

Today's Research on Aging

PROGRAM AND POLICY IMPLICATIONS

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Why Do We Make Bad Decisions? Findings From a New Science

We all make bad decisions from time to time, decisions that diminish our well-being either right away or years later. However, some of these bad decisions are more than occasional, rising to the level of chronic patterns in the general population. Many of these recurring behaviors seemingly defy rational explanations. For example:

- Why do emotions dominate deliberative thinking in many people's working, purchasing, and saving decisions?
- Why do many people save less while they are working than they will obviously need after they retire?
- Why do people tend to overspend and undersave when using a credit card?
- Why do people's perceptions of fairness sometimes affect their decisions in ways that leave everyone involved worse off?

These quandaries represent apparent anomalies in people's decisionmaking. They constitute patterns that depart from what people "ought" to be doing to preserve or improve their own well-being or that of those they care about. These incongruities occur with enough frequency and in such varied circumstances that they have attracted the attention of three groups of scientists—economists, psychologists, and

neuroscientists—who study different aspects of the decision-making process and its outcomes.

The integrated study of decision processes by scientists from these very different disciplines is called neuroeconomics. It is barely two decades old. Its practitioners hope, eventually, to shed light on the aspects of decisionmaking that lead some people to prepare inadequately for their old age and to make decisions during their retirement years that harm their well-being (Camerer, Loewenstein, and Prelec 2005). Some of the findings so far indicate the kind of progress that can be expected.

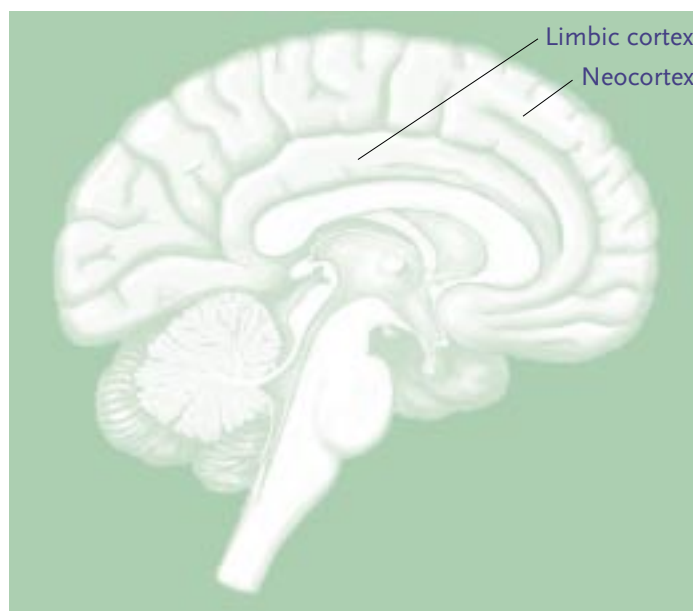
Dual Paths Toward a Decision

Traditional economics distinguishes between "rational" behavior that moves people toward maximizing their own well-being and "irrational" behavior that harms their well-being. The predictions of traditional economic models depend on most people behaving rationally most of the time. Psychologists, for their part, distinguish between "cognitive" and "emotional" mental processes. The first

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This review summarizes research related to the objectives of the National Institute on Aging, with emphasis on work conducted at the NIA demography centers. Our objective is to provide decisionmakers in government, business, and nongovernmental organizations with up-to-date scientific evidence relevant to policy debates and program design. These newsletters can be accessed at www.prb.org/TodaysResearch.aspx.



type is analytic; the second type is affective, dealing with feelings. Neuroscientists distinguish parts of the brain that handle deliberative thinking (the neocortex) and other distinct parts that operate automatically and more quickly (the limbic region).

It is becoming clear that the three distinctions above, although called different names in the three different sciences, are in fact the same (Camerer, Loewenstein, and Prelec 2005). How we *think* when confronting a decision emerges in parallel with how we *feel* about it, and from two different parts of the brain and at different speeds. Evolutionary psychologists have carried this distinction a step further, arguing that the emotional/affective/automatic/irrational/fast aspect of our mental processes is very old (McClure et al. 2007). In fact, humans share these aspects of mental processes, along with the corresponding limbic brain region, with many other mammals, suggesting common sources in the evolutionary chain.

However, the cognitive/analytical/deliberative/rational aspect of our mental processes developed much more recently in evolutionary history, along with the corresponding brain region, the neocortex. Beyond elementary levels, humans possess these mental processes uniquely in the animal kingdom. Nor is this corresponding part of the brain well developed in other animals. Evolutionary psychologists also point out that automatic mental processes may not be adapted for modern life, deriving as they did from very different environments tens of thousands of years ago.

In this light, what economists have decried as irrational appears as a quite normal—and explainable—component of decisionmaking. This scientific finding has three implications. First, individuals—you and I—can come to better understand and control decisionmaking processes and improve the outcomes. Second, social and psychological scientists can learn to predict people's decisions and behaviors more accurately. Third, those who aim to influence our decisions—advertisers, employers, and policymakers—can increasingly base their messages and policies on how people actually decide to purchase or save, work or retire, and engage in healthy or unhealthy behaviors.

Recent Research Projects

Four recent research projects illustrate the methods and findings of this new science. In work supported by the National Institute on Aging, an interdisciplinary team monitored the brain activity of healthy younger and older adults while they anticipated monetary gains and losses (Samanez Larkin et al.

2007). Younger and older adults did not differ in their reaction while considering potential gains, but younger adults reacted more strongly than older adults when considering potential losses. The older participants displayed a considerably reduced negative reaction toward losses than did their younger counterparts, whether their reactions were recorded in brain activity or reported verbally. This asymmetry in the processing of gains and losses in older adults has implications for their decisionmaking. It suggests that they may be less cautious than younger adults in evaluating decision options unfavorable to their well-being.

All people (as well as other mammals) prefer a desirable outcome to happen sooner rather than later. Humans can carry this trade-off into the future, while other mammals do not distinguish between several minutes from now and any more distant outcome. An interdisciplinary team supported by the National Institutes of Health used neuroimaging to understand how people trade off the desirability of a reward against the elapsed time before the reward happens (McClure et al. 2007). They found that the limbic region is more involved when an immediate reward is part of the choice, whereas areas of the neocortex are equally involved whether the choice involves an immediate award or two delayed awards. Hence, emotional and automatic responses are more likely to influence a decision between two desirable outcomes when one of them is available right now and the other one later. Rational, deliberative thinking is more likely to hold sway when both objects of choice are in the future. For example, consider choosing between a pleasurable outing in the country right now and two pleasurable outings a week from now. Both limbic and neocortex areas of the brain would be involved in the process of choosing. But now consider the same choice moved a week forward: You are choosing between the same pleasurable outing a week from now and two pleasurable outings two weeks from now. Limbic activity would be much reduced in making this latter choice. Hence, for older adults, as for others, decisionmaking can be more rational if the choices do not include a desirable outcome available at the moment.

An NIA-supported team of neuroscientists, psychologists, and economists examined how the brain considers preferences and price, two influences on purchasing decisions that are emphasized by economists (Knutson et al. 2007). They found that two distinct brain circuits anticipate gain (preference for the object) and loss (excessive product price). The difference in amount of activity in each of these regions pre-

dicted the actual subsequent purchases. Hence, even commonplace purchasing decisions involve the separate calculation of gains and losses, which lead to (and predict) people's actual decisions. So, people's brains do not rationally balance some gains and losses in making decisions.

In the Ultimatum Game, a well-known economic experiment, people often choose no reward over a small reward if they judge that their opponent in the game is taking unfair advantage. This behavior appears irrational—even a small reward would seem better than none. Sanfey and his colleagues (2003) show that brain activations in the limbic regions (the more ancient region where fast emotional responses occur) are weaker when players think that their opponent is a computer than when they think it is another person. Even with the computer, though, some subjects would choose no reward rather than tolerate extreme unfairness. Players are even less willing to tolerate perceived unfairness, even though they lose the award, when the opponent is thought to be human. These results suggest that concern for fairness is a long-ago evolved trait that today induces decisions that can, in effect, leave all participants worse off. According to James Rilling, a faculty member at Emory University Center for Behavioral Neuroscience, “the tendency to reject unfair offers likely evolved in a social environment in which repeated interactions with the same person were common. Sending a message that one will not tolerate unfair treatment was likely adaptive. In today's world characterized by many single-shot, often anonymous interactions, rejection of unfair offers may be less adaptive.” Public policy choices should therefore be designed so that considerations of fairness will not lead to policies that end up hurting everyone, including those to whom the fairness consideration is directed.

What Can Neuroeconomics Contribute?

Working together, economists, psychologists, and neuroscientists can identify regions of the brain that are involved in particular decision processes, correlate neural activity in these regions with how people report that they make decisions, and predict actual behaviors. In so doing, these scientists can identify components of decisionmaking that, although not rational, are natural and expected. Learning to expect these decisionmaking components to be in play is a first step for persons to take advantage of them in their own lives or minimize their influence, for health care and financial providers to recognize at-risk factors and deal with them,

and for policymakers to design program participation factors that will induce the desired behaviors.

Neuroeconomics also has the potential to increase understanding of how aging changes the neural basis of decisionmaking in response to reward and punishment (Marschner et al. 2005). Beyond the question of whether the young and old process or react similarly to a specific reward system, there is the question of how adaptive older persons are to changing systems of rewards. With global population aging, better understanding of reward-based decisionmaking in the aging brain has implications for advertisers and health care providers, among many other professionals.

At this early stage in the development of neuroeconomics, funding by NIA has fostered the interdisciplinary collaboration crucial to research advances. In addition, this funding spurred a much-needed development of methodology. Investigators have started by studying choices consistent with people's stated preferences. Advances in methodology will soon enable scientists to examine why people make choices inconsistent with their preferences.

Neuroeconomics is in its infancy. Whether the hard work scientists must devote to understanding each other across disciplinary lines will be worth this effort is yet to be known. Initial indications are that the total of new knowledge will be more than the sum of its disciplinary parts.

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The NIA Demography Centers

The National Institute on Aging supports 13 research centers on the demography and economics of aging, based at the University of California at Berkeley, the University of Chicago, Harvard University, the University of Michigan, the National Bureau of Economic Research, the University of North Carolina, the University of Pennsylvania, Pennsylvania State University, Princeton University, RAND Corporation, Stanford University, the University of Southern California/University of California at Los Angeles, and the University of Wisconsin.

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www.csbmb.princeton.edu/ncc/personnel.html

**Science Special Section on Decisionmaking,
October 2007**
www.sciencemag.org/content/vol318/issue5850/index.dtl#special-issue

**Stanford Neuroeconomics Lab
(Antonio Rangel has moved to Caltech)**
<http://neuroeconlab.stanford.edu/team.htm>

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