CHAPTER 36

Emotion Concepts

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"Concepts" are mental representations of categories of entities (natural and artifactual), situations, experience, and action. Cognitive scientists study concepts because they are used in most acts of cognition—including high-level processes such as thinking, reasoning, and language use, and also lower-level processes such as perception, attention, and recognition. Supporting the vast literature in cognitive psychology, the social-psychological literature reports evidence that concepts facilitate encoding, memory retrieval processes (e.g., Cohen, 1981), and the ability to make inferences about never-before-seen entities (e.g., Cantor & Mischel, 1977). When, in a crowded train station, I suddenly "see" my husband carrying our child, I am relying on my concepts of my husband and child to categorize the input as these particular people. Other experiences with the social world also involve concept use. Understanding another person's emotions and knowing how the emotions have come about and what we might do to alter or celebrate them also involves the use of concepts. So does perceiving a facial display as an expression of disgust or contempt. These phenomena are supported by emotion concepts—the topic of interest in the present chapter.

Emotion concepts are not only fundamental for an understanding of the social world; they are fundamental to the development of an individual's behavioral repertoire. One of the most compelling examples of this (an example to which I will return) is that of instructed fear learning. If I tell my son that a certain object or event would be painful or frightening to encounter, he can, even at a relatively early point in cognitive development, avoid that object or event without ever having to experience the pain or fear with which it is (held to be) associated. The example of instructed fear learning is noteworthy, because it demonstrates that individuals' concepts of "fear" or "pain" are sufficiently powerful to determine future behavior. This observation suggests that the understanding of emotion concepts is vital for a full account of human behavior.

It should be noted in starting that in order to study emotion concepts at all, theorists have had to decide on the set of categories that they

are working with. What are the categories of emotion? How can we specify the "natural kinds" to which emotion concepts refer? Or can we (Barrett, 2006)? Because scientists are able to point to cats and trees and furniture in the perceivable world, and even to measure their physical properties, they can be in reasonable agreement about the existence of and labels for these and many other natural-kind and artifactual categories (within a culture). They can then ask in experimental research: What are the properties of such categories that are preserved in individuals' concepts; how are the properties and related concepts structured in memory; and how are the concepts used to understand newly encountered category instances (e.g., Lamberts & Shanks, 1997)? The same is not true of emotions. Some parts of an emotion can be seen, such as a facial expression or a posture, but others cannot. Theorists and laypeople disagree about the categories that accurately cut emotional experience at its joints. So how do scientists proceed in the study of emotion concepts when there is no a priori agreement about the categories that constitute the domain of interest?

There are two ways in which this decision has been made by scientists interested in emotion concepts. One is an empirical method. In this case, many things that could be "an emotion" are studied (usually represented by words), and then the underlying conceptual structure is empirically derived (e.g., Ortony, Clore, & Foss, 1987; Shaver, Schwartz, Kirson, & O'Connor, 1987). The most fully developed account of emotion concepts that relies on this method is the dimensional approach, in which, as we shall see, the underlying structure is derived by the application of various scaling methods to judgments about emotional states and emotional objects. Other approaches, such as semantic-primitives and the semantic-network accounts, rely on evidence in favor of the existence of certain irreducible, perhaps biologically basic emotions (evidence concerned with possible structures for the set of emotion concepts is reviewed in Barrett, 2006, and Niedenthal, Krauth-Gruber, & Ric, 2006, as well as in several chapters of the present handbook). These approaches then try to define the conceptual content for what people appear to explicitly "know" about a set of categories so chosen, rather than what they apparently know, as revealed by scaling studies.

In their explicit knowledge about emotion, individuals seem to know about at least three classes of information. First, people's concepts contain information about the situational antecedents or elicitors of emotions. Individuals know that seeing an oncoming car lose control and head directly at one's own car most often elicits fear (though it can also elicit exhilaration, for example). Second, such concepts contain information about the actions that are likely to be taken when a given emotion is experienced. Thus people know that fear in humans is often associated with an avoidance or a flight response from the situation. Third, concepts contain information about the introspective states that constitute the "hot" component of emotions. So people know, for instance, that fear is associated with very negative and highly aroused feelings, with a high heart rate, and often with sweating and trembling (Rimé, Philippot, & Cisamolo, 1990). A complete model of emotion concepts must be able to account for the representation of all three types of knowledge (most desirably in a parsimonious way), as well as for the differences between what people say they know about emotion and what is revealed by objective measures of parts of emotional experience (Philippot, 1991).

To preview what follows, the first part of this chapter reviews ways in which emotion concepts have been characterized in the literature. These approaches include dimensional, semantic-primitive, prototype, and semantic-network models. After briefly describing these accounts, I discuss some of the assumptions about representation upon which they are more or less explicitly based. By and large, these accounts view the conceptual system as encapsulated from perceptual (input) and motor (output) systems, and thus as a disembodied system of amodal, abstract symbols. An alternative account, an "embodied-simulation" account, is then presented. Evidence in favor of the idea that concepts in general and emotion concepts in particular are embodied (and what that means) is discussed in greater detail.

EMOTION CONCEPTS AS COMPOSED OF IRREDUCIBLE DIMENSIONS OF MEANING

As mentioned, one way to determine how emotions are conceptualized is to find the basic dimensions underlying the ways in which individuals make judgments about different aspects

of emotions, including the co-occurrences of emotions and the perceived similarity in their various components. This approach does not deny that emotion concepts can be more nuanced and contain further information (as in the prototype account discussed later). But the concern is to uncover the fundamental or irreducible features of emotion concepts. Such dimensions have been referred to as the "primary dimensions of meaning," and they were originally thought to include "evaluation," "activity," and "potency" (Osgood & Suci, 1955).

More recently, researchers taking this approach have endorsed a two-dimensional account of emotion knowledge (e.g., Barrett & Russell, 1999; Larsen & Diener, 1992; Mayer & Gaschke, 1988; Russell & Barrett, 1999; Watson & Tellegen, 1985). The two dimensions, with some differences in how they are believed to be related to each other, correspond to the degree to which a state is "pleasant" versus "unpleasant" and the degree to which a state is experienced as "activated" versus "deactivated." The evidence in favor of a two-dimensional structure of emotion concepts is interpreted as meaning that states that are labeled as "fear" and "anger" are understood in terms of the degree of pleasure and activation that typically characterize them. For example, "anger" is conceptualized as highly unpleasant and moderately activated. And many states of "fear" are conceptualized as moderately unpleasant and highly activated (see, e.g., Russell & Barrett, 1999, and Russell & Mehrabian, 1977, for specific empirical demonstrations of these descriptions).

Although relevant research has repeatedly revealed a two-dimensional structure, the meaning of the dimensions and the relationships between them have not been interpreted in precisely the same way by different theorists. Figure 36.1 depicts the ways that the two dimensions have been interpreted in three theories. As the figure illustrates, although the terms that have been employed differ somewhat, Russell (1980; Barrett & Russell, 1999) and Larsen and Diener (1992) both consider the two underlying dimensions of emotion to be something akin to "pleasantness" and "activation." In contrast, although Watson and Tellegen (1985) also find a two-dimensional structure, these researchers propose that a rotation of the axis of the observed factors by 45 degrees constitutes the best characterization of it. Specifically, while two dimensions—"pleasantness" versus "unpleasantness" and what they call "engagement" versus "disengagement" (which can be considered a reinterpretation of the activation dimension)—emerge from their data, they hold that the dimensions of theoretical interest lie 45 degrees between those axes, and should be labeled "negative activation" (high to low) and "positive activation" (high to low) (Watson, Wiese, Vaidya, & Tellegen, 1999). In the original Watson and Tellegen paper, these dimensions were called "positive affect" and "negative affect." In this view, fundamental emotion concepts contain the notion of being engaged in an experience while feeling unpleasant and highly activated ("negative activation") and the notion of being engaged in an experience and feeling pleasant and highly activated ("positive activation").

In support of their interpretation, Tellegen, Watson, and their colleagues note that most of the terms that individuals use in daily life to label their emotions seem to cluster in the parts of the dimensional space corresponding to the 45-degree rotation, so that characterizing emotion structure with a focus on these parts of the space is important. Furthermore, they are most interested in *high* negative activation and *high* positive activation, in part because they do not believe that words such as "sleepy" that anchor the low-activation ends of the dimensions necessarily refer to actual emotional states.

The type of methodological and analytic strategy applied to judgments of and perceptions of the subjective experience of emotion and emotional objects tells us something about the concepts that underlie individuals' perception of the subjective experience of emotion. It does not reveal or account for the antecedent and situational knowledge about emotion that individuals apparently possess. The next two approaches, the semantic-primitives and the prototype approaches, try to readdress these shortcomings.

DEFINING EMOTION CONCEPTS WITH SEMANTIC PRIMITIVES

There is debate about the meaning of the structure revealed by multidimensional and factor analyses of individuals' perceptions of the relations between emotional states. According to some theorists, the resulting dimensional structures reveal the dimensions that are most important for building emotion concepts, but do

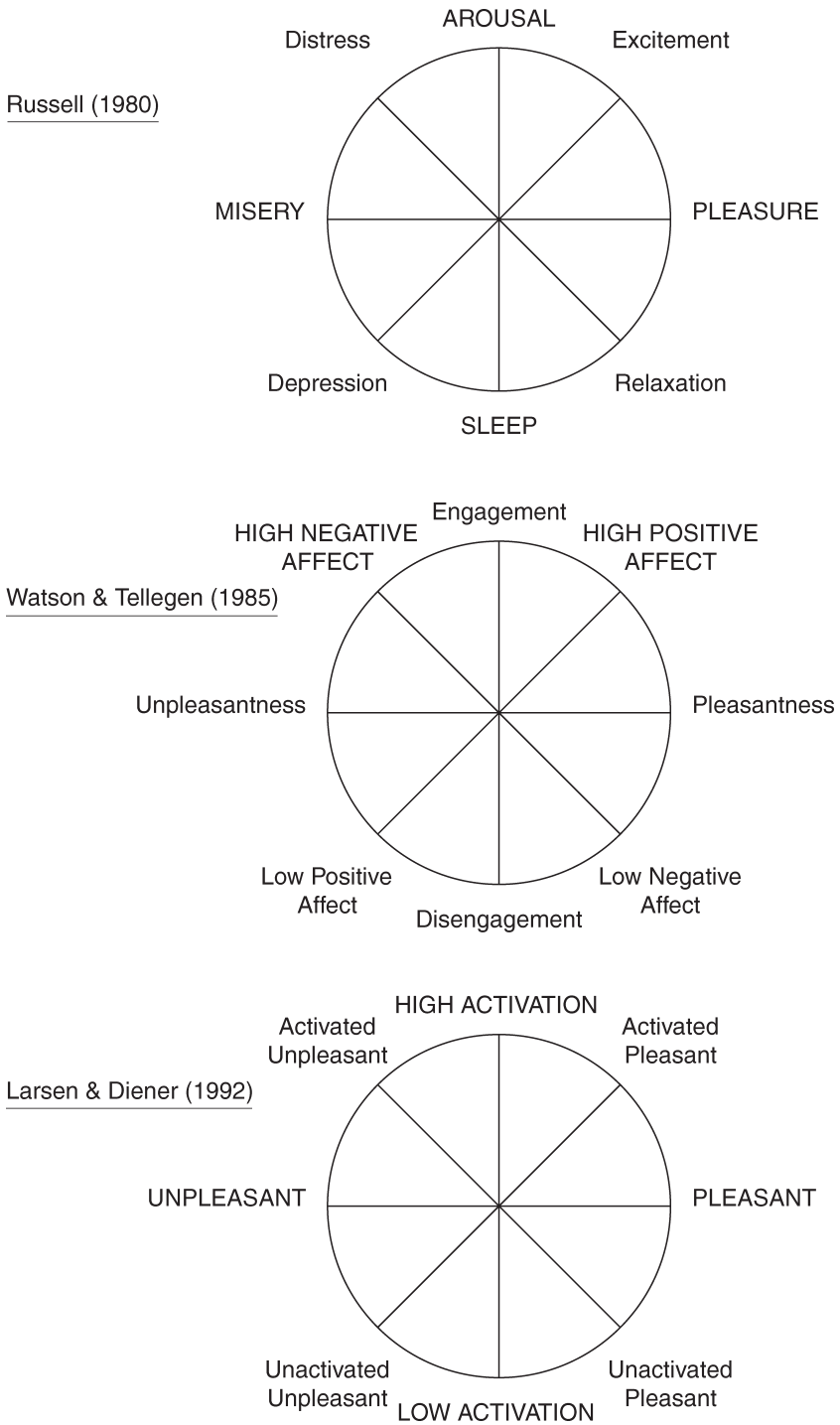

FIGURE 36.1. Three descriptive models of experienced affect. Dimensions of theoretical interest are given in capital letters. From Russell and Barrett (1999). Copyright 1999 by the American Psychological Association. Reprinted by permission.

not solve the problem of characterizing the content of emotion concepts. Wierzbicka (1992), for instance, suggests that the concept "pleasant," while perhaps more inclusive and even basic than the concept "happy," is not in any way better defined; it is probably as complex an abstract concept as "happy." Therefore, while "pleasantness" may be a more fundamental component of experience, this only pushes the need to define emotion concepts to a different level. Now we have to ask what constitutes the concept "pleasant."

One possibility is that emotions, perhaps some set of biologically basic ones, possess classical definitions. Classical theories of concepts call for sets of necessary and sufficient features that characterize all members of a class. A number of arguments can and have been leveled against the classical view as useful to define emotion concepts (Russell, 1991). Because concepts appear to vary across individuals and even within individuals across situations (Barsalou, 2005), it seems that the possibility of deriving classical definitions for any natural kind is unlikely. An alternative approach to defining emotion concepts has been to isolate a set of "semantic primitives" and then to examine the possibility that such concepts can be constructed from this limited set. The construction of lists of semantic primitives is a bootstrapping, bottom-up activity that involves the generation of possibilities and the attempt to define as many concepts as possible, independent of a specific language, and without adding more. Thus, according to proponents of this approach, while the words "anger" and "sadness" are culture-bound and language-specific, semantic primitives such as "good" and "bad," and "want" and "happen," are not. Wierzbicka (1992) proposed the primitives listed in Table 36.1.

These primitives can describe some of the basic themes that characterize emotion (Johnson-Laird & Oatley, 1989). For example, it has been noted that emotions involve good and bad things that happen to ourselves and other people, and that we ourselves and other people do. They also involve other people's and our own evaluations of ourselves and our actions, and the relationships that can be constructed on the bases of these evaluations and reactions. When semantic primitives are used to build these themes, they seem to provide enough nuances to characterize many different emotions. For example, the emotions "happiness" and "fear" can be defined as follows:

Happiness
X feels happy.
X feels something.
Sometimes a person thinks something like this:
    Something good happened to me.
    I wanted this.
    I don't want other things.
Because of this, this person feels something good.
X feels like this.

TABLE 36.1. A List of Semantic Primitives Proposed by Wierzbicka (1992)

Category	Item
Substantives	I, you, someone, something, people
Determiners and qualifiers	this, the same, other, one, two, many/much, all
Mental predicates	thinking (about), say, know (about), feel, want (to)
Actions and events	do, happen (to)
Evaluative	good, bad
Descriptive	big, small
Time and place	when, where, after/before, under/above
Metapredicates	no/negation, because, if/would, can/may
Intensifier	very
Taxonomy/partonomy	kind of, part of
Hedge/prototype	like

Note. From Wierzbicka (1992). Copyright 1992 by the Cognitive Science Society, Inc. Reprinted by permission.

Fear
X feels frightened.
Sometimes a person thinks something like this:
Something bad can happen.
I don't want this.
Because of this, I would want to do something.
I don't know what I can do.
Because of this, this person feels something bad.
X feels like this.

Despite its appeal, the semantic-primitives approach also has some shortcomings. Although the definitions seem to contain information about the antecedents of and situations for emotions, the "hot" or bodily aspect of the emotion, except for its being good or bad, is not contained in the definition. Presumably the bodily experience can be derived from locating a good or bad feeling in the specific semantic context, but it is not clear just how. Some of these problems could be handled by the proposition made by Johnson-Laird and Oatley (1989) that a set of what might be called basic emotions—fear, anger, happiness, sadness, and disgust—are themselves semantic primitives. Then all of the information is consolidated into one symbol for a complex state involving perception, interoception, and action. However, neither use of the semantic-primitives approach addresses the way in which semantic primitives are represented and processed. Although the assumption must be that the primitives are innate, it is still not clear what is being used when they are activated. By default to what has been called "first-generation" representational models in cognitive science (Gallese & Lakoff, 2005), the primitives may be abstract symbols built into the system.

EMOTION CONCEPTS AS PROTOTYPES

As with the search for semantic primitives, the proposal that emotion concepts are defined in terms of probabilistic features was motivated by opposition to classical theories of concepts. Rosch (1973) was an early proponent of two important features of conceptual structure. One is that concepts are organized hierarchically—that is, people know about the features of abstract categories, such as "furniture"; their more specific exemplars, such as "chair"; and even more specific categories, such as "kitchen chair"—and the hierarchies possess certain structural properties, such as nested features and graded structure. Another important idea was that at any given level of abstraction, the represented category (the concept) is a fuzzy one defined by a set of probable features, but not necessary and sufficient ones, that overlap with closely related categories. Thus the boundaries between concepts representing related categories are not strict or impenetrable.

Several researchers have tested the applicability of Rosch's theory of conceptual structure in the domain of emotion knowledge, in order to learn more about how individuals use their knowledge of categories of emotion (e.g., Fehr & Russell, 1984; Shaver et al., 1987). For instance, in Shaver et al.'s (1987) work, experimental participants were supplied with 135 cards, each containing the English name of one emotion or affective state. The participants sorted the cards into piles that represented, for them, groups of words whose meanings went together or were similar. The card sorts were analyzed with another statistical technique—hierarchical cluster analysis, which identifies clusters of variables (emotion words, in this case) and provides information about their hierarchical relations.

Consistent with the work of Rosch, the findings revealed three levels in the structure. The most abstract contained the categories of "negative" and "positive" emotions. The next level contained what appeared to be five or six basic categories. Shaver and colleagues labeled these "love," "joy," "anger," "sadness," and "fear." Although they also found a possible "surprise" category, they were not in favor of allocating it the status of a basic-emotion category. Finally, there were many subordinate categories that reflected fine gradations of the five or six basic categories. For example, the category "fear" could be further broken down into something like "horror/panic" and "nervousness/dread." The authors noted that the five basic categories revealed by the hierarchical cluster analysis are the same as those shown by Bretherton and Beeghly (1982) in their study of emotion terms learned in early childhood. In addition, these five basic categories correspond to the emotions most often proposed to be biologically basic ones in the various lists of basic emotions (e.g., Ekman, 1984). Additional analyses of language report similar findings (e.g., Conway

& Bekerian, 1987; Johnson-Laird & Oatley, 1989; Russell & Bullock, 1986).

Analyses of the explicit content of emotion concepts, as revealed by property generation tasks, have also provided support for Rosch's prototype theory of natural concepts (e.g., Fehr & Russell, 1984; Keltner & Haidt, 2003; Shaver et al., 1987). Knowledge about the basic-emotion categories appears to contain the three types of features described previously (i.e., knowledge of antecedents, situations, and the bodily characteristics of the emotion). Russell (1991) further characterizes the prototypes as scripts (e.g., Abelson, 1981), arguing that prototypes are to objects what scripts are to events. For Russell, emotions are events having a causal and temporal structure, and not objects, and so the notion of a temporally structured script best captures the representation of an emotion (see Table 36.2 for a possible script for anger, based on Lakoff's [1987] analysis). Consistent with prototype theory, moreover, the script contains features that are probabilistic and not "all or none" in nature. Russell (1991) notes that "the features that constitute emotion concepts describe the subevents that make up the emotion: causes, beliefs, feelings, physiological changes, desires, overt actions, and vocal and facial expressions. . . . To know the sense of a term like anger, fear, or jealousy is to know the script for that emotion" (p. 39).

The prototype account of emotion concepts can show and has shown how the three types of information are contained and fit together in an emotion concept. The notion of a prototype, or a script, largely makes claims about how something emotional (a facial expression, a subjective experience, a situation, or a behavior) is classified as constituting an instance of a particular emotion. Or, as Clore and Ortony (1991) have noted, "Prototypes seem, therefore, not to be concerned with the function of 'defining the concept' but with the function of identifying instances" (p. 50). The semantic-network models, discussed last, represent perhaps the only approach to modeling concepts that is not agnostic to the representation and processing of emotional information.

TABLE 36.2. An Anger Script

Step	Subevent
1	The person is offended. The offense is intentional and harmful. The person is innocent. An injustice has been done.
2	The person glares and scowls at the offender
3	The person feels internal tension and agitation, as if heat and pressure were rapidly mounting inside. He feels his heart pounding and his muscles tightening.
4	The person desires retribution.
5	The person loses control and strikes out, harming the offender.

Note. From Russell (1991). Copyright 1991 by the American Psychological Association. Reprinted by permission.

SEMANTIC-NETWORK MODELS OF EMOTION CONCEPTS

The single explicit class of representational models of emotion concepts in the literature to date consists of the semantic-network models of emotion (Bower, 1981, 1991; Ingram, 1984; Lang, 1984; Teasdale, 1983). The variations on these models hold that knowledge is represented in a semantic network of units of representation sometimes called "nodes," or alternatively "concepts," "categories," "traces," "processors," or "units" (Collins & Loftus, 1975; Anderson & Bower, 1973). Nodes store and transform information in propositional form. They are linked by connecting pathways that reflect the strength of semantic associations among them. A particular idea comes to mind, or enters consciousness, when its node is activated above some critical threshold. A node can be excited by the spread of activation from neighboring nodes, or through direct sensory stimulation.

The semantic-network models of emotion all propose that emotions impose a fundamental organizational structure on information stored in the semantic network. Each emotion or affective state is conceptualized as a central, organizing node. Nodes that represent beliefs, antecedents, and physiological patterns associated with given emotions are linked to the nodes corresponding to those nodes in memory. Of course, one has to ask this question: Which emotions impose a fundamental organization? Bower (1981) proposed that the set of so-called "basic emotions" imposed such organization, although his later writings suggested that the network was organized according to valence (e.g., Bower, 1991). Research and theoretical considerations (see Niedenthal, Setterlund, & Jones, 1994, for a discussion)

provide strong arguments in favor of the 1981 model.

A categorical or discrete-emotions version of the model makes the straightforward prediction that when an emotion unit (e.g., the unit that represents "sadness") is activated above some threshold, activation spreads throughout the network to associated information. Autonomic reactions, expressive behaviors, emotion-related events, and personal memories are thereby excited and may enter consciousness. For instance, when one is feeling happy, the material in memory related to happiness becomes activated. As a consequence, one may experience an increase in heart rate and in blood pressure, an activation of the zygomaticus major muscle, and a heightened accessibility to the words and memories associated with happiness. In some versions of this model, the nodes that represent "opposite" states (e.g., perhaps happiness and sadness) are connected by inhibitory links, such that the activation of one emotion node leads to the inhibition of the other one (Bower, 1981). For instance, activating happiness is expected to inhibit the activation of sadness.

This model has been applied to account for "emotion congruence" and to generate other predictions about emotion and information processing. The emotion congruence hypothesis states that the processing of emotional information that has an emotional quality congruent with the quality of the emotional state experienced by the individual/perceiver will be more efficient than the processing the processing of information that has an incongruent emotional quality. For example, when applied to perception, the emotion congruence hypothesis states that objects and events that have the same emotion significance as the individual's current affective state are perceived by that individual with greater efficiency than other stimuli, such as neutral or emotion-incongruent stimuli. Findings supportive of this hypothesis have been reported (e.g., Niedenthal, Halberstadt, & Setterlund, 1997; Niedenthal & Setterlund, 1994; see Niedenthal et al., 1994, for a discussion). Other demonstrations of an emotion congruence effect as predicted by a semantic-network model have been reported for retrieval from long-term memory (e.g., Bower, Gilligan, & Monteiro, 1981; Eich, Macaulay, & Ryan, 1994; Ehrlichman & Halpern, 1988; Fiedler & Stroehm, 1986; Mayer, McCormick, & Strong, 1995) and judgment (e.g., Abele & Petzold, 1994; DeSteno, Petty, Wegener, & Rucker, 2000; Forgas, 1992, 1993, 1995; Lerner & Keltner, 2001).

The semantic-network models are powerful for accounting for and generating some hypotheses regarding the structure and content of emotion concepts (see Niedenthal et al., 1994, for a discussion). However, in these models, each node is connected to many other nodes, and each node is itself defined entirely in terms of its relation to the other nodes. The problem, then, is that tracing out relations between undefined nodes does not result in meaning. Therefore, as in the other models described thus far, it is not clear what grounds emotion concepts. Some underlying assumptions of the approaches described thus far are considered explicitly in the next section.

FIRST-GENERATION MODELS OF EMOTION REPRESENTATION

Although their purposes were not always to test this assumption, or even to be explicit about it, all the accounts of emotion concepts described thus far represent concepts as redescriptions of the input from the sensory system into an abstract language (Barsalou, 1999; Gallese & Lakoff, 2005). Thus extant and explicit representational models of emotion are based on a general view of cognition in which higher-order mental content is represented in an abstract, language-like code (e.g., Fodor, 1975), and the symbols used in higher-level cognitive processes are "amodal." An amodal representation does not preserve anything analogical about the perceptual experience of the object, event, or state, but is abstracted and abstract in format (e.g., Ortony, Clore, & Collins, 1988).

Whether the resulting representation takes a form something like a word, a feature list, or vectors on which different values can be positioned, the assumption is that the representation and the initial perception do not take place in the same system. The dominant approach to representing emotion knowledge thus rests on the "transduction" principle (Bower, 1981; Johnson-Laird & Oatley, 1989; Ortony et al., 1987). According to this principle, knowledge structures are taken from emotional experience

and then redescribed to represent emotion concepts. Furthermore, representing knowledge of an emotion in the absence of experiencing it involves activating the appropriate amodal representation (e.g., in the case of the semantic-network models, an emotion node). Because it describes different parts of the events and experiences relevant to the emotion, when activated the knowledge structure can support inferences about it.

In evaluating the strength of such models, we (Niedenthal et al., 1994) noted:

> [Although] some emotion theorists view propositional codes as sufficient for representing emotional stimuli, meaning, and responses[,] it is possible that other types of code preserve the visual, motor, and somatovisceral aspects of such experience. That we recognize a subjective feeling as "what it is like to be in love" is neither cold nor trivial. Rather, this fact means that there exists a memory of the bodily feeling of an emotion that has been associated with a verbal label. Thus, the general idea that emotions are stored in and organize memory in an associative way does not have to do away with the "hot" aspects of emotion; an exclusive focus on propositional representation may do so. (p. 106)

EMBODIED-SIMULATION THEORY

The social psychology and emotion literatures are filled with evidence (see a review in Niedenthal, Barsalou, Ric, & Krauth-Gruber, 2005), now supported also by findings from neuroimaging studies, that there is a different way to model emotion concepts—one that follows from the concerns cited in the quotation above (Barsalou, 1999; Gallese & Lakoff, 2005). In theories of "embodied cognition," the modality-specific states that represent perception, action, and introception when one is actually in interaction with a particular entity, or having a particular subjective experience, *represent* these same stimuli and events when the original entity or experience is not actually present. Put otherwise, in this view, using knowledge involves simulations that are reactivations in the sensorimotor system. For example, retrieving the memory of a landscape involves reactivating parts of the visual states that were active while the person was originally perceiving it. In the same manner, thinking about the movements involved in riding a bicycle involves partially activating the motor states that support the activity.

What having a concept is, then, is having the ability to reenact being with an instance of a category, or having the ability to simulate it. Concepts in this approach are therefore also called "simulators" (Barsalou, 2003) or "embodied simulations" (Gallese & Lakoff, 2005). According to Barsalou's account, a simulator develops for any object, event, or aspect of experience that has been repeatedly attended to. Due to its exquisite flexibility, attention can be allocated to different parts of our overall experience. Across development, a number of simulators are established in long-term memory to represent these different experiences. After a simulator is established, it can be used to reenact aspects of experience, thus supporting the capacity to perform conceptual tasks.

Representing Emotion Concepts Modally

Extending the embodied-simulation account to emotion knowledge holds that modality-specific states represent the content of concepts of emotion. In considering the three domains of emotion knowledge mentioned earlier—antecedent situations, actions or action tendencies, and introceptive states—the embodied-simulation account says that reenactments of modality-specific states, rather than amodal symbols, represent the conceptual content in these domains. So reenactments of visually perceiving smiles on other people's faces belong to the situational knowledge that triggers "happiness," as do the motor and somatosensory experiences of smiling oneself. Similarly, reenactments of valence and arousal states represent these introspective aspects of emotion concepts, rather than amodal symbols that stand in for them.

In such a view, then, knowledge of an emotion concept is not a separate description of the respective emotion. Instead, knowledge of the emotion is grounded in actual emotional states, some conscious and some unconscious. Although these states may not constitute full-blown emotions, they may usually contain enough information about the original states to function as representations of them conceptually. Importantly, these partial reenactments constitute the core knowledge of emotional concepts. Embodied states are not merely peripheral events that trigger emotion concepts,

or that result from the activation of such concepts. (This latter description does characterize accurately how a semantic-network model would link conceptual knowledge and bodily manifestations of emotion.) Instead, embodied states represent the core conceptual content of an emotion.

Empirical Support for Embodied-Emotion Concepts

Evidence in favor of simulation in the conceptual processing of emotion was recently demonstrated in two studies (Mondillon, Niedenthal, Vermeulen, & Winkielman, 2007). In the first of those studies, individuals had to make judgments about whether words referring to concrete objects (e.g., "vomit") were associated with an emotion (they did not have to say which emotion; they provided simply a "yes" or "no" response). The list of concepts to which the experimental participants were exposed included concepts that were associated with joy, disgust, and anger, as well as no particular emotion. While the participants were exposed to the concepts and making their judgments, the activation of four facial muscles was measured with electromyographic recording. Two of the muscles, the orbicularis (around the eyes) and the zygomaticus major (around the mouth) muscles, are typically activated when an individual is smiling with happiness. The corrugator (over the eyebrows) is typically activated when an individual is frowning with anger. And the levator muscle is activated when an individual makes the grimace of disgust.

According to the amodal representational models, the judgment that, for example, the word "slug" is associated with disgust does not require the simulation of being there with a slug. That it engenders disgust is another feature of slugs that is represented in a feature list by an amodal representation. It can be accessed without recourse to the emotion itself. On the other hand, the embodied-simulation model predicts that the judgment is based on a simulation of being there with a slug. Consequently, the amodal models do not predict that judgments about whether an object is associated with an emotion are accompanied by the specific emotional experience (a simulation, which can be detected by activation of facial muscles), whereas the embodied-simulation model does predict this.

The results of the study just described, as well as a second study in which the words to be judged were abstract emotion words (e.g., "enraged," "delighted," and "disgusted"), supported predictions of a modal account of representation. Specifically, in both studies, judgments about words that refer to objects eliciting joy or that are synonyms for "joy" were accompanied by specific activation of the orbicularis and the zygomaticus major muscles; judgments about words that refer to objects eliciting anger or that are synonyms for "anger" were accompanied by specific activation of the corrugator muscle; and judgments about words that refer to objects eliciting disgust or that are synonyms for "disgust" were accompanied by activation of the levator muscle. Thus the findings support a proposed process by which conceptual processing involves simulation of the concept in sensorimotor systems.

Another type of specific evidence comes from an extension of research on "switching costs" to the area of emotion. Researchers in perception have known for a while that shifting attention from processing in one sensory modality, such as vision, to another, such as audition, involves temporal processing costs (e.g., Posner & DiGirolamo, 2000; Spence, Nicholls, & Driver, 2000). Interestingly, similar costs are also found when participants engage in a purely conceptual task. For example, Pecher, Zeelenberg, and Barsalou (2003) found that participants were slower in verifying properties of a concept from one modality after they had just verified a concept from another modality (e.g., "bomb–loud" followed by "lemon–tart"), once again suggesting involvement of perceptual processes in conceptual representation (see also Kan, Barsalou, Solomon, Minor, & Thompson-Schill, 2003, for neuroimaging evidence).

We (Vermeulen, Niedenthal, & Luminet, 2007) examined switching costs in verifying properties of positive and negative concepts such as "triumph" and "victim." Properties of these concepts were taken from vision, audition, and the affective system. Parallel to the switching costs observed for neutral concepts, the study showed that for positive and negative concepts, verifying properties from different modalities produced costs, such that reaction times were longer and error rates were higher than if no modality switching was required. Importantly, this effect was observed when par-

ticipants had to switch from the affective system to sensory modalities, and vice versa. In other words, verifying that a "victim" can be "stricken" was slower and less accurate if the previous trial involved verifying that a "spider" can be "black" than if the previous trial involved verifying that an "orphan" can be "hopeless." And verifying that a "spider" can be "black" was less efficient when preceded by the judgment that an "orphan" can be "hopeless" than that a "wound" can be "open." This research provides evidence that affective properties of concepts are simulated in the emotional system when the properties are the subject of active thought.

Recently, we (Niedenthal, Barsalou, Ric, & Krauth-Gruber, 2005) reviewed many additional findings from the emotion literature to further reinforce this view of how emotion concepts are grounded. The additional findings indicate that individuals embody other people's emotional gestures and postures; that embodied emotional gestures and postures can produce corresponding emotional states in an individual; that imagining other people and events also produces embodied emotions and corresponding feelings; and that embodied emotions mediate cognitive responses. Taken together, then, the logical and experimental data in favor of this modal account of emotion concepts are very strong and motivate many important questions for the field.

EMOTION CATEGORIES AND CONCEPTUAL CONTENT

If knowledge acquisition occurs through embodiment (Niedenthal, Barsalou, Winkielman, Krauth-Gruber, & Ric, 2005), then this account suggests ways to address two important concerns that have been raised in this chapter. One concerns what emotion concepts really correspond to. In the embodied-simulation account of emotion, concepts are simulations that are used online for the purposes of performing conceptual tasks. So, as we have seen, in order to know that a "slug" is associated with an emotion, we simulate the sight of a slug and our affective response (if any) to it. Or, if we need to list (for Shaver et al. or for Russell) the typical features of a state of anger, we can simulate it and describe that (re)experience in words. This means that there is little difference between what we know about emotion and the process of having an emotion. The situated nature of knowledge about emotion, moreover, makes the link between a concept and a specific "natural-kind" (or other) category a moot point (Barrett, 2006).

Thus the account can address a second concern—namely, individual and cultural differences in emotion concepts. As we have learned, acquiring emotion knowledge is in part determined by the allocation of selective attention to parts of experience or incoming information (such as facial expressions or other emotional gestures). That is, even if many processes operate automatically when an emotion is evoked and experienced, this does not mean that a residue of all such processes is present in a representation in long-term memory of the antecedent events or of the experience of the emotion. Over different experiences with an emotional state, selective attention can be allocated to different aspects of the embodied emotion (because much of it is potentially available to consciousness, including changes in heart rate, breathing, and muscular tension), and this supports nuanced individual and cultural differences in the content of emotion concepts.

Strategies for characterizing these differences are already established. Neuroimaging studies of the brain subsystems that support conditioned learning (e.g., conditioned fear learning), observational learning, and instructed learning can help us better understand the differences in the role of experience versus concepts in knowledge about emotional events. Suggestive evidence shows that there are important similarities, and fewer but also important differences, in neural activation during these three types of fear learning (e.g., Phelps et al., 2001). Future studies will be able to link the role of attention to specific features of the initial experienced situation that are simulated in concept use.

CONCLUSION

In this chapter, I have reviewed some of the dominant models of emotion concepts. I have noted that the models are not competing with each other, as they actually attempt to do quite different things. Dimensional analyses try to define the irreducible structure and content for emotion concepts. A semantic-primitives ap-

proach has a similar aim for defining the content, although not the structure, of emotion concepts. A prototype approach says quite a bit about the content of emotion concepts and how it is used to identity instances. And only the semantic-network models address representation and process. Recent findings in the cognitive, social, and emotion psychology literatures indicate that there is a closer relationship between sensorimotor experience of and with entities in the world and the knowledge we possess about them than the semantic-network models would suggest. In the present chapter, therefore, I have tried to summarize the principles of and the utility of the more recent theory that the conceptual content for emotion knowledge is grounded in the sensorimotor states occurring in interaction with emotional stimuli and in the experience of emotional states. This model will not suffice for accounting for all cognitive phenomena that we observe, and I do not make that argument here (see Solomon & Barsalou, 2004). I believe, however, that this theory should be viewed as providing a priori accounts of embodied phenomena that traditionally have been difficult to explain. I believe that an embodied-simulation account of emotion concepts can provide emotion psychologists with powerful new ways of theorizing about representations and the mechanisms that process emotions.

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