RUNNING HEAD: EMOTION REGULATION AS SITUATED CONCEPTUALIZATIONS

TITLE:

A psychological construction account of emotion regulation and dysregulation:

The role of situated conceptualizations

Lisa Feldman Barrett

Northeastern University; Massachusetts General Hospital / Harvard Medical School

Christine D. Wilson-Mendenhall

Northeastern University

Lawrence W. Barsalou

Emory University

Corresponding Author:

Dr. Lisa Feldman Barrett
Department of Psychology
Northeastern University
Boston, MA 02115
Phone: 617-373-2044
Fax: 617-373-8714
Email: l.barrett@neu.edu

Abstract

In this chapter, we examine the concept of emotion regulation from the perspective of situated conceptualizations. We introduce the general idea that existing knowledge within the brain gives meaning to incoming sensory input to create the variety of mental states that populate the human mind. We then link this insight to the idea of situated conceptualizations from the literature on concepts and categories. We then discuss how emotions might be understood as arising from situated conceptualizations, and how emotion regulation might be reconceptualized as shifting from one situated conceptualization to another, with the effect of altering the experience of emotion, as well as the autonomic and endocrine responses that occur during emotion regulation. Finally, we use this framework to consider how emotional dysregulation might occur from the situated conceptualizations that are constructed.

For the last several centuries, philosophers, and later, psychologists, have assumed that the mind works like a machine – a printing press, a switchboard, a computer. According to the machine metaphor, the mind consists of a number of functionally distinct processes (mental "modules" or "faculties") that interact with one another; if separated, these processes would still retain their identity and function. The machine metaphor dictates a particular view of mental causation: "psychological process A" localized in one swath of brain tissue (a region or a network) causes a change in a separate and distinct "psychological process B" localized in another swath of tissue (see Figure 1). A good example of the machine metaphor at work can be found in the science of emotion regulation. It is largely assumed, for example, that an emotion, like fear, is created by one process that is computed in one part of the brain (usually in subcortical limbic or paralimbic cortex) that is regulated by executive or other cognitive processes located elsewhere in the brain (typically somewhere in prefrontal cortex). In the process model of emotion regulation (Gross, this volume), an emotion can be triggered first and then is subsequently regulated (e.g., you are walking in the woods, and a fuzzy bee buzzing around your head triggers a state of fear, which you then regulate by suppressing the urge to run and by distracting yourself with a close examination of the local scenery, such as an interestingly shaped rock or tree). Regulation might also occur before the response occurs, preempting the emotion from ever taking place (e.g., before you start your walk, you might remind yourself that bees are a part of nature, pollinate beautiful flowers, and make delicious honey). Regardless of which comes first, the emotion is separate from its regulation.

In the last several years, scientists have come to question whether the mind and brain work like a machine with separate, interacting bits and pieces (e.g. Barrett, 2009) and assumptions about modularity, even in sensory cortices, is strongly in question. As a consequence, other working metaphors for the mind and the brain are more apt – say, molecules that are constructed of atoms, chamber music emerging from the interplay of instruments, or recipes from a well-stocked pantry full of ingredients. These metaphor begins with a deceptively simple observation: during every moment of waking life, the brain takes in sensory input captured from the world outside the skin (light, vibrations, odors, etc.) and sensations captured from within the body that holds the brain (the internal "milieu"), and uses knowledge from prior experience (also variously called concepts, memories, associations, beliefs, predictions, etc.) -- stored in association cortex and in sensory neurons and subcortical regions – and makes those sensory inputs meaningful. This occurs by creating *situated conceptualizations* (Barrett, 2006, 2012; Barsalou, 2003, 2009; Barsalou, Niedenthal, Barbey, & Ruppert, 2003; Wilson-Mendenhall, Barrett, Simmons, & Barsalou, 2011). A situated conceptualization initially is like a prediction of what sensory input stands for in the world (i.e., object or event identification), which properties are salient (i.e., are deserving of attention), what to do about that sensory input (i.e., a predicted action) and what the homeostatic and metabolic consequences will be (i.e., affective changes). From our perspective, the brain's architecture can be thought of as a situated conceptualization generator producing the individual brain states that correspond to each individual mental state, such as an individual instance of fear or an instance of regulation.

Building on the kitchen metaphor (in Barrett, 2009), we have proposed that each brain state, each situated conceptualization, can be understood in terms of more core systems (i.e., the ingredients), which can themselves be characterized both at the psychological level (e.g., Barrett, 2006, 2012) and at the level of brain networks (e.g., Barrett & Satpute, 2013; Lindquist & Barrett, 2012). These core systems are like the "mental state variables" (see Salzman & Fusi, 2010), facets or core systems that describe the brain state. As basic "ingredients" of the mind, they are necessary for but not specific to emotion generation or to emotion regulation per se, just as flour and salt are necessary to for but not specific to bread. As the brain transitions from one state to another, mental states ebb and flow, and people give special names to these different states. We refer to this as a psychological constructionist, or merely a constructionist, approach to the mind and brain. From this constructionist point of view, emotions are not unique mental states that are caused by dedicated mechanisms, to modified by another set of dedicated regulatory mechanisms. Instead, emotions emerge, and regulation occurs, as the consequence of an ongoing, continually modified constructive process that makes sensory inputs meaningful. Every mental state, including an emotion both before and after regulation is said to have occurred, is a situated conceptualization, constructed from assemblies of neurons that perform sensory, conceptual, attentional and action functions.

In this chapter, we will examine in more detail the concept of emotion regulation as resulting from the never ending sequence of situated conceptualizations that occur as the brain transitions from one state to another. First, we introduce the general idea that knowledge (as reactivation and recombination of prior experience) gives meaning to incoming sensory input and is itself enactive (i.e., adds novel features via perceptual inference). Next, we link these notions to the idea of situated conceptualizations from the literature on concepts and categories, and discuss how we have broadened it into a general proposal of constructed mental states that involve making meaning of sensory input and even modifying sensations during the process. We then discuss how emotions might be understood as arising from situated conceptualizations, and how emotion regulation might be reconceptualized as changing shifting from one situated conceptualization to another. Finally, we use this framework to consider how emotional dysregulation might be understood in terms of the situated conceptualizations that are constructed.

Making Meaning of Sensory Input

Take a look at the image in Figure 2. As you look at this image, your brain is trying to make sense of the visual input it is receiving. If you are having difficulty making sense of the visual input from the image (e.g., you cannot recognize an object in it), then you are in a state of experiential blindness (e.g., Fine et al., 2003). This is because usually, in the blink of an eye, quite automatically and with no effort whatsoever, your brain is usually able to seamlessly integrate impinging sensory stimulation with its vast amount of stored knowledge (from prior experience), allowing you to construct a visual representation of the object. Such knowledge is not merely helpful – it is necessary to normal perception. Without prior experience, the sensations are meaningless, and if this were an object before you, in three-dimensional space, you would not know how to act on it.

Now look at the image in the Appendix. Then return to look again at Figure 2.

Hopefully, you can now see the object because you have had an experience to help make sense of the visual input. The first lesson here is that it very difficult to "unsee" the object in the original blobby black and white image. A second lesson is that no matter how hard you try, you cannot gain introspective access to the processes in your brain that underlie using stored knowledge to make incoming sensations meaningful. Experimental methods are necessary to unmask its workings. The third lesson from this example is that your brain infers elements of the experience that are not immediately present (e.g., the lines that link the black and gray blobs together into the shape of a bee). Although you cannot gain introspective access to these inferred features, you can get a sense that this inference process works by conjuring some additional perceptual detail –the soft drone of buzzing, or 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. Inference is considered one of the primary purposes of memory and is how experiences of the past help to 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 a vast body of sensory, motor, affective, and other related information stored in memory; I have also referred to it as *categorization* (Barrett, 2006).

The fourth lesson is that these inferences prepare you for situated action. For some people, perhaps 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, perhaps 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 during a prediction of how the body should respond in a specific situation (what we have previously referred to as an "affective prediction"; Barrett & Bar, 2009).

The fifth lesson from this example is that the process of making meaning of external sensations will always produce some kind of automatic change in your physical state, the internal sensations from which likely form the basis of your pleasant or unpleasant core affective tone that accompanies any mental states of which it is a part (Barrett & Bliss-Moreau, 2009; Russell, 2003; Wundt, 1897); the actual visceral changes are not necessary for feeling, of course, 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 3, it will also use such knowledge to make meaning of these bodily sensations. These two meaning making achievements are not happening in quick succession – 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 evolving over time. This meaning making rarely happens deliberately, but more often as instantaneously, continuously, and effortlessly for internal sensations as it does for external sensations. These insights form the basis of our Conceptual Act Theory of emotion (Barrett, 2006). You experience a perception of the situation vs an emotion as a function of your attentional focus. When sensations from the visual world are foregrounded (and sensations from the body are in the background), you will experience the bee as friendly or wicked because you are focused on the bee, and not how your body is responding to the bee (e.g., Anderson et al 2012). When sensations from the body are foregrounded, either because they 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.

The sixth lesson from this example is that 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 modal 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). It is now well known that the same brain network (termed the "default mode" or "mentalizing" network) involved in long term memory is also important for imagining the future (Hanna-Andrews et al., 2010), and recent evidence suggests that these networks are also important for constructing emotions in the present (Kober et al., 2008). It is very likely that when faced with the visual input in Figure 2 your brain reconstituted a number of different associations that were in competition with one another, and that via a variety of selection processes (Barrett, Tugade, & Engle, 2004; Sporns, Tononi, & Edelman, 2000a, 2000b), only one was fully realized (perhaps according to the logic of constraint satisfaction) (e.g., Barrett, Ochsner, & Gross, 2007; Barsalou et al., 2003). The same logic might hold for making meaning of internal sensations. When is a high arousal state fear, or anger, or excitement? It might depend on your prior experience with these sensations in different contexts, and in particular, how those various instances were paired with emotion words like "fear", "anger" or "excitement" (c.f. Barrett, 2006; Barrett, Lindquist, & Gendron, 2007). 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.

Situated Conceptualizations

In our prior writing, we have focused on the process of meaning making as a *psychological construction of emotion* that involves creating *situated conceptualizations* of internal bodily sensations that are highly context-dependent and coordinated with the immediate situation (cf. Barrett, 2006; Wilson-Mendenhall et al., 2011). In fact, however, the notion of a situated conceptualization implies that people are making meaning of both internal and external sensations at the same time, to create a unified conscious field (cf. Barrett, 2009). Conceptual knowledge is distributed throughout the brain's modal systems for perception and action in the form of simulators that re-enact sensory, action, affect, and other elements of situations captured through experience (e.g., Barsalou, 1999; Simmons & Barsalou, 2003). From this perspective, knowledge is not only central to the cognition involved in thinking and imagining offline (re-enacting or simulating a situation that is not present), but also to perceiving external sensations from the world and internal sensations from the body (in which case knowledge fuses with impinging sensory input – this fusion occurs seamlessly because knowledge is stored and represented in the same format or "language" as the sensations), both of which are involved in predicting and guiding one's actions. In this sense, conceptual knowledge is enactive. When your brain was foregrounding your bodily sensations while viewing the bee a few paragraph before, for example, perhaps you experienced the moment as an emotion; when the focus was on the visual sensations, perhaps you experienced it merely as a perception of the bee. In each case, the visual input was the same -- what differed was the situated conceptualization.

In the past, we have referred to the creation of situated coneptualizations as an act of categorization because situated conceptualizations are enactments that develop for categories of experience (e.g., a variety of situated conceptualizations develop for the categories fear, anger, etc; Barrett, 2006). To understand how situated conceptualizations work, then, it is important to understand how concepts and categories work. Categorization is not a narrow, limited process -- it does not happen only when you explicitly attempt to assign an object to one grouping or another. Categorization plays a central role in all cognitive activity, including the sort of high-level perceptions that are involved in emotion and emotion regulation. Categorizing is fundamental cognitive activity. To categorize sensory input is to determine what it is, why it is, and what to do with it.

A central property of human knowledge is that it is organized categorically. Unlike a recording device that simply stores each individual, holistic bitmapped image of the world, the human brain is constantly interpreting aspects of experience, using concepts in memory to make sensations meaningful. 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, a concept develops over time from instances of the respective category experienced across situations (Barsalou, 1999; Barsalou & Hale, 1993; Murphy, 2002). 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.).[1] Concepts develop for all aspects of human 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*). Concepts also develop 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).

Extensive evidence now exists that an instance of conceptual knowledge (an instance of a concept, or a conceptualization) emerges from different multimodal systems in the brain (c.f. McClelland, 2010). Depending on the modalities relevant for processing a concept's instances, particular modal areas of the brain store information about the category and can later represent the category in the absence of actual instances. Martin (2001, 2007) reviews evidence, for example, that different multimodal profiles represent living vs. non-living things. Other research has similarly established the multimodal profiles that represent the self and others (c.f. Legrand & Ruby, 2009; e.g., Northoff et al., 2006; Van Overwalle, 2009), people, buildings, and tools (e.g., Simmons, Reddish, Bellgowan, & Martin, 2010), the external world vs. internal states (Golland, Golland, Bentin, & Malach, 2008), and so forth.

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, the 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 to represent new instances of the category “bee”.[2] 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). From this perspective, conceptual processing is actually more like scene perception because the brain produces a conceptual state using multimodal information about entire situations. In this way, a situated conceptualization allows an experiencer to interpret incoming information and draw inferences that go beyond the information given.

It is impossible to have conscious access to the processes that create situated conceptualizations, because they are initiated in the first milliseconds of perception (or perhaps even before sensory input is actually encountered), and evolve over time, but it is possible to demonstrate the brain’s computational power in creating them by engaging in a little imagination. For example, close your eyes and create an image of a yellow and black bee in your mind (i.e., simulate a bee). In doing this, your brain is creating a representation that includes the sights, sounds, smells, etc. of the bee, along with a situation in which the bee occurred, all of which would prepare you for a certain type of action (to run, to peer closer, to swat, to freeze). This representation involves the activation of neurons throughout your brain, including sensory and motor neurons, as well as neurons that regulate and represent an internal body (somatovisceral) state. All these elements (activation of sensory and motor neurons, changes in the physical state of the body, preparations for action) are examples of what it means to say that a representation is “embodied” (Barrett & Lindquist, 2008). This is also what it means to say that the brain is making a prediction about an object and how to act on it (Lindquist, Wager, Kober, Bliss-Moreau, & Barrett, 2012) or, as we noted before, to say that the brain is simulating a bee. This sort of simulation would occur if you were presented with an image of a bee and asked to recognize it (as in the prior section of this chapter), to explicitly categorize it (assign it to one stimulus grouping over another), to judge it in some way, or to perform any kind of cognitive task with it. It would occur if you were being asked to remember a bee, talk about a bee, think about a bee, or when perceiving bees during an outdoor walk.

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 people experience incoming sensory input from the world and the body, they use prior experience to categorize the agents, objects, setting, behaviors, events, properties, relations, and bodily states 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, conceptual systems on each of them categorize the respective information and draw inferences. At a more global level, abstract relational concepts integrate conceptualizations on the individual processing streams into coherent interpretations of larger events taking place across the situation as a whole. Categorical inferences (i.e., predictions) follow, including inferences about how an object, or entity is likely to behave, how one can best interact with it, the likely value to be obtained from interacting with it, etc., and on a larger 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 a concept is learned, situated conceptualizations generate activity in these systems as they become active on later occasions. On activating the concept for *bee,* a situated conceptualization might activate representations of situation-specific approach/avoid actions (e.g., swatting the bee), representations of internal states such as pleasure or displeasure, and perceptual construals that direct the body towards a particular instance of pleasure or displeasure. Not only does *bee* represent perceptual instances of the concept, it also controls interactions and predicts the resultant events.

Emotions and Emotion Regulation as Situated Conceptualizations

Initial work on situated conceptualizations focused on how this theory of concepts can be applied to perceiving or interacting with concrete objects in relevant situations (for a review see Barsalou, 2009), with conceptual knowledge being represented using the brain's modal systems for perception, action, and internal bodily states. We further developed these ideas into a theory of emotion (Barrett, 2006) and a broader theory of mental states more generally (Barrett, 2009), although in the present discussion we are focusing on emotion. We hypothesize that situated conceptualizations have relevance for understanding the nature of emotion, but also for presenting a computational framework for understanding emotion regulation.

Emotions as Situated Conceptualizations

In our view, an emotion concept typically forms when a given emotion word (e.g., "fear") is explicitly uttered (e.g., by a caregiver or teacher) during many different instances involving a variety of changes in feelings, physiology, and actions, becoming the statistical regularity that holds the concept together across instances involving different sensory input and actions (c.f. Barrett, Lindquist, & Gendron, 2007). Selectively attending with some consistency to components of experience results in category knowledge that is captured in memory (Schyns, Goldstone, & Thibaut, 1998). Because emotions are abstract, language appears to guide selective attention to the changes in internal states that characterize an emotion in a given situation. For example, each time a parent (or some other person) labels a child's internal state or behavior with an emotion term, or a child observes the emotion term being used to label someone else's behavior, the child extracts information about that instance (including the phonological form of the word) and integrates it with past information associated with the same term that is stored in memory. In this way, the phonological form for "fear" could become a perceptual regularity that repeatedly across situations and a concept *fear* forms. (It is certainly the case that young infants can use abstract words to make conceptual inferences about objects that differ in the sensory properties; Dewar & Xu 2009). The consequence is that accumulating conceptual knowledge for *fear*, for example, will vary within a person over instances as context and situated action demand. No single situated conceptualization for *fear* need give a complete account of the category *fear*. There is not one script for *fear* or one abstract representation for *fear*.[3] . For example, fear might occur when excitedly declaring a risky bet, when lethargically sensing the first signs of flu, when frantically fleeing a blazing fire, or when casually flirting with an attractive stranger. On any given occasion, the content of a situated conceptualization for *fear* will be constructed to contain mainly those properties of *fear* that are contextually-relevant, and it therefore contains only a small subset of the knowledge available in long-term memory about the category *fear*.[4] In a given instance, then, the situated conceptualization for *fear* has the potential to change the internal state of the perceiver because when retrieving information about *fear*, sensory, motor, and interoceptive states are partially reinstated in the relevant aspects of cortex, simulating an instance.

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 situated conceptualizations for a specific emotion (e.g., fear) refers to an entire situation, including both the internal and external sensations (Wilson-Mendenhall et al., 2011). In this way, emotions can be thought of as affective changes that are linked to the situation in some way (c.f. Barrett, 2006; Clore & Ortony, 2008) and emotions can be said to reflect the structure of situations. The key hypothesis can be stated as follows: a momentary array of sensations from the world (light, sound, smell, touch, and taste) combined with sensations from the body (X) counts as perception of emotion (Y) during a situated conceptualization (C) (Barrett, 2012). Here, a perception is meant to indicate perceiving an instance of sensations in the self as the experience of emotion, or sensory input (from facial actions, voice, etc.) coming from others as emotional expressions. The meaning acquired by the sensations is not based solely on the physical properties of sensations alone (as body states or actions as represented in the physiology of the body and/or in neural activations within the brain). Conceptual knowledge is required to give it additional functionality and meaning. For example, an increase in heart rate (X_1) counts as feeling afraid (Y_1) when category knowledge about fear is activated as a specific, embodied representation of fear, such as when a bee is attempting to sting you (C_1). In this example, the increase in heart rate takes on a meaning and allows a predicted behavior that it would not otherwise have alone. Emotion regulation might be characterized in the same way. A decrease in heart rate (X_2) counts as evidence of reappraisal (Y_2) when another embodied, situation specific representation of a bee is activated, such as when it is floating above a brightly colored flower petal (C_2). In these examples, the concept *fear* might be applied to internal sensations from the body because they are in the focus of attention, or because *fear* is part of a situated conceptualization that is part of the concept *bee*. It is a misnomer to refer to conceptual knowledge as merely psychological or social. For physical actions and body states (X) to count as an emotion (Y), some kind of physical change has to take place somewhere in the brain of a perceiver to complete a situated conceptualization in that perceiver at that moment in time (C). So, a psychological construction approach makes predictions about the brain basis of emotion (and emotion regulation), but one that is different from the typical machine metaphor illustrated in Figure 1 and found in most natural kind models of emotion (see also Cunningham, this chapter). An instance of emotion is hypothesized to correspond to an entire brain state – or a series of states changing over time -- including representations of the body and/or actions AND the additional information that is necessary to create the new meanings that make emotions real – that is, the parts that are crucial for creating the situated conceptualizations.

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. Instead, they become part of an emotional episode when they take on a certain meaning in a certain situation (Barrett, 2012). Via siuated 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 body 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.

If a situated conceptualization is represented as a distributed brain state (with both cortical and subcortical contributions), or even a series of brain state transitions across time, then mental causation is not mechanistic per se, but probabilistic, such that Brain State A at Time T (bee in the forest) increases the probability of Brain State B at Time T+1 (fear of the bee as a racing heart and sweaty hands and the perception of a stick as a weapon), making swatting more likely (but perhaps also a bee sting more likely) (Figure 3). Alternatively, the encounter with the bee might followed by situated conceptualization (an image of bees making honey) as Brain State C at Time T+1, decreasing the probability of a racing heart and sweating, etc. From this perspective, an emotion, such as fear, is itself not a *process* but instead represents a category of phenomena – a collection of instances of probabilistic situated conceptualizations. This example also illustrates that situated conceptualizations are not independent from one another in time – each occurs in a context of what came before, and what is predicted in the future.

Furthermore, we hypothesize that each situated conceptualization (as a brain state or series of states) can be understood as a construction of more basic, domain general operations and their interactions. These operations can themselves be characterized both at the psychological level (e.g., Barrett, 2006, 2012) and at the level of brain networks that emerge from neural integration across time and space within the brain (e.g., Barrett & Satpute, 2013; Lindquist & Barrett, 2012). Such basic operations are like the “mental state variables” (see Salzman & Fusi, 2010), facets or core systems that describe the brain state, or to return to our kitchen metaphor, these can be thought of as the mind’s “basic ingredients. Rather than presuming that these ingredients function in a modular, mechanistic way, each operation can be thought of as a set of “functional motifs” arising from the structural motif that undergirds 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). Such a componential, constructionist functional architecture of the human brain would not only reveal the distinctions between social, affect, and cognitive neuroscience to artificial (Barrett & Satpute, 2013), but it would present a set of hypotheses for how the phenomena that we refer to as *emotion* and *emotion regulation* are derived within a common mechanistic framework.

Emotion Regulation as Changing Situated Conceptualizations

To the extent that emotions are situated conceptualizations grounded in the modal systems of the brain, then shifting from one situated conceptualization to another intensifies, diminishes or alters the autonomic and endocrine responses that underlie actions and feelings. We propose that a situated conceptualization framework offers an account of emotion regulation that undergirds the process model (Gross, this volume) at a different level of analysis that has the potential to inspire new scientific research and practical applications. Our hypothesis is that stages of emotion regulation are often describing the difference between two consecutive situated conceptualizations, rather than individual processes that can be chained together by a series of linear causal linkages where cognitive systems in the brain modulate separate and anatomically distinct affective or emotional systems. Emotion regulation strategies *describe the changes* from one mental state to another, but these changes *can themselves be decomposed into more basic facets* (i.e., the mental operations and their associated networks that create the situated conceptualizations). As a consequence, the process model (Gross, this volume) can be thought of as offering a more abstract description of what occurs during emotion regulation, whereas the core systems that implement situated conceptualizations are a more mechanistic approach that produces reappraisals, distraction, suppression, and other instances of emotion regulation.

This distinction between levels of analysis maps onto the three levels of analysis described by Marr (1982), which include: a computational level that describes the phenomenon at hand (What problem does the system try to solve? What is the goal when transforming input to output?), an algorithmic level that describes how the transformation from input to output is achieved (How does the system do what it does? What are the representations used by the system? What processes act on these representations?) and an implementation or physical level (How is the system physically realized?). Our hypothesis is that the process model, with its emphasis on situation selection, situation modification, and so on, describes emotion regulation at Marr's computational level, whereas our situated conceptualization account describes emotion regulation at Marr's algorithmic and implementational levels. Each class of regulatory strategies discussed within the process model of emotion regulation can be understood as situated conceptualizations that are constructed from more basic domain-general core systems. The componential, constructionist functional architecture of the human brain for emotion is also the architecture that creates instances of emotion regulation.

Situation selection can be understood as a case in which situated conceptualizations are constructed to anticipate what will happen in the future. Elsewhere (Barrett, 2009; Barrett & Satpute, 2013), we have hypothesized that the nodes within the "mentalizing" network (e.g., Andrews-Hanna et al., 2012) interact to help guide the construction of situated conceptualizations by integrating elements of prior experience (which are represented modally across the brain). These regions help to produce the multimodal simulations that are strongly situated in a particular background context, which make sensory input meaningful and which support specific courses of situated action. Using prior knowledge to simulate possible future situations may guide the decision-making that underlies situation selection. More specifically, situated conceptualizations support simulating what it would be like to experience specific situations (by reenacting and reassembling prior knowledge) that produces information about their value and potential outcomes (e.g., deciding whether to walk in a meadow or a forest depending on the probability of encountering a bee). This hypothesis is consistent with the idea that the "mentalizing" network constructs mental models or simulations that facilitate future behavior (Buckner, 2011).

Because situated conceptualizations are dynamically constructed when thinking about future events, their dynamic assembly is likely influenced by a number of factors, including the current state of the individual (and the situated conceptualization that is being used to interpret this state) and the executive control resources available (e.g., via the "salience" and "frontoparietal control" networks) to help guide the situated conceptualization. These factors can influence elements of the situation that become the focus of the simulation and how detailed or vague the simulation becomes, both of which would impact the inferred outcomes and thus the decision-making that underlies situation selection. The complexity inherent to situation selection is often acknowledged in the literature on emotion regulation (e.g., Gross, 2008), but the dynamics involved in creating such complexity remains unclear, perhaps because these discussions tend draw on traditional approaches to emotion that overlook such dynamics. In contrast, our approach highlights investigating the dynamic integration of multimodal facets involved in situated conceptualization as important goal for future research.

The predictive and inferential capacities provided by situated conceptualizations also allows for situation modification (i.e., they provide a perceiver with the ability to predict what actions in the present will facilitate a change in mental state in the future; e.g., using a branch as a weapon to swat a bee). A situated conceptualization approach draws attention to the underlying processes that facilitate or detract from taking actions to modify the external environment to alter its emotional impact. Because a situation is already in place during situation modification, an individual is drawing on prior knowledge about specific facets present in the situated conceptualization to modify it. For example, when the individual focuses on a nearby tree branch with the goal of killing the bee to avoid being stung, he or she now infers that the branch could be used a weapon because it can be manipulated similarly to a bat (i.e., prior knowledge about using a bat to strike an object is being dynamically applied within the situated conceptualization). In this way, the situated conceptualization used to interpret the environment is shifting dynamically as its multimodal facets change (e.g., heightened arousal and hyper focus on the environment), which guides action.

Cognitive change (e.g., a stinging bee transformed into a flower-loving honey producer) and response modulation (e.g., to keep walking forward, rather than to run away) naturally unfold as the brain shifts from one situated conceptualization to another, making predictions about how to act (i.e., a predicted action) and what the homeostatic and metabolic consequences will be (i.e., affective changes). Cognitive framing and response modulation are perhaps two of the most obvious goals of the brain's functional architecture – knowing what the current sensory array means and how to act on it. They are not unique to emotion regulation – they describe what happens during the construction of every mental state. During emotion regulation, though, an individual is often more aware of these changes because he or she has an explicit goal to regulate through cognitive change or response modulation. An important prediction of a situated conceptualization approach is that these types of changes can also occur without awareness if they become habitual. Bringing situated conceptualizations into awareness and manipulating with effort, intention, and a feeling of agency appears to be one key characteristic that distinguishes the mental events people refer to as "emotion regulation" (vs. those that they refer to as "emotion).

If conceptual knowledge is enactive, and situated conceptualizations have the capacity to actually shape the physiology and actions that are observed in any mental state, then changing a conceptualization via any core system can modify said physiology and action (as well as the feelings that they give rise to). Such regulation might occur when the same physical sensations and actions are conceptualized as a different emotion (e.g., tears are not sadness but anger; a racing heart is not fear but excitement), or when the intensity of physical activation is enhanced or reduced by changing the conceptualization (e.g., a bee means the pain of a sting or the tranquility of a meadow). In such cases, our hypothesis is that emotion regulation is the *result* of conceptual knowledge being activated as part of a situated conceptualization. At the level of subjective experience, it may feel as if a special mechanism is being used to down regulate fear, such as re-appraisal or suppression or to up regulate anger because it is function. Our hypothesis is that these constructs reflect changes in emotions (as mental states) that result from successive situated conceptualizations, using the same processes operations that constitute an emotion in the first place. Thus, an instruction to reappraise, to distract by shifting attention, etc. actually manipulates the underlying underlying core systems of situated conceptualizations, which in turn alter the biological signals that produce sensations, not only how bodily sensations are understood (i.e., it alters the experience of them).

A situated conceptualization framework also suggest the novel hypothesis that is not discussed within the process model: deconstructing an emotion, by attempting to undo its situated conceptualization, is another form of emotion regulation. When the perception and experience of physical sensations from the body is decoupled from the concept knowledge (e.g., a deactivated unpleasant feeling conceptualized more basically as fatigue or glucose depletion as opposed to sadness in a specific situation), they become less potent and result in less suffering. This suspension of conceptualization can be difficult to achieve, and usually requires training. If you were to attempt to learn to paint an image of a bee on a flower, you would have to train yourself across a series of months not to see objects (a bee and flower) but to "undo" this perception and paint pieces of light. Only by doing this can you render a reasonable three-dimensional image on a two-dimensional page. Similarly, when learning to deconstruct emotion, you would have to train yourself not to experience emotions, but to experience physical sensations instead. Meditation practices offer a variety of tools for deconstructing emotion experience that may work in this manner (e.g., Holzel et al., 2011; Papies, Barsalou, & Custers, 2012). In other meditation approaches, an existing emotion is deconstructed and then is replaced with an alternative, more positive experience (Lutz, Brefczynski-Lewis, Johnstone, & Davidson, 2008; Lutz, Greischar, Perlman, & Davidson, 2009).

Recent empirical evidence from our lab also suggests that this may be a productive strategy. During a neuroimaging study (Wilson-Mendenhall et al., 2011), participants immersed themselves affectively charged situations that involved either physical danger or social evaluation. After immersing in a situation, a word cued participants to emote in the situation (experience fear or anger) or to observe in the situation. Significantly greater activity in visual cortex and significantly less activity in medial prefrontal cortex occurred when participants experienced situations by observing than when they experienced the same situations as self-relevant emotions. These results suggest that sensations became the focus of the affectively charged situation when participants were observing in the situation. In this study, observing was an explicit goal, but a situated conceptualization approach suggests that this process of observing could eventually occur automatically (without effort) if repeatedly used in specific situations (e.g., potential anger-inducing situations).

Finally, psychotherapy – particularly cognitive behavioral approaches – might be understood as helping clients to construct new situated conceptualizations (thereby modifying their conceptual system) that either reduce the intensity of their physical responses, or better calibrate the constructed meaning of those responses to the situation at hand. CBT interventions also appear to provide training for when to use these alternative situated conceptualizations. The psychotherapeutic process might be thought of as creating a new population of learned neural assemblies (for the same emotion categories, or for new categories) that would be available to create new or different emotional meaning for the same sensations, or that would modify those sensations (particularly those related to the body). The emotional changes that occur with psychotherapy, then, might result from changes in the conceptual system, or how conceptual knowledge is used to construct the situated conceptualizations that are emotion.

Psychopathology and Dysregulation from a Situated Conceptualization Framework

From a situated conceptualization framework, psychopathology would result from two classes of problems. First, we hypothesize that emotional deficits within certain types of psychopathology, such as schizophrenia, autism spectrum disorders, and neurodegenerative diseases such as frontotemporal dementia arise due to damage to the brain's structural architecture for situated conceptualizations, making it difficult to construct meaning for sensory inputs that constitute normal mental states. Perhaps deficits in white matter connectivity, as those seen in autism (Zikopoulous & Barbas, 2010) compromise the ability to construct and use the distributed conceptual structure that underlies situated conceptualizations. Similarly, autism is related to deficits connectivity that develops during the final stages of cortical development in paralimbic areas particularly within the supragranular layers of cortext (Zikopoulous & Barbas, 2010). These layers mainly contain the corticocortical connections that are important for synchronizing the distributed neuronal assemblies that are responsible for constructing normal situated conceptualizations.

In addition to structural considerations, psychopathology could result from entrenched conceptualizations that are overly ritualized and not sufficiently situation-specific. Deficits in the vocabulary or content of emotion concepts (perhaps due to poor socialization), or problems in accessing and using this knowledge (perhaps associated with problems with long term memory or executive function) might result in a failure to regulate autonomic (and therefore affective) reactivity using situated conceptualizations, as in alexithymia (for a discussion see Lindquist & Barrett, 2008), or might produce inappropriate or ritualized situated conceptualizations. To the extent that repeated processing of a situated conceptualization omits situational details and focuses instead on general abstract themes, chronic emotional responses develop that operate inappropriately across too many situations. For example, imagine that a situated conceptualization develops for shame associated with performing poorly on math tests during elementary school. Subsequently, if attention focuses too much on shame associated with poor performance and omits the situational details associated with elementary school math classes, a decontextualized shame for poor intellectual performance could develop that pervades experience inappropriately. Psychopathology also arise from problems in forming situated conceptualizations that are not well calibrated to the immediate situation, resulting in dysregulated autonomic responses and less effective actions. To the extent that situated conceptualizations are learned assemblies of perceptual, conceptual, interoceptive, and action processes, psychological disorders of one type or another might appear to be disorders of specific emotions (e.g., PTSD as a disorder of fear) because a person's learning history has created a "conceptual habit" or regularity of certain situated conceptualizations, resulting in a sort of entrenchment of certain changes in bodily state, central representations of that state, and meanings that emerge regardless of the immediate situation (e.g., even when no actual threat is present).

.More generally, psychopathology might also occur when sensations from the body are overly personalized and inaccurately construed as self-evaluative as a function of how situated conceptualizations are constructed. Even an over-reliance on such conceptual knowledge (e.g., conceptualizing interoceptive cues as psychological instead of physical) would also result in psychopathology, and might help explain sex differences in certain disorders like depression and anxiety. Problems might also arise when situated conceptualizations are too internally driven input (from the body and prior experience) and insufficiently incorporating external sensory input, as in depression. These overly internally focused situated conceptualizations might occur because a person might possess a very reactive autonomic nervous system, producing frequent and intense internal sensations that demand conceptualization, or because of limited executive control resources. Moreover, if conceptualizations that are not well-tailored to the situation in terms of social/cultural norms (which could happen in a variety of ways) could produce actions that are not effective in a particular cultural context.

To understand how the content of disordered situated conceptualizations emerge, it would be important to focus on the mechanisms of the core systems or "ingredients" that create instances of emotion or implement the moment-to-moment changes that are experienced as emotion regulation, such as an overly active autonomic nervous system that is experienced as affective reactivity, and other related problems with attention, working memory, and context insensitivity (e.g., Kring & Moran, 2008; Poch & Campo, 2012; Williamson & Allman, 2012). These, in turn, can be understood in terms of the dynamic and structure of the core networks such as the "salience" network, the "frontoparietal control" network, and the "mentalizing" network (Barrett & Satpute, 2013). Indeed, these networks, which are intrinsic to the human brain and are structured by anatomical connectivity (and that we understand as the core systems that implement situated conceptualizations; Barrett & Satpute, 2013) are implicated in a range of psychopathologies, including schizophrenia, autism, and frontotemporal dementia, but also in depression and anxiety disorders (Menon, 2011). For example, instead of understanding post traumatic stress disorder (PTSD) as an exaggerated activation of fear circuitry, for example, it is possible that PTSD symptoms are the result of hyper affective reactivity (associated with the "salience" network) combined with problems in conceptualization (associated with the "mentalizing" network) related to working memory deficits (associated with the "frontoparietal" control network) (Suvak & Barrett, 2011).

These ideas present an alternative to the traditional approach to mental illness, where all forms of psychopathology (and many forms of physical illness, such as cardiovascular disease and cancer) are conceived of as involving either excessive or deficient amounts of one emotion or another. For example, various anxiety disorders such as post-traumatic stress disorder (PTSD) and panic disorder are presumed to be disorders of fear, thought to arise from a hyper-reactivity of fear processing. Depression is presumed to be a disorder of sadness and guilt. Hypertension is thought to involve an excess of amount anger. And so on. From the perspective of the traditional machine metaphor, each type of illness would arise from problems with emotions being triggered too frequently or not enough. The development and maintenance of psychiatric disorders are also thought to centrally involve problems in emotion regulation (Kring & Sloan, 2010), and so psychopathology might also arise from an inability to regulate said emotions once they erupt. Our situated conceptualization approach connects these insights with transdiagnostic approaches that attempt to identify psychological and biological processes that are common to many types of psychological disorders (e.g., Fairholme, Boisseau, Ellard, Ehrenreich, & Barlow, 2010; Harvey, Watkins, Mansell, & Shafran, 2004; Haslam, 2002; Kendler, 2008; Kring, 2008; Krueger, Watson, & Barlow, 2005; Millan, 2003; Sanislow et al., 2010). Just as science is coming to the conclusion that emotion categories are not natural kinds (Barrett, 2006), clinical science is also coming to the conclusion that categories for disorders of emotion also do not cut nature at its joints (Haslam, 2002; Kendler, 2008).

Summary

Situated conceptualizations can be thought of as cognitive 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. In this sense, they provide an alternative framework for describing how mental states arise, and how actions and feelings, and the physiological changes that support them, are formulated and regulated. A focus on how situated conceptualizations are constructed from patterns (or functional motifs) across the brain's core systems (or structural motifs) adds utility to existing explanatory frameworks for emotion and emotion regulation by focusing on the mechanistic changes that produce emotional and regulatory phenomena that we give abstract names to.

Perhaps the final lesson of the bee example is 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 whereas another person might automatically experience the terror of a bee attacking and stinging the body, it is possible to retrieve different associations of bees in the next instance, which in turn has the capacity to change the sensations that your brain receives from your body. Our hypothesis is that 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 within the 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.

References

Anderson, E., Siegel, E. H., White, D., & Barrett, L. F. (2012). Out of sight but not out of mind: Unseen affective faces influence evaluations and social impression. *Emotion, 12,* 1210-1221.

Andrews-Hanna, J. R., Reidler, J. S., Sepulcre, J., Poulin, R., & Buckner, R. L. (2010). Functional-anatomic fractionation of the brain's default network. *Neuron, 65*(4), 550-562.

Barrett, L. F. (2006). Solving the emotion paradox: categorization and the experience of emotion. *Pers Soc Psychol Rev, 10*(1), 20-46.

Barrett, L. F. (2009). The Future of Psychology: Connecting Mind to Brain. *Perspect Psychol Sci, 4*(4), 326-339.

Barrett, L. F. & Bar, M. (2009). See it with feeling: Affective predictions in the human brain. *Royal Society Phil Trans B*, 364, 1325-1334.

Barrett, L. F. (2012). Emotions are real. *Emotion, 12*(3), 413-429.

Barrett, L. F., & Bliss-Moreau, E. (2009). Affect as a Psychological Primitive. *Adv Exp Soc Psychol, 41*, 167-218.

Barrett, L. F., & Gross, J. J. (2001). Emotion representation and regulation: A process model of emotional intelligence. In T. Mayne & G. Bonnano (Eds.), *Emotion: Current Issues and Future Directions* (pp. 286-310). New York: Guilford.

Barrett, L. F., & Lindquist, K. (2008). The embodiment of emotion. In G. Semin & E. Smith (Eds.), *Embodied grounding: Social, cognitive, affective, and neuroscience approaches* (pp. 237-262). New York: Cambridge University Press.

Barrett, L. F., Lindquist, K. A., & Gendron, M. (2007). Language as context for the perception of emotion. *Trends Cogn Sci, 11*(8), 327-332.

Barrett, L. F., Ochsner, K. N., & Gross, J. J. (2007). On the automaticity of emotion. In J. Bargh (Ed.), *Social psychology and the unconscious: The automaticity of higher mental processes* (Vol. 173-217). New York: Psychology Press.

Barrett, L. F., & Satpute, A. (2013). Large-scale brain networks in affective and social neuroscience: Towards an integrative architecture of the human brain. *Current Opinion in Neurobiology*, 23, 1-12.

Barrett, L. F., Tugade, M. M., & Engle, R. W. (2004). Individual differences in working memory capacity and dual-process theories of the mind. *Psychol Bull, 130*(4), 553-573.

Barsalou, L. W. (1999). Perceptual symbol systems. *Behav Brain Sci, 22*(4), 577-609; discussion 610-560.

Barsalou, L. W. (2003). Situated simulation in the human conceptual system. *Lang Cogn Process, 18*, 513-562.

Barsalou, L. W. (2008). Grounded cognition. *Annu Rev Psychol, 59*, 617-645.

Barsalou, L. W. (2009). Simulation, situated conceptualization, and prediction. *Philos Trans R Soc Lond B Biol Sci, 364*(1521), 1281-1289.

Barsalou, L. W., & Hale, C. R. (1993). Components of coceptual representation: From feature lists to recursive frames. In I. IVan Mechelen, J. Hampton, R. Michalski & P. Theuns (Eds.), *Categories and concepts: Theoretical views and inductive data analysis* (pp. 97-144). San Diego, CA: Academic Press.

Barsalou, L. W., Niedenthal, P. M., Barbey, A., & Ruppert, J. (2003). Social embodiment. In B. Ross (Ed.), *The Psychology of Learning and Motivation* (Vol. 43, pp. 43-92). San Diego: Academic Press.

Bradley, M. M., Codispoti, M., Cuthbert, B. N., & Lang, P. J. (2001). Emotion and motivation I: defensive and appetitive reactions in picture processing. *Emotion, 1*(3), 276-298.

Buckner, R. L. (2011). The serendipitous discovery of the brain's default network. Neuroimage, 62, 1137-1145.

Carey, S. (2009). *The origin of concepts*. New York: Oxford University Press.

Clore, G. L., & Ortony, A. (2008). Appraisal theories: How cognition shapes affect into emotion. In M. Lewis, J. M. Haviland-Jones & L. F. Barrett (Eds.), *Handbook of emotions* (3rd ed., pp. 628-642). New York, NY: Guilford Press.

Dewar, K. M., & Xu, Fei. (2009). Do early nouns refer to kinds or distinct shapes? Evidence from 10-month old infants. Psychological Science, 20, 252-257.

Edelman, G. M. (1998). *The remembered present: A biological theory of consciousness*. New York: Basic Books.

Fairholme, C. P., Boisseau, C. L., Ellard, K. K., Ehrenreich, J. T., & Barlow, D. H. (2010). Emotions, emotion regulation, and psychological treatment: A unified perspective. In A. M.

Kring & D. M. Sloan (Eds.), *Emotion regulation and psychopathology* (pp. 283-309). New York: Guilford Press.

Golland, Y., Golland, P., Bentin, S., & Malach, R. (2008). Data-driven clustering reveals a fundamental subdivision of the human cortex into two global systems. *Neuropsychologia, 46*(2), 540-553.

Gross, J.J. (2008). Emotion regulation. In M. Lewis, J.M. Haviland-Jones, & L.F. Barrett (Eds.), Handbook of emotions (3rd ed) (pp. 497-512). New York, NY: Guilford.

Harvey, A., Watkins, E., Mansell, W., & Shafran, R. (2004). *Cognitive behavioural processes across psychological disorders: A transdiagnostic approach to research and treatment*. New York: Oxford Univeristy Press.

Haslam, N. (2002). Kinds of kinds: A conceptual taxonomy of psychiatric categories. *Philosophy, Psychiatry, & Psychology, 9*, 203-217.

Holzel, B. K., Lazar, S. W., Gard, T., Schuman-Oliver, Z., Vago, D. R., & Ott, U. (2011). How does mindful meditation work? Proposing mechanisms of action from a conceptual and neural perspective. *Perspectives on Psychological Science, 6*(6), 537-559.

Kendler, K. S. (2008). Explanatory models for psychiatric illness. *Am J Psychiatry, 165*(6), 695-702.

Kober, H., Barrett, L. F., Joseph, J., Bliss-Moreau, E., Lindquist, K., & Wager, T. D. (2008). Functional grouping and cortical-subcortical interactions in emotion: a meta-analysis of neuroimaging studies. *Neuroimage, 42*(2), 998-1031.

Kring, A. M. (2008). Emotion disturbances as transdiagnostic processes in psychopathology. In M. Lewis, J. M. Haviland-Jones & L. F. Barrett (Eds.), *Handbook of Emotion* (3rd ed., pp. 691-705). New York: Guilford Press.

Kring, A. M., & Moran, E. K. (2008). Emotional response deficits in schizophrenia: insights from affective science. *Schizophr Bull, 34*(5), 819-834.

Kring, A. M., & Sloan, D. M. (Eds.). (2010). *Emotion regulation and psychopathology*. New York: Guilford Press.

Krueger, R. F., Watson, D., & Barlow, D. H. (2005). Introduction to the special section: toward a dimensionally based taxonomy of psychopathology. *J Abnorm Psychol, 114*(4), 491-493.

Lang, P. J., Bradley, M. M., & Curthbert, B. N. (2008). *International affective picture system (IAPS): Affective ratings of pictures and instruction manual*. Gainsville, FL: University of Florida.

Legrand, D., & Ruby, P. (2009). What is self-specific? Theoretical investigation and critical review of neuroimaging results. *Psychol Rev, 116*(1), 252-282.

Lindquist, K., & Barrett, L. F. (2008). Emotional complexity. In M. Lewis, J. M. Haviland-Jones & L. F. Barrett (Eds.), *The handbook of emotion* (pp. 513-530). New York: Guilford.

Lindquist, K., A., & Barrett, L. F. (2012). A functional architecture of the human brain: Insights from Emotion. *Trends in Cognitive Sciences, 16, 533-540.*

Lindquist, K. A., Wager, T. D., Kober, H., Bliss-Moreau, E., & Barrett, L. F. (2012). The brain basis of emotion: A meta-analytic review. *Behav Brain Sci, 35*(3), 121-143.

Lutz, A., Brefczynski-Lewis, J., Johnstone, T., & Davidson, R. J. (2008). Regulation of the neural circuitry of emotion by compassion meditation: effects of meditative expertise. *PLoS One, 3*(3), e1897.

Lutz, A., Greischar, L. L., Perlman, D. M., & Davidson, R. J. (2009). BOLD signal in insula is differentially related to cardiac function during compassion meditation in experts vs. novices. *Neuroimage, 47*(3), 1038-1046.

Martin, A. (2001). Functional neuroimaging of semantic memory. In R. Cabeza & A. Kingstone (Eds.), *Handbook of Functional Neuroimaging of Cognition* (pp. 153-186). Cambridge, MA: MIT Press.

Martin, A. (2007). The representation of object concepts in the brain. *Annu Rev Psychol, 58*, 25-45.

Marr, D. (1982). Vision: A computational investigation into the human representation and processing of visual information. New York: Freeman.

McClelland, J. L. (2010). Emergence in cognitive science. *Topics in Cognitive Science, 2*, 751-770.

Menon, V. (2011). Large-scale brain networks and psychopathology: a unifying triple network model. *Trends Cogn Sci, 15*(10), 483-506.

Mesquita, B., Barrett, L. F., & Smith, E. (Eds.). (2010). *The mind in context*. New York: Guilford.

Millan, M. J. (2003). The neurobiology and control of anxious states. *Prog Neurobiol, 70*(2), 83-244.

Murphy, G. L. (2002). The Big Book of Concepts *MIT Press, Cambridge, MA*.

Neumeister, A., Henry, S., & Krystal, J. H. (2007). Neural circuitry and neuroplasticity in PTSD. In M. J. Friedman, T. M. Keane & P. A. Resick (Eds.), *Handbook of PTSD: Science and practice* (pp. 151-165). New York: Guilford Press.

Northoff, G., Heinzel, A., de Greck, M., Bermpohl, F., Dobrowolny, H., & Panksepp, J. (2006). Self-referential processing in our brain--a meta-analysis of imaging studies on the self. *Neuroimage, 31*(1), 440-457.

Papies, E. K., Barsalou, L. W., & Custers, R. (2012). Mindful attention prevents mindless impulses. *Social Psychological and Personality Science 3*, 291-299.

Poch, C., & Campo, P. (2012). Neocortical-hippocampal dynamics of working memory in healthy and diseased brain states based on functional connectivity. *Front Hum Neurosci, 6*, 36.

Rips, L. J. (2010). *Lines of thought*. New York: Oxford University Press.

Russell, J. A. (2003). Core affect and the psychological construction of emotion. *Psychological Review, 110*, 145–172

Salzman, C. D., & Fusi, S. (2010). Emotion, cognition, and mental state representation in amygdala and prefrontal cortex. *Annu Rev Neurosci, 33*, 173-202.

Sanislow, C. A., Pine, D. S., Quinn, K. J., Kozak, M. J., Garvey, M. A., Heinssen, R. K., et al. (2010). Developing constructs for psychopathology research: research domain criteria. *J Abnorm Psychol, 119*(4), 631-639.

Schell, T. L., Marshall, G. N., & Jaycox, L. H. (2004). All symptoms are not created equal: the prominent role of hyperarousal in the course of posttraumatic psychological distress. *J Abnorm Psychol, 113*(2), 189-197.

Schyns, P. G., Goldstone, R. L., & Thibaut, J. P. (1998). The development of features in object concepts. *Behav Brain Sci, 21*(1), 1-17; discussion 17-54.

Simmons, W. K., & Barsalou, L. W. (2003). The similarity-in-topography principle: reconciling theories of conceptual deficits. *Cogn Neuropsychol, 20*(3), 451-486.

Simmons, W. K., Reddish, M., Bellgowan, P. S., & Martin, A. (2010). The selectivity and functional connectivity of the anterior temporal lobes. *Cereb Cortex, 20*(4), 813-825.

Sporns O, Kotter R: Motifs in brain networks. *PLoS Biol* 2004, 2:e369.

Sporns, O., Tononi, G., & Edelman, G. M. (2000a). Connectivity and complexity: the relationship between neuroanatomy and brain dynamics. *Neural Netw, 13*(8-9), 909-922.

Sporns, O., Tononi, G., & Edelman, G. M. (2000b). Theoretical neuroanatomy: relating anatomical and functional connectivity in graphs and cortical connection matrices. *Cereb Cortex, 10*(2), 127-141.

Suvak, M. K., & Barrett, L. F. (2011). Considering PTSD from the perspective of brain processes: a psychological construction approach. *J Trauma Stress, 24*(1), 3-24.

Van Overwalle, F. (2009). Social cognition and the brain: a meta-analysis. *Hum Brain Mapp, 30*(3), 829-858.

Williamson, P. C., & Allman, J. M. (2012). A framework for interpreting functional networks in schizophrenia. *Front Hum Neurosci, 6*, 184.

Wilson-Mendenhall, C.D., Barrett, L.F., & Barsalou, L.W. (in preparation). Emoting vs. observing: Conceptualizing affective situations as self-relevant emotions or sensory-focused mental states.

Wilson-Mendenhall, C. D., Barrett, L. F., Simmons, W. K., & Barsalou, L. W. (2011). Grounding emotion in situated conceptualization. *Neuropsychologia, 49*(5), 1105-1127.

Wundt, W. (1897). *Outlines of psychology* (C. H. Judd, Trans.). Leipzig: Wilhelm Engelmann.

End Notes

[1] 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").

[2] 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.

[3] 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).

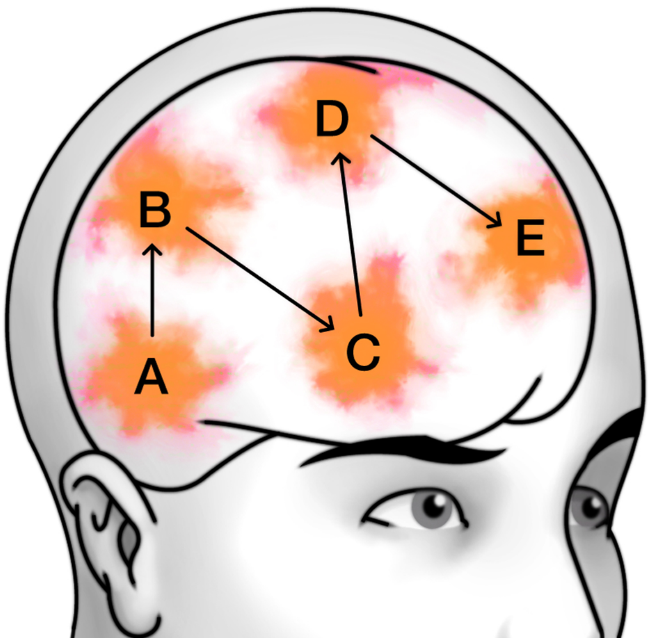
[4] Highly different instances for the same category can become integrated over time, and become available to construct novel simulations that have never been experienced before. This, in part, may help to explain why people believe that emotions like *anger*, *sadness*, *fear*, and so on have specific 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.

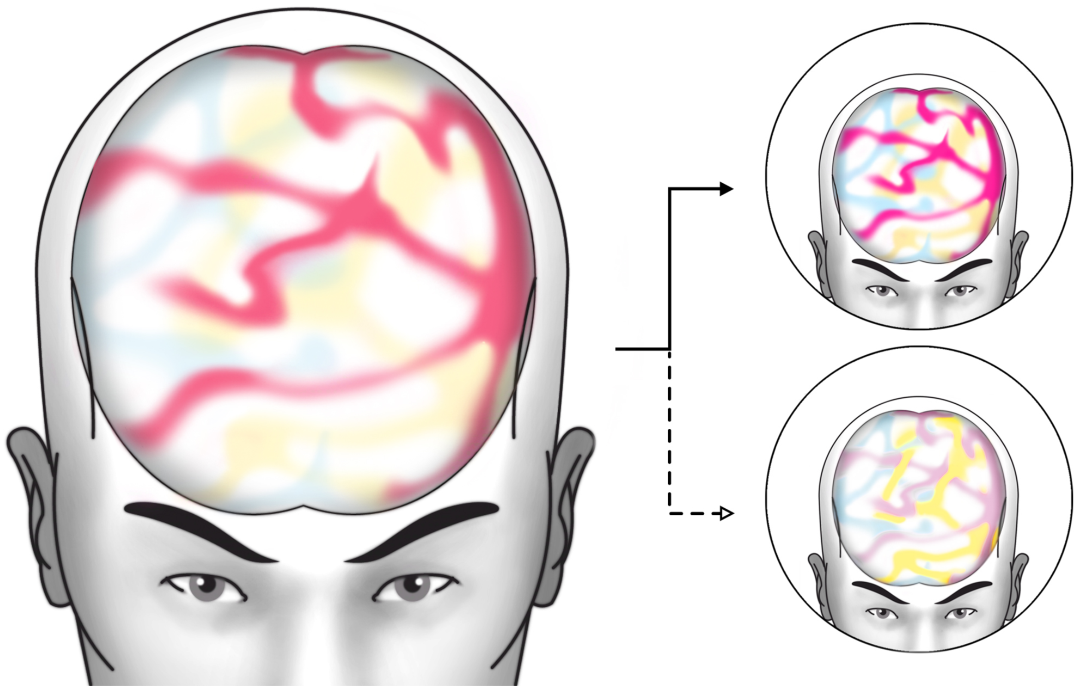
Figure Captions

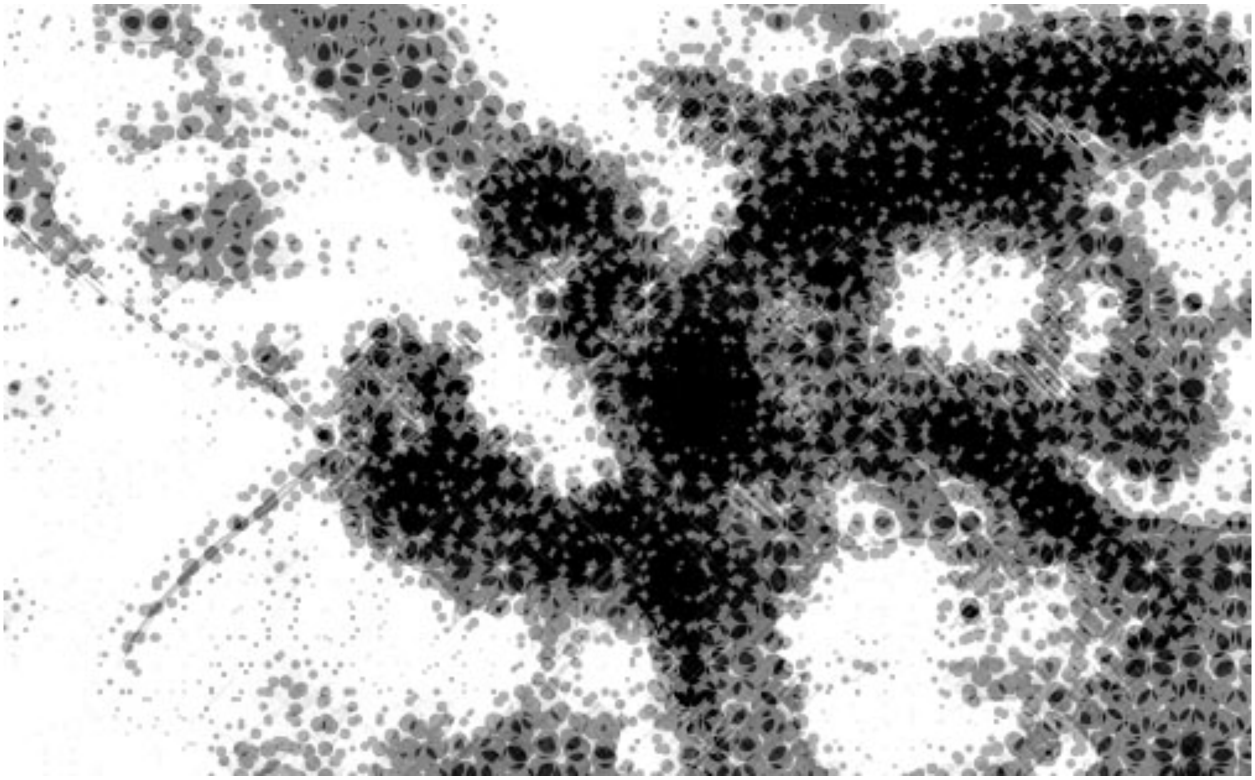
Figure 1. A depiction of the machine metaphor of brain function.

Figure 2. A depiction of the probabilistic state-space metaphor of brain function.

Figure 3. An illustration of experiential blindness.


D
B
E
C
A





Appendix