Chapter 14

Emotion

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If you are looking for an area of psychology fraught with disagreements, battle scars, gossip, intrigue, and even a few lawsuits, look no further than emotion research. Arguably, no subdiscipline in psychology is better known for its heated debates than emotion science where scholars argue about issues ranging from the nature of emotion, to its consequences, the fundamental building blocks, universality, distinct humanness, face, brain, and bodily signatures, required consciousness, and the antecedents and consequences of emotion experience. These debates have played out in theoretical journals (Barrett, 2006; Baumeister, Vohs, DeWall, & Liqing, 2007; Ekman, 1994; Levenson, 2011; Russell, 1994), empirical reports (Cowen & Keltner, 2017; Levenson, 1992; Russell, 1980; Tracy & Robins, 2004), meta-analyses and reviews (Kreibig, 2010; Larsen, Berntson, Poehlmann, Ito, & Cacioppo, 2006; Lindquist, Wager, Kober, Bliss-Moreau, & Barrett, 2012; Siegel et al., 2018), books (Barrett & Russell, 2014; Ekman & Davidson, 1994; Fox, Lapate, Shackman, & Davidson, 2018; Niedenthal & Ric, 2017), and numerous conference symposia. In an effort to understand and evaluate the arguments for yourself, this chapter attempts to present several of the enduring debates from the emotion literature that would be most relevant for social psychologists. The summary of the different questions and evidence for and against are intended to be presented with as little bias as possible, though a completely bias-free review is likely impossible.

This chapter covers five sections organized around a debated issue or core question in emotion research. Each section provides some historical background, a summary of the primary points, and a concluding assessment of the current literature and, in some cases, suggestions on what type of data would be needed to address the debate. The first topic focuses on the fundamental nature of emotion and how emotions are best characterized in terms of their origins (how emotions come to be) and how unique and separable emotion categories are. The second topic is whether discrete emotions have unique, patterned physiologic responses. The third explores how and in what ways emotions are similar and distinct from other affective states like motivation and acute stress. The fourth topic examines the role of cognition in emotion experiences, addressing the question of whether emotions can be experienced unconsciously and how awareness and explicit labeling influence emotional experiences. The last topic reviews the different approaches to manipulate and measure emotion in research studies. The chapter ends with some ideas about the future directions of emotion research.

What Is the Nature of Emotions?

It may seem obvious how emotions occur. We perceive a stimulus in our environment; we make sense of its signal properties; depending on these properties, we have a feeling like fear, anger, sadness, happiness, or some other emotion; and our brains and bodies respond to this emotional state. Though this seems to be an effortless, unlearned process, there are several critical questions that are unresolved regarding the nature of emotions including the boundaries around emotion categories, and the influence of culture, learning, and context. Several key theoretical perspectives exist on the nature of emotion and each have a large literature amassed in its favor and, in some cases, a similarly large literature arguing against the theory. Three broad theoretical traditions that encapsulate most of the theoretical perspectives include (a) basic emotion theory, (b) appraisal theory, and (c) psychological construction theory.

Basic Emotion Theory

Basic emotion theory is most identified with psychologist Paul Ekman, but the principles of this theory have roots in Darwin (1872; cf. Barrett, 2006) and were influenced by Ekman's mentor, Silvan Tomkins. Tomkins's (1984) theory argued that emotions, or affects, were biologically based with specific facial expressions, and there were six discrete affects: excitement, surprise, joy, distress, anger, and fear. Tomkins influence is easily identifiable in Ekman's (1992) basic emotion theory, which argues that *basic* emotions have neural programs that once triggered would coordinate a patterned set of responses in the brain, body, and facial expressions. This perspective considers emotions as a limited set of universal programs that evolved to contend with environmental challenges faced by our ancestors and that each emotion category has a dedicated, specific neural circuit or network. These five[1] basic emotions—fear, anger, sadness, disgust, and happiness—are argued to be core experiences similar to reflexes that need not be learned, are universal, and are immutable across context, development, and culture. Basic emotions are distinct from other emotions—shame, awe, love, etc.—based on being (a) elemental, (b) found across vertebrate species, and (c) related to survival functions (Levenson, 2011). Supportive of the basic emotion perspective, Panksepp (2005), arguing from a genetic and animal perspective, maintained that emotions are a type of instinct that need not be learned and these emotional instincts reflect general solutions stemming from brain mechanisms that appear across mammalian and other vertebrate species.

Basic emotion theory showed strong traction over several decades likely due to early theorists (e.g., Ekman, Levenson, and others) being explicit about the requirements for basic emotions making hypothesis-testing stemming from the theory straightforward. This theoretical foundation allowed others to test unambiguously the theoretical tenets and evidentiary basis; indeed, one could say that the basic emotion theorists set a high bar on what evidence would be needed to support the basic emotion theory claim. For example, Ekman (1992) identified nine criteria that an emotion had to meet to be considered *basic*. There had to be *distinctiveness* in the (a) antecedents, (b) behavioral/facial signal, and (c) physiologic response; *continuity* in terms of (d) presence in all primate species, (e) similar antecedents, and (f) display rules across cultures; and *structure/function* in terms of (g) quick onset and brief experience, (h) coherence across response systems, and (i) automatic/reflexive appraisal. These criteria have been tested empirically, and some have fared well, some poorly, and still other criteria have mixed support. For example, coherence across systems—the idea that multiple output systems like facial expressions, behavior, subjective experience, and physiology respond in a similar, correlated fashion upon experience of a specific emotion—is an aspect of basic emotion theory that has mixed support. Mauss, Levenson, McCarter, Wilhelm, and Gross (2005) examined second-by-second coherence of self-reports, physiology, and facial expressions

during viewing of sad and amusing videos. While facial expressions and subjective experiences were highly correlated on a moment-to-moment basis for both sad and amusing films, changes in physiology were not related to either facial expressions or subjective experiences (see the following discussion for a deeper dive into evidence for basic emotion physiologic responses).

Appraisal Theories

Appraisal theories (Lazarus, 1991; Scherer, 1984; Smith & Ellsworth, 1985) have at their core the idea that people perceive stimuli in varied and individualistic ways. As part of the cognitive revolution in psychology in the 1950s, Arnold (1960) shifted the focus from emotions as feelings and behaviors to thoughts and perceptions. The primary idea behind appraisal theory is that individuals perceive the situation and make sense of it by applying emotion labels. Unlike the basic emotion perspective, which suggests that an emotion would be evoked invariantly from a specific stimulus—a bull charging toward you engenders fear—an appraisal approach situates the emotion experience as stemming from the perceiver not the stimulus. In this case, a bull would not universally evoke fear but could, in cases of a skilled bullfighter, for example, evoke feelings of excitement. This appraisal process consists of a number of dimensions that contribute to the overall appraisal, and it is the weighing of these dimensions that shapes the emotion response.

The various dimensions of appraisal processes differ across theorists, but Smith and Ellsworth (1985) offer an especially comprehensive account. They identify six appraisal dimensions including pleasant–unpleasant, certainty–uncertainty, attention–inattention, effort–disengagement, personal controllability–uncontrollability, and situational controllability–uncontrollability. These dimensions combine to produce different discrete emotional states. For example, disgust would be low on pleasantness and very low on attention (people often turn away from disgusting images) but moderately high on certainty; surprise, in contrast, is very high on pleasantness but low on personal controllability and certainty. Appraisal theories differ from a basic emotion perspective because they emphasize that emotional responses are shaped by individuals' appraisal processes. In other words, the basic emotion theory proposes a limited set of basic emotions that are found in humans and many nonhuman animals and are triggered by stimuli in the environment, whereas the appraisal theories underscore that individuals make sense of their environment and the emotion emerges from this sense-making process.

Appraisal theory is particularly useful for explaining how the same situation engenders different emotions in people (Ellsworth & Smith, 1988). In this perspective, attributions of the cause of the event or situation shape the emotional response. For example, receiving negative social feedback may be painful for everyone, but the specific type of negative emotion (e.g., shame vs. anger) is shaped by the presumed reasons for the feedback. In an interracial setting, for example, attributional ambiguity theory argues that negative feedback from a majority group member to a minority group member may be perceived as due to the bias of the person giving the negative feedback—not receiving a job after an interview could be due to the interviewer's bias rather than one's own poor interview skills (Crocker & Major, 1989). To the extent that negative feedback is externally attributed (i.e., interviewer bias) rather than internally attributed, poor interviewing skills shape the emotional response. In a series of studies, this idea was tested using European American and African American participants who were randomly assigned to interacting with a same-race partner or a different-race partner. When African Americans received negative feedback from a White partner, they were more likely to attribute the feedback to the evaluator's bias and showed more anger and increased sympathetic nervous system (SNS) activation (consistent with an approach response; Mendes, Major, McCoy & Blascovich, 2008). However, when rejected by a same-race partner, participants were more likely to experience greater shame, poorer cooperative performance, and greater vasoconstriction, consistent with a defeat or avoidance response. In a subsequent study that replicated the finding (i.e.,

more anger in cross-race dyads; greater shame in same-race dyads following social rejection), cross-race rejection was associated with more risk-taking behavior (Jamieson, Koslov, Nock, & Mendes, 2013) consistent with the idea that anger leads to greater risk-taking (Lerner & Keltner, 2001).

Psychological Construction Theories

Psychological construction theories (Barrett, 2006; Lindquist, 2013; Lindquist, Gendron, & Satpute, 2016; cf. Harre, 1986; Mesquita, Barrett, & Smith, 2010) argue against a basic emotion perspective that emotions are *natural kinds* and instead propose that emotions are experienced when affective states are made meaningful as specific instances of the emotion categories that exist in a given culture. Put another way, where basic emotions focus on a fixed set of universal emotions with strong innate basis, construction theories emphasize learning and cultural variation. An emotion label, in this view, refers not to an individual stimulus, thought, or reaction but instead refers to a population of many different experiences, each of which cannot be disentangled from the situation in which it was engendered. Instances of emotion are proposed to emerge from a flexible combination and recombination of more domain-general core systems, like perception, categorization, and memory and the neural architecture underlying them. Emotions are considered products, or constructions of, more basic ingredients, like valence, approach/avoid motivation, and intensity (cf. the dimensionalist perspective, Russell, 1991) and shaped by experiences, cultural knowledge, and situational information. In this view, emotions are nominal categories constructed from more basic elements. Emotion categories are a result of an active inference process whereby conceptual knowledge accumulated from experiences, culture, and context shape emotion perception and experience. One of the core tenets of psychological construction is the process of categorization. In this view, emotions are learned through a set of experiences that involve categorizing an affective process. If a child sees a parent scream at the sight of a spider, the child learns that small animals with many legs are something to fear. Constructivist perspectives takes seriously the idea of individual and cultural variability in emotion experience and provides a framework to understand the many and varied ways the same stimuli evokes different emotions and also how the same emotional experience is manifested differently across cultures and across people.

An important element of the constructivist view is that a discrete emotion (i.e., basic emotions) would not have a specific facial expression, physiologic change, or predictable behavioral response, but this theory is explicit that emotions do have concomitant neural and physiologic responses. The responses that are "basic" or elemental in emotion are not the emotion category—anger, sadness—but rather the basic ingredients such as *core affect*. Core affect comprises two primary dimensions: valence and activation. These make up the two dimensions of the circumplex model of emotion, which allows every emotion to be placed somewhere in a two dimensional space. Following from dimensional theories of emotion (Russell, 1980; Russell & Barrett, 1999), emotions occupy a dimensional space of pleasant to unpleasant (i.e., the emotion feels good or bad) and activation to deactivation representing arousal (high or low arousal). All categories of emotions can be represented in this two-factor space; anger for example is negative valence and has high intensity, whereas melancholy or sadness would be negative valence and low activation; grief, which is intense sadness, would be negative valence and high activation.

Language plays a large role in the constructivist view of emotion. When a person experiences situations directly or indirectly where there is yelling, scowling, hostility, passive-aggressiveness, pettiness, and so on these concepts are bound together with language into a category that might be labelled "anger." The idea being that without this category that binds these instances those specific examples might have a different emotion category associated with them.

One especially compelling series of studies points to the importance of language in identifying emotion categories. In one study, healthy participants were assigned to a condition that temporarily impaired access to an emotion concept—a technique called semantic satiation where a word is repeated 30 times out loud and loses its conceptual meaning. Participants who repeated the word *anger* and then were presented with two facial expressions took longer to identify an angry face (Lindquist, Barrett, Bliss-Moreau, & Russell, 2006). Similarly, with clinical patient samples, specifically those with a neurogenerative disease called semantic dementia that impairs language use, there are impairments of emotion perception. Whereas healthy participants sort photos of emotion faces into six or more categories, those with semantic dementia sort faces into fewer piles representing general positive, negative, or neutral faces (Lindquist, Gendron, Barrett, & Dickerson, 2004). This work underscores the critical role that language can provide in differentiating categories of emotion.

The three theoretical perspectives reviewed share some similarities but also many differences. As can be the case in theoretical debates, a great deal of effort is directed at demonstrating weaknesses in an opposing theory. For example, social affective neuroscientists examined whether specific and identifiable neural responses occur within emotion categories as might be predicted by a basic emotion perspective. One meta-analysis (Lindquist et al., 2012) was unable to identify unique emotion categories with neural activation. Instead, the same neural regions were activated across a wide range of emotion categories. Specifically, regions like the anterior cingulate, anterior insula, amygdala, and the orbito-prefrontal cortex were activated in a variety of emotions, but these same areas were also activated in situations with that were considered nonemotional. Thus, neural activation occurs in similar ways for emotional information and nonemotional information.

In sum, theoretical perspectives of emotion differ in substantial ways. While most emotion scholars have a preferred theoretical perspective that brings with it various assumptions, emotion research has not necessarily been hampered by the strong disagreements across theoretical camps. Journals and societies dedicated to emotion and affective science continue to proliferate, and several graduate psychology programs have started (or morphed into) affective science areas. Being well-versed in the theoretical perspectives is important if one is interested in integrating emotion into their research program, and while it is not necessary to be rigidly aligned with one specific theoretical perspective, it is important to understand how and when these different perspectives might influence your own assumptions about the origins of emotion.

Do Emotions Have Unique Bodily Signatures?

One enduring debate in emotion research is whether basic (or distinct) emotions have reliable, specific patterns of physiologic responses that co-occur with the emotion onset (Lang, 2014; Levenson, 2014; Mendes, 2016; Norman, Berntson, & Cacioppo, 2014; Shiota, Neufeld, Yeung, Moser, & Perea, 2011). Emotion researchers who use psychophysiology as one of the methods to measure emotion often will evoke the classic William James's (1884) quote on the essential conditions for what should be considered an emotion: "The only emotions I propose expressly to consider here are those that have a distinct bodily expression" (p. 189). There are intuitive reasons to assume the body responds in specific patterns to discrete emotional states; emotions are felt in the body, and folk language implicates bodily changes in these processes. People report bodily changes when describing an emotion experience: feeling sick to the stomach when experiencing disgust, a racing heart when walking down a dark and dangerous street, or a sudden rush of heat to the face during an argument. These reactions appear to effortlessly couple the emotional state with the bodily change. Given this apparent natural coupling, it is not surprising that a large

literature has amassed examining the relation between emotion experiences and changes to the autonomic nervous system (ANS).

There is clear evidence that affective processes, like emotion, acute stress, and motivation, can change ANS responses like heart rate, respiration, sweat, and blood pressure. What the debate focuses on is whether a basic (or discrete) emotion has a universal pattern of physiologic responses that is unique to a specific emotion: That is, are ANS changes when angry different from ANS responses during fear? As previously noted, the basic emotion perspective argues that there should be specific patterns of physiologic responses and the patterns would be different across the basic emotions (e.g., Ekman, Levenson, & Friesen, 1983). The strong version of this argument is that patterned physiological responses to basic emotions occur across human and nonhuman animals, persist across the life span, and are unmodified by context (Ekman, 1992). Over the past few decades, much has been written in support of and against this strong version of the autonomic specificity of emotions (Lang, 2014; Levenson, 2014; Norman, Berntson, & Cacioppo, 2014).

Interpreting bodily changes as part of an emotion dates back as far as at least the third century when a teenager presented with symptoms of an accelerated heart rate and flushed face, and the physician Erasistratos concluded he was "lovesick" (see Gardner, Gabriel, & Diekman, 2000; Mesulam & Perry, 1972). The contemporary version of emotion-specific ANS changes is most strongly associated with Levenson and his colleagues (e.g., Levenson, 2003). In a classic paper, to examine support for the universality of emotion-specific ANS responses, Levenson Ekman, Heider, and Friesen (1992) traveled to West Sumatra, a large island in Indonesia, and measured a suite of physiologic responses from the Minangkabau, a matrilineal Muslin society with no exposure to Western culture. The study included the directed facial action task, which requires the movement of facial muscles to create a configuration tied to a discrete emotion while seven peripheral physiological responses were obtained: heart rate, finger pulse transit time, finger pulse amplitude, skin temperature, skin conductance, respiration period, and respiration depth. A US sample obtained the same measures using a similar protocol. Although the mean responses for heart rate, finger temperature, and finger pulse transit-time were greater in the US sample than the Minangkabau for all five emotions examined, some of the patterning of the responses were similar. For example, in both samples, disgust resulted in little or no change in heart rate, whereas anger, fear, and sadness increased heart rate. Levenson et al. concluded that the two cultures "evidenced patterns of emotion-specific ANS activity that were similar" though they followed this with the point that these data did "not [establish] universality" (p. 983).

To qualitatively summarize extant physiologic data, Kreibig (2010) identified 134 studies utilizing ANS measures and concluded that there was "considerable ANS response specificity in emotion when considering subtypes of distinct emotions" (p. 394). Additionally, this review also pointed to the need to incorporate ANS measures beyond ones that are the easiest to obtain; heart rate and skin conductance are the most common measures collected but are also easy and inexpensive to obtain. Echoing this point, Levenson (2014) identified rarely studied physiological responses in emotion research that might be more reliably related to emotions such as visible changes in coloration, moisture and secretion, protrusions, and appearance of eyes, which are all ANS-mediated (Levenson, 2003, 2014). In sum, claims that specific emotions show ANS patterning come from (a) cross-cultural research showing similar patterned responses to basic emotions and (b) reviews supporting similar directional changes in physiology as a function of the emotion experienced.

Evidence against the strong view of patterned physiological responses mapping onto discrete emotions comes from meta-analytic approaches that suggest that physiologic patterning might relate to more basic *ingredients* or *dimensions* of emotions (e.g., Barrett, 2006). For example, in meta-analyses that appeared in two editions of the *Handbook of Emotion* (Cacioppo et al., 2000; Larsen et al., 2006), the authors concluded that motivational tendencies embedded within emotional states show some consistent ANS patterning.

Specifically, approach-oriented emotional states in which there is an expectation for the need to mobilize energy are more likely to activate SNS than emotional states in which no expectation of energy reserves is expected. This perspective can be seen in LeDoux's work with rats where he shows that when environmental threats are present a neural defensive response occurs (LeDoux, 2000, 2014).

One especially compelling animal study demonstrated the importance of context in shaping physiologic responses during a discrete emotion. Iwata and LeDoux (1988) either placed rats in an unrestrained-home cage, which allowed free movement, or restrained them in a conditioning box, which forced immobility. When exposed to an aversive signal as part of a classical conditioning study, rats that were restrained had a different profile of physiological responses than rats that were unrestrained. Specifically, unrestrained rats showed greater heart rate increases relative to restrained rats. This finding shows how contextual information can result in varied physiologic responses within the same emotional state. Specifically, when rats' behavioral options include potential to escape, the physiological signatures follow the behavioral options. When escape is possible, an increase in cardiac responses would allow for more oxygenated blood to innervate peripheral muscles, whereas when no escape is possible, a reduction in sympathetic responses facilitate freezing, and, in the case of a predator attack, the lower SNS reaction would reduce blood loss if attacked. This study poses a challenge to basic emotion researchers who argue that fear would have a specific physiological signature. A fear-conditioned rat arguably might be one the purest forms of a "fear" response, and yet heart rate was significantly lower when rats were restrained than when they were free.

Additional evidence suggests that basic emotions do not produce differentiated physiologic profiles. In a meta-analysis of over 300 articles using a statistical technique that focuses on the pattern of responses rather than a single physiologic signal (i.e., multivariate pattern classification), no consistent evidence was found for autonomic signatures of discrete emotions (Siegel et al., 2018). Instead, the authors observed patterns of autonomic reactivity that were associated more with the experimental context than the emotional state. That is, active tasks (giving speeches, completing evaluative tasks) were associated with more SNS responses whereas passive tasks (video watching, viewing still images) were associated with less SNS reactivity. These meta-analytic findings are consistent with the perspective that the *context* in which emotions are examined can alter the physiological responses more than the specific emotion experienced (Lang, Bradley, & Cuthbert, 1997).

Underscoring the heterogeneity of physiological responses observed when examining discrete emotions, some studies have shown different patterns of physiologic responses to subtypes within the same emotion category. For example, Shenhav and Mendes (2014) examined gastrointestinal, SNS, and parasympathetic nervous system (PNS) changes during different types of disgust experiences. Participants were randomly assigned to watch one of three different collections of videos: One condition showed individuals suffering painful injuries and accidents in which legs and arms were contorted beyond natural mobility, but no breaking of the body envelope occurred (e.g., no blood); a second condition showed individuals with body envelope violations, such as emissions of blood, puss, and vomit and consuming disgusting things like feces; and the third collection consisted of neutral stimuli like landscapes, animals, and people in rural and urban areas. Participants in the first two conditions labeled the emotion they were feeling as "disgust" more than any other emotion label provided and showed greater activation of the levator labii (i.e., the muscle region surrounding the nose associated with disgust) relative to participants viewing neutral stimuli. However, participants watching body-envelope violations showed decreases in gastrointestinal activity and heart rate acceleration, whereas viewing painful injuries was associated with no changes in gastrointestinal responses, heart rate deceleration, and heart rate variability increases (an indication of greater PNS activation). Thus, two instantiations of the same emotion, disgust, using the same medium (watching videos), produced similar self-reported and facial expressions but different physiologic patterning of the enteric, SNS, and PNS. These findings suggest variability in physiological patterns within the same emotion category and provide support for the perspective that different "ingredients" of

emotions (i.e., the core motivational properties) produce distinct physiological patterning—with body envelope violations engendering more avoidance responses and witnessing others' painful experiences increasing approach responses (Barrett, 2006; Mendes & Park, 2014). These data further support the perspective that a single emotion category can produce variability in responses when subtypes of that emotion are examined (for a similar point, see Kreibig, 2010).

What type of data would be needed to resolve the debate over whether there are specific physiologic responses that are invariantly related to discrete emotions? Researchers have suggested organization of peripheral responding along evolved neural circuitry might provide a stronger basis for examining emotion–physiology relations (Lang, 2014). Other researchers have noted the paucity of work examining ANS-mediated changes in bodily expressions that might be more closely tied to emotion experiences that manifest in observable bodily changes (e.g., piloerections [goose bumps], blushing, sweating, salivating, tearing, and bulging or twinkling eyes; Levenson, 2014), and by examining these downstream responses, one might be able to draw sharper boundaries around different emotion categories vis-à-vis physiological changes. Still others have urged researchers to take seriously the social and cultural context, individual differences, and developmental factors that alter how emotions are manifested in the body (Barrett, 2006; Mendes, 2010; Mendes & Park, 2014). Whether any of these approaches resolve this debate remains to be seen, but it is likely that most emotion physiologists would agree that multiple measures that assess unique bodily changes and attention to temporal, contextual, and developmental factors are more likely to lead to better insight into the nature of emotion-physiology relations.

Are Emotions Distinct from Other Affective States Like Stress, Mood, and Motivation?

At the broadest level, some psychological research tries to draw sharp boundaries around *hot* affective processes like emotion, acute stress, and motivation compared to *cold* processes like perception, memory, and attention. It is best to conceive of this hot–cold distinction as a continuum with very few mental states falling at the extreme ends. This dichotomy is meant to underscore the differences between thinking and feeling but offers little value from a process level given central control and integrated perceptual systems. That noted, from a didactic and research perspective, there are theories that differentiate cold/cognitive processes from hot/affective ones (Figner & Weber, 2011; Kahneman, 2011; Metcalfe & Mischel, 1999). *Affect* and *affective science* serve as broad umbrella terms that encompass processes such as acute stress, motivation, evaluation, mood, and emotion (Gross, 2015). Given this broad definition, how does one know whether they are studying emotion, motivation, or acute stress? By appreciating the boundaries and overlapping features of these states, one can gain both precision and greater traction from integrating varied areas.

When considering the overlap of affective processes, Gross (2015) identified the general assessment of "Is this good for me or bad for me?" This quick valuation then coordinates general processes like approach or avoid (in motivational language), positive or negative valence (in emotion terms), and challenge or threat (in stress language). All of these states would likely generate a coordinated brain/bodily response and, at the most basic level, generate an approach or avoidance reaction. These affective responses may be shaped by conscious and unconscious processes; may have specific neural, neuroendocrine, and peripheral physiologic responses; and might be associated with behavioral or action readiness responses.

Emotion and stress research traditions share parallel literatures on how to regulate or alter the affective state. In emotion research, *emotion regulation* is the process by which individuals attempt to alter their emotion experience (Gross, 2015). Similarly, in stress research, *coping* is the process by which individuals

attempt to modify their stress responses. Indeed, coping research dating back to the 1970s identified processes like suppression and reappraisal that emerged in the emotion regulation literature a few decades later (Gross et al., 2015). Coping and regulation are fundamentally the same processes by which an individual attempts to modify, dampen, accentuate, or ignore his or her affective state.

While the variety of affective responses may share brain/body responses and have shared antecedents and consequences, the various affective states are differentiated along important lines. The most obvious is the *temporal* component. Of all the affective states, emotions are assumed to be the shortest duration with a quick onset and a fast resolution. Surprise would be the extreme example of a very short duration from onset to offset with the entire emotion occurring over a few seconds. Obviously, not all emotions have this type of quick response—sadness can last for hours, days, or longer—but, in general, emotions are considered to be short-lived, burst experiences. In contrast, acute stress at a minimum tends to last minutes. Anticipatory stress can last much longer, but, in general, the body's stress systems parallel psychological state of acute stress, and it would be difficult to maintain a heightened state of SNS activation for more than an hour other than in extreme situations (e.g., taking cover from enemy fire in a foxhole). Mood, on the other hand, is longest in duration and can last hours or days. These general time frames are simply heuristics to think about how to characterize an affective state that one might be interested in studying and how one might best bring about the affective state and how to measure it, which is reviewed in more detail in the following discussion.

Affective states differ in the *elicitor*—that is, what brings about the affective response. For example, emotions are more likely than moods to have a specific elicitor or event that links the situation to the affective state. Acute stress and motivation are more similar to emotional states than mood states in that there tends to be a specific event or stimuli that engenders the affective state. However, emotions differ from acute stress and motivation in that emotions can occur in both *active* and *passive* situations, whereas acute stress and motivation are typically a response to an active, goal-relevant situation. People can experience emotions from watching videos, reading vignettes or observing others but these passive situations typically do not engender motivational or stress reactions as easily.

Affective states also differ in their *specificity*. There is more differentiation in emotion categories than in any of the other affective states. Sadness feels different than disgust, which feels different than fear (Barrett, Mesquita, Ochsner, & Gross, 2007). Stress, in contrast, at best can be differentiated into two broad categories of maladaptive toxic stress and adaptive stress responses (McEwen, 1998). Similarly, motivation can be characterized as approach, avoidant, or disengagement (Blascovich & Mendes, 2010), and mood generally has just a positive or negative valence.

The differences in affective states have manifested in the type of empirical and theoretical data amassed. Stress research is conducted primarily by health and clinical psychologists and those more medically oriented; thus, it is not surprising that stress research tends to be more applied or at least *translational.* In contrast, emotion research is typically conducted by academic psychologists and is commonly studied among social and personality psychologists and tends to be more theoretical. Given the typical researchers' specialties, it is not surprising that stress research is more sophisticated on the biological and neurological consequences whereas emotion research is more sophisticated theoretically.

The Role of Cognition in Emotion

Does one need to be aware of an emotional state for an emotion to exist? Can emotions exist outside of conscious experience? How does awareness influence emotion experience? Do cognitive processes modify

emotional experiences? These questions circle around a central theme of how cognition and emotion interact. This section reviews some often discussed issues related to the emotion and cognition interplay.

One area that generates much discussion is the extent to which a person has to be consciously aware of an emotion for an emotion to exist. If one is not aware of his or her happiness, for example, is he or she happy? Social-affective neuroscientists, like Matthew Lieberman, make the case that consciousness is a prerequisite for emotion. If one does not have awareness of an emotional state, there can be no emotional response (e.g., Lieberman et al., 2007). In contrast, other neuroscientists point to the temporal trajectory of response and awareness to argue that emotions do not need consciousness to influence behavior. For example, Damasio Tranel, and Damasio (1997) have put forth the somatic marker hypothesis, which is the idea that affective states outside of conscious awareness can influence behavior. In seminal research on this hypothesis, participants are presented with four decks of cards with various gains and losses associated with the four decks—two of the decks result in small gains but small losses, whereas the other two decks result in large gains but also large losses. The authors observed that as participants turned over cards from the various decks, changes in skin conductance (activity in the eccrine gland indicating SNS activation) differentiated the small gain/loss decks (safe choices) from the large gain/loss decks (risky choices) with the latter resulting in large skin conductance changes relative to the former. Importantly, these bodily changes *preceded* conscious reporting of which decks were risky by approximately 40 trials. Thus, the somatic marker hypothesis claims that bodily changes can indicate psychological or mental states prior to people being able to consciously report their affective state.

Cognitive processes can have direct influences on the experience of emotion. Several lines of research converge on the idea that how one remembers or thinks about a situation influences the emotion and its consequences. Self-distancing, for example, is the strategy of adopting a distant, third-person perspective when thinking back on difficult or unpleasant events (Kross & Ayduk, 2011)—thinking about it as if it happened to someone else. This strategy is contrasted to *self-immersion* in which individuals relive an experience from a self-immersed or first-person perspective, whereas self-distancing entails thinking back on the event from a global perspective (e.g., like a fly on the wall). Often experiments examining these strategies will manipulate a self-distancing versus self-immersion perspective by having participants recall an event in either the third-person perspective (e.g., "What was [your name] feeling while going through this?") versus a first-person perspective (e.g., "What was *I* feeling while going through this?"). Self-distancing is believed to facilitate meaning-making and results in a healthier response to a negative emotional memory. Indeed, Kross and Ayduk (2010; Kross & Ayduk, 2017) have garnered considerable evidence that a *self-distanced* versus *self-immersed* perspective reduces negative emotions, lowers blood pressure, and can reduce aggressive behaviors following from an emotion experience like anger. The authors argue that self-distancing improves these responses by allowing individuals to reconstruct the events to allow insight and closure.

This line of work elegantly demonstrates that how one recalls emotional memories influences how those emotions are remembered and experienced. That is, emotions can be modulated—muted or amplified—simply by changing the self-perspective in which the event is remembered. This approach extends to ongoing emotional events as well. That is, if participants adopt a self-distancing perspective while preparing to complete a stressful task they experience the task as less negative. While self-distancing represents a cognitive strategy to *think yourself* into a different emotional state, it certainly isn't the only cognitive strategy that can alter emotion.

Reappraisal can directly influence physiological, cognitive, and behavioral responses during high arousal, negative affect states. Reappraisal is the process of reinterpreting the meaning of an emotional stimulus. In one study examining the effective of reappraising one's bodily reactions during stress, participants were instructed to deliver a speech in the presence of a panel of evaluators for a mock job interview (Jamieson, Nock, & Mendes, 2012). Just before the speech participants were randomly assigned to one of

three strategies, one of which was a reappraisal strategy and the other two were control conditions. In the reappraisal condition, participants read a (manufactured) newspaper article that described research that found that physiological arousal was functional and improved cognitive performance. The article said that increases in physiological responses (like heart rate) before a stressful task helped people to perform well, so this response is adaptive. It suggested to the reader that the best way to cope with a stressor is to remind yourself that increases in arousal are good for you. In contrast, one of the control conditions provided a coping strategy that (unbeknownst to the participant) was ineffective at coping with acute stress—ignoring the source of stress. In this condition, a (manufactured) newspaper article was presented that described research that shows that the best way to cope with stress is to ignore the source of the stressful experience. The second control condition did not include any instructions on how to cope with the stressful task, but rather reiterated general instructions. Cardiovascular reactivity obtained during the speech task showed that the reappraisal condition resulted in more beneficial and adaptive stress responses, specifically more efficient cardiac functioning (higher cardiac output) and decreases in vascular resistance (lower total peripheral resistance) compared to either of the two control conditions. Additionally, a measure of attentional bias (Emotional Stroop; MacLeod Rutherford, Campbell, Ebsworthy, & Holker, 2002) was completed immediately after the stress task. This task provides an indication of attentional bias toward negative self-information and is related to vigilance. Participants who read about the benefits of physiological arousal (i.e., reappraisal condition) did not show evidence of attentional bias whereas the two control conditions did. In short, this study demonstrated that appraising bodily changes that occur during high arousal, negative emotion experiences can lead to adaptive physiological responses as well as less attentional vigilance for threat in the environment.

Using a similar paradigm, reappraisal was manipulated in another study examining exam performance (Jamieson, Mendes, Blackstock, & Schmader, 2010). Students about to take the General Record Exam (GRE) were either assigned to a condition in which they learned arousal during an exam helped their performance (reappraisal condition) versus a no-information (control) condition. Participants in the reappraisal condition showed a significant increase in SNS responses (consistent with approach-oriented, *challenge* responses) and performed better in the quantitative portion of the GRE. Moreover, when students returned to the lab after they had completed the actual GRE with a copy of their tests reports, participants assigned to reappraise their arousal obtained higher GRE math scores than those in the control condition. When queried about their test arousal on exam day, compared to control participants, reappraisal participants reported that arousal was more likely to help their performance, and they reported feeling more certain about their performance.

The importance of these studies is that they underscore how flexible emotion states can be. By thinking about one's physiological arousal engendered during highly emotional situations as adaptive, participants showed more benign physiological functioning, lower threat vigilance, and better test performance. These reappraisal strategies share much in common with *cognitive behavioral therapy*, which uses cognitive relabeling to alter dysfunctional behavior. Indeed, using the same reappraisal intervention for participants with social anxiety disorder (SAD) even individuals with SAD benefited from reappraising arousal as functional during a social evaluation lab task intended to increase negative emotion (Jamieson, Nock, & Mendes, 2013).

How one thinks about emotion is one possible antecedent to altering the meaning and consequences of emotional reactions, but stepping back in this process, it may also be fruitful to ask whether simply inquiring about how one feels can alter emotional experience and consequences. Here, the literature points to differing potential outcomes of emotional assessment. On the one hand, expressive writing, emotional disclosure, and affect labeling are considered possible strategies to reduce the impact of emotion on neurological responses and even ultimately long-term health outcomes. Long-standing work by Pennebaker (1997), for example, argues that individuals who emotionally disclose their thoughts and feelings using

expressive writing interventions will have fewer health clinic visits and better well-being compared to those in a no-expressive writing condition.

On the other hand, several researches have noted potential downsides of emotional disclosure for acute and long-term physical and mental health. For example, in a study that assessed individuals' responses immediately after the 9/11 terrorist attacks, participants were asked whether they wanted to "disclose (put in words) their feelings of the recent events." More than 2,000 respondents replied and responded either "yes" or "no." In addition, if they did want to disclose how they were feeling, they were presented with a dialogue box in which they could type their feelings about the tragic events. The authors then followed this panel of respondents over the next two years and assessed physical and mental health. They observed that, even after controlling for pre-9/11 mental and physical health history, respondents who chose to express their immediate reactions had poorer mental health than those who chose not to express an initial reaction. Furthermore, among those who did decide to express their thoughts, the more they wrote, the worse their mental and physical health (Seery, Silver, Holman, Ence, & Chu, 2008).

This section reviewed how cognition and emotion interact. As this short review shows, there are still open questions about whether consciousness is a prerequisite of emotion experience and whether the effects of expressing emotions are always beneficial for physical and mental health outcomes.

What Is the Best Way to Manipulate and Measure Emotion?

Manipulating Emotions

Often social psychologists are interested in manipulating emotion in a lab or an online environment. In this section, the different approaches to engendering emotion states are reviewed, and some of the benefits and drawbacks are discussed.

As previously described, the directed facial action task is one approach that can putatively engender an emotional response without necessarily evoking a conscious experience of the emotion. This task requires individuals to manipulate muscles in their face—activating the brow muscles so they are contracted, which presumably occurs during anger or other negative emotional states. This task assumes that facial expressions and the muscles activated in different facial expressions are invariantly related to discrete emotions, and so, not surprisingly, this task is primarily used by basic emotion theorists. The advantage of this type of task is that it eliminates the need for stimuli to evoke an emotion response and thus can be used cross-culturally. The disadvantage is that the task assumptions rely strongly on the idea that discrete emotions are invariantly related to specific facial configurations.

A more common approach to emotion induction is emotion elicitation using film (e.g., Gross & Levenson, 1985). This emotion induction approach is highly effective at engendering emotion reports (subjective experiences) of discrete emotions. For example, to elicit sadness, a film clip from the movie *The Champ* showing a young boy trying to wake his dead father after a boxing match is an especially powerful emotion induction (I dare you to watch the clip and not get choked up). The advantages of using film clips is that the stimuli can be shared across researchers, and thus results easily can be compared across labs and studies. The disadvantages include that the emotion inductions are passive—a participant is watching an experience happen to someone else so simulation of that experience is a requirement for the emotion induction. Also, it isn't clear how previous knowledge of the film clip might exacerbate or attenuate

emotional responding. Watching an especially scary film with a jump-scare (i.e., an abrupt and unexpected frightening moment) is not as effective the second or third viewing as the first viewing.

Similar to film stimuli, one of the most common emotion induction manipulations uses static photos from the International Affective Picture Stimuli (IAPS; Lang, Bradley, & Cuthbert, 1997). This large set of photographs (more than 1,000 photos are available) includes a variety of contexts including objects, people, erotica, animals, landscapes, mutilated bodies, and more. Each picture in the IAPS has been rated on dimensions of pleasurable and arousing and has then been numbered and catalogued according to the means and standard deviations of these ratings. IAPS pictures have been used in a variety of emotion studies examining neural activation associated with emotion experience, peripheral physiologic responses, and priming studies intended to bring about an emotion state prior to a task, to name a few. Like emotion inductions using films, IAPS has the advantage of comparison across labs and cultures (without the language barrier that would be inherent in film inductions) and has the added advantage of a large normative database to select images given a desired arousal and pleasurable category. The downside is that the emotion induction is passive rather than active (the same as with using films).

Emotion inductions that tend to be more active rather than passive include re-lived emotion experiences. This approach requires one to think back to an event that brought about a specific intended emotion. In this approach, the experimenter provides specific instructions to help bring about the event in as vivid detail as possible. Presumably, as these memories come back, the individual would experience the targeted emotions. This strategy of re-lived emotional experiences is a common technique for researchers to bring about an emotion in the lab. In the extreme, re-lived experiences can be harmful as in the case of flashbacks and dissociated thinking as can occur with posttraumatic stress disorders. But are these re-lived emotions truly similar to emotions experienced in the moment, and can the emotional memories be influenced by cognitive strategies that can be brought to mind during the retrieval process? It is unclear whether the re-lived experiences are similar to the original experience, and the ability to bring about vivid details and recreate the memory can differ across individuals. Also, unlike film and static stimuli (e.g., IAPS), there is not the same control across individuals given the varied experiences across individuals.

The most labor-intensive emotion induction tasks are active tasks, which create an actual experience in a lab setting. Most notably, Gerhard Stemmler and colleagues have created real-life emotion inductions in the lab (e.g., Stemmler, Heldmann, Pauls, Cornelia, & Scherer, 2001; see also Kassam & Mendes, 2013; Mauss et al., 2007). For example, in one study to induce fear, participants were told that there would be an unexpected blood draw, and a research assistant brought in a dish of syringes while the participants were preparing to deliver a speech. To induce anger, participants interacted with a difficult and quarrelsome research assistant who claims that the participant's performance on a mental arithmetic task is substandard. This type of real-life emotion inductions is highly effective at increasing subjective experiences and physiologic responses in a lab environment. The downside is that these approaches require tremendous experimenter effort, time, and cost. Thus, these studies can be difficult to conduct for those with limited money and resources and are not well-suited for large-scale data collection of hundreds (let alone thousands) of participants.

Measuring Emotions

There is a variety of ways to measure emotions, and the various measurement strategies have advantages and disadvantages. The most obvious approach is to simply ask people what they are feeling. One measure, the Positive and Negative Affect Schedule (PANAS) developed to measure trait like emotional states, the

stem is changed from the original "How do you typically feel?" to "How do you feel right now?" (thus obtaining a state measure; Watson, Clark & Tellegen, 1988). Bypassing discrete word labels, the self-assessment manikin (SAM) is a nonverbal pictorial assessment technique (Bradley & Lang, 1994). This three-dimension scale presents participants with a series of five cartoon-like icons that vary based on three different dimensions: pleasure, arousal, and dominance. For example, the pleasure dimension presents five icons that represent very happy to very sad by changing the mouth, eyes, and eyebrows of the icon. Subjective reports offer face valid information related to emotion experiences but this approach assumes that emotions are always experienced consciously. Subjective reports also potentially suffer from the same obstacle that all self-reports are vulnerable to, which is idiosyncrasies in socially desirable responding or the opposite, defensive responding.

To overcome limitations in self-reports of emotion, implicit measures have been developed in an effort to obtain emotion responses that individuals may be either unwilling or unable to report. One measure, the Implicit Positive and Negative Affect Test (IPANAT) measures the extent to which individuals assign positive or negative adjective ratings to nonsense words (Quirin, Kazen, & Kuhl, 2009). For example, participants rate the word TUNBA in terms of how much they think the word conveys the feeling of happy, helpless, energetic, tense, cheerful, or inhibited. Like other implicit measures, the value is that individuals are unlikely to realize that their responses reflect their current affective state. But, like other implicit measures, it is unclear to what extent implicit responses reflect a more valid way to assessing emotions.

A relatively new approach to measuring emotions takes advantage of the idea that emotions are experienced in the body. In this approach, participants are presented with two silhouettes of bodies and are instructed to color the bodily regions where a specific emotion might create activation or deactivation (Nummenmaa, Glerean, Hari, & Heitanen, 2014). This topographical self-report method yielded separable bodily sensations for different emotions, and the authors argue that the measure could be especially useful cross-culturally. While it is currently unclear how valid and reliable this measure is and to what extent participants are coloring in bodily regions based on experientially differences in emotion or responding to cultural knowledge of where emotions are typically experienced (e.g., disgust in the gut) remains unknown, but this novel method may offer added value to subjective reports.

Facial expressions tied to emotions are examined as a way to provide an unobtrusive, behavioral measure of emotion. The most popular measure of facial expressions stems from Ekman's early work that identified the complete topography of the face and underlying muscular structure. This approach, the Facial Action Coding System (FACS), identifies a complete taxonomy of muscle activation and facial movements (Ekman & Rosenberg, 1997). FACS was originally developed for human coders who manually code each "action unit" (defined as a contraction or relaxation of one or more facial muscles). Discrete emotions are identified by a specific constellation of action units. For example, a "genuine" smile includes activation of the zygomatic major muscle (muscles around the mouth that activate in a smile) plus the contraction of the orbicularis occuli (the outer part of the eye muscles that are presumed to contract in an authentic smile). In one especially impressive use of FACS, Harker and Keltner (2001) coded facial expressions from a women's college yearbook photos and found that positive emotion expressions predicted personal well-being and favorable martial outcomes 30 years later.

The advantage of FACS is the ability to assess emotions from the face without requiring subjective responses from the participant. The downsides include the need to be a "certified" FACS coder, high labor intensity, and the strong assumption that facial expressions, defined by the basic emotion perspective, are invariantly related to emotions (see Gendron, Roberson, van der Vyver, & Barrett, 2014). Recent advances in video scanning, which purports to automatize FACS scoring and thus removes the need for human coders, may provide the type of large-scale data needed to definitively answer the question of whether facial expressions are invariantly related to discrete emotions.

Future of Emotion Science

Emotion experiences animate our lives and social relationships. Positive emotions predict lower incidence of morbidity and mortality, and in just about every domain of our lives, positive relative to negative emotions are associated with better outcomes. But emotions are not just something that lives within an individual, but emotions can also emanate from people and influence those around them making emotions also a dyadic and group level process. Recent advances in analytic approaches, specifically multilevel modeling and dyadic approaches, have ushered in a new age of research examining emotion in dyads and groups (Thorson, West, & Mendes, 2018). *Emotion contagion*—how one person's emotion experience influences the emotion experience of a partner or group—is an exciting area of research that social psychologists would be particularly skilled to study given their training in social settings and interpersonal processes.

Emotion science is an exciting area of research and critical to understand for social psychologists. Although this chapter highlighted many areas that continue to evolve in terms of our understanding of emotion science, there is a wealth of research that provides many exciting avenues for the budding social psychologist to explore.

Note

1. A sixth emotion, surprise, bounces on and off the basic emotion list.

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