Contents

List of Figures x
List of Tables xii
Preface xiii
Acknowledgments xvi
About the Author xvii

Introduction
1 Introduction 3
  1.1 Economics: Neoclassical and behavioral 3
  1.2 The origins of behavioral economics 5
  1.3 Methods 7
  1.4 Looking ahead 8

Part 1 Choice under Certainty
2 Rational Choice under Certainty 13
  2.1 Introduction 13
  2.2 Preferences 13
  2.3 Rational preferences 15
  2.4 Indifference and strict preference 19
  2.5 Preference orderings 24
  2.6 Choice under certainty 25
  2.7 Utility 28
  2.8 Discussion 31

3 Decision-Making under Certainty 34
  3.1 Introduction 34
  3.2 Opportunity costs 34
  3.3 Sunk costs 41
  3.4 Menu dependence and the decoy effect 46
  3.5 Loss aversion and the endowment effect 52
  3.6 Anchoring and adjustment 65
  3.7 Discussion 68

Part 2 Judgment under Risk and Uncertainty
4 Probability Judgment 75
  4.1 Introduction 75
  4.2 Fundamentals of probability theory 75
  4.3 Unconditional probability 79
## Contents

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.4  Conditional probability</td>
<td>84</td>
</tr>
<tr>
<td>4.5  Total probability and Bayes’s rule</td>
<td>88</td>
</tr>
<tr>
<td>4.6  Bayesian updating</td>
<td>91</td>
</tr>
<tr>
<td>4.7  Discussion</td>
<td>93</td>
</tr>
<tr>
<td>5    Judgment under Risk and Uncertainty</td>
<td>98</td>
</tr>
<tr>
<td>5.1  Introduction</td>
<td>98</td>
</tr>
<tr>
<td>5.2  The gambler’s fallacy</td>
<td>98</td>
</tr>
<tr>
<td>5.3  Conjunction and disjunction fallacies</td>
<td>102</td>
</tr>
<tr>
<td>5.4  Base-rate neglect</td>
<td>106</td>
</tr>
<tr>
<td>5.5  Confirmation bias</td>
<td>110</td>
</tr>
<tr>
<td>5.6  Availability</td>
<td>113</td>
</tr>
<tr>
<td>5.7  Overconfidence</td>
<td>116</td>
</tr>
<tr>
<td>5.8  Discussion</td>
<td>120</td>
</tr>
</tbody>
</table>

### Part 3  Choice under Risk and Uncertainty

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>6    Rational Choice under Risk and Uncertainty</td>
<td>129</td>
</tr>
<tr>
<td>6.1  Introduction</td>
<td>129</td>
</tr>
<tr>
<td>6.2  Uncertainty</td>
<td>129</td>
</tr>
<tr>
<td>6.3  Expected value</td>
<td>133</td>
</tr>
<tr>
<td>6.4  Expected utility</td>
<td>140</td>
</tr>
<tr>
<td>6.5  Attitudes toward risk</td>
<td>145</td>
</tr>
<tr>
<td>6.6  Discussion</td>
<td>149</td>
</tr>
<tr>
<td>7    Decision-Making under Risk and Uncertainty</td>
<td>153</td>
</tr>
<tr>
<td>7.1  Introduction</td>
<td>153</td>
</tr>
<tr>
<td>7.2  Framing effects in decision-making under risk</td>
<td>153</td>
</tr>
<tr>
<td>7.3  Bundling and mental accounting</td>
<td>159</td>
</tr>
<tr>
<td>7.4  The Allais problem and the sure-thing principle</td>
<td>165</td>
</tr>
<tr>
<td>7.5  The Ellsberg problem and ambiguity aversion</td>
<td>168</td>
</tr>
<tr>
<td>7.6  Probability weighting</td>
<td>171</td>
</tr>
<tr>
<td>7.7  Discussion</td>
<td>175</td>
</tr>
</tbody>
</table>

### Part 4  Intertemporal Choice

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>8    The Discounted Utility Model</td>
<td>181</td>
</tr>
<tr>
<td>8.1  Introduction</td>
<td>181</td>
</tr>
<tr>
<td>8.2  Interest rates</td>
<td>181</td>
</tr>
<tr>
<td>8.3  Exponential discounting</td>
<td>185</td>
</tr>
<tr>
<td>8.4  What is the rational delta?</td>
<td>191</td>
</tr>
<tr>
<td>8.5  Discussion</td>
<td>193</td>
</tr>
<tr>
<td>9    Intertemporal Choice</td>
<td>195</td>
</tr>
<tr>
<td>9.1  Introduction</td>
<td>195</td>
</tr>
<tr>
<td>9.2  Hyperbolic discounting</td>
<td>195</td>
</tr>
<tr>
<td>9.3  Choosing not to choose</td>
<td>202</td>
</tr>
<tr>
<td>9.4  Preferences over profiles</td>
<td>206</td>
</tr>
<tr>
<td>9.5  Misprediction and miswanting</td>
<td>210</td>
</tr>
<tr>
<td>9.6  Discussion</td>
<td>214</td>
</tr>
</tbody>
</table>
# Contents

## Part 5  Strategic Interaction

10  Analytical Game Theory  221  
   10.1  Introduction  221  
   10.2  Nash equilibrium in pure strategies  221  
   10.3  Nash equilibrium in mixed strategies  228  
   10.4  Equilibrium refinements  233  
   10.5  Discussion  237  

11  Behavioral Game Theory  240  
   11.1  Introduction  240  
   11.2  Social preferences: Altruism, envy, fairness, and justice  240  
   11.3  Intentions, reciprocity, and trust  246  
   11.4  Limited strategic thinking  249  
   11.5  Discussion  251  

## Part 6  Concluding Remarks

12  Behavioral Welfare Economics, Libertarian Paternalism, and the Nudge Agenda  257  
   12.1  Introduction  257  
   12.2  Behavioral welfare economics  258  
   12.3  Libertarian paternalism and the nudge agenda  259  
   12.4  Criticism  262  
   12.5  Discussion  265  

13  General Discussion  268  

Appendix: Answer Key  271  
Bibliography  303  
Index  310
Introduction

1.1 Economics: Neoclassical and behavioral

This is a book about theories of decision. To use the language of the epigraph, such theories are about the negotiation of “the thorny career of life”: they tell us how we make, or how we should make, decisions. Not that the Marquis de Sade would have spoken in these terms, living as he did in the eighteenth century, but the theory of decision seems to be exactly what he had in mind when he imagined “the master-piece of philosophy.”

Developing an acceptable theory of decision would be an achievement. Most human activity – finance, science, medicine, arts, and life in general – can be understood as a matter of people making certain kinds of decisions. Consequently, an accurate theory of decision would cover a lot of ground. Maybe none of the theories we will discuss is the masterpiece of which de Sade thought so highly. Each theory can be, has been, and perhaps should be challenged on various grounds. However, decision theory has been an active area of research in recent decades, and it may have generated real progress.

Modern theories of decision (or theories of choice – I will use the terms interchangeably) say little about what goals people will or should pursue. Goals may be good or evil, mean-spirited or magnanimous, altruistic or egoistic, short-sighted or far-sighted; they may be Mother Teresa’s or the Marquis de Sade’s. Theories of decision simply take a set of goals as given. Provided a set of goals, however, the theories have much to say about how people will or should pursue those goals.

Theories of decision are variously presented as descriptive or normative. A descriptive theory describes how people in fact make decisions. A normative theory captures how people should make decisions. It is at least theoretically possible that people make the decisions that they should make. If so, one and the same theory can simultaneously be descriptively adequate and normatively correct. However, it is possible that people fail to act in the manner in which they should. If so, no one theory can be both descriptively adequate and normatively correct.

Exercise 1.1 Descriptive vs. normative Which of the following claims are descriptive and which are normative? (Answers to this and other exercises can be found in the Appendix.)
(a) On average, people save less than 10 percent of their income for retirement.
(b) People do not save as much for retirement as they should.
(c) Very often, people regret not saving more for retirement.
It can be unclear whether a claim is descriptive or normative. “People save too little” is an example. Does this mean that people do not save as much as they should? If so, the claim is normative. Does this mean that people do not save as much as they wish they did? If so, the claim is descriptive.

Example 1.2 Poker  Suppose that you are playing poker, and that you are playing to win. Would you benefit from having an adequate descriptive theory, a correct normative theory, or both?

A descriptive theory would give you information about the actions of the other players. A normative theory would tell you how you should behave in light of what you know about the nature of the game, the expected actions of the other players, and your ambition to win. All this information is obviously useful when playing poker. You would benefit from having both kinds of theory.

Some theories of decision are described as theories of rational choice. In everyday speech, the word “rationality” is used loosely; frequently it is used simply as a mark of approval. For our purposes, a theory of rational decision is best seen as a definition of rationality, that is, as specifying what it means to be rational. Every theory of rational decision serves to divide decisions into two classes: rational and irrational. Rational decisions are those that are in accordance with the theory; irrational decisions are those that are not. A theory of rational choice can be thought of as descriptive or normative (or both). To say that a theory of rational decision is descriptive is to say that people in fact act rationally. To say that a theory of rational decision is normative is to say that people should act rationally. To say that a theory of rational decision is simultaneously descriptive and normative is to say that people act and should act rationally. Typically, the term rational-choice theory is reserved for theories that are (or that are thought to be) normatively correct, whether or not they are simultaneously descriptively adequate.

For generations now, economics has been dominated by an intellectual tradition broadly referred to as neoclassical economics. If you have studied economics but do not know whether or not you were taught in the neoclassical tradition, it is almost certain that you were. Neoclassical economics is characterized by its commitment to a theory of rational choice that is simultaneously presented as descriptively adequate and normatively correct. This approach presupposes that people by and large act in the manner that they should. Neoclassical economists do not need to assume that all people act rationally all the time, but they insist that deviations from perfect rationality are so small or so unsystematic as to be negligible. Because of its historical dominance, I will refer to neoclassical economics as standard economics, and to neoclassical economic theory as standard theory.

This is an introduction to behavioral economics: the attempt to increase the explanatory and predictive power of economic theory by providing it with more psychologically plausible foundations, where “psychologically plausible” means consistent with the best available psychology. Behavioral economists share neoclassical economists’ conception of economics as the study of people’s decisions under conditions of scarcity and of the results of those
decisions for society. But behavioral economists reject the idea that people by and large behave in the manner that they should. While behavioral economists certainly do not deny that some people act rationally some of the time, they believe that the deviations from rationality are large enough, systematic enough, and consequently predictable enough, to warrant the development of new descriptive theories of decision. If this is right, a descriptively adequate theory cannot at the same time be normatively correct, and a normatively correct theory cannot at the same time be descriptively adequate.

1.2 The origins of behavioral economics

Behavioral economics can be said to have a short history but a long past. Only in the last few decades has it emerged as an independent subdiscipline of economics. By now, top departments of economics have behavioral economists on their staff. Behavioral economics gets published in mainstream journals. Traditional economists incorporate insights from behavioral economics into their work. In 2002, Daniel Kahneman (one of the most famous behavioral economists) won the Nobel Memorial Prize “for having integrated insights from psychological research into economic science, especially concerning human judgment and decision-making under uncertainty.” In spite of its short history, however, efforts to provide economics with plausible psychological foundations go back a long way.

The establishment of modern economics is marked by the publication in 1776 of Adam Smith’s Wealth of Nations. Classical economists such as Smith are often accused of having a particularly simple-minded (and false) picture of human nature, according to which people everywhere and always, in hyper-rational fashion, pursue their narrowly construed self-interest. This accusation, however, is unfounded. Smith did not think people were rational:

How many people ruin themselves by laying out money on trinkets of frivolous utility? What pleases these lovers of toys is not so much the utility, as the aptness of the machines which are fitted to promote it. All their pockets are stuffed with little conveniences … of which the whole utility is certainly not worth the fatigue of bearing the burden.

Smith wrote these words 200 years before the era of pocket calculators, camera phones, iPads, and smartwatches. Nor did Smith think people were selfish: “[There] are evidently some principles in [man’s] nature, which interest him in the fortune of others, and render their happiness necessary to him, though he derives nothing from it except the pleasure of seeing it.” Smith and the other classical economists had a conception of human nature that was remarkably multi-faceted; indeed, they did not draw a sharp line between psychology and economics the way we do.

Early neoclassical economics was built on the foundation of hedonic psychology: an account of individual behavior according to which individuals seek to maximize pleasure and minimize pain. In W. Stanley Jevons’s words: “Pleasure and pain are undoubtedly the ultimate objects of the Calculus of
Economics. To satisfy our wants to the utmost with the least effort ... in other words, to *maximise pleasure*, is the problem of Economics.” The early neoclassical economists were inspired by the philosopher Jeremy Bentham, who wrote: “Nature has placed mankind under the governance of two sovereign masters, *pain* and *pleasure* ... They govern us in all we do, in all we say, in all we think.” Because it was assumed that individuals have direct access to their conscious experience, some economists defended the principles of hedonic psychology on the basis of their introspective self-evidence alone.

After World War II, however, many economists were disappointed with the meager results of early neoclassicism in terms of generating theories with predictive power and so came to doubt that introspection worked. Similar developments took place in other fields: behaviorism in psychology, verificationism in philosophy, and operationalism in physics can all be seen as expressions of the same intellectual trend. Postwar neoclassical economists aimed to improve the predictive power of their theories by focusing on what can be publicly observed rather than on what must be experienced. Instead of taking a theory about pleasure and pain as their foundation, they took a theory of preference. The main difference is that people’s feelings of pleasure and pain are unobservable, whereas their choices can be directly observed. On the assumption that choices reflect personal preferences, we can have direct observable evidence about what people prefer. Thus, postwar neoclassical economists hoped to completely rid economics of its ties to psychology – hedonic and otherwise.

In spite of the relative hegemony of neoclassical economics during the second half of the twentieth century, many economists felt that their discipline would benefit from closer ties to psychology and other neighboring fields. What really made a difference, however, was the cognitive revolution. In the 1950s and 1960s, researchers in psychology, computer science, linguistics, anthropology, and elsewhere rejected the demands that science focus on the observable and that all methods be public. Instead, these figures advocated a “science of cognition” or *cognitive science*. The cognitive scientists were skeptical of naive reliance on introspection, but nevertheless felt that a scientific psychology must refer to things “in the head,” including beliefs and desires, symbols, rules, and images. Behavioral economics is a product of the cognitive revolution. Like cognitive scientists, behavioral economists – though skeptical of the theories and methods of the early neoclassical period – are comfortable talking about beliefs, desires, rules of thumb, and other things “in the head.” Below, we will see how these commitments get played out in practice.

To some, the fact that behavioral economists go about their work in such a different way means that they have become economists in name only. But notice that behavioral economics is still about the manner in which people make choices under conditions of scarcity and the results of those choices for society at large – which is the very definition of economics. *Behavioral science* refers to the scientific study of behavior, which makes behavioral economics a kind of behavioral science. *Psychology and economics* is also a broader category, referring to anything that integrates the two disciplines, and which therefore does not need to be about choice at all.
1.3 Methods

Before we explore in earnest the concepts and theories developed by behavioral economists in the last few decades, I want to discuss the data that behavioral economists use to test their theories and the methods they use to generate such data.

Some of the earliest and most influential papers in behavioral economics relied on participants’ responses to hypothetical choices. In such studies, participants were asked to imagine that they found themselves in a given choice situation and to indicate what decision they would make under those conditions. Here is one such question: “Which of the following would you prefer? A: 50% chance to win 1,000, 50% chance to win nothing; B: 450 for sure.” Other early papers relied on readers’ intuitions about how people might behave under given conditions. Thus, they offered scenarios such as: “Mr S. admires a $125 cashmere sweater at the department store. He declines to buy it, feeling that it is too extravagant. Later that month he receives the same sweater from his wife for a birthday present. He is very happy. Mr and Mrs S. have only joint bank accounts.” These thought experiments were apparently inspired in part by the author’s observations of the behavior of fellow economists, who argued that people were always rational but at times behaved irrationally in their own lives.

More recently, hypothetical choice studies were almost completely displaced by laboratory experiments in which laboratory participants make real choices involving real money. Such experiments have been run for decades. In the early 1970s, for example, psychologists Sarah Lichtenstein and Paul Slovic ran experiments at a Las Vegas casino, where a croupier served as experimenter, professional gamblers served as participants, and winnings and losses were paid in real money. More frequently, behavioral economists use college undergraduates or other easily accessible participants. When behavioral economists engage in experimental studies, they can be hard to distinguish from neoclassical experimental economists, that is, neoclassical economists who use experiments to explore how people make decisions. Experimentalists agree that decisions performed by laboratory subjects must be real, and that actual winnings must be paid out.

Behavioral economists, during the last decade or so, have increasingly relied on data gathered “in the field.” In one famous field study, Colin F. Camerer and colleagues studied the behavior of New York City cab drivers by using data from “trip sheets” – forms that drivers use to record the time passengers are picked up and dropped off as well as the amount of the fares – and from the cabs’ meters, which automatically record the fares. Researchers in this study simply observed how participants behaved under different conditions. In field experiments, researchers randomly assign participants to test and control groups, and then note how (if at all) the behavior of individuals in the two groups differs. In one prominent field experiment, Jen Shang and Rachel Croson tracked how voluntary donations to a public radio station varied when prospective donors were given different social information, that is, information about how much other people had given.
To some extent, behavioral economists use what psychologists call **process measures**, that is, methods that provide hints about cognitive and emotional processes underlying decision-making. Some rely on **process-tracing** software to assess what information people use when making decisions in games. Others employ brain scans, typically functional Magnetic Resonance Imaging (fMRI), which allows researchers to examine, albeit crudely, which parts of an individual’s brain are activated in response to a task or decision. Imaging methods have already been applied to a diversity of economic tasks, including decision-making under risk and uncertainty, intertemporal choice, buying and selling behavior, and strategic behavior in games. Even more exotic neuroscience methods are sometimes employed. One recent study explored what happens when you use a tool called Transcranial Magnetic Stimulation to disable a part of participants’ brains. The increasing use of methods borrowed from neuroscience is, not coincidentally, connected to the rise of **neuroeconomics**, which integrates economics with neuroscience.

The use of multiple methods to generate evidence raises interesting methodological problems. This is particularly true when evidence from different sources points in slightly different directions. Sometimes, however, evidence from multiple sources points in the same direction. When this is true, behavioral economists have more confidence in their conclusions. It can be argued that part of the reason why behavioral economics has turned into such a vibrant field is that it successfully integrates evidence of multiple kinds, generated by a variety of methods.

### 1.4 Looking ahead

As stated in the Preface, this book is arranged in five main parts: (1) choice under certainty, (2) judgment under risk and uncertainty, (3) choice under risk and uncertainty, (4) intertemporal choice, and (5) strategic interaction. Each of these parts contains two chapters: an even-numbered one outlining standard neoclassical theory and an odd-numbered one discussing behavioral alternatives. A final part (6) concludes. As suggested in Section 1.1, the ultimate goal of behavioral economics is to generate novel insights into people’s decisions under conditions of scarcity and the results of those decisions for society. Behavioral and neoclassical economists alike try to attain this goal by building abstract, formal theories. In this book we will explore increasingly general theories, both neoclassical and behavioral.

Studying behavioral economics is a non-trivial enterprise. For one thing, the level of abstraction can pose an initial challenge. But as we will see below, it is the very fact that economics is so abstract that makes it so very useful: the more abstract the theory, the wider its potential application. Some readers may be prone to putting down a book like this as soon as they notice that it contains mathematics. Please do not. There is no advanced math in the book, and **numeracy** – the ability with or knowledge of numbers – is incredibly important, even to people who think of themselves as practically oriented.
Exercise 1.3 Numeracy  In a recent study on financial decision-making, people’s answers to three quick mathematics questions were strong predictors of their wealth: households where both spouses answered all three questions correctly were more than eight times as wealthy as households where neither spouse answered any question correctly. So if you have ever struggled with math, be glad that you did. You can try answering the three questions for yourself:

(a) If the chance of getting a disease is 10 percent, how many people out of 1000 would be expected to get the disease?
(b) If five people all have the winning numbers in the lottery, and the prize is 2 million dollars, how much will each of them get?
(c) Let us say you have $200 in a savings account. The account earns 10 percent interest per year. How much would you have in the account at the end of two years?

To underscore the usefulness of behavioral economics, the book discusses a variety of applications. Among other things, you will learn how to choose a wingman or wingwoman, how to design a marketing scheme that works, how not to fall for such marketing schemes, how to compute the probability that your love interest is seeing somebody else, how to sell tires, and how to beat anyone at rock-paper-scissors. Ultimately, behavioral economics sheds light on human beings – the way they really are, as opposed to the way great thinkers of the past have thought they should be – and on the nature of the human condition.

FURTHER READING

Daniel Kahneman’s *Thinking, Fast and Slow* (2011) and Richard H. Thaler’s *Misbehaving: The Making of Behavioral Economics* are must-reads for anyone interested in behavioral economics, both for their unparalleled understanding of the theory and for their illuminating personal reminiscences. Angner and Loewenstein (2012) and Heukelom (2014) discuss the nature, historical origins, and methods of behavioral economics; Angner (in press) explores further the relationship between behavioral and neoclassical economics. The *Wealth of Nations* is Smith (1976 [1776]); the quotations in the history section are from Smith (2002 [1759], p. 211) and Smith (2002 [1759], p. 11), Jevons (1965 [1871], p. 37), and Bentham (1996 [1789], p. 11). The sample questions in the methods section come from Kahneman and Tversky (1979, p. 264) and Thaler (1985, p. 199). The psychologists who went to Vegas are Lichtenstein and Slovic (1973). The study of NYC cabdrivers is Camerer et al. (1997), the one about social information Shang and Croson (2009), and that which disabled parts of participants’ brains Knoch et al. (2006). Camerer et al. (2005) provides a widely cited overview of neuroeconomics. The study on financial decision-making is Smith et al. (2010); the three numeracy questions were adapted from the University of Michigan Health and Retirement Study.
Index

30 Rock, 16

A
actuarially fair lottery, 139
adaptation, 210–211
addiction, 195, 216
  rational, 187
Adler, Alfred, 112
affect heuristic, 119, 121
Affordable Care Act, 63
Afghanistan, 110, 125
African nations, 65–66
air fares, 162
airplane crashes, 115, 119
Alabama, 108
alarm clocks, 99
alcohol, 115, 196
Allais problem, 165–167
alternatives, set of, 15, 29
altruism, 243, 245–247
ambiguity aversion, 170, 177–178
American Economic Association (AEA), 69
analytical game theory, 221, 223, 237–238
  and neoclassical economics, 240
anchor, 65
anchoring and adjustment, 65–66, 101, 105, 119
AND rule, 81, 87–88, 135
ant and the grasshopper, the, 187
anti-symmetry, 21, 32
anti-vaccination, 115
Apollo 11, 118
Auburn, 108
Aristotle, 43
Armstrong, Neil, 118
Asian disease problem, 153, 156–157
aspiration treadmill, 60–61
asymmetric paternalism, 257, 260
asymmetrical domination, 49
athletes, 61
attraction effect, 49
Auburn, 108
auxiliary assumptions, 268
availability, 114
availability bias, 116, 118, 124
availability cascades, 115
availability heuristic, 114–115, 119
aviation safety, 105
axiomatic theory, 13, 75
axioms, 13

B
backward induction, 226–227
Ball, George, 44
base rate, 107
base-rate
  base-rate fallacy, 107, 116
  base-rate neglect, 107, 108, 124
battle of the sexes, 223–224, 229–230, 234
Bayes’s rule, 90–94
Bayes’s theorem, 90
Bayesian updating, 91–93
Beautiful Mind, A, 226
beauty-contest game, 249–250
Becker, Gary, 31, 187
Beckett, Samuel, 270
beer, 141, 202
behavior detection, 109–110
behavioral economics, 4–5, 258, 269–270
  and data, 269
  methods of, 7–8
vs. neoclassical economics, 262, 268
origins of, 5–6
behavioral game theory, 240, 251–252
behavioral welfare economics, 258–259
behaviorism, 6
Bentham, Jeremy, 5
beta–delta function, 197–198, 200–201
beta–delta model, 198
bias, 66, 101, 119
  availability, 114–115
  confirmation, 110–111
  diversification, 211
  impact, 212–213
  projection, 211–212
  status quo, 63–64
binary relations, 13–14
Binmore, Ken, 252
Biometric Identity Management, 110
birthday problem, 105
Blackjack, 102
Blackburn, Simon, 265
bliss, 24, 28, 144
Bloomberg ban, 262
Boeing 747–400, 102
Boethius, 176
bonds, 176

Copyrighted material – 9781137512925
Bonds, Barry, 60
booksellers, online, 163
boyfriends, and sunk-cost fallacy, 43
brain tumors, 113–114
breast cancer, 106–107
brinkmanship, 232
British police, 108
Brooks, David, 257
Brown, Jerry, 45
Brutus, 17
Bryant, Kobe, 193
budget line, 26
budget set, 25–26, 46
buffet lines, 213
Bugatti, 49, 51
bullet trains, 45
bundles
  consumption, 15
  in indifference curves, 24
bundling, 57–58, 159–160
Buridan’s ass, 33
Burroughs, William S., 195

C
  cab company, 107–108
  cab drivers, 7, 39
  Caesar, 17
  cake, 199
    division of, 241
  calculator/jacket problem, 38, 156
  calibration, 116–117
  California, 22
  California Medical Association, 167
  Camerer, Colin F., 7
  cancellation, 177–178
  cancer, 89, 106–107
  cancer screening, 200
  Caplan, Bryan, 264
  car, used, 66
  carpe diem, 192
  cash bonuses, 59
  cash-back offers, 164
  centipede game, 237
  Central Intelligence Agency (CIA), 122–123
  certainty equivalent, 147–148
  charitable donations, 242
  cheap talk, 226, 248
  chemical substances, regulation of, 150
  chess, 66–67, 221, 231–232
  Chetty, Raj, 266
  Chicago, 132
  chicken, 232
  choice architect, 263
  choice under certainty, 13, 19, 25
  choice under risk, 129, 150–151, 153
  choice under uncertainty, 129–132, 149
  choice, paradox of, 40–41
  choice, reason-based, 51–52
choice, theories of, 3–4
Christmas, 161, 185
Christmas presents, 161
Clapton, Eric, 69
cleaning, 206–207
climate change, 193
closure, 64
Coase Theorem, 63
coding, in prospect theory, 164, 174
coffee shops, 59, 223, 228
cognitive revolution, 6
cognitive science, 6
coin toss, 170
Coke, 41–42
Cold War, 232
colon cancer, 200
colonoscopy, 200
combination, in prospect theory, 174
competence, 118, 120
competence hypothesis, 170, 177–178
competitors, 48–49
completeness, 17–19, 32
compound interest, 183–184
compromise effect, 51
confidence, 141, 154–155
Concorde fallacy, 42
conditional probability, 84–86, 106
certainty, 116. see also overconfidence
confirmation bias, 110–111, 118, 124
confirmation theory, 91
cornerstone fallacy, 82, 102, 105, 124
Consolations of Philosophy, The, 176
conspiracy theories, 112
cost-benefit analysis, 55, 138, 193
costs
  explicit, 34–35
  opportunity, 34–35
  sunk, 41–42
covenant, 227–228
crash cocaine, 173
credible vs. non-credible threats, 234–235
credit cards, 59, 182–184
credit scores, 194
Croson, Rachel, 7
CT scans, 113–114
cycling preferences, 24
### D

**Daily Show, The**, 77  
Dante, 185  
dating, 90, 131  
Dawes, Robyn M., 248  
de Menezes, Jean Charles, 108–109  
de Morgan’s law, 22, 104–105  
de Sade, Marquis, 3  
*Dead Poets Society*, 192  
*Deal or No Deal*, 138, 151  
Dean, James, 232  
death penalty, 110–111  
decision trees, 34–35, 43  
decision, theories of, 3–4  
decoys, 49–50  
default options, 261  
defection, 226  
deforestation, 226  
delta function, 186  
delta model, 186  
Democrats, 63  
Department of Defense (DoD), 44  
Department of Homeland Security, 110  
Depp, Johnny, 205, 206  
descriptive theory, 3–4  
diagnosticity, 109–110  
dictator game, 240–242  
dieting, 200  
discount factor, 185, 193  
discount rate, 191  
discounting, hyperbolic, 198–199  
diseases, 116  
disjunction fallacy, 103, 105, 124  
diversification, 98, 207  
diversification bias, 211  
*Divina Commedia*, 185  
dominance, 49, 144  
  asymmetrical, 49  
  strict, 225  
  weak, 226  
Donald Duck’s nephews, 14  
Donner, Andrew, 170  
doomsday machine, 236  
Down syndrome, 108  
*Dr Strangelove*, 236  
drugs, 187, 200  
Du Bois, W.E.B., 71  
Dulles International Airport, 241  
Dulles, John Foster, 232  
Dunning–Kruger effect, 120  
duration neglect, 209  
Dylan, Bob, 69

### E

economics, 4–5  
  behavioral, 4–5  
  behavioral vs. neoclassical, 262, 268  
  criticism of, 31–32, 151  
  definition of, 6  
  and law, 139  
  nature of, 31–32  
  neoclassical, 4–5  
  and psychology, 6  
economics professors, 208  
*Economist, The*, 46, 51  
editing phase, of prospect theory, 174  
Einstein, Albert, 184  
*Either/Or*, 131  
Ellsberg problem, 168–169  
empathy gap, 212  
empirical-reflective method, 213–214  
endowment effect, 54  
endowments, 61–62, 155  
engine failure, 105  
engineering, 98  
evvy, 243  
Epicurus, 207, 217  
equilibrium, 222  
  mixed strategy, 229–231  
  Nash, 223–224  
  refinements of, 234, 236  
  subgame-perfect, 236, 242  
  trembling-hand-perfect, 234  
  uniqueness of, 238  
equiprobability, 77  
ergonomics, 266  
estoration situation, 43–44  
Euripides, 207  
europe, 63  
evaluation phase, of prospect theory, 174  
even odds, 83  
EVERYTHING rule, 80  
evidence, 91  
evolutionary game theory, 232–233  
exam scores, 60  
  exhaustive options, 25  
  expansion condition, 47  
  expected utility, 140–142, 165–166  
  expected value, 133–135, 138  
  expected-utility maximization, 142  
  expected-utility theory, 145, 170, 175  
  experimental economics, 189  
  explicit costs, 34–35  
  exponential discounting, 185, 186, 195–196  
  extensive form games, 235  
  extremeness aversion, 51

### F

F-35, 44  
fairness, 244  
field experiments, 7  
field study, 7  
flooding, 104  
Florida, 22, 122  
focal points, 238  
  focusing illusion, 212–213  
  four-card swindle, 79  
  Fox News, 123
Index

framing effects, 54, 153–155

Freakonomics, 173

free trade, 64–65

freedom, 40

Friedman, Milton and Rose, 64

frisbee factory, 88–90, 107

functional Magnetic Resonance Imaging (fMRI), 8

fungibility, 164

G

gains, 154–155, 158, 160–161

gambler’s fallacy, 100

gambling, 7, 112, 133–135, 158

gambling vs. insurance, 171–172

game shows, 138, 151

game theory, 221

analytical, 221, 223

behavioral, 240

descriptive vs. normative, 237–238

evolutionary, 232–233

games, 222

dictator, 240–242

impure coordination, 224

pure coordination, 223

sequential, 235

ultimatum, 240–242

Gandhi, Mahatma, 252

Gangnam Style, 37

gasoline prices, 243

gelato, 13

gender discrimination, 95, 122

General Theory of Employment, Interest and Money, The, 249

genetic enhancement, 64

genetically modified organisms (GMOs), 123

Gervais, Ricky, 120

get-rich-quick schemes, 97

Gilbert, Daniel, 192, 214

Goodreads.com, 43

Google, 263

Greenspan, Alan, 257

H

Halloween candy, 207

Hangover: Part III, The, 221

Hanukkah, 161

happiness, 27, 69, 213–214, 262

Harsanyi, John C., 132

hawk & dove, 232–233

Hayek, Friedrich A., 251, 258

health care, 63

hearing loss, 143

hedonic psychology, 5–6

hedonic-editing hypothesis, 164

Hendrix, Jimi, 100

heuristics, 66, 100–101, 119

affect, 119

availability, 114–115, 119

representative, 119

heuristics-and-biases program, 66, 100, 119

hiking, 103–104

hindsight bias, 118, 124

Hobbes, Thomas, 227–228

Homer, 202

Horace, 192

hot–cold empathy gap, 212

housecleaning, 206–207

human-factors engineering, 266

Hume, David, 27

hyperbolic discounters, naifs vs. sophisti-
cates, 203

hyperbolic discounting, 198–199, 216–217

hypothesis, 91

hypothetical choices, 7

I

impact bias, 212–213

impartial spectator, 188

impatience, 187, 200

implicit costs, 35

implicit interest, 183

impulsivity, 200

impure coordination game, 224

In Search of Lost Time, 112

in vitro fertilization (IVF), 122

incomplete relations, 17–19

increasing utility profiles, preference for, 207

independence, 81, 87–88, 98–99

index, 28–29

India, 226

indifference, 19, 144, 189–190

indifference curves, 24–25

reversible, 62

and utility, 30

indifference maps, 24

indirect proofs, 21

inequality aversion, 244

inside information, 112

insurance vs. gambling, 171–172

integration, 159

intelligence quotient (IQ), 64

intentions, 246

interactions, strategic, 221

interest, 181–183, 193–194

interest, simple vs. compound, 183–184

intransitive relations, 16–17

investments, 247

failed, 42

managing, 98

opportunity costs of, 35

and trust games, 247

Irish Republican Army (IRA), 104

Iron Bowl, 108

Iroquois, 188

irreflexivity, 21, 32
J
jacket/calculator problem, 38, 156
jackpot, 94
jealousy, 112
Jesus nut, 102
jet, private, 105
Jevons, W. Stanley, 5–6
Jobs, Steve, 192
Johnson, President Lyndon B., 44
Joplin, Janis, 100
judgment, theory of, 98
Juliet, 19
junk bonds, 58
Junky, 195
jury, 110
justice, 131–132

K
Kabul, Afghanistan, 110
Kahneman, Daniel, 5, 119, 175
Keynes, John Maynard, 249, 265
Kierkegaard, Søren, 131
“known knowns,” 171
Krugman, Paul, 257
Kubrick, Stanley, 236

L
laboratory experiments, 7
Langford, Larry, 94–95, 101
Large Hadron Collider, 77
law and economics, 139
behavioral, 258
Law and Order, 124
dependence, 46–48, 51–52
menu, 25
microeconomics, 61–62, 240
minimax-risk criterion, 131
money illusion, 54
money, diminishing marginal utility of, 141
Moneyball, 54
Monty Hall Problem, 79
morality, 46
Morrison, Jim, 100
Most Dangerous Man in America, The, 168
Mother Teresa, 3
movies, 71
mugs, 52, 63
multiple-choice tests, 96
Muslims, 123
mutually assured destruction (MAD), 236
mutually exclusive options, 25
mutually exclusive outcomes, 79–80

N
naifs, 203
Nash equilibrium, 223–224, 238
convergence on, 250
in mixed strategies, 229–231
rationality, 226
refinements of, 234, 236
Nash, John, 226, 231
Nash’s Theorem, 231
National Public Radio (NPR), 123
nature preserves, 55
negative reciprocity, 246
negative time preference, 207
negative transitivity, 22
negotiations, failure of, 59
neighborhood cleanup, 249
neoclassical economics, 4–5, 151, 269
vs. behavioral economics, 262, 268

M
magazine subscriptions, 46, 51
magnitude effect, 215
makeup exam, 221–222
malaria, 124
mammograms, 106–107
mandatory drug testing, 122
marginal utility, diminishing, 65, 141, 145
market equilibrium, 31
marriage, 32, 39–40
Marshmallow Test, 192
Marx brothers, 15–16
matching pennies, 229
materialism, 27, 31, 268
Matthew, Book of, 123
maximin criterion, 130
maximin criterion, 129–130, 132, 150
maximization, 30
MBA students, 46
measure, 28–29
mental accounting, 164, 177–178
menu dependence, 46–48, 51–52
menus, 25
meteorology, 117
microeconomics, 61–62, 240
minimax-risk criterion, 131
miswanting, 212
mixed strategy equilibrium, 229–231
money illusion, 54
money, diminishing marginal utility of, 141
Moneyball, 54
Monty Hall Problem, 79
morality, 46
Morrison, Jim, 100
Most Dangerous Man in America, The, 168
Mother Teresa, 3
movies, 71
mugs, 52, 63
multiple-choice tests, 96
Muslims, 123
mutually assured destruction (MAD), 236
mutually exclusive options, 25
mutually exclusive outcomes, 79–80

Copyrighted material – 9781137512925
and game theory, 240, 251–252
and social preferences, 245–246
neuroeconomics, 8
New York City, 7, 39, 132, 262
New York Times, 45, 61
newsletters, 97
newspaper boxes, 141
No Exit, 16–17
Nobel Memorial Prize, 5, 248–249
non-diagnosticity, 107
normative theory, 3–4, 68, 75
not rule, 80–81, 104–105
nuclear arms races, 226
nuclear facilities, Iranian, 125
nuclear meltdowns, 98, 115
nudge agenda, 257–261, 266
nudges, 260
numeracy, 8–9

O
Obamacare, 63
objectivism, 257
Oblomov, Ilya Ilyich, 196
Oblomovitis, 199
odds, 76–77, 83, 117
Oliver, John, 77
On the Shortness of Life, 192
online booksellers, 163
operationalism, 6
ophthalmologist, 114–115
opportunity costs, 34–36, 40, 59–60
optometrist, 114
or rule, 79, 103
ordinal utility, 30
ostrich farms, 157
Ostrom, Elinor, 248–249
outcome bias, 176
outcome bundling, 159–162
outcome space, 76
outcomes, 76, 99, 150, 159
outcomes, equiprobable, 77
outlet malls, 44
overconfidence, 117–118, 124

P
pain, 5–6, 55
Pakistan, 226
paradox of choice, 40–41
paradoxes of rationality, 238
Pareto dominance, 226
Pareto optimality, 226
parking, 137, 139
Pascal, Blaise, 144
Pascal’s wager, 144
paternalism, libertarian, 259–261
patience, 186–187
payday loans, 184–185
payoff matrix, 222
peak–end rule, 208
Pentagon Papers, 168
Pepsi, 41–42
Picture of Dorian Gray, The, 131
Piggly Wiggly, 41
Pigou, A.C., 191–192
Pitt, Brad, 54
plane accident, 132
planning, 102
planning fallacy, 102–103, 108
plastic bags, 71–72
players, 222
pleasure, 5–6, 27, 191–192, 207
poker, 4
policy, and nudge agendas, 266
political campaigns, 50–51
political reform, 39
pollution, 226
polyps, 200
Pope, Alexander, 118
Popper, Karl, 112
positive reciprocity, 246
positive time preference, 207
posterior probability, 91
predictability, vs. rationality, 269
preface paradox, 105
preference cycling, 24
preference ordering, 24, 28
preference relations, 14–15
anti-symmetric, 21
complete, 17–19
incomplete, 17–19
intransitive, 16–17
irreflexive, 21
rational, 15–16
reflexive, 18–19
strict/strong, 20
symmetric, 19
transitive, 15–17
weak, 14, 21
preference, theory of, 6
preferences, 6, 13, 207
altruistic, 243
and decision making, 210
vs. happiness, 262
inequality-averse, 244
Rawlsian, 244
social, 243–245
stable, 31, 215
utilitarian, 244
pregnancy tests, 96–97
preproportion, 206
President of the US, 17
principal, 181
prior probability, 91
priors, washing out of the, 110
prisoners’ dilemma, 224–225, 227, 245, 247
Prius owner, 243
probability, 76–77
axioms of, 77
probability (continued)
conditional, 84–86, 106
posterior, 91
prior, 91
total, 88–89
unconditional, 79–81
probability function, 76
probability matching, 121–122
probability weighting, 171–172
probability-weighting function, 172–174, 176
probability, theory of, 75–77, 93–94, 120
process measures, 8
process-tracing software, 8
procrastination, 181, 202, 206
profiles, preference over, 207
projection bias, 211–212
projects, failed, 158
proof by contradiction, 21
proofs, indirect, 21
proposer, 240
prospect evaluation, 157
prospect theory, 55, 174, 261
and bundling, 160
and probability weighting, 172–173
Proust, Marcel, 112
psychology, 5–6, 269
Psychology of Intelligence Analysis, 122–123
public economics, behavioral, 258
public health, 153
public safety, 39
public-goods games, 247–248
Publix, 41
pure coordination game, 223
pure strategies, Nash equilibrium in, 223

Q
quasi-hyperbolic discounting, 198–199

R
racism, 112
rail projects, 103
rain, 129
raises, 60
Ramsey, Frank P., 192
Rand, Ayn, 257
range of probabilities axiom, 77
rational addiction, 187, 195
rational preference relation, 15–16
rational-choice theory, 4, 13, 68
rationality, 4, 26–27
and analytical game theory, 238
definition of, 4
and discounting, 191–192
and maximizing utility, 30
and Nash equilibrium, 226
nature of, 175–176
and opportunity costs, 35–36, 40
and outcomes, 150
vs. predictability, 269
and time discounting, 215
under uncertainty, 131
rationality, paradoxes of, 238
ratios, 38
Rawls, John, 131–132, 244
Rawlsian preferences, 244
real estate, 34–35, 40
real-estate sales, 50, 59
real-estate markets, 250
reason-based choice, 51–52
Rebel Without a Cause, 232
receiver, 246–247
reciprocity, 246–247
reference-point phenomena, 54
reflexivity, 18–19, 32
regret, 131
regret aversion, 131, 165, 167
regulation, 150
relations, 13
binary, 13–14
ternary, 13–14
see also preference relations
relationships, failed, 43, 44
representation theorem, 29
representativeness heuristic, 100–101, 119
research and development (R&D), 41
responder, 240
retirement savings, 215–216, 261
return policies, 59
reversable indifference curves, 62
reward points, 164
risk, 129, 131, 149–150, 150–151
and expected-utility theory, 145
framing effects and, 153–155
risk assessment, 104
risk aversion, 145–146, 158, 159
risk preference, 146
robbery, 58
rock-paper-scissors, 231, 250–251
Roma, 124
Romeo, 19
room service, 38
root beer, 17
roulette, 99, 136–137, 165–166
Rousseau, Jean-Jacques, 233
rule of total probability, 89
Rumsfeld, Donald H., 171
Russell, Bertrand, 232
Russian roulette, 175

S
S-shaped value function, 155–156, 175
Sartre, Jean-Paul, 16–17
SAT test, 94
satisfaction, 28–29
Save More Tomorrow (SMarT) Program, 261
savings, 176–177, 215–216
savings behavior, 181
Schelling, Thomas C., 238
Schumpeter, Joseph, 124
Schwartz, Barry, 40
Schwarzenegger, Governor Arnold, 95–96
scuba diving certification, 89, 90
segregation, 159
self-control problems, 203
self-interest, 27
selfishness, 27, 31
selfishness axiom, 246, 268
sender, 246–247
Seneca, 60–61, 71, 192, 216
sequential games, 235
set of alternatives, 15, 29
sex, unsafe, 115, 187
sexism, 112
sexual arousal, 212
Shang, Jen, 7
Sidgwick, Henry, 213, 217
sign effect, 215
silver lining, 164, 177–178
simple interest, 183
simplification, in prospect theory, 174
slippery slope, 264–265
Slovic, Paul, 7
small numbers, law of, 101
Smith, Adam, 5, 55, 120, 188, 213, 226
smoking, 196, 200
snacks, 202
social comparisons, 61
social preferences, 243–246
soda ban, 262
soft drinks, 202
softball, 95
Sophie’s Choice, 33
sophisticates, 203
speeding, 54, 124
Spousonomics, 231
spread, preference for, 207
St Petersburg gamble, 141–142
St Petersburg paradox, 140, 148
stable preferences, 31
stag hunt, 233
Stalin, Joseph, 162
standard economics, 4
state of nature, 227
state of the world, 129
status quo bias, 63–64
stereotypes, 112
Stevenson, Betsey, 69
stock market, 58, 112, 249
stocks, 98, 177, 221
storytelling, 115
strategic interaction, 221
strategy, 222
strategy profile, 222
strict/strong preference, 20
subgame, 235
subgame-perfect equilibrium, 236, 242
substitution, 119
suggested retail price, 67
sunk costs, 41–42, 59–60
sunk-cost fallacy, 42, 45–46
sunset provisions, 64
Sunstein, Cass R., 262, 264, 266
sure thing, 166
sure-thing principle, 166, 169
SUV owners, 243
Sydney Opera House, 103
symbols, logical, 18
symmetry, 19, 32
T
targets, 48–49
taxes, 59, 63, 163–164
tea, cups of, 23
tennis, 170, 231
Tennyson, Alfred, Lord, 131
ternary relations, 13–14
terror, war on, 39, 108–109
terrorism suspect, 108–109
terrorism, probability of, 104
terrorist attacks, 115
test, multiple-choice, 96
testimony, 107–108
Thaler, Richard H., 248, 266
Thanksgiving, 144
Thatcher, Margaret, 104
theories of choice, 3–4
theories of decision, 3–4
theory of choice under certainty, 19, 25
theory of choice under risk, 129, 150–151, 153
theory of choice under uncertainty, 129–132, 149
theory of expected utility, 140–142, 149–150, 175
and ambiguity aversion, 170
and Ellsberg problem, 169
and risk, 145
theory of expected value, 149–150
theory of judgment, 98
Theory of Moral Sentiments, 188
theory of preference, 6
theory of probability, 75–77
theory of rational choice, 4, 13, 26–27, 68
and maximizing utility, 30
and opportunity costs, 35–36, 40
under uncertainty, 131
theory, axiomatic, 13, 75
theory, confirmation, 91
theory, evolutionary game, 232–233
theory, game, 221
theory, normative, 75
theory, probability, 93–94, 120
threats, credible vs. non-credible, 234–235
three-card swindle, 78–79
ties, in preference relations, 19
time consistency, 196
time discounting, 185, 215
time inconsistency, 195
time preference, 185, 207
time, and decision making, 181, 214–215
tire sales, 45
toasters, 67
Top Five Regrets of Dying, The, 131
total probability, 88–89
Toyota/Toy Yoda, 56, 57
traffic signs, 260, 261
Transcranial Magnetic Stimulation, 8
transitivity, 15–17, 22
Transportation Security Administration (TSA), 109
trembling, 234
trembling-hand perfection, 233–234, 266
trinkets, 5
trust, 247–249
trust games, 246–247
Tversky, Amos, 175
twins, 101
U
Ubel, Peter, 265
ultimatum game, 240–242, 245, 246
Ulysses, 202
umbrella, 144
uncertainty, 129–132, 149–150
unconditional probability, 79–81
underprediction of adaptation, 210–211
unicorns, 141
United Nations, 14, 65
universe, 14–16
unpaid work, 39
unsafe sex, 115, 187
US-VISIT program, 110
usury, 185
utilitarian preferences, 244
utility, 28–30
  expected, 140–142, 145
  functions, 28–29, 53–54, 147–148, 269
  marginal, 65, 141
  maximization, 30, 142
  and opportunity costs, 35–36, 39–40
  ordinal, 30
  streams, 185–186, 188–189
V
vaccines, 115
value function, 55–57, 155–156, 159–161
value function, S-shaped, 155–156, 175
value, expected, 133–135, 149–150
variation, preference for, 207
veil of ignorance, 132
Vietnam War, 44
violent crime, 115, 124
W
Wagner, Walter, 77
Wall Street Journal, 141
“war of all against all,” 228
warranties, 139, 172
wars, losing, 44, 158
washing dishes, 248
washing out of the priors, 110
weak preference relations, 14, 21
wealth effects, 158–159
Wealth of Nations, The, 5
welfare criterion, 262
welfare economics, behavioral, 258
White, Richard, 45
Wicksteed, Philip, 201
Wicksteed’s blanket, 201
Wilde, Oscar, 131
Williams, Juan, 123
Williams, Robin, 192
willingness-to-accept (WTA), 52, 55, 147
willingness-to-pay (WTP), 52, 55, 147
windfalls, 38
wine, 33, 67
wingman or wingwoman, 50–51
Wolfers, Justin, 69
World Health Organization, 116
Worstward Ho, 270
Y
yoga, 70
YOLO (You Only Live Once) criterion, 130
York, Byron, 63
youth sports, 193
Z
zero expected value, 177
zero-sum game, 229