gardner, the person has no “early-warning system” to guide their reasoning and, in the face of uncertainty, have difficulty making any choice at all.

Damasio stresses that the early-warning system does not act alone. Humans, after all, are set apart from animals by their ability to reason, he says. Still, “human beings are also the sum of all their previous emotional experiences of rewards and punishments”—experiences from which we learn, it seems, whether we know it or not.

—Gretchen Vogel