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

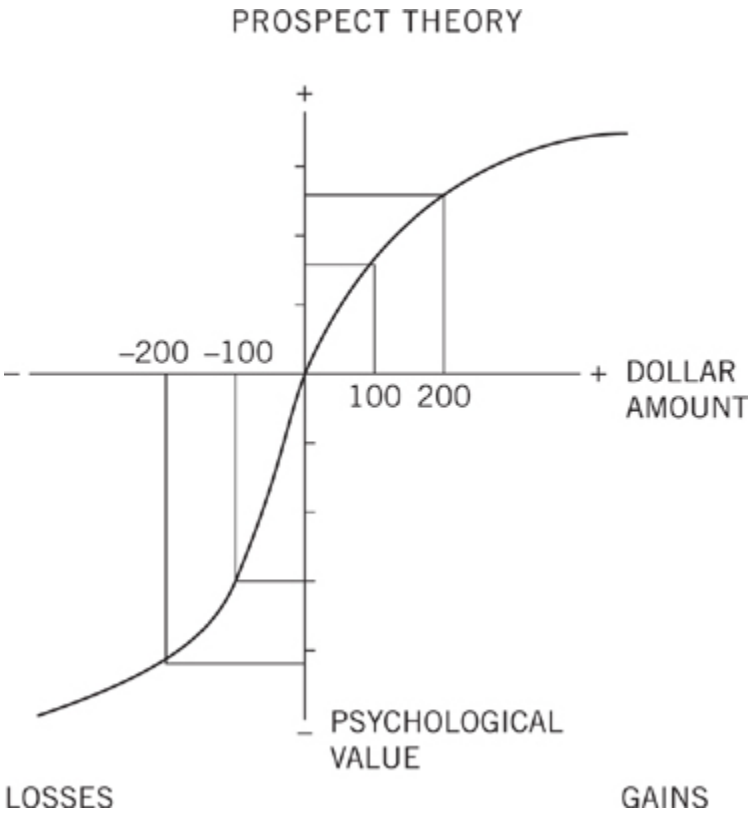

Figure 10

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?