RUNNING HEAD: THE CONCEPTUAL ACT THEORY

TITLE:

The Conceptual Act Theory:

A road map

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For the past several centuries, many philosophers and psychologists have assumed that the mind is structured as a typology, containing Platonic types such as anger, sadness, fear, etc. Emotions are presumed to be basic elements (i.e., they are thought to be biological and psychological primitive). Scientists have searched for the corresponding physical essences for these emotion types in patterns of peripheral nervous system response, in facial muscle movements, and in the structure or function of the mammalian brain, attempting to identify the "natural joints" that distinguish different one emotion type from another. This approach, aptly termed the *natural kind* approach (Barrett, 2006a), has its roots in the 17th century mental philosophy of *faculty psychology* (e.g., see works by Wolff as discussed in Klein, 1970; Gall 1835; Spurzheim, 1832; cf. Lindquist & Barrett, 2012). When viewed as mental faculties, emotions are considered to be adaptations in the teleological sense (as natural processes that evolved to serve a specific end goal).

Faculty psychology has not been without its critics over the centuries, and criticisms of this approach have laid the groundwork for an alternative approach to understanding the mind's structure, termed *psychological construction*. In this chapter, we present an overview of our psychological construction model of emotion, named the *Conceptual Act Model,* and later, the *Conceptual Act Theory*. The Conceptual Act Theory of emotion was introduced in 2006 and has been elaborated through a series of theoretical and empirical papers (Barrett, 2006b, 2009a, 2009b, 2011, 2012, in press; Barrett & Bar, 2009; Barrett & Bliss-Moreau, 2009; Barrett, Lindquist, & Gendron, 2007; Barrett, Mesquita, Ochsner, & Gross, 2007; Barrett, Ochsner, & Gross, 2007; Barrett & Satpute, 2013; Barrett, Wilson-Mendenhall, & Barsalou, in press; Duncan & Barrett, 2007; Lindquist & Barrett, 2008, 2012; Lindquist et al., 2012; Wilson-

Mendenhall, Barrett, Simmons, & Barsalou, 2011). In this chapter, we present a summary of the main ideas within those papers.

To introduce the Conceptual Act Theory, we first discuss the hypothesis that mental states emerge as the consequence of an ongoing, continually modified constructive process during which stored knowledge within an experiencer (as reactivation and recombination of prior experience, referred to as “top-down” influence) makes incoming sensory inputs meaningful as *situated conceptualizations*. This discussion sets the stage for an overview of four major tenets of the Conceptual Act Theory. First, emotions (like all mental states) are not assumed to be Platonic, physical types, but instead are treated as abstract categories that are populated with variable instances (Tenet 1: Variability). Variability is created when physical responses (e.g., from behavioral adaptations) are optimized for a particular situation or context because sensory inputs (from the body and the world) are made meaningful using highly context-dependent and culturally-dependent conceptual information about emotion derived from past learning or experience. Second, the brain’s architecture can be thought of as a situated conceptualization generator producing the individual brain states that correspond to each individual instance of an emotion (Tenet 2: Core Systems). Each category of conceptualized instances does not share an essence, but instead arises from the interaction of core systems within the brain’s architecture that are domain-general (meaning the systems are not specific to the traditional domains of emotion, cognition, or perception). These core systems can be characterized both at the psychological level and at the level of brain networks. Third, instead of redefining (or reducing) mental phenomena into these core systems, the goal of the Conceptual Act Theory is to analyze how mental states emerge from their interaction (Tenet 3: Constructive analysis). Fourth, from this viewpoint, emotions exist as conceptualized instances of sensation based on functional (rather than teleological) considerations (Tenet 4: Social Ontology). The idea is that conceptual knowledge is embodied and enactive, producing novel features during an instance of emotion via inference, such that emotional episodes take on functions that the physical sensations do not have on their own during the trajectory of a situated conceptualization. At the chapter's conclusion, we briefly consider how the Conceptual Act Theory provides a unified framework for studying emotional experience, emotion perception, and emotion regulation, and more generally provides a novel approach to the functional architecture of the human brain.

Conceptual Knowledge Combines with Sensory Inputs to Construct Human Experiences

Please take a look at Figure 1. Most of you, right now, are in a state called "experiential blindness" (e.g., Fine et al., 2003). You are taking in visual input, but your brain cannot make sense of it, so you don't see an object -- you see black and white blobs.

Normally, in the blink of an eye, your brain is able to seamlessly integrate this sensory stimulation with its vast amount of stored knowledge (from prior experience, often referred to as "top-down" contributions), allowing you to construct a visual experience of the object. In fact, it is well accepted, now, that this is how normal vision works (Gilbert & Li, 2013). Such knowledge is not merely helpful – it is necessary to normal perception. With this knowledge, you normally categorize incoming information to construct a visual representation of the object in Figure 1. Such knowledge is not merely helpful – it is essential for normal perception. This instance of experiential blindness unmasks what you brain normally does so automatically and effortlessly. Without prior experience, sensations are meaningless, and you would not know how to act in the world.

To cure your experiential blindness, please look at the Appendix, and then look back to Figure 1. If you now see a fully formed object, several important things just happened. First, you *categorized the sensory input* using conceptual knowledge from past experience. No matter how hard you try, you cannot gain introspective access to how your brain accomplished this feat of making incoming sensations from Figure 1 a meaningful visual experience. Also, once the conceptual knowledge is applied, it should now be virtually impossible to "unsee" the object -- to deconstruct the experience by the sheer force of will. The process of combining incoming sensory input with stored knowledge is ongoing, obligatory, and automatic (meaning, you have no sense of agency, effort, or control in constructing your visual experience). Experimental methods are necessary to unmask its workings (or exercises such as the one we are engaged in right now). To you, it feels as if the act of seeing is passive, that seeing is merely the reflexive detection of visual information from the page. You are unaware of the extent to which *your prior knowledge contributes to your own experiences*.

Second, in viewing the image, it is now probably not that hard to infer experiential detail – to imagine the soft drone of buzzing, or to feel the delicate flutter of wings. In your mind's eye, you might see the object nose around as it searches for pollen. You might even be able to smell the sweet fragrance of the flower. Perhaps you feel the sun warming your skin. Or see the yellow petals swaying in the light breeze. The knowledge you bring to bear (as reactivation and recombination of prior experience that is represented in modal systems of the brain) to perceive this bee is *enactive* -- your brain performs a *perceptual inferenc*e. Inferring elements that are not immediately present in the visual input (e.g., the lines that link the black and white blobs together into the shape of a bee) create your visual experience. Inference is considered one of the primary purposes of memory and it is how experiences of the past inform situated action in the present. You could not survive in the world without this capacity. Some scientists refer to this inference process as *simulation* (e.g., Barsalou, 1999, 2009), where you can connect immediate sensory input with vast amounts of sensory, motor, affective, and other related information stored in memory. Others refer to it simply as *categorization* (Barrett, 2006). Categorization typically is viewed as containing two processes: (a) accessing and activating a relevant category representation and binding it to a perceived instance and (b) drawing inferences from knowledge associated with the category, and applying them to the instance.

Third, because the primary purpose of categorization is to produce inferences, it *prepares you for situated action*. For people who have experienced bees as part of a beautiful garden and/or as producing a sweet, tasty delight (honey), the image of a bee is calming and bucolic. For these people, seeing a bee might mean moving in to get a closer look, with an associated reduction in heart rate, blood pressure, and skin conductance. For other people who were stung, resulting in pain and swelling, the image of a bee is terrifying. For these people, seeing a bee might mean freezing, with an associated increase in heart rate, blood pressure and skin conductance. Or, it might mean waving their arms or running away, with an increase in heart rate and skin conductance but a decrease in blood pressure. These are the sorts of physiological changes that we scientists record when we show study participants images from the International Affective Picture System (IAPS; Lang, Bradley, & Curthbert, 2008) stimulus set (e.g., Bradley, Codispoti, Cuthbert, & Lang, 2001). They arise when your brain predicts how the body should respond in a specific situation (what we have previously referred to as an "affective prediction"; Barrett & Bar, 2009).

Fourth, because categorization is enactive and prepares you for a specific action, it will always produce *some kind of automatic change in your physical state*, impacting the internal sensations that contribute to your pleasant or unpleasant core affective tone (Barrett & Bliss-Moreau, 2009; Russell, 2003; Wundt, 1897). In this way, the concepts that are used during categorization can be thought of as tools used by the human brain to modify and regulate the body (i.e., homeostasis and allostasis, metabolism, and/or inflammatory processes), to create feelings, and to create dispositions towards action. The actual visceral changes are not necessary for feeling, although some representation of them in the brain is required. In the same way that your brain used prior experience to make meaning of the visual sensations in Figure 1, it will also use such knowledge to make meaning of these bodily sensations. These two meaning making achievements (of external and internal sensations) are not happening sequentially – they are occurring simultaneously, as a function of how the brain understands the current sensory array to create a unified conscious moment (cf. Barrett, 2009). They are not occurring in a single instant, but they are a conceptual act that is evolving over time.

Fifth, this process of meaning making rarely happens because of a deliberate, conscious goal to figure things out, but more often as instantaneously, continuously, and effortlessly for internal sensations as it does for external sensations. Whether you experience the situation as a perception or as an emotion depends on your attentional focus. When your brain is foregrounding visual sensations while viewing the bee, you will experience a perception -- the bee is friendly or wicked because you are using the affective feelings that correspond to your physical response as information about the state of the world (Zadra & Clore, 2011; e.g., Anderson et al 2012). When your brain is foregrounding sensations from your body, and when these sensations are particularly intense (because such focus has been useful and reinforced in a prior situation like this one, or because you focus explicitly on them), you will experience tranquility or distress. When your brain is foregrounding the sound of the bee buzzing (which you can infer from past encounters with a bee), you will experience a cognition in which you do not experience strong feelings about the bee(?). In each case, information from the world, the body, and from prior experience was present -- what differed was the attentional focus within the dynamic conceptualization.

Sixth, prior experiences *seed* the construction of present and future experiences by shaping the meaning of momentary, incoming sensory input. Why might you automatically experience the calm of a bee buzzing in a bucolic garden whereas another person might automatically experience the terror of a bee attacking and stinging the body? The answer lies in the nature of prior experience. Actual experiences with bees, movie scenes that involve bees, stories, or simply instruction about bees constitute the knowledge that is used to make sensations meaningful. Your learning history predisposes you to experience sensations from the world and from your own body in particular ways. All things being equal, you have developed experiential "habits" -- what you have experienced in the past is very likely what you will experience in the present, because stored representations of the past help to constitute the present (hence, the phrase "the remembered present"; Edelman, 1998). With additional learning or training, it should be possible to change your experiential habits. By deliberately cultivating certain types of experiences, it should be possible to modify the population of representations that are available for use in the present.

Finally, the bee example also illustrates that *states* and *processes* are easy to confuse when it comes to meaning making. Regardless of whether you automatically experience the calm of a bee buzzing in a bucolic garden or the terror of a bee attacking and stinging the body, it is possible to retrieve different concepts related to bees in the next instance, which in turn has the capacity to change the sensations that your brain receives from your body. The same processes that were engaged during the initial instance of meaning making (creating tranquility or fear) are engaged again, and again, and again. When your bodily response changes, along with the feelings and actions that you easily have access to, you experience this as emotion regulation. If this is correct, then what we call "emotion regulation" is grounded in the more basic meaning making processes that are operating all the time to create the flow of mental states that constitute your mind. Reappraisal, distraction, and other terms might not refer to processes per se, but to changes that occur as one mental state flows into another (and one physical state transitions to another) as meaning changes. A series of sequential mental states that are experientially distinct are easy to understand as distinct psychological processes, even though scientists have known for a long time that experiences don't reveal the processes that make them.

To sum up these insights: you performed a *conceptual act* when you applied prior knowledge to incoming visual input to construct the visual experience of the bee. It was an "act" on your part rather than a passive event because you are not merely detecting and experiencing what it is out there in the world or what is going on inside your body – your prior experiences (i.e., knowledge) played a role in creating momentary experience. Any conceptual act is embodied, because prior experience, in the form of category knowledge, comes "on-line" as the activation of sensory and motor neurons, *reaching down* to influence bodily activations and/or their representations and sensory processing. Conceptual acts are also self-perpetuating, such that experiences created today *reach forward* to shape the trajectory of future experiences. Our hypothesis is that this is the way the mind works: the act of seeing the bee was at once a perception, a cognition, and a feeling. All mental states are, in fact, *conceptualizations* of internal bodily sensations and incoming sensory input. These conceptualizations are *situated* in that they use highly context-dependent representations that are tailored to the immediate situation.

There are four broad hypotheses that derive from this view of mental states as situated conceptualizations: (1) emotions, like other mental state categories, are populations of instances that are tailored to the environment; (2) each instance of emotion is constructed within the brain's functional architecture for creating situated conceptualizations, involving domain-general core systems; (3) emotional episodes cannot be deconstructed and reduced into these domain general systems but instead emerge from their interaction; therefore, the workings of each system cannot be studied alone and must be holistically understood within the momentary state of the brain and body; (4) being emergent states, emotional episodes have functional features that physical states, alone, do not have. We address each hypothesis in turn.

Tenet 1: Variation

Whereas the faculty psychology approach to emotion is a textbook case of classical typological thinking (where emotions are simply organized as a limited number of physical or morphological types), the Conceptual Act Theory make the more complex assumption that emotions like anger, sadness, fear, etc., are abstract categories that contain a variety of unique instances. Within each abstract category, say anger, or fear, instances (emotional episodes) vary in their physical manifestations (heart rate can go up or down, there can be avoidance or approach, etc.) that reflect different avenues of coping with particular kinds of situations. In this view, emotional episodes are situated affective states that are tailored to the immediate situation (for congruent views, see Cunningham et al., this volume; Ortony & Clore, this volume). If each emotion category represents a population of instances, then experiments can be designed to model and capture those instances (rather than attempting to evoke only the most typical instance in the lab, which itself produces variation that then has to be explained after the fact). For example, we explicitly studied how neural responses differed during fearful instances of social threat and physical danger, as well as how neural responses during fear and anger were similar when experienced in a similar context (e.g., social threat) (Wilson-Mendenhall et al., 2011). In fact, a growing number of papers are designed explicitly to capture heterogeneity within emotion categories, both within individuals and across cultures (e.g., Ceulemans, Kuppens, & Van Mechelen, 2012; Horensius, Schutter, & Harmon-Jones, 2012; Kuppens, Van Mchelen & Rijmen, 2008; Kuppens, Van Mechelen, Smits, De Boeck & Ceulemans, 2007; Nezlek & Kuppens, 2008; Stemmler, Aue, & Wacker, 2007).

There appear to be at least five sources of the variation that occurs for emotional episodes within a category of emotion: (1) the behavioral adaptations that serve as affective predictions about how to best act in a particular situation, (2) the concepts that develop for emotion, (3) the vocabulary used for emotions, (4) the variation in the types of situations that arise in different cultures, and (5) stochastic processes. Each of these is discussed briefly in turn.

Behavioral adaptations. As a human, you have a variety of “behavioral adaptations” that help you “survive and thrive”. Like other animals, you can flee, freeze, fight, and so on. Many of these adaptations are preserved options for dealing with threat (LeDoux, 2012). Upon the presentation of new sensory input, your brain quickly and efficiently predicts which will be optimal given the current situation, constituting an affective prediction (Barrett & Bar, 2009). In humans, these adaptations are neither necessary nor sufficient for emotion: You don’t routinely freeze, flee, or fight in emotion, and when you do, it is not always in the way prescribed by emotion stereotypes (e.g., people can withdraw during anger or fight during fear). Even in a rat, there is no necessary one to one correspondence between a particular behavioral adaptation and an emotion category (e.g., Barrett, 2012; LeDoux, 2012) – depending on the context, a rat will flee, freeze, or defensively tread (i.e., aggress) in a threatening situation.

Concepts that Develop for Emotions. The brain state corresponding to an instance of an emotional episode is not just whatever happens in the body, in the subcortical neurons responsible for fighting, fleeing, freezing, or mating, etc., or in the brain regions that represent or regulate the body (such as the insula, amygdala, and orbitofrontal cortex); the brain state for an emotion represents the state of affairs in the world in relation to that physical state, as understood in the context of past instances. Thus, the second source of variation within an emotion category derives from the concepts that develop to represent emotions, which, themselves, are populations with unique instances.

A concept can be viewed as aggregated memories that accumulate for a category across experiences with its instances. By focusing attention on some aspect of experience repeatedly, you develop a concept over time from instances of the respective category experienced across situations (Barsalou, 1999; Barsalou & Hale, 1993; Murphy, 2002; Schyns, Goldstone, & Thibaut, 1998). The concept of *bee*, for example, aggregates diverse information about the category of bees across a variety of situations into a loosely organized representation that includes properties (e.g., yellow and black, with wings), relations (e.g., flowers), rules (e.g., for something to be a bee, it must have black and yellow stripes, it must fly, etc.), and exemplars (e.g., instances of honey bees, carpenter bees, a queen bee, etc.).[i] Concepts develop for all aspects of your experience related to *bee*, including objects, settings, and actions (e.g., *flowers, honey, gardens, freezing, running, swatting, flying buzzing stinging*). From simpler concepts, more complex concepts emerge for events (e.g., *strolling in a garden, fear of the bee*). You also develop concepts for a wide variety of internal states (e.g., *aroused, quiet*), as well as for the properties and relations that describe instances of concepts (e.g., *yellow, fast, sweet, above, after, cause*). Although concepts reflect experience to a considerable extent, they undoubtedly have biological bases that scaffold learning (Barsalou, 1999, 2008; Carey, 2009; Rips, 2010; Simmons & Barsalou, 2003).

Category instances (e.g., a bee) are never encoded alone into conceptual knowledge, even though their context may not explicitly be the focus of attention. Initially, when encoding a category instance of a bee, for example, from actual prior experience with bees, observational learning about bees, hearing stories about bees, being told rules about bees, your brain captures the elements of the setting in which the bee occurs (i.e., other agents and objects), internal sensory (i.e., somatovisceral) cues from the body, as well as actions, instructions from others (in the form of rules) and words (e.g., the phonological form for "bee"). Over time, these situated conceptualizations create a heterogeneous population of information that is available for you to represent new instances of the category "bee".[ii] Later, when your brain requires conceptual knowledge to process some incoming sensory input, it samples from the populations of situated conceptualizations, associated with relevant concepts, to create a novel situated conceptualization, integrating current sensory input and retrieved (modal) conceptual knowledge (Barsalou, 2009). In this way, a situated conceptualization allows you to interpret incoming information and draw inferences that go beyond the information given.

Once concepts become established in memory, they play central roles throughout cognition and perception (e.g., Barsalou, 2003b; Murphy, 2002), and, as we suggest, emotion. As you experience incoming sensory input from the world and the body, you use prior experience to categorize the agents, objects, setting, behaviors, events, properties, relations, and interoceptive inputs that are present. As described in Wilson-Mendenhall et al. (2011), a situated conceptualization is the conceptualization of the current situation across parallel streams of conceptual processing for all of these elements. As information from the current situation registers simultaneously in these processing streams, local concepts in each of these streams categorize the respective information and draw inferences. At a more global level, abstract relational concepts, like emotions, integrate conceptualizations produced by local concepts on the individual processing streams into a coherent representation of the situation, which is constructed to interpret what is happening in the world in relation to the body and mind. Categorical inferences (i.e., predictions) follow, including inferences about how an object, or entity is likely to behave, how you can best interact with it, the likely value to be obtained from interacting with it, etc., and on a temporal scale, about how situations may unfold during an event. From the perspective of grounded cognition, situated conceptualizations are responsible for producing the action, internal states, and perceptual construals that underlie goal-related activity in the current situation. Because modalities for action, internals states, and perceptual construals are typically active when you learn a concept, situated conceptualizations generate activity in these systems as they become active on later occasions to interpret experience. When the concept for *bee* becomes active in your brain*,* the situated conceptualization might include representations of situation-specific approach/avoid actions (e.g., swatting the bee), representations of internal states such as pleasure or displeasure, and perceptual construals. Not only does *bee* represent perceptual instances of the concept, it also controls interactions and predicts the resultant events.

We have hypothesized that concepts and categories for emotion work in essentially the same way as other kinds of abstract concepts in the conceptual system, where each individual's situated conceptualizations for an emotion (e.g., fear or anger) refers to an entire situation, including both the internal and external sensations (Wilson-Mendenhall et al., 2011). Initially, when your brain is encoding an instance of an emotion category in memory, say *anger*, for example, we hypothesize that your brain captures the elements of the setting in which the anger occurs (i.e., other agents and objects), internal sensory (i.e., somatovisceral) cues from your body, as well as actions, instructions from others (in the form of rules), and words (e.g., the phonological form for "anger" or "angry"). Over time, these situated conceptualizations create a heterogeneous population of information that is available for you to represent new instances of the category *anger*.

No single situated conceptualization for *anger* need give a complete account of your category for *anger*. There is not one script for *anger?* or one abstract representation for *anger*.[iii] Consider the actions you might take upon experiencing *anger* in the following situations. When another driver cuts off you off in traffic, you might shout as you slam on the breaks. When your child picks up a sharp knife, you might calmly take it from her or ask her to put it down. When you hear a news report about a bombing or a hurricane, you might turn up the radio. When a colleague criticizes you in front of a group, you might sit very still and perhaps even nod your head and smile. You may tease a friend who threatens your view of yourself, and so on. During these instances, your blood pressure might go up, or down, or stay the same – whatever will allow you to prepare for the situated action. Sometimes you will feel your heart beating in your chest, and other times you will not. Your hands might become clammy, or they might remain dry. Sometimes your eyes will widen but other times your brow will furrow, or you may even smile. On any given occasion, the content of a situated conceptualization for *anger* will be constructed to contain mainly those properties of *anger* that are contextually-relevant, and it therefore contains only a small subset of the knowledge available in long-term memory about the category *anger*.[iv] Later, when your brain requires conceptual knowledge to construct an instance of *anger*, it samples from the populations of situated conceptualizations, associated with relevant concepts, to create a novel situated conceptualization, which integrates current sensory input and retrieved conceptual knowledge. In a given instance, then, the situated conceptualization for *anger* has the potential to change the internal state of the perceiver because when retrieving information about *anger*, sensory, motor, and interoceptive states are partially reinstated in the relevant aspects of cortex, simulating an instance. The consequence is that accumulating conceptual knowledge for *anger*, for example, will vary within a person over instances as context and situated action demand.

Emotion vocabulary. According to the Conceptual Act Theory, your emotion concepts, and the instances that populate each concept, vary as a function of learning, and in particular, how such learning is directly shaped by emotion words. Accumulating evidence shows that words are powerful in concept learning. Words facilitate learning novel categories (Lupyan, Rakison & McClelland, 2007) and activate conceptual information effectively and efficiently (Lupyan & Thompson-Shill, 2012). 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 salient and inferred similarities shared by animals or by objects with the same name (Fulkerson, & Waxman, 2007; Booth & Waxman, 2002). Words even allow infants to go beyond perceptual features and group things together that look and sound nothing alike (Dewar & Xu, 2009; Plunkett et al., 2009). Words also allow infants to extend their working memory span, taking a larger number of objects and chunking them into smaller units that can be more efficiently stored in memory (Feigenson & Halberda, 2008). Xu, Cote, & 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.

Initially, young children are exposed to instances where caregivers and other adults use emotion words to label and communicate changes in physical sensations and actions (either the child's or their own), setting the stage for statistical learning of the emotion concept. So, when developing a concept of anger, for example, the child's brain encodes instances where the word "anger" or "angry" is used. When an emotion word (e.g., "anger") is explicitly uttered (e.g., by a caregiver or teacher), the brain captures the elements of the setting in which anger occurs (i.e., including the other agents and objects), the internal sensory (i.e., somatovisceral) cues from the child's body, as well as the child's actions and the actions of others, instructions from others (in the form of rules), and words (e.g., the phonological form for "anger"). Across unique instances involving different feelings, physiology, and actions, the phonological form of the word becomes the statistical regularity that holds the concept together across instances (c.f. Barrett, Lindquist, & Gendron, 2007). There is evidence that in infants, conceptual learning proceeds via the rational, constructive form of statistical inference (also called rational constructivism; e.g., Xu & Kushnir, 2013) that supports inferences about the world and that guides behavior. Because emotions are abstract (i.e., emotions are not a specific, concrete thing that one can point to in the world), language most likely guides selective attention to the changes in internal states that characterize an emotion in a given situation. For example, each time your parent (or some other person) labeled your internal state or behavior with an emotion term when you were a child, or you observed the emotion term being used to label someone else's behavior when you were a child, you extracted information about that instance (including the phonological form of the word) and integrated it with past information associated with the same term in memory. In this way, the phonological form for "fear" could become a perceptual regularity that, when repeateded across situations, underlies formation of the concept *fear*, even if there are no strong physical similarities in the internal body states or actions from instance to instance (e.g., Barrett, 2006b).

The structure of situations. Linked to variation within the conceptual system is variation in the recurring situations that people find important and meaningful within a cultural context. If the conceptual system for emotion is constituted out of past experience, and if past experience is largely structured by people within a cultural context, then both the emotion categories that develop, and the population of instances within each category, will be culturally relative. Such ideas integrate the Conceptual Act Theory with social construction approaches, positing that interpersonal situations "afford" certain emotions (or certain varieties of an emotion category) (see Boiger & Mesquita, this volume), and with Clore & Ortony's OCC model where the structure of emotion categories is thought to represent the structure of recurrent, important situations (see Ortony & Clore, this volume). The word "affordance" here is meant to convey the idea that as an emotional episode is constructed, the construction process is dynamic, not solely proceeding within the brain of a single perceiver, but also in the transaction with the surrounding circumstances. As practices and reinforcements differ within a cultural context, so too will the emotional episodes that unfold. In this way, the practices and reinforcements structuring interpersonal situations come from the concepts that people share within a common cultural context; to the extent that concepts are enactive in the moment, they lead people to act in certain ways towards each other. To the extent that these practices and reinforcements shape the immediate emotional episode, they further seed the conceptual system for emotion. Concepts, then, are the carriers of culture.

The word "affordance" might also have a more literal Gibsonian meaning in social construction (i.e., given by the sensory properties of the world). For example, conceptualization leads one person to modulate the acoustics of his or her vocalizations while talking to another person, the frequency with which he or she touches another person, or the frequency of certain facial movements (e.g., widening of the eyes). Each of these changes influence the affective state of the other person (i.e., the perceive) in an immediate way making certain responses from that person more or less likely.

Stochastic variability. A final source of variation in the population of instances for an emotion category is the idea that incoming sensory input and conceptual knowledge do not combine in a deterministic way to create emotional episodes. Instead, they are probabilistic and combine stochastically (meaning that there is not one and only one behavioral adaptation or conceptual representation for a given situation). Other influences (some of which are random) such as the state of the body or the prior state of the brain might influence the specific emotional episode that is constructed in a given instance.

Tenet 2: Core Systems

According to the Conceptual Act Theory, your brain's architecture can be thought of as a situated conceptualization generator producing the sequences of brain states that correspond to each mental state that you experience. As such, an emotion category does not have a single physical essence, such as brain circuit, or a psychological essence, such as an affect program or a pattern of appraisals, to determine the identity of an instance. Although there might be a stereotype or a schema or script for a category prototype, it is misleading to believe that this represents the most typical instance of each category in an arithmetic sense (cf. Barrett, 2006b; Clore & Ortony, in press). William James, one of the original psychological constructionists (cf. Gendron & Barrett, 2009; but see Scarantino, this volume), described the danger of essentialism when he wrote, ‘‘Whenever we have made a word . . . to denote a certain group of phenomena, we are prone to suppose a substantive entity existing beyond the phenomena, of which the word shall be the name'' (p. 195).

Instead of essences (either as a domain-specific system for each emotion type or as a general emotion-specific system such as in certain accounts of the limbic system), we hypothesize that each situated conceptualization (as a series of brain states) can be understood as a construction that derives from the interaction of more basic, domain general operations. These operations can themselves be characterized both at the psychological level (e.g., Barrett, 2006, 2012) and are supervenient on (emerge from) different combinations of brain networks that emerge from neural integration across time and space within the brain (e.g., Barrett & Satpute, 2013; Lindquist & Barrett, 2012; Oosterwijk et al., this volume; see Figure 2). Such basic operations are akin to the "mental state variables" (see Salzman & Fusi, 2010), facets, or core systems that describe the brain state. Rather than presuming that each network functions in a modular, mechanistic way, each operation can be thought of as arising from a family of "functional motifs" (i.e., patterns of activation) arising from the structural motif (i.e., the anatomical connectivity) that undergirds the "structural motif" of each network (e.g., Sporns 2004). Moreover, if these operations serve as the functional architecture for how mental events and behaviors are constructed, then this implies that the science of emotion should focus on modeling emotions as high-dimensional brain states (reflecting the engagement of domain general networks, their internal operations, and their interactions).

At the most general level of description, the Conceptual Act Theory hypothesizes that an instance of emotion is constructed when physical changes in the body (or their corresponding affective feelings) are made psychologically meaningful as being related to or caused by a situation in the world. Physical changes are occurring all the time in your body – blood pressure is going up and down, breathing rates speed and slow, voluntary muscles are contracting so that limbs are moving. Your affective feelings of pleasure and displeasure with some level of arousal, which are in part based on your body's moment-to-moment homeostatic and energy changes, are ever present and always changing. Only sometimes you perceive these changes as being causally related to surrounding events, however, and when this happens, an emotion is constructed (this occurs whether or not you are aware it is happening and whether or not you experience effort or agency or have an explicit goal to make sense of things). Said more formally, emotional episodes, no matter the category, are created with at least two domains of core systems: a system (or systems) for representing sensations related to the body (which is usually referred to as "affective"), and a system (or systems) for conceptually making sense of these sensations and/or feelings in relation to the situation (including the language network). Categorization is not specifically directing the construction of emotional episodes -- it is necessary for every mental state. If you are awake, you are categorizing.

The Conceptual Act Theory also proposes that the brain's matrix of attentional networks is an additional domain-general, core system that supports constructing emotions (including the endogenous attention that is linked to goals and values) (Barrett, Tugade, & Engle, 2004; see also Cunningham et al., this volume). In our view, an individual is more likely to experience an emotion when an emotion concept is activated because attention foregrounds affective changes that are occurring in relation to a specific situation in the world (in contrast, an individual is more likely to experience a perception when attention is directed to events in the world; Barrett, 2009).

As we noted above, other systems important to constructing emotional episodes also include the circuits for basic behavioral adaptations like freezing, fleeing, and fighting, although there is no necessary one to one correspondence between a behavior and an emotion category (e.g., Barrett, 2012; LeDoux, 2012). When your brain predicts that one of these behavioral adaptations might be necessary, you might experience affective changes even when the prediction is modified and the action is not realized (Barrett & Bar, 2009; Clark, 2013).

Tenet 3: Constructive Analysis

Instead of redefining (or reducing) situated conceptualizations as these core systems, the Conceptual Act Theory directs scientists to create a constructive analytic approach to understanding how situated conceptualizations arise from their ongoing interaction over time. Reductionism is impossible because any situated conceptualization (as a sequence of brain states) contains properties that emerge at a different level of integration from the individual networks that construct them (referred to as *emergentism*). The idea is that a composite whole has properties not evident in its individual parts. The concept of emergentism has long been a key assumption of psychological constructionist accounts; emotions have been described as "psychical compounds" (Wundt, 1897), as "unanalyzable wholes" (Harlow & Stagner, 1932), as "emotional gestalts" (Barrett, Mesquita et al., 2007). The Conceptual Act Theory highlights the importance of analyzing and understanding emotions as integrated wholes.

The idea that emotional episodes are emergent has become popular over the past decade. Nearly all psychological construction approaches to emotion make this assumption, as evidenced throughout this volume. The Conceptual Act Theory is somewhat unique, however, in also proposing that reductionism is ill-advised because the function of each network within the brain's functional architecture is conditional on the whole system in that instance (referred to as *holism*; for a discussion of Holism, see Harrington ref). Holism is the other side of the coin from emergentism. If emergentism is the idea of studying properties of a whole system that no part alone can produce, then holism is the idea of studying the interacting parts in a complex system, or never studying a part alone, out of context (also called *contextualism* or *compositionalism*). Holistic thinking means that it is not possible to know how a part of a system works without consider its role in the whole system.

In the Conceptual Act Theory, the core systems of your brain's intrinsic architecture are the neural "ecosystem" that creates the states that transition through time and from which a mental state, like an instance of emotion, emerges. As a result, an analytic strategy of constructive analysis, rather than reductionism, is preferred. Understanding how emotions are constructed does not require defining them out of existence. Instead, it requires understanding the dynamics of how core systems interact and influence each other through time. This represents a serious analytic challenge for a psychological constructionism at the moment, however, since most data analytic and modeling strategies are based on reductionist mathematical models (for alternatives, see Bechtel & Herschbach, this volume; see Coan, 2010, this volume, but then see Barrett, 2011). Theoretical need often spurs methodological development, however. For example, a recent paper reported the development of a Network Cohesion Index that can be used to investigate how the dynamics of interacting brain networks over time are related to self-reported emotional experience and to peripheral nervous system arousal. Subjects passively watched movies during fMRI scans, and then after the scan, subjects watched the films again, continuously rating the intensity of their emotional experiences. The fMRI BOLD signal collected during movie watching was used to compute the connectivity between brain networks across time using a sliding time window of each movie (i.e., what the authors refer to as network cohesion index). The dynamic changes in network cohesion during the movie clips predicted the moment-to-moment self-reported changes in the intensity of emotional experience during the clip (Raz et al., 2012).

Unlike constructive analysis, most analytic approaches applied within the science of emotion are stimulus driven and assume some version of the Stimulus→ Organism→ Response model, where the causal mechanism for an emotion is "off" until it is switched "on" by the properties of a stimulus (whether physical or appraised). This assumption uses the logic of an experimental trial as a metaphor for how the mind works. In contrast, the Conceptual Act Theory is, to a large extent, unmoored from the exteroceptive stimulus as the triggering event for the unfolding emergence of an emotional episode. The state of core systems within your brain before the onset of the stimulus (and perhaps even the process of deciding stimulus from non-stimulus) is as important to the scientific explanation of emotion as the subsequent perturbations of the systems. The mind is understood as brain and body in context (usually in the context of other brains and bodies), transitioning from one state to another over time, with conceptualization creating emotional episodes that reflect a series of these state transitions.

Tenet 4: Social Ontology

When emotions are viewed as mental faculties that correspond to physical types, they are often said to have evolved to solve a specific functional need. Shariff and Tracy (2011), for example, believe that emotions have evolved specifically to deal with "recurrent environmental events that pose fitness challenges". This view of emotion (along with similar typological views) are explicitly called "evolutionary", leading to the unfortunate and mistaken implication that psychological construction views are not consistent with the principles of evolution. At issue is what evolved, not whether evolution occurred or not. In our view, this approach to emotion suffers from the weaknesses of the "adaptationist programme" discussed out by Gould and Lewontin (1979), not the least of which is that natural selection is presumed to be teleological. Emotions are thought to have evolved to serve specific functions because a need for those functions existed (but for a discussion of how this view of emotions exemplifies the error of arbitrary aggregation, see Barrett, 2006c).

The Conceptual Act Theory instead proposes that a neural architecture supporting situated conceptualizations evolved as the ability to conceptualize physical states in a context-specific fashion and that it underlies other mental phenomena besides emotions. As such, it is possible to discuss *what* functions situated conceptualizations serve (the utility question) without answering the question of *why* they came to exist (which itself is a very interesting and important question with multifaceted and complicated answers). In our view, the utility of emotions does not necessarily reveal anything about their ultimate reason for existing.

Our hypothesis is that when physical sensations, such as your own interoceptive state, and others' movements and vocalizations, are conceptualized as emotions, those sensations take on functions that they would not normally have on their own (i.e., by virtue of their physical structure alone) (for a full discussion, see Barrett, 2012). They are what philosophers call social reality. Conceptualization supports five functions that are necessary for getting along and getting ahead in social life: (1) it prescribes specific, situated actions (over and above approaching and avoiding); (2) it allows you to communicate about many aspects of experience and the situation efficiently, with a word or two; (3) it creates meaning about the social value of the physical sensations, over and above their immediate sensorial valence and arousal; (4) it provides you with an avenue for social influence (as a bid to control the mental states and actions of another person) over and above the valence and arousal of your own vocal prosody or facial actions; and (5) it represents a way for you to use prior experience (including cultural learning) to influence your own momentary homeostasis, glucose metabolism, and inflammatory responses, over and above the immediate properties of any physical stimulation. To say that emotional episodes exist in the domain of social reality does not deny that physical actions and sensations exist in nature. Instead, it highlights the hypothesis that part of their physical nature involves the parts of your brain (often in concert with other brains) making meaning of those physical events. This hypothesis is consistent with the idea that an emotional episode corresponds to a series of brain states that include both parts of the brain that represent and regulate the body (limbic tissue, motor cortex) as well as the additional information necessary for creating the new functions that create emotions from physical sensations—that is, the parts that are crucial for creating the conceptualizations necessary for emotional gestalts.

Evolution has endowed humans with the capacity to shape the microstructure of our own brains, in part via the complex categories that we transmit to one another within the social and cultural context. This means that even though emotions are real in the social world, they both cause and are caused by changes in the natural world. They can be causally reduced, but not ontologically reduced, to the brain states that create them. To more fully explain how humans get to social reality (e.g., emotions) from the properties of the natural world -- that is, to explain social reality in physical terms -- it might even be necessary to consider a human brain in context (including other human brains).

In our view, then, changes in heart rate or blood pressure, facial actions like smiles or frowns, and behaviors like crying or freezing are not evidence of emotions in and of themselves, and the fact that these behavioral adaptations are shared with non-human animals is not evidence that emotions are shared with other animals. Instead, these physical changes become part of an emotional episode when they take on a certain meaning in a certain situation, and it is this capacity to make meaning of them that evolved (Barrett, 2006a, 2012). Via situated conceptualizations, physical changes acquire the ability to perform functions that they do not have on their own (creating social meaning, prescribing actions, allowing communication, aiding social influence). In this view, category knowledge about emotions does not *cause* emotions per se – it *constitutes* emotions by adding epistemologically novel functions to sensory input and action. Said another way, an emotion is constructed when embodied conceptual knowledge is enacted to shape the perception of sensory information from the body and the world, binding a physical state to an event in the world (as opposed to being merely a physical sensation or action). A bodily state or an action has a certain physical function (e.g., changes in respiration might regulate autonomic reactivity or widened eyes increase the size of the visual field), but these events do not intrinsically have certain functions *as an emotion*; events are assigned those functions in the act of categorizing them as emotion during the construction of a situated conceptualization.

Concluding Remarks

Given that the Conceptual Act Theory is less than a decade old, it is not surprising that many of its key formulations represent hypotheses yet to be tested. Perhaps its main value at present moment is to prescribe a different scientific paradigm for the design and interpretation of experiments (to explicitly seek out and model variation *within* each emotion category rather than attempting to aggregate across instances to find the essence of each category, and to engage in complex analysis of interacting, domain-general systems over the time that an emotional episode unfolds). But the Conceptual Act Theory holds other insights for the science of emotion. Its use of population logic and constructive analysis brings it closer to a Darwinian approach to emotion than the basic emotion models that claim Darwin as their intellectual heir (cf. Barrett, in press). The Conceptual Act Model also unites emotional experience and emotion perception within a single theoretical framework with a single set of common domain-general mechanisms involved in mind-perception (Barrett, 2006a), suggesting, for example, that your state as a perceiver is as important during an act of emotion perception as during an act of emotional experience (Anderson et al., 2011). The Conceptual Act Theory also represents a set of hypotheses for how the phenomena that we refer to as *emotion* and *emotion regulation* are derived within a common mechanistic framework (Barrett, Wilson-Mendenhall, & Barsalou, in press). Specifically, "emotion regulation" might be grounded in the more basic meaning making processes that are operating all the time, such that reappraisal, distraction, and other terms might not refer to processes, but to changes that occur from one mental state to another (and from one physical state to another) as meaning changes.

Finally, the Conceptual Act Theory also represents an opportunity to unify theories of how the brain creates the mind. Faculty psychology tradition carved up human brain imaging research into at least three sister disciplines -- affective, social, and cognitive neuroscience. But by uniting social, affect, and cognitive neuroscience within one componential, constructionist functional brain architecture (Barrett & Satpute, 2013). Emotions, social cognitions, and non-social cognitions (and perceptions, which for this paper we include in the category "cognition") are better thought of as mental events (prompted by specific experimental tasks, or arising as naturally occurring states) that are constructed from interactions within and between these networks that compute domain-general functions. There is no "affective" brain, "social" brain, or "cognitive" brain. Each human has one brain whose functional properties can be understood differently for different time scales and levels of organization.

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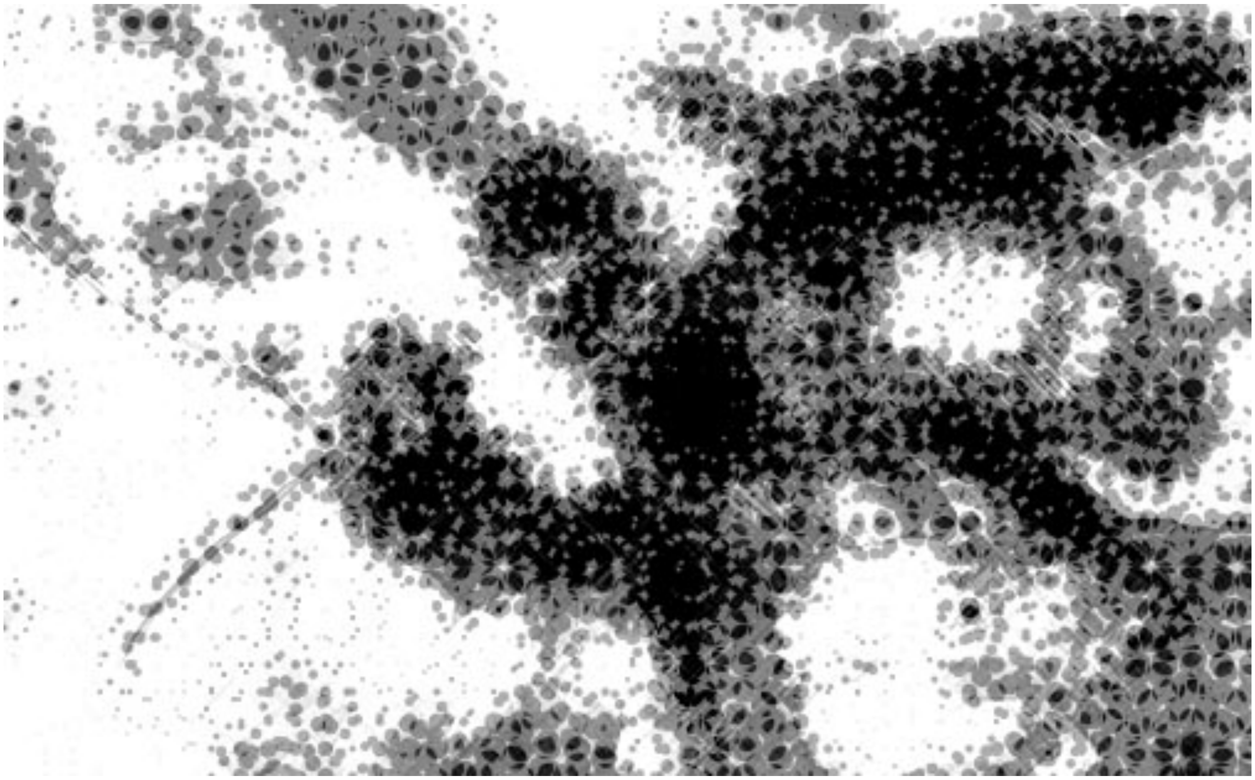
Figure Captions

Figure 1. An illustration of experiential blindness.



Appendix

End Notes

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[i] Throughout this article, we use italics to indicate a concept (e.g., *car*) and quotes to indicate the word or phrase associated with it (e.g., "car").

[ii] Theory and research strongly suggest that concepts do not have conceptual cores (i.e., information that is necessary and sufficient for membership in the associated category). Instead, concepts are represented with loose collections of situated exemplars that are related by family resemblance. Exemplar theories of categorization further illustrate that loose collections of memories for category members can produce sophisticated classification behavior, demonstrating that abstractions for prototypes and rules are not necessary. Neural net systems similarly demonstrate that only loose statistical coherence is necessary for sophisticated categorization. To the extent that abstraction does occur for a category, it may only occur partially across small sets of category instances, reflect the abstraction of non-defining properties and relations that can be used to describe category members in a dynamcial manner, or reflect an online abstraction at retrieval, rather than stored abstractions in memory. Nevertheless, people often believe mistakenly that categories do have cores, perhaps because a word can lead people to essentialize.

[iii] As goal-directed categories that develop to guide action, the most typical member of a category like fear is not the one that is most frequently encountered, but rather, one that maximally achieves the theme or goal of the category (Barsalou, 2003). As a result, the most typical instances of a category contain properties that represent the ideal form of the category – that is, whatever is ideal for meeting the goal that the category is organized around – not those that most commonly appear as instances of the category. From a situated conceptualization

viewpoint, prototypes do not exist as stored representations in memory, but can be constructed (or simulated) when needed (Barsalou et al., 2003).

[iv] Highly different instances for the same category can become integrated over time, and become available to construct novel simulations that have never been experienced before. This, in part, may help to explain why people believe that emotions like *anger*, *sadness*, *fear*, and so on have specific response signatures, even though the available data do not support this view. A simulation of *fear* could allow a person to go beyond the information given to fill in aspects of a internal sensation that are not present at a given perceptual instance. In such a case, the simulation essentially produces an illusory correlation between response outputs, helping to explain why researchers continue to search for coordinated autonomic, behavioral, and experiential aspects of a *fear* response.