Emotion *and* CONSCIOUSNESS

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CHAPTER 14

Emotion, Behavior, and Conscious Experience

Once More without Feeling

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This chapter focuses on the relation of unconscious components of emotion to conscious feeling. By *conscious feeling* we mean the experiential, phenomenological, "what-it's-like" aspect of emotion. We ask whether valenced states—affect and emotion—can exist as well as drive the organism's behavior without participation of conscious feeling. The question is controversial because, as we will see shortly, there is a tradition in the human emotion literature to view conscious feeling as central for emotion.

The chapter is structured as follows. First, we summarize the traditional view on emotion and conscious feeling. Second, we argue for the idea of unconscious or unfelt emotion. Third, we address some of the empirical and philosophical challenges of this idea. Fourth, we address the relation between conscious and unconscious components of emotion.

EMOTION WITH FEELING

Definitions

An old line says there are more emotion definitions than emotion researchers. However, if there is one definition on which most researchers agree, it

1. *What is the scope of your proposed model? When you use the term* emotion, *how do you use it? What do you mean by terms such as* fear, anxiety, *or* happiness?

We think of emotion as a state in which several systems of the organism are directed toward a specific valence. As we discuss in the section titled "Definitions," it is typically assumed that emotion is characterized by loosely coordinated changes in several components, including (a) conscious feeling, (b) perception and cognition, (c) action tendency, (d) bodily expression, and (e) physiology. Our chapter examines whether the conscious feeling component is indeed necessary for emotion in human and nonhuman animals. We conclude that it is not.

2. *Define your terms:* conscious, unconscious, awareness. *Or say why you do not use these terms.*

One important aspect of consciousness is the potential of the organism to introspect about a state and to express it verbally or nonverbally. As we argue in the chapter, sometimes an emotion state can be principally unconscious, that is, unavailable to the systems responsible for expression and introspection, even under proper motivational and cognitive conditions.

3. *Does your model deal with what is conscious, what is unconscious, or their relationship? If you do not address this area specifically, can you speculate on the relationship between what is conscious and unconscious? Or if you do not like the conscious–unconscious distinction, or if you do not think this is a good question to ask, can you say why?*

The relation between conscious and unconscious aspects of emotion involves a complex set of psychological and neural factors. Conscious aspects of emotion probably emerge from a hierarchy of unconscious emotional processes, implemented by interactive brain systems that form reciprocal connections across subcortical and cortical networks. Some specific factors are discussed in our section "What Makes Emotion Unconscious or Conscious?"

is probably close to this. Emotion is a state characterized by loosely coordinated changes in the following five components: (1) *feeling*—changes in subjective experience; (2) *cognition*—changes in attentional and perceptual biases, low-level appraisals, and high-level beliefs; (3) *action*—changes in the predisposition for specific responses and the general behavioral direction; (4) *expression*—changes in facial, vocal, postural appearance; and (5) *physiology*—changes in the central and peripheral nervous systems. This definition is presented in several classic textbooks on emotions and is used throughout this volume (e.g., Atkinson & Adoplphs, Chapter 7; Scherer, Chapter 13; but for a critical position, see Barrett, Chapter 11).

It is also useful to distinguish between affect and emotion. The term *affect* describes a state that can be identified primarily by its positive–negative valence. The term *emotion* describes a state that can be identified by more than its valence and includes specific types of negative states (e.g., fear, guilt, anger, sadness, disgust) and specific positive states (e.g., happiness, love, pride). Throughout this chapter we primarily use the term *emotion* because we believe that our arguments also apply to specific emotion states, even though the empirical evidence for our position has been obtained primarily in the domain of affect. We return to this issue later.

Theories of Emotion: Feeling as a Central Component

Theorists have long recognized that there are many components of emotion. Typically they have considered feeling as a central or even a necessary component. Consider some of the influential theorists. In "What Is An Emotion?" William James proposes that *conscious feeling*, generated through the perception of bodily changes, is exactly what distinguishes emotion from other mental states. Without it, "we find that we have nothing left behind, no 'mind-stuff' out of which the emotion can be constituted" (James, 1884, p. 193). Similarly, Freud, though often portrayed as the father of the unconscious, specifically excluded emotions from the realm of states that can exist without being experienced. Freud believed that emotions are always conscious, even if their underlying causes sometimes are not: "It is surely of the essence of an emotion that we should feel it, i.e. that it should enter consciousness." (Freud, 1950, pp. 109–110). These assumptions are shared by contemporary theorists. Clore (1994) titled one of his essays "Why Emotions Are Never Unconscious" and declared subjective feeling as a necessary (although not a sufficient) condition for emotion (see also Clore, Storbeck, Robinson, & Centerbar, Chapter 16). In defining affect, Frijda says that the term "primarily refers to hedonic *experience*, the experience of pleasure and pain" (1999, p. 194; emphasis added). In short, past and present theorists of human emotion emphasize the centrality of conscious feeling.[1]

Emotion Research: Feeling as a Central Agenda

The feeling component is emphasized not only in theories but also in research on human emotion. In social-psychological studies, for example, the presence of an emotion is typically determined by self-reports of feelings (e.g., mood questionnaires, affective checklists, interviews). When studies collect multiple measures of emotion, including the cognitive, behavioral, expressive, or physiological components, the self-report is often considered as the "gold standard" for determining whether emotion had occurred (Larsen & Fredrickson, 1999). There is also a lot of substantive interest in the nature of feelings. For example, some of the debates in emotion literature concern the contribution of bodily responses to feelings (Niedenthal, Barsalou, Ric, & Krauth-Gruber, Chapter 2; Prinz, Chapter 15), the dimensional structure of feelings (Russell, 2003), individual differences in the valence versus arousal component of feelings (Barrett, Chapter 11), the role of culture in type and frequency of feelings (Mesquita & Markus, 2004), and the simultaneous coexistence of positive and negative feelings (Cacioppo, Larsen, Smith, & Berntson, 2004).

Most important, conscious feeling is seen as a central causal force in emotional impact on behavior. One example comes from research on judgment. A dominant model, tellingly called "feeling-as-information," proposes that emotions influence judgment via changes in conscious feelings, which people use as a shortcut to judgment, following the "how-do-I-feel-about-it-heuristic" (Clore et al., Chapter 16; Schwarz & Clore, 2003). The feeling-as-information model has received strong empirical support and certainly captures many cases of affective influence on judgment. However, most studies testing this model relied on manipulations designed to produce conscious feeling states, using stimuli such as music, movies, recall of autobiographical memories, etc. Yet the model is silent on the mechanism by which emotional stimuli that do not change feelings could influence judgments and behavior.

EMOTION WITHOUT FEELING

As we have just shown, conscious feeling has a central place in both the theoretical thinking and empirical practice of human emotion research. However, do emotions always require consciousness? Can one meaningfully talk about "unfelt" or "unconscious" emotions? Over the last several years, researchers have increasingly started to consider these possibilities.

Unconscious Elicitation of Emotion

The first challenge to the role of consciousness in emotion came from demonstrations that subliminal stimuli trigger emotional reactions. These demonstrations are now widely accepted in the emotion research community. In fact, in a recent *Emotion Researcher*, newsletter of the International Society for Emotion Research (2004), on the issue of "unconscious emotion," no contributor expressed doubts that emotion can be elicited outside of awareness or attention.

An example of a subliminal elicitation of positive affect comes from research on the mere-exposure effect, or the increase in preference to repeated items (Kunst-Wilson & Zajonc, 1980). In one study, participants were first subliminally exposed to several repeated neutral stimuli consisting of random visual patterns. Later those participants reported being in a better mood than participants who had been subliminally exposed to different nonrepeated neutral stimuli (Monahan, Murphy, & Zajonc, 2000). An example of a subliminal induction of negative affect comes from studies in which subliminal stimuli, such as gory scenes embedded in a movie or pictures of snakes presented to phobic participants, led to an increase in self-reported anxiety (Öhman & Soares, 1994; Robles, Smith, Carver, & Wellens, 1987).

Note, however, that in these studies only the affect-triggering stimulus is unconscious; the affective reaction itself is conscious. Indeed, the very presence of the affective reaction is determined by asking people to self-report. Thus it is useful, instead, to look at other studies that tested the presence of an affective reaction using physiological measures. For example, skin conductance response, an indicator of sympathetic arousal, can be triggered by subliminally presented emotional words (Lazarus & McCleary, 1951) and by pictures of fear-relevant objects (Lundqvist & Öhman, Chapter 5). Similarly, subliminal facial expressions activate the amygdala, a structure involved in assigning affective significance to stimuli (Whalen et al., 1998), and elicit facial reactions detectable with electromyography (Dimberg, Thunberg, & Elmehed, 2000) (for a review, see Lundqvist & Öhman, Chapter 5; de Gelder, Chapter 6; Atkinson & Adolphs, Chapter 7; and Öhman, Flykt, & Lundqvist, 2000). Unfortunately, these studies are not conclusive on the question of unconscious emotion. First, the physiological measures used in these studies cannot distinguish between the arousal and valence components of a response, or may reflect other processes such as facial mimicry. Thus it is not clear if a valenced reaction actually occurred. Second, in these studies self-reports of emotion were either not collected or collected after the physiological measure of affective reactions, so it is not clear if the reaction registered in physiology was itself conscious or not. Third, because these studies did not measure behavioral consequences, it is possible that any emotion reaction was extremely weak and possibly inconsequential. Still, the physiological studies are suggestive and raise the possibility that under right conditions, people could have genuine affective reactions that are not manifested in their conscious experience.

Unconscious Emotion

Over the last several years we have offered theoretical arguments and empirical support for the idea of unconscious emotion (Berridge & Winkielman, 2003; Winkielman & Berridge, 2004). Our views are in agreement with several other authors. For example, Kihlstrom (1999) suggested that the term *implicit emotion* could be used to refer to "changes in experience, thought or action that are attributable to one's emotional state, independent of his or her conscious awareness of that state" (p. 432). Damasio (1999) and LeDoux (1996) described how deep brain structures participate in generating an unconscious stage of fear, anger, happiness, and sadness reactions. Lambie and Marcel (2002) suggested that there are "several kinds of unawareness of genuine concurrent emotion" (p. 220), including "an entirely nonconscious emotion state" (p. 229).[2]

In the next several sections we review the main theoretical and empirical arguments for the idea that emotion may exist independent of conscious experience. First, we present functional and evolutionary considerations. Second, we review evidence from research on the emotional brain. Third, we discuss relevant psychological studies. Fourth, we address theoretical and empirical challenges to the notion of unconscious emotion and address outstanding issues.

Functional and Evolutionary Considerations

Does the capacity for emotional behavior evolutionarily precede, follow, or co-occur with the capacity for conscious feeling? This is a difficult question as it involves making historical assumptions about the conjunction of two complex mental faculties: emotion and consciousness (Heyes & Huber, 2001). It is more manageable to ask whether basic affective reactions require conscious processing. Consider simple positive/negative reactions that animals produce to stimuli such as predators, prey, strangers, conspecifics, food, drink, or mates (Konorski, 1967). The function of these affective reactions is to allow animals to react appropriately to favorable or unfavorable events by adjusting sensory apparatus (e.g., prioritizing certain stimuli), physiology (e.g., cardiovascular and hormonal changes), and action (e.g., priming of motor programs). From a design standpoint, it would be disadvantageous if performing this basic function required the organism to possess a cognitive apparatus capable of consciousness (Cosmides & Tooby, 2000). Though little is known about the exact mechanisms of consciousness, it is unlikely it can be implemented by the computational architecture of simple organisms (Dennett, 1991; Prinz, Chapter 15). Further, even in humans, conscious mechanisms are often too slow and imprecise to coordinate an emotional response (Smith & Neumann, Chapter 12). Most important, consciousness is often unnecessary. After all, many relatively complex coordination functions in organisms are efficiently performed without

experiential representation (e.g., coupling between the cardiovascular, respiratory, and digestive systems, Porges, 1997). In short, it is reasonable to assume that at least basic affective reactions can be performed without engaging mechanisms responsible for conscious feelings (LeDoux, 1996).

One standard challenge psychologists sometimes offer to the above arguments is that positive/negative reactions of simple organisms should not be called *affective*. For example, paramecia can approach a variety of stimuli, but it makes little sense to use the term *positive affect* for an organism that does not even have neurons. Further, even in more complex organisms, many reactions to favorable or unfavorable stimuli are more aptly classified as reflexes, than affective behaviors. For example, when a spider jumps to kill a prey, it makes little sense to explain this behavior by proposing an underlying negative affect state. We agree, and along with most authors, require that to count as affective, the behavior should meet several criteria (Scherer, Chapter 13). First, the organism must be able to assess the input in terms of valence. Second, this assessment must lead to a temporary state that involves several synchronized components (i.e., perceptual, hormonal, cardiovascular, muscular). Importantly, these criteria do not require the organism to explicitly represent its goals or explicitly make emotional "judgments"—only to respond in a coherent way to challenges and opportunities in their environment (see Prinz, Chapter 15).

Given these criteria, affect perhaps should *not* be assigned to reflexes or to creatures such as paramecia. However, it should be assigned to organisms that respond in a coherent, multisystemic fashion to challenges and opportunities, even if these organisms have little cognitive capacity for consciousness. For example, under these criteria, reptiles are capable of affect because they show coherent cardiovascular, hormonal, perceptual, and behavioral responses to favorable and unfavorable stimuli (Cabanac, 1999). In fact, there are many structural homologies between the reptilian and the mammalian limbic system (Martinez-Garcia, Martinez-Marcos, & Lanuza, 2002), and there are also remarkable similarities in the affective neurochemistry in reptiles, fish, birds, and mammals (Goodson & Bass, 2001).

In short, the available data suggest that vertebrates are capable of coordinated, multisystemic responses to emotionally relevant stimuli, via homologous neural circuitry that regulates these responses across a diversity of vertebrate groups. Thus, while it seems inarguable that the neural substrates required for conscious experience are quite different across these groups, there is nonetheless remarkable consistency in other components of affective response. It therefore seems reasonable to propose that neural components of emotional processing can function in a way that is largely uncoupled from the neural components of consciousness.

Neuroscientific Considerations

These evolutionary arguments are consistent with research on modern mammalian brains. As we discuss next, both subcortical and cortical structures participate in affective processes. However, as many have suggested, the "old" subcortical structures might be especially important for basic affective reactions, whereas the "new" cortical structures might be especially important for conscious feelings. The locations of the most important structures of the generalized emotional brain are indicated in Figure 14.1. Below we provide a brief overview of what is known about the roles of these structures in generating positive and negative affect. However, we remind the reader that our presentation here is very simplified and does not capture the multiple roles these structures play in both affect and cognition, and their complex neuroanatomy and neurochemistry (see Berridge, 2003).

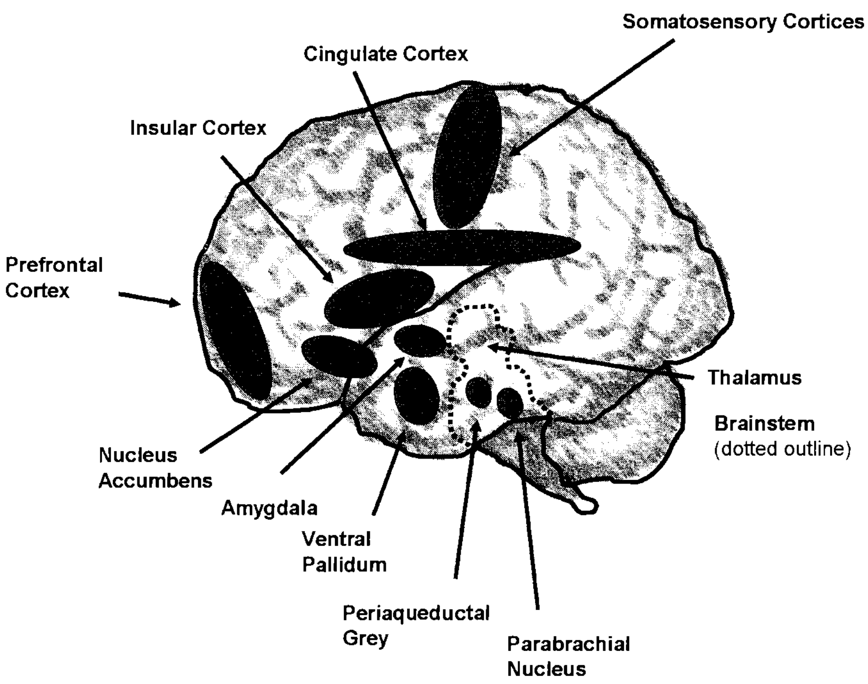

FIGURE 14.1. Approximate location of brain structures important for emotion. The figure does not show the relative depth of any structure and shows only one of each pair of bilateral structures.

Subcortical Networks and Basic Affective Reactions

The subcortical structures involved in causing basic affective reactions range from the "mere" brainstem to the complex network of the "extended amygdala" (Berridge, 2003). Let us illustrate the critical role of these structures in both positive and negative affect with a few examples.

Brainstem. Though some view it as a merely reflexive structure, almost every physical pleasure or pain must climb its way up through the brainstem. Research shows that in both animals and humans basic affective responses are modulated by structures in the brainstem. For example, in the domain of positive affect, research highlights the importance of the parabrachial nucleus (PBN). The PBN receives signals ascending from many sensory modalities, including visceral signals regarding internal bodily functions, and also taste sensations from the tongue.[3] Not surprisingly, PBN plays a role in generating positive responses to tasty foods. For example, when a rat's PBN is tweaked by microinjections that activate its benzodiazepine/gamma-aminobutyric acid (GABA) receptors, the rat produces greater "liking" reactions to sugar, such as tongue protrusions and lip licking (Berridge & Pecina, 1995). In the domain of negative affect, research highlights the importance of the periaqueductal grey (PAG). In animals, the PAG mediates defensive reactions to threatening stimuli (Panksepp, 1998), and in both animals and humans, the PAG mediates responses to pain (Willis & Westlund, 1997). Importantly, the PAG does not simply compile incoming information to relay to the forebrain, but forms reciprocal connections with subcortical forebrain structures, thereby providing an anatomical basis by which sensory stimuli can be processed by the PAG in a context-dependent and coordinated fashion (Panksepp, 1998).

A particularly poignant demonstration of the importance of the brainstem to basic affective reactions is offered by a cruel experiment of nature. As a result of a birth defect, some infants have a congenitally malformed brain, possessing only a brainstem but no cortex and little else of the forebrain (i.e., no amygdala, nucleus accumbens, etc). Yet in these anencephalic infants, the sweet taste of sugar still elicits facial expressions that resemble normal "liking" reactions, such as lip sucking and smiles, whereas bitter tastes elicit facial expressions that resemble "disliking" reactions, such as mouth gapes or nose wrinkling (Steiner, 1973). In this context, it is also interesting that positive facial expressions to sweetness are emitted by chimpanzees, orangutans, gorillas, various monkeys, and even rats (Berridge, 2000; Steiner, Glaser, Hawilo, & Berridge, 2001). The pattern of positive facial expression becomes increasingly less similar to humans as the taxonomic distance increases between a species and us. But all of these species share some reaction components that are homologous to ours, suggesting common evolutionary ancestry and a similar neural mechanism that might be anchored in the brainstem.

Extended Amygdala. The term *extended amygdala* designates a configuration that includes the amygdala, nucleus accumbens, ventral pallidum, bed nucleus of the stria terminalis, and other structures. Recent years have witnessed an explosion of research highlighting the role of the extended amygdala in basic affective reactions.

Amygdala. The amygdala consists of a pair of almond-shaped structures located in the medial temporal lobe, just anterior to the hippocampus. The amygdala is reciprocally connected to a variety of areas, including the visual thalamus and visual cortex, allowing for affective modification of perception; the dorsolateral prefrontal cortex, allowing for upstream and downstream regulation of affect state; and subcortical structures, allowing for affective influence on sympathetic and parasympathetic regulation of cardiovascular activity, respiration, hormone levels, and basic muscular reactions. The role of the amygdala in perceptual and learning aspects of emotion has been confirmed in animal research as well as human neuroimaging and lesion studies (Phelps, Chapter 3; Atkinson & Adolphs, Chapter 7). Thus patients with congenital or acquired amygdala damage show impairments in conditioned fear responses, fear-potentiated startle responses, and arousal-enhanced perception and memory. Remarkably, patients with damage to the amygdala show little, if any, impairment in their subjective experience of emotion, at least as measured by the magnitude and frequency of self-reported positive and negative affect assessed by the positive and negative affect schedule (PANAS) (Anderson & Phelps, 2002). This finding suggests a relative independence of the amygdala from the mechanisms underlying the generation of feelings.

There is also evidence that the amygdala can modulate emotional responses independent of any conscious evaluation of the stimulus. Some of this evidence comes from observations that the amygdala can be activated with facial expressions that are not consciously perceived, presumably via a direct pathway from the visual thalamus (see Atkinson & Adolphs, Chapter 7). Thus amygdala activation has been observed with expressions of fear and anger presented subliminally (Morris, Öhman, & Dolan, 1999; Whalen et al., 1998), under condition of binocular suppression (Williams, Morris, McGlone, Abbott, & Mattingley, 2004), or to a patient's blind visual field (de Gelder, Chapter 6).

Additional evidence for the independence of basic affective reactions and conscious stimulus evaluation comes from autism—a neurodevelopmental disorder characterized by deficits in communicative and social skills, restricted interests, repetitive behaviors, and impairments in emotional abilities (Hobson, 1993; Kasari, Sigman, Yirmiya, & Mundy, 1993). There are several reports of amygdala abnormalities in people with autism (Baron-Cohen et al., 2000). Thus one can expect individuals with autism to be impaired in their basic affective responses, which are dependent on the amygdala, and relatively unimpaired on affective responses that rely on more deliberate, conscious strategies. We have recently obtained such evidence in studies of affective startle modulation (Wilbarger, McIntosh, & Winkielman, 2004) which refers to a phenomenon that when individuals are startled by a loud noise, their defensive reflexes, such as the eyeblink, are larger in the context of negative than positive stimuli. This penomenon presumably reflects the modulation of an aversive versus approach response system (Lang, 1995). The amygdala is critical for such modulation, as suggested by the finding that electrical stimulation of the amygdala enhances startle amplitude, whereas lesions diminish it (Davis, 1997; Funayama, Grillon, Davis, & Phelps, 2001; Phelps, Chapter 3). In our studies the individuals without autism replicated the classic startle modulation pattern: potentiation of an eyeblink response to a loud noise after negative pictures and reduction of the eyeblink after positive pictures. In contrast, the individuals with autism spectrum disorder (ASD) showed startle potentiation after both negative *and* positive stimuli. Importantly, the ASD individuals did not differ from typical individuals on conscious, explicit evaluation of the stimuli, as reflected in self-reports of valence and arousal (Wilbarger et al., 2004). In sum, these data again suggest that the impact of affective stimuli on basic behavioral responses can be dissociated from conscious responses to the same stimuli.

Ventral Pallidum. The ventral pallidum borders on the lateral hypothalamus at its front and lateral sides and is a part of the extended amygdala. In rats, this structure is involved in producing positive reactions to tasty foods, as suggested by the facts that (1) ventral pallidal neurons fire to tasty rewards, (2) behavioral "liking" reactions to sweetness are increased by opioid drug microinjections in the ventral pallidum, and (3) excitotoxin lesions of the ventral pallidum abolish hedonic reactions and cause aversive reactions (e.g., gaping and headshakes) to be elicited even by normally palatable foods (Cromwell & Berridge, 1993; Tindell, Berridge, & Aldridge, 2004). The ventral pallidum may also be crucial to sexual and social pair bonding in rodents (Insel & Fernald, 2004). Less is known regarding the role of the ventral pallidum in affect mediation for humans, because the structure is too small to study via brain imaging. However, there are a few intriguing observations. For example, electrical stimulation of the adjacent structure, the globus pallidus, has been reported to sometimes induce bouts of affective mania that can last for days (Miyawaki, Perlmutter, Troster, Videen, & Koller, 2000). In addition, the induction of a state of sexual or competitive arousal in normal men was found to be accompanied by increased blood flow in the ventral globus pallidus (Rauch et al., 1999).

Nucleus Accumbens. The nucleus accumbens, which lies at the front of the subcortical forebrain and is rich in dopamine and opioid neurotransmitter systems, is as famous for positive affective states as the amygdala is for fearful ones. The accumbens systems are often portrayed as reward and pleasure systems. In fact, activation of dopamine projections to the accumbens and related targets has been viewed by many neuroscientists as a neural "common currency" for reward. There is actually evidence that the accumbens reflects not "pleasure" or "liking" of the stimulus, but rather an incentive salience, or "wanting," of the stimulus (Berridge & Robinson, 1998). However, for the purpose of our argument here it is only important to highlight the role of the accumbens in positive affective reactions. For example, in rats, brain microinjections of drug droplets that activate opioid receptors in the nucleus accumbens cause increased "liking" for sweetness (Pecina & Berridge, 2000). In humans, the accumbens activates to drug cues and to other desired stimuli, including foods, drinks, and even money (Knutson, Adams, Fong, & Hommer, 2001).

Cortical Networks and Subjective Experience

We cannot talk about the emotional brain of mammals without discussing the cortex. In fact, when human subjects spontaneously recall emotional events, a host of cortical structures activate, including the prefrontal cortex, the insular cortex, the somatosensory cortices, and the cingulate cortex (Damasio et al., 2000). The approximate location of these structures is shown in Figure 14.1. Several chapters in this volume address the role of cortical structures in more detail (Niedenthal et al., Chapter 2; Phelps, Chapter 3; Gray, Schaefer, Braver, & Most, Chapter 4; Atkinson & Adolphs, Chapter 7; Prinz, Chapter 15; other chapters suggest it: Barrett, Chapter 11; Clore et al., Chapter 16). Here we only mention research most relevant to the proposition that the cortex mediates conscious experience by hierarchically monitoring and rerepresenting subcortical processes.

Prefrontal Cortex. The prefrontal cortex lies, not surprisingly, at the very front of the brain. The ventral or bottom one-third of the prefrontal cortex is called the orbitofrontal cortex and is the most elaborately developed in humans and other primates. There is some evidence that subcortical projections to the prefrontal cortex contribute to conscious affective experience. For example, the intense feeling of pleasure experienced by heroin users appears to involve accumbens-to-cortex signals that are relayed to cortical regions via the ventral pallidum and thalamus (Wise, 1996). In another example, self-reports of excitement in typical participants are related to the degree of activation in the nucleus accumbens and prefrontal cortex (Knutson et al., 2004). The prefrontal cortex is important not only for conscious feelings; it also participates in affective reactions by modulating lower brain structures via descending projections (Damasio, 1999; Phan, Wagner, Taylor, & Liberzon, 2002). For example, the orbitofrontal cortex projects back to the accumbens (Davidson, Jackson, & Kalin, 2000), and the dorsolateral prefrontal cortex projects back to the amygdala (Ochsner & Gross, 2004).

Somatosensory Cortex and Insula. The primary (S1) and secondary (S2) somatosensory cortices are located behind the central sulcus and are responsible for monitoring the state of the body, including sensations (e.g., touch) and proprioception (i.e., state of muscles and joints), and for creating the internal "image" of the body (Ramachandran & Blakeslee, 1998). The insula is located near the bottom of the somatosensory cortices, almost at the intersection of the frontal, parietal, and temporal lobes, and receives inputs from limbic structures, such as the amygdala, and cortical structures, such as the prefrontal and posterior parietal cortices and the anterior cingulate. It appears to be particularly important for introception: monitoring the state of internal organs (Craig, 2003; Critchley, Wiens, Rothstein, Öhman, & Dolan, 2004).

There is evidence that the somatosensory cortices and the insula might jointly contribute to emotional experience by generating a model of the current body state. The neuropsychological evidence for this mechanism is extensively discussed by Atkinson and Adolphs (Chapter 7), and psychological evidence is reviewed by Niedenthal et al. (Chapter 2). For example, neuroimaging studies show that recall of emotional memories is associated with extensive activation of the somatosensory cortices (Damasio et al., 2000). In another example, lesions to the right somatosensory cortex are associated with both impaired perception of facial expressions and impaired touch perception (Adolphs, Domasio, Tranel, Cooper, & Domasio, 2000). Finally, human studies show involvement of the insula in pain (Peyron, Laurent, & Garcia-Larrea, 2000), disgust (Wicker, Keyers, Plailly, Royet, Gallese, & Rizzolatti, 2003), and appreciation of sweet tastes and related rewards (O'Doherty, Deichmann, Critchley, & Dolan, 2002).

Cingulate Cortex. The cingulate cortex consists of a longitudinal strip running front to back along the midline of each brain hemisphere. It is a richly interconnected structure thought to interface between the limbic system and the prefrontal cortex. The cingulate cortex has been implicated in human clinical conditions such as pain, depression, anxiety, and other distressing states (Davidson, Abercrombie, Nitschke, & Putnam, 1999; Peyron et al., 2000). Interestingly, some research suggests that a conscious experience of emotion, per se (e.g., "I'm angry"), is associated with the dorsal anterior region of the cingulate cortex, whereas more reflective parts of the emotional awareness (e.g., "I know I'm angry"), are associated with the rostral anterior region (Lane, 2000).

Interactions of Cortical and Subcortical Networks

As our brief review indicates, both subcortical and cortical systems participate in emotion as a complex network connected in multiple loops. Within those loops, however, the subcortical systems seem essential for triggering basic affective reactions, whereas the cortical systems seem essential for supporting conscious affective experience. Specifically, the conscious experience appears to emerge from the interaction between the cortical and subcortical loops, as the cortex hierarchically rerepresents and feeds back on the causally active subcortical processes. Importantly, we are not diminishing the causal role of the cortex in emotion; as obviously, for humans, many events trigger an emotional response after extensive cortical processing. We are simply suggesting that in order to have a conscious emotional experience, the cortical networks may need to receive and reprocess input from subcortical networks.

Is it possible that conscious feelings exist subcortically, perhaps in structures as deep as the brainstem's periaqueductal grey (PAG)? For example, Panksepp argued that "the most basic form of conscious activity . . . arises from the intrinsic neurodynamics of the PAG" (1998, p. 314) and suggested that "it is the PAG that allows creatures to first cry out in distress and pleasure" (p. 314). We agree that it is logically possible that brainstem circuits generate a rudimentary but real consciousness. This possibility can never be conclusively disproved. For now, it seems more likely that these subcortical circuits simply instantiate unconscious affective process. Those processes do not give rise to conscious feelings by themselves. They are not even directly accessible to conscious introspection in a normal brain, as evidenced by people's inability to report subliminally induced affect (discussed shortly). Accordingly, we propose that the isolated brainstem is capable of unconscious "likes" and "dislikes," which it reflects behaviorally, but not of conscious feelings of pleasure or displeasure.

Finally, it is worth highlighting that our point really is not about anatomical separation—a neat division of labor in which subcortical networks instantiate unconscious processes, whereas cortical networks instantiate conscious processes. Our point is that the *mechanisms* of consciousness are computationally demanding and require ability to rerepresent the input, integrate across multiple sources of input, and probably create some rudimentary representation of the self (Dennett, 1991). On that view, different mechanisms could be mixed together in the same brain divisions, or the same brain divisions could have both conscious and unconscious modes.

In sum, the multiplicity of loops and levels within brain networks raises the possibility for functional decoupling, possibly producing emotional reactions without conscious feelings, as well as conscious feelings without emotional reactions reflected in physiology or behavior. In fact, some research reviewed earlier could be interpreted as showing a double dissociation (A occurs without B, and B occurs without A). For example, "liking" responses in anacephalic babies represent the preservation of basic affective reactions after damage to mechanisms supporting consciousness (Steiner, 1973), whereas intact conscious feelings in patients without the amygdala (Anderson & Phelps, 2002) represent preservation of conscious experience after damage to subcortical mechanisms supporting basic affective reactions. This possibility is consistent with research in experimental psychology, as we review next.

Experimental Psychology

All statements about whether emotion can or cannot be divided into conscious versus unconscious are mere speculations. Without actual evidence of unconscious emotion, even positing its existence is a matter of taste. Neuroscientific evidence by itself is suggestive, but not enough—it could be consistent with either possibility. Further, much of neuroscientific evidence comes from animal studies and studies of brain-damaged patients. What is needed is an unambiguous demonstration of unconscious emotion—if it indeed exists—in typical individuals who are not brain damaged, not drug addicted, not under hypnosis, not under extreme circumstance, and not lacking in verbal or intellectual skills. If evidence could actually be obtained, then the discussion would shift from *whether* unconscious emotion is possible to *how* it is possible and *what it means* for psychology and neuroscience. So—is there any clear evidence?

Uncorrected and Unremembered Affective Reactions to Facial Expression

An initial approach to the question of whether participants can be unaware of their affective responses was made in a study that asked participants to rate novel and neutral stimuli, such as Chinese ideographs (Winkielman, Zajonc, & Schwarz, 1997). Unbeknownst to the participants, some ideographs were preceded by subliminally presented happy or angry faces. As mentioned earlier, neuroimaging studies suggest that subliminal angry and fearful faces activate the amygdala and related limbic structures, and are particularly likely to trigger unconscious affective reactions. As participants were making judgments of the ideographs, some were asked to monitor changes in their conscious feelings and told not to use their feelings as a source of their preference ratings. Those participants were also given instructions containing plausible alternative explanations for why their feelings might change, such as music playing in the background, or, closer to the truth, participants were told about invisible subliminal stimuli that might influence their mood. In effect, these instructions encouraged corrective attributions that typically eliminate the contaminating influence of conscious feelings on evaluative judgments (Clore, 1994). However, even for participants who knew to disregard their "contaminated" feelings, the subliminal happy faces increased, and the subliminal angry faces decreased, preference ratings. Most relevant to the question of unconscious emotion, participants did not remember experiencing any changes in their mood when asked after the experiment about their emotions. Still, these studies are subject to criticism. Affective memory is not infallible. A skeptic could well argue that participants had a conscious emotional experience when exposed to subliminal affective faces, but simply failed to remember it later. Further, misattributional manipulations can fail for a variety of cognitive and motivational reasons.

Unconscious Affective Reactions Strong Enough to Change Behavior

We agree that stronger evidence is needed. Such evidence would show that cognitively able and motivated participants are *unable to report a conscious feeling* at the same time that their behavior reveals the *presence of an affective reaction*. Ideally, the affective reaction should be strong enough to change even behavior that has real consequences for the individual. To obtain such evidence, we assessed consumption behavior, requiring ingestion of a novel substance, after exposing participants to several subliminal emotional facial expressions (either happy, neutral, or angry). Each of the subliminal expressions was masked by a clearly visible neutral face on which participants performed a simple gender detection task (Winkielman, Berridge, & Wilbarger, 2005). Immediately after the subliminal affect induction, some participants rated their feelings (mood and arousal) and then consumed a fruit beverage. Other participants performed consumption behavior and feeling ratings in opposite order. In Study 1, the consumption behavior involved pouring themselves a cup of a novel drink from a pitcher and then drinking it. In Study 2, participants were asked to take a small sip of the drink and rate it on different dimensions (e.g., monetary value). In both studies, there was no evidence of any change in conscious mood or arousal, regardless of whether participants rated their feelings on a simple scale from positive to negative or on a multi-item scale asking about specific emotions. That is, participants did not feel more positive after viewing subliminal happy expressions, nor did they feel more negative after angry expressions. Yet participants' consumption behavior and drink ratings were influenced by those subliminal affective stimuli, especially when participants were thirsty. Specifically, thirsty participants exposed to subliminal happy faces poured significantly more drink from the pitcher and drank more from their cup than those exposed to subliminal angry faces (Study 1). Thirsty participants were also willing to pay about twice as much more for the drink after exposure to happy, rather than angry, expressions (Study 2). That is, subliminal emotional faces evoked affective reactions that altered participants' consumption behavior and evaluation of the beverage, but produced no mediating change in their conscious feelings at the moment the affective reactions were caused. Since participants rated their feelings of mood immediately after the subliminal affect induction, these results cannot be explained by the failure of affective memory. Thus we propose that these results demonstrate unconscious affect in the strong sense—an affective process strong enough to alter behavior, but of which people are simply not aware, even when attending to their feelings.

CHALLENGES TO UNCONSCIOUS EMOTION

Findings such as the one just described constitute some evidence for the independence of affect and conscious experience. But there are several challenges to be met.

How Does Unconscious Affect Work?

One challenge involves specifying the mechanisms by which affect can influence behavior toward an object without eliciting conscious feelings.

One possibility is that unconscious affect directly modulates the object's ability to trigger affective and motivational responses via a "front-end" or perceptual–attentional mechanism (Phelps, Chapter 3). That is, instead of triggering feelings, the affect could modify the position of relevant target objects on the organism's "incentive landscape." For example, in our beverage studies, the exposure to subliminal happy or angry expressions could transiently multiply up or down the incentive value of the drink, leading to differential behavior and ratings. To give a neuroscientific account of a possible mechanism, we speculate that subliminal facial expressions might activate the amygdala, which then might activate the adjacent accumbens and related structures responsible for processing natural incentives (Berridge, 2003; Rolls, 1999; Whalen et al., 1998). Altered neuronal activity in the nucleus accumbens (constituting unconscious "liking") could then change the human affective reaction to the sight and taste of a drink, leading to differential behavior and ratings, all without eliciting conscious feelings. In other words, we propose a mechanism that is not unlike what happens when a morphine microinjection into a rat's shell of accumbens enhances the rat's affective reaction to sweetness and leads to behavioral reaction of greater "liking." This proposal awaits empirical testing.

Affect or Emotion?

Some skeptics accept *unconscious affect* but deny *unconscious emotion* (e.g., Barrett, Chapter 11). They point out that much of the evidence concerns basic unconscious positive–negative or liking–disliking reactions, and not the categorically different states associated with emotion (e.g., fear, anger, disgust, sadness, joy, love, pride). However, note that subcortical circuitry is capable of at least some qualitative differentiation. For example, animals, even reptiles, show some categorical reactions to situations demanding different emotional response (Panksepp, 1998). In another example, human neuroimaging studies reveal different patterns of amygdala activation to consciously presented facial expressions of fear, anger, sadness, and disgust (Phan et al., 2002; Whalen, 1998). If future research shows that masked expressions of fear, anger, disgust, or sadness can create different physiological reactions with different behavioral consequences, all without eliciting conscious feelings, then there might indeed be processes fully deserving the label "unconscious emotion." Studies that measure psychophysiological, behavioral, and self-report manifestations of emotion within a single design could be particularly useful to address such issues (Winkielman, Berntson, & Cacioppo, 2001).

Affect or Cognition?

A critic may challenge the idea of unconscious affect by explaining the relevant empirical phenomena using a cognitive framework (e.g., Clore et al., Chapter 16). For example, the critic could argue that in our beverage studies, facial expressions influenced behavior via cognitive reinterpretation of the consumption situation. In general, note that such an explanation is divorced from the larger animal and human literature suggesting involvement of subcortical mechanisms in the processing of facial expressions and consumption stimuli. More specifically, note that the cognitive account cannot explain several findings from the beverage studies. First, the cognitive account predicts that all evaluations should be influenced by subliminal facial expressions. However, subliminal expressions influenced only ratings related to the incentive value of the drink, as predicted by our account, but not ratings of mood or ratings of the drink that were irrelevant to its incentive value (e.g., sweetness), as would be predicted by the cognitive account. Second, a cognitive account cannot easily explain why the influence of facial expressions was selectively amplified by a motivational state (thirst), whereas that prediction naturally follows from our incentive value account. In short, our proposed explanation in terms of unconscious affect changing the drink's incentive value is more consistent with the literature as well as the obtained data.

Unnoticed, Unverbalized, or Unconscious Affect?

Yet another challenge comes from the difficulty of conclusively establishing the absence of feelings. For one, there is the pesky problem of "proving the absence." This problem can be addressed, however, through converging replications, such that the presence of conscious feelings is established as unlikely (just as Santa Claus cannot be proven nonexistent, but can be proven unlikely to exist). A more substantive problem involves the very nature of reporting on phenomenal states. Several writers point out the difference between primary "experiencing" or "raw" consciousness and secondary "reflecting" or "meta" consciousness (Charland, Chapter 10; Lambie & Marcel, 2002; Schooler, 2002). This distinction suggests that people can "feel" without being "aware that they feel." Thus, perhaps in our drinking experiments, angry facial expression did indeed elicit "raw" anger, but our participants never reached a conscious, reportable belief that they "feel angry." Or perhaps participants' feelings were too subtle to be reflectively appraised. Or perhaps participants' attempts to reflect destroyed their fleeting feelings. These are all interesting possibilities.

However, we find them unlikely. First, the impact of the unconscious affect was sufficiently strong to change our participants' behavior, so it should have been sufficiently strong to change their reports of experience. Second, our participants were able to self-report on other aspects of their mood and sensations, as reflected in individual differences in reports of their baseline mood states and in their precise reports of drink experience (see Winkielman et al., 2005). Still, future research should examine to what extent the absence of self-reported feelings in human studies represents a genuine absence of phenomenology or an inability to reflect on that phenomenology. Several writers have suggested that these questions could be addressed by providing participants with training in (1) introspection, (2) use of beepers, ratings scales, or momentary affect dials, and (3) alternative, nonverbal ways of expressing emotion (Bartoshuk, 2000; Lambie & Marcel, 2002; Nielsen & Kaszniak, in press; Schooler & Schreiber, 2004). Finally, neuroscience may be of help. If it is possible in the future to reliably identify a neural correlate of subjective experience, the presence of conscious feelings could be suggested by changes in relevant neural activation.

CONSCIOUS AND UNCONSCIOUS EMOTION

In the preceding section we have presented a variety of arguments for the existence of "unfelt" affect and emotion. So are feelings just "icing on the cake"—nice, but not necessary? Are they the "red herring" of emotion research? We do not believe so. In the following section we offer speculation on the role of conscious feelings in emotion and the relation between conscious and unconscious components in emotion.

What Good Is Conscious Feeling?

Just like it makes functional sense that emotion can be "unfelt," there are good reasons why at least some creatures are capable of conscious feelings. In general, there are several benefits for a mental state, whether emotional or cognitive, to be conscious (see Gray et al., Chapter 4; Smith & Neumann, Chapter 12; Prinz, Chapter 15). Consciousness allows flexibility and depth. The organism can go beyond simple, habitual reactions and design novel, complex, context-sensitive forms of responding (Dennett, 1991; Rolls, 1999). Consciousness also allows control. The organism can stop undesirable responses and promote the desirable ones, deciding how and when to respond (Ochsner & Gross, 2004). On top of these standard perks of consciousness, the capacity for conscious feelings may give emotion a specific communicative and motivational function. Conscious feelings give internal feedback about how well the organism is doing with the current pursuits, telling it to maintain or change its path (Clore et al., Chapter 16). Feelings also come with psychological immediacy and urgency, making the organism "care" about its fate in a way that may not available to any other mechanism (Searle, 1997). This immediacy and urgency applies to simple hedonic states, such as pain and pleasure, and to complex emotions. Thus, pangs of guilt propel us to make amends, whereas green eyes of jealousy make us watch for trespasses of our mates (Frank, 1988).

What Makes Emotion Unconscious or Conscious?

Given the many benefits of consciousness, why then are humans sometimes unaware of their emotion? We suppose that a variety of neuroscientific and psychological factors play a role. Most of these factors probably apply regardless of whether the process is emotional or cognitive. Earlier we speculated that under some circumstances, relevant neural processes could simply bypass the circuitry for subjective experience and feed directly into behavioral circuitry. That is, sometimes emotion can be unconscious for the same reason why vision can be unconscious. As documented in research on "vision for perception vs. vision for action" (Goodale & Milner, 2004) and in research on "blindsight" (de Gelder, Chapter 6; Weiskranz, 1996), the relevant information can feed into the action system without ever reaching brain areas responsible for subjective experience. Further, sometimes rudimentary affective processes may be like other neural processes, such as thermoregulation or fluid regulation which can run unconsciously and elicit conscious experience (e.g., feeling cold, or feeling thirsty) only when there is a need for conscious intervention. Another important factor might be the brain's inability to construct a coherent percept, as when alternative sources of activation compete for interpretation (Crick & Koch, 2003).

Still other factors preventing the emergence of conscious representation are more psychological. The input might be too weak or too brief, as amply demonstrated in the work on backward masking (Enns & DiLollo, 2000). Or the input may be strong but inconsistent with the perceivers' expectations and thus escape attentional processing, as demonstrated in research on change blindness (Simons & Chabris, 1999). Or the input may not make sense in the context of the current situation (Dennett, 1991). Yet, in all these cases, the input may be sufficient to influence behavior.

Unfortunately, there is little empirical work on factors that determine the emergence of conscious emotional feelings. Future work could make some progress by, for example, systematically examining what determines whether subliminal stimuli elicit conscious mood. As we discussed earlier, in our research, exposure to subliminal facial expressions did not elicit feeling (Winkielman et al., 2005). However, other studies observed feeling changes after subliminal bloody pictures (Robles et al., 1987) or mere-exposed ideographs (Monahan et al., 2000). These findings suggest that perhaps simple or highly practiced stimuli, such as happy and angry faces used in our studies, are less likely to elicit feelings than more complex or novel stimuli, such as visual scenes or ideographs. The impact on feelings could also depend on the individual's sensitivity to a particular emotion inducer. For example, subliminally presented snakes increased conscious anxiety in phobic but not typical participants (Öhman & Soares, 1994). Similarly, introspectively sensitive participants are better at detecting the impact of subliminal stimuli and use their own reactions in behavior (Katkin, Wiens, & Öhman, 2001). Another interesting factor is the salience of the self representation. That is, when the self is salient, a change in an affective state might be channelled to a conscious feeling, rather than a representation of an external object (Clore et al., Chapter 16; Lambie & Marcel, 2002). Finally, motivational factors could also channel the affect to the representation of the external object or to the conscious feeling. For example, in our drinking studies, the only hint of change in subjective experience as a result of subliminal expression was observed among nonthirsty participants (for discussion, see Berridge & Winkielman, 2003). In sum, the emergence of conscious feelings may be determined by a host of stimulus, personal, and motivational factors. Though little is known at this point, it seems clear that the question of when and how emotion becomes conscious can be fruitfully investigated in an empirical manner, especially given all the new experimental and neuroscientific techniques now available.

CONCLUSION

In this chapter we argued for the existence of verifiable but unconscious emotional reactions. These reactions may be grounded in the oldest part of the emotional brain and may be similar in humans and animals. Nevertheless, they can be powerful enough to guide even human behavior and judgments. Thus emotion researchers should not limit themselves to subjective experiences when theorizing about emotion and conducting relevant empirical research. However, we also believe that conscious feelings are critical for understanding the mechanisms of emotion and its impact on behavior. Thus self-reports of feelings and other techniques that tap subjective experience have a major place in emotion theory and research. In fact, we see some of the most exciting topics in emotion research as understanding how and when emotion becomes conscious. Investigations of implicit emotional processes, techniques from human and animal affective neuroscience, and refinements in self-report methodology all can help us better understand the relation between conscious and unconscious emotions.

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NOTES

1. Emotion theorists grounded in animal research typically do not consider subjective experience as a central or necessary component of emotion (e.g., Bouton, Chapter 9).
2. Lambie and Marcel's (2002) endorsement of nonconscious emotion is qualified by their statement that "to be in an emotion state is almost always to be in a phenomenal state" (p. 229).
3. Some have suggested that in humans the PBN participates in generating the "protoself," an unconscious but coherent representation of the momentary state of the body (Damasio, 1999).

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