5

Consciousness

Consciousness is one of the most mysterious aspects of being human. Every normal person is aware of being alive and of having a mental life. Most of us do not believe, however, that things like rocks and machines are conscious; we wonder about which animals may have consciousness and what sort they may have.

We all know what consciousness means until we try to study it. We are reminded of Supreme Court Justice Potter Stewart who said that he couldn't define pornography, but he knew it when he saw it. When we try to define *consciousness*, we find that the term is used in several distinct, albeit related, senses (Farthing, 1992):

1. *Consciousness as wakefulness.* We speak of being conscious as opposed to unconscious, distinguishing wakefulness from sleep or coma.
2. *Consciousness as voluntary action.* We say that certain actions are conscious in the sense of voluntary, as when we say that we consciously reach for a bite of food; our digestion of that food, however, will not require conscious attention.
3. *Consciousness as awareness.* We speak of being conscious of something, as you are conscious of the fact that you are reading a book that is in front of you right now or that you have a mosquito bite on your left hand.

Any unabridged dictionary will list other uses of the term consciousness; but we can see from this list that consciousness is used to refer to a number of different features of our behavior and experience.

We will not spend any more time trying to define consciousness, because it is a mistake to suppose that we need a complete definition of a term or concept in order to study it. In fact, one of the reasons we study something is so we can make a better definition of it. Biologists study life without worrying too much about exactly what constitutes life. Following normal scientific practice, we discuss some aspects of consciousness about which we can make testable predictions.

Trail Marker: Scientists are able to study consciousness even though they do not have a complete definition of it.

We consider examples of each of the above three senses of consciousness. First, we consider something that we spend approximately a third of our lives doing: sleeping.

CONSCIOUSNESS AS WAKEFULNESS: WHY DO WE SLEEP?

> Why we sleep has puzzled thinkers at least since the time of Aristotle. Lab shelves sag beneath volumes of data, yet no one has discerned that sleep has any clear biological function. Then what evolutionary pressure selected this curious behavior that forces us to spend a third of our lives unconscious? Sleeping animals . . . have less time to search for food, to eat, to find mates, to procreate, to feed their young. As Victorian parents told their children, sleepy-heads fall behind—in life and evolution. (Chet Raymo, 1988, as quoted by Dennett, 1995, p. 339)

One evolutionary clue to the function of sleep is provided by the fact that night and day divide any piece of real estate into very different ecological niches. There is a big difference in the amount of light, obviously, but also in temperature and humidity. An evolutionist would expect different animals to evolve to fill these different niches. A hypothetical animal that was designed to function equally well in the day and at night would be outcompeted in the daytime by animals with better vision or better ability to withstand heat; it would be outcompeted at night by animals with better hearing or that are better adapted to dampness. One logical idea, then, is that sleep functions to keep animals quiet and out of harm's way during the part of the 24-hour cycle to which it is not adapted, the part that constitutes a different ecological niche occupied by another organism.

A testable prediction is that diurnal (daytime) creatures should sleep more in the winter and less in the summer. This effect is well known for many animals but has only recently been demonstrated in humans. Studies of people going about their normal routines show small and inconsistent results, probably because electric lighting permits us to escape the limitations of sunshine. A controlled study in which volunteers remained in the laboratory under controlled light conditions showed that they slept three hours longer when there were 14 hours of darkness and 10 of light, compared to when there were 8 hours of darkness and 16 of light (Wehr, Moul, Barbato et al., 1993). Consistent with this explanation is that blind cave fish, adapted to living completely inside dark caves, do not sleep (Pitcher, 1993).

But Daniel Dennett (1995) turns the question of why we sleep on its head. In the light of evolution, he says, the real question is, why are we ever awake? Being awake is costly: Even when resting, an awake person consumes about 10 to 30 percent more calories per hour than when asleep (Carskadon, 1993). We need to be awake to find food and to mate and do many other essential tasks, some of which can increase our energy consumption up to 10 times resting level; but otherwise we should sleep to conserve energy. "Powering down" by 25 percent for 8 hours a day can be the difference between life and death, or between fertility and infertility, for hunter-gatherers when food is scarce.

We are familiar with the phenomenon of hibernation by which certain animals drastically reduce their metabolism during the winter when food is scarce and activity is metabolically expensive. Other animals use a similar strategy during hot or dry spells. Some desert frogs, toads, and fish lie buried in mud during the dry season in a state of estivation for most of the year. They become active and reproduce during the brief wet season, only to estivate until the next rainy season. During droughts, they may estivate for several years. Even squirrels estivate when it is hot and dry.

The percent of time spent sleeping varies widely among animals. Because small animals have higher metabolic rates, they pay a relatively heavier price than larger animals do for being active. Thus, it is not surprising that small animals sleep more than large animals (Carskadon, 1993).

Predators, such as cats, tend to eat very large meals when they make a kill, and they sleep much of the rest of the time. (See Figure 5–1.) Moreover, predators can sleep deeply because they are relatively safe when asleep. Grazers, who are among the prey of large cats, sleep little and lightly. Woody Allen said that "the

Figure 5–1. *Lion sleeping.* Larger animals and predators sleep more than smaller ones and prey animals.

lion and the lamb shall lie down together, but the lamb will not be very sleepy." (*Love and Death*, 1975, as cited by Myers, 1998)

CONSCIOUSNESS AS VOLUNTARY ACTION

The next aspect of conscious that we consider is consciousness as voluntary action. The simple fact that we are conscious and generally in control of our actions causes most of us to assume that consciousness plays the primary role in everyday life. Most of us assume that our behavior is largely controlled by conscious mechanisms and that our thought processes are constantly available to consciousness. This assumption underlies much of ordinary human social interaction. If a man strikes us with his fist, we assume he was not only aware of what he did but did it on purpose. You may recall an obnoxious kid in grade school who bumped into you in the hallway, causing you to drop your books, and then said in mock innocence, "Oops, sorry. It was just an accident—no hard feelings." You did your own calculation of whether he did it on purpose. Our legal system is based on the same sort of calculation; it makes conscious intent the basis for distinguishing between accidental homicide and murder. The difference means freedom or a life spent in jail. These experiences make it difficult for us to accept that consciousness is but the tip of our psychological iceberg. Laypersons are not alone in overestimating the role of consciousness in the control of behavior. As John Bargh and Tanya Chartrand say, "Much of contemporary psychological research is based on the assumption that people are consciously and systematically processing incoming information in order to construe and interpret their world and to plan and engage in courses of action. . . . The authors [of this quote] question this assumption" (Bargh & Chartrand, 1999, p. 462).

Not Everything We Do or Think Involves Consciousness

One of the main functions of consciousness is to permit us to focus neural resources on novel problems and let routine ones be handled automatically. As we have already discussed, organs and functions incur metabolic costs. We would expect to find conscious control of behavior only when its benefits outweigh its costs. When something can be done automatically, without consciousness, it should be.

> The unconscious operations of the mind frequently far transcend the conscious ones in intellectual importance. . . . [The position of consciousness] appears to be that of a helpless spectator of but a minute fraction of a huge amount of brain work.
>
> —Francis Galton, quoted by Karl Pearson, 1924, p. 236.

What are some things we do without engaging our consciousness? Recall our discussion in Chapter 4 that the purpose of perception is to guide action. One action that is of great importance and that we do a lot of is walking. Walking without falling down requires our sense of balance, which is largely mediated by our **vestibular system,** an organ closely associated with the sense of hearing. It is well established that the vestibular system operates mostly outside of consciousness; it ordinarily works by means of reflexes. We walk and do all sorts of things without any conscious awareness of the whereabouts and actions of our limbs. So, here we have a sense that does not usually involve any conscious sensations!

Trail Marker: Voluntary behavior does not always operate by way of conscious sensations.

We generally become conscious of the details of our motor movements only under certain circumstances. One such situation is when our reflexes fail us, as when our leg "goes to sleep," when we are intoxicated, when we become dizzy by spinning around, or from diseases such as Meniere's. We also pay attention to our motor movements when we must perform unfamiliar tasks or try to learn new ones. Occasionally, we are self-conscious about our motor movements, as when we walk into a room of people who seem to be watching our every step. The rest of the time, we have better things to do with our limited consciousness.

In fact, the single most common voluntary human behavior is the eye movements we make as we look around (e.g., Monty, 1976). Until only about 130 years ago, when scientists first began recording eye movements, people thought we move our eyes smoothly from place to place as we look around, the way a camera pans a scene. Instead, **saccadic eye movements,** as they are known, have a particular, stereotyped form: a fast, ballistic movement to a location followed by a fixation. The most basic fact about the most common thing we do was completely unknown to anyone until fairly recently. In other words, while we may consciously look at something, we are not conscious of the actions we perform in doing so.

As another example, how do you turn right on a bicycle? Over the years we have asked thousands of students in dozens of classes this question. Without fail, they answer that you turn the handlebars to the right. When we point out that this will cause the rider to fall off the bike to the left, they suggest you first lean to the right and then turn right. Of all those thousands of students, no one has ever correctly described the maneuver, which is to first turn to the *left,* causing you to lean to the right (see Figure 5–2). Only then is it possible to turn to the right, bringing the bike under you as you make the turn to the right. Believe us, you cannot turn right on a bicycle without first turning left. Better yet, try it for yourself (but be careful). This fact is what makes it so hard to stay on the pavement when you are riding on the very edge of it, for example.

We assume that all of those students who could not describe how to turn right on a bicycle could actually ride a bike perfectly well. They could turn right on a bicycle, but they could not *describe* how to turn right. This maneuver, although well learned, does not require consciousness and may not be available to it. There are countless other examples.

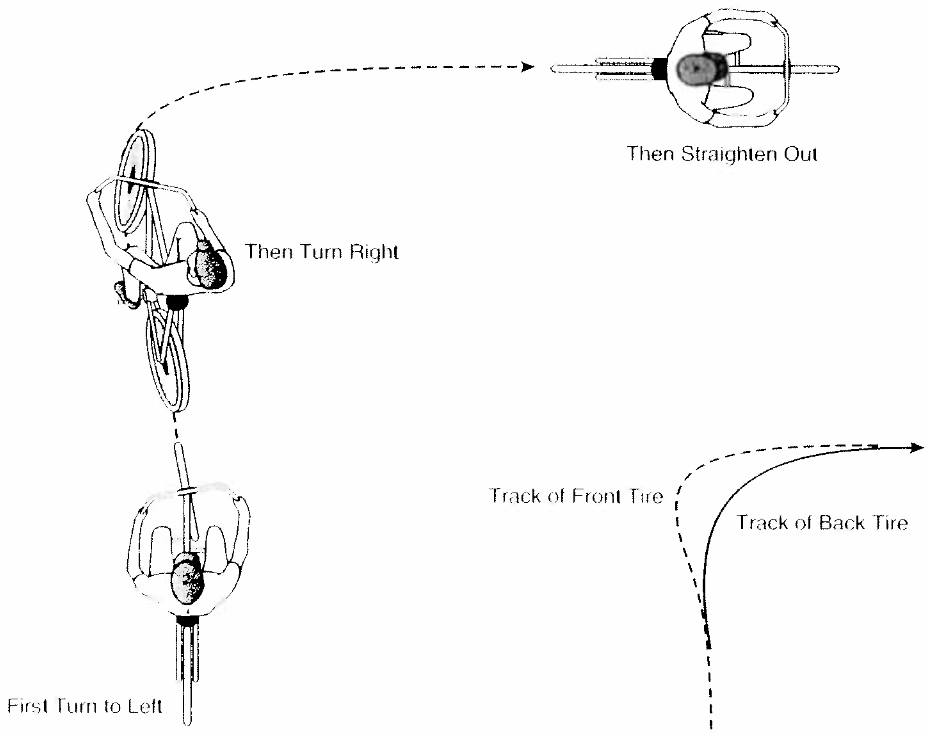

Figure 5-2. *Bird's eye view of turning right on a bicycle.* Before turning right, the rider turns the handlebars to the left, causing the bike to lean, and permitting the rider to execute the turn without falling off. Inset shows the tracks made by the front (dashed line) and rear (solid line) tires.

Many Cognitive Processes Are Unavailable to Consciousness. The previous section showed that much of what we do does not require consciousness. This section extends that point to show that some cognitive processes plainly are unavailable to consciousness under any circumstance. What was your mother's maiden name? The answer to this question just popped into your head without your having the slightest clue *how* you accomplished it. It does not matter whether you imagine your memory to be like a filing cabinet, a computer network, or a giant laundry pile. Your belief about the matter has no effect whatever on the way your memory works.

A great deal of our mental life takes place without the benefit of consciousness. We perceive speech, see colors, judge depth and distance, and solve many kinds of problems using the **cognitive unconscious** (Kihlstrom, 1987). (This term has nothing to do with Freudian notions of the unconscious; it simply refers to cognitive processes that are not available to consciousness.) Processes that are part of the cognitive unconscious are not only unavailable to consciousness, they are not affected in any way by what we believe—about the world, the brain, or how it works.

Trail Marker: Scientists use the term *unconscious* in a way that has nothing to do with Freudian notions.

Consider the famous Müller-Lyer illusion, shown in Figure 5–3. Although the two horizontal lines are identical in length, they look considerably different. Even after you know the lines are the same length—even if you measure them with a ruler, which we hope you do—even if you have known about this illusion for 40 years, as we have—the two lines still look unequal. All those processes that take place in the cognitive unconscious, including the Müller-Lyer illusion, have the property of **cognitive impenetrability;** they are inaccessible to consciousness and are unaffected by it. (In case you are wondering why evolution would build a mechanism that fools us about the world, the leading theory of this illusion is that it is a quirk of the mechanism by which we normally and accurately perceive size and depth.)

Evolutionary thinking leads us to expect that we should make use of consciousness only when its benefits outweigh its costs. This explains why a host of behaviors take place outside of consciousness, including chewing without biting our tongues and swallowing without choking. You are reading this book without paying the slightest attention to staying upright, swallowing your saliva, and blinking your eyes. Behavior should not be equated with consciousness.

Some Behaviors Are Conscious While They Are Being Learned, but Become Lost to Consciousness. It is possible (although doubtful) that people are consciously aware they need to turn left before turning right on a bicycle while they are learning to ride, and lose awareness of this as they become more skilled. Nevertheless, some actions are conscious when we are learning them only to be lost when they become automatic. As I (DMcB) sit and type this sentence, I am totally unable to say which letters are located on either side of the *R* on the keyboard. Yet

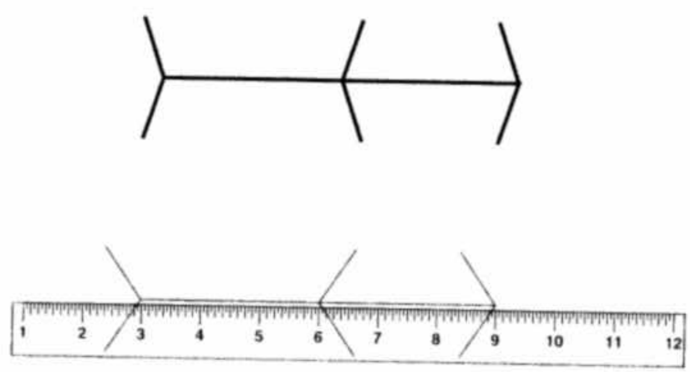

Figure 5–3. *Müller-Lyer Illusion.* Knowledge that the two horizontal lines are actually the same length does not affect the illusion.

I am a skilled typist; I can type any word containing the letter *R* effortlessly. It is likely that when I was learning to type, I memorized the layout of the keyboard and could tell you that *R* lies between *E* and *T*. (I just peeked.)

Psychologists distinguish between *controlled* and *automatic* processing (Schneider & Shiffrin, 1977; Shiffrin & Schneider, 1977). Controlled processes require our conscious attention, and we perform them slowly and effortfully. Further, we are easily distracted while engaged in controlled processing. Controlled processing is typical of tasks that we are only beginning to learn, such as our first efforts at typing or driving a car. You may recall that when you first learned to drive a car, whenever you changed stations on the radio, the car seemed to wander off the road because you could not concentrate on steering and tuning at the same time.

After considerable practice, these tasks become automatic: We do them rapidly, effortlessly, and simultaneously with other tasks. A skilled driver can drive while carrying on a conversation and listening to the news on the radio. Driving becomes so automatic that most drivers have occasionally realized that they have driven for several miles without being aware of driving at all. Similarly, I have known typists so skilled they could engage in complicated conversations at the same time they were transcribing a manuscript.

We save enormous amounts of time and effort by routinizing the tasks we do every day. Let's see, do I put on my socks before or after I put on my shirt? Where did I leave my keys?

Consciousness Is Not Required for Learning to Take Place. Conscious attention is required to master some tasks, such as typing or driving a car, but you should not assume that this is always true. One of many examples of this point is given by the work of Ralph Hefferline and his colleagues (Hefferline, Keenan, & Harford, 1959) who had human subjects learn to turn off an annoying noise that interfered with their listening to music. They placed recording electrodes in several places on their body, but did not tell subjects what it was they could do to turn off the noise. What actually turned off the noise was a tiny twitch of the thumb so small that subjects could not even do it on purpose. If they so much as thought about it, they made too big a twitch to count. Nevertheless, subjects learned to turn off the noise. Some subjects were not even told they could turn off the noise, and they learned to do it anyway. One subject thought that he (or she—we aren't told which) was controlling the noise by doing various actually irrelevant things, such as wriggling his ankles, holding his jaw in a certain position, making subtle rowing motions with his wrists, and breathing carefully. All the subjects learned to turn off the noise except for those who tried to move their thumbs—they could not make a small enough response. This classic experiment illustrates vividly that learning can take place outside of consciousness.

Trail Marker: Learning can take place outside of consciousness.

Arthur Reber (1992) makes a strong case that a considerable amount of *implicit learning* takes place outside of awareness, when we are not even conscious that we are learning anything. Implicit learning can be thought of roughly as learning *how* rather than *what*. It is more like learning a skill than a set of facts. It is more like learning to ride a bicycle than learning the laws of physics that the bicycle obeys.

We learn our native tongue effortlessly and speak it without giving a thought to the rules of grammar. Young children (3 to 5 years old) say that a monster that eats mice is a *mice eater*, but one that eats rats is a *rat eater*, not *rats eater* (Gordon, 1986). It is extremely unlikely that children learn this rule by imitating adults who talk about rat eaters. Nevertheless, they unconsciously follow a rule that is so subtle that neither they nor adults can articulate it: It is ungrammatical in English to form compounds with *regular* plurals (e.g., "cats-breeder" or "wines-collector"), but it is perfectly grammatical to do so with *irregular* plurals (e.g., "men-hater" or "cattle-farmer").

We learn innumerable practical skills:

which way to turn the key in the front door
which way to turn the faucet
how hard to step on the brake
how to swing a golf club
how far to lower yourself before putting your weight on the sofa
how fast to pour the milk from the carton
how to turn right on a bicycle

We also learn innumerable social skills and attitudes:

how and when to flirt
how close to stand to someone we are talking with
how to take turns in conversation
when to talk to strangers
how loud to converse in public places
when to use bad words
political opinions
prejudices toward outgroups

We learn all of these things without the slightest awareness that we are doing so. We are not even aware that we have learned the feel of the brake until we have trouble driving a different car. We are not aware of how the faucet works until we scald ourselves on a different model. We are not aware that we have learned how to sit down until we drop too far into a different sofa. Similarly, we do not realize we have learned the social skills, attitudes, and prejudices until we embarrass ourselves by blurting out something inappropriate.

Implicit learning is particularly important in many kinds of expertise. A physician ordinarily makes a diagnosis quickly and effortlessly without consciously thinking through all the possibilities and ruling out the alternatives. In one study

(Carmody et al., 1984, as cited by Reber, 1992), radiologists were observed while they taught medical students how to read chest X-rays. The experts gave the students clear and explicit instructions on how to locate tumors. A camera that recorded the experts' eye movements, however, revealed that the experts were basing their own judgments on other criteria, of which they were totally unaware. The students, of course, remained ignorant of these criteria.

To be fair, we should mention that some psychologists believe that awareness *is* required for learning (e.g., Shanks, 1996). They base their belief on classical conditioning experiments in which people learn a connection between two stimuli, such as a tone and a puff of air to the eyeball. In these experiments it is sometimes found that only those subjects who realized there was a connection between the two stimuli actually learned the task. We will not review the debate here, but simply note that recent evidence favors the position that awareness is not necessary in classical conditioning (Papka, Ivry, & Woodruff-Pak, 1997).

Evolutionary considerations make it highly improbable that consciousness is required for learning. For one thing, it drives a wedge between learning in humans and other organisms. We do not assume that the consciousness of planaria (a kind of worm) and digger wasps approaches that of humans, but they learn nevertheless. Second, it pays too much attention to what we are conscious of and ignores the host of processes that take place without benefit of consciousness.

CONSCIOUSNESS AS AWARENESS

The previous section gives us one answer to the question of what consciousness is for: It permits us to focus attention on novel problems and let routine ones be handled outside of consciousness. Considering consciousness as awareness gives us another evolutionary insight into consciousness. As we said in Chapter 4, perception could not have evolved just to provide useless knowledge. Similarly, consciousness could not have evolved just to permit us to ponder the meaning of life, the universe and everything. Selection would have weeded out any genes that caused us to waste energy on such pursuits when alternative alleles were causing our competitors to search for food and mates, and avoid predators.

The Unity of Consciousness

We become aware of many psychological processes only when they fail. Examples we have mentioned already include our sense of balance and the ability to recognize faces. We do not give them a thought unless we get dizzy or suffer from prosopagnosia. The unity of consciousness is another ability we take for granted. We assume that we are a single person, not a collection of independent modules. We also assume that the world we live in is one world, not a different, parallel universe for each sense.

The unity of consciousness, although seldom a problem in everyday life, is a problem for psychology. Recall that we have emphasized a number of times that evolution crafts adaptations, which operate as separate brain modules. How do these modules work together? We consider the problem in two parts: the unity of the world and the unity of the self.

When you take a bite of a barbecued potato chip, you see the golden brown color, taste the saltiness, smell the spices, feel the crispness, hear the crunch, and experience the pain from the red pepper. (Red pepper stimulates pain, not taste.) Eating food is a multisensory experience; yet you perceive a potato chip, not six (or more) separate sensory experiences. Change any one attribute of the potato chip and it will "taste" different. How do we integrate all of that information into a single, unified percept? This is known as the **binding problem** and has bothered thinkers since the time of the ancient Greek philosophers. Aristotle's solution to the binding problem was to postulate the existence of **the common sense.** Aristotle's idea of common sense is not what keeps us from trying to roast a marshmallow by holding it in the fire with our bare hands. The common sense is a super sense that unifies all the information from the different senses. We can perceive a big dog because it looks big, makes a big noise when it barks, feels big to our hands, or because it is heavy to lift.

> "It matters little through which sense I realize that in the dark I have blundered into a pig-sty."
>
> —Hornbostel, 1925, as cited by Marks, 1974, p. 5

We can say that no organ of common sense has been located in the brain. There are, to be sure, places in the brain that respond to more than one type of sensory input, but there is no super sense where information from all the other senses goes. We do, however, have some hints about how the brain accomplishes the astonishing task of unifying the input from different senses.

For many years, some philosophers held that touch is the fundamental sense because it is in actual contact with the world. When we look at a stone, our only contact with it is by the light rays that bounce off it to our eyes. But when we stub our toe on the rock, our body comes into direct physical contact with it. For this reason, these philosophers held that "touch educates vision." They thought we learned to see things according to how they felt to touch. The case is actually the reverse, however.

It is easy to put vision and touch into conflict, although everyday examples are few. When we look through prism lenses, straight lines look curved. Surprisingly, if we feel a straight edge while looking through the distorting prisms, it feels distinctly curved. This phenomenon is called **visual dominance,** or **visual capture.** You may get some idea of this by feeling some object while looking at it through the wrong end of binoculars. Vision dominates other senses besides touch. Any time you watch a movie, you are experiencing visual dominance over audition if you perceive the sound to be coming from the actors' mouths. Of course, the sound is actually coming from the speakers, which are many inches to several feet away from where the voices appear to emanate. (This is the basis of ventriloquism. The ventriloquist doesn't "throw" his voice. The dummy captures it.)

It appears that evolution has solved the problem of the unity of the senses in large part by the mechanism of visual dominance, suppressing any information that conflicts with vision, even when vision is wrong. Of course, in the real world conflicts between vision and the other senses seldom arise, so evolution has solved the problem of the unity of the senses in a manner that seldom causes us problems. We will deal with the other half of the question of the unity of awareness—unity of the self—after we have discussed self-awareness, to which we turn next.

Self-Awareness

One of the most important things that we humans are conscious of is ourselves. We are aware that we are distinct from the rest of the world:

> It hurts when you bite yourself but not someone else.
>
> Wherever you go, there you are.
>
> Other people act as if you do things on purpose.
>
> You are admonished to do unto others as you would have them do unto you.

Richard Dawkins (1989) suggests that self-awareness evolved because it is helpful for us to make ourselves the objects of our thought. For example, What did I do to make my neighbor angry at me? Is that tree branch strong enough to hold me?

In fact, Daniel Povinelli and John Cant (1995) propose it was exactly the problem of swinging through the branches that led to the evolution of consciousness in the larger arboreal primates. Consider that differences in physical size have important consequences for the way animals interact with the environment. A spider that drops 20 feet floats to the ground; a squirrel bounces; an elephant splats. Further, a very small animal is supported by almost any surface, but a larger one will cause many objects to bend or break.

Povinelli and Cant note that smaller primates such as monkeys run on all fours through the forest canopy in a stereotyped manner that suggests they do not pay much attention to the strength of the branches and vines that support them. Larger primates such as orangutans, however, show much more variability in their behavior. They generally clamber rather than run through the canopy—hanging from branches, bridging from one limb to the next, and causing the tree to sway so as to bring them closer to their next means of support. See Figures 5–4 and 5–5.

Povinelli and Cant propose that the demands of locomotion through the canopy led to the development in the larger primates of the ability to think of themselves as an object that interacts with the world. This notion is admittedly speculative, but it has the advantage of making testable predictions. It predicts that orangutans and chimpanzees will pass certain tests for self awareness that monkeys will fail.

One such test is the mirror test. A wide variety of animals react to mirrors. Some animals, including fish and birds, will attack their image, as if it were a rival,

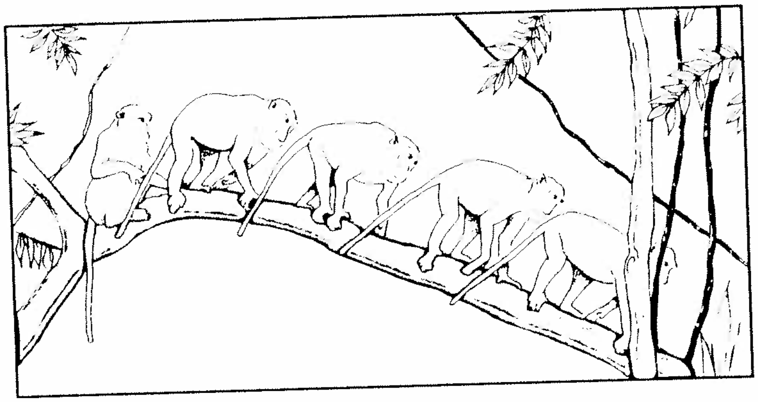

Figure 5–4. *Monkey running through tree.*

suggesting they are unaware they are looking at themselves. After a while these animals may come to ignore the mirror. Some primates, on the other hand, will gaze raptly into a mirror. What are they thinking? An orangutan or a chimp that has looked at a mirror for a while begins to use it to examine parts of the body that they cannot normally see, such as their teeth and their hindquarters. This behavior strongly suggests that they are aware they are looking at themselves. See Figure 5–6.

Gordon Gallup (1977, 1991) tested this hypothesis by painting a red dot on the forehead and ear of primates while they were anesthetized, so they would not have any way of knowing the dot was there. When they came to, chimps and orangutans showed great interest in the dots while looking in the mirror, touching them and rubbing at them. Monkeys, however, did not.

The one large ape that fails the mirror test for self-awareness is the gorilla. Consistent with Povinelli and Cant's hypothesis, the gorilla is terrestrial and does not ordinarily climb more than a foot or two off the ground.

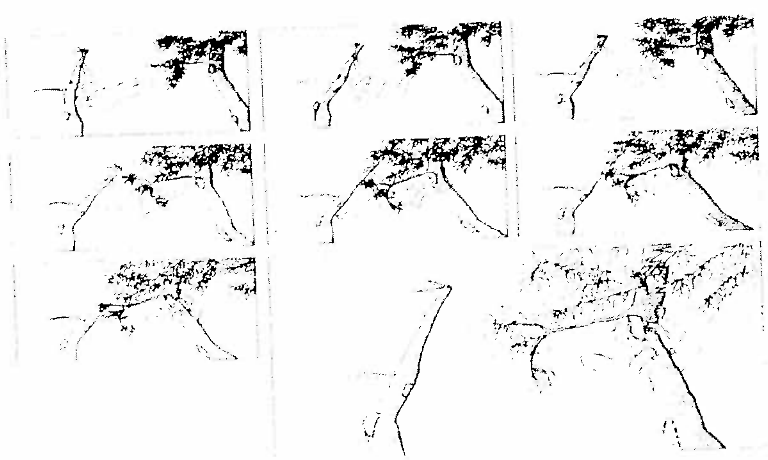

Figure 5–5. *Ape clambering through tree.*

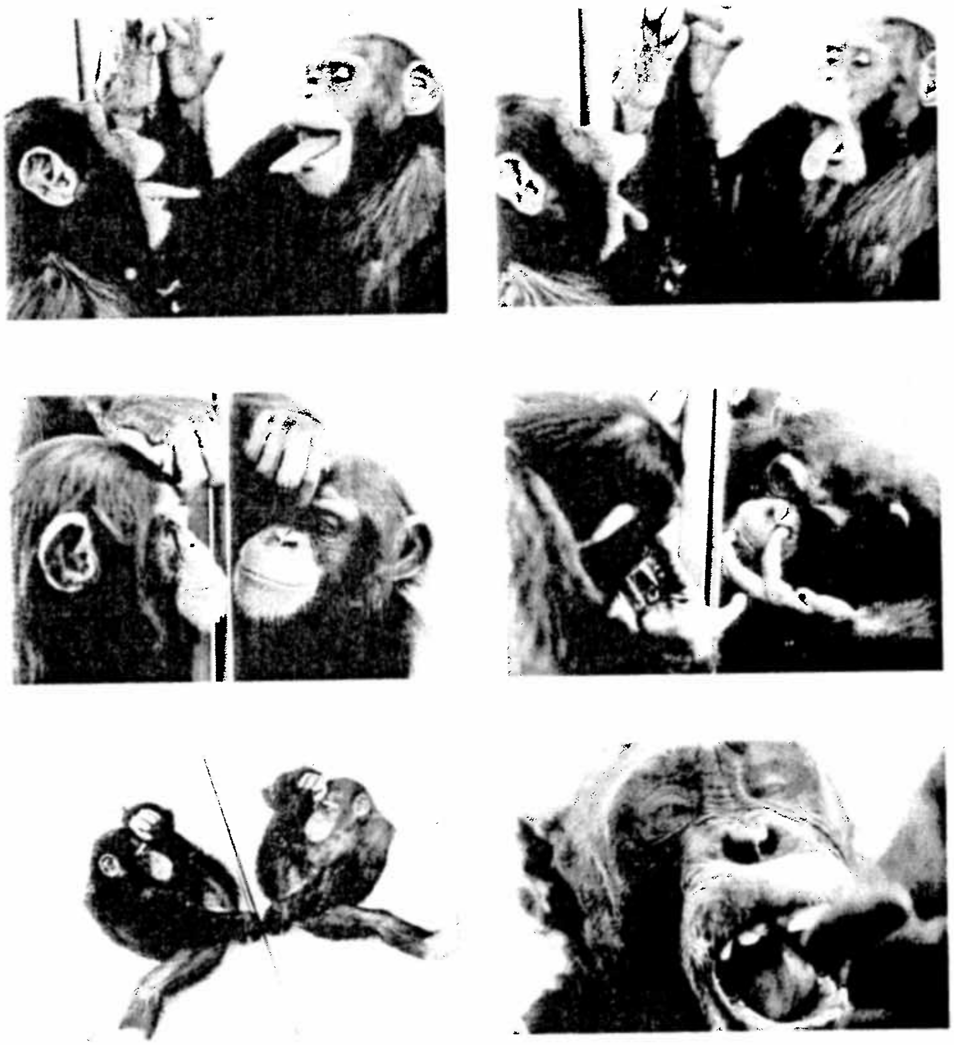

Figure 5–6. *Chimp using mirror for self-exploration.*

It may have occurred to you that humans do not swing through trees on a regular basis outside of Tarzan movies. Does Povinelli and Cant's hypothesis have any relevance to humans? It is important to realize that organs that evolve for one purpose are often further taken over later for another purpose. For example, according to one popular theory, wings of insects evolved from structures that originally served in thermoregulation (Kingsolver & Koehl, 1985). Similarly, the three little bones in the middle ear of mammals that transmit sound to the inner ear evolved from the jaw bones of fish.

Trail Marker: Organs that evolve for one purpose are often later adapted for an entirely different purpose.

So, once self-awareness evolved to serve some purpose in a hominid ancestor, it could have been further adapted for other purposes. Because humans are highly social creatures, it is likely that self-awareness was then turned to serve functions such as asking questions like, "Why does my neighbor refuse to share meat with me? Is it because I failed to share my last kill with him?" The complex social life of humans creates many situations in which self-awareness would be useful.

Unity of the Self, Deception, and Self-Deception

We discussed the unity of the world earlier. Here we discuss the conviction that we each have that we are a unified person, which is the other half of the concept of the unity of consciousness. (We are talking about normal people, not those with personality disorders.) But normal people often behave in ways that make us wonder whether they are aware of how they appear. A middle-aged man who is spreading at the waist dyes what is left of his hair and wears a muscle shirt. A middle aged woman dresses like a teenager. How could they look in the mirror and not cringe? Such human foibles prompted the Scottish poet, Robert Burns, to exclaim,

> Oh wad some power the giftie gie us
> To see ourselves as others see us!

The puzzle of self-deception has intrigued psychologists as well as poets. Much research and theorizing on the matter has been based on Freudian psychodynamics. Perhaps this is the reason psychologists have made little progress in understanding self-deception! A classic paper was entitled, "Self-deception: A concept in search of a phenomenon" (Gur & Sackheim, 1979). The problem with the concept of self-deception is that the deceiver and the deceived are the same person. How can a person logically believe two opposite things at the same time? The Freudian answer is that one belief is conscious and the other is relegated to the unconscious. Attempts to demonstrate the presence of the two beliefs at the same time in the same person, however, have not been persuasive.

Evolutionary thinking suggests that psychologists may have been barking up the wrong tree. For one thing, the concept of a unitary self as a single, integrated entity should not be taken for granted. Although our consciousness tells us that we are a unitary self, we may well be mistaken. Remember that consciousness does not have access to everything; we can ride a bicycle but cannot say how we do it. There are also clear examples of inner disharmony. We have all said things like, "I have half a mind to dye my hair," or "Half of me wants to shave my beard and the other half doesn't." These remarks reflect a reality about the human mind. That the mind is modular should suggest that different modules may well have different, and conflicting, goals. Further, the existence of the cognitive unconscious implies that we will not always be aware of these conflicting inclinations.

In a telling example, Michael Gazzaniga and Joseph LeDoux (1978) describe the case of a patient, P.S., a young boy who had the two halves of his brain surgically separated to alleviate a serious medical condition. In most split-brain patients the left hemisphere is in control of speech, whereas the right hemisphere is unable to speak. P.S. was unusual in that his right hemisphere, although mute, was able to read and write. When Gazzaniga asked P.S. what he wanted to be when he grew up, he said, "draftsman." When he presented the written question to only the right hemisphere of P.S.'s brain, P.S. spelled out "race car driver."

The fact that P.S.'s two different hemispheres have different thoughts and actions is only half the story. His speaking left hemisphere often made up explanations for the actions of his right hemisphere. In one experiment, a picture of a winter snow scene was shown to his nonspeaking right hemisphere while the speaking hemisphere saw a chicken foot. The hand controlled by the speaking hemisphere correctly matched a chicken to the chicken foot; the hand controlled by the nonspeaking hemisphere correctly matched a snow shovel to the snow scene. When Gazzaniga asked P.S. what he saw, he said, "I saw a claw and picked the chicken, and you have to clean out the chicken shed with a shovel" (p. 148). Time after time, P.S. instantly made up stories like this to explain what he saw his two hands doing. The term for this sort of behavior is **confabulation,** which means filling in gaps in memory or knowledge by fabrication. It is not the same as lying, because the confabulator is unaware that the story is anything other than factual. Confabulation is common in certain psychiatric disorders. Other examples from Gazzaniga and LeDoux's study include a split-brain patient whose nonspeaking hemisphere was given the command to laugh. When asked why she had laughed, she said without hesitation, "Oh, you guys really are something!" (p. 146).

Split-brain patients are not normal, of course, but the sobering implication of the split-brain research is that we all confabulate constantly. Gazzaniga and LeDoux argue that all people contain a set of selves, or modules, each with its own desires and motives. Marvin Minsky (1986) has called this idea the *society of mind.* Gazzaniga and LeDoux say that in all normal people the verbal system gains control over the other mental processes to the extent that it becomes the only self that we are aware of. In other words, the self that we know is the verbal self. Other selves exist outside of our ability to verbalize. According to this view, the unity of the self is an achievement, not a given. More recently, Gazzaniga has called this system the interpreter mechanism (Gazzaniga, 1998). We find ourselves yawning, and we say, "I'm really tired." Or we eat a big meal and say, "I was really hungry." We explain or interpret our own behavior both to ourselves and to others. We are doing far too many things at once to monitor them all consciously. We (our interpreter mechanism, that is) freely make up stories that give our actions consistency.

Trail Marker: The unity of the self is an accomplishment, not a necessity.

Anthony Greenwald (1988) takes a different approach to solving the problem of self-deception. He agrees that the Freudian approach involves a paradox: The same person both knows and does not know at the same time. But he believes that giving up the concept of unity of the self is too drastic. How can we get around that problem? He suggests that the Freudian approach sees the unconscious as having the same ability to understand, except of course that it is unconscious. Instead, Greenwald proposes that unconscious processes (there are many of them) have very limited abilities. They do only a preliminary analysis of information and pass the results on to later, more conscious processes. They can reject information without analyzing it completely. He calls this the *junk-mail model* of self-deception. We receive a great deal of junk mail along with important mail. Although advertisers are very clever in disguising junk mail as important information ("You are guaranteed to be a winner!"), we discard junk mail without reading it by relying on clues such as a lack of first-class postage.

According to the junk-mail model, we first analyze the message according to low-level clues (e.g., presence of a first-class stamp). If it passes these criteria, we open it and read the message. The junk-mail model explains how the middle-aged man can wear the muscle shirt. (Don't look in the mirror.) It explains how we can ignore signs of serious illness. (It's probably just a cold.) We believe the junk-mail model avoids the problems of the Freudian model, which must assume two intelligent processes, one conscious and the other unconscious. At the same time, however, we believe that the society-of-mind model is supported by a wide range of cognitive phenomena.

A second idea about self-deception suggested by evolutionary thinking is that accurate perception of ourselves is not always the best thing. To be sure, our perceptions must be close to reality. A 95-pound weakling who thinks he can beat up a linebacker does not become anyone's ancestor. But maybe there is an advantage to be gained by seeing yourself as a little better than you are. That middle-aged man in his inappropriately youthful clothes might just get lucky with the right woman. If two women of similar attractiveness are competing for the same man, the one whose ego is inflated the right amount may try harder and persist longer enough to win out.

Psychologists use the term **self-serving bias** to describe our strong tendency to see ourselves as above average. A large body of social psychological findings presents a consistent pattern: We consistently think of ourselves as above average on many dimensions. The average person rates himself or herself more ethical, more persistent, more original, a better driver (even those who have been hospitalized for automobile accidents!), and more intelligent than average (Myers, 1996). Now, by definition, the average person is average. But we all tend to act like we live in

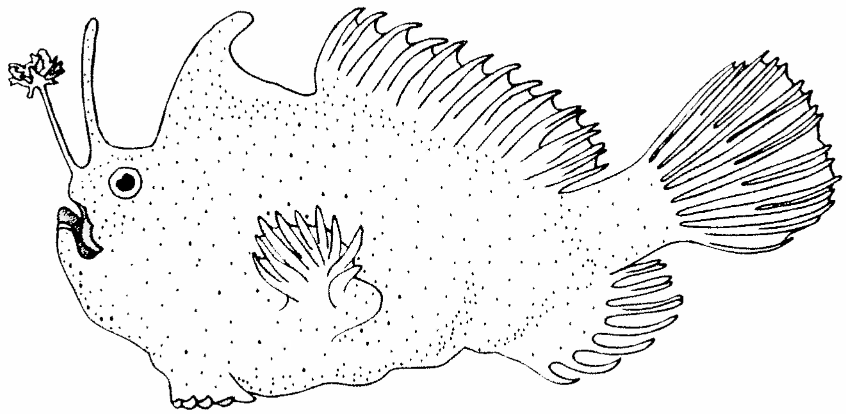

Figure 5–7. *Animal deception.* The angler fish uses its appearance to lure prey. Animals will present themselves in any way that advances their survival and reproduction. Consciousness need not be assumed to play a part in deception. (From *Feeding Ecology of Fish,* Shelby D. Gerking. Copyright © 1994, Academic Press, Inc. Reprinted by permission of Elsevier.)

Garrison Keillor's mythical Lake Wobegone, where "all the women are strong, all the men are good looking, and all the children are above average."

A little reflection reveals that deception is widespread among living things. Some insects look like sticks, and so avoid being eaten; some fish have wormlike projections on their tongues, and so attract unwary prey (Figure 5–7). Some flowers smell like rotting flesh, and so attract flies to pollinate them. It is clear that organisms (plants as well as animals) will evolve to present themselves in ways that augment their fitness, even if these ways are deceptive.

Trail Marker: Deception is a predictable outcome of natural selection.

In humans the best deception could be self-deception (Trivers, 1971). The suitor says with all his heart, "I love you more than anyone else in the whole world. I will be faithful to you for the rest of my life." This kind of message will be all the more convincing if he can conveniently forget that he said the same to someone else last year! Evolutionary thinking suggests that the man who really believes that he will never leave his love will make the most convincing suitor, something that ordinarily would increase fitness. It also suggests that the married man who really believes that the troubles in the marriage are all his wife's fault will more easily rationalize his search for another partner. It is totally unnecessary to assume that one belief is conscious while the other is unconscious according to some Freudian process.

We can see that these ideas reflect the modular view of the mind that characterizes evolutionary psychology. Byrne and Kurland (2001) developed a formal, modular model of self-deception and tested its predictions in a simulation. They found that self-deceiving individuals performed better than others in a competitive game.

This chapter takes an evolutionary approach to a subject that is not usually looked at from this perspective. We began asking questions that are usually ignored. In the case of sleep we turned the usual question on its head, thereby explaining a number of puzzling features of sleep. Perhaps the most important lesson from this chapter is that realizing consciousness incurs metabolic costs implies that it should be used sparingly, only when we cannot function as well without it.

SUMMARY

1. The concept of consciousness is used in a number of distinct ways, including voluntary action, awareness, and wakefulness.
2. Dennett suggests that the question of why we sleep should be, rather, why we are ever awake.
3. Sleep may have evolved to save energy during periods when activity was unlikely to be advantageous and to keep animals out of harm's way.
4. Humans sleep more during the winter than the summer.
5. Smaller animals (which have higher metabolic rates) sleep more than larger ones, predators sleep more than prey, and blind cave fish do not sleep at all.
6. Laypersons and much of contemporary psychology assumes that most behavior is under direct, conscious control.
7. Even voluntary behavior involves many mechanisms of which we have no conscious awareness.
8. Some behaviors are conscious while they are being learned, but become lost to consciousness.
9. Controlled processes require conscious attention and are performed slowly and effortfully; automatic processes are rapid, effortless, and may be performed simultaneously with other tasks.
10. Learning can take place without consciousness.
11. Learning a skill, called implicit learning, takes place outside of consciousness to a considerable extent.
12. Many cognitive processes are unavailable to consciousness but take place in the cognitive unconscious.
13. The problem of perceiving a unified world via distinct sensory systems is called the binding problem.
14. Conflict between sensory systems is generally settled in favor of vision.
15. Richard Dawkins suggests that self-awareness evolved to permit making ourselves the object of thought.
16. Daniel Povinelli suggests that locomotion through trees by larger primates led to the evolution of consciousness.