

others. This impairment reveals itself in the emotional instability, social dysfunction, poor response to stress, and cognitive disorganization and disorientation that characterize both children and adults in this attachment grouping. As we've discussed, children with disorganized attachment tend to become controlling in their behaviors with others and may be hostile and aggressive with their peers. Disorganized attachment in children and unresolved/disoriented attachment in adults has been proposed by a number of authors to predispose these individuals to violent behavior.²⁰⁹ Finding ways as a society to identify these high-risk individuals and help them to heal their unresolved trauma and repair the devastating effects of such chaotic attachment histories may enable us to help them develop more coherent internal function and more socially adaptive and rewarding interpersonal relationships.

The inability to integrate a sense of self and of the self with others across time may be due to the disorganization in a more fundamental self-organizational process. Studies of early trauma and neglect reveal that neural structure and function within the brain can be severely affected and lead to long-lasting and extensive effects on the brain's capacity to adapt to stress.²¹⁰ As we explore the nature of relationships, emotion, and representational processes in the next chapters, we will lay the groundwork for a more in-depth discussion of how the mind regulates its own functioning. It is clear that certain early experiences create a fundamental impairment in self-organization. At one extreme are dismissing or avoidant attachments, which reveal excessively restrictive processes. At the other are preoccupied or ambivalent attachments, which have intrusions of past elements onto the present. In unresolved or disorganized attachments, there is a primary difficulty in organizing the self, which leads both to internal flooding and to disruptions in interpersonal relationships.

Siegel, D. 1999. *The Developing Mind, Towards a Neurobiology of Interpersonal Experience*, Guilford Press, NY

CHAPTER 4

Emotion

APPROACHING EMOTION

Defining Emotion

Attachment relationships differ in the ways in which states of mind and emotional communication are shared between parent and child. We have seen how a "state of mind" can be defined as the clustering of a profile of activation within the brain's neural network. These states organize brain functioning and thus the experience of mind. A child uses a parent's state of mind to help organize her own mental processes. The alignment of states of mind permits the child to regulate her own state by direct connection with that of her parent. For example, in the process of "social referencing," the child looks to the facial expressions and other nonverbal aspects of the parent's signals to determine how she should feel and respond in an ambiguous situation.¹ Social referencing reveals the fundamental way in which nonverbal communication is the medium in which states are aligned. What do these nonverbal signals actually represent?

The study of emotion suggests that nonverbal behavior is a primary mode in which emotion is communicated.² Facial expression, eye gaze, tone of voice, bodily motion, and the timing of response are each fundamental to emotional messages. But what exactly is "emotion"? We can know when others are upset and "emotional," but what does this really mean? This chapter attempts to define emotion and to explore its central role in human relationships and the developing mind.

A much-emphasized universal finding has been that certain types of affective expression seem to be both expressed and recognized in all cultures throughout the world; however, professionals often have quite different notions about what these affective expressions actually represent.³ There is a wide range of ideas about how to define emotional processes. The definitions that follow incorporate both research and clinical concepts in an effort to outline some fundamental aspects of emotion. The specific purposes of providing these definitions are (1) to attempt to clarify the basic functions of emotions, and (2) to characterize which features of emotions are shared among different individuals and which may be quite distinct.

There is quite a bit of controversy among scientists from various disciplines about what emotions actually are.⁴ For example, some physiological and cognitive psychologists view emotions as existing within the individual, whereas more interpersonally oriented social psychologists and cultural anthropologists view emotions as being created between people.⁵ Even within the field of neuroscience, there is a heated debate about the nature of emotion in the brain.⁶ For example, it was generally accepted for many decades that emotions emanate from the part of the brain called the limbic system. Various authors defined this system as the "primitive" or "old reptilian" brain, and described it as including such structures as the amygdala, orbitofrontal cortex, and anterior cingulate. Research paradigms attempted to delineate the boundaries and specific functions of this frequently cited system, but often failed to identify its functional limits.⁷ The essential point here is that emotion is *not* limited to some specifically designed circuits of the brain that were once thought to be the center of emotion. Instead, these same "limbic" regions appear to have wide-ranging effects on most aspects of brain functioning and mental processes.⁸ The limbic system is specialized to carry out the appraisal of meaning or value of stimuli. It is also a center for the mental module or information-processing system which carries out social cognition, including face recognition, affiliation, and "theory of mind" (the view that another person has a subjective experience of mind). Some authors use these findings to argue for the socially constructed nature of emotion.⁹ These findings also support the idea that emotion is found throughout the entire brain.¹⁰

Within cognitive psychology, debate exists over the importance of the "discrete" or "basic" emotions: what they are and how important they are in helping us understand emotional experience. Some authors argue that there is little "basic" about these discrete emotions,¹¹ while

others suggest that studying the manifestations of these universally expressed states is crucial to understanding the role of emotions in both cognitive processing and interpersonal relationships.¹² Within the field of developmental psychology and psychopathology, emotion and emotion regulation are seen as woven from the same cloth.¹³ In this manner, emotions both are regulated and perform regulatory functions. One might surmise from these viewpoints that emotions are everywhere in the processes of the mind. For instance, Kenneth Dodge states that "all information processing is emotional, in that emotion is the energy that drives, organizes, amplifies, and attenuates cognitive activity and in turn is the experience and expression of this activity."¹⁴ This view describes both the ubiquitous nature of emotion and the way in which the common distinction made between thought and feeling, cognition and emotion, is artificial and potentially harmful to our understanding of mental processes.

Despite these controversial points, most theories of emotion share some common themes. One is that emotion involves complex layers of processes that are in constant interaction with the environment. At a minimum, these interactions involve cognitive processes (such as appraisal or evaluation of meaning) and physical changes (such as endocrine, autonomic, and cardiovascular changes), which may reveal some repeated patterns over time. As Alan Sroufe has described, emotions involve "a subjective reaction to a salient event, characterized by physiological, experiential and overt behavioral change."¹⁵ A similar view suggests that emotion can be seen as involving neurobiological, experiential, and expressive components.¹⁶

For our purposes, it will be helpful to approach a unifying definition of emotions with an open mind. Our everyday ideas about emotions will undoubtedly influence how we approach these definitions, but looking at what is known in science about how the brain functions may help to open our minds to some new and helpful perspectives. Let us assume that the familiar end products of emotion—what we usually consider in everyday thinking as the common feelings of anger, fear, sadness, or joy—are actually *not* central to the initial experience of emotion. Let us also assume that emotions do not necessarily exist at all as we may usually think of them: as some kind of packets of something that can be experienced, identified, and expressed, as implied in the statement "Just get your feelings out." Instead, let's consider that *emotions represent dynamic processes created within the socially influenced, value-appraising processes of the brain.* Finally, as we examine what emotion might be in the individ-

ual, let us recall what we have learned about attachment relationships and the alignment of states of mind. This requires that we continue the challenging task of thinking about the individual mind within the context of human relationships, rather than in isolation from social meaning.

Initial Orientation, Appraisal, and Arousal

In the brain, a signal of heightened activity can be called an "initial orienting response." This expression refers to how the brain and other systems of the body enter a state of heightened alertness with an internal message of "something important is happening here and now." This initial orienting response activates a cognitive alerting mechanism of "Pay attention now!" that does not require conscious awareness and does not initially have a positive or negative tone.¹⁷ Very rapidly (within microseconds), the brain processes the representations of the body and the external world generated with this initial orienting process. As this occurs, processes that can be called "elaborative appraisal and arousal" begin and direct the flow of energy through the system. Elaborative appraisal and arousal serve to modulate the state of mind by directing the flow of activation of certain circuits and the deactivation of others. In this way, initial orientation sets off a cascade of subsequent elaborative appraisal-arousal circuits, which serve to differentiate the unfolding states of mind within the individual.¹⁸

Elaborative appraisals assess whether a stimulus is "good" or "bad" and determine whether the organism should move toward or away from the stimulus. The evolutionary benefit of having core processes that rapidly assess the value of events in the world helps us to understand why the appraisal and arousal processes are so central to the functioning of the brain.¹⁹ As the circuits are activated in response to this "good-bad" evaluation, the mind has a further elaboration of the flow of energy through its various mental processes involved in approach or withdrawal.²⁰ *Emotional processing prepares the brain and the rest of the body for action.* Elaborative appraisal and arousal extend the initial orienting process of "Pay attention!" to "Act!" within a short period of time. The appraisal process evaluates the informational meaning of stimuli; the arousal process directs the flow of energy through the system.

Appraisal involves a complex web of evaluative mechanisms, in which both external and internal factors play active roles. The spe-

cific nature of appraisal incorporates past experience of the stimulus, including emotional and representational elements of memory; present context of the internal emotional state and external social environment; elements of the stimulus, such as intensity and familiarity; and expectations for the future.

Alan Sroufe has described the central role of "discrepancy" of the stimulus from internal expectations in the generation of emotional engagement with the environmental surround.²¹ In Sroufe's terms, the emotional arousal generated in response to such a discordance between internal set and external features is called "tension." Emotion and its regulation are examined within a "tension modulation hypothesis": Such tension is not in need of reduction, but is managed within an individual's interaction with the environment, especially with significant others in the social world. Emotional forms of arousal are distinguished from other forms of arousal—such as those arising from exercise or drinking caffeinated beverages—in that they reflect a subjective sense of meaning, which is evaluated in response to engaging with experience (internal or external). The framework offered here is consonant with this view of emotional tension, and I use the general term "arousal" with this emotional engagement frame in mind.

Primary Emotions

The term "primary" emotions can be used to describe the textures of the shifts in brain state that are the results of both initial orientation and elaborative appraisal-arousal processes. This concept is distinct from that of "basic" or "discrete" emotions, sometimes also called "categorical," which refers to differentiated emotional states. The use of the term "primary" is suggested here to emphasize the initial, core, and ubiquitous quality of these essential emotional features. As in "primary" colors, the term also implies that various combinations of primary emotional elements may constitute a wide range of textures within the spectrum of emotional experience.

These primary emotional sensations of the mind's state are without words and can exist without consciousness. They reflect the non-verbal sensation of shifts in the flow of activation and deactivation—the flow of energy and evaluations of information—through the system's changing states. Primary emotions directly reflect the changes in states of mind. These changes may be subtle or intense; they may be fleeting or persistent; they may continue as gentle sensations, like

waves lapping on a shore, or they may evolve into larger, global changes, like a storm pounding on the beach. Primary emotions are dynamic processes of change; again, they are not packets of something, but rather are fluctuations in the energy and informational flow of the mind. As such, the idea of primary emotions is congruent with Ross Thompson's notion of "emotion dynamics," which involve the timing/immediacy, magnitude, and specificity of emotional response.²²

When an event has meaning for an individual, because it is discrepant from prior experiences or because other evaluative processes label it with significance, the brain is alerted to focus attention: "This is important! Pay attention!" At this point, the orientation serves as a kind of jolt to the system. The primary emotional experience is one of increased energy and alertness. Second, the brain must further appraise the meaning of the stimulus and of the aroused state itself. At this moment, primary emotions are now being experienced as developing "hedonic tone" or "valence." For example, the elaborative appraisal and arousal processes may create a sensation such as "This important thing is bad. Watch out! There is danger here," and the flow of energy through the system becomes channeled toward a cautious, hypervigilant stance. At this point, the rush of energy has now been directed to a fearful, unpleasant state reflected in a high primary emotional intensity with a sense of danger. In contrast, elaborative appraisal and arousal may assess the initial orientation as good, something to seek more of; this creates a primary emotional state of eager anticipation. In this way, appraisal and arousal create a state of mind that is predisposing the individual to act in a certain fashion. At the most basic level, valence can be labeled as good and involve approach, or can be labeled as bad and involve withdrawal.²³

Primary emotions themselves, in addition to the stimulus itself, can be appraised by the value systems of the brain. This evaluation of primary emotions reflects the basic flow of emotions from initial orientation to elaborated appraisal-arousal processes. In this manner, the mind begins to assess the value of its own evaluative and activation processes. The recursive nature of such a continuing "appraisal of appraisals" is actually quite common in the complex system of the mind (we shall return to this characteristic in Chapter 6). This also raises the issue of how both temperament and learning directly affect core emotional responsiveness.²⁴ Some individuals may react to their own intense arousal with a negative appraisal and a tendency to

withdraw both behaviorally and cognitively from the further elaboration of their own emotional states, as in the case of shy individuals.²⁵ Others may have learned that certain intense emotional states are not tolerated by others.²⁶ Such lack of attunement to intense states may lead to the sense that they are "out-of-control" states, and thus "bad" and to be avoided. Such individuals learn to avoid emotional intensity. In contrast, Jerome Kagan has demonstrated that parents who support and encourage shy children to explore novel situations actually enhance the children's capacity to tolerate new experiences.²⁷ In either of these examples, the appraisal of states of arousal is influenced by interpersonal experience and leads to further elaboration of appraisal-arousal circuits, which directly influence the unfolding primary emotional states.

Differentiation and Categorical Emotions

Following the first two steps of initial orientation and elaborative appraisal-arousal, a third phase that can occur in the experiencing of emotions is the "differentiation" or channeling of activation pathways. The more highly categorized activations represent the differentiation of primary emotional states. Sometimes we may feel "neutral," being unable to identify any particular verbalizable feelings. At other times, however, our primary emotional states—the flow and change of energy through our emerging states of mind—become further differentiated into more well-defined states.

The differentiation of primary emotional states into specific classifications of emotions, such as fear, brings us to the more familiar notion of "categorical emotions."²⁸ "Categorical," "basic," or "discrete" are terms commonly used for those classifications of sensations that have been found universally throughout human cultures, such as sadness, anger, fear, surprise, or joy.²⁹ These internal emotional states are often communicated through facial expressions, and each culture seems to have words to describe their unique manifestations.³⁰ They also appear to have unique physiological profiles in which they manifest themselves. *Categorical emotions can be thought of as differentiated states of mind that have evolved into specific, engrained patterns of activation.* The cross-cultural similarities in the manifestation of categorical emotions suggests that the human brain and body have characteristic, inborn, physiologically mediated pathways for the elaboration of these states of mind.

The brain has a physical reality to its construction through

which internal states are expressed via our genetically and experientially created bodies. Throughout the world, human beings share common pathways to the expression of categorical emotions. In every culture, we can identify these characteristic expressions of "basic" emotions³¹—for example, as sadness, anger, or fear. In sadness, the face will show the typical findings of turned-down lips and squinted eyes, together with slower bodily motions. Anger will involve dilated pupils, widened orbital area, raised eyebrows, furrowed brow, and pursed lips. Fear reveals the combination of raised eyebrows, flattened brow, and open mouth. Though we can categorize emotions within an individual and across cultures,³² this does not mean that one person's categorical emotion, such as sadness or fear, is identical to that of another individual.

Affect and Mood

The way an internal emotional state is externally revealed is called "affective expression" or simply "affect." Affect appears within non-verbal signals, including tone of voice, facial expression, and bodily motion. These external expressions can be defined as "vitality affects" or as "categorical affects,"³³ revealing the primary or the differentiated nature of the emotional states, respectively. For many researchers, affect is essentially a social signal.³⁴ The purpose of the expression of emotion is considered to be social communication, as supported by the general finding that individuals reveal more affective displays in social settings than they do when alone.

It is interesting how often people consider the categorical emotions the only emotional processes they can try to know, or attempt to communicate to others. Examining the three phases of emotional response—states of initial orientation, elaborative appraisal and arousal, and then categorical emotions—yields a new way of thinking about how to respond to the question "How are you feeling?"¹ The term "feeling" can be used to describe the conscious awareness of either an emotion or an affect.²

We can feel (categorically) "sad" or "mad" or "happy." We may come to be aware of this by how we sense our minds or our bodies, or by what we detect on our faces. We may, as children so often do, be aware of just feeling "bad" or "good," or just "normal" (neutral), reflecting our initial appraisals without further differentiation into categorical emotions. Often we may also be aware of only feeling less differentiated primary emotional states, such as surges of energy, a sense

of deflation, images of one sort or another, diffuse fogginess, or nervous agitation. These flows in our states of mind—the changes in activations within our brains—are defined here as our primary emotions, and can be seen externally as what have been termed vitality affects. Primary emotions are a frequent part of our basic "feelings."

Parents attune to the subtle changes in a baby's state of arousal, not merely the categorical affect that the infant may or may not be expressing.³⁵ In fact, this expression of internal state through vitality affects is the primary mode of communication between an infant and a caregiver during the early years of life. These affective expressions reveal the profile or energy level of the state of mind at a particular moment. The profile contains within it a picture of how the individual's internal state is being expressed in a changing state of activation of the face, motion in the body, and tone and intensity of the voice. Vitality affects reveal aspects of the primary nature of emotion—the changes in the system's state of arousal.

Individuals may attune to vitality affects across sensory modalities. For example, a facial expression of joy can be mirrored in the response of another person's tone of voice, with the rising and falling of intensity of the sounds reflecting those of the muscles of the face. It may be that primary emotional experience reveals both how we know ourselves and how we connect to one another. In parent-child relationships in which the parent is depressed, vitality affects may reveal a "depressed" state, with low energy and a global negative hedonic tone. Research also suggests that depression is associated with a decreased capacity to perceive the emotional expressions of others.³⁶ The impaired ability to perceive facial expressions has been correlated with alterations in the activity of the parts of the brain responsible for such perceptual capacities.³⁷ Studies of dyads with a depressed parent reveal significant effects on the emotional development of the child.³⁸ The experience of expressing one's emotional state and having others perceive and respond to those signals appears to be of vital importance in the development of the brain. Such sharing of primary emotions does not merely allow the child to feel "good"; it allows the child to develop normally.

Primary emotions are expressed in a unique manner in the moment, just as an individual's state of mind at a particular time is a one-of-a-kind state. The flow of states moves forward in time and never repeats itself. This flow of states is unique. Vitality affects are the external expressions of primary emotions. In contrast, the external expressions of categorical emotions may reflect

the very specific routes through which the physical body is able to reveal certain aspects of these differentiated internal states. The mechanisms facilitating this movement toward these different forms of categorical emotions, such as the differentiation of sadness, anger, or fear from one another, are not fully understood at this time. The view proposed here is that the process from primary to categorical emotions is influenced directly by the unique components of neural processes that form a state of mind. In other words, the mental state active at a given time may shape the elaboration of arousal and meaning from primary to categorical emotions. More often, however, our changing states of activation within the mind, our primary emotions, may ebb and flow without necessarily becoming intense, entering consciousness, or becoming further differentiated into categorical emotional states.

The term "mood" refers to the general tone of emotions across time. Mood can be thought of as a bias of the system toward certain categorical emotions. Mood shapes the interpretation of perceptual processing and gives a "slant" to thinking, self-reflection, and recollections. For example, a person who is in a "down" mood may find himself interpreting things as evidence of his failures, think of the future in dismal terms, reflect upon himself as a "loser," and have increased recollections of the numerous times he has made mistakes in his life. The influence of mood upon all of these cognitive functions reveals how general emotional tone reinforces itself in a feedback loop that keeps one's mood spiraling in the same direction. This may explain the tenacious nature of emotional disturbances such as depression or chronic anxiety, in which a given mood becomes a relatively fixed and disabling state. In certain individuals, the ability to maintain a flexible flow of primary emotional states may be quite impaired and reflect difficulty in their ability to modulate their emotions.

THE CONVERGENCE OF SOCIAL PROCESSING AND EMOTION

By clarifying the distinction between primary emotions and the more familiar idea of categorical emotions, we can become more sensitive to the early stages of meaning-making interactions with others. As we'll see in the pages to follow, emotion in general is a complex series of processes and is of central importance in the mind. It involves the dual nature of the essence of mind: the flow of energy

and the processing of information. Emotion also reflects the essential way in which the mind emerges from the interface between neurophysiological processes and interpersonal relationships: It serves as a set of integrating processes linking various systems in a dynamic flow across domains and through time. Within the brain itself, emotion links various systems together to form a state of mind. Emotion also serves as a set of processes connecting one mind to another within interpersonal relationships.

The appraisal centers of the brain are located within the limbic system. A brief review of the anatomy involved will help us to visualize how these processes converge.³⁹ These centers involve such areas as the amygdala, anterior cingulate, and orbitofrontal cortex. External stimuli enter the brain via the sensory systems, such as vision, hearing, and touch. The representations generated from these perceptual processes are then filtered through the thalamus and passed on to the amygdala, where they are appraised and given initial value: "Pay attention? Is this good or bad?" The amygdala is able to directly affect these basic evaluative and perceptual processes. It also sends these representations on for further evaluation by the anterior cingulate and orbitofrontal cortex.⁴⁰ Like the amygdala, these centers are processing information about the social environment: the facial expression, direction of eye gaze, and other aspects of others' non-verbal behavior that reveal their state of mind.⁴¹ *Information about the social context directly affects the appraisal process.* These areas of the limbic system also register the state of the body and directly affect its states of activation.⁴² Information from these areas is passed on to the hippocampus for "cognitive mapping" and, in some cases, transfer into explicit memory. The orbitofrontal cortex also plays a major role in coordinating these appraisal and arousal processes with the more complex representations of "higher thinking" and social cognition.⁴³

This brief review of the limbic system's neurophysiological coordination of input and brain/body response highlights the general statements made throughout this book about the mind: Neural processes and social relationships both contribute to the creation of mental life. The limbic system functions as the center of processing of social information, autobiographical consciousness, the evaluation of meaning, the activation of arousal, and the coordination of bodily response and higher cognitive processing. These processes are not limited to the limbic region, however; rather, they emerge as a convergence of information processing and energy flow that directly

influences a wide array of both basic and more complex processes of the brain.

NONCONSCIOUS AND CONSCIOUS EMOTION

Emotions are primarily nonconscious mental processes. In their essence, they create a state of readiness for action, for "motion," disposing us to behave in particular ways within the environment. Emotional reactions create this disposition by determining the brain's activation of a wide array of circuits leading to changes in the state of arousal within the mind/brain and other areas of the body. The amygdala is a cluster of neurons that serves as a receiving and sending station between input from the outer world and emotional response. As a coordinating center within the brain, the amygdala, along with related areas such as the orbitofrontal cortex and anterior cingulate, plays a crucial role in coordinating perceptions with memory and behavior. These regions are especially sensitive to social interactions. They nonconsciously assign significance to stimuli; their actions influence a wide array of mental processes without the involvement of conscious awareness. These circuits are widely connected to other regions that directly influence the functioning of the entire brain as a whole system.

In fact, the limbic system also registers the state of the body and directly influences the body's state of activation via regulation of the autonomic nervous system.⁴⁴ In this manner, the limbic system serves as a source of social processing, stimulus appraisal, and brain/body ("emotional") arousal; these may originate within particular limbic regions, but there are no clear boundaries to their effects.⁴⁵ Once again, emotion is not merely a function restricted to the areas defined as central to the limbic system; emotion directly influences the functions of the entire brain and body, from physiological regulation to abstract reasoning.⁴⁶

The amygdala has been studied more than any other appraisal center and has been found to play a crucial part in the fight-or-flight response. Classic studies have examined its role especially with regard to fear states.⁴⁷ Let's look at the amygdala as an example of the elaborative feedback mechanism of the appraisal process that occurs without the requirement of consciousness. Studies of the amygdala have examined how the initiation of an appraisal leads to

subsequent perceptual biases that reinforce the nature of the initial appraisal. The flow of activation of the brain's circuits begins a process of further assembly of various activations, which then ready the individual organism for a particular response. The amygdala receives and sends signals directly from and to the visual system, reacting to visual stimuli without the involvement of consciousness. The amygdala responds to the initial visual representation—say, of a dog—by sending signals back to the same and even earlier layers of the visual processing system, and then by producing initial orientation of the attentional and perceptual apparatus of the brain: "Watch carefully; this is important!" If the amygdala also registers the visual input as dangerous, it can establish elaborative appraisal-arousal processes that create a state of fear in the brain and then feed back to the visual system. First receiving from and then sending signals to the visual centers, the amygdala can rapidly bias the perceptual apparatus toward interpreting the stimuli as dangerous. All of this occurs within seconds and does not depend on conscious awareness.

Nonconsciously, the brain is wired, at least with regard to the fear response, to create a "self-fulfilling prophecy." If the amygdala is excessively sensitive and fires off a "Danger!" signal, it will automatically alter ongoing perceptions to appear to the individual as threatening. This may be a basis for phobias and other anxiety disorders. For example, if a child encounters a dog that growls and lunges at her, she may have a response of fear. At this time, the amygdala directly activates arousal centers (located in the brainstem and forebrain) that create a general state of increased excitability through the release of substances such as noradrenaline in the brain and adrenaline in the body. The whole child becomes hyperalert and ready to deal with the "danger." If particular mental representations are active at the time of this arousal, then they will become associated in memory with a feeling of danger. This association occurs via Hebb's axiom (neurons that fire together wire together; see Chapter 2). Now a learned feedback loop has been established in which a dog can be a source of amygdala activation firing in the future. The brain learns to anticipate a bodily response of hypervigilance to the animal, and a constellation of fear and avoidance behaviors to dogs can then unfold. Such early experiences of fear may become indelible subcortical emotional memories, which may have lasting effects.⁴⁸

How does this rapid, automatic process become conscious? Consciousness is a controversial subject that has long intrigued philosophers and more recently neuroscientists.⁴⁹ Though there is no universally accepted explanation for the experience of consciousness, either

in the sense of awareness or in the qualitative sensation of subjective experiencing, there are some substantiated views that are quite helpful in understanding aspects of the mind. One such view of the internal experience of conscious awareness is the view of consciousness as involving a system in the brain responsible for working memory, the "chalkboard of the mind." In this perspective, perceptual representations from external stimuli or internally generated images from imagination or memory are functionally connected within an area of the brain called the lateral prefrontal cortex. It is in this region that attention is modulated, so that an "attentional spotlight" can be focused on particular representational profiles in the brain.³⁰ Working memory is able to handle only a limited amount of units of information, usually in a serial fashion. Neural activation profiles can be linked to the activity of the lateral prefrontal cortex and give the internal sensation of being within an attentional focus of consciousness. The lateral prefrontal cortex is located to the outer side of the front part of the brain, just to the side of the orbitofrontal cortex; it is thought to act by linking items together within conscious awareness, where they can be focally attended to and manipulated.³¹

What exactly it means for neural activation profiles to become "linked" is a central concern for scientists of the brain and mind. How do simultaneously activated processes bind together to form a continuity of experience? One approach to trying to answer this binding question comes from studies of the waves of electrical activity sweeping across the brain on a regular basis. A forty-cycle-per-second ("forty-hertz" or "40-Hz") pattern has been noted, in which the brain becomes active from back to front.³² This activity occurs in both halves of the brain and has been identified as a "thalamocortical" sweep, going from the deeper areas such as the thalamus up toward the higher cortical regions. One view is that representational processes (the neural net profiles activated at a particular moment in time) that are "on" at the time of the sweep are bound together as one seemingly continuous flow of conscious experience. This view allows us to see how the phenomenon of consciousness creates a sense of continuity out of what is really a set of quite discontinuous representational processes, such as sights, sounds, thoughts, bodily states, and self-reflections.³³ This "40-Hz" view also gives us insight into how the lateral prefrontal cortex may become "linked" to a particular set of representations—those that are active during the sweep. The attentional focus of working memory can select from those representations the limited number it may be able to handle at any one

time. Because of the nature of the sweeping, each hemisphere can function quite independently of the other. There are probably left-hemisphere and right-hemisphere forms of consciousness that are quite distinct from each other, based on the unique nature of the representational processes of each hemisphere. This will be explored briefly below and in depth in the next chapter.

A related view³⁴ is that when distributed neural assemblies become active in a rapid and strong manner such that they can achieve a certain degree of functional clustering, a temporarily stable state of complexity is achieved. When these assemblies achieve a certain level of integration, they can become "linked" to the thalamocortical system and their mental processes become a part of consciousness. This view is also compatible with the notion of some core thalamocortical 40-Hz sweeping process and the linkage with the activity of the lateral prefrontal regions. As we shall discuss in more detail in later chapters, these models of consciousness will be useful in helping to understand a number of aspects of mental life.

One view of how emotions become conscious is when their effects are connected to the activity of the attentional mechanisms of the lateral prefrontal cortex.³⁵ For example, when we say that we have a "gut feeling" about something, we may be referring, literally, to a somatic representation in our brains of our "gut response"—the body's response—to a stimulus.³⁶ This feedback loop of bodily response leading to emotional reaction has been a perspective long held by researchers with much scientific validation.³⁷ What is crucial to note, however, is that our brains frequently receive this bodily information without the involvement of conscious awareness. The binding of consciousness may be an "epiphenomenon" in many situations—something that is not essential for other neural reactions subsequently to occur. We may frequently have nonconscious "gut reactions" that profoundly influence our decision-making processes without our awareness of their impact.

We can also become aware of a sense that something feels "meaningful." In this case, we have caught a conscious glimpse of emotion as a value system for the appraisal of the significance of stimuli. Some aspect of the effects of emotional processing has become bound in consciousness. Another example of emotion's becoming a part of our conscious experience is when we feel ourselves becoming lost in a "sea of emotion." Our minds are capable of being bombarded by a flood of stimuli from emotional processes, which fill us with an overwhelming feeling. These sensations may

reflect primary emotions (such as internal shifts in states of arousal) or categorical emotions (such as anger, fear, sadness, excitement, or joy). Emotions are what create meaning in our lives, however, whether we are aware of them or not.

Some people have very little awareness of their emotional reactions to things. For one man, for example, it was easy to be conscious of his thoughts about interactions with others, but he had a difficult time letting his wife know verbally "how he felt" beyond simple statements of "good," or "bad," or "I don't know." We could say that for some reason, the representations of his emotional state—things like his bodily response or shifts in his mental state—did not get linked to his lateral prefrontal attentional processes. We cannot say whether they in fact were present or not in his mind. In a sense, this person was emotionally blind. Unfortunately, this blindness to emotions included his unawareness of his wife's states as well as his own.

This illustrates the importance of recognizing that emotional processes are primarily nonconscious. Some people, and certainly this man's wife, would be prone to say that he "has no feelings." As we've seen in Chapter 3, avoidant attachment fosters an emotional disconnection of the child from the parent. There is some suggestion that this disconnection may also be prominent in this man's lack of conscious access to his own nonverbal experience of primary emotions. The lack of connection between consciousness and the arousal-appraisal system does not mean that there is a lack of emotion, however. Instead, we can state that there is a lack of binding of emotion to consciousness. Consciousness may be necessary for an intentional alteration in behavior patterns beyond "reflexive" responses. Without the involvement of consciousness and the capacity to perceive others' and one's own emotions, there may be an inability to plan actively for the future, to alter engrained patterns of behavior, or to engage in emotionally meaningful connections with others.

EMOTION AS A VALUE SYSTEM FOR THE APPRAISAL OF MEANING

The functioning of the brain as a complex system of neuronal circuits requires it to have some way of determining which firings are useful, neutral, or harmful. Without such an appraisal mechanism, stimuli from the outside world and internally generated states and

representations would all be equally welcome. Such an organism would not be able to organize its behavior, to accomplish tasks that allowed it to survive, or to pass on its traits.⁵⁸ The brain must have a way of establishing value in order to organize its functions. Value disposes us to behave in particular ways. At the most basic level, the first phase of this process, initial orientation, lets the organism "know" whether to pay attention to something that is important. The second phase, consisting of elaborative appraisal and arousal, gives the individual the value of whether the stimulus is good or bad. Good things should be sought; bad things should be avoided. *Value systems in the brain function by way of increasing states of arousal.* Evaluative circuits serve as a neuromodulatory system with extensive innervation throughout the brain that can lead to hyperexcitability and increased neuronal plasticity. Chemically, this makes the neurons hypersensitive and more readily activated. By initiating attentional mechanisms, arousal enhances the focus of attention on a particular stimulus. In this way, attention is often considered the process that directs the flow of information processing. For perceptual processing, this means, for example, that a person will pay more attention to an object. For memory, arousal leads to enhanced encoding via increased neuronal plasticity and the creation of new synaptic connections and therefore increased likelihood of future retrieval.⁵⁹

As the activations within the brain change, energy flows through the system. Changes in the state of the system are changes in this flow of energy. Many factors in addition to appraisal influence what determines how the system's state changes over time. These determining factors include present input from the external world or from other components of the body, as well as constraints established from prior experience (such as Hebbian connections) and present appraisals. Moreover, there are many forms of arousal, which involve different circuitry. Initial orientation may then activate specific elements of attention. This initial stage "energizes" attentional and perceptual circuits, which then lead to further, elaborated appraisals. This elaboration can produce different forms of subsequent arousal, depending on the nature of the appraisal. At the most basic level, stimuli appraised as "good" will arouse elements of cognitive and behavioral approach. Stimuli appraised as "bad" will arouse withdrawal patterns of neural circuitry activation. When we think of the concept of "arousal," we need to keep in mind that it is a general notion referring to a wide range of specific activation patterns.

It is interesting to note that some of these approach/avoidance

distinctions may in fact be hard-wired into the brain. For example, recent studies suggest that the ability to process others' facial expression of emotions, an ability thought to exist in the anterior cingulate, the orbitofrontal cortex, and the amygdala, may have distinct characteristics in different regions. Preliminary findings suggest that the amygdala appears to contain face-recognition cells that exist solely to respond to expressions of fear and anger—not positive emotions or even other negative ones, such as disgust.⁶⁰ The limbic regions use input of others' emotions to regulate a person's internal state and external responses directly. As Main and Hesse have proposed, disorganized attachment is commonly associated with parents who show frightening or frightened behaviors.⁶¹ Perhaps these findings reflect the role of parental anger and fear in repeatedly activating specific face-recognition cells within the amygdala as well as generating the characteristic fight-flight response mediated by this limbic region. Could such a specific and ingrained set of limbic states be at the core of the disorganized behaviors (and dissociation) exhibited by these children? As we've discussed in Chapter 3, as they grow older, such children tend to develop controlling, hostile, and aggressive behavior with their peers.⁶² These behaviors can be proposed as elements of an excessively sensitized amygdala's fight response. Low levels of stress may be able to activate these reflexive responses and may trigger the rapid perceptual-amygdala feedback loop, which reinforces the sensation of threat. In general, the communication of different types of emotions in children's home environments and the unique neurobiological effects of these emotions may be important in determining the children's patterns of response over time.

Some aspects of a value system are inborn, and some are acquired through experience. Some constitutional aspects of a value system include the motivational systems of attachment and novelty seeking. Within the brain are clusters of cells that are designed to fire in response to eye contact and facial expressions.⁶³ These clusters of social responders are located within the value centers of the brain, such as the amygdala and the orbitofrontal cortex. For example, *seeking proximity to a caregiver and attaining face-to-face communication with eye gaze contact is hard-wired into the brain from birth.* It is not learned. Similarly, infants are "natural explorers," seeking out new stimuli within their increasingly sophisticated ability to search the environment. Discussions of the genetic determinants of emotional behavior offer helpful insights into the way in which our value systems organize our behavior to increase the chance of survival. Evolutionary theory suggests that those organisms with geneti-

cally encoded specificity to their appraisal, such as fearing a snake or becoming aroused by a suitable mate, will have a significantly increased likelihood of passing on their genetic information to future generations.⁶⁴ Genes clearly play a large role in the value system of the brain.

Action, learning, and development can be viewed as interrelated sets of phenomena throughout life.⁶⁵ For infants, interactions with the environment are driven by the emergence of the increasingly complex capacities of their brains to represent the world around them. The inborn aspects of the value system are in place from the beginning of life, but the system is also shaped by learning from experience. For example, a child will naturally make eye contact with a parent as a "good" interaction. However, if such eye contact results in her being overwhelmed and intruded upon by the actions of the parent, then such interactions may become associated with a negative value. The child learns that eye contact should be avoided. The brain can learn to modify its response to the evaluative system's initial criteria of what is good or bad, based on past interactions with others. If past eye contact leads to a flood of disorganizing activations, the avoidance of such experiences in the future will help keep the self organized.

The appraisal of stimuli and the creation of meaning are central functions of the mind that occur with the arousal process of emotion. Incoming stimuli are appraised for their value, and the representations of these stimuli are then linked with a sense of "goodness" or "badness." As the child develops, the increasingly complex representational system becomes capable of more subtle evaluative sensations. These variations on the "good or bad" theme are what lead to the wide variety of emotions we are capable of feeling. We are unique individuals precisely because both our value systems and our interactional histories are one-of-a-kind combinations. As the intertwined nature of value system responses and environmental encounters unfolds, each of us continually emerges and defines ourselves.

RESPONSE FLEXIBILITY, RELATIONSHIPS, AND EMOTION

Central to this process of creating meaning and emotion is the orbitofrontal cortex.⁶⁶ As noted in Chapter 1, this area of the brain sits at the interface between "lower" regions involved in taking input from the body and the senses, and the "higher" parts involved in

integrating information and creating complex thoughts and plans. This integrating region is involved in stimulus appraisal (the meaning, value, or emotional valence given to a stimulus),⁶⁷ affect regulation (the capacity of the brain to modulate its psychophysiological state),⁶⁸ social cognition (the complex process by which one individual is able to have "mindsight" or the ability to perceive the mental state of another),⁶⁹ and auto-noetic consciousness (the ability to perform mental time travel).⁷⁰ It is this region that is postulated to be one of the core areas of deficit in the major disorder of social cognition, autism.⁷¹ Other cognitive processes involving the appraisal-arousal structures, such as the orbitofrontal cortex, the anterior cingulate, and the amygdala, include emotional memory (especially fear),⁷² empathy (feeling what another feels),⁷³ and categorical emotions.⁷⁴

The orbitofrontal cortex has also been demonstrated as central in mediating a process we can call "response flexibility." As Nobre and colleagues have demonstrated in visual stimulus experiments, this region appears to mediate the "switching or reversing of stimulus-response associations" and is at the "interface between automatic default-mode operations of the CNS [central nervous system] and neural processes that allow for flexible adaptations to shifting contexts and perspectives."⁷⁵ In other words, the orbitofrontal region is active in taking changing or unexpected internal and external conditions and creating new and flexible behavioral and cognitive responses instead of automatic reflexive ones.⁷⁶

We can propose that this response-flexibility process may become integrated with the other functions subsumed by the orbitofrontal cortex, as described above, as well as other related regions, such as the lateral prefrontal cortex and its mediation of working memory. As Mesulam has stated, "The prefrontal cortex plays a critical role in these attentional and emotional modulations and allows neural responses to reflect the significance rather than the surface properties of sensory events."⁷⁷ The prefrontal mediation of response flexibility may thus entail a coordinated process incorporating sensory, perceptual, and appraisal mechanisms and enabling new and personally meaningful responses to be enacted. We can propose that such an integrating function may allow an individual, for example, to approach life decisions, relationships, and perhaps narrative responses with self-reflection and with a sense of perspective on past, present, and future considerations. In this manner, the capacity for response flexibility may become functionally linked with other prefrontally mediated domains that we have discussed, such as

auto-noetic consciousness, social cognition, emotionally attuned communication, and working memory. The outcome of such well-developed and integrated functioning can be proposed to play a central role in the individual's ongoing development, subjective experiences, and interpersonal relationships.

Response flexibility enables the mind to assess incoming stimuli or emotional states and then to modify external behaviors as well as internal reactions. Such an ability can be proposed as an important component of collaborative, contingent communication. The capacity for response flexibility may also be revealed in the coherence of the discourse process of the AAI. As suggested by Main,⁷⁸ coherent narratives require the flexible focusing of attention on attachment-related issues. The inability to exhibit response flexibility can thus be proposed to contribute to incoherent narratives of the insecure adult attachment findings. Such an impairment may also be revealed in the collapse in the maintenance of a narrative strategy seen in the "cannot classify" adult category described by Hesse.⁷⁹ Thus, response flexibility can be proposed to be a contributing link between parent-child attachment and adult narratives. In situations where this function fails to develop or its integration with other processes is impaired, especially with those mediated by the prefrontal regions, we can predict that tenacious, global effects may be exerted within the individual's internal and interpersonal experiences across time. As with other mental processes, response flexibility is likely to be state-dependent: Internal and interpersonal contexts can promote or inhibit the integrative mechanisms on which they are created. In this manner, response flexibility can be seen as an integrative capacity that is achieved under certain conditions, rather than a fixed developmental accomplishment. For these reasons, an individual may exhibit this adaptive flexibility in certain situations and not in others. As we'll discuss in the final three chapters, the ways in which emotional states flexibly integrate and organize widely distributed internal and interpersonal processes—the manner in which the flow of energy and information is adaptively modulated—can be seen as having a direct effect on self-regulation, relationships, and development across the lifespan. Future studies will be helpful in clarifying the nature of response flexibility, its mediation by the orbitofrontal region, its potentially experience-dependent development, and its possible relationship to incoherent narratives and patterns of parent-child communication.

How are response flexibility and other integrative processes influenced by the emotional communication inherent in many inter-

personal relationships? Looking toward neurobiological structure and function may shed some light on this question. The orbitofrontal cortex sits at a crucial neuroanatomic position at the uppermost part of the limbic system—the center of our basic appraisals, thought to be the origin of our widely distributed emotional experiences. As discussed earlier in this chapter, a controversy exists as to what the limitations of the limbic region actually are: Its boundaries as a major center for influencing the functioning of the brain cannot be clearly delineated, and in this way the entire brain can be considered “emotional.”⁸⁰ As we can see, the social/emotional/meaning-making processes of the limbic system help coordinate a wide range of mental functions. The result of the adaptive integration of these functions may be the proposed process of response flexibility.

The orbitofrontal cortex receives direct input from the sensory cortex, which is responsible for perception; the somatosensory cortex and brainstem, which register somatic sensation; the autonomic nervous system, which controls bodily functions; the dorsolateral prefrontal cortex, involved in attentional processes; the medial temporal lobe, involved in explicit memory; and the associational cortex, involved in abstract forms of thought. Allan Schore has described how the development of the orbitofrontal cortex is thought to depend on stimulation from the emotional connections of the attachment figure in the form of eye contact, face-to-face communication, and affective attunement.⁸¹ The orbitofrontal cortex, like the amygdala, has specific cells particularly responsive to facial expression and eye gaze direction.⁸² These fundamental aspects of social signals specifically activate these regions of the brain. The orbitofrontal cortex is also crucial in coordinating bodily states and the widely distributed and linked representations that are fundamental to reasoning processes, motivation, and the creation of emotional meaning.⁸³

Emotion is a fundamental part of attachment relationships in the early years and throughout the lifespan. The earliest forms of communication are about primary emotional states. This sharing of basic appraisal and arousal processes establishes the fundamental way in which one person becomes connected to another within emotional relationships. We can also propose that the reciprocal collaboration within such contingent communication facilitates the development of a parallel, prefrontally mediated process, response flexibility, that enables the individual to respond to changing internal and interpersonal contexts in an adaptive, “internally collaborative” manner.

Such internal collaboration may be seen as a way in which widely distributed neural processes come to be recruited into a flexible state of mind, one that is adaptive to a range of internal as well as external factors. In this way, we can see how intimate, reciprocal human communication may directly activate the neural circuitry responsible for giving meaning, integrating the capacity for flexible responses, and shaping the subjective experience of living an emotionally vibrant life.

EMOTION AND SOMATIC RESPONSE

The signals from the body also directly shape our emotions. Our awareness of bodily state changes—such as tension in our muscles, shifts in our facial expressions, or signals from our heart or intestines—lets us know how we feel, though bodily feedback occurs even without awareness. Perceptions of the environment certainly occur in the brain, but the subsequent reactions of the body may follow very soon after and become the “data” informing us about what those perceptions mean to us. In this way, our appraisal mechanisms may depend upon bodily reactions to determine the direction of subsequent elaboration. States of mind are created within the psychobiological states of the brain and other parts of the body.⁸⁴

For example, contracting the muscles of the face in a characteristically negative (frown) or positive (smile) manner produces a respective bias in interpreting data.⁸⁵ If we sense our own faces smiling, we are more likely to enter a positive state of mind and to view our experience from that stance. Studies even demonstrate that contracting the muscles of the left side of the face (presumably requiring activation of the right hemisphere) is associated with negative bias, whereas contracting those of the right side of the face (presumably requiring left-brain activation) leads to positive appraisals.⁸⁶ Somatosensory data from the face are registered in the brain and directly influence the state of activation, so that information processing is shaped by the effects of this information.

The neurologist Antonio Damasio has postulated that the change in bodily state is perceived and represented in the brain as what he calls a “somatic marker.”⁸⁷ Two forms of bodily response are especially relevant. Muscle changes in our limbs and faces are highly sensitive components of emotional reactions, and these send input directly to the brain and are represented in an area called the

somatosensory cortex. Of note is that the portion of the somatosensory cortex in the *right* hemisphere has more integrated representations than that in the *left* hemisphere, suggesting a more direct role of the right brain in the processing of somatic markers. As we'll see, the brain's asymmetry plays an important role in understanding emotion and the mind. The other form of bodily response is in changes in the viscera, such as the stomach, intestines, heart, and lungs. Visceral changes are registered in the orbitofrontal cortex and related areas, also especially in the right hemisphere. Interestingly, these regions of the brain monitor as well as regulate these visceral reactions.⁸⁸

Experience establishes learned associations between external stimuli and these bodily responses. In this view, our knowledge of how we feel is based in large part upon the nature of these somatic markers. As we develop, Damasio postulates further, we acquire the capacity to have an "as-if" loop, in which an internal stimulus (such as a thought, image, or memory) can activate an "as-if" somatic marker.⁸⁹ Our brains create a representation of bodily changes that is independent of the present-day response. A thought can be associated with an emotional response containing a somatic marker that has been generated internally. This is a representation of a shift in bodily state created by our brains from imagination and past experiences. Memories of emotional experiences evoke as-if somatic markers, which can feel as real as direct bodily responses and can deeply enliven the associated imagery of the recollection. In some cases we will also have the actual bodily changes, such as increased heart rate, sweating, and dilated pupils when we are recalling a past frightening event.

For example, if an adult was bitten by a cat as a child, the state of fear and arousal at the time will be registered in the brain as a somatic marker of fear associated with the image and idea of a cat. In the future, seeing a cat may activate a similar bodily state of fear, instantiating a somatic marker similar to the time of the initial cat bite and activating a set of associational memory processes linked to the time of the original bite. An "as-if" somatic marker reveals how the process of imagination or memory can elicit a sensory response, which then initiates a cascade of fear-related associations that may be quite debilitating. This may be one way in which unresolved posttraumatic conditions continue to perpetuate frightening reactions from long ago; such individuals feel as if they are being traumatized over and over again.

INDIVIDUAL DIFFERENCES IN EMOTIONAL EXPERIENCE

Some couples experience a kind of "compatibility" that both members of a pair may have felt when they first met: They resembled each other in certain favored ways of being, in certain needs for play and relaxation, or in preferred times for work. In some pairs where there is a discordant match in the partners' attachment histories, the disparity between their individual appraisal systems may lead to difficulty in their pattern of communicating despite this compatibility. For example, a husband with a dismissing state of mind with respect to attachment had experiences with his mother that appeared not to have reinforced the positive effects of emotional intimacy. His relationship with her seemed not to have offered him encounters in which eye gaze and face-to-face contact were associated with a sense of soothing. Recall that studies of avoidantly attached pairs reveal that the body continues to register distress during separation (for children) and in discussion of attachment issues (in adults). This finding suggests that the original value system, which assigned a "good" meaning to affective connections between people, has probably remained intact even after repeatedly disappointing and rejecting experiences. What has been learned is the person's development of behavioral and complex cognitive responses, such as memory and narrative, that serve to minimize conscious access to this persistent distress. The brain has learned to adapt itself to the learned experience by minimizing the manifestations of such distress on other aspects of mental functions.

In this couple, the wife's experience of her husband was that in a quiet way he seemed to enjoy her presence. To her, his lack of focus on her emotional states provided a sense of first safety and then frustration. She seemed to have had an ambivalent attachment with her own mother and a disorganized one with her father; she now had an unresolved adult attachment status, with a best-fitting alternative classification of preoccupied. On some nonverbal level, she felt that her husband liked being "close" to her, though he would never state this directly. She was probably sensing something real—an intact but frightened emotional system in her husband, which did indeed continue to value attachment. Both on the surface of his behavior and in his conscious experience, however, he denied the importance of such connections. In fact, the husband seemed to pride himself on his autonomy, often stating that the sign of healthy development is to

"not need anyone, just want them." His wife did not feel needed. She often didn't even feel wanted.

With many couples, the very characteristics that each partner initially found attractive in the other become the same qualities that create intolerable frustration and drive them to a therapist for help. In this couple, the wife was attracted at first to the husband's "autonomy and independence." She felt safe and unthreatened by his emotional distance. The husband liked his wife's "sensitivity and ability to express her emotions." She offered him something he had never had. As time went on, however, she began to feel so isolated that his autonomy made her infuriated. He began to sense her emotional response as attacks on his personality. This couple became stuck in an emotional rut.

In this case example, the wife's capacity to experience emotion was quite different from that of her husband. She was able to notice changes in her body's sensations, such as a tightening in her muscles, a queasy feeling in her stomach, and a trembling in her hands. She might feel her face beginning to smile, or notice tears on her cheeks. Each of these bodily messages let her know some aspect of her emotional state: anger, fear, sadness, joy. The ability to sense this somatic feedback is the kind of self-awareness that has led numerous researchers to postulate that *the body's response lets us know how we feel*.

Somatic markers—actual or "as-if"—can be generated without consciousness. These representations can influence perceptual bias, memory processes, and rational decision making without our awareness. In this couple, the wife often could sense when she was having an intense "emotional experience" by the way her body felt. For her husband, life was not so full of these sensations. He would make decisions, perceive the world, and recall things (or not) without a sense that any kind of biasing was occurring. But we cannot say that he was any less influenced by his hidden value system than his wife, whose emotions were more readily accessible to her conscious experience.

Working memory is able to contain a number of processes and manipulate them within conscious awareness. These processes include present perceptual representations, items from long-term memory, and states of the body. To minimize distress and maximize function, the brain of this dismissingly attached husband might have had the challenge of focusing his conscious attention away from attachment-related experiences. This diverting of attention might have concerned external events, such as the behavioral response of acting as if his mother didn't return (as seen in the infant separation studies), as well as internal events, such as the minimization of the importance of

parental relationships (as revealed in the AAI; see Chapter 3). A distressed response is most readily seen in the body's state of increased sweating, heart rate, respiration, and muscle tension. Each of these may become activated in attachment situations with avoidantly attached children and dismissing adults. To avoid impairment of functioning, the representation of these responses must be kept away from working memory. To accomplish such a task means creating a pattern of neural interactions in which somatic markers are not linked to the working memory processes of the lateral prefrontal cortex.

Given the location of these processes, we can hypothesize how this husband might have been affected by such an adaptation. The cortical representations of somatic muscle responses are most highly integrated in the right hemisphere of the brain. Visceral responses are monitored by the orbitofrontal cortex and the closely associated anterior cingulate, also primarily on the right side. The lateral prefrontal cortex is centered just to the side of the orbitofrontal cortex, with which it receives and sends direct connections. Reduction in input to the right lateral prefrontal cortex would be quite helpful to avoid receiving the representations of the right-sided somatosensory and orbitofrontal cortices.

What would this mean for this man and others with a similar attachment history of distant emotional communication from a primary caregiver? Impaired input of the right-sided sources of somatic markers would functionally lead such individuals to be consciously unaware of their bodies' responses. They would therefore not be able to know easily how they feel. Furthermore, if the right lateral prefrontal cortex had more general blockages, we would predict that the other functions of the right hemisphere might also be less accessible to conscious awareness. In this case, the husband had a difficult time seeing the gist or context of things. He also seemed unable to read his wife's state of mind as expressed through her nonverbal signals. Such difficulties are all problems in functions of the right hemisphere. We shall return to the issue of hemispheric specialization in the mind both below and in the next chapter.

A common belief in everyday life is that there appears to be a pattern of differences in emotion, especially the empathic sharing of emotional states, between males and females. Developmental studies have focused on the gender differences in relationships among friends during the school years. In general, these studies find "masculine" and "feminine" styles that most boys and girls, respectively, seem to exhibit.²⁰ The masculine style has been defined as a form of mutual assertion of one's individual talents and skills. Boys' interest in ath-

letic prowess is one example of such a form of shared assertion. The feminine style has been described as one of mutual empathy; girls' interactions with each other tend to focus on shared expression and resonance with each other's emotional experiences.³¹ Clearly, however, many girls have elements of the masculine style, and many boys have elements of the feminine style. Although generalizations of any sort must be carefully examined, it is important to try to understand the genetic, hormonal, developmental, and/or social factors that contribute to such observable gender differences.

EMOTIONAL COMMUNICATION: EMPATHY AND AFFECTIVE EXPRESSION

An important aspect of emotions is their social function. Emotions, both primary and categorical, serve as the vehicles that allow one person to have a sense of the mental state of another. The capacity to feel another person's experience has many labels, such as "empathy," "sympathy," "mirroring," and "attunement." In its essence, the ability of one mind to perceive and then experience elements of another person's mind is a profoundly important dimension of human experience. We are a social species, and having the ability to "mind-read," or having "mindsight," lets us rapidly detect the emotional state of another. Why is this so important? There are several reasons. This form of communication allows us to perceive the intentions, attentional focus, and evaluation of events in others; it therefore allows us to understand social interactions and anticipate the behavior of other people. Our minds are capable of detecting the nonverbal signals of others, which reveal these internal aspects of their states of mind. Young infants begin to differentiate between animate and inanimate objects in the world, attributing intention and emotional responses to the former and not the latter. With the assignment of intention, our minds are able to compare external behaviors with implied internal motivational states.³² This ability allows us to detect "cheaters" and note when we are being misled. A further evolutionary benefit of mindsight is that our ancestors could rapidly sense when a member of their own social group was detecting danger by the look on her face, her gestures, or her tone of voice. Those social beings capable of such mindsight escaped danger more often, were less often tricked by the destructive motivations of others, and

thus were more likely to survive and pass on the capacity for such state-to-state lines of communication.³³

From a developmental perspective, the most utilitarian of these benefits is that parents can sense the inner needs of their children and therefore maximize the potential of their offspring's survival. Another benefit of empathic attunement is that it creates an attachment bond between parent and child, which provides a source of increasingly complex layers of external and then internal security for the growing child in the increasingly challenging world encountered as he develops. The experience of being understood develops a mental model or inner expectation that needs are important and goals are achievable. Also, the child's system requires the parent's attunement to help organize the child's own mind. Positive emotional states are amplified and negative ones modulated within these attuned communications. As the child grows, these repeated alignments of mental states allow him to develop a self-organizational capacity for autonomous state regulation. Human infants have profoundly underdeveloped brains. Maintaining proximity to their caregivers is essential, both for survival and for allowing their brains to use the mature states of the attachment figure to help them organize their own mental functioning.

The subjective side of these emotional connections is that it allows a sense of belonging to grow within the individual. "Feeling felt" is the subjective experience of mental state attunement. The pleasurable response to such a resonance of minds may be built into our brains as a genetic inheritance of evolutionary history. For us as social animals, our having such a sense encourages group behavior, which has been of great survival value to our species as we evolved. It may also be the reason why large groups are experienced so differently from smaller ones, in which face-to-face eye contact and other aspects of shared nonverbal communication are readily available. Committees of over a dozen people become unwieldy and inefficient (not that some smaller ones do much better!). Feeling felt for some requires even smaller group settings, with one-to-one situations being the ideal for many people.

Empathic emotional connections require some way in which internal states are expressed externally. Primates are the only group of animals with muscle endings on the skin of the face; this gives us the capacity for a huge assortment of facial expressions, which are directly controlled by our nervous systems.³⁴ Our tremendously rich innervation allows for exquisitely subtle and rapid alterations in facial

expression. To match this expressive ability, primates have neuronal groups in the brain that are specialized to respond to faces, and also to particular facial expressions! As we've discussed, these neuronal groups often rest in the value system circuits of our brains, such as in the amygdala and orbitofrontal cortex. We are hard-wired to have meaning and emotion shaped by the perception of eye contact and facial expression.⁹⁵ We are also hard-wired to express emotional states through the face.

Complex neural/bodily aspects of emotional processes are not easily translated into words. Nonverbal expressions, including those of the face, tone of voice, and gestures, can transfer information about internal states more fully to the outside world than words can do. Words go only so far. When anyone asks, "How are you feeling?", it is a huge translational challenge to turn such subtle and dynamic neural processes into a verbal statement. Emotion can be seen as an energizing drive toward motion. Seeing what a person does, rather than asking her how she feels, can often be a more direct road into the person's emotional state. Nevertheless, we often feel compelled to ask others how they feel. The social process of "talking about feelings" with each other is much more an interactive event than the mere telling of a linguistic message. Linguistic representations, such as the words "sad" or "angry," are quite limited and distant symbolic packets we send to each other in response to the query, "How are you feeling?" The message is in the medium of how we respond, not in the words alone.⁹⁶

The link between emotion and action is in the appraisal-arousal foundation of these processes. At their core, appraisals define what is good or bad, what should be approached or avoided. Children are often more at ease with the hedonic tone of primary emotional states than with trying to define the categorical emotions they may be experiencing. When children say, "I feel bad," or "I feel good," this may be a very direct statement reflecting this basic aspect of their appraisal system and primary emotional experience.

EMOTION AND THE HEMISPHERES

Affect can be expressed through facial expressions and through modulations in the tone and prosody of the voice. These nonverbal aspects of language communication, in both their expression and perception, appear to be mediated predominantly by the right hemi-

isphere.⁹⁷ The body's posture and movement can also blend with the voice and facial expression in sending affective signals that are readily perceived by other people. What is striking is the finding that the registration of the status of the body itself is also much more highly integrated in the right hemisphere than in the left. As we've discussed briefly, even the regulation of the body's autonomic nervous system is primarily mediated by right-brain mechanisms.⁹⁸ The right hemisphere therefore appears to play a major role in mediating emotional processes, as well as in permitting the expression of emotional states and the conscious awareness of emotional experience.

For this discussion of emotion, it is important to provide some background information. Appraisal and arousal occur on both sides of the brain, as do other emotional processes. However, the subjective experience and the nature of emotion on either side of the brain may be quite different. Leading theories propose a number of disparate views of emotions and brain asymmetry.⁹⁹ One major perspective is that of the valence hypothesis, which suggests that unpleasant emotions are processed on the right side and pleasant ones on the left.¹⁰⁰ Consistent with this suggestion is the view that withdrawal states and processes are located on the right side, whereas approach states and processes are located on the left.¹⁰¹ Another view is that socially mediated emotions, such as guilt or the enactment of social display rules, are processed in the left hemisphere, whereas more basic, spontaneous emotions are processed in the right hemisphere.¹⁰² Still others argue that raw, intense emotional experience is primarily mediated via the right hemisphere.¹⁰³

From a neuroscientific view of emotion as a socially mediated set of processes affecting all other mental processes, one can look to our basic elements of the mind as composed of the flow of energy and of information within the brain for insights into this dilemma of multiple theories. Primary emotional states are often directly expressed via nonverbal components of communication, including facial expressions and tones of voice. Primary emotional states are directly shaped by bodily response and directly influence bodily responses. These two basic somatic functions of primary emotions have been demonstrated to be mediated and perceived by the right hemisphere of the brain. Furthermore, in studies of patients with blocked communication between the two hemispheres, the left brain appears unable to register the facial expression of others. The right brain both perceives and sends messages through facial expressions and tone of voice.¹⁰⁴ It may therefore be fair to propose that the non-

verbal right hemisphere may be the location for the subjective awareness and expression of primary emotions as we have defined them. The processing of such emotions, however, is likely to be mediated by both hemispheres.

Developmental studies suggest that in fact each hemisphere may mediate quite different processes of engagement with the environment. As noted above, this may mean that approach is mediated by the left hemisphere and withdrawal by the right. For example, behaviorally inhibited (shy) children reveal a dominance in right frontal electrical activity at baseline; more adventurous children demonstrate left frontal activation. Nathan Fox has suggested that such findings support the notion that characteristic emotional styles may reflect profiles of frontal activation.¹⁰⁵ Left frontal activation is associated with active approach, positive affect, exploration, and sociability. The absence of left frontal activation leads to an absence of positive affect and the experience of depression. In contrast, right frontal activation leads to active withdrawal, negative affect, and fear/anxiety. Hypoactivation of the right frontal region leads to disinhibition of approach, with impulsivity and hyperactivity. Such a view can explain some features of shy and of aggressive children and the changes in their states as the context may alter their frontal activation profiles.

Further developmental studies suggest that both constitutional/temperamental and experience/attachment features may directly shape these patterns of frontal activation.¹⁰⁶ In the case of depressed mothers, for example, there is a marked decrease in shared positive affect states, and the infants (and their mothers) are seen as withdrawn. In both parents and children, there is a marked decrease in left frontal activation. If such depression lasts beyond the first year of life, the infants may continue to express this pattern of frontal activity.¹⁰⁷

SUBJECTIVE EXPERIENCE

Emotion is inherently a subjective experience involving the evaluation of meaning and the interaction with the environment. Experiences evoke within us textured subjective states that create the fabric of our lives and our relationships with others. Music has been described as one of the purest expressions of emotions that exists. It is filled with contours and spacing, varied intensities, and modulations in sound. These could be considered as categorical features,

such as joy or sadness, but perhaps they are more appropriately reflecting profiles of arousal so parallel to vitality affects that we could call primary emotions the "music of the mind." The process of creating and listening to music is a form of emotional experience and affective communication.

Several studies, and my own informal survey of dozens of children, reveal a common preference among unprofessionally trained individuals for the left ear when listening to music.¹⁰⁸ Sound heard with the left ear may induce a more holistic sensation, a floating with the flow of the music, quite distinct from the sensation produced by music heard with the right ear. How can this be? The left auditory nerve goes primarily to the right hemisphere! Though there is some crossover, the auditory stimulation in the right brain appears to evoke a different sensation from that which goes to the left brain from the right ear.

We are filled with representations of all sorts: sensations and images in a context-rich form mediated by the right hemisphere, and linguistic symbols in a linear, logical, detail-oriented mode mediated by the left hemisphere.¹⁰⁹ If this view is true, then our daily conversations are filled with a blending of right-sided and left-sided communication. Some authors argue that emotional attunement is fundamentally right-brain-to-right-brain communication.¹¹⁰ This view may sound too reductionistic and simple to be either true or useful. But let's take a look at a fundamental notion of attunement: the feeling of another person's experience. Merely to understand another person requires an intellectual grasp of the other's experience. To have the ability to conceptualize the mind of another, as well as to perceive what the other's subjective world might be like, requires special tools enabling the kind of reflective functioning discussed in Chapter 3. The neurological bases of these tools have been established over thousands of years of evolution and are a fundamental part of the social circuitry of the brain so intimately related to emotional experience. These circuits are located primarily in the right hemisphere. To feel another person's experience requires the ability to take in the essential data of how the other person in fact is feeling by way of specific signals generated by this person. These data then directly affect the receiver's state of mind. Would it be such a big surprise to find that the neural processes of one hemisphere are best expressed externally by that hemisphere, and then perceived best by the same hemisphere, but in another person? After all, words generated by the left hemisphere of one person are best perceived and understood by the left hemisphere of the listener. What we are really talking about

are the forms of information that the mind is processing. As we'll discuss more fully in the next chapter, the types of mental representations are quite distinct in each hemisphere. Learning about the nature of these differences can give us a better understanding of emotional experience and communication between minds.

Emotions recruit distributed clusters of neuronal groups in the emerging states of mind that organize the systems of the brain.¹¹⁷ Recruitment can be generally defined here as a process that temporarily links distinct, differentiated elements into a functional whole. In the brain, recruitment involves the binding of the activity of spatially distributed neural circuits at a given moment and across time. Emotion can be proposed to serve this integrative role by way of its involvement of neuromodulatory systems that are themselves widely distributed and have direct effects on neural excitability and activation, neural plasticity and the growth of synaptic connections, and the coordination of a range of processes in the brain. We can suggest that perhaps the most active representations may be the ones that become recruited and then have the potential to enter the spotlight of conscious awareness. Consciousness may in fact be quite distinct on each side of the brain. Some authors have suggested that the right hemisphere is a master at representing social context, whereas the left remains focused on details devoid of contextual meaning.¹¹⁸ The social context of a situation determines the nature of action of the appraisal systems. Internal context, the history of present and recent representational activity, also directly affects the way the appraisal systems work. The impact of representational processes on each side of the brain may create quite distinct contextual influences on the appraisal process and lead to distinct senses of conscious awareness.

The brain looks to the body's response to "know how it feels." An experiment that illuminated this involved subjects being told to contort their facial muscles in specific patterns. Unbeknownst to them, these configurations represented the various categories of emotions, such as anger, fear, or sadness. When they were presented with a standardized story, their appraisal of meaning was directly influenced by which facial musculature patterns they had activated. If their muscles were held in a sad way, they interpreted the story presented as sad. If their faces were held in a way to show joy, they had a "happy" reaction to the same story. The finding that the right hemisphere has a more integrated representation of the body, including the face, suggests that this form of information will have more impact on the experience of emotion on the right side of the brain.

By our second year of life we have learned the trick of how to

show facial affective expressions that are different from our internal emotional states.¹¹⁹ This form of social deception allows us to act in socially appropriate and sanctioned ways. In a fundamental manner, this behavior creates a division between the private, internal self and the public, external self. Most of us carry out this dual role every day in our private and public lives. If we spend too much of our time attempting to be "socially appropriate" by having a public self, and do not express authentic feelings or thoughts, then we may be vulnerable to developing a "false self" quite distant from our actual primary emotional experience. Of note are findings suggesting that the left hemisphere plays a more significant role in the communication of emotions that conform to social rules.¹¹⁴

As noted earlier, words are often quite limited in their ability to convey our internal states. Attunement to one another's nonverbal means of communicating emotional experience is a much more direct and satisfying mechanism for joining with others. However, we must use words and concepts to attempt to understand the nature of emotion if we are to begin to comprehend the human mind. Some might argue that without words, we cannot reflect on the conceptual nature of our own minds. As we've seen in Chapter 3, those parents who have the capacity to reflect on the importance of mental states are more likely to have secure attachments with their children. This reflective function is revealed in both affective attunements and the ability of these individuals to state, in words, the importance of mental states in human experience.¹¹⁵ In fact, the ability to use "mental state language"—words reflecting mentalizing concepts, such as beliefs, feelings, attitudes, intentions, and thoughts—is associated with parents of children with secure attachments.¹¹⁶ These ideas can inspire an approach to creating "reflective dialogues" with children in order to help them develop emotionally. In this way, having the capacity for reflecting in one's own mind on the importance of mental life can be revealed in both attuned (nonverbal) and language-based communication. Using both our nonverbal right and verbal left hemispheres, we can find ways to communicate the important subjective emotional experience of ourselves and others.

EMOTION REGULATION

Emotion is indeed a complex set of processes. As we've seen in this chapter, emotion is at the core of internal and interpersonal processes that create our subjective experience of the self. The organization of

the self is dependent upon the manner in which emotion is regulated. Research on emotion regulation reveals that emotion as a set of processes is both regulated and regulatory. That is, emotional processes cannot exist without influencing other such processes and being influenced themselves by other such processes. Thus the study of emotion and that of emotion regulation go hand in hand.¹¹⁷

Self-regulation—the manner in which the process called the “self” comes to regulate its own processes—consists in part of the regulation of emotion. Sroufe describes the “twin tasks” of emotion in development as the expression of affect and its management. He states, “The ability to maintain flexibly organized behavior in the face of high levels of arousal or tension is a central aspect of stable individual differences in personality organization.”¹¹⁸

Susan Calkins has described pathways to such differences in emotion regulation as involving both internal and external sources.¹¹⁹ Internal features include constitutional aspects of neuroregulatory structures (such as neuroendocrine, autonomic, and frontal lobe systems), behavioral traits (such as attentiveness, adaptability, reactivity, soothability, and sociability) and cognitive components (including social referencing, beliefs and expectations, awareness of need for regulation, and ability to apply strategies). External features include interactive caregiving patterns (responsiveness, cooperation, reciprocity, accessibility, support, and acceptance) and explicit training (including modeling, reinforcement, and discipline).

In general, our skills at regulating emotion allow us to achieve a wide range and high intensity of emotional experience while maintaining flexible, adaptive, and organized behavior. The processes of emotion regulation—and dysregulation—can involve any of the basic levels of emotion: physiology, subjective experience, and behavioral change. As we’ll discuss in detail in Chapter 7, the regulation of emotion involves the modulation of states of mind. Regulation of the flow of states can involve internal (physiological and cognitive) and interactive (engaging with the social environment) elements. For example, alterations in attentional focus, perceptual bias, or the evaluation of meaning can directly change the course of elaboration of primary emotional states into more differentiated categorical emotions. We can utilize the very processes of emotion to regulate their flow.

Before we can appreciate the details of these complex regulatory processes more fully, we will need to review what is known about how the mind constructs reality with representational processes (Chapter 5) and how states of mind are created within the complex

system of the mind (Chapter 6). Then we will be ready to wrestle with the questions of how the brain organizes its own functioning, including how it regulates emotional states within itself and in connection with others, in the creation of the mind.

REFLECTIONS: EMOTION AND THE MIND

An amusing cycle of responses sometimes enters the classroom when a psychotherapy student or teacher asks the question “What is a feeling?” “A feeling,” the response sometimes goes, “is an emotion. It is what you feel when you are emotional. Emotions generate feelings.” An initial way out of this endless loop of confusion comes from the knowledge of how central these elusive things, these emotional processes, are for human relationships. Emotions are the contents and processes of interpersonal communication early in life, and they create the tone and texture of such communications throughout the lifespan. This view at least brings emotions out of the individual and into the interaction between people. But, still, this leaves us with only a bit more clarity about the challenging task of how to define emotions.

Everyday descriptions of what emotions are may seem to be more appealing than trying to create seemingly restrictive, scientifically derived concepts and definitions. Emotions are what allow us to fall in love. They are the stuff of poetry, art, and music. Emotions fill us with a sense of connection to others. They link families together; they remind us of who is important in our lives. Emotions make life worth living.

For some, the risk of becoming scientific about emotions is that it has the potential to reduce the essential and passionate stuff of subjectivity into some neural-circuitry-based explanation that appears on the surface to be cold and useless. However, ironically, it seems that the application of neural science principles to understanding our feelings can actually expand and enrich the subjective experience of our own emotional minds. Understanding the neuroanatomic reality of the convergence of social interactions, appraisal, and emotional arousal helps us to see how the mind creates and is created by interactions with other minds. We can now move beyond circular definitions and embrace the metaphors of emotion in a deeply impassioned and integrated manner.

At the most basic level, the brain must have value systems that

appraise the significance of internal and external stimuli. The centers of these value systems, so often linked to areas that respond to social signals, act by initiating activity or arousal within specific circuits in the brain. This chapter has provided a broad set of specific definitions of emotion that can enable us to understand human experience more fully. At its most basic level, this view sees emotions as the flow of energy, or states of arousal and activation, through the brain and other parts of the body. This process emerges from and directly affects the further processing of information within the mind by way of the appraisal of meaning. Three phases can be identified: First, a stimulus (internal or external) evokes a state of initial orientation, creating a sensation of "Something important is happening; pay attention now!" This focus of attention is automatic and does not need to involve conscious awareness. Next, the value systems of the brain continue to appraise the meaning of that stimulus and of that initial orientation itself by means of elaborated appraisal and arousal processes and the activation of certain circuits. At this point, the sensation may begin to become "This is good" or "This is bad." These first two steps of an emotional response contain activation profiles, such as surges of energy, that can be defined as "primary" emotions. In their essence, primary emotions are the beginning of how the mind creates meaning.

Externally, primary emotions can be seen as vitality affects, expressed by the contours of activation of the body, facial expressions, nonverbal gestures and tone of voice. These vitality affects constitute the primary connection between infant and parent. This finding reveals the exquisite sensitivity of the appraisal centers to social interaction and shows how emotions are initially created within our relationships with others.

A third phase in emotional response is what is more generically thought of as "emotion": the differentiation of initial orientation and elaborated states of arousal and appraisal into categorical emotions. Examples of such emotions found throughout the world in characteristic expressions are sadness, anger, disgust, surprise, joy, fear, and shame. The brain and other body systems appear to have common pathways by which each of these distinct categorical emotional states are physiologically manifested and expressed as categorical affects.

Generated by the value systems of the brain, these emotional activations pervade all mental functions and literally create meaning in life. *In this way, we can say that emotion and meaning are created by the same processes.*

Information processing involves the creation and manipulation of cognitive representations. Attentional mechanisms direct the flow of information processing. Within perception and memory, the appraisal systems of the brain must label representations as significant or value-laden. In this way, the appraisal and arousal processes—the central features of emotion—are interwoven with the representational processes of "thinking." *Creating artificial or didactic boundaries between thought and emotion obscures the experiential and neurobiological reality of their inseparable nature.*

Energy flow is a basic aspect of primary emotions. As states of mind emerge within the individual, the changing activations that create them are often experienced as primary emotions. The regulation of emotion, or the regulation of the flow of information and energy within the brain, creates the self. The capacity to assess the personal significance of events and alter automatic, reflexive responses may be carried out by the prefrontal regions in a process we have called response flexibility. When such an ability becomes integrated with other aspects of emotional and memory processing, the individual may be able to generate a set of internal and interpersonal experiences that enables the self to have a flexible form of regulation. In the next two chapters, we will examine how the mind organizes itself by how it regulates the flow of information and mental states both within itself and with other minds. Emotion and its modulation are in this way a fundamental part of the information processing and energy flow that are central features of the organization of the self.