THINKING, FAST AND SLOW

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FARRAR, STRAUS AND GIROUX / NEW YORK

Farrar, Straus and Giroux
18 West 18th Street, New York 10011

Printed in the United States of America
First edition, 2011

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Library of Congress Cataloging-in-Publication Data
Kahneman, Daniel, 1934–
Thinking, fast and slow / Daniel Kahneman. — 1st ed.
p. cm.
Includes bibliographical references and index.
ISBN 978-0-374-27563-1 (alk. paper)
1. Thought and thinking. 2. Decision making. 3. Intuition. 4. Reasoning. I. Title.

BF441 .K238 2011
153.4'2—dc23

2011027143

Designed by Abby Kagan

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17 19 20 18 16

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THE CHARACTERS OF THE STORY

To observe your mind in automatic mode, glance at the image below.

Figure 1

Your experience as you look at the woman's face seamlessly combines what we normally call seeing and intuitive thinking. As surely and quickly as you saw that the young woman's hair is dark, you knew she is angry. Furthermore, what you saw extended into the future. You sensed that this woman is about to say some very unkind words, probably in a loud and strident voice. A premonition of what she was going to do next came to mind automatically and effortlessly. You did not intend to assess her mood or to anticipate what she might do, and your reaction to the picture did not have the feel of something you did. It just happened to you. It was an instance of fast thinking.

Now look at the following problem:

$$17 \times 24$$

You knew immediately that this is a multiplication problem, and probably knew that you could solve it, with paper and pencil, if not without. You also had some vague intuitive knowledge of the range of possible results. You would be quick to recognize that both 12,609 and 123 are implausible. Without spending some time on the problem, however, you would not be certain that the answer is not 568. A precise solution did not come to mind, and you felt that you could choose whether or not to engage in the computation. If you have not done so yet, you should attempt the multiplication problem now, completing at least part of it.

You experienced slow thinking as you proceeded through a sequence of steps. You first retrieved from memory the cognitive program for multiplication that you learned in school, then you implemented it. Carrying out the computation was a strain. You felt the burden of holding much material in memory, as you needed to keep track of where you were and of where you were going, while holding on to the intermediate result. The process was mental work: deliberate, effortful, and orderly—a prototype of slow thinking. The computation was not only an event in your mind; your body was also involved. Your muscles tensed up, your blood pressure rose, and your heart rate increased. Someone looking closely at your eyes while you tackled this problem would have seen your pupils dilate. Your pupils contracted back to normal size as soon as you ended your work—when you found the answer (which is 408, by the way) or when you gave up.

TWO SYSTEMS

Psychologists have been intensely interested for several decades in the two modes of thinking evoked by the picture of the angry woman and by the multiplication problem, and have offered many labels for them. I adopt terms originally proposed by the psychologists Keith Stanovich and Richard West, and will refer to two systems in the mind, System 1 and System 2.

- *System 1* operates automatically and quickly, with little or no effort and no sense of voluntary control.

- *System 2* allocates attention to the effortful mental activities that demand it, including complex computations. The operations of System 2 are often associated with the subjective experience of agency, choice, and concentration.

The labels of System 1 and System 2 are widely used in psychology, but I go further than most in this book, which you can read as a psychodrama with two characters.

When we think of ourselves, we identify with System 2, the conscious, reasoning self that has beliefs, makes choices, and decides what to think about and what to do. Although System 2 believes itself to be where the action is, the automatic System 1 is the hero of the book. I describe System 1 as effortlessly originating impressions and feelings that are the main sources of the explicit beliefs and deliberate choices of System 2. The automatic operations of System 1 generate surprisingly complex patterns of ideas, but only the slower System 2 can construct thoughts in an orderly series of steps. I also describe circumstances in which System 2 takes over, overruling the freewheeling impulses and associations of System 1. You will be invited to think of the two systems as agents with their individual abilities, limitations, and functions.

In rough order of complexity, here are some examples of the automatic activities that are attributed to System 1:

- Detect that one object is more distant than another.
- Orient to the source of a sudden sound.
- Complete the phrase "bread and . . ."
- Make a "disgust face" when shown a horrible picture.
- Detect hostility in a voice.
- Answer to 2 + 2 = ?
- Read words on large billboards.
- Drive a car on an empty road.
- Find a strong move in chess (if you are a chess master).
- Understand simple sentences.
- Recognize that a "meek and tidy soul with a passion for detail" resembles an occupational stereotype.

All these mental events belong with the angry woman—they occur automatically and require little or no effort. The capabilities of System 1 include innate skills that we share with other animals. We are born prepared to perceive the world around us, recognize objects, orient attention, avoid losses, and fear spiders. Other mental activities become fast and automatic through prolonged practice. System 1 has learned associations between ideas (the capital of France?); it has also learned skills such as reading and understanding nuances of social situations. Some skills, such as finding strong chess moves, are acquired only by specialized experts. Others are widely shared. Detecting the similarity of a personality sketch to an occupational stereotype requires broad knowledge of the language and the culture, which most of us possess. The knowledge is stored in memory and accessed without intention and without effort.

Several of the mental actions in the list are completely involuntary. You cannot refrain from understanding simple sentences in your own language or from orienting to a loud unexpected sound, nor can you prevent yourself from knowing that 2 + 2 = 4 or from thinking of Paris when the capital of France is mentioned. Other activities, such as chewing, are susceptible to voluntary control but normally run on automatic pilot. The control of attention is shared by the two systems. Orienting to a loud sound is normally an involuntary operation of System 1, which immediately mobilizes the voluntary attention of System 2. You may be able to resist turning toward the source of a loud and offensive comment at a crowded party, but even if your head does not move, your attention is initially directed to it, at least for a while. However, attention can be moved away from an unwanted focus, primarily by focusing intently on another target.

The highly diverse operations of System 2 have one feature in common: they require attention and are disrupted when attention is drawn away. Here are some examples:

- Brace for the starter gun in a race.
- Focus attention on the clowns in the circus.
- Focus on the voice of a particular person in a crowded and noisy room.
- Look for a woman with white hair.
- Search memory to identify a surprising sound.
- Maintain a faster walking speed than is natural for you.
- Monitor the appropriateness of your behavior in a social situation.
- Count the occurrences of the letter *a* in a page of text.
- Tell someone your phone number.
- Park in a narrow space (for most people except garage attendants).
- Compare two washing machines for overall value.
- Fill out a tax form.
- Check the validity of a complex logical argument.

In all these situations you must pay attention, and you will perform less well, or not at all, if you are not ready or if your attention is directed inappropriately. System 2 has some ability to change the way System 1 works, by programming the normally automatic functions of attention and memory. When waiting for a relative at a busy train station, for example, you can set yourself at will to look for a white-haired woman or a bearded man, and thereby increase the likelihood of detecting your relative from a distance. You can set your memory to search for capital cities that start with *N* or for French existentialist novels. And when you rent a car at London's Heathrow Airport, the attendant will probably remind you that "we drive on the left side of the road over here." In all these cases, you are asked to do something that does not come naturally, and you will find that the consistent maintenance of a set requires continuous exertion of at least some effort.

The often-used phrase "pay attention" is apt: you dispose of a limited budget of attention that you can allocate to activities, and if you try to go beyond your budget, you will fail. It is the mark of effortful activities that they interfere with each other, which is why it is difficult or impossible to conduct several at once. You could not compute the product of 17 × 24 while making a left turn into dense traffic, and you certainly should not try. You can do several things at once, but only if they are easy and undemanding. You are probably safe carrying on a conversation with a passenger while driving on an empty highway, and many parents have discovered, perhaps with some guilt, that they can read a story to a child while thinking of something else.

Everyone has some awareness of the limited capacity of attention, and our social behavior makes allowances for these limitations. When the driver of a car is overtaking a truck on a narrow road, for example, adult passengers quite sensibly stop talking. They know that distracting the driver is not a good idea, and they also suspect that he is temporarily deaf and will not hear what they say.

Intense focusing on a task can make people effectively blind, even to stimuli that normally attract attention. The most dramatic demonstration was offered by Christopher Chabris and Daniel Simons in their book *The Invisible Gorilla*. They constructed a short film of two teams passing basketballs, one team wearing white shirts, the other wearing black. The viewers of the film are instructed to count the number of passes made by the white team, ignoring the black players. This task is difficult and completely absorbing. Halfway through the video, a woman wearing a gorilla suit appears, crosses the court, thumps her chest, and moves on. The gorilla is in view for

9 seconds. Many thousands of people have seen the video, and about half of them do not notice anything unusual. It is the counting task—and especially the instruction to ignore one of the teams—that causes the blindness. No one who watches the video without that task would miss the gorilla. Seeing and orienting are automatic functions of System 1, but they depend on the allocation of some attention to the relevant stimulus. The authors note that the most remarkable observation of their study is that people find its results very surprising. Indeed, the viewers who fail to see the gorilla are initially sure that it was not there—they cannot imagine missing such a striking event. The gorilla study illustrates two important facts about our minds: we can be blind to the obvious, and we are also blind to our blindness.

PLOT SYNOPSIS

The interaction of the two systems is a recurrent theme of the book, and a brief synopsis of the plot is in order. In the story I will tell, Systems 1 and 2 are both active whenever we are awake. System 1 runs automatically and System 2 is normally in a comfortable low-effort mode, in which only a fraction of its capacity is engaged. System 1 continuously generates suggestions for System 2: impressions, intuitions, intentions, and feelings. If endorsed by System 2, impressions and intuitions turn into beliefs, and impulses turn into voluntary actions. When all goes smoothly, which is most of the time, System 2 adopts the suggestions of System 1 with little or no modification. You generally believe your impressions and act on your desires, and that is fine—usually.

When System 1 runs into difficulty, it calls on System 2 to support more detailed and specific processing that may solve the problem of the moment. System 2 is mobilized when a question arises for which System 1 does not offer an answer, as probably happened to you when you encountered the multiplication problem 17 × 24. You can also feel a surge of conscious attention whenever you are surprised. System 2 is activated when an event is detected that violates the model of the world that System 1 maintains. In that world, lamps do not jump, cats do not bark, and gorillas do not cross basketball courts. The gorilla experiment demonstrates that some attention is needed for the surprising stimulus to be detected. Surprise then activates and orients your attention: you will stare, and you will search your memory for a story that makes sense of the surprising event. System 2 is also credited with the continuous monitoring of your own behavior—the control that keeps you polite when you are angry, and alert when you are driving at night.

System 2 is mobilized to increased effort when it detects an error about to be made. Remember a time when you almost blurted out an offensive remark and note how hard you worked to restore control. In summary, most of what you (your System 2) think and do originates in your System 1, but System 2 takes over when things get difficult, and it normally has the last word.

The division of labor between System 1 and System 2 is highly efficient: it minimizes effort and optimizes performance. The arrangement works well most of the time because System 1 is generally very good at what it does: its models of familiar situations are accurate, its short-term predictions are usually accurate as well, and its initial reactions to challenges are swift and generally appropriate. System 1 has biases, however, systematic errors that it is prone to make in specified circumstances. As we shall see, it sometimes answers easier questions than the one it was asked, and it has little understanding of logic and statistics. One further limitation of System 1 is that it cannot be turned off. If you are shown a word on the screen in a language you know, you will read it—unless your attention is totally focused elsewhere.

CONFLICT

Figure 2 is a variant of a classic experiment that produces a conflict between the two systems. You should try the exercise before reading on.

Your first task is to go down both columns, calling out whether each word is printed in lowercase or in uppercase. When you are done with the first task, go down both columns again, saying whether each word is printed to the left or to the right of center by saying (or whispering to yourself) "LEFT" or "RIGHT."

LEFT		upper	
	left	lower	
right			LOWER
RIGHT		upper	
	RIGHT	UPPER	
	left		lower
LEFT			LOWER
	right		upper

Figure 2

You were almost certainly successful in saying the correct words in both tasks, and you surely discovered that some parts of each task were much easier than others. When you identified upper- and lowercase, the left-hand column was easy and the right-hand column caused you to slow down and perhaps to stammer or stumble. When you named the position of words, the left-hand column was difficult and the right-hand column was much easier.

These tasks engage System 2, because saying "upper/lower" or "right/left" is not what you routinely do when looking down a column of words. One of the things you did to set yourself for the task was to program your memory so that the relevant words (*upper* and *lower* for the first task) were "on the tip of your tongue." The prioritizing of the chosen words is effective and the mild temptation to read other words was fairly easy to resist when you went through the first column. But the second column was different, because it contained words for which you were set, and you could not ignore them. You were mostly able to respond correctly, but overcoming the competing response was a strain, and it slowed you down. You experienced a conflict between a task that you intended to carry out and an automatic response that interfered with it.

Conflict between an automatic reaction and an intention to control it is common in our lives. We are all familiar with the experience of trying not to stare at the oddly dressed couple at the neighboring table in a restaurant. We also know what it is like to force our attention on a boring book, when we constantly find ourselves returning to the point at which the reading lost its meaning. Where winters are hard, many drivers have memories of their car skidding out of control on the ice and of the struggle to follow well-rehearsed instructions that negate what they would naturally do: "Steer into the skid, and whatever you do, do not touch the brakes!" And every human being has had the experience of *not* telling someone to go to hell. One of the tasks of System 2 is to overcome the impulses of System 1. In other words, System 2 is in charge of self-control.

ILLUSIONS

To appreciate the autonomy of System 1, as well as the distinction between impressions and beliefs, take a good look at figure 3.

This picture is unremarkable: two horizontal lines of different lengths, with fins appended, pointing in different directions. The bottom line is obviously longer than the one above it. That is what we all see, and we

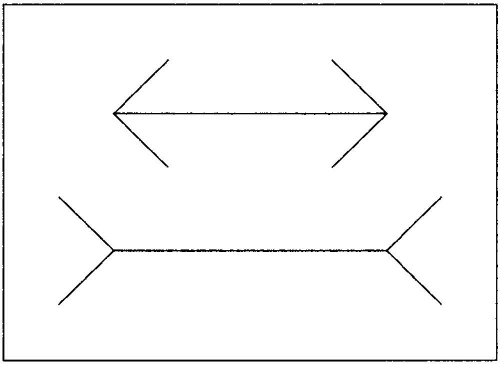

Figure 3

naturally believe what we see. If you have already encountered this image, however, you recognize it as the famous Müller-Lyer illusion. As you can easily confirm by measuring them with a ruler, the horizontal lines are in fact identical in length.

Now that you have measured the lines, you—your System 2, the conscious being you call "I"—have a new belief: you *know* that the lines are equally long. If asked about their length, you will say what you know. But you still *see* the bottom line as longer. You have chosen to believe the measurement, but you cannot prevent System 1 from doing its thing; you cannot decide to see the lines as equal, although you know they are. To resist the illusion, there is only one thing you can do: you must learn to mistrust your impressions of the length of lines when fins are attached to them. To implement that rule, you must be able to recognize the illusory pattern and recall what you know about it. If you can do this, you will never again be fooled by the Müller-Lyer illusion. But you will still see one line as longer than the other.

Not all illusions are visual. There are illusions of thought, which we call *cognitive illusions.* As a graduate student, I attended some courses on the art and science of psychotherapy. During one of these lectures, our teacher imparted a morsel of clinical wisdom. This is what he told us: "You will from time to time meet a patient who shares a disturbing tale of multiple mistakes in his previous treatment. He has been seen by several clinicians, and all failed him. The patient can lucidly describe how his therapists misunderstood him, but he has quickly perceived that you are different. You share the same feeling, are convinced that you understand him, and will be able to help." At this point my teacher raised his voice as he said, "Do not even *think* of taking on this patient! Throw him out of the office! He is most likely a psychopath and you will not be able to help him."

Many years later I learned that the teacher had warned us against psychopathic charm, and the leading authority in the study of psychopathy confirmed that the teacher's advice was sound. The analogy to the Müller-Lyer illusion is close. What we were being taught was not how to feel about that patient. Our teacher took it for granted that the sympathy we would feel for the patient would not be under our control; it would arise from System 1. Furthermore, we were not being taught to be generally suspicious of our feelings about patients. We were told that a strong attraction to a patient with a repeated history of failed treatment is a danger sign—like the fins on the parallel lines. It is an illusion—a cognitive illusion—and I (System 2) was taught how to recognize it and advised not to believe it or act on it.

The question that is most often asked about cognitive illusions is whether they can be overcome. The message of these examples is not encouraging. Because System 1 operates automatically and cannot be turned off at will, errors of intuitive thought are often difficult to prevent. Biases cannot always be avoided, because System 2 may have no clue to the error. Even when cues to likely errors are available, errors can be prevented only by the enhanced monitoring and effortful activity of System 2. As a way to live your life, however, continuous vigilance is not necessarily good, and it is certainly impractical. Constantly questioning our own thinking would be impossibly tedious, and System 2 is much too slow and inefficient to serve as a substitute for System 1 in making routine decisions. The best we can do is a compromise: learn to recognize situations in which mistakes are likely and try harder to avoid significant mistakes when the stakes are high. The premise of this book is that it is easier to recognize other people's mistakes than our own.

USEFUL FICTIONS

You have been invited to think of the two systems as agents within the mind, with their individual personalities, abilities, and limitations. I will often use sentences in which the systems are the subjects, such as, "System 2 calculates products."

The use of such language is considered a sin in the professional circles in which I travel, because it seems to explain the thoughts and actions of a person by the thoughts and actions of little people inside the person's head. Grammatically the sentence about System 2 is similar to "The butler steals the petty cash." My colleagues would point out that the butler's action actually explains the disappearance of the cash, and they rightly question whether the sentence about System 2 explains how products are calculated. My answer is that the brief active sentence that attributes calculation to System 2 is intended as a description, not an explanation. It is meaningful only because of what you already know about System 2. It is shorthand for the following: "Mental arithmetic is a voluntary activity that requires effort, should not be performed while making a left turn, and is associated with dilated pupils and an accelerated heart rate."

Similarly, the statement that "highway driving under routine conditions is left to System 1" means that steering the car around a bend is automatic and almost effortless. It also implies that an experienced driver can drive on an empty highway while conducting a conversation. Finally, "System 2 prevented James from reacting foolishly to the insult" means that James would have been more aggressive in his response if his capacity for effortful control had been disrupted (for example, if he had been drunk).

System 1 and System 2 are so central to the story I tell in this book that I must make it absolutely clear that they are fictitious characters. Systems 1 and 2 are not systems in the standard sense of entities with interacting aspects or parts. And there is no one part of the brain that either of the systems would call home. You may well ask: What is the point of introducing fictitious characters with ugly names into a serious book? The answer is that the characters are useful because of some quirks of our minds, yours and mine. A sentence is understood more easily if it describes what an agent (System 2) does than if it describes what something is, what properties it has. In other words, "System 2" is a better subject for a sentence than "mental arithmetic." The mind—especially System 1—appears to have a special aptitude for the construction and interpretation of stories about active agents, who have personalities, habits, and abilities. You quickly formed a bad opinion of the thieving butler, you expect more bad behavior from him, and you will remember him for a while. This is also my hope for the language of systems.

Why call them System 1 and System 2 rather than the more descriptive "automatic system" and "effortful system"? The reason is simple: "Automatic system" takes longer to say than "System 1" and therefore takes more space in your working memory. This matters, because anything that occupies your working memory reduces your ability to think. You should treat "System 1" and "System 2" as nicknames, like Bob and Joe, identifying characters that you will get to know over the course of this book. The fictitious systems make it easier for me to think about judgment and choice, and will make it easier for you to understand what I say.

SPEAKING OF SYSTEM 1 AND SYSTEM 2

"He had an impression, but some of his impressions are illusions."

"This was a pure System 1 response. She reacted to the threat before she recognized it."

"This is your System 1 talking. Slow down and let your System 2 take control."

3

THE LAZY CONTROLLER

I spend a few months each year in Berkeley, and one of my great pleasures there is a daily four-mile walk on a marked path in the hills, with a fine view of San Francisco Bay. I usually keep track of my time and have learned a fair amount about effort from doing so. I have found a speed, about 17 minutes for a mile, which I experience as a stroll. I certainly exert physical effort and burn more calories at that speed than if I sat in a recliner, but I experience no strain, no conflict, and no need to push myself. I am also able to think and work while walking at that rate. Indeed, I suspect that the mild physical arousal of the walk may spill over into greater mental alertness.

System 2 also has a natural speed. You expend some mental energy in random thoughts and in monitoring what goes on around you even when your mind does nothing in particular, but there is little strain. Unless you are in a situation that makes you unusually wary or self-conscious, monitoring what happens in the environment or inside your head demands little effort. You make many small decisions as you drive your car, absorb some information as you read the newspaper, and conduct routine exchanges of pleasantries with a spouse or a colleague, all with little effort and no strain. Just like a stroll.

It is normally easy and actually quite pleasant to walk and think at the same time, but at the extremes these activities appear to compete for the limited resources of System 2. You can confirm this claim by a simple experiment. While walking comfortably with a friend, ask him to compute 23×78 in his head, and to do so immediately. He will almost certainly stop in his tracks. My experience is that I can think while strolling but cannot engage in mental work that imposes a heavy load on short-term memory. If I must construct an intricate argument under time pressure, I would rather be still, and I would prefer sitting to standing. Of course, not all slow thinking requires that form of intense concentration and effortful computation—I did the best thinking of my life on leisurely walks with Amos.

Accelerating beyond my strolling speed completely changes the experience of walking, because the transition to a faster walk brings about a sharp deterioration in my ability to think coherently. As I speed up, my attention is drawn with increasing frequency to the experience of walking and to the deliberate maintenance of the faster pace. My ability to bring a train of thought to a conclusion is impaired accordingly. At the highest speed I can sustain on the hills, about 14 minutes for a mile, I do not even try to think of anything else. In addition to the physical effort of moving my body rapidly along the path, a mental effort of self-control is needed to resist the urge to slow down. Self-control and deliberate thought apparently draw on the same limited budget of effort.

For most of us, most of the time, the maintenance of a coherent train of thought and the occasional engagement in effortful thinking also require self-control. Although I have not conducted a systematic survey, I suspect that frequent switching of tasks and speeded-up mental work are not intrinsically pleasurable, and that people avoid them when possible. This is how the law of least effort comes to be a law. Even in the absence of time pressure, maintaining a coherent train of thought requires discipline. An observer of the number of times I look at e-mail or investigate the refrigerator during an hour of writing could reasonably infer an urge to escape and conclude that keeping at it requires more self-control than I can readily muster.

Fortunately, cognitive work is not always aversive, and people sometimes expend considerable effort for long periods of time without having to exert willpower. The psychologist Mihaly Csikszentmihalyi (pronounced six-cent-mihaly) has done more than anyone else to study this state of effortless attending, and the name he proposed for it, *flow*, has become part of the language. People who experience flow describe it as "a state of effortless concentration so deep that they lose their sense of time, of themselves, of their problems," and their descriptions of the joy of that state are so compelling that Csikszentmihalyi has called it an "optimal experience." Many activities can induce a sense of flow, from painting to racing motorcycles—and for some fortunate authors I know, even writing a book is often an optimal experience. Flow neatly separates the two forms of effort: concentration on the task and the deliberate control of attention. Riding a motorcycle at 150 miles an hour and playing a competitive game of chess are certainly very effortful. In a state of flow, however, maintaining focused attention on these absorbing activities requires no exertion of self-control, thereby freeing resources to be directed to the task at hand.

THE BUSY AND DEPLETED SYSTEM 2

It is now a well-established proposition that both self-control and cognitive effort are forms of mental work. Several psychological studies have shown that people who are simultaneously challenged by a demanding cognitive task and by a temptation are more likely to yield to the temptation. Imagine that you are asked to retain a list of seven digits for a minute or two. You are told that remembering the digits is your top priority. While your attention is focused on the digits, you are offered a choice between two desserts: a sinful chocolate cake and a virtuous fruit salad. The evidence suggests that you would be more likely to select the tempting chocolate cake when your mind is loaded with digits. System 1 has more influence on behavior when System 2 is busy, and it has a sweet tooth.

People who are *cognitively busy* are also more likely to make selfish choices, use sexist language, and make superficial judgments in social situations. Memorizing and repeating digits loosens the hold of System 2 on behavior, but of course cognitive load is not the only cause of weakened self-control. A few drinks have the same effect, as does a sleepless night. The self-control of morning people is impaired at night; the reverse is true of night people. Too much concern about how well one is doing in a task sometimes disrupts performance by loading short-term memory with pointless anxious thoughts. The conclusion is straightforward: self-control requires attention and effort. Another way of saying this is that controlling thoughts and behaviors is one of the tasks that System 2 performs.

A series of surprising experiments by the psychologist Roy Baumeister and his colleagues has shown conclusively that all variants of voluntary effort—cognitive, emotional, or physical—draw at least partly on a shared pool of mental energy. Their experiments involve successive rather than simultaneous tasks.

Baumeister's group has repeatedly found that an effort of will or self-control is tiring; if you have had to force yourself to do something, you are less willing or less able to exert self-control when the next challenge comes around. The phenomenon has been named *ego depletion.* In a typical demonstration, participants who are instructed to stifle their emotional reaction to an emotionally charged film will later perform poorly on a test of physical stamina—how long they can maintain a strong grip on a dynamometer in spite of increasing discomfort. The emotional effort in the first phase of the experiment reduces the ability to withstand the pain of sustained muscle contraction, and ego-depleted people therefore succumb more quickly to the urge to quit. In another experiment, people are first depleted by a task in which they eat virtuous foods such as radishes and celery while resisting the temptation to indulge in chocolate and rich cookies. Later, these people will give up earlier than normal when faced with a difficult cognitive task.

The list of situations and tasks that are now known to deplete self-control is long and varied. All involve conflict and the need to suppress a natural tendency. They include:

avoiding the thought of white bears
inhibiting the emotional response to a stirring film
making a series of choices that involve conflict
trying to impress others
responding kindly to a partner's bad behavior
interacting with a person of a different race (for prejudiced individuals)

The list of indications of depletion is also highly diverse:

deviating from one's diet
overspending on impulsive purchases
reacting aggressively to provocation
persisting less time in a handgrip task
performing poorly in cognitive tasks and logical decision making

The evidence is persuasive: activities that impose high demands on System 2 require self-control, and the exertion of self-control is depleting and unpleasant. Unlike cognitive load, ego depletion is at least in part a loss of motivation. After exerting self-control in one task, you do not feel like making an effort in another, although you could do it if you really had to. In several experiments, people were able to resist the effects of ego depletion when given a strong incentive to do so. In contrast, increasing effort is not an option when you must keep six digits in short-term memory while performing a task. Ego depletion is not the same mental state as cognitive busyness.

The most surprising discovery made by Baumeister's group shows, as he puts it, that the idea of mental energy is more than a mere metaphor. The nervous system consumes more glucose than most other parts of the body, and effortful mental activity appears to be especially expensive in the currency of glucose. When you are actively involved in difficult cognitive reasoning or engaged in a task that requires self-control, your blood glucose level drops. The effect is analogous to a runner who draws down glucose stored in her muscles during a sprint. The bold implication of this idea is that the effects of ego depletion could be undone by ingesting glucose, and Baumeister and his colleagues have confirmed this hypothesis in several experiments.

Volunteers in one of their studies watched a short silent film of a woman being interviewed and were asked to interpret her body language. While they were performing the task, a series of words crossed the screen in slow succession. The participants were specifically instructed to ignore the words, and if they found their attention drawn away they had to refocus their concentration on the woman's behavior. This act of self-control was known to cause ego depletion. All the volunteers drank some lemonade before participating in a second task. The lemonade was sweetened with glucose for half of them and with Splenda for the others. Then all participants were given a task in which they needed to overcome an intuitive response to get the correct answer. Intuitive errors are normally much more frequent among ego-depleted people, and the drinkers of Splenda showed the expected depletion effect. On the other hand, the glucose drinkers were not depleted. Restoring the level of available sugar in the brain had prevented the deterioration of performance. It will take some time and much further research to establish whether the tasks that cause glucose-depletion also cause the momentary arousal that is reflected in increases of pupil size and heart rate.

A disturbing demonstration of depletion effects in judgment was recently reported in the *Proceedings of the National Academy of Sciences*. The unwitting participants in the study were eight parole judges in Israel. They spend entire days reviewing applications for parole. The cases are presented in random order, and the judges spend little time on each one, an average of 6 minutes. (The default decision is denial of parole; only 35% of requests are approved. The exact time of each decision is recorded, and the times of the judges' three food breaks—morning break, lunch, and afternoon break—during the day are recorded as well.) The authors of the study plotted the proportion of approved requests against the time since the last food break. The proportion spikes after each meal, when about 65% of requests are granted. During the two hours or so until the judges' next feeding, the approval rate drops steadily, to about zero just before the meal. As you might expect, this is an unwelcome result and the authors carefully checked many alternative explanations. The best possible account of the data provides bad news: tired and hungry judges tend to fall back on the easier default position of denying requests for parole. Both fatigue and hunger probably play a role.

THE LAZY SYSTEM 2

One of the main functions of System 2 is to monitor and control thoughts and actions "suggested" by System 1, allowing some to be expressed directly in behavior and suppressing or modifying others.

For an example, here is a simple puzzle. Do not try to solve it but listen to your intuition:

> A bat and ball cost $1.10.
> The bat costs one dollar more than the ball.
> How much does the ball cost?

A number came to your mind. The number, of course, is 10: 10¢. The distinctive mark of this easy puzzle is that it evokes an answer that is intuitive, appealing, and wrong. Do the math, and you will see. If the ball costs 10¢, then the total cost will be $1.20 (10¢ for the ball and $1.10 for the bat), not $1.10. The correct answer is 5¢. It is safe to assume that the intuitive answer also came to the mind of those who ended up with the correct number—they somehow managed to resist the intuition.

Shane Frederick and I worked together on a theory of judgment based on two systems, and he used the bat-and-ball puzzle to study a central question: How closely does System 2 monitor the suggestions of System 1? His reasoning was that we know a significant fact about anyone who says that the ball costs 10¢: that person did not actively check whether the answer was correct, and her System 2 endorsed an intuitive answer that it could have rejected with a small investment of effort. Furthermore, we also know that the people who give the intuitive answer have missed an obvious social cue; they should have wondered why anyone would include in a questionnaire a puzzle with such an obvious answer. A failure to check is remarkable because the cost of checking is so low: a few seconds of mental work (the problem is moderately difficult), with slightly tensed muscles and dilated pupils, could avoid an embarrassing mistake. People who say 10¢ appear to be ardent followers of the law of least effort. People who avoid that answer appear to have more active minds.

Many thousands of university students have answered the bat-and-ball puzzle, and the results are shocking. More than 50% of students at Harvard, MIT, and Princeton gave the intuitive—incorrect—answer. At less selective universities, the rate of demonstrable failure to check was in excess of 80%. The bat-and-ball problem is our first encounter with an observation that will be a recurrent theme of this book: many people are overconfident, prone to place too much faith in their intuitions. They apparently find cognitive effort at least mildly unpleasant and avoid it as much as possible.

Now I will show you a logical argument—two premises and a conclusion. Try to determine, as quickly as you can, if the argument is logically valid. Does the conclusion follow from the premises?

> All roses are flowers.
> Some flowers fade quickly.
> Therefore some roses fade quickly.

A large majority of college students endorse this syllogism as valid. In fact the argument is flawed, because it is possible that there are no roses among the flowers that fade quickly. Just as in the bat-and-ball problem, a plausible answer comes to mind immediately. Overriding it requires hard work—the insistent idea that "it's true, it's true!" makes it difficult to check the logic, and most people do not take the trouble to think through the problem.

This experiment has discouraging implications for reasoning in everyday life. It suggests that when people believe a conclusion is true, they are also very likely to believe arguments that appear to support it, even when these arguments are unsound. If System 1 is involved, the conclusion comes first and the arguments follow.

Next, consider the following question and answer it quickly before reading on:

> How many murders occur in the state of Michigan in one year?

The question, which was also devised by Shane Frederick, is again a challenge to System 2. The "trick" is whether the respondent will remember that

Detroit, a high-crime city, is in Michigan. College students in the United States know this fact and will correctly identify Detroit as the largest city in Michigan. But knowledge of a fact is not all-or-none. Facts that we know do not always come to mind when we need them. People who remember that Detroit is in Michigan give higher estimates of the murder rate in the state than people who do not, but a majority of Frederick's respondents did not think of the city when questioned about the state. Indeed, the average guess by people who were asked about Michigan is *lower* than the guesses of a similar group who were asked about the murder rate in Detroit.

Blame for a failure to think of Detroit can be laid on both System 1 and System 2. Whether the city comes to mind when the state is mentioned depends in part on the automatic function of memory. People differ in this respect. The representation of the state of Michigan is very detailed in some people's minds: residents of the state are more likely to retrieve many facts about it than people who live elsewhere; geography buffs will retrieve more than others who specialize in baseball statistics; more intelligent individuals are more likely than others to have rich representations of most things. Intelligence is not only the ability to reason; it is also the ability to find relevant material in memory and to deploy attention when needed. Memory function is an attribute of System 1. However, everyone has the option of slowing down to conduct an active search of memory for all possibly relevant facts—just as they could slow down to check the intuitive answer in the bat-and-ball problem. The extent of deliberate checking and search is a characteristic of System 2, which varies among individuals.

The bat-and-ball problem, the flowers syllogism, and the Michigan/Detroit problem have something in common. Failing these minitests appears to be, at least to some extent, a matter of insufficient motivation, not trying hard enough. Anyone who can be admitted to a good university is certainly able to reason through the first two questions and to reflect about Michigan long enough to remember the major city in that state and its crime problem. These students can solve much more difficult problems when they are not tempted to accept a superficially plausible answer that comes readily to mind. The ease with which they are satisfied enough to stop thinking is rather troubling. "Lazy" is a harsh judgment about the self-monitoring of these young people and their System 2, but it does not seem to be unfair. Those who avoid the sin of intellectual sloth could be called "engaged." They are more alert, more intellectually active, less willing to be satisfied with superficially attractive answers, more skeptical about their intuitions. The psychologist Keith Stanovich would call them more rational.

INTELLIGENCE, CONTROL, RATIONALITY

Researchers have applied diverse methods to examine the connection between thinking and self-control. Some have addressed it by asking the correlation question: If people were ranked by their self-control and by their cognitive aptitude, would individuals have similar positions in the two rankings?

In one of the most famous experiments in the history of psychology, Walter Mischel and his students exposed four-year-old children to a cruel dilemma. They were given a choice between a small reward (one Oreo), which they could have at any time, or a larger reward (two cookies) for which they had to wait 15 minutes under difficult conditions. They were to remain alone in a room, facing a desk with two objects: a single cookie and a bell that the child could ring at any time to call in the experimenter and receive the one cookie. As the experiment was described: "There were no toys, books, pictures, or other potentially distracting items in the room. The experimenter left the room and did not return until 15 min had passed or the child had rung the bell, eaten the rewards, stood up, or shown any signs of distress."

The children were watched through a one-way mirror, and the film that shows their behavior during the waiting time always has the audience roaring in laughter. About half the children managed the feat of waiting for 15 minutes, mainly by keeping their attention away from the tempting reward. Ten or fifteen years later, a large gap had opened between those who had resisted temptation and those who had not. The resisters had higher measures of executive control in cognitive tasks, and especially the ability to reallocate their attention effectively. As young adults, they were less likely to take drugs. A significant difference in intellectual aptitude emerged: the children who had shown more self-control as four-year-olds had substantially higher scores on tests of intelligence.

A team of researchers at the University of Oregon explored the link between cognitive control and intelligence in several ways, including an attempt to raise intelligence by improving the control of attention. During five 40-minute sessions, they exposed children aged four to six to various computer games especially designed to demand attention and control. In one of the exercises, the children used a joystick to track a cartoon cat and move it to a grassy area while avoiding a muddy area. The grassy areas gradually shrank and the muddy area expanded, requiring progressively more precise control. The testers found that training attention not only improved executive control; scores on nonverbal tests of intelligence also improved and the improvement was maintained for several months. Other research by the same group identified specific genes that are involved in the control of attention, showed that parenting techniques also affected this ability, and demonstrated a close connection between the children's ability to control their attention and their ability to control their emotions.

Shane Frederick constructed a Cognitive Reflection Test, which consists of the bat-and-ball problem and two other questions, chosen because they also invite an intuitive answer that is both compelling and wrong (the questions are shown in chapter 5). He went on to study the characteristics of students who score very low on this test—the supervisory function of System 2 is weak in these people—and found that they are prone to answer questions with the first idea that comes to mind and unwilling to invest the effort needed to check their intuitions. Individuals who uncritically follow their intuitions about puzzles are also prone to accept other suggestions from System 1. In particular, they are impulsive, impatient, and keen to receive immediate gratification. For example, 63% of the intuitive respondents say they would prefer to get $3,400 this month rather than $3,800 next month. Only 37% of those who solve all three puzzles correctly have the same shortsighted preference for receiving a smaller amount immediately. When asked how much they will pay to get overnight delivery of a book they have ordered, the low scorers on the Cognitive Reflection Test are willing to pay twice as much as the high scorers. Frederick's findings suggest that the characters of our psychodrama have different "personalities." System 1 is impulsive and intuitive; System 2 is capable of reasoning, and it is cautious, but at least for some people it is also lazy. We recognize related differences among individuals: some people are more like their System 2; others are closer to their System 1. This simple test has emerged as one of the better predictors of lazy thinking.

Keith Stanovich and his longtime collaborator Richard West originally introduced the terms System 1 and System 2 (they now prefer to speak of Type 1 and Type 2 processes). Stanovich and his colleagues have spent decades studying differences among individuals in the kinds of problems with which this book is concerned. They have asked one basic question in many different ways: What makes some people more susceptible than others to biases of judgment? Stanovich published his conclusions in a book titled *Rationality and the Reflective Mind*, which offers a bold and distinctive approach to the topic of this chapter. He draws a sharp distinction between two parts of System 2—indeed, the distinction is so sharp that he calls them separate "minds." One of these minds (he calls it algorithmic) deals with slow thinking and demanding computation. Some people are better than others in these tasks of brain power—they are the individuals who excel in intelligence tests and are able to switch from one task to another quickly and efficiently. However, Stanovich argues that high intelligence does not make people immune to biases. Another ability is involved, which he labels rationality. Stanovich's concept of a rational person is similar to what I earlier labeled "engaged." The core of his argument is that *rationality* should be distinguished from *intelligence.* In his view, superficial or "lazy" thinking is a flaw in the reflective mind, a failure of rationality. This is an attractive and thought-provoking idea. In support of it, Stanovich and his colleagues have found that the bat-and-ball question and others like it are somewhat better indicators of our susceptibility to cognitive errors than are conventional measures of intelligence, such as IQ tests. Time will tell whether the distinction between intelligence and rationality can lead to new discoveries.

SPEAKING OF CONTROL

"She did not have to struggle to stay on task for hours. She was in a state of *flow.*"

"His ego was depleted after a long day of meetings. So he just turned to standard operating procedures instead of thinking through the problem."

"He didn't bother to check whether what he said made sense. Does he usually have a lazy System 2 or was he unusually tired?"

"Unfortunately, she tends to say the first thing that comes into her mind. She probably also has trouble delaying gratification. Weak System 2."

4

THE ASSOCIATIVE MACHINE

To begin your exploration of the surprising workings of System 1, look at the following words:

Bananas Vomit

A lot happened to you during the last second or two. You experienced some unpleasant images and memories. Your face twisted slightly in an expression of disgust, and you may have pushed this book imperceptibly farther away. Your heart rate increased, the hair on your arms rose a little, and your sweat glands were activated. In short, you responded to the disgusting word with an attenuated version of how you would react to the actual event. All of this was completely automatic, beyond your control.

There was no particular reason to do so, but your mind automatically assumed a temporal sequence and a causal connection between the words *bananas* and *vomit*, forming a sketchy scenario in which bananas caused the sickness. As a result, you are experiencing a temporary aversion to bananas (don't worry, it will pass). The state of your memory has changed in other ways: you are now unusually ready to recognize and respond to objects and concepts associated with "vomit," such as sick, stink, or nausea, and words associated with "bananas," such as yellow and fruit, and perhaps apple and berries.

Vomiting normally occurs in specific contexts, such as hangovers and indigestion. You would also be unusually ready to recognize words associated with other causes of the same unfortunate outcome. Furthermore, your System 1 noticed the fact that the juxtaposition of the two words is uncommon; you probably never encountered it before. You experienced mild surprise.

This complex constellation of responses occurred quickly, automatically, and effortlessly. You did not will it and you could not stop it. It was an operation of System 1. The events that took place as a result of your seeing the words happened by a process called associative activation: ideas that have been evoked trigger many other ideas, in a spreading cascade of activity in your brain. The essential feature of this complex set of mental events is its coherence. Each element is connected, and each supports and strengthens the others. The word evokes memories, which evoke emotions, which in turn evoke facial expressions and other reactions, such as a general tensing up and an avoidance tendency. The facial expression and the avoidance motion intensify the feelings to which they are linked, and the feelings in turn reinforce compatible ideas. All this happens quickly and all at once, yielding a self-reinforcing pattern of cognitive, emotional, and physical responses that is both diverse and integrated—it has been called *associatively coherent*.

In a second or so you accomplished, automatically and unconsciously, a remarkable feat. Starting from a completely unexpected event, your System 1 made as much sense as possible of the situation—two simple words, oddly juxtaposed—by linking the words in a causal story; it evaluated the possible threat (mild to moderate) and created a context for future developments by preparing you for events that had just become more likely; it also created a context for the current event by evaluating how surprising it was. You ended up as informed about the past and as prepared for the future as you could be.

An odd feature of what happened is that your System 1 treated the mere conjunction of two words as representations of reality. Your body reacted in an attenuated replica of a reaction to the real thing, and the emotional response and physical recoil were part of the interpretation of the event. As cognitive scientists have emphasized in recent years, cognition is embodied; you think with your body, not only with your brain.

The mechanism that causes these mental events has been known for a long time: it is the association of ideas. We all understand from experience that ideas follow each other in our conscious mind in a fairly orderly way. The British philosophers of the seventeenth and eighteenth centuries searched for the rules that explain such sequences. In *An Enquiry Concerning Human Understanding*, published in 1748, the Scottish philosopher

David Hume reduced the principles of association to three: resemblance, contiguity in time and place, and causality. Our concept of association has changed radically since Hume's days, but his three principles still provide a good start.

I will adopt an expansive view of what an idea is. It can be concrete or abstract, and it can be expressed in many ways: as a verb, as a noun, as an adjective, or as a clenched fist. Psychologists think of ideas as nodes in a vast network, called associative memory, in which each idea is linked to many others. There are different types of links: causes are linked to their effects (virus → cold); things to their properties (lime → green); things to the categories to which they belong (banana → fruit). One way we have advanced beyond Hume is that we no longer think of the mind as going through a sequence of conscious ideas, one at a time. In the current view of how associative memory works, a great deal happens at once. An idea that has been activated does not merely evoke one other idea. It activates many ideas, which in turn activate others. Furthermore, only a few of the activated ideas will register in consciousness; most of the work of associative thinking is silent, hidden from our conscious selves. The notion that we have limited access to the workings of our minds is difficult to accept because, naturally, it is alien to our experience, but it is true: you know far less about yourself than you feel you do.

THE MARVELS OF PRIMING

As is common in science, the first big breakthrough in our understanding of the mechanism of association was an improvement in a method of measurement. Until a few decades ago, the only way to study associations was to ask many people questions such as, "What is the first word that comes to your mind when you hear the word DAY?" The researchers tallied the frequency of responses, such as "night," "sunny," or "long." In the 1980s, psychologists discovered that exposure to a word causes immediate and measurable changes in the ease with which many related words can be evoked. If you have recently seen or heard the word EAT, you are temporarily more likely to complete the word fragment SO_P as SOUP than as SOAP. The opposite would happen, of course, if you had just seen WASH. We call this a *priming effect* and say that the idea of EAT primes the idea of SOUP, and that WASH primes SOAP.

Priming effects take many forms. If the idea of EAT is currently on your mind (whether or not you are conscious of it), you will be quicker than usual to recognize the word SOUP when it is spoken in a whisper or presented in a blurry font. And of course you are primed not only for the idea of soup but also for a multitude of food-related ideas, including fork, hungry, fat, diet, and cookie. If for your most recent meal you sat at a wobbly restaurant table, you will be primed for wobbly as well. Furthermore, the primed ideas have some ability to prime other ideas, although more weakly. Like ripples on a pond, activation spreads through a small part of the vast network of associated ideas. The mapping of these ripples is now one of the most exciting pursuits in psychological research.

Another major advance in our understanding of memory was the discovery that priming is not restricted to concepts and words. You cannot know this from conscious experience, of course, but you must accept the alien idea that your actions and your emotions can be primed by events of which you are not even aware. In an experiment that became an instant classic, the psychologist John Bargh and his collaborators asked students at New York University—most aged eighteen to twenty-two—to assemble four-word sentences from a set of five words (for example, "finds he it yellow instantly"). For one group of students, half the scrambled sentences contained words associated with the elderly, such as *Florida*, *forgetful*, *bald*, *gray*, or *wrinkle*. When they had completed that task, the young participants were sent out to do another experiment in an office down the hall. That short walk was what the experiment was about. The researchers unobtrusively measured the time it took people to get from one end of the corridor to the other. As Bargh had predicted, the young people who had fashioned a sentence from words with an elderly theme walked down the hallway significantly more slowly than the others.

The "Florida effect" involves two stages of priming. First, the set of words primes thoughts of old age, though the word *old* is never mentioned; second, these thoughts prime a behavior, walking slowly, which is associated with old age. All this happens without any awareness. When they were questioned afterward, none of the students reported noticing that the words had had a common theme, and they all insisted that nothing they did after the first experiment could have been influenced by the words they had encountered. The idea of old age had not come to their conscious awareness, but their actions had changed nevertheless. This remarkable priming phenomenon—the influencing of an action by the idea—is known as the ideomotor effect. Although you surely were not aware of it, reading this paragraph primed you as well. If you had needed to stand up to get a glass of water, you would have been slightly slower than usual to rise from your chair—unless you happen to dislike the elderly, in which case research suggests that you might have been slightly faster than usual!

The ideomotor link also works in reverse. A study conducted in a German university was the mirror image of the early experiment that Bargh and his colleagues had carried out in New York. Students were asked to walk around a room for 5 minutes at a rate of 30 steps per minute, which was about one-third their normal pace. After this brief experience, the participants were much quicker to recognize words related to old age, such as *forgetful*, *old*, and *lonely*. Reciprocal priming effects tend to produce a coherent reaction: if you were primed to think of old age, you would tend to act old, and acting old would reinforce the thought of old age.

Reciprocal links are common in the associative network. For example, being amused tends to make you smile, and smiling tends to make you feel amused. Go ahead and take a pencil, and hold it between your teeth for a few seconds with the eraser pointing to your right and the point to your left. Now hold the pencil so the point is aimed straight in front of you, by pursing your lips around the eraser end. You were probably unaware that one of these actions forced your face into a frown and the other into a smile. College students were asked to rate the humor of cartoons from Gary Larson's *The Far Side* while holding a pencil in their mouth. Those who were "smiling" (without any awareness of doing so) found the cartoons funnier than did those who were "frowning." In another experiment, people whose face was shaped into a frown (by squeezing their eyebrows together) reported an enhanced emotional response to upsetting pictures—starving children, people arguing, maimed accident victims.

Simple, common gestures can also unconsciously influence our thoughts and feelings. In one demonstration, people were asked to listen to messages through new headphones. They were told that the purpose of the experiment was to test the quality of the audio equipment and were instructed to move their heads repeatedly to check for any distortions of sound. Half the participants were told to nod their head up and down while others were told to shake it side to side. The messages they heard were radio editorials. Those who nodded (a yes gesture) tended to accept the message they heard, but those who shook their head tended to reject it. Again, there was no awareness, just a habitual connection between an attitude of rejection or acceptance and its common physical expression. You can see why the common admonition to "act calm and kind regardless of how you feel" is very good advice: you are likely to be rewarded by actually feeling calm and kind.

PRIMES THAT GUIDE US

Studies of priming effects have yielded discoveries that threaten our self-image as conscious and autonomous authors of our judgments and our choices. For instance, most of us think of voting as a deliberate act that reflects our values and our assessments of policies and is not influenced by irrelevancies. Our vote should not be affected by the location of the polling station, for example, but it is. A study of voting patterns in precincts of Arizona in 2000 showed that the support for propositions to increase the funding of schools was significantly greater when the polling station was in a school than when it was in a nearby location. A separate experiment showed that exposing people to images of classrooms and school lockers also increased the tendency of participants to support a school initiative. The effect of the images was larger than the difference between parents and other voters! The study of priming has come some way from the initial demonstrations that reminding people of old age makes them walk more slowly. We now know that the effects of priming can reach into every corner of our lives.

Reminders of money produce some troubling effects. Participants in one experiment were shown a list of five words from which they were required to construct a four-word phrase that had a money theme ("high a salary desk paying" became "a high-paying salary"). Other primes were much more subtle, including the presence of an irrelevant money-related object in the background, such as a stack of Monopoly money on a table, or a computer with a screen saver of dollar bills floating in water.

Money-primed people become more independent than they would be without the associative trigger. They persevered almost twice as long in trying to solve a very difficult problem before they asked the experimenter for help, a crisp demonstration of increased self-reliance. Money-primed people are also more selfish: they were much less willing to spend time helping another student who pretended to be confused about an experimental task. When an experimenter clumsily dropped a bunch of pencils on the floor, the participants with money (unconsciously) on their mind picked up fewer pencils. In another experiment in the series, participants were told that they would shortly have a get-acquainted conversation with another person and were asked to set up two chairs while the experimenter left to retrieve that person. Participants primed by money chose to stay much farther apart than their nonprimed peers (118 vs. 80 centimeters). Money-primed undergraduates also showed a greater preference for being alone.

The general theme of these findings is that the idea of money primes individualism: a reluctance to be involved with others, to depend on others, or to accept demands from others. The psychologist who has done this remarkable research, Kathleen Vohs, has been laudably restrained in discussing the implications of her findings, leaving the task to her readers. Her experiments are profound—her findings suggest that living in a culture that surrounds us with reminders of money may shape our behavior and our attitudes in ways that we do not know about and of which we may not be proud. Some cultures provide frequent reminders of respect, others constantly remind their members of God, and some societies prime obedience by large images of the Dear Leader. Can there be any doubt that the ubiquitous portraits of the national leader in dictatorial societies not only convey the feeling that "Big Brother Is Watching" but also lead to an actual reduction in spontaneous thought and independent action?

The evidence of priming studies suggests that reminding people of their mortality increases the appeal of authoritarian ideas, which may become reassuring in the context of the terror of death. Other experiments have confirmed Freudian insights about the role of symbols and metaphors in unconscious associations. For example, consider the ambiguous word fragments W_ _H and S_ _P. People who were recently asked to think of an action of which they are ashamed are more likely to complete those fragments as WASH and SOAP and less likely to see WISH and SOUP. Furthermore, merely thinking about stabbing a coworker in the back leaves people more inclined to buy soap, disinfectant, or detergent than batteries, juice, or candy bars. Feeling that one's soul is stained appears to trigger a desire to cleanse one's body, an impulse that has been dubbed the "Lady Macbeth effect."

The cleansing is highly specific to the body parts involved in a sin. Participants in an experiment were induced to "lie" to an imaginary person, either on the phone or in e-mail. In a subsequent test of the desirability of various products, people who had lied on the phone preferred mouthwash over soap, and those who had lied in e-mail preferred soap to mouthwash.

When I describe priming studies to audiences, the reaction is often disbelief. This is not a surprise: System 2 believes that it is in charge and that it knows the reasons for its choices. Questions are probably cropping up in your mind as well: How is it possible for such trivial manipulations of the context to have such large effects? Do these experiments demonstrate that we are completely at the mercy of whatever primes the environment provides at any moment? Of course not. The effects of the primes are robust but not necessarily large. Among a hundred voters, only a few whose initial preferences were uncertain will vote differently about a school issue if their precinct is located in a school rather than in a church—but a few percent could tip an election.

The idea you should focus on, however, is that disbelief is not an option. The results are not made up, nor are they statistical flukes. You have no choice but to accept that the major conclusions of these studies are true. More important, you must accept that they are true about *you.* If you had been exposed to a screen saver of floating dollar bills, you too would likely have picked up fewer pencils to help a clumsy stranger. You do not believe that these results apply to you because they correspond to nothing in your subjective experience. But your subjective experience consists largely of the story that your System 2 tells itself about what is going on. Priming phenomena arise in System 1, and you have no conscious access to them.

I conclude with a perfect demonstration of a priming effect, which was conducted in an office kitchen at a British university. For many years members of that office had paid for the tea or coffee to which they helped themselves during the day by dropping money into an "honesty box." A list of suggested prices was posted. One day a banner poster was displayed just above the price list, with no warning or explanation. For a period of ten weeks a new image was presented each week, either flowers or eyes that appeared to be looking directly at the observer. No one commented on the new decorations, but the contributions to the honesty box changed significantly. The posters and the amounts that people put into the cash box (relative to the amount they consumed) are shown in figure 4. They deserve a close look.

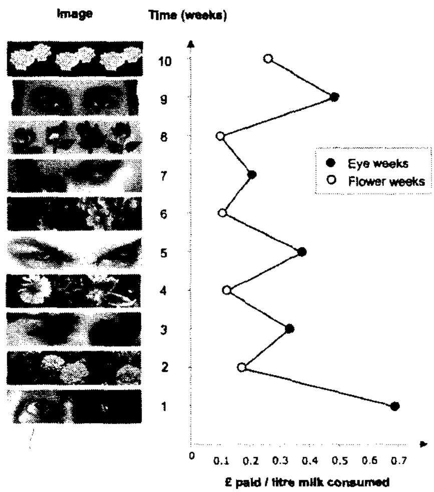

Figure 4

On the first week of the experiment (which you can see at the bottom of the figure), two wide-open eyes stare at the coffee or tea drinkers, whose average contribution was 70 pence per liter of milk. On week 2, the poster shows flowers and average contributions drop to about 15 pence. The trend continues. On average, the users of the kitchen contributed almost three times as much in "eye weeks" as they did in "flower weeks." Evidently, a purely symbolic reminder of being watched prodded people into improved behavior. As we expect at this point, the effect occurs without any awareness. Do you now believe that you would also fall into the same pattern?

Some years ago, the psychologist Timothy Wilson wrote a book with the evocative title *Strangers to Ourselves*. You have now been introduced to that stranger in you, which may be in control of much of what you do, although you rarely have a glimpse of it. System 1 provides the impressions that often turn into your beliefs, and is the source of the impulses that often become your choices and your actions. It offers a tacit interpretation of what happens to you and around you, linking the present with the recent past and with expectations about the near future. It contains the model of the world that instantly evaluates events as normal or surprising. It is the source of your rapid and often precise intuitive judgments. And it does most of this without your conscious awareness of its activities. System 1 is also, as we will see in the following chapters, the origin of many of the systematic errors in your intuitions.

SPEAKING OF PRIMING

"The sight of all these people in uniforms does not prime creativity."

"The world makes much less sense than you think. The coherence comes mostly from the way your mind works."

"They were primed to find flaws, and this is exactly what they found."

"His System 1 constructed a story, and his System 2 believed it. It happens to all of us."

"I made myself smile and I'm actually feeling better!"