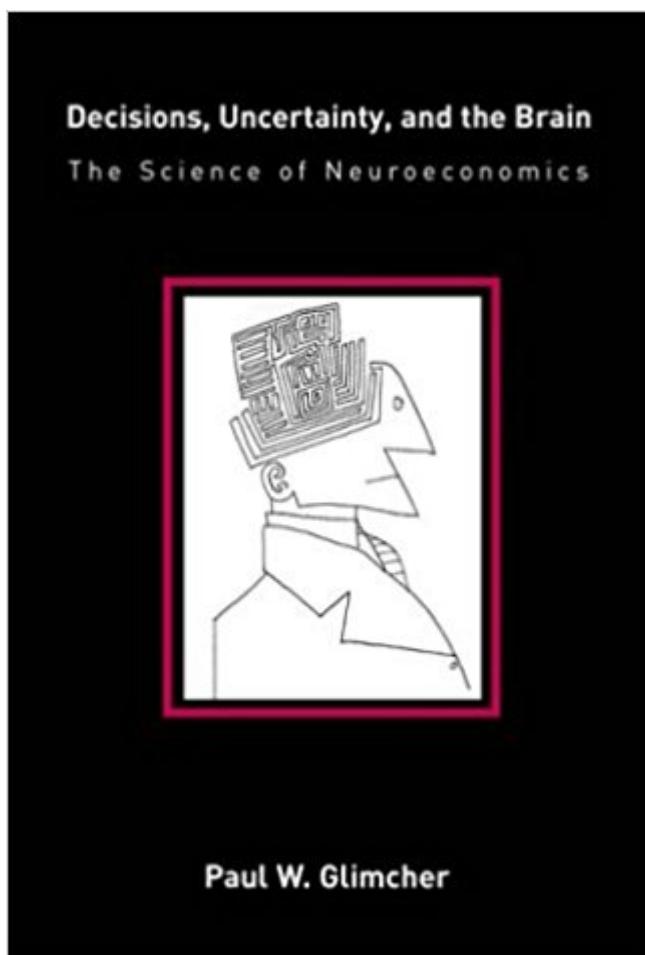


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# Decisions, Uncertainty, And The Brain: The Science Of Neuroeconomics (MIT Press)



## **Synopsis**

In this provocative book, Paul Glimcher argues that economic theory may provide an alternative to the classical Cartesian model of the brain and behavior. Glimcher argues that Cartesian dualism operates from the false premise that the reflex is able to describe behavior in the real world that animals inhabit. A mathematically rich cognitive theory, he claims, could solve the most difficult problems that any environment could present, eliminating the need for dualism by eliminating the need for a reflex theory. Such a mathematically rigorous description of the neural processes that connect sensation and action, he explains, will have its roots in microeconomic theory. Economic theory allows physiologists to define both the optimal course of action that an animal might select and a mathematical route by which that optimal solution can be derived. Glimcher outlines what an economics-based cognitive model might look like and how one would begin to test it empirically. Along the way, he presents a fascinating history of neuroscience. He also discusses related questions about determinism, free will, and the stochastic nature of complex behavior.

## **Book Information**

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## **Customer Reviews**

The notion that the brain and central nervous system are made of circuits that process stimuli and evoke bodily responses is a founding principle of neuroscience. And we humans believe that once we understand every neural pathway, we will be able to predict a motor response to every sensory

input&#x97;from feeling the tug of a fish on a hook to catching your spouse in bed with someone else. All we have to do is build the right deterministic model of the brain. In *Decisions, Uncertainty, and the Brain: The Science of Neuroeconomics*, Paul W. Glimcher, an associate professor of neural science and psychology at New York University, recounts how the history of neuroscience has brought humankind to this reflex-based model&#x97;and then explains why it is insufficient. Simple behaviors might arise from stimulus-response rules, he allows, but complex behaviors are far less predictable. For example, the brain can weigh value and risk, even with incomplete or uncertain information. But how? Fortunately, Glimcher points out, there is already a science to answer that question: economics, particularly game theory. Other scientists have tapped economic theory to explain the natural world. In the 1960s certain ecologists used the discipline to model how animals forage for food and choose a mate. Glimcher makes a case that "neuroeconomics" can complete our understanding of our brains. He cites his own experiments on humans and monkeys to show how economic principles can accurately represent intricate thought processes, in situations rife with competing values and interests. As the book proceeds, the going can get tough, but the historical insight is worth the trip. Readers may feel a bit unsatisfied when Glimcher notes that a unified theory of neuroeconomics has yet to be written and then admits that he doesn&#x92;t know what this theory would look like. Yet he rises to the occasion by suggesting how scientists could begin to apply neuroeconomics to define the optimal course of action that a person might select and by providing a mathematical route for deriving that solution. In this way, Glimcher says, scientists can devise a better understanding of how the brain makes complex decisions in an uncertain world.

Dennis Watkins

Glimcher has achieved an extraordinary synthesis of perspectives that have remained isolated for far too long. He views the brain as a system designed to maximise neither pleasure nor social or economic success, but biological fitness instead. He goes on to show why this matters in fields as disparate as psychology, economics and his own field of neurobiology. This is an impressive and highly readable journey through vast areas of scientific and philosophical knowledge. (Alex Kacelnik, Professor of Behavioural Ecology, Oxford University)"Glimcher's seminal book is a must-read in the emerging field of neuroeconomics. His analysis of the biological foundations of economic behavior makes for exciting reading for economists and neuroscientists alike, who will be fascinated by his insightful research connecting neuronal firing and economic decision making."

(Kevin A. McCabe, Professor of Economics and Law, and Director of the Neuroeconomics Laboratory at the Interdisciplinary Center for Economic Science, George Mason University)Glimcher

does extraordinary neuroscience and relates it to the most fundamental of all questions: how the brain makes decisions. His use of game theory to characterize decision making in both humans and monkeys under conditions of strategic conflict is unique. What could be more important than studying the neurobiological basis of volitional choice in earnest? The implications and applications of his work are singular. (Michael S. Gazzaniga, Center for Cognitive Neuroscience, Dartmouth College) Decisions, Uncertainty, and the Brain is a worthwhile book. (William H. Redmond, Journal of Economic Issues) The book is an absorbing introduction to the emerging field of neuroeconomics, which combines economic concepts with the study of brains and behavior in humans and animals. Decisions, Uncertainty, and the Brain makes a strong case that the marriage of neuroscience's history and of philosophical implications of neuroeconomics. (Kenneth Silber, Tech Central Station) This book will surely ignite discussion and soul searching among serious neuroscientists... (P. Read, Montague Nature)

This book will some day be recognized as a turning point in human knowledge. Paul Glimcher manages to link disparate sciences like biology, neuroscience and economics into a coherent model of behavior and decision making. I particularly enjoyed his breakthrough answers to the questions of free will and consciousness. The book is not an easy read but it's so worth the effort!

Interestingly I wrote my first review on PG's book almost 3 years ago. Today after more study more degrees more experience more knowledge about the world and about me I am sold. Brilliant mind and book. This book is better than any science fiction book or movie including Ray Bradbury and today one of my favorite tools. The whole thing makes me feel like spitting in the air and try to predict where that's gonna go? In my second reading or I should say studying PG's book made me realize if we can have neuroeconomics we could certainly have psychoeconomics or psychaeconomics and I am very excited about that. So PG is going ahead and throwing himself out of a plane with an unchecke parachut but he's not jumping alone another guy is jumping with him essentially David Marr. So the more jumpers we get the more experience will be accumulated and may provide a verification for many of PG's points and his probabilities of survival after he jumps. What are the chances PG will land safely on planet earth? That jump to me resumes PG's book. Meanwhile the goal define the question thanks to the genius of David Marr. Another conclusion seems to me it is not to have one so I'll have to agree at many levels nothing is predetermined unless of course it is but how do we know that? Keep your mind open forget all you know and just hang on... This book is a huge adventure in the unknown realm of planet earth the universe and the

most unknown of all mysteries the human being and am all for it...It is the most amazing book I reopened lately...

Neuroeconomics is a relatively new field but one that shows great promise in providing insight into how the human brain makes financial decisions and to what degree human behavior is determined by the environment. It could give answers as to what motivates people to acquire wealth in spite of not having enough time to enjoy this wealth and shed light on why some people are risk adverse while others are not. If neuroeconomics is to be a successful theory it must of course deal with what is real and observable, and not engage in fanciful, philosophical speculation. This is another way of saying that it must be scientific in its methodologies, however difficult this might become. To perform real-time experiments in economics is extremely difficult, and this difficulty is exacerbated by the need to integrate what is observed in the everyday life with what is observed in laboratory experiments on the brain that are performed with the assistance of fMRI and other brain-scanning techniques. This book is an effort to introduce the field of neuroeconomics as a counter to what the author calls the 'classical Cartesian paradigm' and its arbitrary classification of behaviors into 'simple' and 'complex'. The simple behaviors are essentially deterministic and are now called 'reflexes.' Complex behaviors, on the other hand, are the result of processes that occur in the 'soul', and have no discernable relation between cause and effect. These processes are called 'cognitive mechanisms' by some and their scientific viability has been cast in doubt. The book should not be considered one that attempts to establish the field of neuroeconomics as a scientific one. Instead, the author wants to define cognitive mechanisms in the same way as that done in the field of economics. Only then can they be referred to as scientific, argues the author, and he further asserts that the use of reflexes itself is not scientifically viable. It is therefore the Cartesian paradigm of dualism that the author argues against, and neuroeconomics plays on a minor role in his case. Readers may therefore be disappointed if they are expecting a more thorough discussion of neuroeconomics. Indeed, it is only in the last two chapters of the book that the author gets down to analyzing the neural correlates of economic decision-making. In these chapters the author discusses experiments that he and a collaborator performed that point to the parietal cortex as being the part of the brain that is responsible for decision-making. It is interesting that for animals at least, game theory is thought to be the best computational model for indeterminate decision-making. Bayesian probability theory plays a role in these computational models, and work from ecological biologists is quoted as supporting the notion that models based on economics are needed to describe the decision-making processes of animals as they encounter situations where fitness must be

maximized. The author gives examples of how neuroeconomic strategies can be employed in practice, but he is also aware of the enormity of the problem of building a complete neuroeconomic theory of the brain, a task requiring large amounts of empirical data and an understanding of how individual behaviors have their origins in computational processes that occur in various neural modules in the brain.

Glimcher looks carefully at a paper by Shadlen & Newsome on MT neurons in behavioral paradigms. The concept of Neuroeconomics as developed in the book Behavioral Game Theory by Colin Camerer is developed somewhat by Glimcher, but I think he realizes we are at the beginning of the role of uncertainty and probability in brain function. Certainly digital EEGs and brain waves show randomness, even though Llinas and others claim that 40 Hz. is the frequency of binding. I think there are going to be other binding frequencies as well. Multielectrode arrays will allow us to look not only at frequency maps, but spatial, color, and other probability maps through redundancy and repetition of brain symbols in adjacent microanatomical regions of the brain, like in V1 in the primate. Glimcher begins his glorious ride and tour through Neuroscience by describing its History: DesCartes, John Stuart Mill, Sherrington, and so on. This book is written for the specialist and the novice; the writing style is simple and lucid. Paul models probabilistically LIP neurons by looking at receptive field paradigms. Near the end of the book, Glimcher ties everything together in a cohesive theory of Neuroeconomics. This will prove to be a valid and interesting approach to neurophysiological function. Another book to look at exploring similar issues is Probabilistic Models of the Brain by Rao.

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