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Constructing Emotion

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Abstract

Constructionist approaches to emotion have existed since the time of William James, and are united in the assumption that the psychological events called "anger", "sadness", and "fear" are not the elemental building blocks of emotion, but instead are mental events that result from the interplay of more basic psychological systems. This paper summarizes the three fundamental hypotheses that ground the Conceptual Act Model, a recently introduced constructionist approach to emotion. First, the mental events that people refer to as "emotion" are constructed, in the blink of an eye; from more basic psychological primitives that are always in play. Second, psychological primitives are not themselves specific to emotion, and are hypothesized to participate to some degree in constructing every psychological moment. Third, factors that have traditionally been treated as non-emotional such as concepts and language play a central role in making an instance of emotion what it is. Implications of the Conceptual Act Model for the science of emotion are then discussed.

Keywords: Conceptual Act Model, emotions, constructionist approach

In the last six years, my students and I have put forth what we hope is a novel approach to understanding the nature of emotion, called the Conceptual Act Model. The Conceptual Act Model is a social neuroscience model of emotion that respects the nature of the human brain. The logic and hypotheses that make up the model have been set out (in pieces) in a number of different papers (Barrett, 2005, 2006b, 2006c, 2009, 2011; Barrett & Lindquist, 2008; Barrett, Lindquist, Bliss-Moreau et al., 2007; Barrett, Lindquist, & Gendron, 2007; Barrett, Mesquita, Ochsner, & Gross, 2007; Barrett, Ochsner, & Gross, 2006; Duncan & Barrett, 2007; Lindquist & Barrett, 2008). The goal of present article is distill the major social psychological

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principles of the model and to contextualize the model past writings and future research. To begin, I briefly situate the Conceptual Act Model in the psychological history of emotion science. I then outline three of its defining hypotheses, and in so doing review emerging evidence from my lab that represents the beginning of a much larger empirical effort to evaluate the veracity of the model. I then discuss how the model builds on, but is distinct from, other constructionist models of emotion (most notably, Schachter & Singer, 1962). Finally, I end by discussing how the Conceptual Act Model moves the science of emotion forward.

A Brief Psychological History of Emotion

The Conventional View

To many researchers, the psychological history of emotion is straightforward. The golden age of emotion research begins with Darwin's (Darwin 1859/1965) publication of *"Expressions of the emotions in man and animals"* (emotions cause stereotypic bodily expressions), followed by James' (James 1884) critique in "*What is an emotion*?" (bodily activity causes emotion, not the other way around). James, in turn, was criticized by Cannon in his 1927 paper *"The James-Lange theory of emotions: A critical examination and an alternative theory"* (the body cannot cause emotion because visceral changes are too slow and too difficult to feel, and the same visceral changes occur in both emotional and non-emotional states) (Cannon, 1927).

Psychology, the story goes, by then in the grip of behaviorism, sank into the dark ages, and did not produce anything worthwhile on the topic of emotion for about 40 years, although some important neurobiology papers by Papez (1937) and MacLean (1949) were published.

A renaissance period then was said to emerge in the 1960's, first with Magda Arnold's "*Emotion and Personality*" (Arnold, 1960), followed by *"Affect-Imagery-Consciousness"* (Tompkins, 1962, 1963) and Schachter & Singer's (1962) paper entitled *"Cognitive, social, and physiological determinants of an emotional state."* As the conventional history goes, these works rescued the science of emotion and set it on its current course, solidifying the two competing perspectives that essentially define the modern approach to emotion. As psychological events, emotions are either discussed as complex reflexes that are automatically triggered by objects and events in the world (the "basic emotion" approach), or as automatically triggered by a meaningful interpretation of the situation (the "appraisal approach"). In effect, these works launched the modern era of scientific research on emotion.

In psychological research on emotion today, the question of what emotions are and how they function is largely answered in either basic emotion or appraisal terms. The basic emotion vs. appraisal distinction not only shapes the scientific

present (influencing which questions are asked, how they are asked, and how the findings are interpreted), but it also forms the lens through which the scientific past is viewed. Emphasizing the difference between the two approaches masks what the two approaches have in common, however, and leaves unexamined an entire line of theorizing in science of emotion.

An Unconventional Observation

A close read of the literature reveals that there are really two different classes of appraisal models. The first class, derived from Arnold's writings, have a lot more in common with basic emotion models than might first be assumed (e.g., Frijda, 1986; Roseman, Spindel, & Jose, 1990; Scherer, 1984). "For each emotion, there is a distinct pattern that remains more or less constant and is recognized as characteristic for that emotion" wrote Arnold. "Whether we are afraid of a bear, a snake, or a thunderstorm, our bodily sensations during these experiences are very much alike. … there will always be a core that is similar from person to person and even from man to animal" (Arnold, 1960, p. 179). Appraisals were imbued with the power to diagnose objects or situations as personally relevant, and were given responsibility for triggering emotions that pre-exist within the individual, so that anger, sadness, fear, and so on, are different biological kinds that, in essence, are grounded in distinct behaviors. Essentially, Arnold has proposed that a meaning analysis will trigger basic emotions.

When Arnold's writing is viewed in its proper context, then, basic emotion approaches and Arnold-style appraisal-as-cause models (where appraisals are the literal cognitive mechanisms that trigger recognizable syndromes of behavior and bodily reactions) are more similar than different (with basic emotion models focusing on the output side of the equation and appraisal models focusing on the input side). Together the basic emotion and appraisal-as-cause models form the current scientific paradigm for emotion science, in what has been called "the natural kind view" (Barrett, 2006a) or the modal model (Barrett, Lindquist, & Gendron, 2007) of emotion. Despite the differences in their surface features, these models all assume that the mental events that correspond to these English words, plus a few others ("fear" and "disgust"), have firm boundaries that can be observed in nature (meaning in the brain or body), and are therefore recognized, not constructed, by the human mind. Individual instances of an emotion category (e.g., anger) are presumed to cluster together in a meaningful way because they have something real in common (their physical signature and/or the neural module or cognitive pattern that *produced* them). In this view, emotions are like atoms – they are elemental features of the mind and brain.

If Arnold's view was that a meaning analysis *causes* an emotion, then Schachter & Singer's (1962) view belongs to a second, rather different class of appraisal models where a meaning analysis *constitutes* what an emotion is as a

psychological event (e.g., Ortony, Clore, & Collins, 1988; Smith & Ellsworth, 1985). These works, along with many papers and books that were published from 1890 to 1970, constitute a constructionist approach to emotion that is very different from the natural kind view inspired by Tompkins and Arnold. Constructionist approaches are united in the assumption that the psychological events called "anger," "sadness," and "fear" are not basic, elemental building blocks of emotion, but instead are mental events that result from the interplay of more basic psychological systems (Brenner, 1974; Dashiell, 1928; Duffy, 1934, 1941; Dunlap, 1932; Hunt, 1941; James, 1890, 1894; Mandler, 1975; Ruckmick, 1936; Schachter,1959; Titchener, 1909; Wundt, 1897; Young, 1943). James proposed what is, perhaps, the first constructionist approach to emotion. In *The Principles of Psychology*, James (1980) wrote:

The trouble with the emotions in psychology is that they are regarded too much as absolutely individual things. So long as they are set down as so many eternal and sacred psychic entities, like the old immutable species in natural history, so long all that can be done with them is reverently to catalogue their separate characters, points, and effects. But if we regard them as products of more general causes (as 'species' are now regarded as products of heredity and variation), the mere distinguishing and cataloguing becomes of subsidiary importance. Having the goose which lays the golden eggs, the description of each egg already laid is a minor matter (p. 449).

This quote illustrates two of the grounding principles for constructionist views of emotion. First, emotions are states of mind that are assembled from more basic, general causes. Second, emotions are not psychic entities, but are highly variable mental states. James also makes clear a key implication of the constructionist approach to emotion: psychology must develop from a science that classifies emotional states into a science that explains their existence.

A Modern Constructionist Approach: The Conceptual Act Model

Recently, my lab has introduced a constructionist approach, called the Conceptual Act Model (Barrett, 2006a, 2009, 2011; Barrett, Lindquist, Bliss-Moreau et al., 2007; Barrett, Lindquist, & Gendron, 2007; Barrett, Mesquita et al., 2007; Lindquist, Wager, Kober, Bliss-Moreau, Barrett, in press). Like other constructionist models, the Conceptual Act Model states that an emotion word, like "anger", names a commonsense category that corresponds to a range of mental events that emerge from the interaction of more basic psychological ingredients. In this model, emotions are perceptions – they are mental contents, not process. They are not modules in the brain, but they do, of course, correspond to brain states.

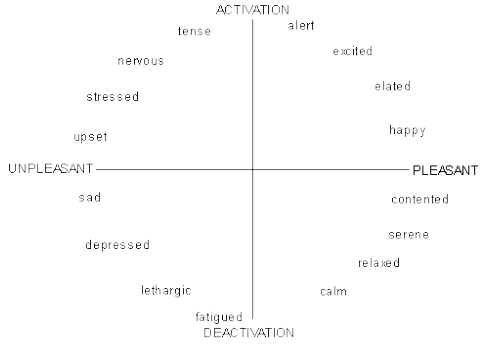
The Conceptual Act Model can be summarized as three basic hypotheses. First, the mental events that people refer to as "emotion" are constructed, in the blink of an eye, from more basic two psychological processes that are always in play: a psychologically basic and biologically basic mammalian system that produces

some variation on positive or negative states (producing variations in "core affect") and a human conceptual system for emotion (i.e., what people "know" about emotion) that could exist in a more limited form in non-human great apes. As a result, different instances that people refer to by the same word ("anger") can feel and look very different, and mental referred to by different words ("anger" and "fear") are not caused by different mechanisms. In this view, emotions are not natural kinds. As a consequence, the model predicts (rather than explains away) the considerable variability in emotional life that has been observed within individuals over time, across individuals from the same culture, and of course across cultures. Second, psychological primitives are not themselves specific to emotion, and are hypothesized to participate to some degree in constructing every psychological moment. The implication is that certain aspects of emotion (e.g., core affect) can play an intrinsic role in what people consider to be non-emotional events (e.g., seeing). The more far reaching consequence of this hypothesis is that the mental events people call "emotions" and "cognitions" and "perceptions" differ phenomenologically, but may themselves not be natural kinds (for a more extended discussion, see Duncan & Barrett, 2007). Third, factors that have traditionally been treated as non-emotional such as concepts and language play a central role in making an instance of anger what it is. In this view, understanding the meaning emotion words and emotion concepts is a piece of the puzzle to understanding what emotions are and how they work. Each hypothesis is discussed in turn.

Psychological Primitives

The first defining hypothesis of the conceptual act model is that there are a number of psychological primitives that combine like ingredients to make a variety of mental states that people call "emotion." The first psychological primitive that creates mental life is a *core affective system* that consists of neurobiological states that can be described as pleasant or unpleasant with some degree of arousal (Figure 1; for reviews, see Barrett, 2006c; Russell, 2003).

Figure 1. *A Map of Core Affect: The Affective Circumplex. Taken from Barrett and Russell (1998)*



The general function of this core affect system is to integrate incoming sensory information from the external world with homeostatic and interoceptive information from the body to produce a mental state that can be used to safely navigate the world, by predicting reward and threat, friend and foe. People are often aware of their core affective state, although they need not be.

The idea of core affect as a psychological primitive is distinct from the more general usage of the word "affect" to mean anything emotional. Core affect has been characterized as the constant stream of transient alterations in an organism's neurophysiological and somatovisceral state that represent its immediate relationship to the flow of changing events (Barrett 2006c; Russell, 2003; Russell & Barrett 1999); in a sense, core affect is a neurophysiologic barometer of the individual's relationship to an environment at a given point in time. To the extent that an object or event changes a person's "internal milieu", it can be said to have affective meaning – these changes are what we mean when we say that a person has an affective reaction to an object or stimulus. They are the means by which information about the external world is translated into an internal code or representations (Damasio, 1999; Nauta, 1971; Ongur & Price, 2000). When sensory information from the world sufficiently influences a person's internal bodily state (which can be experienced as pleasant or unpleasant with some degree of arousal), the processing of that information is prioritized, so that the resulting object is more easily seen (for a review see Vuillieumier & Driver, 2007) and remembered (for a review see Kensinger & Schacter, in press).

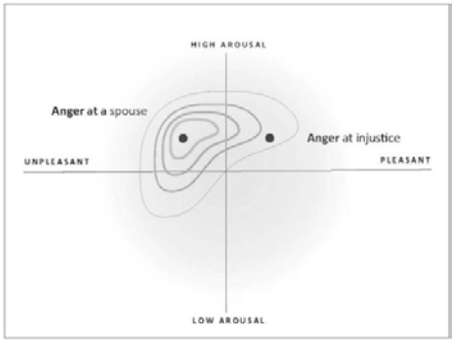
The experience of feeling an emotion, or the experience of seeing emotion in another person, requires the participation of a second psychological primitive, which is effectively "what people 'know' about emotion". This *conceptual system* is a storehouse of knowledge that is sculpted by prior experience. It is system of rich, context-specific concepts for anger, sadness, and fear (or whatever the categories are in your culture) that people use to categorize core affect. People easily and effortlessly experience anger and sadness and fear and see these emotions in others because, in the blink of an eye, they conceptualize (or categorize) the ebb and flow of core affect, bounding it as a discrete experience. This corresponds to the colloquial idea of "having an emotion."

Categorizing is an on-going, fundamental cognitive activity, and constitutes the brain's prediction for what sensory information means (e.g., Bar, 2007). To categorize something is to render it meaningful; it is to determine what something is, why it is, and what to do with it. It then becomes possible to make reasonable inferences about that thing, predict how to best to act on it, and communicate our experience of the thing to others. In the construction of emotion, the act of categorizing core affect performs a kind of figure-ground segregation (Barsalou, 1999, 2003), so that the experience of an emotion will pop-out as a separate event from the ebb and flow in on-going core affect (where core affect is associated with the direction and urgency of initial behavioral responses). In doing so, people

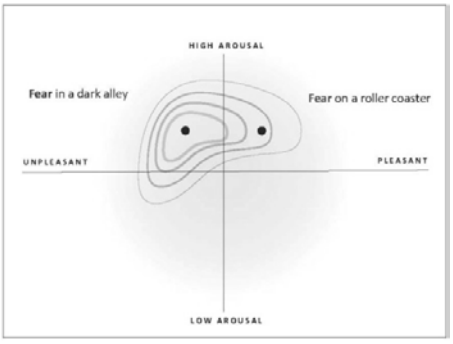
divide ongoing changes in core affect into meaningful experiences. Conceptualizing core affect renders it intentional (about something), so that we experience our own core affect as meaning that the world is a particular way, or experience another person's core affect as emotional behavior and infer something about their experience of the world in the process. Conceptualizing also allows us to make reasonable inferences about what to do next, and to communicate with others in an efficient manner. So, when you feel angry, for example, you have categorized your core affect using your conceptual knowledge of anger (Figure 2a). As a result, you will experience your unpleasant, high arousal state as evidence that someone is offensive. In fear, you will experience the same state as evidence that the world is threatening (Figure 2b). Another example, when you feel sad you have categorized your core affect using your conceptual knowledge of sadness (Figure 2c). And either way, you will behave accordingly.

Figure 2. *Depicting the Conceptualization of Core Affect*

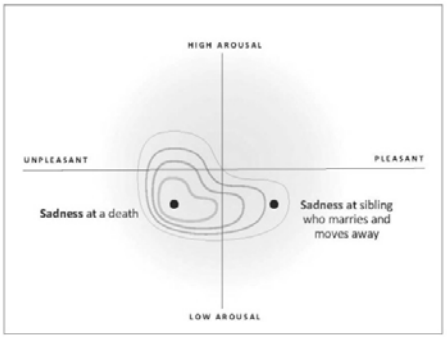
(a) A momentary core affective state that is negative and high in arousal conceptualized as an instance of anger (where an instance of conceptual knowledge for "anger" is represented by contour lines of probability to reflect its situated and probabilistic nature)



(b) Core affect as conceptualized as an instance of fear



(c) Core affect as conceptualized as an instance of sadness



Concepts, in this view, are not amodal (lists of beliefs or propositions), but are embodied (e.g., Barsalou, 2008; Niedenthal, Barsalou, Winkielman, Krauth-Gruber, & Ric, 2005), blurring the boundary between conception and perception. In the conceptual act model, the conceptualization of core affect is not something that occurs after the fact, as in the common idea of interpreting or cognizing a snapshot of affective change after it has taken place. Instead, an instance of a concept, to the extent that it is expressed as a brain state that includes activity in sensory and motor neurons (some of which may be representing affect), intrinsically shapes the mental event that emerges as an emotion.[1] This suggests, of course, the any particular pattern of physiological or motor activity that is observed in a given instance of anger will be influenced both by a person's core affective state and whatever conceptual knowledge they bring to bear during the categorization process at a given point in time.

According to the Conceptual Act Model, you don't have one concept for anger, you have a collection and they can be combined in any number of diverse and flexible ways. Following the work on situated conceptualizations, the conceptual knowledge that is called forth to categorize affect in a given instance is tailored to the immediate situation, acquired from prior experience, and supported by language. For example, core affect can be categorized as anger when another driver

[1] More formally, then, a situated conceptualization of *anger* (that is, an instance of conceptualizing *anger*) is produced by a simulator (or set of simulators). A simulator for a category of knowledge, like *anger*, develops as sensory, motor, and somatovisceral features are integrated across instances and settings where instances of *anger* are labeled. Sensory information about the object that is in the focus of attention (e.g., visual information about the person you are interacting with, auditory information about his or her voice, as well as that person's relation to you in this instance), somatovisceral information about your core affective state (i.e., your current homeostatic state in the relational context), motor programs for interacting with that person, and for regulating your own core affective behavior, associated with unpleasant, high arousal states (e.g., facial movements, body movements, loudness of the voice), as well as the label "anger" (provided by yourself or others), and so on, bind together (via conjunctive neurons; Simmons & Barsalou, 2003) to form an instance of *anger*. Said more simply, properties that are pointed out by parents (or other speakers) or those that are functionally relevant in everyday activities will bind to core affect to represent *anger* in that instance. As instances of *anger* accumulate, and information is integrated across instances, a simulator for *anger* develops, and conceptual knowledge about *anger* accrues. The resulting conceptual system is a distributed collection of modality-specific memories captured across all instances of a category. These establish the conceptual content for the basic level category *anger*, and can be retrieved for later simulations of *anger*. Once a simulator for an emotion category, such as anger, is established, it is available to re-enact small subsets of its content as specific simulations as needed. When conceptual knowledge about anger is primed, either by an aspect of sensory environment, by a motor action, or by a deliberate need to explain core affect, the simulator becomes active, and generates a representation of anger that is tailored to the particular context or situation. For example, the *anger* simulator might simulate a state of core affect with yelling on one occasion, core affect with running on another, and core affect with crying on yet another. All the experienced content for *anger* resides within the simulator for *anger*, so that different combinations can be simulated as the situation requires.

cuts off in traffic, and you yell and wave your fist; when a disobedient child breaks a rule, and you calmly re-explain; when you hear the voice of a hated politician, and you turn off the radio; when a colleague insults your opinion, and you sit very still and perhaps even smile; when you tease a friend instead of criticize; or when you stub your toe and kick the kitchen table.

When combined, core affect and conceptual knowledge about emotion (along with controlled attention; see below) produce a highly flexible system that can account for the full richness and range of experience that characterizes human emotional life (including the appearance of distinct biobehavioral profiles of emotional response however rarely they occur). The ability to categorize confers some adaptive advantage, and so is likely evolutionarily preserved, even if the specific categories are not. Many cultures may share similar emotion concepts (basic in the Roschian sense) because these concepts are optimal tools for negotiating in the kind of social environment that humans typically occupy (living in large groups with complicated relational rules).

In my lab, we now have preliminary evidence that at least one emotion - fear - can be constructed from the interplay of more basic elements of core affect and conceptual knowledge about fear (Lindquist & Barrett, in press). We also completed a recent meta-analysis of neuroimaging studies of emotion showing that brain activations during emotion fit the Conceptual Act Model better than they do a natural kind approach (Lindquist et al., in press). Moreover, using a novel neuroimaging paradigm we recently demonstrated that situated conceptual knowledge is, in fact, a key element in emotional experiences (Wilson-Mendenhall, Barrett, Simmons, & Barsalou, 2011).

Although the Conceptual Act Model has largely focused on the interplay between two psychological primitives, it seems clear that a third psychological primitive can be found in the controlled attention network that resolves conflict between competing representations or inhibiting pre-potent responses when necessary (Miller & Cohen 2001). Controlled attention has been referred to as the central executive (Baddeley & Hitch, 1974), the Supervisory Attention System (Norman & Shallice, 1986), executive control (Posner & DiGirolamo, 2000) and working memory capacity (Barrett, Tugade, & Engle, 2004). It continually shapes processing, often without any of the four elements that given a subjective feeling of control first discussed by James (1890), and Hemholtz (1910/1925) and later elaborated by Bargh (1994) (i.e., a feeling of agency, effort, control, or awareness).

One hypothesis is that the degree of controlled attention in play during conceptualization will influence the modularity of emotion perception and emotional action. A cognitive module is defined as a fast, domain specific set of processes that have evolved to handle particular types of information. Modules are assumed to be encapsulated and impenetrable (activities and outputs cannot be influenced by other classes of information such as expectations or beliefs), reflexive (they provide predetermined outputs when predetermined inputs are

present), and unconscious (it is impossible to reflect upon the operations of a module). Working memory capacity may produce a kind of "functional modularity", however, where a system appears modular, but only because of insufficient attention (rather than because of the architecture of the brain systems themselves. Individuals who are lower in working memory capacity, or situations which require intensive attentional resources, may produce functionally modular conceptualizations of their affective state that results in less flexible and therefore less functionally effective emotional episodes (cf. Barrett et al., 2004).

Psychological Primitives in Mental Life

The second idea that defines the Conceptual Act Model is that psychological primitives are not themselves specific to emotion and are participate to some degree in constructing every psychological moment. This can be seen in how the concept of core affect differs from the more generic use of the term affect: core affect is a hypothesized to be a fundamental feature of consciousness. The broad, distributed circuitry for core affect projects both directly and indirectly to sensory cortices and coordinates sensory processing in the entire cortical mantle via a series of bottom-up and top-down routes (summarized in Barrett & Bar, 2009; Duncan & Barrett, 2007). Because core affect modulates sensory processing, any psychological process that draws on sensory information will have an affective quality to it. As a result, core affect influences forms of cognitive activity that are traditionally considered distinct from emotion. Perhaps the most discussed example of affect's role in cognition comes from the literature on decision-making (e.g., Bechara, 2004; Janis & Mann, 1977; Kahneman & Tversky, 1979) but there is also evidence for affect's contribution to normal consciousness, language and memory (for a review, see Duncan & Barrett, 2007). In our most recent work, we have demonstrated that core affect influences visual consciousness (Anderson, Siegel, & Barrett, 2011; Anderson, Siegel, Bliss-Moreau, & Barrett, 2011) and person perception (Anderson, Siegel, White, & Barrett, in press).

Importantly, there is accumulating functional evidence that core affect influences the most basic stage of visual processing, as reflected in activity in primary visual cortex or V1. Neuroimaging studies report increased activation around the V1/V2 boundary in response to affectively evocative (compared to neutral) stimuli (e.g., Moll et al., 2002). In our recent meta-analysis of neuroimaging studies of emotion (Wager et al., 2008), we found that studies consistently report increased activation in V1 during affective (compared to neutral) conditions. In addition, we now have pilot evidence of increased V1 activation and functional connectivity between V1 through V4 is produced by face/ring pairs that were presented outside the focus of attention, but whose affective value was enhanced (by pairing them with shock on a prior trial Damaraju et al., 2010). Additional evidence for affective modulation of V1 activity comes from a study using event related potentials (ERPs) to classically conditioned

images, where black and white gratings (CS+) previously paired with affectively evocative images (i.e. IAPS images) elicited higher amplitude ERPs recorded over primary visual cortex than did gratings (CS-) not paired with images (Stolarova, Keil, & Moratti, 2006); the increased CS+ event-related potential amplitude over V1 occurs roughly 50 ms post-stimulus onset, well before information could reach core affective circuitry and feedback to V1. Even pairing a neutral stimulus with reward changes the activation in early visual cortex (see work by the Wantanabe lab). Taken together, these data suggest that if stimulus is associated with an affective state, then it will receive enhanced sensory processing on your next encounter, even before you consciously see anything at all.

Given the neuroanatomy of this circuitry, you can think of affect not as competing with attention (e.g., Vuillieumier & Driver, 2007) but as a *source* of attention in the mammalian brain that helps to binds sensory information from the external world to sensory information from the body. As a consequence, conscious percepts are intrinsically infused with affective content. This is why a drink tastes good or is unappetizing (e.g., Winkielman, Berridge, & Wilbarger, 2005), why we experience some people as nice, and others as mean; why some foods tastes good but others are distasteful; and why some paintings are beautiful while others are ugly. It is under these circumstances when core affect is experienced as a property of the world that it acts in stealth by directly translating into a behavior. When core affect is foregrounded in consciousness it is experienced as your reaction to the world: you like or dislike a drink, a person, or a painting. Or you experience foregrounded affect as emotion.

In a fundamental sense, the Conceptual Act Model suggests that the broader categories of "emotion," "cognition," and "perception" reflect subjective distinctions rather than distinctions in kind (Barrett, 2009). The clearest evidence for this point is the fact that these categories seem not to be respected at the level of the brain. Many of the brain areas involved with the emergence of emotional episodes are typically considered cognitive (cf. Barrett, Mesquita et al., 2007; Duncan & Barrett, 2007; Kober et al., 2008; Lindquist et al., in press; a similar point is made by Pessoa, 2008). And areas that are involved in affective processing (e.g., ventromedial prefrontal cortex and closely related anterior cingulate cortices) are involved in a range of cognitive processes (e.g., vmPFC and ACC are part of the default network that is active during spontaneous, highly associative mental activity that occurs in the absence of an eliciting stimulus, and that is also active in memory and mental time travel; Buckner & Carroll, 2007). Ventromedial prefrontal cortex is also an important area for making predictions about the meaning of sensory stimulation during simple object perception (Bar, Aminoff, Mason, & Fenske, 2007) (for a discussion, see Suvak & Barrett, 2011). It might be more accurate to say that broad psychological categories "emotion" or even "anger" refer to collections of mental states that correspond to broadly distributed "neural reference spaces" (cf. Barrett, Mesquita et al., 2007). Psychological primitives (core

affect and categorization, as well as others we have not considered here, such as executive control) are the building blocks of the mind that constitute the neuronal assemblies that populate this neural reference space.

The Role of Language in Emotion

The third defining hypothesis of the Conceptual Act Model comes from the motivation for its inception. The Conceptual Act model was fashioned as a solution to the emotion paradox (Barrett, 2006b): studies that measure emotion by relying on human perception (subjective reports of feelings or judgments of other people's faces and bodies) typically produce consistent evidence for the categories that in English people call "anger," "sadness," and "fear;" but instrument-based measures of the brain, face, and body (what might be called "objective" measures) do not. But if the psychological events people refer to as "anger" have no signatures (no known statistical regularities to ground the categories), then how to people learn the category? What serves to glue the various instances of anger together into a single category if they look very different from one another – according to the Conceptual Act Model, the answer is a word.

Words are powerful. Words facilitate the learning of novel categories (Lupyan, Rakison, & McClelland, 2007). As early as 6 months of age, words guide an infant's categorization of animals and objects by directing the infant to focus on the obvious and inferred similarities shared by animals or objects with the same name (Booth & Waxman, 2002; Fulkerson, Waxman, & Seymour, 2006). Xu, Cote, and Baker (2005) refer to words as "essence placeholders" because a word allows an infant to categorize a new object as a certain kind, and to make inductive inferences about the new object based on prior experiences with other objects of the same kind. Words are ontologically powerful for nominal kinds (artifact categories that exist because a group of people have a shared concept and name it with a word). In fact, a nominal kind might not exist without a word.

This perspective suggests that words provide an important top-down context in emotion perception. For example, emotion words cause a perceptual shift in the way that emotional faces are seen. Morphed faces depicting an equal blend of happiness (or sadness) and anger were encoded as angrier when those faces were paired with the word "angry" and even angrier when participants were asked to explain why those faces were angry (Halberstadt, 2005; Halberstadt & Niedenthal, 2001). Verbalizing any words at all disrupts the ability to make correct perceptual judgments about faces, presumably because it interferes with access to judgment-necessary language (Roberson, Damjanovic, & Pilling, 2007; Roberson & Davidoff, 2000).

In 2004, our lab launched a program of research to experimentally examine how changing the accessibility of an emotion word would impact emotion perception, and this research offers the most direct experimental evidence for the

role of language in emotion perception to date. We used a technique called semantic satiation to manipulate word accessibility. In the typical satiation experiment, participants repeat a category word out loud either 3 or 30 times, following which they judge whether or not a word or perceptual object is a member of the repeated category (i.e., does the exemplar match the repeated word or not). Prior research has found that, relative to repeating a word 3 times, repeating a word 30 times leads to a temporary decrease in the accessibility of the word's meaning, slowing word associations, judgments of category membership, and identity recognition. In our original experiment (Lindquist, Barrett, Bliss-Moreau, & Russell, 2006, Study 1), we found that relative to repeating an emotion word 3 times, repeating it 30 times led to slower and less accurate judgments of a subsequently presented face as matching the repeated word (or not). In subsequent studies, participants were presented with two pictures of facial behaviors depicting emotion following word repetition, and were asked to judge whether the faces matched each other or not. This 'perceptual matching task' allowed us to examine how language influenced perception even though the participants were not required verbally to label the face stimuli. We found that participants were slower (Study 2) and less accurate (Study 3) to see the emotion (e.g., anger) in the faces of targets after the relevant emotion word ("anger") was satiated. By examining response times and accuracy rates for various trial types, we were able to rule out the possibility that the observed effects were merely due to fatigue. Furthermore, we now have preliminary evidence that emotion words participate in the construction of emotional percepts. We predicted and found that satiating the relevant emotion word interfered with the encoding of the emotional features of face depicting emotion (Gendron, Lindquist, Barsalou, & Barrett in press).

Differences from Other Constructionist Models

Although the Conceptual Act Model is similar (and builds on) other constructionist approaches to emotion, it also has some unique and distinctive features. In the long tradition of constructionist approaches to emotion, scientists used the conceptual tools available to them. The same is true for the conceptual act model.

Unlike prior constructionist models, the Conceptual Act Model is not a two-stage model where unexplained or ambiguous physical arousal (e.g., Mandler, 1975; Schachter & Singer, 1962) or core affect (Russell, 2003) is later interpreted or cognitively elaborated after the fact. The conceptual act model makes reference to several psychological primitives that are always in play. These systems are continually shaping one another via the logic of constraint satisfaction (Barrett, Ochsner, & Gross, 2007) to produce an emergent phenomenon: an experience of anger, or an experience of someone else (even a rat) as angry.

Unlike many other constructionist models, the Conceptual Act Model does not treat emotions as special mental events (e.g., states of ambiguous arousal) that turn on and off in response to a stimulus. Nor are the "cognitive" influences in emotion deliberate, or necessarily produced by affiliation, attribution, or interpretation. Instead, the model presumes that psychological primitives are always running, and when they combine in particular ways, people name those mental states "anger" or "sadness" or "fear." The idea is that psychological primitives combine like ingredients in various recipes to make a variety of mental states-only some of which people experience "emotion".

The Conceptual Act Model is also broadly consistent with the componential approaches found in the appraisal perspective on emotion, to the extent that appraisals can be thought of as descriptions of mental content that resulting from conceptual knowledge about emotion. What differentiates the conceptual act model from these most appraisal perspectives is the emphasis on categorization processes as a core mechanism driving the emergence of emotion. Separate cognitive mechanisms for computing a situation's meaning (as found in some appraisal models, e.g., Lazarus, 1991; Roseman et al., 1990; Scherer, 1984) are not necessary to account for emotion. Appraisals, instead, represent dimensions of meaning that are associated with particular emotions (e.g., Clore & Ortony, 2000; Frijda, 1986; Ortony et al., 1988).

Moving the Study of Emotion Forward

The Conceptual Act Model also allows the field to move past several distinctions within the emotion literature that, while useful for a time, might in the end be seen as obstacles to progress: nature vs. nurture; evolution vs. social construction; categories vs. dimensions; and, automatic vs. controlled processing.

First, the Conceptual Act Model avoids the false dichotomy between nature and nurture and represents a model of emotion that is grounded in nature without being a nativist. Every human thought, feeling, and behavior must be causally reduced to the firing of neurons in the human brain. Prior experience and learning are encoded as neuronal connections within the human brain, so even a strict constructionist approach must have some grounding in nature.

Second, the model avoids the distinction between evolution and social construction by suggesting that core affect and conceptualization processes are themselves given by nature (in that humans are born with the ability to have simple affective responses and quickly acquire perceptual categories that develop into a conceptual system that provides the grounding for perception), although the content that they represent is learned and may vary across individuals and cultures. In this view, then, the evolutionary legacy to the newborn is not a set of modular emotion circuits that are hardwired into the subcortical features of the mammalian brain, but may be, instead, a set of mechanisms that compute core affect and allow affective

learning, as well as those that allow conceptual learning and categorization. The ability to categorize confers adaptive advantage, and so it is likely biologically preserved, even if the specific categories are not. The specific categories are more likely culture-sensitive solutions to common problems that derive from our major adaptive advantage as a species: living in complex social groups. From this point of view, it is conceptual and affective processes themselves, rather than the contents that they produce (in the form of emotion) that form the basic psychological truths about what emotions are and how they work.

Third, the model favors neither a dimensional nor a categorical approach, but instead integrates the two. The dimensional aspect can be found in the suggestion that all emotional events, at their core, are based in a psychologically primitive kind of affective response to events in the world as positive or negative, helpful or harmful (although the neural states that instantiate a pleasant or unpleasant affective state may be numerous and varied). The categorical aspect can be found in the suggestion that people automatically and effortlessly categorize the ebb and flow of core affect using conceptual knowledge for emotion.

Finally, the model does not rely on the automatic vs. controlled processing distinction that is the hallmark of dual process models of the mind and that has caused great confusion in the emotion literature of the past (e.g., the Lazarus-Zajonc debate). In the constraint-satisfaction logic employed by the Conceptual Act Model, processes are not themselves automatic or controlled. Rather, bottom-up (sensory) information from the world and the body and top-down (conceptual) associative processing interact and shape one another so that every psychological moment (i.e., an instance of emotion) emerges in a way that can be characterized somewhere along an automatic-controlled continuum, and can be said to have some degree of conditional automaticity (Bargh, 1989, 1994).

Conclusion

Originally, psychologists believed that people, like physical objects, had real and immutable properties that could be objectively observed, so that it was possible to quantify how accurately a perceiver could perceive those properties (Brunswick, 1947). For example, if dominance is a real property that can be quantified, then it should be possible to assess how accurate we are in judging a person as dominant or not. Very quickly, however, the field shifted away from questions about accuracy because the person-properties under investigation – traits – defied simple measurement and clear definition. Instead, researchers became interested in understanding the processes of person perception - how perceivers infer the properties of others – in particular, why they see certain behaviors, and how they come to understand what caused those behaviors (e.g., Heider, 1944).

Social psychology has now accumulated a large and nuanced body of research

on how people perceive and make inferences about the causes of other people's behavior (for a historical review, see Gilbert, 1998). Now, the word "perception" is used to refer to the process of assigning someone (or his or her behavior) to a meaningful category so that a perceiver "sees" an instance of that category and can infer something about the person's internal state and/or enduring disposition. In essence, "perception" now refers to the process of categorization (Allport, 1954; Macrae & Bodenhausen, 2000). The general idea is that knowledge of people and situations automatically and effortlessly shapes the behaviors people "see" and gives rise to their explanations for those behaviors.

And so it is with emotion. The Conceptual Act Model treats emotion as a mental event that results from a form of person-perception that is applied not only to the mental states and behaviors of other people, but also to those of the self (and to animals). Knowledge about emotion in automatically and effortless shapes the emotions people see in others, and experience themselves. By employing the notion of situated conceptualizations, it predicts that emotions are not static entities, but rather are context-sensitive emergent phenomena. And it explains how one instance of anger (or of any emotion category) may not look or feel like another, and yet all can be rightly called instances of emotion are "anger". Labeling a mental event or behavior as "anger" does not explain what caused the event or behavior. At the writing of this paper, there is still no objective criterion that a scientist can use to say when a person is angry and when he or she is not. And yet, with the Conceptual Act Model, the nature of anger (or any emotion) can be explained.

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