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BERNOULLI'S ERRORS

One day in the early 1970s, Amos handed me a mimeographed essay by a Swiss economist named Bruno Frey, which discussed the psychological assumptions of economic theory. I vividly remember the color of the cover: dark red. Bruno Frey barely recalls writing the piece, but I can still recite its first sentence: "The agent of economic theory is rational, selfish, and his tastes do not change."

I was astonished. My economist colleagues worked in the building next door, but I had not appreciated the profound difference between our intellectual worlds. To a psychologist, it is self-evident that people are neither fully rational nor completely selfish, and that their tastes are anything but stable. Our two disciplines seemed to be studying different species, which the behavioral economist Richard Thaler later dubbed Econs and Humans.

Unlike Econs, the Humans that psychologists know have a System 1. Their view of the world is limited by the information that is available at a given moment (WYSIATI), and therefore they cannot be as consistent and logical as Econs. They are sometimes generous and often willing to contribute to the group to which they are attached. And they often have little idea of what they will like next year or even tomorrow. Here was an opportunity for an interesting conversation across the boundaries of the disciplines. I did not anticipate that my career would be defined by that conversation.

Soon after he showed me Frey's article, Amos suggested that we make the study of decision making our next project. I knew next to nothing about the topic, but Amos was an expert and a star of the field, and he said he would coach me. While still a graduate student he had coauthored a textbook, *Mathematical Psychology*, and he directed me to a few chapters that he thought would be a good introduction.

I soon learned that our subject matter would be people's attitudes to risky options and that we would seek to answer a specific question: What rules govern people's choices between different simple gambles and between gambles and sure things?

Simple gambles (such as "40% chance to win $300") are to students of decision making what the fruit fly is to geneticists. Choices between such gambles provide a simple model that shares important features with the more complex decisions that researchers actually aim to understand. Gambles represent the fact that the consequences of choices are never certain. Even ostensibly sure outcomes are uncertain: when you sign the contract to buy an apartment, you do not know the price at which you later may have to sell it, nor do you know that your neighbor's son will soon take up the tuba. Every significant choice we make in life comes with some uncertainty—which is why students of decision making hope that some of the lessons learned in the model situation will be applicable to more interesting everyday problems. But of course the main reason that decision theorists study simple gambles is that this is what other decision theorists do.

The field had a theory, expected utility theory, which was the foundation of the rational-agent model and is to this day the most important theory in the social sciences. Expected utility theory was not intended as a psychological model; it was a logic of choice, based on elementary rules (axioms) of rationality. Consider this example:

> If you prefer an apple to a banana,
> then
> you also prefer a 10% chance to win an apple to a 10% chance to win a banana.

The apple and the banana stand for any objects of choice (including gambles), and the 10% chance stands for any probability. The mathematician John von Neumann, one of the giant intellectual figures of the twentieth century, and the economist Oskar Morgenstern had derived their theory of rational choice between gambles from a few axioms. Economists adopted expected utility theory in a dual role: as a logic that prescribes how decisions should be made, and as a description of how Econs make choices. Amos and I were psychologists, however, and we set out to understand how Humans actually make risky choices, without assuming anything about their rationality.

We maintained our routine of spending many hours each day in conversation, sometimes in our offices, sometimes at restaurants, often on long walks through the quiet streets of beautiful Jerusalem. As we had done when we studied judgment, we engaged in a careful examination of our own intuitive preferences. We spent our time inventing simple decision problems and asking ourselves how we would choose. For example:

> Which do you prefer?
> A. Toss a coin. If it comes up heads you win $100, and if it comes up tails you win nothing.
> B. Get $46 for sure.

We were not trying to figure out the most rational or advantageous choice; we wanted to find the intuitive choice, the one that appeared immediately tempting. We almost always selected the same option. In this example, both of us would have picked the sure thing, and you probably would do the same. When we confidently agreed on a choice, we believed—almost always correctly, as it turned out—that most people would share our preference, and we moved on as if we had solid evidence. We knew, of course, that we would need to verify our hunches later, but by playing the roles of both experimenters and subjects we were able to move quickly.

Five years after we began our study of gambles, we finally completed an essay that we titled "Prospect Theory: An Analysis of Decision under Risk." Our theory was closely modeled on utility theory but departed from it in fundamental ways. Most important, our model was purely descriptive, and its goal was to document and explain systematic violations of the axioms of rationality in choices between gambles. We submitted our essay to *Econometrica*, a journal that publishes significant theoretical articles in economics and in decision theory. The choice of venue turned out to be important; if we had published the identical paper in a psychological journal, it would likely have had little impact on economics. However, our decision was not guided by a wish to influence economics; *Econometrica* just happened to be where the best papers on decision making had been published in the past, and we were aspiring to be in that company. In this choice as in many others, we were lucky. Prospect theory turned out to be the most significant work we ever did, and our article is among the most often cited in the social sciences. Two years later, we published in *Science* an account of framing effects: the large changes of preferences that are sometimes caused by inconsequential variations in the wording of a choice problem.

During the first five years we spent looking at how people make decisions, we established a dozen facts about choices between risky options. Several of these facts were in flat contradiction to expected utility theory. Some had been observed before, a few were new. Then we constructed a theory that modified expected utility theory just enough to explain our collection of observations. That was prospect theory.

Our approach to the problem was in the spirit of a field of psychology called psychophysics, which was founded and named by the German psychologist and mystic Gustav Fechner (1801–1887). Fechner was obsessed with the relation of mind and matter. On one side there is a physical quantity that can vary, such as the energy of a light, the frequency of a tone, or an amount of money. On the other side there is a subjective experience of brightness, pitch, or value. Mysteriously, variations of the physical quantity cause variations in the intensity or quality of the subjective experience. Fechner's project was to find the psychophysical laws that relate the subjective quantity in the observer's mind to the objective quantity in the material world. He proposed that for many dimensions, the function is logarithmic—which simply means that an increase of stimulus intensity by a given factor (say, times 1.5 or times 10) always yields the same increment on the psychological scale. If raising the energy of the sound from 10 to 100 units of physical energy increases psychological intensity by 4 units, then a further increase of stimulus intensity from 100 to 1,000 will also increase psychological intensity by 4 units.

BERNOULLI'S ERROR

As Fechner well knew, he was not the first to look for a function that relates psychological intensity to the physical magnitude of the stimulus. In 1738, the Swiss scientist Daniel Bernoulli anticipated Fechner's reasoning and applied it to the relationship between the psychological value or desirability of money (now called *utility*) and the actual amount of money. He argued that a gift of 10 ducats has the same utility to someone who already has 100 ducats as a gift of 20 ducats to someone whose current wealth is 200 ducats. Bernoulli was right, of course: we normally speak of changes of income in terms of percentages, as when we say "she got a 30% raise." The idea is that a 30% raise may evoke a fairly similar psychological response for the rich and for the poor, which an increase of $100 will not do. As in Fechner's law,

the psychological response to a change of wealth is inversely proportional to the initial amount of wealth, leading to the conclusion that utility is a logarithmic function of wealth. If this function is accurate, the same psychological distance separates $100,000 from $1 million, and $10 million from $100 million.

Bernoulli drew on his psychological insight into the utility of wealth to propose a radically new approach to the evaluation of gambles, an important topic for the mathematicians of his day. Prior to Bernoulli, mathematicians had assumed that gambles are assessed by their expected value: a weighted average of the possible outcomes, where each outcome is weighted by its probability. For example, the expected value of:

> 80% chance to win $100 and 20% chance to win $10
> is $82 (0.8 x 100 + 0.2 x 10).

Now ask yourself this question: Which would you prefer to receive as a gift, this gamble or $80 for sure? Almost everyone prefers the sure thing. If people valued uncertain prospects by their expected value, they would prefer the gamble, because $82 is more than $80. Bernoulli pointed out that people do not in fact evaluate gambles in this way.

Bernoulli observed that most people dislike risk (the chance of receiving the lowest possible outcome), and if they are offered a choice between a gamble and an amount equal to its expected value they will pick the sure thing. In fact a risk-averse decision maker will choose a sure thing that is less than expected value, in effect paying a premium to avoid the uncertainty. One hundred years before Fechner, Bernoulli invented psychophysics to explain this aversion to risk. His idea was straightforward: people's choices are based not on dollar values but on the psychological values of outcomes, their utilities. The psychological value of a gamble is therefore not the weighted average of its possible dollar outcomes; it is the average of the utilities of these outcomes, each weighted by its probability.

Table 3 shows a version of the utility function that Bernoulli calculated; it presents the utility of different levels of wealth, from 1 million to 10 million. You can see that adding 1 million to a wealth of 1 million yields an

Wealth (millions)	1	2	3	4	5	6	7	8	9	10
Utility units	10	30	48	60	70	78	84	90	96	100

Table 3

increment of 20 utility points, but adding 1 million to a wealth of 9 million adds only 4 points. Bernoulli proposed that the diminishing marginal value of wealth (in the modern jargon) is what explains risk aversion—the common preference that people generally show for a sure thing over a favorable gamble of equal or slightly higher expected value. Consider this choice:

Equal chances to have 1 million or 7 million	Utility: (10 + 84)/2 = 47
OR	
Have 4 million with certainty	Utility: 60

The expected value of the gamble and the "sure thing" are equal in ducats (4 million), but the psychological utilities of the two options are different, because of the diminishing utility of wealth: the increment of utility from 1 million to 4 million is 50 units, but an equal increment, from 4 to 7 million, increases the utility of wealth by only 24 units. The utility of the gamble is 94/2 = 47 (the utility of its two outcomes, each weighted by its probability of 1/2). The utility of 4 million is 60. Because 60 is more than 47, an individual with this utility function will prefer the sure thing. Bernoulli's insight was that a decision maker with diminishing marginal utility for wealth will be risk averse.

Bernoulli's essay is a marvel of concise brilliance. He applied his new concept of expected utility (which he called "moral expectation") to compute how much a merchant in St. Petersburg would be willing to pay to insure a shipment of spice from Amsterdam if "he is well aware of the fact that at this time of year of one hundred ships which sail from Amsterdam to Petersburg, five are usually lost." His utility function explained why poor people buy insurance and why richer people sell it to them. As you can see in the table, the loss of 1 million causes a loss of 4 points of utility (from 100 to 96) to someone who has 10 million and a much larger loss of 18 points (from 48 to 30) to someone who starts off with 3 million. The poorer man will happily pay a premium to transfer the risk to the richer one, which is what insurance is about. Bernoulli also offered a solution to the famous "St. Petersburg paradox," in which people who are offered a gamble that has infinite expected value (in ducats) are willing to spend only a few ducats for it. Most impressive, his analysis of risk attitudes in terms of preferences for wealth has stood the test of time: it is still current in economic analysis almost 300 years later.

The longevity of the theory is all the more remarkable because it is seriously flawed. The errors of a theory are rarely found in what it asserts

explicitly; they hide in what it ignores or tacitly assumes. For an example, take the following scenarios:

> Today Jack and Jill each have a wealth of 5 million.
> Yesterday, Jack had 1 million and Jill had 9 million.
> Are they equally happy? (Do they have the same utility?)

Bernoulli's theory assumes that the utility of their wealth is what makes people more or less happy. Jack and Jill have the same wealth, and the theory therefore asserts that they should be equally happy, but you do not need a degree in psychology to know that today Jack is elated and Jill despondent. Indeed, we know that Jack would be a great deal happier than Jill even if he had only 2 million today while she has 5. So Bernoulli's theory must be wrong.

The happiness that Jack and Jill experience is determined by the recent *change* in their wealth, relative to the different states of wealth that define their reference points (1 million for Jack, 9 million for Jill). This reference dependence is ubiquitous in sensation and perception. The same sound will be experienced as very loud or quite faint, depending on whether it was preceded by a whisper or by a roar. To predict the subjective experience of loudness, it is not enough to know its absolute energy; you also need to know the reference sound to which it is automatically compared. Similarly, you need to know about the background before you can predict whether a gray patch on a page will appear dark or light. And you need to know the reference before you can predict the utility of an amount of wealth.

For another example of what Bernoulli's theory misses, consider Anthony and Betty:

> Anthony's current wealth is 1 million.
> Betty's current wealth is 4 million.

They are both offered a choice between a gamble and a sure thing.

> The gamble: equal chances to end up owning 1 million or 4 million
> OR
> The sure thing: own 2 million for sure

In Bernoulli's account, Anthony and Betty face the same choice: their expected wealth will be 2.5 million if they take the gamble and 2 million if they prefer the sure-thing option. Bernoulli would therefore expect Anthony and Betty to make the same choice, but this prediction is incorrect. Here again, the theory fails because it does not allow for the different *reference points* from which Anthony and Betty consider their options. If you imagine yourself in Anthony's and Betty's shoes, you will quickly see that current wealth matters a great deal. Here is how they may think:

> Anthony (who currently owns 1 million): "If I choose the sure thing, my wealth will double with certainty. This is very attractive. Alternatively, I can take a gamble with equal chances to quadruple my wealth or to gain nothing."
>
> Betty (who currently owns 4 million): "If I choose the sure thing, I lose half of my wealth with certainty, which is awful. Alternatively, I can take a gamble with equal chances to lose three-quarters of my wealth or to lose nothing."

You can sense that Anthony and Betty are likely to make different choices because the sure-thing option of owning 2 million makes Anthony happy and makes Betty miserable. Note also how the *sure* outcome differs from the *worst* outcome of the gamble: for Anthony, it is the difference between doubling his wealth and gaining nothing; for Betty, it is the difference between losing half her wealth and losing three-quarters of it. Betty is much more likely to take her chances, as others do when faced with very bad options. As I have told their story, neither Anthony nor Betty thinks in terms of states of wealth: Anthony thinks of gains and Betty thinks of losses. The psychological outcomes they assess are entirely different, although the possible states of wealth they face are the same.

Because Bernoulli's model lacks the idea of a reference point, expected utility theory does not represent the obvious fact that the outcome that is good for Anthony is bad for Betty. His model could explain Anthony's risk aversion, but it cannot explain Betty's risk-seeking preference for the gamble, a behavior that is often observed in entrepreneurs and in generals when all their options are bad.

All this is rather obvious, isn't it? One could easily imagine Bernoulli himself constructing similar examples and developing a more complex theory to accommodate them; for some reason, he did not. One could also imagine colleagues of his time disagreeing with him, or later scholars objecting as they read his essay; for some reason, they did not either.

The mystery is how a conception of the utility of outcomes that is vulnerable to such obvious counterexamples survived for so long. I can explain

it only by a weakness of the scholarly mind that I have often observed in myself. I call it theory-induced blindness: once you have accepted a theory and used it as a tool in your thinking, it is extraordinarily difficult to notice its flaws. If you come upon an observation that does not seem to fit the model, you assume that there must be a perfectly good explanation that you are somehow missing. You give the theory the benefit of the doubt, trusting the community of experts who have accepted it. Many scholars have surely thought at one time or another of stories such as those of Anthony and Betty, or Jack and Jill, and casually noted that these stories did not jibe with utility theory. But they did not pursue the idea to the point of saying, "This theory is seriously wrong because it ignores the fact that utility depends on the history of one's wealth, not only on present wealth." As the psychologist Daniel Gilbert observed, disbelieving is hard work, and System 2 is easily tired.

SPEAKING OF BERNOULLI'S ERRORS

"He was very happy with a $20,000 bonus three years ago, but his salary has gone up by 20% since, so he will need a higher bonus to get the same utility."

"Both candidates are willing to accept the salary we're offering, but they won't be equally satisfied because their reference points are different. She currently has a much higher salary."

"She's suing him for alimony. She would actually like to settle, but he prefers to go to court. That's not surprising—she can only gain, so she's risk averse. He, on the other hand, faces options that are all bad, so he'd rather take the risk."

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PROSPECT THEORY

Amos and I stumbled on the central flaw in Bernoulli's theory by a lucky combination of skill and ignorance. At Amos's suggestion, I read a chapter in his book that described experiments in which distinguished scholars had measured the utility of money by asking people to make choices about gambles in which the participant could win or lose a few pennies. The experimenters were measuring the utility of wealth, by modifying wealth within a range of less than a dollar. This raised questions. Is it plausible to assume that people evaluate the gambles by tiny differences in wealth? How could one hope to learn about the psychophysics of wealth by studying reactions to gains and losses of pennies? Recent developments in psychophysical theory suggested that if you want to study the subjective value of wealth, you should ask direct questions about wealth, not about changes of wealth. I did not know enough about utility theory to be blinded by respect for it, and I was puzzled.

When Amos and I met the next day, I reported my difficulties as a vague thought, not as a discovery. I fully expected him to set me straight and to explain why the experiment that had puzzled me made sense after all, but he did nothing of the kind—the relevance of the modern psychophysics was immediately obvious to him. He remembered that the economist Harry Markowitz, who would later earn the Nobel Prize for his work on finance, had proposed a theory in which utilities were attached to changes of wealth rather than to states of wealth. Markowitz's idea had been around for a

quarter of a century and had not attracted much attention, but we quickly concluded that this was the way to go, and that the theory we were planning to develop would define outcomes as gains and losses, not as states of wealth. Knowledge of perception and ignorance about decision theory both contributed to a large step forward in our research.

We soon knew that we had overcome a serious case of theory-induced blindness, because the idea we had rejected now seemed not only false but absurd. We were amused to realize that we were unable to assess our current wealth within tens of thousands of dollars. The idea of deriving attitudes to small changes from the utility of wealth now seemed indefensible. You know you have made a theoretical advance when you can no longer reconstruct why you failed for so long to see the obvious. Still, it took us years to explore the implications of thinking about outcomes as gains and losses.

In utility theory, the utility of a gain is assessed by comparing the utilities of two states of wealth. For example, the utility of getting an extra $500 when your wealth is $1 million is the difference between the utility of $1,000,500 and the utility of $1 million. And if you own the larger amount, the disutility of losing $500 is again the difference between the utilities of the two states of wealth. In this theory, the utilities of gains and losses are allowed to differ only in their sign (+ or –). There is no way to represent the fact that the disutility of losing $500 could be greater than the utility of winning the same amount—though of course it is. As might be expected in a situation of theory-induced blindness, possible differences between gains and losses were neither expected nor studied. The distinction between gains and losses was assumed not to matter, so there was no point in examining it.

Amos and I did not see immediately that our focus on changes of wealth opened the way to an exploration of a new topic. We were mainly concerned with differences between gambles with high or low probability of winning. One day, Amos made the casual suggestion, "How about losses?" and we quickly found that our familiar risk aversion was replaced by risk seeking when we switched our focus. Consider these two problems:

Problem 1: Which do you choose?
Get $900 for sure OR 90% chance to get $1,000

Problem 2: Which do you choose?
Lose $900 for sure OR 90% chance to lose $1,000

You were probably risk averse in problem 1, as is the great majority of people. The subjective value of a gain of $900 is certainly more than 90% of the value of a gain of $1,000. The risk-averse choice in this problem would not have surprised Bernoulli.

Now examine your preference in problem 2. If you are like most other people, you chose the gamble in this question. The explanation for this risk-seeking choice is the mirror image of the explanation of risk aversion in problem 1: the (negative) value of losing $900 is much more than 90% of the (negative) value of losing $1,000. The sure loss is very aversive, and this drives you to take the risk. Later, we will see that the evaluations of the probabilities (90% versus 100%) also contributes to both risk aversion in problem 1 and the preference for the gamble in problem 2.

We were not the first to notice that people become risk seeking when all their options are bad, but theory-induced blindness had prevailed. Because the dominant theory did not provide a plausible way to accommodate different attitudes to risk for gains and losses, the fact that the attitudes differed had to be ignored. In contrast, our decision to view outcomes as gains and losses led us to focus precisely on this discrepancy. The observation of contrasting attitudes to risk with favorable and unfavorable prospects soon yielded a significant advance: we found a way to demonstrate the central error in Bernoulli's model of choice. Have a look:

Problem 3: In addition to whatever you own, you have been given $1,000.
You are now asked to choose one of these options:
50% chance to win $1,000 OR get $500 for sure

Problem 4: In addition to whatever you own, you have been given $2,000.
You are now asked to choose one of these options:
50% chance to lose $1,000 OR lose $500 for sure

You can easily confirm that in terms of final states of wealth—all that matters for Bernoulli's theory—problems 3 and 4 are identical. In both cases you have a choice between the same two options: you can have the certainty of being richer than you currently are by $1,500, or accept a gamble in which you have equal chances to be richer by $1,000 or by $2,000. In Bernoulli's theory, therefore, the two problems should elicit similar preferences. Check your intuitions, and you will probably guess what other people did.

- In the first choice, a large majority of respondents preferred the sure thing.
- In the second choice, a large majority preferred the gamble.

The finding of different preferences in problems 3 and 4 was a decisive counterexample to the key idea of Bernoulli's theory. If the utility of wealth is all that matters, then transparently equivalent statements of the same problem should yield identical choices. The comparison of the problems highlights the all-important role of the reference point from which the options are evaluated. The reference point is higher than current wealth by $1,000 in problem 3, by $2,000 in problem 4. Being richer by $1,500 is therefore a gain of $500 in problem 3 and a loss in problem 4. Obviously, other examples of the same kind are easy to generate. The story of Anthony and Betty had a similar structure.

How much attention did you pay to the gift of $1,000 or $2,000 that you were "given" prior to making your choice? If you are like most people, you barely noticed it. Indeed, there was no reason for you to attend to it, because the gift is included in the reference point, and reference points are generally ignored. You know something about your preferences that utility theorists do not—that your attitudes to risk would not be different if your net worth were higher or lower by a few thousand dollars (unless you are abjectly poor). And you also know that your attitudes to gains and losses are not derived from your evaluation of your wealth. The reason you like the idea of gaining $100 and dislike the idea of losing $100 is not that these amounts change your wealth. You just like winning and dislike losing—and you almost certainly dislike losing more than you like winning.

The four problems highlight the weakness of Bernoulli's model. His theory is too simple and lacks a moving part. The missing variable is the *reference point*, the earlier state relative to which gains and losses are evaluated. In Bernoulli's theory you need to know only the state of wealth to determine its utility, but in prospect theory you also need to know the reference state. Prospect theory is therefore more complex than utility theory. In science complexity is considered a cost, which must be justified by a sufficiently rich set of new and (preferably) interesting predictions of facts that the existing theory cannot explain. This was the challenge we had to meet.

Although Amos and I were not working with the two-systems model of the mind, it's clear now that there are three cognitive features at the heart of prospect theory. They play an essential role in the evaluation of financial outcomes and are common to many automatic processes of perception, judgment, and emotion. They should be seen as operating characteristics of System 1.

- Evaluation is relative to a neutral reference point, which is sometimes referred to as an "adaptation level." You can easily set up a compelling demonstration of this principle. Place three bowls of water in front of you. Put ice water into the left-hand bowl and warm water into the right-hand bowl. The water in the middle bowl should be at room temperature. Immerse your hands in the cold and warm water for about a minute, then dip both in the middle bowl. You will experience the same temperature as heat in one hand and cold in the other. For financial outcomes, the usual reference point is the status quo, but it can also be the outcome that you expect, or perhaps the outcome to which you feel entitled, for example, the raise or bonus that your colleagues receive. Outcomes that are better than the reference points are gains. Below the reference point they are losses.
- A principle of diminishing sensitivity applies to both sensory dimensions and the evaluation of changes of wealth. Turning on a weak light has a large effect in a dark room. The same increment of light may be undetectable in a brightly illuminated room. Similarly, the subjective difference between $900 and $1,000 is much smaller than the difference between $100 and $200.
- The third principle is loss aversion. When directly compared or weighted against each other, losses loom larger than gains. This asymmetry between the power of positive and negative expectations or experiences has an evolutionary history. Organisms that treat threats as more urgent than opportunities have a better chance to survive and reproduce.

The three principles that govern the value of outcomes are illustrated by figure 10. If prospect theory had a flag, this image would be drawn on it. The graph shows the psychological value of gains and losses, which are the "carriers" of value in prospect theory (unlike Bernoulli's model, in which states of wealth are the carriers of value). The graph has two distinct parts, to the right and to the left of a neutral reference point. A salient feature is that it is S-shaped, which represents diminishing sensitivity for both gains and losses. Finally, the two curves of the S are not symmetrical. The slope of the function changes abruptly at the reference point: the response

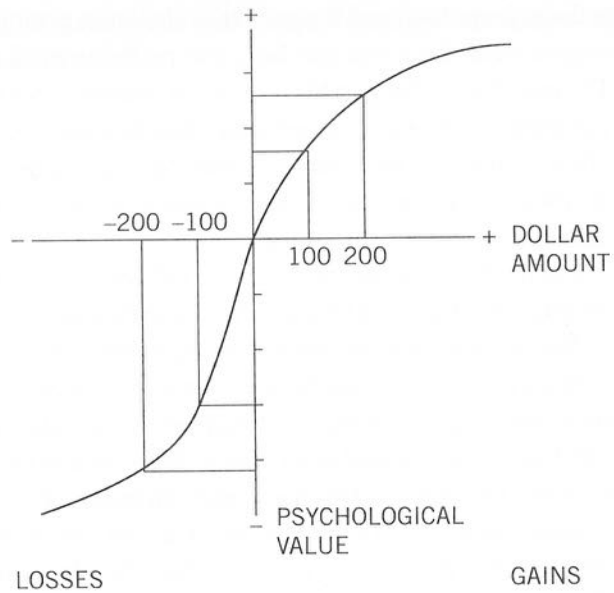

Figure 10

to losses is stronger than the response to corresponding gains. This is loss aversion.

LOSS AVERSION

Many of the options we face in life are "mixed": there is a risk of loss and an opportunity for gain, and we must decide whether to accept the gamble or reject it. Investors who evaluate a start-up, lawyers who wonder whether to file a lawsuit, wartime generals who consider an offensive, and politicians who must decide whether to run for office all face the possibilities of victory or defeat. For an elementary example of a mixed prospect, examine your reaction to the next question.

> Problem 5: You are offered a gamble on the toss of a coin.
> If the coin shows tails, you lose $100.
> If the coin shows heads, you win $150.
> Is this gamble attractive? Would you accept it?

To make this choice, you must balance the psychological benefit of getting $150 against the psychological cost of losing $100. How do you feel about it? Although the expected value of the gamble is obviously positive, because you stand to gain more than you can lose, you probably dislike it—most people do. The rejection of this gamble is an act of System 2, but the critical inputs are emotional responses that are generated by System 1. For most people, the fear of losing \$100 is more intense than the hope of gaining \$150. We concluded from many such observations that "losses loom larger than gains" and that people are *loss averse.*

You can measure the extent of your aversion to losses by asking yourself a question: What is the smallest gain that I need to balance an equal chance to lose \$100? For many people the answer is about \$200, twice as much as the loss. The "loss aversion ratio" has been estimated in several experiments and is usually in the range of 1.5 to 2.5. This is an average, of course; some people are much more loss averse than others. Professional risk takers in the financial markets are more tolerant of losses, probably because they do not respond emotionally to every fluctuation. When participants in an experiment were instructed to "think like a trader," they became less loss averse and their emotional reaction to losses (measured by a physiological index of emotional arousal) was sharply reduced.

In order to examine your loss aversion ratio for different stakes, consider the following questions. Ignore any social considerations, do not try to appear either bold or cautious, and focus only on the subjective impact of the possible loss and the offsetting gain.

- Consider a 50–50 gamble in which you can lose \$10. What is the smallest gain that makes the gamble attractive? If you say \$10, then you are indifferent to risk. If you give a number less than \$10, you seek risk. If your answer is above \$10, you are loss averse.
- What about a possible loss of \$500 on a coin toss? What possible gain do you require to offset it?
- What about a loss of \$2,000?

As you carried out this exercise, you probably found that your loss aversion coefficient tends to increase when the stakes rise, but not dramatically. All bets are off, of course, if the possible loss is potentially ruinous, or if your lifestyle is threatened. The loss aversion coefficient is very large in such cases and may even be infinite—there are risks that you will not accept, regardless of how many millions you might stand to win if you are lucky.

Another look at figure 10 may help prevent a common confusion. In this chapter I have made two claims, which some readers may view as contradictory:

- In mixed gambles, where both a gain and a loss are possible, loss aversion causes extremely risk-averse choices.
- In bad choices, where a sure loss is compared to a larger loss that is merely probable, diminishing sensitivity causes risk seeking.

There is no contradiction. In the mixed case, the possible loss looms twice as large as the possible gain, as you can see by comparing the slopes of the value function for losses and gains. In the bad case, the bending of the value curve (diminishing sensitivity) causes risk seeking. The pain of losing \$900 is more than 90% of the pain of losing \$1,000. These two insights are the essence of prospect theory.

Figure 10 shows an abrupt change in the slope of the value function where gains turn into losses, because there is considerable loss aversion even when the amount at risk is minuscule relative to your wealth. Is it plausible that attitudes to states of wealth could explain the extreme aversion to small risks? It is a striking example of theory-induced blindness that this obvious flaw in Bernoulli's theory failed to attract scholarly notice for more than 250 years. In 2000, the behavioral economist Matthew Rabin finally proved mathematically that attempts to explain loss aversion by the utility of wealth are absurd and doomed to fail, and his proof attracted attention. Rabin's theorem shows that anyone who rejects a favorable gamble with small stakes is mathematically committed to a foolish level of risk aversion for some larger gamble. For example, he notes that most Humans reject the following gamble:

50% chance to lose \$100 and 50% chance to win \$200

He then shows that according to utility theory, an individual who rejects that gamble will also turn down the following gamble:

50% chance to lose \$200 and 50% chance to win \$20,000

But of course no one in his or her right mind will reject this gamble! In an exuberant article they wrote about the proof, Matthew Rabin and Richard

Thaler commented that the larger gamble "has an expected return of $9,900—with exactly zero chance of losing more than $200. Even a lousy lawyer could have you declared legally insane for turning down this gamble."

Perhaps carried away by their enthusiasm, they concluded their article by recalling the famous Monty Python sketch in which a frustrated customer attempts to return a dead parrot to a pet store. The customer uses a long series of phrases to describe the state of the bird, culminating in "this is an ex-parrot." Rabin and Thaler went on to say that "it is time for economists to recognize that expected utility is an ex-hypothesis." Many economists saw this flippant statement as little short of blasphemy. However, the theory-induced blindness of accepting the utility of wealth as an explanation of attitudes to small losses is a legitimate target for humorous comment.

BLIND SPOTS OF PROSPECT THEORY

So far in this part of the book I have extolled the virtues of prospect theory and criticized the rational model and expected utility theory. It is time for some balance.

Most graduate students in economics have heard about prospect theory and loss aversion, but you are unlikely to find these terms in the index of an introductory text in economics. I am sometimes pained by this omission, but in fact it is quite reasonable, because of the central role of rationality in basic economic theory. The standard concepts and results that undergraduates are taught are most easily explained by assuming that Econs do not make foolish mistakes. This assumption is truly necessary, and it would be undermined by introducing the Humans of prospect theory, whose evaluations of outcomes are unreasonably short-sighted.

There are good reasons for keeping prospect theory out of introductory texts. The basic concepts of economics are essential intellectual tools, which are not easy to grasp even with simplified and unrealistic assumptions about the nature of the economic agents who interact in markets. Raising questions about these assumptions even as they are introduced would be confusing, and perhaps demoralizing. It is reasonable to put priority on helping students acquire the basic tools of the discipline. Furthermore, the failure of rationality that is built into prospect theory is often irrelevant to the predictions of economic theory, which work out with great precision in some situations and provide good approximations in many others. In some contexts, however, the difference becomes significant: the Humans described by prospect theory are

guided by the immediate emotional impact of gains and losses, not by long-term prospects of wealth and global utility.

I emphasized theory-induced blindness in my discussion of flaws in Bernoulli's model that remained unquestioned for more than two centuries. But of course theory-induced blindness is not restricted to expected utility theory. Prospect theory has flaws of its own, and theory-induced blindness to these flaws has contributed to its acceptance as the main alternative to utility theory.

Consider the assumption of prospect theory, that the reference point, usually the status quo, has a value of zero. This assumption seems reasonable, but it leads to some absurd consequences. Have a good look at the following prospects. What would it be like to own them?

A. one chance in a million to win $1 million
B. 90% chance to win $12 and 10% chance to win nothing
C. 90% chance to win $1 million and 10% chance to win nothing

Winning nothing is a possible outcome in all three gambles, and prospect theory assigns the same value to that outcome in the three cases. Winning nothing is the reference point and its value is zero. Do these statements correspond to your experience? Of course not. Winning nothing is a nonevent in the first two cases, and assigning it a value of zero makes good sense. In contrast, failing to win in the third scenario is intensely disappointing. Like a salary increase that has been promised informally, the high probability of winning the large sum sets up a tentative new reference point. Relative to your expectations, winning nothing will be experienced as a large loss. Prospect theory cannot cope with this fact, because it does not allow the value of an outcome (in this case, winning nothing) to change when it is highly unlikely, or when the alternative is very valuable. In simple words, prospect theory cannot deal with disappointment. Disappointment and the anticipation of disappointment are real, however, and the failure to acknowledge them is as obvious a flow as the counterexamples that I invoked to criticize Bernoulli's theory.

Prospect theory and utility theory also fail to allow for regret. The two theories share the assumption that available options in a choice are evaluated separately and independently, and that the option with the highest value is selected. This assumption is certainly wrong, as the following example shows.

Problem 6: Choose between 90% chance to win $1 million OR $50 with certainty.

Problem 7: Choose between 90% chance to win $1 million OR $150,000 with certainty.

Compare the anticipated pain of choosing the gamble and *not* winning in the two cases. Failing to win is a disappointment in both, but the potential pain is compounded in problem 7 by knowing that if you choose the gamble and lose you will regret the "greedy" decision you made by spurning a sure gift of $150,000. In regret, the experience of an outcome depends on an option you could have adopted but did not.

Several economists and psychologists have proposed models of decision making that are based on the emotions of regret and disappointment. It is fair to say that these models have had less influence than prospect theory, and the reason is instructive. The emotions of regret and disappointment are real, and decision makers surely anticipate these emotions when making their choices. The problem is that regret theories make few striking predictions that would distinguish them from prospect theory, which has the advantage of being simpler. The complexity of prospect theory was more acceptable in the competition with expected utility theory because it did predict observations that expected utility theory could not explain.

Richer and more realistic assumptions do not suffice to make a theory successful. Scientists use theories as a bag of working tools, and they will not take on the burden of a heavier bag unless the new tools are very useful. Prospect theory was accepted by many scholars not because it is "true" but because the concepts that it added to utility theory, notably the reference point and loss aversion, were worth the trouble; they yielded new predictions that turned out to be true. We were lucky.

SPEAKING OF PROSPECT THEORY

"He suffers from extreme loss aversion, which makes him turn down very favorable opportunities."

"Considering her vast wealth, her emotional response to trivial gains and losses makes no sense."

"He weighs losses about twice as much as gains, which is normal."

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THE ENDOWMENT EFFECT

You have probably seen figure 11 or a close cousin of it even if you never had a class in economics. The graph displays an individual's "indifference map" for two goods.

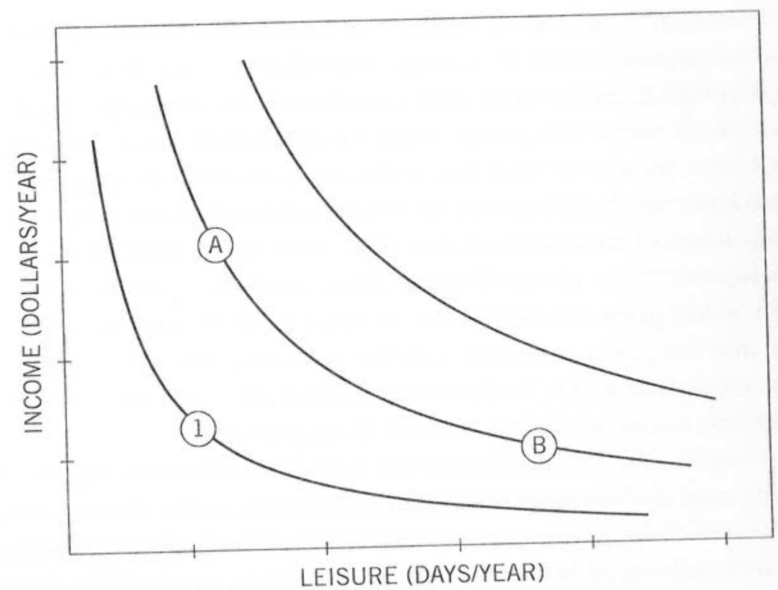

Figure 11

Students learn in introductory economics classes that each point on the map specifies a particular combination of income and vacation days. Each "indifference curve" connects the combinations of the two goods that are equally desirable—they have the same utility. The curves would turn into parallel straight lines if people were willing to "sell" vacation days for extra income at the same price regardless of how much income and how much vacation time they have. The convex shape indicates diminishing marginal utility: the more leisure you have, the less you care for an extra day of it, and each added day is worth less than the one before. Similarly, the more income you have, the less you care for an extra dollar, and the amount you are willing to give up for an extra day of leisure increases.

All locations on an indifference curve are equally attractive. This is literally what indifference means: you don't care where you are on an indifference curve. So if A and B are on the same indifference curve for you, you are indifferent between them and will need no incentive to move from one to the other, or back. Some version of this figure has appeared in every economics textbook written in the last hundred years, and many millions of students have stared at it. Few have noticed what is missing. Here again, the power and elegance of a theoretical model have blinded students and scholars to a serious deficiency.

What is missing from the figure is an indication of the individual's current income and leisure. If you are a salaried employee, the terms of your employment specify a salary and a number of vacation days, which is a point on the map. This is your reference point, your status quo, but the figure does not show it. By failing to display it, the theorists who draw this figure invite you to believe that the reference point does not matter, but by now you know that of course it does. This is Bernoulli's error all over again. The representation of indifference curves implicitly assumes that your utility at any given moment is determined entirely by your present situation, that the past is irrelevant, and that your evaluation of a possible job does not depend on the terms of your current job. These assumptions are completely unrealistic in this case and in many others.

The omission of the reference point from the indifference map is a surprising case of theory-induced blindness, because we so often encounter cases in which the reference point obviously matters. In labor negotiations, it is well understood by both sides that the reference point is the existing contract and that the negotiations will focus on mutual demands for concessions relative to that reference point. The role of loss aversion in bargaining is also well understood: making concessions hurts. You have much

personal experience of the role of reference point. If you changed jobs or locations, or even considered such a change, you surely remember that the features of the new place were coded as pluses or minuses relative to where you were. You may also have noticed that disadvantages loomed larger than advantages in this evaluation—loss aversion was at work. It is difficult to accept changes for the worse. For example, the minimal wage that unemployed workers would accept for new employment averages 90% of their previous wage, and it drops by less than 10% over a period of one year.

To appreciate the power that the reference point exerts on choices, consider Albert and Ben, "hedonic twins" who have identical tastes and currently hold identical starting jobs, with little income and little leisure time. Their current circumstances correspond to the point marked 1 in figure 11. The firm offers them two improved positions, A and B, and lets them decide who will get a raise of $10,000 (position A) and who will get an extra day of paid vacation each month (position B). As they are both indifferent, they toss a coin. Albert gets the raise, Ben gets the extra leisure. Some time passes as the twins get accustomed to their positions. Now the company suggests they may switch jobs if they wish.

The standard theory represented in the figure assumes that preferences are stable over time. Positions A and B are equally attractive for both twins and they will need little or no incentive to switch. In sharp contrast, prospect theory asserts that both twins will definitely prefer to remain as they are. This preference for the status quo is a consequence of loss aversion.

Let us focus on Albert. He was initially in position 1 on the graph, and from that reference point he found these two alternatives equally attractive:

Go to A: a raise of $10,000
OR
Go to B: 12 extra days of vacation

Taking position A changes Albert's reference point, and when he considers switching to B, his choice has a new structure:

Stay at A: no gain and no loss
OR
Move to B: 12 extra days of vacation and a $10,000 salary cut

You just had the subjective experience of loss aversion. You could feel it: a salary cut of $10,000 is very bad news. Even if a gain of 12 vacation days was as impressive as a gain of $10,000, the same improvement of leisure is not sufficient to compensate for a loss of $10,000. Albert will stay at A because the disadvantage of moving outweighs the advantage. The same reasoning applies to Ben, who will also want to keep his present job because the loss of now-precious leisure outweighs the benefit of the extra income.

This example highlights two aspects of choice that the standard model of indifference curves does not predict. First, tastes are not fixed; they vary with the reference point. Second, the disadvantages of a change loom larger than its advantages, inducing a bias that favors the status quo. Of course, loss aversion does not imply that you never prefer to change your situation; the benefits of an opportunity may exceed even overweighted losses. Loss aversion implies only that choices are strongly biased in favor of the reference situation (and generally biased to favor small rather than large changes).

Conventional indifference maps and Bernoulli's representation of outcomes as states of wealth share a mistaken assumption: that your utility for a state of affairs depends only on that state and is not affected by your history. Correcting that mistake has been one of the achievements of behavioral economics.

THE ENDOWMENT EFFECT

The question of when an approach or a movement got its start is often difficult to answer, but the origin of what is now known as behavioral economics can be specified precisely. In the early 1970s, Richard Thaler, then a graduate student in the very conservative economics department of the University of Rochester, began having heretical thoughts. Thaler always had a sharp wit and an ironic bent, and as a student he amused himself by collecting observations of behavior that the model of rational economic behavior could not explain. He took special pleasure in evidence of economic irrationality among his professors, and he found one that was particularly striking.

Professor R (now revealed to be Richard Rosett, who went on to become the dean of the University of Chicago Graduate School of Business) was a firm believer in standard economic theory as well as a sophisticated wine lover. Thaler observed that Professor R was very reluctant to sell a bottle from his collection—even at the high price of $100 (in 1975 dollars!).

Professor R bought wine at auctions, but would never pay more than $35 for a bottle of that quality. At prices between $35 and $100, he would neither buy nor sell. The large gap is inconsistent with economic theory, in which the professor is expected to have a single value for the bottle. If a particular bottle is worth $50 to him, then he should be willing to sell it for any amount in excess of $50. If he did not own the bottle, he should be willing to pay any amount up to $50 for it. The just-acceptable selling price and the just-acceptable buying price should have been identical, but in fact the minimum price to sell ($100) was much higher than the maximum buying price of $35. Owning the good appeared to increase its value.

Richard Thaler found many examples of what he called the *endowment effect*, especially for goods that are not regularly traded. You can easily imagine yourself in a similar situation. Suppose you hold a ticket to a sold-out concert by a popular band, which you bought at the regular price of $200. You are an avid fan and would have been willing to pay up to $500 for the ticket. Now you have your ticket and you learn on the Internet that richer or more desperate fans are offering $3,000. Would you sell? If you resemble most of the audience at sold-out events you do not sell. Your lowest selling price is above $3,000 and your maximum buying price is $500. This is an example of an endowment effect, and a believer in standard economic theory would be puzzled by it. Thaler was looking for an account that could explain puzzles of this kind.

Chance intervened when Thaler met one of our former students at a conference and obtained an early draft of prospect theory. He reports that he read the manuscript with considerable excitement, because he quickly realized that the loss-averse value function of prospect theory could explain the endowment effect and some other puzzles in his collection. The solution was to abandon the standard idea that Professor R had a unique utility for the state of *having* a particular bottle. Prospect theory suggested that the willingness to buy or sell the bottle depends on the reference point—whether or not the professor owns the bottle now. If he owns it, he considers the pain of *giving up* the bottle. If he does not own it, he considers the pleasure of *getting* the bottle. The values were unequal because of loss aversion: giving up a bottle of nice wine is more painful than getting an equally good bottle is pleasurable. Remember the graph of losses and gains in the previous chapter. The slope of the function is steeper in the negative domain; the response to a loss is stronger than the response to a corresponding gain. This was the explanation of the endowment effect that Thaler had been searching for. And the first application of prospect theory to an economic puzzle now appears to have been a significant milestone in the development of behavioral economics.

Thaler arranged to spend a year at Stanford when he knew that Amos and I would be there. During this productive period, we learned much from each other and became friends. Seven years later, he and I had another opportunity to spend a year together and to continue the conversation between psychology and economics. The Russell Sage Foundation, which was for a long time the main sponsor of behavioral economics, gave one of its first grants to Thaler for the purpose of spending a year with me in Vancouver. During that year, we worked closely with a local economist, Jack Knetsch, with whom we shared intense interest in the endowment effect, the rules of economic fairness, and spicy Chinese food.

The starting point for our investigation was that the endowment effect is not universal. If someone asks you to change a $5 bill for five singles, you hand over the five ones without any sense of loss. Nor is there much loss aversion when you shop for shoes. The merchant who gives up the shoes in exchange for money certainly feels no loss. Indeed, the shoes that he hands over have always been, from his point of view, a cumbersome proxy for money that he was hoping to collect from some consumer. Furthermore, you probably do not experience paying the merchant as a loss, because you were effectively holding money as a proxy for the shoes you intended to buy. These cases of routine trading are not essentially different from the exchange of a $5 bill for five singles. There is no loss aversion on either side of routine commercial exchanges.

What distinguishes these market transactions from Professor R's reluctance to sell his wine, or the reluctance of Super Bowl ticket holders to sell even at a very high price? The distinctive feature is that both the shoes the merchant sells you and the money you spend from your budget for shoes are held "for exchange." They are intended to be traded for other goods. Other goods, such as wine and Super Bowl tickets, are held "for use," to be consumed or otherwise enjoyed. Your leisure time and the standard of living that your income supports are also not intended for sale or exchange.

Knetsch, Thaler, and I set out to design an experiment that would highlight the contrast between goods that are held for use and for exchange. We borrowed one aspect of the design of our experiment from Vernon Smith, the founder of experimental economics, with whom I would share a Nobel Prize many years later. In this method, a limited number of tokens are distributed to the participants in a "market." Any participants who own a token at the end of the experiment can redeem it for cash. The redemption values

differ for different individuals, to represent the fact that the goods traded in markets are more valuable to some people than to others. The same token may be worth $10 to you and $20 to me, and an exchange at any price between these values will be advantageous to both of us.

Smith created vivid demonstrations of how well the basic mechanisms of supply and demand work. Individuals would make successive public offers to buy or sell a token, and others would respond publicly to the offer. Everyone watches these exchanges and sees the price at which the tokens change hands. The results are as regular as those of a demonstration in physics. As inevitably as water flows downhill, those who own a token that is of little value to them (because their redemption values are low) end up selling their token at a profit to someone who values it more. When trading ends, the tokens are in the hands of those who can get the most money for them from the experimenter. The magic of the markets has worked! Furthermore, economic theory correctly predicts both the final price at which the market will settle and the number of tokens that will change hands. If half the participants in the market were randomly assigned tokens, the theory predicts that half of the tokens will change hands.

We used a variation on Smith's method for our experiment. Each session began with several rounds of trades for tokens, which perfectly replicated Smith's finding. The estimated number of trades was typically very close or identical to the amount predicted by the standard theory. The tokens, of course, had value only because they could be exchanged for the experimenter's cash; they had no value for use. Then we conducted a similar market for an object that we expected people to value for use: an attractive coffee mug, decorated with the university insignia of wherever we were conducting the experiments. The mug was then worth about $6 (and would be worth about double that amount today). Mugs were distributed randomly to half the participants. The Sellers had their mug in front of them, and the Buyers were invited to look at their neighbor's mug; all indicated the price at which they would trade. The Buyers had to use their own money to acquire a mug. The results were dramatic: the average selling price was about double the average buying price, and the estimated number of trades was less than half of the number predicted by standard theory. The magic of the market did not work for a good that the owners expected to use.

We conducted a series of experiments using variants of the same procedure, always with the same results. My favorite is one in which we added to the Sellers and Buyers a third group—Choosers. Unlike the Buyers, who had to spend their own money to acquire the good, the Choosers could receive either a mug or a sum of money, and they indicated the amount of money that was as desirable as receiving the good. These were the results:

Sellers	\$7.12
Choosers	\$3.12
Buyers	\$2.87

The gap between Sellers and Choosers is remarkable, because they actually face the same choice! If you are a Seller you can go home with either a mug or money, and if you are a Chooser you have exactly the same two options. The long-term effects of the decision are identical for the two groups. The only difference is in the emotion of the moment. The high price that Sellers set reflects the reluctance to give up an object that they already own, a reluctance that can be seen in babies who hold on fiercely to a toy and show great agitation when it is taken away. Loss aversion is built into the automatic evaluations of System 1.

Buyers and Choosers set similar cash values, although the Buyers have to pay for the mug, which is free for the Choosers. This is what we would expect if Buyers do not experience spending money on the mug as a loss. Evidence from brain imaging confirms the difference. Selling goods that one would normally use activates regions of the brain that are associated with disgust and pain. Buying also activates these areas, but only when the prices are perceived as too high—when you feel that a seller is taking money that exceeds the exchange value. Brain recordings also indicate that buying at especially low prices is a pleasurable event.

The cash value that the Sellers set on the mug is a bit more than twice as high as the value set by Choosers and Buyers. The ratio is very close to the loss aversion coefficient in risky choice, as we might expect if the same value function for gains and losses of money is applied to both riskless and risky decisions. A ratio of about 2:1 has appeared in studies of diverse economic domains, including the response of households to price changes. As economists would predict, customers tend to increase their purchases of eggs, orange juice, or fish when prices drop and to reduce their purchases when prices rise; however, in contrast to the predictions of economic theory, the effect of price increases (losses relative to the reference price) is about twice as large as the effect of gains.

The mugs experiment has remained the standard demonstration of the endowment effect, along with an even simpler experiment that Jack Knetsch reported at about the same time. Knetsch asked two classes to fill out a

questionnaire and rewarded them with a gift that remained in front of them for the duration of the experiment. In one session, the prize was an expensive pen; in another, a bar of Swiss chocolate. At the end of the class, the experimenter showed the alternative gift and allowed everyone to trade his or her gift for another. Only about 10% of the participants opted to exchange their gift. Most of those who had received the pen stayed with the pen, and those who had received the chocolate did not budge either.

THINKING LIKE A TRADER

The fundamental ideas of prospect theory are that reference points exist, and that losses loom larger than corresponding gains. Observations in real markets collected over the years illustrate the power of these concepts. A study of the market for condo apartments in Boston during a downturn yielded particularly clear results. The authors of that study compared the behavior of owners of similar units who had bought their dwellings at different prices. For a rational agent, the buying price is irrelevant history—the current market value is all that matters. Not so for Humans in a down market for housing. Owners who have a high reference point and thus face higher losses set a higher price on their dwelling, spend a longer time trying to sell their home, and eventually receive more money.

The original demonstration of an asymmetry between selling prices and buying prices (or, more convincingly, between selling and choosing) was very important in the initial acceptance of the ideas of reference point and loss aversion. However, it is well understood that reference points are labile, especially in unusual laboratory situations, and that the endowment effect can be eliminated by changing the reference point.

No endowment effect is expected when owners view their goods as carriers of value for future exchanges, a widespread attitude in routine commerce and in financial markets. The experimental economist John List, who has studied trading at baseball card conventions, found that novice traders were reluctant to part with the cards they owned, but that this reluctance eventually disappeared with trading experience. More surprisingly, List found a large effect of trading experience on the endowment effect for new goods.

At a convention, List displayed a notice that invited people to take part in a short survey, for which they would be compensated with a small gift: a coffee mug or a chocolate bar of equal value. The gifts were assigned at random. As the volunteers were about to leave, List said to each of them, "We gave you a mug [or chocolate bar], but you can trade for a chocolate bar [or mug] instead, if you wish." In an exact replication of Jack Knetsch's earlier experiment, List found that only 18% of the inexperienced traders were willing to exchange their gift for the other. In sharp contrast, experienced traders showed no trace of an endowment effect: 48% of them traded! At least in a market environment in which trading was the norm, they showed no reluctance to trade.

Jack Knetsch also conducted experiments in which subtle manipulations made the endowment effect disappear. Participants displayed an endowment effect only if they had physical possession of the good for a while before the possibility of trading it was mentioned. Economists of the standard persuasion might be tempted to say that Knetsch had spent too much time with psychologists, because his experimental manipulation showed concern for the variables that social psychologists expect to be important. Indeed, the different methodological concerns of experimental economists and psychologists have been much in evidence in the ongoing debate about the endowment effect.

Veteran traders have apparently learned to ask the correct question, which is "How much do I want to *have* that mug, compared with other things I could have instead?" This is the question that Econs ask, and with this question there is no endowment effect, because the asymmetry between the pleasure of getting and the pain of giving up is irrelevant.

Recent studies of the psychology of "decision making under poverty" suggest that the poor are another group in which we do not expect to find the endowment effect. Being poor, in prospect theory, is living below one's reference point. There are goods that the poor need and cannot afford, so they are always "in the losses." Small amounts of money that they receive are therefore perceived as a reduced loss, not as a gain. The money helps one climb a little toward the reference point, but the poor always remain on the steep limb of the value function.

People who are poor think like traders, but the dynamics are quite different. Unlike traders, the poor are not indifferent to the differences between gaining and giving up. Their problem is that all their choices are between losses. Money that is spent on one good is the loss of another good that could have been purchased instead. For the poor, costs are losses.

We all know people for whom spending is painful, although they are objectively quite well-off. There may also be cultural differences in the attitude toward money, and especially toward the spending of money on whims and minor luxuries, such as the purchase of a decorated mug. Such a difference may explain the large discrepancy between the results of the "mugs study" in the United States and in the UK. Buying and selling prices diverge substantially in experiments conducted in samples of students of the United States, but the differences are much smaller among English students. Much remains to be learned about the endowment effect.

SPEAKING OF THE ENDOWMENT EFFECT

"She didn't care which of the two offices she would get, but a day after the announcement was made, she was no longer willing to trade. Endowment effect!"

"These negotiations are going nowhere because both sides find it difficult to make concessions, even when they can get something in return. Losses loom larger than gains."

"When they raised their prices, demand dried up."

"He just hates the idea of selling his house for less money than he paid for it. Loss aversion is at work."

"He is a miser, and treats any dollar he spends as a loss."