f what emotions are, how they operate in the brain, and why they have such important influences on our lives.

Several themes about the nature of emotions will emerge and recur. Some of these will be consistent with your commonsense intuitions about emotions, whereas others will seem unlikely if not strange. But all of them, I believe, are well-grounded in facts about the brain, or at least in hypotheses that have been inspired by such facts, and I hope that you will hear them out.

- The first is that the proper level of analysis of a psychological function is the level at which that function is represented in the brain. This leads to a conclusion that clearly falls into the realm of the bizarre at first—that the word "emotion" does not refer to something that the mind or brain really has or does.[10] "Emotion" is only a label, a convenient way of talking about aspects of the brain and its mind. Psychology textbooks often carve the mind up into functional pieces, such as perception, memory, and emotion. These are useful for organizing information into general areas of research but do not refer to real functions. The brain, for example, does not have a system dedicated to perception. The word "perception" describes in a general way what goes on in a number of specific neural systems—we see, hear, and smell the world with our visual, auditory, and olfactory systems. Each system evolved to solve different problems that animals face. In a similar vein, the various classes of emotions are mediated by separate neural systems that have evolved for different reasons. The system we use to defend against danger is different from the one we use in procreation, and the feelings that result from activating these systems—fear and sexual pleasure—do not have a common origin. There is no such thing as the "emotion" faculty and there is no single brain system dedicated to this phantom function. If we are interested in understanding the various phenomena that we use the term "emotion" to refer to, we have to focus on specific classes of emotions. We shouldn't mix findings about different emotions all together independent of the emotion that they are findings about. Unfortunately, most work in psychology and brain science has done this.

- A second theme is that the brain systems that generate emotional behaviors are highly conserved through many levels of evolutionary history. All animals, including people, have to satisfy certain conditions to survive in the world and fulfill their biological imperative to pass their genes on to their offspring. At a minimum, they need to obtain food and shelter, protect themselves from bodily harm, and procreate. This is as true of insects and worms as it is of fish, frogs, rats, and people. Each of these diverse groups of animals has neural systems that accomplish these behavioral goals. And within the animal groups that have a backbone and a brain (fish, amphibians, reptiles, birds, and mammals, including humans), it seems that the neural organization of particular emotional behavioral systems—like the systems underlying fearful, sexual, or feeding behaviors—is pretty similar across species. This does not imply that all brains are the same. It instead means that our understanding of what it means to be human involves an appreciation of the ways in which we are like other animals as well as the ways in which we are different.
- A third theme is that when these systems function in an animal that also has the capacity for conscious awareness, then conscious emotional feelings occur. This clearly happens in humans, but no one knows for sure whether other animals have this capacity. I make no claims about which animals are conscious and which are not. I simply claim that when one of these evolutionarily old systems (like the system that produces defensive behaviors in the presence of danger) goes about its business in a conscious brain, emotional feelings (like being afraid) are the result. Otherwise, the brain accomplishes its behavioral goals in the absence of robust awareness. And absence of awareness is the rule of mental life, rather than the exception, throughout the animal kingdom. If we do not need conscious feelings to explain what we would call emotional behavior in some animals, then we do not need them to explain the same behavior in humans. Emotional responses are, for the most part, generated unconsciously. Freud was right on the mark when he described consciousness as the tip of the mental iceberg.

- The fourth theme follows from the third. The conscious feelings that we know and love (or hate) our emotions by are red herrings, detours, in the scientific study of emotions. This will surely be hard to swallow at first. After all, what is an emotion but a conscious feeling? Take away the subjective register of fear and there's not much left to a dangerous experience. But I will try to convince you that this idea is wrong—that there is much more than meets the mind's eye in an emotional experience. Feelings of fear, for example, occur as part of the overall reaction to danger and are no more or less central to the reaction than the behavioral and physiological responses that also occur, such as trembling, running away, sweating, and heart palpitations. What we need to elucidate is not so much the conscious state of fear or the accompanying responses, but the system that detects the danger in the first place. Fear feelings and pounding hearts are both effects caused by the activity of this system, which does its job unconsciously—literally, before we actually know we are in danger. The system that detects danger is the fundamental mechanism of fear, and the behavioral, physiological, and conscious manifestations are the surface responses it orchestrates. This is not meant to imply that feelings are unimportant. It means that if we want to understand feelings we have to dig deeper.
- Fifth, if, indeed, emotional feelings and emotional responses are effects caused by the activity of a common underlying system, we can then use the objectively measurable emotional responses to investigate the underlying mechanism, and, at the same time, illuminate the system that is primarily responsible for the generation of the conscious feelings. And since the brain system that generates emotional responses is similar in animals and people, studies of how the brain controls these responses in animals are a pivotal step toward understanding the mechanisms that generate emotional feelings in people. Studies of the neural basis of emotion in humans vary from difficult to impossible for both ethical and practical reasons. The study of experimental animals is, as a result, both a useful and a necessary enterprise if we are to understand emotions in the human brain. Understanding emotions in the human brain is

clearly an important quest, as most mental disorders are emotional disorders.

- Sixth, conscious feelings, like the feeling of being afraid or angry or happy or in love or disgusted, are in one sense no different from other states of consciousness, such as the awareness that the roundish, reddish object before you is an apple, that a sentence just heard was spoken in a particular foreign language, or that you've just solved a previously insoluble problem in mathematics. States of consciousness occur when the system responsible for awareness becomes privy to the activity occurring in unconscious processing systems. What differs between the state of being afraid and the state of perceiving red is not the system that represents the conscious content (fear or redness) but the systems that provide the inputs to the system of awareness. There is but one mechanism of consciousness and it can be occupied by mundane facts or highly charged emotions. Emotions easily bump mundane events out of awareness, but nonemotional events (like thoughts) do not so easily displace emotions from the mental spotlight—wishing that anxiety or depression would go away is usually not enough.
- Seventh, emotions are things that happen to us rather than things we will to occur. Although people set up situations to modulate their emotions all the time—going to movies and amusement parks, having a tasty meal, consuming alcohol and other recreational drugs—in these situations, external events are simply arranged so that the stimuli that automatically trigger emotions will be present. We have little direct control over our emotional reactions. Anyone who has tried to fake an emotion, or who has been the recipient of a faked one, knows all too well the futility of the attempt. While conscious control over emotions is weak, emotions can flood consciousness. This is so because the wiring of the brain at this point in our evolutionary history is such that connections from the emotional systems to the cognitive systems are stronger than connections from the cognitive systems to the emotional systems.
- Finally, once emotions occur they become powerful motivators of future behaviors. They chart the course of moment-to-

moment action as well as set the sails toward long-term achievements. But our emotions can also get us into trouble. When fear becomes anxiety, desire gives way to greed, or annoyance turns to anger, anger to hatred, friendship to envy, love to obsession, or pleasure to addiction, our emotions start working against us. Mental health is maintained by emotional hygiene, and mental problems, to a large extent, reflect a breakdown of emotional order. Emotions can have both useful and pathological consequences.

As emotional beings, we think of emotions as conscious experiences. But when we begin probing emotion in the brain, we see conscious emotional experiences as but one part, and not necessarily the central function, of the systems that generate them. This does not make our conscious experiences of love or fear any less real or important. It just means that if we are going to understand where our emotional experiences come from we have to reorient our pursuit of them. From the point of view of the lover, the only thing important about love is the feeling. But from the point of view of trying to understand what a feeling is, why it occurs, where it comes from, and why some people give or receive it more easily than others, love, the feeling, may not have much to do with it at all.

Our journey into the emotional brain will take us down many different paths. We start with the curious fact that the study of emotion has long been ignored by the field of cognitive science, the major scientific enterprise concerned with the nature of the mind today (Chapter 2). Cognitive science treats minds like computers and has traditionally been more interested in how people and machines solve logical problems or play chess than in why we are sometimes happy and sometimes sad. We will then see that this shortcoming has been corrected in an unfortunate way—by redefining emotions as cold cognitive processes, stripping them of their passionate qualities (Chapter 3). At the same time though, cognitive science has been very successful, and has provided a framework that, when appropriately applied, provides an immensely valuable approach for pursuing the emotional as well as the cognitive mind. And one of the major

conclusions about cognition and emotion that comes from this approach is that both seem to operate unconsciously, with only the outcome of cognitive or emotional processing entering awareness and occupying our conscious minds, and only in some instances.

The next stop along the way takes us into the brain, in search of the system that gives rise to our emotions (Chapter 4). We'll see that there is no single emotion system. Instead, there are lots of emotion systems, each of which evolved for a different functional purpose and each of which gives rise to different kinds of emotions (Chapter 5). These systems operate outside of consciousness and they constitute the emotional unconscious.

We then concentrate on one emotion system that has been extensively studied, the fear system of the brain, and see how it is organized (Chapter 6). The relation between unconscious emotional memory and conscious memories of emotional experiences is then discussed (Chapter 7). The breakdown of emotion systems, especially the fear system, is then considered (Chapter 8). We see how anxiety, phobias, panic attacks, and post-traumatic stress disorders emerge out of the depths of the unconscious workings of the fear system. Psychotherapy is interpreted as a process through which our neocortex learns to exercise control over evolutionarily old emotional systems. Finally, we explore the problem of emotional consciousness, and the relation of emotion to the rest of the mind (Chapter 9). I conclude with the hypothesis, based on trends in brain evolution, that the struggle between thought and emotion may ultimately be resolved, not simply by the dominance of neocortical cognitions over emotional systems, but by a more harmonious integration of reason and passion in the brain, a development that will allow future humans to better know their true feelings and to use them more effectively in daily life.

2
SOULS ON ICE

"Think, think, think."

Winnie the Pooh[1]

"Ahab never thinks, he just feels, feels, feels."

Herman Melville, *Moby-Dick*[2]

THE HUMAN BRAIN CONTAINS about 10 billion neurons that are wired together in enormously complex ways. Although the electrical sparks within and chemical exchanges between these cells accomplish some amazing and perplexing things, the creation of our emotions stands out as one of their most amazing and perplexing feats.

When we turn our mind's eye inward on our emotions, we find them at once obvious and mysterious. They are the states of our brain we know best and remember with the greatest clarity. Yet, sometimes we do not know where they come from. They can change slowly or suddenly, and their causes can be evident or opaque. We don't always understand what makes us wake up on the wrong side of the bed. We can be nice or nasty for reasons other than the ones we believe are guiding our actions. We can react to danger before we "know" we are in harm's way. We can be drawn toward the aesthetic beauty of a painting without consciously understanding what it is we like about it. Although our emotions are at the core of who we are, they also seem to have their own agenda, one often carried out without our willful participation.

It's hard to imagine life without emotions. We live for them, structuring circumstances to give us moments of pleasure and joy,

and avoiding situations that will lead to disappointment, sadness, or pain. The rock critic Lester Bangs once said, "The only questions worth asking today are whether humans are going to have any emotions tomorrow, and what the quality of life will be if the answer is no."[3]

Scientists have had lots to say about what emotions are.[4] For some, emotions are bodily responses that evolved as part of the struggle to survive. For others, emotions are mental states that result when bodily responses are "sensed" by the brain. Another view is that the bodily responses are peripheral to an emotion, with the important stuff happening completely within the brain. Emotions have also been viewed as ways of acting or ways of talking. Unconscious impulses are at the core of an emotion in some theories, while others emphasize the importance of conscious decisions. A popular view today is that emotions are thoughts about situations in which people find themselves. Another notion is that emotions are social constructions, things that happen between rather than within individuals.

A scientific understanding of emotions would be wonderful. It would give us insight into how the most personal and occult aspects of the mind work, and at the same time would help us understand what may go wrong when this part of mental life breaks down. But, as the above comments indicate, scientists have not been able to agree about what an emotion is. The careers of many a scientist have been devoted to, if not devoured by, the task of explaining emotions. Unfortunately, one of the most significant things ever said about emotion may be that everyone knows what it is until they are asked to define it.[5]

This state of affairs might seem to pose a major stumbling block for our attempt to understand the emotional brain. If we can't say what emotion is, how can we hope to find out how the brain does it? But this book is not about mapping one area of knowledge (the psychology of emotion) onto another (brain function). It is instead about how studies of brain function allow us to understand emotion as a psychological process in new ways. I believe that we can get a unique and advantageous view of this puzzling part of the mental terrain by peering at it from inside the nervous system.

But I don't intend to ignore the psychology of emotion. Psychol-

ogists have had lots of insights. The problem is deciding which are correct and which are clever but wrong. Studies of the emotional brain can give us additional insights, but can also help us pick and choose from the psychological offerings. Aspects of the psychology of emotion are discussed in Chapter 3.

Our pursuit of the psychology of emotion, though, needs to be prefaced with an exploration of how emotion fits into a larger view of the mind—we need to delve into the nature of cognition, emotion's partner in the mind. The study of cognition, or just plain thinking, has advanced amazingly far in recent years. These advances provide a conceptual framework and methodology that is useful as an approach to all aspects of the mind, including emotion. The business of this chapter will therefore be to see what cognition is and how emotion and cognition relate.

Reason and Passion

Since the time of the ancient Greeks, humans have found it compelling to separate reason from passion, thinking from feeling, cognition from emotion. These contrasting aspects of the soul, as the Greeks liked to call the mind, have in fact often been viewed as waging an inner battle for the control of the human psyche. Plato, for example, said that passions and desires and fears make it impossible for us to think.[6] For him, emotions were like wild horses that have to be reined in by the intellect, which he thought of as a charioteer. Christian theology has long equated emotions with sins, temptations to resist by reason and willpower in order for the immortal soul to enter the kingdom of God. And our legal system treats "crimes of passion" differently from premeditated transgressions.

Given this long tradition of separation of passion and reason, it should not be too surprising that a field currently exists to study rationality, so-called cognition, on its own, independent of emotions. This field, known as cognitive science, tries to understand how we come to know our world and use our knowledge to live in it. It asks how we recognize a certain pattern of visual stimulation falling on the retina as a particular object, say an apple, or determine the apple's color, or judge which of two apples is bigger, or control our arm and hand in the act of catching an apple falling out of a tree, or remember where we were or who we were with when we last ate an apple, or imagine an apple in the absence of one, or tell or understand a story about an apple falling out of a tree, or conceive of a theory of why an apple falling out of a tree goes toward the earth instead of the sky.

Cognitive science emerged recently, around the middle of this century, and is often described as the "new science of mind."[7] However, in fact, cognitive science is really a science of only a part of the mind, the part having to do with thinking, reasoning, and intellect. It leaves emotions out. And minds without emotions are not really minds at all. They are souls on ice—cold, lifeless creatures devoid of any desires, fears, sorrows, pains, or pleasures.

Why would anyone want to conceive of minds without emotions? How could such a field focused on emotionless minds be so successful? How do we get emotion and cognition back together? To answer these questions we need to see where cognitive science came from and what it's all about.

Thinking Machines

Throughout much of the first half of this century, psychology was dominated by behaviorists, who believed that the subjective inner states of mind, like perceptions, memories, and emotions, are not appropriate topics for psychology.[8] In their view, psychology should not be the study of consciousness, as had been the case since Descartes said "Cogito, ergo sum,"[9] but instead should be the study of observable facts—objectively measurable behaviors. Being subjective and unobservable (except by introspection), consciousness could not, in the behaviorists' mind, be examined scientifically. Mental states came to be known pejoratively as "ghosts in the machine."[10] Behaviorists were known to ridicule those who dared to speak of mind and consciousness.

By mid-century, though, the behaviorist stronghold on psychology began to weaken.[11] Electronic computers had been developed,

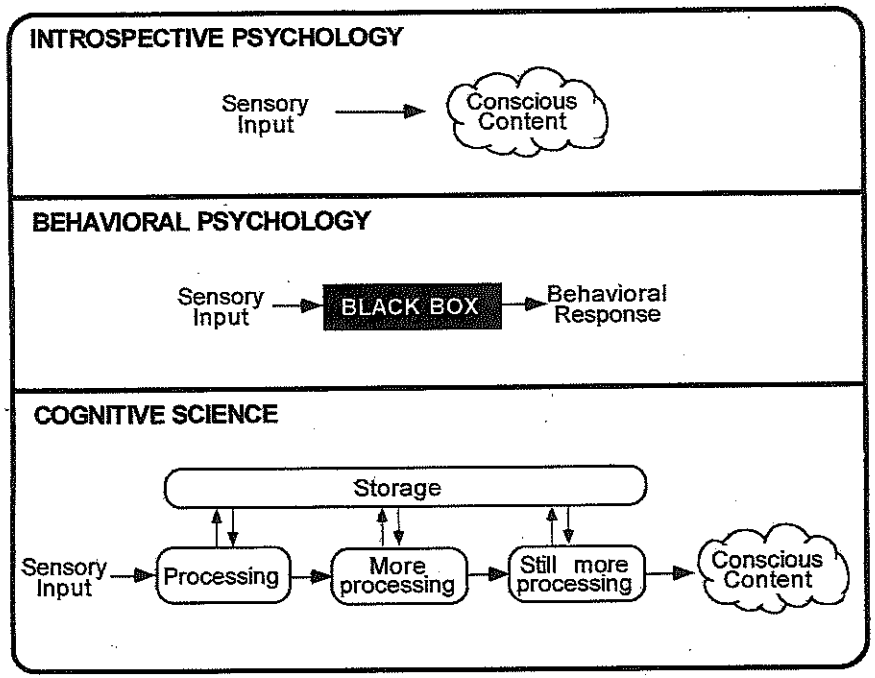

FIGURE 2-1
Three Approaches to the Science of Mind and Behavior.

Introspective psychology *is mainly concerned with the contents of immediate conscious experience.* Behaviorism *rejected consciousness as a legitimate subject matter for psychology and treated the events occurring between stimuli and responses as hidden in a black box.* Cognitive science *tries to understand the processes that occur inside the black box. These processes tend to occur unconsciously. In focusing on processes rather than conscious content, cognitive science did not exactly revive the view of the mind that the behaviorists rejected. More and more, however, cognitive scientists are beginning to try to understand the mechanisms of consciousness as well as the unconscious processes that sometimes do and sometimes do not give rise to conscious content.* (Bottom panel is based on figure 1 in U. Neisser [1976], *Cognition and Reality*. San Francisco: W.H. Freeman.)

and engineers, mathematicians, philosophers, and psychologists quickly saw similarities in the way computers process information and the way minds work. Computer operations became a metaphor for mental functions, and the field of artificial intelligence (AI), which seeks to model the human mind using computer simulations,

was born. Pretty soon, anyone who bought into the notion of the mind as an information-processing device came to be known as a cognitive scientist. Cognitive science caused a revolution in psychology, dethroning the behaviorists and bringing the mind back home. But the impact of cognitive science reached far beyond psychology. Today, cognitive scientists can be found in linguistics, philosophy, computer science, physics, mathematics, anthropology, sociology, and brain science, as well as psychology.

One of the most important conceptual developments in the establishment of cognitive science was a philosophical position known as functionalism, which holds that intelligent functions carried out by different machines reflect the same underlying process.[12] For example, a computer and a person can both add 2 + 5 and come up with 7. The fact that both achieve the same answer cannot be explained by the use of similar hardware—brains are made of biological stuff and computers of electronic parts. The similar outcome must be due to a similar process that occurs at a functional level. In spite of the fact that the hardware in the machines is vastly different, the software or program that each executes may be the same. Functionalism thus holds that the mind is to the brain as a computer program is to the computer hardware.

Cognitive scientists, carrying the functionalist banner, have been allowed to pursue the functional organization of the mind without reference to the hardware that generates the functional states. According to functionalist doctrine, cognitive science stands on its own as a discipline—it does not require that we know anything about the brain. This logic was a shot in the arm to the field, giving it a strong sense of independence. Regardless of whether they do experiments on humans or use computer simulations of the human mind, many cognitive scientists today are functionalists.

It would be natural to presume that the cognitive revolution resulted in the return of consciousness as the number one topic of psychology. But this was not the case. The cognitive movement brought the mind back to psychology, but not exactly the all-knowing conscious mind that Descartes had popularized. For Descartes, if it wasn't conscious it wasn't mental: mind and consciousness became synonymous after him.[13] In contrast, as we'll soon see, cognitive scientists tend to think of the mind in terms of unconscious *processes* rather

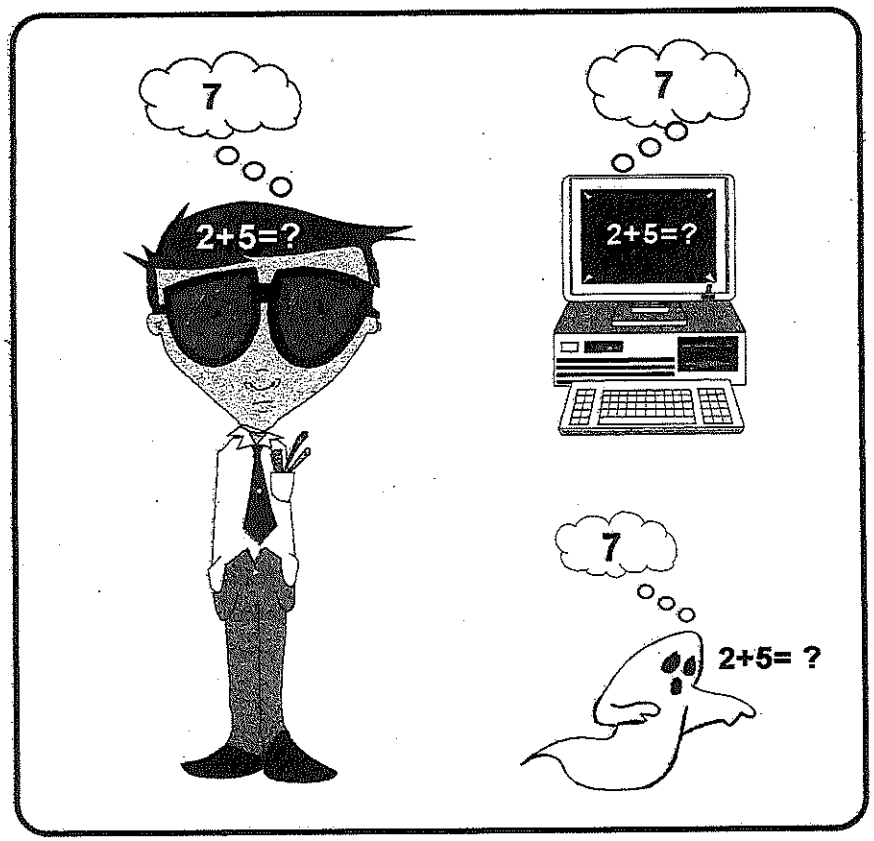

FIGURE 2-2
Functionalism.

This is a philosophical position which proposes that mental functions (thinking, reasoning, planning, feeling) are functional rather than physical states. When a person and a computer add 2 to 5 and come up with 7, the similar outcome cannot be based on similar physical makeup, but instead must be due to a functional equivalence of the processes involved. As a result, it is possible to study mental processes using computer simulations. Minds might in principle even exist without bodies. (Based on J.A. Fodor, The Mind-Body Problem. *Scientific American* [January 1981], Vol. 244, p. 118.)

than conscious *contents*. And in leaving out consciousness, cognitive science left behind those conscious states called emotions. Later, we'll see why this occurred. For now, we want to explore the unconscious nature of cognitive processes.

The Cognitive Unconscious

Rooted in the idea of mind as an information processing device, cognitive science has been geared toward understanding the functional organization and processes that underlie and give rise to mental events, and much less toward understanding the nature of consciousness and its subjective contents. In order for you to consciously perceive an apple in front of you in space, the apple must be represented in your brain and that representation must be made available to the conscious part of your mind. But the mental representation of the apple that you consciously perceive is created by the unconscious turnings of mental gears. As Karl Lashley long ago pointed out, conscious content comes from processing, and we are never consciously aware of the processing itself but only of the outcome.[14] These mental processes are the bread and butter of cognitive science. Cognitive scientists sometimes speak of consciousness as the end result of processing, but are usually far more interested in the underlying processes than in the contents of consciousness that occur during and as a result of the processing. This emphasis on unconscious *processes* as opposed to conscious *content* underlies much work in cognitive science.[15] And for adherents of strong versions of functionalism these processes can be studied equally well in any device that can solve the functional problem at hand, regardless of whether the device is made of neurons, electrical components, mechanical parts, or sticks and stones.[16]

The psychologist John Kihlstrom coined the term "cognitive unconscious" to describe the subterranean processes that have been the main preoccupation of cognitive science.[17] These processes span many levels of mental complexity, all the way from the routine analysis of the physical features of stimuli by our sensory systems, to remembrance of past events, to speaking grammatically, to imagining things that are not present, to decision making, and beyond.

Like Freud before them, cognitive scientists reject the view handed down from Descartes that mind and consciousness are the same. However, the cognitive unconscious is not the same as the Freudian or dynamic unconscious.[18] The term cognitive unconscious merely implies that a lot of what the mind does goes on outside of consciousness, whereas the dynamic unconscious is a darker, more

malevolent place where emotionally charged memories are shipped to do mental dirty work. To some extent, the dynamic unconscious can be conceived in terms of cognitive processes,[19] but the term cognitive unconscious does not imply these dynamic operations. We are going to also discuss the dynamic unconscious in some detail in later chapters. But for now we are focused on the tamer cognitive unconscious, which consists of processes that take care of the mind's routine business without consciousness having to be bothered. Let's consider some examples.

The first level of analysis of any external stimulus by the nervous system involves the physical properties of the stimulus. These low-level processes occur without awareness.[20] The brain has, for example, mechanisms for computing the shape, color, location, and movement of objects we see, and the loudness, pitch, and location of sounds we hear. If we are asked to say which of two objects is closer or which of two sounds is louder, we can do so, but we cannot explain what operations the brain performed to allow us to reach these conclusions. We have conscious access to the outcome of the computation but not to the computation itself. The processing of physical stimulus features makes possible all other aspects of perception, including our conscious awareness of perceiving something. It is just as well that we are unaware of these processes, as we would be so busy doing the computations that we would never get around to actually perceiving anything if we had to do it all with deliberate concentration.

On the basis of its analysis of physical features of stimuli, the brain begins to construct meaning. In order to know that the object you are looking at is an apple, the physical features of the stimulus have to find their way into your long-term memory banks. Once there, the stimulus information is matched up with stored information about similar objects and is classified as an apple, allowing you to "know" that you are looking at an apple and perhaps even leading you to remember past experiences you've had that involved apples. The end result is the creation of conscious memories (conscious contents) but through processes that you have little conscious access to. Presumably you can remember what you had for dinner last night, but you are not likely to be able to explain the machinations your brain went through to pull that information out.

Even that most ghostly of cognitions, the mental image, is the product of unconscious processes. For example, the cognitive psychologist Stephen Kosslyn asked subjects to draw an imaginary island that contained certain objects (tree, hut, rock, etc.).[21] The subjects were then asked to imagine the map and focus on one of the objects. A test word was then given and the subjects had to press a button to indicate whether the word named one of the objects on the map. The amount of time taken to press the button was directly related to the distance between the object named by the test word and the object being imagined. This suggested to Kosslyn that the brain actually computes geometric distances in mental images. But the subjects did not deliberately perform these calculations. They just gave the answers by pressing a button. All the work was done by the brain operating unconsciously.

Just because your brain can do something does not mean that "you" know how it did it. If it seems odd that the brain can unconsciously solve geometric problems, imagine the kinds of automatic calculations that go on in the brain when we turn the steering wheel to navigate a curve at 60 mph, or better yet, the kinds of processes that go on in the nervous system of homing pigeons or honeybees as they fly out into the world in search of food and then effortlessly find their way home using an internal compass.

Speech, consciousness' favorite behavioral tool, is also the product of unconscious processes.[22] We do not consciously plan the grammatical structure of the sentences we utter. There simply isn't enough time. We aren't all great orators, but we usually say things that make sense linguistically. Speaking roughly grammatically is one of the many things that the cognitive unconscious takes care of for us.

The cognitive unconscious also extends to complex judgments about the mental origins of beliefs and actions. In 1977, Richard Nisbett and Timothy Wilson published an extremely interesting paper, "Telling More Than We Can Know: Verbal Reports on Mental Processes."[23] They created a number of carefully structured experimental situations in which people were required to do things and then say why they did what they did. In one study, they lined up several pairs of stockings on a table. Female subjects were then allow to examine the stockings and to choose which one they liked b

When the women were questioned, they had all sorts of wonderful answers about the texture and sheerness of the stockings that justified their choices. But unbeknownst to them, the stockings were identical. The subjects believed that they had decided on the basis of their internal judgments about the quality of the stockings. In this and a host of other studies, Nisbett and Wilson showed that people are often mistaken about the internal causes of their actions and feelings. Although the subjects always gave reasons, the reasons came not from privileged access to the processes that underlay their decisions, but from social conventions, or ideas about the way things normally work in such situations, or just plain guesses. Accurate introspective reports, Nisbett and Wilson say, often occur in life because the stimuli involved in causing the behavior or the belief are salient and plausible causes of these. But when salient and plausible stimuli are not available, people make up reasons and believe in them. In other words, the inner workings of important aspects of the mind, including our own understanding of why we do what we do, are not necessarily knowable to the conscious self.[24] We have to be very careful when we use verbal reports based on introspective analyses of one's own mind as scientific data.

Around the same time that Nisbett and Wilson were performing their studies, Michael Gazzaniga and I were engaged in studies of split-brain patients that led us to a similar conclusion.[25] It was well-known from earlier work by Gazzaniga and others that information presented exclusively to one hemisphere of a split-brain patient is unavailable to the other.[26] We capitalized on this as a model of how consciousness deals with information generated by an unconscious mental system. In other words, we secretly instructed the right hemisphere to perform some response. The left hemisphere observed the response but did not know why the response was performed. We then asked the patient why he did what he did. Since only the left hemisphere could talk, the verbal output reflected that hemisphere's understanding of the situation. Time after time, the left hemisphere made up explanations as if it knew why the response was performed. For example, if we instructed the right hemisphere to wave, the patient would wave. When we asked him why he was waving, he said he thought he saw someone he knew. When we instructed the right hemisphere to laugh, he told us that we were funny guys. The spoken

explanations were based on the response produced rather than knowledge of why the responses were produced. Like Nisbett and Wilson's subjects, the patient was attributing explanations to situations as if he had introspective insight into the cause of the behavior when in fact he did not. We concluded people normally do all sorts of things for reasons they are not consciously aware of (because the behavior is produced by brain systems that operate unconsciously) and that one of the main jobs of consciousness is to keep our life tied together into a coherent story, a self-concept. It does this by generating explanations of behavior on the basis of our self-image, memories of the past, expectations of the future, the present social situation, and the physical environment in which the behavior is produced.[27]

Although a good deal remains uncertain about the cognitive unconscious,[28] it seems clear that much of mental life occurs outside of conscious awareness. We can have introspective access to the outcome of processing (in the form of conscious content), but not all processing gives rise to conscious content. Stimulus processing that does not reach awareness in the form of conscious content can nevertheless be stored implicitly or unconsciously (see chapter 7) and have important influences on thought and behavior at some later time.[29] Further, it is worth emphasizing that information can be simultaneously processed separately by systems that do and do not give rise to conscious content, leading to the conscious representation in some and the unconscious representation in other systems. We may sometimes be able to introspect and verbally describe the workings of the systems that create and use conscious representations, but introspection is not going to be very useful as a window into the workings of the vast unconscious facets of the mind. This will be an especially important point when we consider the emotional unconscious in the next chapter.

The field of cognitive science has been incredibly successful in its stated mission of understanding information processing, which turns out to mean the unconscious processing of information. We now have excellent models of how we perceive the world in an orderly fashion, remember events from the past, imagine stimuli that are not present, focus our attention on one stimulus while ignoring many others, solve logical problems, make decisions on the basis of incomplete information, make judgments about our beliefs, attitudes, and

behaviors, and many other aspects of mental functioning.[30] That much of the processing involved in these functions occurs unconsciously has allowed cognitive science a luxury that earlier forms of mentalism did not have—the field could get on with the business of studying the mind without having to first solve the problem of consciousness.[31] This does not mean that consciousness is irrelevant or unimportant. It is so important that when it has come up in the past it has completely dominated the scientific pursuit of the mind. This time around, though, scientists have figured out that the unconscious aspects of the mind are also important. In fact, it is probably not too far off the mark to say that consciousness will only be understood by studying the unconscious processes that make it possible. In this regard, cognitive science seems right on track. We'll return to the topic of consciousness, and especially emotional consciousness, in Chapter 9.

cognitive science and helped establish a new approach to the mind. But now it is time to put cognition back into its mental context—to reunite cognition and emotion in the mind. Minds have thoughts as well as emotions and the study of either without the other will never be fully satisfying. Ernest Hilgard, an eminent psychologist, makes the point nicely when he says that sibling rivalry is as important a concept to child development as is the maturation of thought processes.[54] "Mind science" is the natural heir to the united kingdom of cognition and emotion. To call the study of cognition and emotion cognitive science is to do it a disservice.

Minds, Bodies, Emotions

The idea of what the mind is has changed a number of times since the early Greeks, many of whom were preoccupied with rationality, but tended to view the mind as having both knowable and unknowable facets. Descartes redefined the mind to include only what we are aware of, making mind and consciousness the same thing. Since consciousness was viewed as a unique human gift, other animals were treated as mindless creatures. Freud, in formalizing the unconscious as the home of primitive instincts and emotions, helped reestablish a mental link between animals and humans, and began to dethrone consciousness as the sole occupant of the mind. The behaviorists dismissed the whole idea of mind, and took a step that really put animals and people on the same continuum, but one involving behavioral rather than mental functions. Cognitive science resurrected the Greek idea of mind, mind as reason and logic. And because the kind of mental states that were being suggested in the earlier days were based on the rules of logic, which is closely tied up with the human capacity for language, cognitive science was, for some time, not very friendly to the idea of animal minds. The idea of the human mind as a carefully engineered machine seemed more appealing than the idea of the mind as a biological organ with an evolutionary history.

The emergence of ideas about unconscious processing, and the re-realization that mind is more than cognition, again puts major parts of the mental life of humans and other animals on a continuum and encourages cognitive scientists to study mental functions in the

context of the machine in which the functions are housed rather than as complete abstractions. Reacting to the functionalist credo that the mind can be modeled independent of knowledge of how the brain works, philosopher Patricia Churchland and computational neuroscientist Terrence Sejnowski have argued, "Nature is more ingenious than we are. And we stand to miss all that power and ingenuity unless we attend to neurobiological plausibility. The point is, *evolution has already done it,* so why not learn how that stupendous machine, our brain, actually works?"[55]

The functionalist conception of mind as a program that can run on any machine (mechanical, electronic, biological) has been fairly easy to accept, or at least tolerate, in the area of cognition. The biological machine of relevance to cognition, of course, is the brain. And the idea that the brain is a cognitive computer is now commonplace. However, in emotions, unlike in cognitions, the brain does not usually function independently of the body. Many if not most emotions involve bodily responses.[56] But no such relation exists between cognitions and actions. In the case of cognitively driven responses, the response is arbitrarily linked to cognition. This is partly why cognition is so powerful—cognitions allow us to be flexibile, to choose how we will respond in a certain situation. Such responses are used by but are not essential to the cognition. The capacity to understand language, one of man's highest forms of cognition, and the form of cognition most closely tied to a specific set of expressive responses, works just fine in people who live their lives without being able to express this capacity in speech. In the case of emotion, though, the response of the body is an integral part of the overall emotion process. As William James, the father of American psychology, once noted, it is difficult to imagine emotions in the absence of their bodily expressions.[57]

We know our emotions by their intrusions (welcome or otherwise) into our conscious minds. But emotions did not evolve as conscious feelings. They evolved as behavioral and physiological specializations, bodily responses controlled by the brain, that allowed ancestral organisms to survive in hostile environments and procreate. If the biological machine of emotion, but not cognition, crucially includes the body, then the kind of machine that is needed to run emotion is different from the kind needed to run cognition. Even if the

functionalist argument (that the hardware is irrelevant) could be accepted for mind as cognition (and it is not clear that it can), it would not seem to work for the emotional aspects of the mind (since the hardware does seem to make a difference when it comes to emotion).

Programming a computer to be conscious would be an essential first step toward programming it to have a full-blown emotional experience, since the feelings through which we know our emotions occur when we become conscious of the unconscious workings of emotional systems in the brain. However, even if a computer could be programmed to be conscious, it could not be programmed to have an emotion, as a computer does not have the right kind of composition, which comes not from the clever assembly of human artifacts but from eons of biological evolution.

3
BLOOD, SWEAT, AND TEARS

"My love was so hot as mighty nigh to burst my boilers."

Davy Crockett, *A Narrative of the Life of David Crockett.*[1]

IN SPITE OF THE benign neglect of the topic of emotion by cognitive science, scientists who study emotion have by no means ignored cognition. In fact, psychologists interested in emotion, seduced by the intellectual excitement and appeal of cognitive science, have for some time been preoccupied with attempts to explain emotions in terms of cognitive processes. By this way of thinking, an emotion is not different from a cognition—emotions are just thoughts about situations we find ourselves in. Although this approach has had its share of successes, these have come at a high price. In trading in the passion of an emotion for thoughts about it, cognitive theories have turned emotions into cold, lifeless states of mind. Lacking sound and fury, emotions as cognitions signify nothing, or at least nothing very emotional. Our emotions are full of blood, sweat, and tears, but you wouldn't know this from examining modern cognitive research on emotion. Emotion research wasn't always this way, so let's see how and why the transformation occurred.

Body Heat

Why do we run away if we notice that we are in danger? Because we are afraid of what will happen if we don't. This obvious (and incorrect) answer to a seemingly trivial question has been the central concern of a century-old debate about the nature of our emotions.

It all began in 1884 when William James published an article titled "What Is an Emotion?"[2] The article appeared in a philosophy journal called *Mind*, as there were no psychology journals yet. It was important, not because it definitively answered the question it raised, but because of the way in which James phrased his response. He conceived of an emotion in terms of a sequence of events that starts with the occurrence of an arousing stimulus and ends with a passionate feeling, a conscious emotional experience. A major goal of emotion research is still to elucidate this stimulus-to-feeling sequence—to figure out what processes come between the stimulus and the feeling.

James set out to answer his question by asking another: do we run from a bear because we are afraid or are we afraid because we run? He proposed that the obvious answer, that we run because we are afraid, was wrong, and instead argued that we are afraid because we run:

> Our natural way of thinking about . . . emotions is that the mental perception of some fact excites the mental affection called emotion, and that this latter state of mind gives rise to the bodily expression. My thesis on the contrary is that the bodily changes follow directly the PERCEPTION of the exciting fact, and that our feeling of the same changes as they occur IS the emotion.[3]

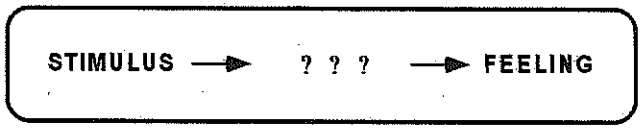

FIGURE 3-1
The Stimulus-to-Feeling Sequence.

Identification of the processes that intervene between the occurrence of an emotion-arousing stimulus and the conscious emotions (feelings) it elicits has been one of the major goals of emotion research. Unfortunately, this goal has often been pursued to the exclusion of some other equally important goals.

The essence of James' proposal was simple. It was premised on the fact that emotions are often accompanied by bodily responses (racing heart, tight stomach, sweaty palms, tense muscles, and so on) and that we can sense what is going on inside our body much the same as we can sense what is going on in the outside world. According to James, emotions feel different from other states of mind because they have these bodily responses that give rise to internal sensations, and different emotions feel different from one another because they are accompanied by different bodily responses and sensations. For example, when we see James' bear, we run away. During this act of escape, the body goes through a physiological upheaval: blood pressure rises, heart rate increases, pupils dilate, palms sweat, muscles contract in certain ways. Other kinds of emotional situations will result in different bodily upheavals. In each case, the physiological responses return to the brain in the form of bodily sensations, and the unique pattern of sensory feedback gives each emotion its unique quality. Fear feels different from anger or love because it has a different physiological signature. The mental aspect of emotion, the feeling, is a slave to its physiology, not vice versa: we do not tremble

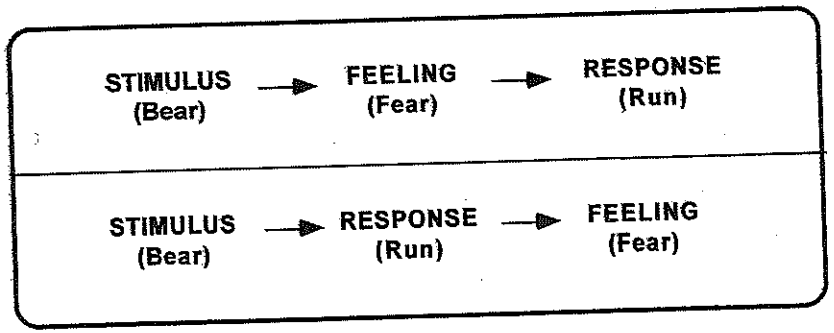

FIGURE 3-2
William James' Two Chains of Emotion.

The modern era in emotion research began when James asked whether feelings cause emotional responses or responses cause feelings. In answering that responses cause feelings, he started a century-old debate about where feelings come from. The question of what causes responses in the first place has, unfortunately, often been ignored.

FIGURE 3-3
James' Feedback Theory.

James' solution to the stimulus-to-feeling sequence problem was that feedback from responses determine feelings. Since different emotions have different responses, the feedback to the brain will be different and will, according to James, account for how we feel in such situations.

because we are afraid or cry because we feel sad; we are afraid because we tremble and sad because we cry.

Fight or Flight

James' theory dominated the psychology of emotion until it was called into question in the 1920s by Walter Cannon, a prominent physiologist who had been researching the bodily responses that occur in states of hunger and intense emotion.[4] Cannon's research led him to propose the concept of an "emergency reaction," a specific physiological response of the body that accompanies any state in which physical energy must be exerted. According to Cannon's hypothesis, the flow of blood is redistributed to the body areas that will be active during an emergency situation so that energy supplies, which are carried in the blood, will reach the critical muscles and organs. In fighting, for example, the muscles will need energy more than the internal organs (the energy used for digestion can be sacrificed for the sake of muscle energy during a fight). The emergency reaction, or "fight-or-flight response," is thus an adaptive response that occurs in anticipation of, and in the service of, energy expenditure, as is often the case in emotional states.

The bodily responses that make up the emergency reaction were believed by Cannon to be mediated by the sympathetic nervous system, a division of the autonomic nervous system (ANS). The ANS is a web of neural cells and fibers located in the body that controls the activity of the internal organs and glands, the so-called internal

milieu, in response to commands from the brain. The characteristic bodily signs of emotional arousal—like pounding hearts and sweaty palms—were known in Cannon's day to be the result of the activation of the sympathetic division of the ANS, which was believed to act in a uniform way, regardless of how or why it was activated. Given this supposed singularity of the sympathetic response mechanism, Cannon proposed that the physiological responses accompanying different emotions should be the same regardless of the particular emotional state that is experienced. As a result, James could not be right about why different emotions feel different, since all emotions, according to Cannon, have the same ANS signature.[5] Cannon also noted that ANS responses are too slow to account for feelings—we're already feeling the emotion by the time these responses occur. So even if different emotions had different bodily signatures, these would be too slow to account for whether we feel love, hate, fear, joy, anger, or disgust in a particular situation. The answer to the riddle of emotion, according to Cannon, is found completely within the brain, and does not require that the brain "read" the bodily response, as James had said.[6] We'll discuss the neural views espoused by James and Cannon in the next chapter, and we'll return to the issue of bodily feedback contributions to emotional experience in Chapter 9.

Cannon felt that while bodily feedback could not account for differences between emotions, it nevertheless played an important role, giving emotions their characteristic sense of urgency and intensity. Although James and Cannon disagreed about what distinguishes different emotions, they would seem to have agreed that emotions feel different from other (nonemotional) states of mind because of their bodily responses.

Passions as Reasons

During the behaviorists' reign in psychology, emotions, like other mental processes, were treated as ways of acting in certain situations.[7] There was little or no effort to explain what gives rise to conscious emotional experiences, as these were not recognized as legitimate phenomena for scientific investigation. The stimulus-to-feeling sequence was simply not an issue. In fact, the concept of

emotion as a subjective state was often singled out by behaviorists as a prime example of the kind of fuzzy idea that needed to be dispensed with in a scientific psychology. It was one of the prime mental fictions, ghosts in the machine, created by psychologists to overcome their ineptness at explaining behavior.[8]

In the early 1960s, though, all this began to change. Stanley Schachter and Jerome Singer, social psychologists at Columbia University, revived the issue of where our feelings come from and proposed a new solution to the James-Cannon debate.[9] Like James, Schachter and Singer suggested that bodily arousal or feedback was indeed crucial in the genesis of an emotional experience, but not quite in the way that James had proposed. And, like Cannon, they believed that physiological feedback lacked specificity. Riding the tide of the cognitive revolution, which had begun to penetrate deep into the heart and soul of most areas of psychology by this time, they argued that cognitions (thoughts) fill the gap between the nonspecificity of feedback and the specificity of felt experiences.

Schachter and Singer started with the assumption that physiological responses in emotion (sweaty palms, rapid heart beat, muscle tension) inform our brain that a state of heightened arousal exists. However, since these responses are similar in many different emotions they do not identify what kind of aroused state we are in. Schachter and Singer suggested that, on the basis of information about the physical and social context in which we find ourselves, as well as knowledge about what kinds of emotions occur in these particular kinds of situations, we label the aroused state as fear or love or sadness or anger or joy. According to Schachter and Singer, this labeling of the aroused state is what gives rise to and accounts for the specificity of felt emotion. In other words, emotional feelings result when we explain emotionally ambiguous bodily states to ourselves on the basis of cognitive interpretations (so-called attributions) about what the external and internal causes of the bodily states might be.

The major prediction from the Schachter-Singer theory was that if ambiguous physiological arousal was induced in human subjects it should be possible to bias the kind of emotion experienced by arranging the social context in which the arousal occurs. Schachter and Singer tested this hypothesis by giving subjects injections of adrenaline, a drug that induces physiological arousal by artificially

activating the sympathetic division of the ANS. The subjects were then exposed to either a pleasant, unpleasant, or emotionally neutral situation. As predicted, mood varied in accord with the context for the subjects given adrenaline but not for the control group that received placebo injections: adrenaline-treated subjects exposed to a joyful situation came out feeling happy, those exposed to an unpleasant situation came out feeling sad, and the neutral ones felt nothing in particular. Specific emotions were produced by the combination of artificial arousal and social cues. By inference, then, when emotionally ambiguous physiological arousal occurs naturally in the presence of real emotional stimuli, the aroused feeling is labeled on the basis of social cues. Emotions, in short, result from the cognitive interpretation of situations.

Stuart Valins, another social psychologist, performed a series of experiments to try to elucidate the nature of the cognition-arousal-emotion interaction.[10] Subjects were given inaccurate information about how their body was responding to some situation. For example, Valins showed male subjects pictures of partially nude women. The subjects were at the same time listening to a sound that was supposed to be indicative of the rate at which their heart was beating. Valins manipulated the sounds independent of true heart beat so that some

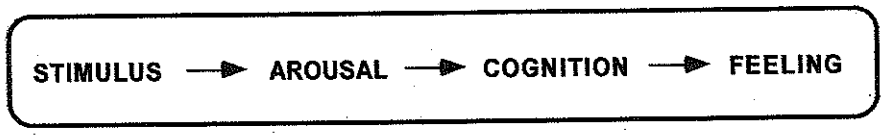

FIGURE 3-4
The Schachter-Singer Cognitive Arousal Theory.

Schachter and Singer, like Cannon, accepted that feedback is not specific enough to determine what emotion we feel in a given situation, but, like James they felt it was still important. Their idea was that feedback from bodily arousal is a good indicator that something significant is going on, even though it is not able to signal exactly what is happening. Once we detect bodily arousal (through feedback) we are then motivated to examine our circumstances. On the basis of our cognitive assessment of the situation, we then label the arousal. The labeling of arousal is what determines the emotion we feel. Cognitions thus fill the gap between the nonspecificity of bodily feedback and feelings for Schachter and Singer.

pictures were associated with high false heart rates and others with low rates. Later, the subjects judged as more attractive the pictures that had been associated with the high heart rate sounds, even though their actual heart rate was not high during exposure to these pictures. Valins concluded that in order for physiological activity to contribute to an emotional experience, the activity has to be represented cognitively. He argued that it is the cognitive representation of the physiological arousal, not the arousal itself, that interacts with thoughts about the situation in the generation of feelings.

The Schachter-Singer theory and the research that followed were criticized on many points.[11] The real impact of this work, though, was not so much that it explained where our emotions come from but instead that it revitalized an old notion, one that was implicit in the philosophical writings of Aristotle, Descartes, and Spinoza—that emotions might be cognitive interpretations of situations.[12] Schachter and Singer put the idea into a package that fit nicely into the cognitive pandemonium that was everywhere in psychology. The success of their efforts is exemplified by the fact that the psychology of emotion, to this day, is mostly about the role of cognition in emotion.

The Big Chill

Something was missing in the cognitive theory espoused by Schachter and Singer. They tried to explain how we deal with emotional responses once they occur (when you notice your heart beating and your forehead sweating as you begin to run away from a bear in the woods, you label the experience fear) but did not give an account of what generates the responses in the first place. Obviously, the brain has to figure out that the bear is a source of danger and has to arrange for the responses that are appropriate to danger to occur. The brain's emotional business is thus well underway by the time Schachter and Singer's mechanism kicks in. So what happens first? What makes us run from danger? What comes between the stimulus and the response? Cognitive evaluations, according to appraisal theorists, fill this gap.

The concept of appraisal was crystallized by Magda Arnold in a influential book on emotion published at about the same time t

Schachter and Singer were doing their experiments.[13] She defined appraisal as the mental assessment of the potential harm or benefit of a situation and argued that emotion is the "felt tendency" toward anything appraised as good or away from anything appraised as bad. Although the appraisal process itself occurs unconsciously, its effects are registered in consciousness as an emotional feeling.

Arnold's interpretation of James' bear-in-the-woods story would go like this: we perceive the bear and appraise it unconsciously, and our conscious experience of fear results from the tendency to run. In contrast to James, for Arnold the response does not need to occur in order to have the feeling—a feeling only requires an action tendency rather than an actual action. Emotions thus differ from nonemotional states of mind by the presence of appraisals in their causal sequence, and different emotions are distinguished from one another because different appraisals elicit different action tendencies, which give rise to different feelings.

In Arnold's view, once the appraisal outcome is registered in consciousness as a feeling, it becomes possible to reflect back on the experience and describe what went on during the appraisal process. This is possible because, according to Arnold, people have introspective access to (conscious awareness of) the inner workings of their mental life, and in particular access to the causes of their emotions. Arnold's approach assumes that we can, after an emotional experience, gain access to the unconscious processes that gave rise to the emotion. As we will see, this assumption is open to challenge.

The appraisal concept was adopted by other researchers in the 1960s. One of these was Richard Lazarus, a clinical psychologist who used the concept to understand the way people react to and cope with stressful situations.[14] Studies by Lazarus clearly showed that interpretations of situations strongly influence the emotion experienced. For example, in a classic experiment, subjects watched a gruesome film clip of a circumcision ritual involving teenage members of an aboriginal Australian tribe. For some subjects, the soundtrack verbally played up the gory details, whereas for others the episode was either minimized or intellectualized by the voice overlay. The group that had the first soundtrack, in which the gruesome details were emphasized, had stronger ANS responses and their self-reports suggested that they felt worse afterward than the other two

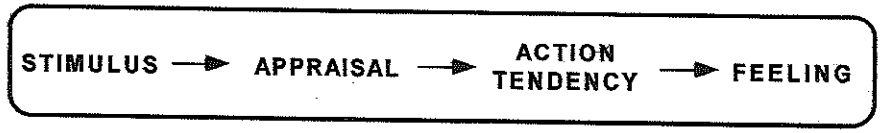

FIGURE 3-5
Arnold's Appraisal Theory.

Arnold argued that in order for a stimulus to produce an emotional response or an emotional feeling, the brain must first appraise the significance of the stimulus. Appraisals then lead to action tendencies. The felt tendency to move toward desirable objects and situations and away from undesirable ones is what accounts for conscious feelings in this model. Although appraisals can be either conscious or unconscious, we have conscious access to the appraisal processes after the fact.

groups, in spite of the fact that the arousing parts of the film were the same for all. Lazarus suggested that the different soundtracks caused the subjects to appraise the films in different ways and this led to different feelings about the situation. Lazarus argued that emotions can be initiated automatically (unconsciously) or consciously, but he emphasized the role of higher thought processes and consciousness, especially in coping with emotional reactions once they exist. Summarizing his position, he recently noted that "cognition is both a necessary and sufficient condition of emotion."[15]

Appraisal remains the cornerstone of contemporary cognitive approaches to emotion.[16] In the tradition started by Arnold, most work in this field has proceeded under the assumption that the best way to find out about appraisals is the old-fashioned way—to ask the subjects to introspect and figure out what went through their minds when they had some past emotional experience. For example, in a seminal study of these *emotion-antecedent appraisal processes* by Craig Smith and Phoebe Ellsworth, people were asked to recall a past experience implied by emotion words (pride, anger, fear, disgust, happiness, etc.) and to rate the recalled experiences on different dimensions (pleasantness, effort involved, self-other involvement, attentional activity, controllability, etc.).[17] They found that remembered experiences triggered by thoughts about emotion words could

be accounted for by the interplay of several different appraisals. For example, pride was characterized as occurring in situations involving pleasantness associated with little effort but much concentration of attention and personal responsibility, whereas anger involved unpleasantness associated with much effort, lack of control, and someone else being responsible. Smith and Ellsworth concluded that people's emotions are intimately related to their cognitive appraisals of their circumstances and that it is possible to gain insights into them by asking people to reflect back on what different emotions are like. These and other researchers assume that the kind of information that subjects use when they reflect back on an emotional experience is the same kind of information that the brain uses in creating the emotional experiences.[18]

To my mind, appraisal theories came very close to getting things right: the evaluation of a stimulus is clearly the first step in the initiation of an emotional episode; appraisals occur unconsciously; emotion involves action tendencies and bodily responses, as well as conscious experiences. But appraisal theories took two wrong turns on the road to understanding the emotional mind. First, they based their understanding of appraisal processes largely on self-reports—introspective verbal reflections. As we saw in the last chapter, introspection is often a blurry window into the workings of the mind. And if there is one thing about emotions that we know well from introspection, it is that we are often in the dark about why we feel the way we do. Second, appraisal theories overemphasized the contribution of cognitive processes in emotion, thereby diminishing the distinction between emotion and cognition. Given that a major failing of cognitive science as a science of mind is its lack of concern with emotion (see Chapter 2), it is not too surprising that the cognitive approach to emotion suffers from the same problem—in emphasizing cognition as the explanation of emotion, the unique aspects of emotion that have traditionally distinguished it from cognition are left behind.

FIGURE 3-6
General Purpose Appraisal Model.

Following Arnold, many psychologists today recognize the importance of appraisal processes in emotional phenomena, but they do not necessarily accept Arnold's equation of emotional feelings with action tendencies. The general-purpose appraisal model shown here thus simply suggests that appraisals fill the stimulus-to-feeling gap.

The Psychologist Who Came in from the Cold

By 1980, the cognitive approach to emotion was just about the only approach. But this began to change with the publication of a paper by social psychologist Robert Zajonc (pronounced, zy-unce).[19] The paper was called "Feeling and Thinking: Preferences Need No Inferences." It very persuasively argued, on the basis of logic and clever experiments, that preferences (which are simple emotional reactions) could be formed without any conscious registration of the stimuli. This, he said, showed that emotion has primacy over (can exist before) and is independent of (can exist without) cognition. The net effect was a stall, rather than the demise, of the cognitive approach to emotion, as much appraisal research has occurred in the years following Zajonc's paper. Nevertheless, Zajonc had a major impact on the field, keeping alive the idea that an emotion is not just a cognition.

Zajonc summarized several experiments that he and his colleagues had performed using a psychological phenomenon, called the mere exposure effect, that he had discovered earlier. If subjects are exposed to some novel visual patterns (like Chinese ideograms) and then asked to choose whether they prefer the previously exposed or new patterns, they reliably tend to prefer the preexposed ones. Mere exposure to stimuli is enough to create preferences.

The twist to the new experiment was to present the stimuli subliminally—so briefly that the subjects were unable in subsequent tests to accurately state whether or not they had seen the stimulus before. Nevertheless, the mere exposure effect was there. The subjects judged the previously exposed items as preferable over the new (previously unseen) ones, in spite of the fact that they had little ability to consciously identify and distinguish the patterns that they had

seen from those that they had not. As Zajonc put it, these results go against common sense and against the widespread assumption in psychology that we must know what something is before we can determine whether we like it or not. If in some situations emotion could be present without recognition of the stimulus, then recognition could not be viewed as a necessary precursor to emotion.

The subliminal mere exposure effect has been confirmed by many different laboratories and the idea that preferences can be formed for stimuli that do not enter consciousness seems rock solid.[20] However, Zajonc's interpretation was controversial. He argued that the absence of conscious recognition meant that preferences (emotions) were forming without the aid of cognition—that emotion and cognition are separate functions of the mind. As we saw in Chapter 2, many information-processing functions that are considered prototypical examples of cognition also occur without conscious awareness. The absence of conscious recognition is not, strictly speaking, a useful basis for exclusion of cognition from emotional processing. At the same time, although Zajonc's studies did not prove that emotion and cognition are separable aspects of the mind, this does not mean that the opposite is correct, a point that we will return to at the end of the chapter.

Regardless of the relevance of Zajonc's subliminal mere exposure studies for understanding whether emotion depends on cognition, the experiments provided incontrovertible evidence that affective reactions could take place in the absence of conscious awareness of the stimuli. Although some appraisal theories accept that appraisal is, or can be, unconscious, they have tended to also suggest that the individual has conscious access to the processes underlying appraisals (thus justifying the use of verbal reports to identify emotion-antecedent appraisal processes). If unconscious occurrences such as those found by Zajonc were commonplace, rather than esoteric outcomes of a clever experimental design, the conscious introspections that make up the database of appraisal theory would not be a very solid foundation for an understanding of the emotional mind.

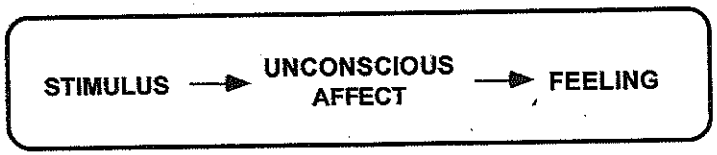

FIGURE 3-7
Zajonc's Affective Primacy Theory.

Contrary to much work in psychology, Zajonc has argued that affect precedes and occurs independent of cognition. This controversial hypothesis has been heatedly debated. What seems clear now is that emotional processing can occur in the absence of conscious awareness, but that this is a different issue from whether emotion and cognition are independent.

The Emotional Unconscious

Zajonc was certainly not the first experimental psychologist to be interested in the emotional unconscious. There was a time, back around mid-century, when the emotional unconscious was quite the rage in psychology. It all began with the New Look movement,[21] which challenged the stimulus-response view of perception espoused by the behaviorists. The New Look argued that perceptions are constructions that integrate sensory information about physical stimuli with internal factors, such as needs, goals, attitudes, and emotions. When New Look psychologists started doing experiments showing that subjects could have ANS responses to emotionally charged stimuli in the absence of conscious awareness of the stimuli (see below), it seemed as though the gap between two strange (if not estranged) bedfellows, psychology and psychoanalysis, might be closing.[22] After all, the unconscious, and especially the emotional unconscious, is the linchpin of psychoanalytic theory.

After a brief period of enthusiastic reception, the unconscious perception studies of the New Look were extensively criticized and they were essentially dismissed. Unconscious perception just did not make sense to many psychologists, as there was no adequate framework for thinking about perception without awareness of the perceived stimulus. The cognitive movement and its emphasis on unconscious processing was knocking on the door, but psychology was still strongly behavioristic, and verbal responses were the primary behaviors of interest in research on humans. As one commentator,

Matthew Erdelyi of Brooklyn College, noted, there is a certain irony in this history.[23] Studies of unconscious processing were being buried at just the time that cognitive science was beginning to discredit the behaviorist preconceptions that made non-verbalizable perceptions seem impossible. But there is another irony here—that behaviorists, whose field was created to rid psychology of ghostly concepts like consciousness, should have befriended conscious introspections (verbal reports) as a method for validating psychological ideas.[24] Below, we will take a look at some early unconscious perception studies and the criticisms of them, and then turn to the new wave of research on this topic.

One of the major areas of research on unconscious processing to come out of the New Look involved *perceptual defense*, the demonstration that "dirty" words have a higher threshold for stimulus recognition than comparable words that lack sexual, scatological, or other taboo connotations. In a typical experiment, subjects were shown words on a screen. By varying the amount of time that the words were shown, it was possible to determine the amount of time a particular subject needed to recognize a given word. It was discovered that the exposure time required for "taboo" words (e.g., bitch, fuck, Kotex, cancer) was longer than for words lacking taboo connotations.[25] The results were interpreted in terms of Freudian defense mechanisms, particularly repression: the taboo words were perceived subconsciously and censured (prevented from entering consciousness) because their appearance in consciousness would have elicited anxiety.

A related line of work involved *subliminal perception*. One of the classic studies was performed by Richard Lazarus, before his appraisal theory days.[26] In that experiment, patterns of letters were briefly flashed on a screen using exposure durations that were determined to be too short to allow verbal identification. Some of the patterns had been previously paired with an electric shock in order to transform the meaningless letters into emotionally charged stimuli capable of eliciting ANS responses. When these conditioned emotional stimuli were presented subconsciously, but not when emotionally neutral stimuli occurred, the ANS responded, indicating that the emotional meaning of the conditioned stimuli had been registered, in

spite of the fact that the subjects reported no awareness of the stimuli (ANS responses have been a favorite in this kind of work since they do not depend on verbal processes and can thus be used to track emotions that occur in the absence of the ability to verbally describe the stimulus).

Marketing experts seized upon the implications of subliminal perception research, hoping to surreptitiously influence consumers to buy products. A theater in New Jersey, for example, gave audiences quick flashes of the phrase "Drink Coke" or "Eat popcorn" in order to promote visits to the concession stand.[27] Whether the tactic actually worked or not is not clear, but the public was outraged over this unethical act of manipulation and the invasion of privacy.[28] In point of fact, though, the advertising industry uses emotional cues (implicitly and explicitly) to persuade consumers to buy products all the time. Persuasion is, after all, their business, as Vance Packard noted in a famous book, *The Hidden Persuaders*.[29] Persuasion always works better when the persuadee is not aware that he or she is being influenced.[30] Implicit messages are the bread and butter of many advertising campaigns.

In spite of a great deal of initial interest in the theoretical implications of the perceptual defense and subliminal perception experiments, the interpretation of the results in terms of unconscious perception of emotional meaning was called into question by Charles Eriksen in the early 1960s.[31] Eriksen believed that unconscious perception was a logical impossibility[32] and he challenged this interpretation of the findings. He argued that the failure of the subjects in perceptual defense studies to verbally identify the taboo stimuli was due, not to the failure of the stimulus to enter consciousness, but to an unwillingness of the subjects to say these embarrassing words in public. And the inability of subjects in the subliminal perception experiments to verbally identify the secret stimuli was due, not to a failure to consciously perceive the stimuli, but to imperfections of verbal processes when it comes to accurately characterizing perceptual experiences.

Widespread acceptance of Eriksen's critique sealed research on the emotional unconscious into what seemed to be a coffin, but turned out to be a time capsule. After somewhat of a hiatus in the 1960s and 1970s, a new surge of interest in unconscious emotional

processes emerged, spurred on by Zajonc's studies and by Matthew Erdelyi's reinterpretation of the perceptual defense and subliminal perception work in terms of the principles of cognitive science.[33] Nevertheless, within the psychology of emotion, especially amongst the cognitively minded appraisal theorists, the emphasis has remained on the conscious, verbally accessible aspects of emotion. The evidence for the existence of unconscious aspects of emotion is often ignored or denied, or when accepted is given second billing to the conscious aspects. As several researchers who work on unconscious processes have stated, they are so busy trying to prove that unconscious processing exists that there is little time to actually explore how it works.[34] But due to the creation of new and improved techniques for studying unconscious processing,[35] the existence proofs now seem clear. Below I will review some of the evidence showing that emotional processing can take place outside of conscious awareness. Some of the work involves subliminal stimulation, whereas other studies utilize stimuli that are consciously perceived but their emotional implications are implicit and not noticed at the time the stimulus is seen or heard.

Zajonc's subliminal mere exposure studies were some of first to use the new techniques that made unconscious processing seem undeniable. In the wake of this research, many similar experiments were performed. In one particularly interesting variation by Robert Bornstein, subjects were brought into the laboratory and given very brief exposures to pictures of faces.[36] As expected, they were unable to identify which ones they had seen before, but when asked to rate how much they liked the pictures, the preexposed ones received more positive ratings. Mere exposure works for faces. In a second part of the study, the subjects were given brief (subliminal/unconscious) exposures to pictures of person A or of person B. Then, the subject, together with persons A and B, was asked to try to decide on the gender of the author of several poems. By a prearrangement unknown to the subject, A and B disagreed and the subject had to break the tie. As predicted by the mere exposure hypothesis, the subjects tended to side with the person whose face they had been unconsciously exposed to. Familiarity does not necessarily breed contempt. Bornstein later performed what is called a "meta-analysis" of subliminal mere exposure research, which means he analyzed the published data from many different studies.[37] This led him to conclude that the mere exposure effect is much stronger when the stimuli are subliminally presented than when the stimuli are freely available for conscious inspection. This turns out to be a common finding in a number of different kinds of studies of unconscious emotional processing, and it emphasizes a point that we will see time and again—our emotions are more easily influenced when we are not aware that the influence is occurring.

The emotional unconscious has also been studied with a procedure called subliminal emotional priming that has been used extensively by Zajonc and several of his associates in recent years.[38] In this kind of experiment, a priming stimulus with some emotional connotation, such as a picture of a frowning or smiling face, is presented very briefly (5 milliseconds, or 1/200th of a second) and is immediately followed by a masking stimulus, which eliminates the subject's ability to consciously recall the prime—the mask displaces the prime from consciousness, essentially blanking it out. Following a delay, a target stimulus pattern is presented. It remains on a comfortable amount of time (seconds) and is consciously perceived. After seeing many patterns in this way, the subject is asked to rate how much they liked the target stimuli. Zajonc found that whether the subjects liked or disliked a stimulus (for example, a Chinese ideogram) was related to whether the stimulus was primed by an unconscious smile or frown. The target stimulus acquired emotional significance by virtue of its relationship with an emotional meaning activated subliminally by the unconsciously processed smile or frown. And, as in the mere exposure work, the emotional priming was much more effective for subliminal (masked, thus unconscious) presentations than for presentations that were not masked and where conscious awareness of the stimulus was possible.

And then there is the Pöetzl effect.[39] Otto Pöetzl, a Viennese psychiatrist, performed studies in 1917 in which a complex visual picture, like a landscape, was shown to subjects subliminally. He then asked the subjects to draw as much of the picture as possible. After-