Running head: EMOTIONS AND METAPHOR

The Origins of Some Emotions in Conceptual Metaphor

Lisa M. Lindeman

University of Wisconsin, Madison

Abstract

According to cognitive theories of emotion, some emotional responses to life events are determined by conceptual evaluations, or appraisals, of the abstract meaning or personal significance of the event. How do these evaluations yield emotion, and how are appraisals and emotions related? Research on embodied cognition offers a clue. Abstract concepts, such as time, power, and communication, involve the partial mental simulation or reenactment of particular sensory perceptions and motor activity. Some of these simulations form the basis of conceptual metaphors, where a sensory experience supplies the substance and structure of the abstract concept due to their conflation in early experience. Because sensory-motor imagery is subjectively like perception, using some of the same areas of the brain and producing peripheral physiological activity that mirrors the imagined scene, metaphorical concepts should generate sensations and motor impulses like those composing certain emotions. I propose that some emotions are simulations or reenactments of sensory-motor experiences, such as falling, smothering, or carrying something heavy, where these experiences are metaphors for the abstract, personal significance of events, such as failure, limitation, or responsibility.

Keywords: emotion, appraisal, metaphor, embodied cognition

The Origins of Some Emotions in Conceptual Metaphor

How do life events generate emotion? Consider the experience of an employee who depends heavily on her salary and suddenly gets laid off. Her manager approaches her, pulls her aside, and tells her things are not working out. Upon hearing the news, she is devastated. Overcome with a heavy sinking feeling deep within, her body feels shaky, her knees feel weak, and she finds it difficult to breath. She walks away slowly and leans on a chair for support. How did her conversation with her manager produce such an intense emotional reaction? One could imagine another employee in the same establishment receiving the same news, yet walking away feeling light and liberated, as if a weight had been lifted. One could also imagine the same employee receiving the same news a day earlier or a day later and feeling angry or depressed rather than devastated. This leaves one to wonder what processes interceded to transform a conversation with no immediate physical consequences into such an overpowering bodily experience.[1]

Conceptual evaluations of the abstract meaning or personal significance of events, known as appraisals, play a major role in determining the emotional outcome of events, particularly in response to novel events with no physical consequences or intrinsic (i.e., genetically-endowed) meaning (Arnold & Gasson, 1954; Arnold, 1960, 1970; Lazarus, 1966; Beck, 1976; Ellis, 1973; Abramson et al., 2002; Weiner, 1985; Roseman, 1991; Smith & Kirby, 2001). For example, getting a flat tire has no intrinsic emotional value. Upon evaluation, however, the fact that the

[1] In this paper, emotion primarily refers to the feeling tone or subjective qualia associated with emotional experience, including bodily sensations, physical urges and motor impulses as opposed to the cognitive components or cognitive effects of emotion. How these two aspects of emotion are related is clarified later in context with the current model.

flat results in a loss of personal mobility, damage to a useful possession, and delayed arrival to a desired destination can elicit frustration and a sense of powerlessness. On the other hand, the flat tire can be evaluated as an opportunity to demonstrate skill at repairing mechanical equipment, which would elicit pride or delight. Frijda (1993a) notes that "assuming a process of appraisal mediates between events and emotions is the clue to understanding that a particular event evokes an emotion in one individual and not in another, or evokes an emotion at one moment, and no emotion, or a weaker or stronger one, at another moment."

If conceptual evaluations translate simple perceptions of events into emotional reactions, how does the conceptual evaluation then generate emotion? Theoretical models of appraisal have focused on the content of appraisals with the aim of identifying the key evaluations (e.g., control, certainty, blame, anticipated effort) that correspond to each emotion (Roseman & Smith, 2001; Ellsworth & Smith, 1988; Roseman, 1991; Scherer, 1993). For example, in the model proposed by Ellsworth and Smith, happiness is associated with low effort and high certainty while fear and anxiety are associated with uncertainty, low control, and a lack of predictability. Roseman (1979) constructed a list in which judgments on the availability, desirability, probability, agency, and legitimacy of an event determine the appropriate emotion. Patterns of these dimensions differentiate among a wide variety of emotions (Roseman, Antoniou, and Jose, 1996). However, research correlating dimensions of appraisal with different emotions offers only a partial answer to the question of how events lead to emotion. How does the appraisal of an event, or how do these various components of appraisal, then generate emotion? More specifically, what are the causal mechanisms linking thoughts in the mind to emotional sensations and motor impulses in the body?

Theoretical Model

The purpose of this paper is to present a theoretical model describing how certain conceptual evaluations of the personal significance of situations and events yield emotion. According to the model, *some emotions are simulations or reenactments of common sensory-motor experiences* that result when we conceptualize the abstract, personal meaning of an event metaphorically in terms of that physical experience (see Figure 1). These simulations occur fairly automatically, involuntarily, and mostly outside of conscious awareness. However, they are accompanied by subjective sensations that resemble the simulated experience, as if one were reliving that experience.

In the case of the employee who lost her job, the woman sees her job metaphorically as a physical support structure, the ground under her feet. In other words, she conceptualizes the abstract support provided by her job as the physical structure upon which she stands, which is to say that her understanding of the situation is grounded in partial simulations of her experiences with physical support structures. The job "holds her up," providing a "foundation" for her goals, a "platform" from which to launch her dreams. She "leans heavily" on it, because she has no "safety net." When she loses her job, this support structure is abruptly demolished and suddenly gives way. She has "nothing left to stand on" and begins to fall. In attempting to articulate her perceptions of the situation, she might say, "they pulled the rug out from underneath me" or "the bottom fell out." She feels as if she is plummeting, responding physically to this metaphorical simulation as though it were real. She feels a sudden lack of pressure from under her resulting in uncomfortable tingling sensations in her feet, shins, and knees. Her legs become wobbly, and she takes more careful steps. She interprets these sensations as an emotional experience, which she might describe as devastation or shock.

In contrast, another employee might instead see her job as a restraint or burden impeding her movement or weighing her down. When this employee loses her job, she is "relieved" of her "work load" or "released" from the "confinement" of a job, "unfettered" by work, no longer "shackled" by a full-time commitment. Instead of feeling devastated, she feels uninhibited and buoyant. Her body seems to weigh less, and it feels easier to move about. Due to their different conceptual metaphors for the same event, while the first employee would report despair, the second would report relief, with the subjective sensations associated with these emotions matching their respective metaphors.

I refer to this process as metaphor simulation, not because the process of simulation is merely figurative, but because the simulated experiences are metaphorically related to the event as it is appraised.

Bodily Effects of Conceptual Metaphors

According to the above account, metaphor simulation leads to subjective sensations and motor impulses associated with activity in the brain similar to what one would see if the simulation were real. Metaphor simulation in appraisal also leads to some peripheral physiological activity that resembles the experience, such as localized changes in body temperature, blood flow, or breathing patterns, as well as motor responses, reflexes, or urges to act consistent with the bodily experience, such as flinching or wincing, extending or withdrawing extremities, running away, bracing for impact, gagging, gasping or holding one's breath, aggressive or self-protective gestures, slouching, or pushing against a restraint. These peripheral effects are not necessarily intentional or voluntary. They may occur even if the person is unaware of the bodily experience being simulated. Of note, the simulation may include aspects

of the original sensory-motor experience that people are generally unaware of, such as a faint queasiness associated with rapid motion.

Finally, metaphor simulation in appraisal also leads to any innate or learned physiological, behavioral, or affective responses (e.g., distress, pleasure, the startle reflex, the fight-or-flight response, physiological arousal, piloerection) associated with the metaphorical scenario (e.g., physical contact with a caregiver, falling, physical attack, a rapidly approaching object, a gust of cold air). For the devastated employee who lost her job, for example, in addition to feeling as if she is plunging into an abyss, she would experience the heart palpitations, shortness of breath, and general arousal that occur when actually falling. Thus, *some of the physiological correlates of some emotions result from the simulation of bodily experiences*.

The Mechanisms of Appraisal

The metaphor simulation model represents an elaboration of appraisal theory. Current explanations for how concepts give rise to emotion generally call upon three cognitive processes: associative learning, verbal reasoning, or innate, evolved links between perceptions and emotion or between patterns of appraisal and emotion. Smith and Kirby (2001) propose that these three occur in parallel. Associative processing involves the rapid and automatic activation of memories. A particular song, for instance, might remind a person of the sadness they felt saying goodbye to a close friend, because the song was playing in the background or happened to be their friend's favorite tune. Associative processing contrasts with slower, more deliberative reasoning, which they contend is linguistically encoded (e.g., verbal internal dialogue, such as, "I am a bad person"). However, they do not explain the process by which verbal reasoning would ultimately generate an emotional state. Finally, they propose that the connection between certain

stimuli and certain appraisals may be innate: "some perceptual stimuli... may be preset to carry certain appraisal meanings that can be detected directly, without involving either the activation of memories or reasoning processes." Öhman and his colleagues also attribute emotional responses rapidly evoked by certain stimuli, such as the image of snakes and spiders, to evolutionarily prepared appraisal patterns (Öhman, 1997, 1999; Öhman, Flykt, & Lundqvist, 2000). Whether such perceptions can or should be called appraisals is debated. While Öhman argues for a direct link between perceptions and emotions, Lazarus (1994) proposes that "the connection between relational meaning and each emotion is innate, a characteristic of the species… if the person appraises his or her relationship to the environment in a particular way, then a specific emotion—which is tied to the appraisal pattern—always follows." According to these proposals, evolution established fairly direct links between certain stimuli and certain conceptual evaluations and between those conceptual evaluations and certain emotions. Thus, the causal mechanisms are simply evolutionarily determined links.

The metaphor simulation model adds to the above accounts by (1) proposing additional causal mechanisms linking thought and emotion and (2) allowing for the generation of emotional experience in response to events with no direct innate or learned effects. It offers an explanation for how appraisals acquire the power to generate emotion, an explanation that extends beyond the proposition that the connection between the two is solely the result of evolution or simple associative processing. It instead draws upon theory and research on the nature of cognition. According to the model, the connection between appraisal (or mental concepts) and emotion (specifically, the sensations and behavioral impulses associated with emotion) is facilitated by conceptual metaphors which simultaneously capture the abstract or psychological meaning of

events and replicate sensory-motor experience. Through conceptual metaphor, evolved tendencies and associative learning may continue to play a role in linking thought and emotion.

Scope of the Model

Before moving on, the scope of the model should be clarified. The domain of emotion is highly variegated (Lambie & Marcel, 2002), with multiple causal pathways to emotional experience (Parkinson, 2007). Not all events require conceptual evaluation in order to elicit emotion. In some cases, the physical properties of a stimulus are sufficient to trigger an innate or learned emotion response program (such as the startle response upon hearing a loud noise, alarm upon sighting a predator, pleasant affect in good weather, distress when in physical pain, or the gag reflex when tasting something bitter) (Izard, 1993; LeDoux, 1996; Cosmides & Toobey, 2000; Toobey & Cosmides, 1990). The extent to which perceptions of the stimulus qualify as appraisals is largely a matter of definition. In either case, the emotional response appears to be a fairly direct effect of simply perceiving features of the stimulus.

However, direct stimulus effects cannot account for all emotional experiences. For example, students experience trepidation, disappointment, exultation, and sorrow over the grades they receive on final exams. Essentially, they are physically affected by a letter of the alphabet on a sheet of pressed wood pulp (or displayed on a monitor). How does something so inherently meaningless generate a feeling? How do events that have no apparent bearing on physical survival and no explicit significance, like watching an unfair law go into effect or losing a board game, elicit vivid and moving bodily sensations that seem so relevant? These are the questions addressed by cognitive theories of emotion.

Like other cognitive theories of emotion, the metaphor simulation model is not intended to be a comprehensive explanation for every emotion. It is not intended to replace or subsume

learning theories of emotion or the idea that some emotion results from innate psychological and biological responses to certain perceived stimulus features (see Cosmides and Toobey, 2000). Rather, the model is essentially a marriage of cognitive theories of emotion and embodied cognition with interesting consequences for emotion phenomenology and physiology. The model applies primarily to cases in which the situation evoking the emotion requires some conceptual evaluation and does not trigger an emotion in virtue of certain objective stimulus properties. Furthermore, the model does not necessarily encompass all of the cognitive precursors of emotion. Other non-metaphorical cognitive processes (e.g., making predictions, recognizing patterns of experience) are likely involved in evoking emotion. At the very least, these other cognitive processes would influence one's choice of concept to represent the meaning of an event.

SENSORY-MOTOR SIMULATION IN CONCEPTUALIZATION

In exploring exactly how abstract concepts lead to emotion, the underlying nature of abstract concepts is, of course, highly relevant. A growing paradigm in the cognitive sciences is embodiment, which holds that concepts, rather than consisting of arbitrary symbols for things in the outside world, are rooted in sensory-motor experience (see Barsalou, 2008, for a review; Barsalou, 1999; Lakoff & Johnson, 1980, 1999; Johnson, 1987; Lakoff & Turner, 1989; Lakoff & Núñez, 2000; Pecher, Zeelenberg, & Barsalou, 2004). In embodied cognition, sensations and motor actions are the necessary building blocks of thought. Thelen et al. (2001) explain: "To say that cognition is embodied means that it arises from bodily interactions with the world. From this point of view, cognition depends on the kinds of experiences that come from having a body with particular perceptual and motor capacities that are inseparably linked and that together form the matrix within which memory, emotion, language, and all other aspects of life are meshed."

More precisely, concepts involve the partial mental simulation or reenactment of perceptions and actions using many of the same neurons as actual perception and action (Barsalou, 1999; Gallese, 2005; Gallese and Lakoff, 2005). Gallese and Lakoff (2005) conclude that "the same neural substrate used in imagining is used in understanding." For instance, according to embodiment, the concrete concept of dessert is rooted in sensory experiences with desserts and comprises the partial simulation of the tastes, smells, and images associated with desserts.

Abstract concepts, such as infinity, opportunity, certainty, and time, also involve mental simulations or reenactments of sensory-motor experiences. For instance, Barsalou (1999) explains how perceptual simulations can structure an abstract concept such as truth. Although truth itself is intangible, the course of events or arrangement of circumstances that one would label as truth (e.g., comparing a visual scene to one in memory) is rooted in perceptions and actions and can be mentally recreated.

Several lines of research support the idea that concepts involve sensory-motor simulations: (1) concepts activate sensory-motor areas of the brain; (2) concepts interfere with sensory-motor experiences and vice versa; (3) concepts affect the body in ways consistent with sensory-motor simulation; (4) constraints on sensory-motor experience influence conceptualization; and finally, (5) the existence of multimodal neurons. These five findings are discussed below.

First, concepts activate relevant sensory-motor areas of the brain (see Barsalou et al., 2003, for a review). Concepts for motor actions, such as kicking, activate areas of the brain responsible for the particular motor movement (the primary and premotor cortex) (Hauk, Johnsrude, and Pulvermüller, 2004; Tettamanti et al., 2005; Kable, Lease-Spellmeyer, & Chatterjee, 2002). These concepts may be evoked through reading or hearing the word for the

action or seeing a picture depicting the action. Damage to sensory-motor regions of the brain disrupts the ability to process categories (e.g., birds) strongly associated with the damaged modality (e.g., vision) (Barsalou, 1999; Damasio, 1989; Gainotti et al., 1995; Pulvermüller, 1999).

Second, concepts interfere with current sensory-motor experiences, and current sensory-motor experiences interfere with the comprehension of conceptual language. Conceptual processing takes place more quickly or more slowly when the sensory-motor features of the concepts are at odds with a person's bodily state. Glenberg and Kaschak (2002) found that response times were faster for verifying the sensibility of sentences when the action required to make the response (pushing a button closer to or away from oneself to answer affirmatively) matched the action suggested in the sentence (e.g., "Close the drawer" vs. "Give me the bottle"). Stanfield and Zwaan (2001) presented subjects with sentences and pictures, and asked them if the object in the sentence (e.g., "The pencil is in the cup") was depicted in the picture. When the objects in the picture matched the orientation suggested by the sentence (e.g., a vertical vs. horizontal pencil), subjects responded more quickly. Meteyard, Bahrami, and Vigliocco (2007) found that reading verbs describing motion influenced the visual detection of motion.

Third, concepts lead to bodily effects consistent with simulation or reenactment. Buccino et al. (2005) found, using transcranial magnetic stimulation (TMS), that listening to sentences about action produces motor impulses corresponding to that action. Glenberg et al. (2007), also using TMS, found that reading sentences involving giving or receiving objects (e.g., "You give Liz the book") modulated motor system activity as measured in the hand.

Fourth, constraints in sensory-motor experience also appear in conceptualization. In sensory perception, switching attention between modalities (e.g., from visual images to sounds)

takes time. Pecher, Zeelenberg, and Barsalou (2003) reasoned that the same time lag would occur when switching modalities in conceptualization. They asked subjects to verify whether or not an object, such as a lawnmower, had a given property, such as being loud or heavy. On the following trial, if the property given for the new object (e.g., "rustle" for "leaves") involved the same perceptual dimension as the property in the preceding trial ("loud"), subjects took less time to verify the relationship. This suggested that the task involved perceptual simulation. If the concepts of loudness or heaviness were symbolically coded, the shift in modality between trials should not have made any difference.

Finally, certain neurons in sensory-motor areas of the brain are activated in response to perceptions of the same event regardless of the sensory modality, suggesting a process of abstraction occurring in areas responsible for sensation and action. The existence of single neurons in sensory-motor areas of the brain that respond to objects and actions whether they are seen, touched, or heard provides evidence for the involvement of sensory-motor experiences in the formation of coherent concepts for objects and actions. Canonical neurons are active during both a specific action, such as a pincer grasp, and the perception of an object that can be acted on in that way, such as a cup with a small handle (Rizzolatti, Fogassi, & Gallese, 2000, 2002; Gallese, 2003b). Neurons in the sensorimotor cortices known as "mirror neurons" are active during both the performance of specific actions like grasping as well as the perception of another person performing those same actions or when hearing a sound associated with that action (Kohler et al., 2002; Gallese, 1999, 2000, 2003a, b; Gallese, Fadiga, Fogassi, & Rizzolatti, 1996; Gallese, Fogassi, Fadiga, & Rizzolati, 2002; Rizzolatti, Fadiga, Gallese, & Fogassi, 1996; Rizzolatti et al., 2000, 2001; Garbarini & Adenzato, 2004). Mirror neurons indicate that the

abstract conceptualization of motor movements shares some of the same neural substrates as the performance of motor movements. According to Garbarini and Adenzato:

> Mirror neurons do not respond to the presentation of objects, but to observation of actions carried out by other individuals. Hence, mirror neurons represent a mechanism capable of coupling the execution and observation of actions: the observation of another individual's action, evokes a specular response in the neural system of the observer, which is activated as-if he himself were carrying out the action that he is observing. The existence of a mechanism coupling the execution and observation of actions decidedly confirms the role of the premotor area, not only in the planning of movements, but also in *the representation of action in the abstract terms of its underlying purpose*. (italics added)

The Traditional Model

Embodiment arose in cognitive science in response to what was perceived as a fundamental flaw in the prevailing information processing paradigm, the symbol grounding problem (Searle, 1980; Harnad, 1990). In the information processing paradigm (Fodor, 1975; Newell, 1980), cognitive processes are computations that transform information (e.g., visual images) using algorithms and result in some output (e.g., memory retrieval, word comprehension, categorization). The mind is thus viewed as a computer (Putnam, 1960). Information is stored in the form of symbols that represent objects in the environment and is structured by schemas, frameworks specifying the relationships between these symbols. The symbols in an information processing system have no intrinsic meaning of their own. They are arbitrary and do not "care" what they are about. However, if concepts are composed of arbitrary

symbols, how do they carry meaning about their real-world referents? Searle elucidated this problem using the analogy of an isolated individual capable of receiving and returning meaningless Chinese symbols based on processing instructions (e.g., if you receive symbol X and symbol Y, output symbol W). Though the individual could return correct answers to questions in Chinese, they would not truly understand Chinese.

Viewing cognition as inherently perceptual helps to resolve the symbol grounding problem. Rather than viewing cognition as a process of symbol manipulation where the symbols have been divorced from the perceptions they represent, or where the perceptual origins of concepts have been "bleached out" (Pinker, 1997), the perceptions remain a fundamental part of those concepts. Barsalou (1999) proposes that perceptions or components of perception can even perform the same functions as symbols:

> Once a perceptual state arises, a subset of it is extracted via selective attention and stored permanently in long-term memory. On later retrievals, this perceptual memory can function symbolically, standing for referents in the world, and entering into symbol manipulation. As collections of perceptual symbols develop, they constitute the representations that underlie cognition. Perceptual symbols are modal and analogical. They are modal because they are represented in the same systems as the perceptual states that produced them. The neural systems that represent color in perception, for example, also represent the colors of objects in perceptual symbols, at least to a significant extent. On this view, a common representational system underlies perception and cognition, not independent systems. Because perceptual symbols are modal, they are also analogical. The

structure of a perceptual symbol corresponds, at least somewhat, to the perceptual state that produced it.

In the context of embodiment, the central claim of the model proposed in this paper is that *appraisal is a form of embodied cognition*. More specifically, evaluations of the personal significance of events involve various abstract concepts (e.g., certainty, agency, control) that are rooted in sensory-motor experience (e.g., moving across a terrain, manipulating objects). The implications of embodiment for appraisal theory have been largely unexplored.

CONCEPTUAL METAPHOR

Abstract concepts derive significant richness and structure from simulations of perceptions and actions that are metaphorical in nature (Lakoff & Johnson, 1980, 1999; Boroditsky & Ramscar, 2002; Boroditsky, 2000; Gallese & Lakoff, 2005). For example, the concept of understanding an idea is enriched by the experience of grasping and manipulating physical objects. This metaphor is expressed verbally in phrases such as "a good grasp of math." Thus, the idea of grasping, whether it be grasping a mug or grasping the meaning of a joke, involves the simulation of sensations and actions involved in wrapping one's hand around an object. Gallese and Lakoff predict that when a person conceptualizes the act of comprehension metaphorically as grasping, sensory-motor areas of the brain responsible for the motor performance of grasping (as well as the perception of another person grasping) will be active. Preliminary evidence supports this prediction (Rohrer, 2001).

Lakoff and Johnson (1980) argue that "metaphor is a way of thinking." Abstract concepts are metaphorical to the extent that a concrete sensory-motor experience is used to think about or structure the intangible or introspective aspects of a situation or entity. The sensory-motor simulations that make an abstract concept metaphorical often involve perceptual features

that do not directly define that concept. Then, later, instances of the concept that lack the particular concrete feature can nevertheless be thought of in terms of that feature. For instance, similarity refers to a situation in which two objects have physical attributes in common. Frequently, similar objects are close together in space, although they need not be close together to be classified as similar. Physical proximity becomes a metaphor for similarity when the concept is applied to objects or entities that are not close together in space or, better yet, have no physical substance at all. For example, one might describe the acting style of two thespians as being close or near to each other to mean that they are similar.

Another example of conceptual metaphor is the simulation of large physical size when considering something important. Lakoff and Johnson (1980) propose that seeing and manipulating large vs. small physical objects provides the perceptual basis for concepts of importance, significance, triviality, or inconsequentiality. Spreading one's arms wide can indicate the huge impact of an idea while holding a slightly-parted pincer grasp near one's eye can indicate miniscule consequences. The concept of importance as size leads to expressions such as "he has a big idea" or "he played a small role." Lakoff and Johnson (1999) explain, "Metaphor allows conventional mental imagery from sensorimotor domains to be used for domains of subjective experience. For example, we may form an image of something going by us or over our heads (sensorimotor experience) when we fail to understand (subjective experience). A gesture tracing the path of something going past us or over our heads can indicate vividly a failure to understand."

Research by Glenberg et al. (2007, mentioned earlier in regard to literal concepts) suggests that the concept of giving or receiving abstract entities (e.g., information, responsibilities) involves the simulation of giving and receiving physical objects with one's

hands. In their first experiment, participants read sentences involving the transfer of abstract entities toward or away from the reader (e.g., "Arthur presents the argument to you" or "You delegate the responsibilities to Anna"). Participants responded faster when the hand movement involved in making the response (i.e., toward or away from the participant's body) matched the direction of the transfer described in the sentence. In their second experiment, using single-pulse TMS, they found that sentences describing transfer modulated motor activity in hand muscles.

The abstract concept of power or control can be conceptualized metaphorically as motor incapacity, low physical elevation or being down (Lakoff, 1987; Lakoff & Johnson, 1980; Schubert, 2005). When classifying the relative power of group labels (e.g., "master-servant" or "parents-child"), response times are faster when the more powerful group label is presented above the label for the powerless group or the powerful group is depicted in the top half of the screen. Judgments regarding power are faster when one must press the up cursor key to identify powerful groups and the down cursor key to identify powerless groups (as opposed to the reverse). In addition, response times are generally slower when making judgments or determinations about powerless groups, suggesting that the concept of powerlessness involves a simulation of motor incapacity (see Lindeman & Abramson, in press).

Lakoff and Johnson (1980) have argued that time is often conceptualized as a landscape across which we move (e.g., "she's approaching a deadline"). Alternatively, events moving through time can be conceptualized as moving objects (e.g., "the deadline is approaching," "her birthday is coming up," "the meeting has been pushed back"). Boroditsky (2000) showed that spatial schemas can be used to structure events in time. She also reviews evidence showing that cultural differences in conceptions of space are accompanied by differences in conceptions of time. Boroditsky and Ramscar (2002) found that traveling through space by flying on a plane or

waiting in line alters how people think about time. Gentner, Imai, and Boroditsky (2002) demonstrated that sentences about events in time are processed by accessing these conceptual metaphors (time-moving vs. ego-moving). They asked subjects to place events on a timeline after reading a sentence describing the temporal relation between two events. The sentence was preceded by three unrelated sentences about time. In one condition, all four sentences illustrated either the time-moving or ego-moving conceptual metaphor. In another condition, the first three sentences illustrated one metaphor (time-moving or ego-moving) while the final sentence involved the other, making it inconsistent with the first three sentences. They found that the response time needed to place events on a timeline as described in the final sentence was greater when the final sentence involved an inconsistent metaphor.

Conceptual vs. Linguistic Metaphor

Conceptual metaphors are neither verbal expressions nor verbal internal dialogue, although they motivate various metaphorical expressions in language (Lakoff and Johnson, 1980, 1999; Reddy, 1993; Nayak & Gibbs, 1990; Gibbs, 1992). Rather, conceptual metaphors (or metaphorical concepts) are simulated sensory-motor experiences, such as moving across a landscape, that provide the structure or substance of abstract concepts, such as the progression of time (e.g., "his birthday is just on the horizon," "after turning forty, you are over the hill," and "put the past behind you"). According to Lakoff (1993), "the locus of metaphor is not in language at all, but in the way we conceptualize one mental domain in terms of another." For instance, one might see an idea as an object, a thing to be created, lost, given or stolen. In this concept, ideas can be big or small depending on their impact, growing or dying depending on their accuracy or usefulness, and new or old depending on when someone first experienced the

idea. The result of conceptualizing ideas as objects are common, mundane expressions such as "I *have* an idea," "that *gives* me an idea," "he *took* my idea," or "we are *looking for* ideas."

The distinction between conceptual and linguistic metaphors is critical. The metaphor simulation model pertains primarily to conceptual metaphors as opposed to their many hackneyed linguistic counterparts. Compared to metaphorical concepts, metaphorical expressions are often more specific and tailored to the situation at hand than metaphorical concepts, and thus offer only an approximation of the underlying concept. Finally, metaphorical expressions, particularly those easily recognized as metaphorical, are often very colorful and imaginative (e.g., "the ideas fell out of her head and landed neatly on the paper"). Metaphorical concepts, on the other hand, are typically very ordinary, conventional, and mundane, as in "he got the idea out of nowhere," but can be extended poetically, as in "he pulled that idea out of his hat" (Lakoff and Turner, 1989), and do not require the exercise of any special creative thinking skills. Indeed, language abilities may be unnecessary for metaphorical thinking. A particular conceptual metaphor need not be reflected in language at all but may be expressed in other ways. Lakoff and Johnson (1999) note, "not all conceptual metaphors are manifested in the words of a language. Some are manifested in grammar, others in gesture, art, or ritual."

Despite this important distinction, throughout this paper, conceptual metaphors will be exemplified by referring to common expressions in language that appear to be motivated by the metaphor. The intention is merely to illustrate the relevant conceptual metaphor. The verbal expressions are not intended to provide empirical data. Thinking or speaking in terms of the words or specific details of these particular expressions is not necessary for having the concept in mind. In addition, the expressions, as opposed to the concepts upon which they are based, are not the causal elements in the proposed model. In fact, the expressions may be partially

engendered by the emotions that result from the metaphorical concepts. The primacy of metaphorical concepts over metaphorical expressions in the proposed model means that the emotions under discussion will not necessarily closely resemble the scenarios in the exemplary expressions but should instead resemble the basic sensory-motor experiences motivating those expressions. For instance, in the opening example, although the employee who lost her job may say, "They pulled the rug out from underneath me," her emotional experience would not necessarily feel just like having a rug yanked out from underfoot but would instead feel more generally like a sudden loss of ground support.

Not Mere Embellishment

Metaphor has a reputation for supplying superfluous linguistic enhancements. Yet, in enabling abstract domains of experience to be understood in terms of sensory-motor domains of experience, metaphor makes concepts more tangible and sophisticated and enables a new set of systematic inferences. For example, the abstract concepts of progress or improvement are often understood as forward movement, as in "the project is moving right along" and "the students sped through the program." Features of forward motion, such as ease or difficulty, fast or slow speed, and direction of motion, are mapped onto features of progress, such as the ease with which subtasks are fulfilled, the pace of progress, and how well one remains on course towards a final goal. In addition, inferences associated with forward motion are mapped onto inferences for progress. If one moves backward, more forward motion is necessary just to catch up. If progress is compromised, more effort is necessary to return to the former state. The sensory-motor domain is referred to as the vehicle or source domain, while the domain of subjective, abstract experience is referred to as the target domain.

To what extent do abstract concepts involve metaphor? According to Lakoff and Johnson (1999), abstract concepts derive most of their richness and substance from metaphor. Lakoff and Núñez (2001) extensively outline the ways in which even the domain of mathematics is heavily structured by metaphorical thought. They conclude, "Metaphor is not a mere embellishment; it is the basic means by which abstract thought is made possible." Lakoff (1993) underscores the ubiquity of conceptual metaphor: "as soon as one gets away from concrete physical experience and starts talking about abstractions... metaphorical understanding is the norm." In contrast, Barsalou (1999) argues that metaphor is unnecessary for abstract concepts. Future empirical research is needed to map out the gray area between Lakoff and Johnson and Barsalou and determine the conditions that herald metaphorical thought and the degree to which metaphor structures cognition. Nevertheless, the research discussed in the previous section suggests that conceptual metaphor strongly influences how people see and respond to the world.

Conceptual metaphor is largely automatic and involuntary, according to Lakoff and Johnson (1999, p. 13), who argue that the cognitive processes that give rise to metaphorical concepts are largely unconscious. People do not necessarily consciously choose to see work, for instance, as a physical burden. However, consciously altering one's metaphorical understanding of events does appear quite possible. For instance, a difficult work assignment can be conceptualized as a burden to be carried, a puzzle to be pieced together (i.e., a challenge), or an obstacle to be circumvented. Each of these concepts has differing implications with respect to the emotional outcome and the most effective behavioral response.

Linguistic Evidence for Conceptual Metaphor

Despite emphasis on the distinction between linguistic and conceptual metaphor, metaphorical expressions are suggestive of their conceptual roots. Lakoff and Johnson (1980,

1999) offer several arguments in support of conceptual metaphor theory that are based primarily on cross-cultural linguistic analysis, chief of which is the systematicity of metaphorical expressions. Many of the metaphorical expressions commonly used to talk about a given topic, such as a love relationship or a dispute, are systematically related. They form clusters that draw upon one domain of sensory-motor experience, with elements of the source domain mapping tightly onto elements of the target domain. For instance, verbal arguments are often spoken of in terms of physical combat. Table 1 contains a list of expressions shaped by this metaphorical concept. If these expressions were not motivated by underlying concepts, each would be an arbitrary quirk of the language in which it was spoken (see Lakoff and Johnson for a more thorough review). Instead, taken together, they paint a coherent picture of a physical scene that effectively communicates what is going on in the abstract sense.

Many conceptual metaphors (as opposed to linguistic expressions motivated by the same metaphor) are also interrelated and form systems of metaphors (Grady, Oakley, & Coulson, 1999). For example, Lakoff (1990) describes an overall event structure metaphor, which pulls together numerous metaphors involving causes and effects, including the concept of change as physical movement or physical transformation (e.g., "I went from smiling to laughing" or "he twisted his personality to fit her desires"), causes as physical forces (e.g., "he pushed me into applying for the job"), purposes or goals as destinations (e.g., "my dreams are within reach"), and events as large, moving objects (e.g., "the party is coming up").

Developmental Roots

The metaphor simulation model differs from other process theories of appraisal in its account of the etiology of emotion. While process theories outlined by Lazarus (1994), Smith and Kirby (2001), and Ohman and colleagues (Öhman, 1997, 1999; Öhman, Flykt, & Lundqvist,

2000) point to evolution or conditioning as the origin of appraisal-emotion pairs, the metaphor simulation model points to sensory-motor experiences in early development. The model is rooted in developmental accounts of conceptual metaphor.

Lakoff and Johnson (1980, 1999) assert that conceptual metaphors are not formed arbitrarily. Nor are they based on objective similarities between the target and source domains. Rather, the metaphorical mapping of features and inferences from the sensory-rich source domain to the abstract, sensory-impoverished target domain is based on their association in certain common, ordinary, sensory-motor experiences that begin early in life and occur across most cultures (Lakoff and Johnson, 1980, 1999; Johnson, 1997; Grady, 1997). In other words, metaphors have an experiential basis. As a result, many conceptual metaphors appear in cultures around the world (Kövecses, 2005). For instance, the subjective observation of increases in quantity (more objects in a pile) is frequently conflated with the visual perception of increasing elevation (the pile gets higher). As a result, increases in quantity are often conceptualized metaphorically as increases in the height or volume of a pile even when the entity of concern has no physical form (e.g., "the strikes against him are rising" or "the number of facts she retained in memory is reaching new heights").

Johnson (1997) studied the development of conceptual metaphor by examining the utterances of a child named Shem recorded over a span of several years (MacWhinney, 1995) and found that initially, the verb "see" was used exclusively to indicate the visual acquisition of knowledge, as in "let's see what's in the box." Eventually, however, "see" was used to represent knowing or understanding when visual perception was not involved, as in "I see what you mean." According to Johnson, in early childhood, the two domains of the metaphor (e.g., knowing and seeing) are part of the same experience (i.e., to see is to know). Later, however, the

sensory-rich source domain comes to represent and structure the more sensory-impoverished target domain.

According to Johnson (1997) and Grady (1997), numerous basic conceptual metaphors are learned at an early age when the source domain (e.g., "carrying a heavy object") and the target domain (e.g., "difficulty") are conflated in experience (e.g., carrying something heavy equals subjective difficulty). For example, one learns from direct experience that when a mass of objects increases in quantity, the mass tends to grow taller (e.g., more toys in the pile make the pile higher, pouring more juice into a cup makes the juice taller). As a result, increases in quantity in an abstract sense can be conceptualized as objects moving up, as in "costs have risen," "gas prices continue to skyrocket," "her vacation days are piling up," or "his qualifications stack up." Conversely, decreases in quantity involve moving down. This metaphorical concept influences reasoning about quantity. If a person uses all their vacation days, for example, and takes one more day off, they might say, "I'm in the hole," and a person in deep debt will have a hard time digging themselves out.

In another example, sensations of warmth and soft, gentle physical contact from a caregiver are initially conflated with the subjective perception of loving affection, nurturance, or care. Later, care and affection in an abstract sense, such as getting a compliment or a promise of support, are conceptualized as warmth and softness, as in "she had a warm personality," "when grading papers, the professor is a teddy bear," or "she used gentle words in her critique," and a lack of warmth represents a lack of affection, as in "she gave me the cold shoulder." Interestingly, when asked to describe how love feels, 70% of respondents in research by Davitz (1969) indicated "a feeling of warmth all over" and 80% indicated an urge "to be tender and gentle with another person" while 76% reported a desire "to touch, hold, be close physically,"

and 72% indicated "a unity, a closeness." This suggests that some forms of emotional love involve the metaphorical simulation of soft, warm physical contact.

A Form of Associative Learning

The above developmental account suggests that metaphorical concepts involve a form of associative learning, which Narayana (1997) terms "neural recruitment learning" (Johnson and Lakoff, 2002). Internal, subjective perceptions, like knowing, are associated with sensory-motor perceptions, like seeing. However, unlike typical forms of associative learning in which there is simply a link between two experiences such that one conjures up thoughts of the other, in conceptual metaphor, the internal structure of the source domain becomes the internal structure of the target domain, and the connection is not made arbitrarily.

The developmental account of concept development does not rely on an extreme form of empiricism in which humans are born a "blank slate," a criticism of Rakova (2002; see Johnson & Lakoff, 2002, for a rebuttal). Grady claims that the subjective, cognitive perceptions in the target domain, such as the observation of similarity, changes in quantity, and knowledge acquisition, are innate cognitive capacities. However, these perceptions are initially rather simple or skeletal. The sensory perceptions and motor actions that consistently accompany and exemplify things like similarity (physical proximity), knowing (vision), and quantity (height) offer these concepts a richness they would otherwise lack, and the sensory-motor domain facilitates reasoning and inference.

The developmental account has implications for the proposal that cognitive appraisals employ conceptual metaphors. Appraisal metaphors would also be rooted in common human experiences beginning early in life. As a result, people around the world should evaluate life

events using a similar set of metaphors, and any given situation would impose constraints on what metaphors could be used to represent their meaning.

In contrast with the above account, many conceptual metaphors appear to have no immediate basis in experience. In response to this observation, Grady (1997) proposed that early development yields a set of basic, primary metaphors (e.g., affection is warmth), and that these metaphors can be blended to form more complex metaphors which are not themselves directly experientially based but are still structured by sensory-motor experience. Grady (1997) illustrates this with the concept of theories as buildings, which underlies expressions such as "the theory had a strong framework," "the theory was built on solid ground," or "the theory stood up under pressure." He decomposes this metaphor into two primary metaphors: organizational structure as physical structure and viability as erectness. The first metaphor is based on the experience of planning a physical structure, like building an object with toy blocks or stacking toy donuts, where elements of organizing and planning the structure are conflated with elements of the structure itself. The second metaphor is based on the observation that ably constructed objects tend to remain standing while poorly constructed or broken objects tend to fall over. When these two metaphors are blended, they result in the concept of viable organizational structures (theories) as erect physical structures (buildings).

THE PHYSIOLOGY OF SENSORY-MOTOR IMAGERY

What happens then when a concept utilizing sensations and actions from experience, either literally or metaphorically, arises in the mind? Not surprisingly, thinking of sensations and actions partially recreates the imagined perceptions in subjective experience and the body. Research has demonstrated that sensory imagery leads to the subjective perception of the imagined experience as well as peripheral physiological effects that mirror the imagined

situation. In other words, sensory-motor imagery is qualitatively like actual perception and action, both mentally and, to some extent, physically. This is true not just for vision but for various sensory modalities, such as spatial perception, touch, taste, smell, and kinesthetic and proprioceptive senses. Recalling the scent of an iris or the gritty sweetness of a gumdrop, for example, feels like smelling an iris or eating a gumdrop, as if one is reliving the experience, although to a lesser degree. Aaron T. Beck (1976) describes the experience of imagined sensations in clients with phobias:

> A patient with a fear of the water felt as though she were drowning when she had a visual fantasy of being in the water.… A young adolescent…was particularly sensitive to any stimulus that suggested bones breaking. When his therapist showed him a bone, he thought, "My leg could be broken" and felt pain in his leg and the sensation of the bone protruding through the skin of his leg.… When [another client] read an account of a disturbed patient whose arms were pinned down by an attendant, he felt strong pressure in his arms, as though they were being gripped.

Sensory imagery involves some of the same areas of the brain as actual perception (see Kosslyn, 1994, for a review; Parsons et al., 1995; Reisberg, 1992). The process of visual imagery, for example, is similar to the process of visual perception (Finke, 1980; Kosslyn, Pinker, Smith, & Shwarz, 1979; Shepard, 1984) and activates parts of the brain involved in actual vision (Farah et al., 1988; Kosslyn et al., 1993). In addition, imagined events appear to involve the simulation of perceptions and actions as they play out over the typical time course of those events. Mental rotation of an imagined object, for instance, takes more time as the angle of

rotation increases just as it would if the rotation were performed with a real object (Cooper and Shepard, 1973). Finally, accessing perceptual knowledge also activates sensory areas of the brain (Goldberg, Perfetti, & Schneider, 2006).

Sensory imagery also produces some matching peripheral physiological effects (see Cuthbert, Vrana, and Bradley, 1991, for a review), including changes in heart rate, body temperature, skin conductance, and muscle tension, all of which are common physiological markers of emotion (Ekman, Levenson, & Friesen, 1983). For example, if one imagines placing one's hand in a bucket of hot or cold water, this not only results in subjective sensations of warm or cold skin, it also produces real changes in local skin temperature consistent with the imagery (Kojo, 1985, 1990). In their review of research on the physiological effects of imagery, Cuthbert, Vrana, and Bradley (1991) conclude that "imagery of an event produces somatic responses that mirror those occurring in the actual situation."

Motor Imagery

Motor imagery resembles motor activity, involving areas of the brain overlapping with those of motor planning and execution (Decety, 1996; Decety & Ingvar, 1990; see Jeannerod & Frak, 1999, for a review), an increase in the excitability of the spinal reflex pathways (Li et al., 2004), and attenuated motor signals to the body (or "efferent leakage," Lang, 1979, 1984) ostensibly designed to reproduce the imagined action (Jacobson, 1931; Hale, 1982). Imagining a lack of movement or an inability to move suppresses corticospinal excitability and attenuates twitching of the thumb induced by transcranial magnetic stimulation (Sohn, Dang, & Hallett, 2003). When athletes imagine performing activities particular to their sport, they exhibit distinct patterns of muscle tension, according to EMG measurements, that match those occurring when they actually perform those actions in real life (Bird, 1984; Suinn, 1980). Motor imagery also

reproduces some of the involuntary effects of motor activity such as changes heart rate and breathing frequency (Decety et al., 1991, 1993) and increases in muscle strength (Yue and Cole, 1992). As a result of these physiological and neural activations, motor imagery leads to the subjective impulse or felt urge to perform the imagined movement (Ulich, 1967). People may use motor imagery without being aware of it (Jeannerod & Frak, 1999). Jeannerod and Frak (1999) note that "whereas the term 'motor image' classically refers to explicit or conscious representation of action (imagine yourself running or raising your hand), the same concept also includes other, implicit or unconscious, aspects of the same phenomenon."

THE METAPHOR SIMULATION MODEL OF EMOTION

The physiological effects of sensory-motor simulation, coupled with the role of sensory-motor simulation in cognition, particularly appraisal, has profound implications for emotion. The metaphor simulation model proposed in this paper is based on the assertion that, if metaphors are a common, ordinary way of understanding the world and necessary for much of abstract reasoning, they play a major role in appraisal where the abstract, personal meaning of events is ascertained (e.g., losing social status or gaining influence, receiving devotion, being slighted or taken advantage of). Essentially, conceptual metaphors translate the perceived, abstract meaning of events or situations into the sensations and motor impulses that comprise emotion.

The model can be summarized as follows. Some emotions are created by conceptual metaphors in appraisal. In these body metaphors, the target domain is the personal significance of a situation (e.g., acquiring respect), and the source domain is the physical impact on the body, or a state of the physical body (e.g., injury, nourishment, erect stature). These body metaphors develop as a result of early experiences in which the target and source domains are conflated

(e.g., being nourished is being loved). The sensory-motor experiences in the source domain are mentally simulated, producing the subjective experience of the sensations and actions as well as some corresponding peripheral physiological effects. The simulation (both centrally and peripherally) is the emotion.

For example, being criticized might be conceptualized as physical injury, as in "his character was attacked" or "they tore him apart." This metaphor involves the simulation of physical pain, and this simulation *is* the emotional response to the criticism. Reading or listening to a message with which one strongly disagrees (say, a theoretical article) might be conceptualized as (or evoke the simulation of) contacting something that is grating, irritating, rough, jagged, uneven, out of alignment or off-kilter, and this simulation *is* the emotional response to the disagreeable message. Simulations of these aversive tactile or kinesthetic stimuli may explain why it is sometimes emotionally difficult to read materials that contain incorrect ideas, especially about one's own area of expertise. Strenuous efforts on the part of the speaker to get the message across might be conceptualized as having a repulsive object (i.e., foul or distasteful) pushed in one's face (i.e., being "force-fed"). Performance failure can be conceptualized metaphorically as failure at a motor task, particularly walking, as in "I tripped up during my presentation," "I slipped in the ratings," or "I took a nosedive on the exam." The sensations, physiological changes, and motor impulses that accompany motor failure would then characterize the emotional response to performance failure (see Lindeman & Abramson, in press, for a discussion of the simulation of motor incapacity in depression). As another example, a difficult task or immense obligation can be conceptualized as a physical burden (e.g., a "heavy work load," a "ton" of homework), which then leads one to feel literally as if one were carrying something heavy, with sensations of pressure on the upper body and increased body weight,

labored breathing, difficulty maintaining an upright posture (i.e., slouching), and tension in the arms, shoulders, and abdomen. Loss of an abstract resource can be conceptualized as losing hold of a physical object, as in "my dreams were ripped from my arms" or "they took my last chance away from me." What it feels like to lose hold of a physical object then characterizes what it feels like to lose hold of a goal or idea. A loss of self-worth or self-importance can be conceptualized as a loss of bodily density, or feeling lighter, as in "without my job, I am nothing," or "I no longer carry any weight in conversations with my friends." Powerlessness is often conceptualized as physical paralysis, as in "I could not make my way through the system" or "I am stuck in a dead end job." Bothers can be conceptualized as skin irritants (e.g., "she rubs me the wrong way"). As a result, the sensations that characterize irritability would feel like sore or tender skin. When effortless progress at a task is conceptualized as gently coasting along a path, the pleasurable sensations associated with coasting constitute an emotion of contentment or joy. Fondness or positive regard is often conceptualized as physical affection and warmth (e.g., "warm welcome", "touching stories").

These and other metaphors in appraisal involve a wide-range of sensations in different modalities, such as (a) bodily movements (e.g., flying, stumbling, paralysis, obstruction or ease of motion), (b) touch and pressure (e.g., softness, heaviness, irritation, sharpness, heat), (c) the position of the body (e.g., curled up, slumped), particularly in reference to surrounding space (e.g., cramped, sprawled), (d) internal states (e.g., hunger, fatigue, weightlessness, motion sickness), and (e) tastes and smells.

Appraisal metaphors are body metaphors. In contrast to metaphors such as "the idea withstood the test of time," where the source domain is a physical object or process, the source domains for appraisal metaphors are bodily experiences. Given that the function of appraisal is

to determine the personal meaning of an event, the relevant metaphors for this task would be, most generally, ones in which abstract effects involving oneself (e.g., failure or success, rejection, difficulty, love, power, or obligation) are conceptualized as physical effects involving one's own body (e.g., falling, stumbling, warmth, being lifted up high, injury, getting pummeled, juggling). Thus, the target domain in an appraisal metaphor is the personal significance of a situation or event, the psychological impact on one's psychological self. The source domain is a physical impact on the physical self, the body.

Theoretical Context

In forming hypotheses about emotion, one might begin by assuming that the structure and form of the emotions is preset, that emotions are restricted to a handful of fixed physiological patterns of experience triggered fairly directly by events rather than dynamic, evolving experiences shaped by the complex mental world of ongoing thoughts and evaluations. While this raises the issue of what qualifies as emotion, it also suggests that the metaphor simulation model represents a significant shift in perspective. Pulling together theory and research on embodied cognition, conceptual metaphor, mental imagery, and the cognitive precursors of emotion leads to an account of emotional experience in which thoughts and feelings share a common core. In this account, conceptual metaphors in appraisal involve the simulation of sensory-motor experiences with corresponding effects on the peripheral nervous system, and the experience of these simulations *is* the emotion. Consequently, emotions *feel like* physical bodily experiences, such as floating weightlessly or straining to push a large object. Whereas Lakoff and Johnson (1980) argue that metaphors are a way of thinking, this model adds that *metaphors are a way of feeling*. More specifically, the crux of the model is that many emotions owe their existence to conceptual metaphor.

Further, the idea that some emotions are metaphorical appraisals reverses the usual perspective on emotion in much of the embodiment literature. Because emotions are themselves bodily experiences, research on the nexus of embodiment and emotion has primarily explored how the reenactment or generation of emotions (as set patterns of bodily experience) plays a role in concepts *about emotion* or metaphors *for* emotion (e.g., anger as hot fluid in a container, as in "she was boiling mad" or "he blew his top") or the comprehension of language about emotion (explicitly or connotatively) (see Niedenthal, 2007, for a review; Niedenthal, et al., 2005; Lakoff, 1987; Schnall, 2001; Glenberg, Havas, Becker, and Rinck, 2004; Kövecses, 1990, 2000). However, the question of how embodied cognition might be involved in originating emotion (from scratch, so to speak) has been largely unexplored. Whereas these avenues of research have explored how emotion supports conceptualization, the metaphor simulation model holds that in some cases, emotions are the result of embodied concepts about situations and events (e.g., "facing an obstacle" or "meeting with resistance"). It is important to note that these perspectives are not mutually exclusive.

According to the model, the common features of appraisal espoused in current structural theories would correspond to different elements or configurations of the metaphorical scene (or different metaphors altogether). For example, causal agency (whether oneself or another person is to blame for an event) might be conceptualized either as a physical force acting on one's body (e.g., a physical attack or burden) or, when oneself is to blame, as a particular state of one's physical body (e.g., disfigured, infirm, or sullied).

Sustained Emotions and Construction of a Metaphorical Worldview

Consistent with the view of Lazarus (2001) that appraisal is an ongoing process and that experiences are constantly reappraised, I propose that metaphors in appraisal form part of a

larger metaphorical worldview that is ever present and continuously adjusted by new experiences and reevaluations of old experiences. A metaphorical worldview as an ongoing appraisal process may partially account for moods, which by most definitions have a longer duration than emotions and often seem unattached to any particular event. From this perspective, numerous past appraisals are allowed to build up, to sit or remain in play, because instances of appraisal could affect permanent change in one's metaphorical worldview. Here, appraisals are not viewed as discrete events or cognitive styles but as the building blocks of a long-term vision describing one's place in the environment. Though the original event that instigated an emotion may have passed, one may still consider oneself to exist in the same metaphorical scene (e.g., helplessness, persecution, loss). This could lead to what might seem like disconnected emotions ("free-floating" anxiety, unprovoked anger, unwarranted sadness) or affective traits, especially if the target domain is forgotten. Some longer term somatic complaints (e.g., sore neck and shoulders, fatigue, headache, abdominal cramps) may be the result of chronic muscle tension or body postures sustained by conceptual metaphors in how one sees the world.

A pre-existing metaphorical worldview might also help to account for how one's current mood or emotional state biases one's emotional response to a subsequent event. A total loss of support, for example, conceptualized as the sudden loss of solid ground under one's feet, would prove devastating were it unexpected. However, if one has already "hit rock bottom" and is "standing on the ground," it may simply evoke feelings of exhaustion and powerlessness.

What Emotions Feel Like

When asked to describe what emotions feel like, the model predicts that people should allude to physical experiences that are apt metaphors for the event or situation that gave rise to the emotion. Ortony and Fainsilber (1989) and Davitz (1969) found that descriptions of how

emotions feel commonly use body metaphors. Descriptive statements obtained in interviews by Davitz (1969) include, "I feel empty, drained, hollow," "as if I'm suffocating, smothering," "I feel taller, stronger, bigger," "as if there is a lid or some sort of clamp which keeps me from perceiving," "as if I'm breaking apart inside, with pieces flying off in all directions," "a sense of wandering, lost in space with nothing solid to grab onto," and "I feel as if I'm under a heavy burden." To the author's knowledge, the metaphor simulation model is the only hypothesis that predicts these types of responses a priori. Ortony and Fainsilber explain their findings by arguing that people use metaphorical descriptions to help them express the vague and ineffable qualities of emotion. In contrast, the proposed model suggests that these descriptions literally and specifically reflect the subjective sensations that characterize the reported emotion. This latter possibility is supported by the fact that there is some consistency in how particular emotions are described. For example, Davitz found that 62% of people describe the emotion of (psychological) affection as "a feeling of warmth all over." Warmth is an apt metaphor for positive regard and psychological nurturing behavior (e.g., encouragement). Descriptions of elation (which in Latin means "raised" or "exalted") include "a sense of lightness, buoyancy and upsurge of the body" (68%), "a floating, soaring sensation" (52%), "an inner buoyancy" (72%), and "effervescent, bubbly" (74%). Floating and weightlessness are apt metaphors for one's place in the world when events suddenly unfold in one's favor (e.g., a sudden windfall) without the need for any effort or exertion, especially when long-term efforts finally pay off or long awaited desires finally materialize. One is no longer weighed down by societal pressures or the responsibility of completing a task. Instead, one is lifted up by success, carried on the wings of good fortune, or elevated by admiration or appreciation. One entailment of this metaphor is that when one flies too high (e.g., too much success, too much admiration) or when the mechanisms

allowing one to fly are weak or flimsy (e.g., uncertain success, fickle admiration), there is the danger of descending and crashing. One would then expect elation to become tinged with apprehension.

Some descriptions, however, refer to bodily experiences that are physically unachievable. Humiliation, for instance, might be described as feeling "ten inches tall." Such expressions represent poetic elaborations of conventional metaphorical concepts (Lakoff & Turner, 1989) and are based on sensory-motor experiences that are achievable. Feeling ten inches tall is an elaboration of small physical size representing unimportance or insignificance, and simply feeling small is a common enough experience when one is crouched low to the ground or physically cramped in a small space. Being physically low to the ground or cramped in a small space is often conflated with being unimportant. Primacy in a group often determines the amount of physical space one is allotted during group activities. People with more space have more visibility and more influence, while people with little space tend to get lost in the crowd. Another example is the pain associated with romantic loss often described as a broken heart. While actual heartbreak is a rare physical experience, one might speculate that this metaphor refers to the wrenching chest pains that typify grief, and these pains in turn arise from conceptualizing the loss of love as a loss of physical contact, particularly the warmth and pressure one feels on the center of one's chest during an embrace or caretaking, leaving an aching maw as one reaches out to regain contact.

Metaphors as Byproducts?

A common objection to the metaphor simulation model is that metaphors seem more like byproducts of emotion rather than causes. Undoubtedly, some metaphorical expressions about emotion, similar to those discussed above, are byproducts rather than causes and do not reflect

metaphors in appraisal, as I have argued. When someone is described as a "pain in the neck," for instance, this most likely refers to the fact that the person causes them to feel tense. Emotional experiences themselves, like other situations and events, can be conceptualized in different ways, including metaphorically (Averill, 1974, 1990; Averill and Kövecses, 1990; Baxter (1992), Duck (1994), Holland and Kipnis, 1995; Quinn, 1987, 1991; Lakoff and Kövecses, 1987; Lakoff, 1987; Kövecses, 1986, 1988, 1990, 1991a, 1991b, 1993b, 1994b, 1995a, 1995b). Some metaphors capture how emotion influences attention. For example, metaphors for anger (e.g., "she was blind with rage") and happiness (e.g., "she wore rose colored glasses") may reflect the way in which these emotions restrict or distort our perceptions (Niedenthal, 1992; Lakoff, 1987).

However, metaphors describing the emotional impact of an event are often highly compatible with (and somewhat indistinguishable from) metaphors for those events. In his investigations of metaphors for emotion, Kövecses (2000) observed that "emotions can be, and are, comprehended via both their assumed typical causes and their assumed typical effects." For example, happiness is often conceptualized as elevation, as in "she was on cloud nine," "I was walking on air," or "my spirits rose." Success, an experience that often elicits happiness, can also be conceptualized as elevation, as in "she is flying high," "he aimed for the top," or "climb the corporate ladder." Impediments to success are impediments to ascent, which is apparent in the expression "the glass ceiling." Conversely, descent is a common metaphor for failure, as in "the performer is slipping," "she dropped in status," or "the business is sinking."[2] The coherency

[2] The experiential basis of these metaphors, it can be argued, need not include happiness or sadness. For example, the concept of failure as descent might be rooted in the conflation of motor failure (e.g., falling down) and a mismatch between motor experience (falling) and motor intent (to walk across the room). Later, a situation in which the mismatch is abstract rather than

between appraisal metaphors and metaphors for the emotions those appraisals create suggests, in line with the model, that how emotions feel depend on how situations are conceptualized, and metaphors are not merely byproducts of the arbitrary subjective quality of emotions.

For cases in which a metaphorical concept is purportedly responsible for an emotion, metaphorical expressions for the personal impact of the antecedent event may be byproducts of how the emotion feels. In other words, the concept can be seen to motivate the linguistic expression in part by generating the sensations and impulses characterizing the emotional response. To illustrate this subtle distinction, imagine that a student is given a difficult, lengthy assignment. The student evaluates the personal significance of this event, seeing it as hard work. Their concept of hard work involves the simulation of physical strain. The student simulates the experience of physical strain and feels tired and tense. Finally, the student exclaims, "This assignment is weighing me down!" Does this metaphorical expression represent a cause or byproduct of the emotion? In this instance, it reflects both. The student is expressing their experience of feeling subjective heaviness in response to the assignment.

Action Tendencies

Emotions lead to felt urges to perform particular actions and behaviors. Arnold and Gasson (1954) referred to these urges to act as "action tendencies," which they defined as "felt tendencies toward an object judged suitable, or away from an object judged unsuitable, reinforced by specific bodily changes according to the type of emotion." Frijda (1986) also proposed that emotions involve perceptions of urges or impulses to act, which he called "action readiness." Frijda, Kuipers, and ter Schure (1989) asked subjects to rate episodes of emotion

---

physical (e.g., between communicative intent and interpersonal experience) could be conceptualized as motor failure and result in the simulation of physical descent.

from memory based on 29 dimensions of action readiness, which included: "I wanted to oppose, to assault, hurt or insult," "I wanted to approach, make contact," "I wanted to have nothing to do with someone or something, to be bothered by it as little as possible, to stay away," "I wanted to move, be exuberant, sing, jump, undertake things," "I stood above the situation; I felt I was in command; I held the ropes," and "I felt inhibited, paralyzed, or frozen." These dimensions correctly predicted 46% of the emotion names subjects provided.

According to the metaphor simulation model, action tendencies are urges to perform particular physical actions, and these urges arise from the metaphorical simulation of sensory-motor experiences. Many of the action tendencies listed above are consistent with urges and reflexes one would feel during these bodily experiences. An urge to physically and literally "stay away," for example, might arise when an offensive idea is conceptualized as a foul substance and lead one to avoid physical contact with a book containing that idea. Being "stuck" or "constricted" by societal pressure would elicit the urge to break free of a restraint. One might bristle at the thought of an "irritating" social interaction, gasp for air when a relationship is "smothering," or contract one's body at the thought of being approached with a dangerous proposal. An uncontrollable series of events, such as dealing with a bureaucratic department that continually loses forms or denies privileges based on technicalities, might cause a person to feel irritated and beleaguered, as if being pummeled by numerous flying objects, which would lead to an understandable urge to flail around and pulverize everything in sight. Emotional burdens would lead to muscle tension in the arms or shoulders consistent with bracing against a heavy object, holding one's breath in order to distend the chest and provide more support for carrying the burden, a rigid posture, and an urge to unload the burden (drop it, throw it, or shrug it off). In a suffocating relationship, constant control and restrictions on personal freedom can be

conceptualized as a tight enclosure. Trapped in this metaphorical small space, one feels short of breath, a smothering tightness around the upper body, and uncomfortable warmth, as if the surrounding air is stuffy and hot. An urge to escape the trap leads to the desire to *get out of* the relationship, which might be communicated metaphorically as a need for personal *space*. Hunger sometimes forms the basis for concepts of deprivation and being unloved, while nourishment is a common metaphor for love. Thus, feeling deprived of love or attention may often indicate the simulation of physical hunger and prompt overeating.

These urges to act are the reflexive motor responses one would display in the actual situations (supporting a weight, withdrawing from a painful tactile stimulus, holding one's breath upon submersion in water). While many such reflexes are innate, in the context of the current model, 1) they are triggered by a metaphor rather than an innate stimulus, and 2) many are not commonly considered emotional responses in their original context.

Maner, Kaschak, and Jones (under review) showed that the abstract concept of social power influences basic motor behavior. Participants began with a task designed to measure the speed of their approach and withdrawal movements, providing a baseline for comparison. Upon hearing a tone, participants were required to press a button by moving their hand away from or towards their body (corresponding to approach or withdrawal). Following this task, the experimenters primed the concept of social power by briefly presenting words such as authority, boss, control, executive, influence, and rich, with backward masking. Participants then repeated the movement task. Compared to neutral words, power words led to faster movements away from the body and slower movements towards the body.

Consistent with this account, emotional body language often appears to reflect metaphor. For example, when people feel vulnerable or insecure as a result of metaphorical threats, they

may cross their arms and legs as if guarding their bodies from a physical attack, and when people feel "weighed down," they often slouch, sigh, and drag their feet. This behavior is consistent with the simulation of a physical burden. According to the metaphor simulation model, this behavior is not necessarily intended as an emotional expression, signal, or communication (although it can be utilized as such) but instead reflects an action tendency associated with carrying heavy objects. Conversely, when people feel as if a weight has been lifted, they have renewed physical energy and a bounce in their step.

Maladaptive Motivations

In metaphor simulation, the most adaptive behavioral response to an event is stipulated in part by the bodily experience being simulated. For example, difficulties can be conceptualized either as burdens (e.g., "my homework is weighing me down") or as impediments to motion (e.g., "I can't get past this homework problem"). In the former metaphor, the adaptive behavior is to shrug the burden off or set it down before it crushes one's body, whereas in the latter metaphor, one must circumnavigate or physically destroy the impediment. The former metaphor implies that one can return to the homework after a short break while the latter implies that no amount of waiting will produce a solution. In addition, prolonged exposure to the situation is only imminently dangerous in one metaphor. As another example, a lack of freedom can result from an impediment to motion (e.g., "the rules pose a hindrance") or from having the ability to move taken away (e.g., "she revoked my privileges," "they took away her rights"). In the former case, one must either circumvent or destroy the hindrance to regain freedom (e.g., "sneak behind her back," "break the rules"), while in the latter case, one must confront the entity that confiscated the ability and get it back (or find another way to move around).

The proposed model offers one possible explanation for some instances of maladaptive emotional behavior characteristic of modern human life. Behavior may be suitable in the context of a metaphor but maladaptive in the real-world situation that the metaphor represents. Being weighed down by difficult homework, for example, might motivate abandonment of the assignment and getting rest (i.e., laziness and procrastination). People cover their faces to alleviate shame even if it exacerbates negative social judgments and drive faster, putting themselves in danger, when frustrated by other matters. Physical laziness in response to metaphorical burdens, physical assault in response to metaphorical attacks, and physical withdrawal in response to metaphorical injury are all examples of potentially maladaptive behaviors that would otherwise further survival had the metaphors been literal. Physically straining in a vain attempt to acquire an expression of affection from a friend, as if the expression were a physical object one can reach out for and seize hold of, also represents a metaphor-based action tendency that cannot achieve its desired end. Making one's body appear larger and taller might alleviate humiliation, or the feeling of being small and lowly, but it does little to directly address the abstract reasons for one's social status. The macho gesture might evoke feelings of respect in others, or it might simply offend them.

Similarly, when an emotional need cannot be met, people may seek somatic remedies for abstract problems. For example, if nurturance is represented metaphorically as nourishment (a metaphor apparent in numerous common nicknames for loved one's, such as "sweetheart" and "honey"), then people may eat when they feel lonely. Food then becomes a maladaptive substitute for love (Roth, 1992).

Adaptive behavior may be facilitated by attunement to how one's urges should map back onto the real world. For example, a verbal attack might be represented as a physical attack,

prompting one to physically assail the person in self-defense. However, the more adaptive response is to defend oneself verbally (or metaphorically "walk away" by not responding). Responding in this adaptive way would require the person to translate impulses based on the metaphor into behaviors based on the real-world situation, to see how the metaphor corresponds to the literal event. Thus, adaptive functioning requires that metaphorical appraisals be followed by metaphorical behaviors, and dysfunction is more likely to result when metaphorical appraisals are followed by literal behaviors (although literal behaviors may send a clearer message to others). The relief or reward for acting adaptively on one's impulses would come from appraising the metaphorical effects of the adaptive behavior, such as getting a critic to "back down," thereby altering one's metaphorical worldview and eliminating the source of the urge.

Innate Responses

Metaphor simulation allows life events that are otherwise irrelevant to physical survival to evoke innate physiological processes or innate emotional responses (emotions not originally generated via metaphor). Conceptual metaphors may permit these otherwise meaningless situations to trigger innate responses by allowing those situations to be understood in terms of stimuli with innate emotion-provoking properties. For instance, loud noises and sudden movements trigger an innate startle response, and this might occur when an event, like hearing good news, is conceptualized as a sudden, intense stimulus. An innate claustrophobic reaction to cramped spaces (e.g., hyperventilation, panic) might be evoked when a situation, such as a lack of viable options to a problem, is conceptualized as being trapped. Separation from a caregiver elicits separation anxiety in infants beginning at around nine months. This anxiety and distress is triggered by the physical absence of the caregiver, registered visually and perhaps haptically by the absence of physical contact. If separation were conceptualized metaphorically, however, a

child may respond with this same pattern of distress, even despite continued physical contact with a caregiver, when the caregiver is merely intellectually unengaged with the child or uninterested (i.e., metaphorically absent). This metaphor is apparent when people speak of being momentarily "somewhere else." The possible basis of this metaphor is the conflation of physical absence with a lack of personal engagement or interest. Conceptual metaphors for attention may also mediate some instances of embarrassment. Simply being stared at or pointed at can elicit embarrassment or fear (Kalin & Shelton, 2000; Lewis, 2000). Consequently, conceptualizing scrutiny or evaluation as visual attention (as in "the employer is looking her over" or "the agency has its eyes on me") might also elicit this same embarrassment and fear, as when a parent inspects a report card or makes a revealing comment about a child's personality or behavior. The possible basis of this metaphor is the conflation of being stared at and the subjective knowledge that one is receiving excessive attention. In a metaphorical context, the emotion might be better understood as shame, because it involves the psychological self rather than the physical self. Yet, the child may still be motivated to hide from view. Interestingly, at around ages 3 or 4, children begin to respond to shame by trying to evade the gaze of others (Baetz, 1999). Severe panic normally elicited by the impending doom of an acute mortal threat (e.g., a looming tidal wave or anticipation of grave physical injury) may arise when a situation is conceptualized metaphorically as impending doom. The trembling, shortness of breath, palpitations, and dizziness that accompany panic attacks are often not recognized as emotional experiences. Instead, they are interpreted as signs of impending physical death (Clark, 1986). Clark concludes that this is a misinterpretation of the bodily symptoms of a panic attack. However, in some instances, the interpretation may be metaphorically true. People suffering a panic attack may face metaphorical doom and disaster and respond as if they were literally about to die. A

relationship on the verge of collapse, a critical venture in peril, or a profound threat to one's livelihood may be conceptualized as severe threats to one's bodily integrity. The striking disparity between the powerful biological effects of the situation and the lack of any apparent physical mechanism for these effects may be responsible for the frequent reluctance to attribute the panic attack to the situation at hand.

Simply imagining events that elicit innate emotional responses, such as approaching a snake, produces autonomic activity consistent with what one would experience in the actual situation (Wolpe, 1958; Bauer & Craighead, 1979; Grayson, 1982; Grossberg & Wilson, 1968; Haney & Euse, 1976; Lang et al., 1980; May, 1977a, 1977b; McNeil et al., 1985; Van Egeren et al., 1971; Marks & Huson, 1973). According to the current model, this occurs even if the imagery is only a metaphor for the current situation (e.g., approaching a dangerous object in one's path, such as a snake, might represent encountering a logistical threat, such as a warning from an administrator, to the progress of an important project).

The distinction between sensory-motor perceptions and innate responses in a given bodily experience does not mean that both cannot contribute to the same emotional experience. While being stared at is enough to elicit embarrassment and apprehension, for example, a stare can also be evaluated for its personal significance. An appraisal of a stare might indicate that a person lacks fondness or affection. With the lack of affection conceptualized as coldness, one might feel a lack of warmth and say the person has "an icy stare."

Metaphors in appraisal may also be responsible for the affective tone of an emotion. Most bodily perceptions seem to involve some sort of basic emotional tone in the form of pain or pleasure. Even the raw physical pain of a skinned elbow is accompanied by an affective

component (Price, 2000). Consequently, emotions arising from the simulation of these bodily perceptions will also exhibit these affective tones.

The implication here is that the quality of some emotions (i.e., the subjective sensations, affective tone, and action tendencies of an emotion) depends on the nature of the experience being metaphorically simulated. A heavy work load feels bad, in other words, to the extent that carrying a heavy object feels bad. A moral offense is repellent to the extent that one finds foul substances repellent. In other words, some emotions have their historical roots in bodily perceptions. While some emotions are innate (those evoked through direct stimulus effects or through metaphors for innate stimuli), some must be learned, and a lack of experience with certain bodily perceptions will result in a lack of certain emotional experiences. Importantly, while metaphors in appraisal can elicit autonomic activity associated with an innate emotional response, they can also elicit physiological responses associated with other non-emotional experiences as well, such as hunger, salivation, or indigestion in response to smelling or eating different foods.

Overall, the metaphor simulation model predicts that many emotions, particularly those in adult humans navigating modern life, consist of a menagerie of sensations and motor impulses, pains and pleasures, and innate or learned physiological, affective, and behavioral responses. Most importantly, all of these components are organized according to the particular bodily experience being mentally simulated in the appraisal process.

SOCIAL AND MORAL DISGUST, AN EXAMPLE

If an emotion is attributable to metaphor simulation, then the emotional response and the simulated bodily experience should exhibit shared physiological mechanisms, and people should behave in ways that are consistent with the metaphor. For instance, a social or moral offense

conceptualized as a foul tasting or stinky object, as in "his actions were distasteful" or "he has a rotten disposition," should activate areas of the brain involved in tasting foul objects. Facial expressions and physiology should mimic oral revulsion, and people should exhibit a tendency to respond to moral offenses with actions that serve to clean or protect the body. This is what research on moral disgust has found.

Imagine popping a grape in your mouth and discovering the grape is rotten. The foul taste causes you to gag, your tongue protrudes from your mouth, and your stomach feels sour. You are motivated to expel the grape, get as far away from it as possible, and rinse your mouth out. Now imagine sitting in a classroom beside a college student who was recently associated with a crime. He chose not to intercede while his buddy strangled to death a young girl in a casino. He defends his inaction with lame excuses. He says he has lost no sleep over the fate of the girl, plans to make money off the case, and even claims that his notoriety has helped him score with women. Students at the University of California, Berkeley, responded to this individual, David Cash, with intense disgust. They strongly protested his presence at the university (Robertson, 1998), and some even spit at him as he walked across campus (which the author witnessed first-hand). Why would this egregious behavior elicit a response similar to that of the rotten grape?

Disgust can be evoked in the absence of a foul substance by abnormal or unethical behavior, cowardice, mental weakness, psychological wounds, or unfairness (Haidt, 2003). Yet, disgust is rooted in physiological responses to foul substances, such as tasting something bitter, smelling something rotten, or touching something filthy (Rozin & Fallon, 1987). Moll et al. (2005) subdivide this emotion into distaste and social or moral disgust: "The most general and elementary forms of disgust are distaste and core disgust that occur in conjunction with offensive

and/or aversive sensory experiences. More specific psychological forms of disgust are typical of humans and occur principally in the social domain, where they are represented by interpersonal and moral disgust."

Research on social or moral disgust (see Rozin, Haidt, and McCauley, 2000) suggests that, in line with the metaphor simulation model, disgust in response to certain social behaviors involves the simulation of tasting or coming into close bodily contact with a foul substance. The apparent physiological signs of disgust are consistent with oral revulsion. Rozin et al. (2000) note that "the most distinct physiological concomitant of disgust—nausea—is a food-related sensation that inhibits ingestion." Facial expressions of disgust are also consistent with oral revulsion (Vrana, 1993; Izard, 1971; Ekman, 1972; Ekman and Friesen, 1975; Rozin, Lowery, and Ebert, 1994). Rozin et al. (2000) write, "The facial expression of disgust can be seen as functional in rejecting unwanted foods and odors... activity centers around the mouth and nose, and... the movements tend either to discourage entry into the body (e.g., nose wrinkle, lower lip raise) or to encourage discharge (gape with or without tongue extension)." Wierzbicka (1986) comments that the emotion of disgust is "similar to what one feels when one has something in one's mouth that tastes bad and when one wants to cause it to come to be out of one's mouth" (p. 590).

Brain imaging studies also indicate a significant overlap between moral disgust and responses to foul substances. Moral disgust recruits overlapping neural substrates with pure or core disgust in the frontal and temporal lobes (Moll et al., 2002, 2005). Specifically, pure disgust and moral indignation activate areas in the orbital prefrontal cortex that are associated with visceral-emotional responses to things like foul smells and bitter tastes. Sanfey et al. (2003) found that emotional responses to disdainfully unfair offers in a computerized economic game

activated areas of the anterior insula specifically associated with pure disgust, or disgust arising from perceptions of a foul taste or odor. The left anterior insula is also active during the observation of facial expressions of disgust (Phillips et al., 1997; Wicker et al., 2003). Stimulation of this area of the anterior insula leads not only to feelings of nausea and sickness (Penfield & Faulk, 1955) but unpleasant sensations in the mouth and throat (Krolak-Salmon et al., 2003).

With respect to behavior, Zhong and Liljenquist (2006) found that moral disgust with oneself generates an action tendency to physically clean the body of foul substances. In their first study, they asked participants to recall an ethical or unethical deed from their past and describe their emotional response. Participants who recalled an unethical deed were more likely to complete word fragments to produce words related to physical cleansing (e.g., W _ _ H as WASH as opposed to WISH). This suggests that the concept or emotion associated with moral disgust is related to the concept or emotion of physical disgust. In their second study, participants hand-copied a short story written in the first person describing an ethical or unethical act. Those who copied the unethical act rated cleansing products (e.g., Dove shower soap) more highly than those who copied the ethical act. Noncleansing products were rated similarly by both groups. In the third study, participants were offered their choice of an antiseptic cleansing wipe or a pencil following recall of an ethical or unethical deed. Participants who recalled the unethical deed were more likely to choose the antiseptic wipe (67%) compared to participants who recalled an ethical deed (33%). A control condition demonstrated that the wipe and pencil were equally attractive. In their final study, they found that physical cleansing mitigates the need to compensate for immoral behavior. Participants recalled ethical or unethical deeds. Those who then cleansed their hands with an antiseptic wipe were less likely to volunteer for another

study (41%) than those who did not cleanse their hands (74%). The latter also reported feeling less moral disgust. They conclude that "exposure to one's own and even to others' moral indiscretions poses a moral threat and stimulates a need for physical cleansing."

Social disgust has an obvious abstract quality in relation to core disgust. Tomkins (1963) notes that "disgust is recruited to defend the self against *psychic incorporation* or any increase in intimacy with a repellent object" (p. 233) (italics added). The core relational themes of emotion described by Lazarus (2001) include, for disgust, "taking in or being too close to an indigestible object *or idea*" (italics added). Thus, exposure to egregious acts, cowardice, abnormality, perversion, sin, and similar threats to the abstract self evoke a response that originally developed to protect the physical self (the body) from physical objects.

According to the proposed model, the relationship between social and core disgust is built on metaphor. Specifically, social disgust is a metaphorical simulation of the innate, automatic, physiological response of revulsion and distaste associated with tactile, olfactory, or gustatory contact with foul substances. Of note, social disgust would then represent a certain type of emotion in which the simulated experience (oral revulsion) is originally classified as an emotion (core disgust). However, not all emotions attributable to metaphor simulation necessarily fall into this category.[3] Some involve the simulation of experiences that would not originally be called emotions (yet they may still involve positive or negative affect and innate physiological

---

[3] In this context, core disgust seems more prototypically a physiological reflex coupled with discomfort (falling more along the lines of other sensory-motor experiences), while moral disgust is more prototypical of an emotion. In this way, the metaphor simulation model has potential implications for the definition and taxonomy of emotion.

responses). Examples include simulations of tasting something sweet, carrying a heavy object, physical injury, difficulty breathing, hunger, warmth, or skin irritation.

If social disgust is a simulation of core disgust, greater sensitivity in core disgust should result in greater sensitivity in social disgust. Rozin et al. found positive intercorrelations between different domains of elicitors using their Disgust Scale, which they interpreted as "evidence that the domains converge on a common dimension of sensitivity to disgust." Conceptual metaphor supplies this common dimension. Where an abstract concept utilizes sensory-motor areas of the brain or body, any individual differences in these areas (e.g., gustatory sensitivity) should be reflected in conceptual differences.

Developmental Origins of Social Disgust

Rozin et al. (2000) argue that gustatory disgust is extended in individual development to moral offenses through social and cultural evolution. They state, "disgust originated as a rejection response to bad tastes, and then evolved into a much more *abstract and ideational* emotion. In this evolution the function of disgust shifted: A mechanism for avoiding harm to the body became a mechanism for avoiding harm to the soul" (italics added). According to this enculturation account, a social situation is disgusting to the extent that society decrees the situation a threat, and this decree is based on abstract similarities to physical threat. Rozin et al. (2000) note:

> The 'output' side of disgust (physiology, behavior, expression) has remained relatively constant in cultural evolution, and still bears noticeable similarities to its animal precursors. However, the elicitors and meaning of disgust have been transformed and greatly expanded in cultural evolution….Consistent with our claim that the cultural evolution of disgust has involved a conservative output

> system and a flexible and expanding input/evaluative (elicitor/meaning) system, we hold that the principle cultural differences in disgust have to do with the input/evaluative system.

The metaphor simulation model holds that this "input/evaluative system" expands by way of conceptual metaphor. In other words, the original elicitors of disgust are bodily contact with foul substances, but this same response is later elicited by situations with abstract meaning (specifically, meaning that can be represented as contact with a foul substance). More specifically, the model, which incorporates developmental accounts in conceptual metaphor theory (discussed earlier), suggests that moral disgust is not simply a product of cultural transmission but reflects the learning of conceptual metaphors. Social and cultural influences may promote this learning, but the primary or initial mechanism is the conflation of core disgust with abstract social events.

Based on developmental or etiological accounts of conceptual metaphor (Lakoff and Johnson, 1980), this linking of core disgust and immorality is not arbitrary. Rather, conceptual metaphors are rooted in experiences within which the two domains of the metaphor (the physical and the subjective) are conflated. There are several plausible experiential bases for metaphors in which moral offenses, psychological weakness, behavioral abnormalities, or deviations from social norms are understood in terms of foul or bitter substances. For example, harmful physical disfiguration is often accompanied by sickening tastes or smells, as when we eat a disfigured, unripe, or rotten piece of fruit or stumble across a decaying animal. The concept of deformity or deviance from a norm (visually ascertained in these scenes) is conflated with foulness. Later, certain atypical social behaviors, particularly those indicating a deviation from a healthy state, can be conceptualized as foul substances and elicit disgust. In line with the cultural account of

Rozin et al., what counts as atypical in an unhealthy sense would, of course, depend on the cultural context just as the deformity of a fruit depends on the appearance of other nearby fruits of the same kind. (This account of social and moral disgust comes into play specifically when disgust is evoked by the conceptual analysis of an event rather than via direct stimulus effects. However, it does not preclude the possibility that disgust in response to certain foul substances is learned by witnessing the disgust of others.)

As another example, lapses in personal hygiene, as when a person becomes dirty and fails to bathe, are also often accompanied by unpleasant smells and reactions of disgust from others. The concepts of impurity and social disgrace are thus conflated with being unclean. Later, negative evaluations from others or lapses in maintaining a specified public persona or self-image (e.g., sins) can be conceptualized as dirtiness or filthiness and elicit disgust. Finally, cowardice or psychological weakness may be associated in early experience with bodily conditions humans find innately repulsive. For example, an emaciated physique may be conflated with a lack of assertiveness or initiative in physical challenges (e.g., an unwillingness to engage in combat). As a result, a lack of assertiveness in abstract social challenges (e.g., a political debate) may evoke disgust of the same sort evoked by emaciation.

Humans and other animals show an innate distaste for bitter substances, which is accompanied by gaping and oral rejection (Peiper, 1963; Steiner, 1979). However, social and moral disgust (i.e., disgust primarily in the absence of direct stimulus effects) arise later in development (Rozin, Hammer, Oster, Horowitz, & Marmara, 1986; Rozin, Fallon, and Augustoni-Ziskind, 1986). This is consistent with an account based on the development of conceptual metaphor. Rozin et al. (2000) explain:

> Although 3-year-olds typically reject feces as food, it is not clear that this rejection has contaminating or offensive features, and it may be no different from a distaste, or a distaste combined with danger. So far as we know, there is no sense of offensiveness or rejection outside of the sensory realm in either infants or nonhumans, and hence no gape elicitors other than certain negative tastes. Disgust seems to require enculturation.

Though not necessarily indicative of metaphorical thought, children speak and understand metaphorical expressions at an early age. Vosniadou (1987) observes that "children produce metaphor-like utterances as soon as they start talking, and are capable of understanding simple metaphorical expressions by the age of 4." This ability is not dependent on language skill. Johnson (1991) showed that the development of metaphor comprehension was only weakly related to language proficiency. The ability to form metaphorical concepts may arise even earlier than the ability to speak and understand metaphorical expressions. Such a cognitive advance would enable more complex appraisals of events. For example, of children entering conceptual stages of development, Lewis (2001) states, "The violation of one's property or territory still causes anger, but so does the violation of rights or rules." The metaphor simulation model offers that this anger results from the simulation of territorial violation. The ability to conceptualize events metaphorically may be observable in early gestures or behavior, as when a child frustrated by a curtailed freedom acts as though they are straining with all might to break free of a physical restraint.

IMPLICATIONS FOR THEORY AND RESEARCH

The proposed model has several implications for emotion theory and research. For instance, if some emotions are simulations of physical experiences, it suggests that a novel

physical experience (e.g., driving a car at 55 mph) could form the basis of a novel emotion, which would open up the possibility of generating new emotions in the lab. For instance, rapid, effortless progress on a task could be conceptualized as riding in a vehicle moving swiftly and smoothly along the road (e.g., "smooth sailing," "coasting downhill," "speeding along smoothly") and lead to the same visceral sensations. With respect to psychosomatic illness and the mind-body connection, the model also shows how certain physical states (e.g., arthritis, asthma) might influence self-perceptions of one's emotional state (e.g., social pain or negative regard, being smothered in a relationship), or, conversely, how some emotions might be perceived as physical states (e.g., anxiety as the flu),. Broadly, the model offers new perspectives on the etiological roots, underlying nature, or internal structure of emotion, particularly in modern humans, and predicts certain individual and cross-cultural differences (and commonalities) in both the causes and experience of emotions. The model also suggests additional avenues for studying the physiological correlates of emotion and for how emotions are categorized.

The Relationship Between Emotion and Cognition

Demarcating Appraisal and Emotion

Whether conceptual evaluations of life events are a cause, component, or consequence of emotion has been the subject of ongoing debate (Frijda & Zeelenberg, 2001). Some have viewed appraisal as a cause of emotion with temporal precedence (Parkinson & Manstead, 1992; Frijda, 1993b). Lazarus, Opton, Nomikos, and Rankin (1965), for instance, showed that appraisals of films featuring physical injury determined the resulting stress response. Tomaka et al. (1997) demonstrated that changes in situational meaning lead to changes in physiological responses to threat, but the reverse is not always true. More recently, however, some have considered

appraisal an integral component or facet of emotion (Parkinson, 1997; Lewis, 2005). Parkinson (1997) viewed appraisals as "representing the message value of interpersonally directed emotions." Lewis (2005) frames appraisal and emotion using dynamic systems modeling and argues that emotion-appraisal states emerge from the sophisticated interplay between concepts and physiological responses. Schachter and Singer (1962a) proposed that emotions result from cognitive attributions about the situational or biological causes of general bodily arousal. Mandler (1984) argued that emotions are a combination of general bodily arousal and cognitive interpretations of the situation which form a unified experience. According to the somatic marker hypothesis, bodily sensations associated with emotion are juxtaposed to mental images of current or potential events, leading to changes in judgment and decision making (Damasio, 1994, pp. 145-147). Clearly, the relationship between concepts and emotions is not simple.

The metaphor simulation model implies that, at least in some cases, appraisals and emotions are part of the same process of perceptual simulation (and the physiological concomitants) comprising abstract concepts. Research on embodied cognition has shown that thoughts and evaluations about the meaning of events have an intrinsic sensory quality. Therefore, some of the subjective sensations associated with emotional experience may be inseparable from the concepts in appraisal that yielded them.

The model potentially reframes some emotional experiences described by the somatic marker hypothesis. In some cases, somatic markers may consist of the physiological concomitants of conceptual metaphors in how one sees an event and influence decision making by activating innate physical response mechanisms, such as approach or withdrawal. These action tendencies might then be satisfied abstractly. For example, an impulse to physically withdraw might be satisfied by avoiding an economic risk.

Emotion as Information

One consequence of the proposed model is that emotional sensations contain information about the events that caused them. This is consistent with research showing that people use their emotions and moods as information about their situation in life (Sinclair, Mark, & Clore, 1994; Schwartz & Clore, 2003). For instance, if a relationship is conceptualized as smothering, the simulation or reenactment of smothering (i.e., labored breathing, body heat, tightness around the chest) says something about that relationship. Aspects of the relationship might even be inferred on the basis of this feeling experience. If the literal details of an event are forgotten, how the emotion feels (e.g., "I feel as if I've lost something" or "I feel like I'm under attack") might be used to reconstruct the event. However, the reconstructed memory could be a literal version of the original metaphor for the event. For instance, upon wondering what originally caused one to feel "under attack," how the emotion feels could lead one to infer a physical attack rather than a metaphorical attack. Chronic feelings of vulnerability could lead to inferences of a forgotten or repressed physical assault. Events might also be reconstructed in dreams in much the same way that physical aches and pains during sleep lead to dreams featuring hypothetical causes for those pains (e.g., dreaming of a clamp around one's head when experiencing a headache). One might dream of drowning when feeling overwhelmed by life, falling when feeling socially and financially unsupported, or flying when feeling in control.

Emotion Physiology

Emotions involve vivid sensory experiences. Fear and dread, anger and frustration, delight, annoyance, panic, and contentment all involve a rich array of bodily sensations. Heaviness, buoyancy, warmth, an irritable tingling, a peculiar twinge, a dull ache or a piercing cramp, tension and pressure are some of the sensations one might associate with emotion. What

mental or physiological processes differentiate among emotions? Psychologists have been working to answer this question for more than a hundred years (James, 1884; Cannon, 1927; Schachter & Singer, 1962a). Some emotional sensations undoubtedly correspond to physiological changes that prepare the body for action. Most notably, the increase in heart rate that occurs in fear and anger leads to subjective sensations, a sense of trembling and verve, while preparing a person to fight or run away from a threat. However, even though some emotions can be differentiated based on heart rate and skin temperature (Ekman, 1983), general activity in the autonomic nervous system does not necessarily capture all of the subjective aspects of emotional experience, especially given that autonomic activity is indicative of general metabolic demands and may be correlated with emotions merely by way of the general physical demands of emotion and behavior. The bodily sensations involved in emotion give different emotions widely different flavors. More importantly, these sensations seem strikingly relevant to the events that trigger them.

One explanation for the difficulty in differentiating emotions based on measures of ANS activity is that cognitive interpretations of general autonomic arousal are responsible for different emotional experiences (Schachter & Singer, 1962a). A similar explanation is that people give differential focus to physiological changes depending on the cause of the emotion. Parkinson (1995) gives this example: "although embarrassment may be accompanied by a wide variety of physiological responses, the fact that the emotion is concerned with feelings of exaggerated social visibility makes facial flushing the most salient symptom."[4] Some differentiation has been

---

[4] Based on the metaphor simulation model, the perception of social visibility is represented metaphorically as physical exposure, and mental imagery of physical exposure leads

found (Ekman, Levenson, & Friesen, 1983), and the view that ANS activity is identical for all emotions is waning. Because autonomic activity is strongly tied to the general physical and metabolic demands of emotions, however, Levenson (1994) argues, "Perhaps most improbable is the notion that *every* emotion is autonomically different... Autonomic uniqueness is doubtful because quite different behaviors make quite similar demands on certain elements of the autonomic nervous system."

The model has implications for research and debate in this area. If emotional experience is constituted or augmented by sensations associated with metaphorical imagery with some corresponding physiological effects, autonomic activity may not provide an adequate account of the phenomenology of emotion. Parkinson notes that "it is important to maintain a distinction between felt bodily symptoms of emotion, and the actual physiological changes that may or may not underlie them." Specific patterns of muscle tension may also be important, particularly in accounting for physical preparation for specific behaviors. According to the model, changes in muscle tension and respiration as a result of body metaphors are responsible in part for changes in general ANS activity that accompany emotion.

The current model makes specific predictions about emotion-specific physiology. Namely, it predicts that emotions caused by conceptual evaluations of an event will exhibit central and peripheral patterns of activity consistent with the sensory-motor experiences (e.g., carrying a heavy object) used to understand the abstract meaning of the event. Also, the peripheral signs may be somewhat redundant to subjective sensory-motor experiences associated with activity in the brain.

---

to a heightened awareness of the face as well as facial flushing and sensations of tingling and warmth of the skin.

Some facial expressions of emotion appear to reflect metaphor simulation. While many key elements of emotional expression, such as smiling, seem primarily aimed at social communication, other elements seem to coincide with specific physical activities. For instance, frustration resembles facial contortions involved in physical strain and exertion produced by struggling to break free from a physical restraint or plow through a set of obstacles. Sadness and depression provoked by a sense of helplessness and powerlessness resemble physical exhaustion, sleepiness, or fatigue, all of which leave one physically helpless. Despair or acute grief resembles expressions associated with struggling to hold on to an object, maintain a firm grip, and keep the object in close physical contact. Contentment resembles expressions associated with ease of motion, weightlessness, buoyancy, and the relief of physical strain.

Individual Differences

Implications of the model for individual differences in emotional experience are intriguing. One prediction is that individual differences in actual bodily experiences are reflected in individual differences in their simulation. For example, emotional burdens, arising from obligations, care giving, or debt, should feel worse for a person with chronic back pain. A person of low physical fitness should more easily become depressed when a situation is conceptualized as a physical challenge than someone for whom physical activity requires less effort or feels pleasurable. A person with asthma, having more intimate knowledge of what it feels like to suffocate, should experience greater panic when they represent a situation as a confining trap in which they are suffocating, metaphorically. Similarly, a person who had a very salient experience in which they nearly drowned should feel as though they are drowning when, for example, they conceptualize a situation as one in which they have lost all power and can no longer sustain themselves (the abstract side of drowning). Interestingly, people diagnosed with

lung disorders such as asthma are more likely to report thoughts of self-harm and suicide (thoughts linked to feeling "trapped," Beck, 1976, p. 84) than those diagnosed with major depression or other physical ailments, such as hypertension, heart conditions, arthritis, diabetes, cancer, liver disease, or kidney disease (Goodwin et al., 2003). Sensitivities to physical pain and a lower threshold for physical pain are also reflected in sensitivities to social pain due to rejection or exclusion; chronic pain increases sensitivity to rejection, and social support mitigates chronic pain (MacDonald and Leary, 2005; Eisenberger, Jarcho, Lieberman, & Naliboff, 2006). These findings suggest that the emotional response to social rejection is the metaphorical simulation of physical injury.

Actual bodily states occurring in the middle of an emotional experience might influence that emotional experience. For example, a student might feel more overwhelmed by schoolwork when they are carrying a heavy backpack or climbing a steep hill. Bad news may indeed feel less devastating or "earth shattering" when one is sitting down.

Individual differences in the cognitive and physiological processes involved in metaphor simulation should lead to differences in emotional experience. For instance, the extent to which a person experiences peripheral physiological effects in response to sensory imagery should predict emotion intensity or response thresholds. In line with this, vividness of mental imagery is correlated with emotional intensity. People who are anxious about spiders experience prolonged skin and body sensations upon imagining a spider and report more vivid imagery than people who are not anxious about spiders (Pratt, Cooper, and Hackmann, 2004). In Miller et al. (1987), subjects who scored high in imagery ability showed greater heart rate, skin conductance levels, and respiration rates than poor imagers in response to imagining affective scenes.

Potential Therapeutic Applications

People who face no threats to their physical well-being can easily become deeply unhappy. Clearly, the abstract meaning of life events can have profound emotional effects. Attention to conceptual metaphor may facilitate change in psychotherapy. Metaphors have been recognized and manipulated to some extent in cognitive psychotherapy. In this domain, the focus has been chiefly on the utility of metaphor in promoting change or accentuating important messages from the therapist (Muran and DiGiuseppi, 1990; Martin, Cummings, and Hallberg, 1992), metaphorical expressions that clients use to describe their emotions (Angus, 1996) (not to be confused with metaphor for the events that elicit those emotions), metaphors as indicators of therapy outcomes (Levitt, Korman, and Angus, 2000), and the use of metaphors to develop rapport with clients (Linehan et al., 2000). Although practitioners have recognized metaphors in how clients describe life events (Witztum, Van der Hart, & Friedman, 1988), no theory has been proposed to systematically elucidate what kind of metaphors are relevant, what emotions they bring about, and how they influence emotions. The examples described throughout this paper may offer some starting points.

One possible goal of therapy would be finding new metaphors to represent the same events. For example, numerous work assignments can be seen as physical burdens, leading people to feel pressured and overwhelmed. Adopting a new metaphor, the assignments could be seen as helium balloons. Although there are many, they weigh nothing, and one can hold onto them all by easily grasping their many strings in one hand. To encourage such a metaphor, the collection of strings could represent a "to do" list, which links the assignments together in one handy, easy to access place.

For faster relief, the model suggests ways in which emotions might be immediately altered regardless of one's power to change or reappraise the environment. First, certain physical interventions should be highly effective in alleviating emotional pain. For instance, experiencing the weightlessness of a swing at the park should alleviate, at least transiently, the emotional burden caused by a heavy work load. Eating something sweet should make it more difficult to experience social disgust. Schacter and Singer (1962b) demonstrated a similar process in their experiment on anger and epinephrine. These sensory experiences may in turn influence ongoing appraisals of life events. As intended, the bodily sensations will resemble emotional experiences and, in line with the emotion-as-information hypothesis (Schwarz & Clore, 2003), be taken as indicators of the abstract meaning of events.

Second, the model suggests targeted uses of mental imagery that could also alleviate emotional pain. Rather than creating a physical experience to counteract the simulated metaphor, one could simply imagine it. Many meditation practices appear to utilize imagery in this way (e.g., Buddhist compassion meditation or visualization techniques by Shakti Gawain). Visualizing light, warmth, and energy moving in sophisticated patterns through various areas of the body should have a profound effect on one's emotions.

Finally, at a most simple level, one might alleviate emotional distress by attending to current bodily experiences in order to dissolve or override simulated bodily experiences (i.e., realizing that one is not in fact falling or suffocating). This may account for some of the beneficial effects of meditation on mood (Carlson & Garland, 2005). A therapeutic practice of meditation aimed at eliminating metaphorical thought and attending exclusively to present-moment sensory experience should thus dramatically influence emotion. Upon mentally dissolving a simulation in this manner, people with metaphorical models of the world in which

they carry a heavy burden or are trapped may feel sudden relief or freedom from a situation they scarcely realized they were creating.

SUMMARY

The question addressed in this paper is how conceptual evaluations of the abstract, psychological meaning or personal significance of events lead to emotion. To answer this question, theory and research on the nature of abstract thought was brought to bear on the issue. Specifically, research in embodied cognition, conceptual metaphor, and mental imagery was pulled together to form a theoretical model outlining the processes that translate thought into feeling. The metaphor simulation model holds that some emotions are simulations or reenactments of bodily experiences, such as floating, touching something soft, tasting something sweet, bodily warmth, or effortless motion, where these bodily experiences form the basis of metaphorical concepts in appraisal.

In metaphorical concepts, a physical, sensory-motor experience (e.g., carrying something heavy) provides the substance and structure for the intangible meaning of a situation (e.g., the psychological demands of work). These concepts are formed during experiences in which the abstract and sensory-motor elements of the metaphor are part of the same experience (e.g., carrying something heavy poses a psychological demand). The sensory-motor elements arise later with little mental effort or volition as part of the abstract concept. The types of bodily experiences that are most relevant to emotions resulting from metaphor simulation are those involving somatic sensations (e.g., movement, pressure, temperature, and tactile stimuli). When the personal significance of an abstract event, such as losing a job, is understood in terms of such bodily experiences, the simulation or reenactment of the experience and its physiological effects (forming an essential component of the concept) *is* the emotion.

This model offers one possible explanation for how some events evoke an emotional response. While this account does not apply to all types of emotional experiences, particularly those evoked more directly by sensory stimuli or low-level appraisal processes, it does have far-reaching implications for many areas of emotion research, including the search for emotion-specific physiology. One contribution of the model is an explanation for how emotions in humans navigating modern life are related to emotions in non-human animals and infants. The model offers a bridge between research in these two domains. Through metaphor, innate physiological responses to sensory stimuli (e.g., oral revulsion in response to a foul substance, autonomic arousal in response to a sudden fall, embarrassment in response to being stared at, separation anxiety) can arise in situations in which the personal significance is abstract rather than physical. More importantly, sensory experiences that are initially non-emotional (albeit physically pleasant or unpleasant, e.g., softness, sweetness, satiety) can also be simulated or reenacted metaphorically, subsequently becoming emotional in nature (e.g., fondness, delight, contentment).

Finally, the model carries significant therapeutic implications. A deeper understanding of the psychological processes that give rise to emotion expands the range of opportunities for interrupting the link between misfortune and suffering. By altering their metaphorical simulations, people can alter their emotions regardless of their circumstances.

References

Abramson, L. Y., Alloy, L. B., Hankin, B. L., Haeffel, G. J., MacCoon, D. G., & Gibb, B. E. (2002). Cognitive vulnerability-stress models of depression in a self-regulatory and psychobiological context. In I. H. Gotlib & C. L. Hammen (Eds.), *Handbook of Depression*. New York: Guilford.

Angus, L. E. (1996). An intensive analysis of metaphor themes in psychotherapy. In J. Mio and A. Katz (Eds.), *Metaphor: Implications and Applications* (pp. 73-84). Mawhaw, NJ: Lawrence Erlbaum Associates.

Arnold, M. B. (1960). *Emotion and personality*. Vols I and II. New York: Columbia University Press.

Arnold, M. B. (1970). Perennial problems in the field of emotion. In M. B. Arnold (Ed.), *Feelings and Emotions: The Loyola Symposium* (pp. 169-185). New York: Academic Press.

Arnold, M. B., & Gasson, J. A. (1954). Feelings and emotions as dynamic factors in personality integration. In M. B. Arnold & S. J. Gasson (Eds.), *The human person* (pp. 294-313). New York: Ronald.

Baetz, C.P. (1999, February). Shame and the superego: A dynamic systems perspective. Paper presented at the Annual Convention of the Ontario Psychological Association, Toronto.

Barsalou, L. W. (1999). Perceptual symbol systems. *Behavioral and Brain Sciences, 22*, 577-609.

Barsalou, L. W., Simmons, W. K., Barbey, A. K., & Wilson, C. D. (2003). Grounding conceptual knowledge in modality-specific systems. *Trends in Cognitive Sciences*, 7, 84-

91.

Barsalou, L.W. (2008). Grounded cognition. *Annual Review of Psychology*, 59.

Bauer, R. M., & Craighead, W. E. (1979). Psychophysiological responses to the imagination of fearful and neutral situations: The effects of imagery instructions. *Behavior Therapy*, 10, 389-403.

Beck, A. T. (1976).*Cognitive Therapy and the Emotion Disorders*, New York: Meridian.

Bird, E. I. (1984). EMG quantification of mental rehearsal. *Perceptual and Motor Skills*, 59, 899-906.

Boroditsky, L. (2000). Metaphoric structuring: Understanding time through spatial metaphors. *Cognition*, 75, 1-28.

Boroditsky, L., & Ramscar, M. (2002). The roles of body and mind in abstract thought. *Psychological Science*, 13, 185-189.

Buccino G, Riggio L, Melli G, Binkofski F, Gallese V, Rizzolatti G. (2005). Listening to action-related sentences modulates the activity of the motor system: a combined TMS and behavioral study. *Brain Res Cogn Brain Res*, 24, 355–363.

Cannon, W. B. (1927). The James-Lange theory of emotions: A critical examination and an alternate theory. *American Journal of Psychology*, 39, 106-124.

Carlson, L. E., & Garland, S. N. (2005). Impact of mindfulness-based stress reduction (MBSR) on sleep, mood, stress and fatigue symptoms in cancer outpatients. *International Journal of Behavioral Medicine,* 12, 278-285.

Clark, D. M. (1986). A cognitive model of panic. *Behaviour Research and Therapy*, 24, 461–470.

Cooper, L. A., & Shepard, R. N. (1973). Chronometric studies of the rotation of mental images. In W. G. Chase (Ed.), *Visual information processing* (pp. 75-175). New York: Academic Press.

Cosmides, L. & Toobey, J. (2000). Evolutionary psychology and the emotions. In M. Lewis and J. M. Haviland-Jones (Eds.), *Handbook of Emotions*, 2nd edition. New York: Guildford.

Cuthbert, B. N., Vrana, S. R., & Bradley, M. M. (1991). Imagery: Function and physiology. *Advances in Psychophysiology*, 4, 1-42.

Damasio, A. R. (1989). Time-locked multiregional retroactivation: A systems-level proposal for the neural substrates of recall and recognition. *Cognition*, 33, 25-62.

Damasio, A. R. (1994). *Descartes' Error: Emotion, Reason, and the Human Brain*. Avon Books: New York.

Davitz, J. R. (1969). *The language of emotion*. New York: Academic Press.

Decety, J., & Ingvar, D. H. (1990). Brain structures participating in mental simulation of motor behavior. A neuropsychological interpretation. *Acta Psychologica*, *73*, 13-34.

Decety, J., Jeannerod, M., Durozard, D., & Baverel, G. (1993). Central activation of autonomic effectors during mental simulation of motor actions in man. *Journal of Physiology, 461*, 549-563.

Decety, J., Jeannerod, M., Germain, M., & Pastene, J. (1991). Vegetative response during imagined movement is proportional to mental effort. *Behavioral Brain Research*, 34, 35–42.

Decety. J. (1996). The neurological basis of motor imagery. *Behavioural Brain Research*, 77, 45-52.

Eisenberger, N. I., Lieberman, M. D., & Williams, K. D. (2003). Does rejection hurt? An fMRI study of social exclusion. *Science, 302*, 290-292.

Ekman, P. (1972). Universal and cultural differences in facial expressions of emotions. In J. K. Cole (Editor), *Nebraska Symposium On Motivation*. University of Nebraska Press, 207-283.

Ekman, P., & Friesen, W. V. (1975). *Unmasking The Face: A Guide To Recognizing Emotions From Facial Clues*. New York: Prentice-Hall.

Ekman, P., Levenson, R. W., & Friesen, W. V. (1983). Autonomic nervous system activity distinguishes between emotions. *Science*. 221, 1208-1210.

Ellsworth, P. C., & Smith, C. A. (1988). From appraisal to emotion: Differences among unpleasant feelings. *Motivation and Emotion*, 12, 271-302.

Farah, M. J., Péronnet, F., Gonon, M. A., & Giard, M. H. (1988). Electrophysiological evidence for a shared representation medium for visual images and visual percepts. *Journal of Experimental Psychology: General*, 117(3), 248-257.

Finke, R. A. (1980). Levels of equivalence in imagery and perception. *Psychological Review*, 87, 113-132.

Fodor, J. A. (1975). *The language of thought*. New York: Crowell.

Frijda, N. H. (1986). *The emotions*. Cambridge: Cambridge University Press.

Frijda, N. H. (1993a). Appraisal and beyond. *Cognition and Emotion*, 7 (3/4), 225-231.

Frijda, N. H. (1993b). The place of appraisal in emotion. *Cognition and Emotion*, 7 (3/4), 357-387.

Frijda, N. H., & Zeelenberg, M. (2001). Appraisal: What is the dependent? In K. R. Scherer & A. Schorr (Eds.), *Appraisal processes in emotion: Theory, methods, research*. Series in affective science. London: Oxford University Press.

Frijda, N. H., Kuipers, P., & ter Schure, E. (1989). Relations among emotion, appraisal, and emotional action readiness. *Journal of Personality and Social Psychology*, 57, 212-228.

Gainotti, G. Silveri, M. C., Daniele, A., & Giustolisi, L. (1995). Neuroanatomical correlates of category-specific semantic disorders: A critical survey. *Memory*, 3, 247-264.

Gallese, V. (2003a). The manifold nature of interpersonal relations: The quest for a common mechanism. *Philosophical Transactions of the Royal Society of London*, 358, 517–528.

Gallese, V. (2003b). A neuroscientific grasp of concepts: From control to representation. *Philosophical Transactions of the Royal Society of London, 358,* 1231–1240.

Gallese, V. (2005). Embodied simulation: From neurons to phenomenal experience. *Phenomenology and the Cognitive Sciences*, 4, 23-48.

Gallese, V., & Lakoff, G. (2005). The brain's concepts: The role of the sensory-motor system in conceptual knowledge. *Cognitive Neuropsychology*, in press.

Gallese, V., Fadiga, L., Fogassi, L., & Rizzolatti, G. (1996). Action recognition in the premotor cortex. *Brain*, 119, 593–609.

Gallese, V., Fogassi, L., Fadiga, L., & Rizzolatti, G. (2002). Action representation and the inferior parietal lobule. In W. Prinz & B. Hommel (Eds.), *Attention and performance* XIX (pp. 247–266). Oxford: Oxford University Press.

Garbarini, F., & Adenzato, M. (2004). At the root of embodied cognition: Cognitive science meets neurophysiology. *Brain and Cognition*, 56, 100-106.

Gentner, D., Imai, M., & Boroditsky, L. (2002). As time goes by: Evidence for two systems in processing space-time metaphors. *Language and Cognitive Processes*, 17, 537-565.

Gibbs, R.W. (1992). Categorization and metaphor understanding. *Psychological Review*, 99(3), 572-577.

Glenberg, A. M., & Kaschak, M. P. (2002). Grounding language in action. *Psychonomic Bulletin & Review*, 9(3), 558-565.

Glenberg, A. M., Havas, D., Becker, R., & Rinck, M. (2005). Grounding Language in Bodily States: The Case for Emotion. R. Zwaan and D. Pecher (Eds.) *The grounding of cognition: The role of perception and action in memory, language, and thinking*. Cambridge: Cambridge University Press.

Glenberg, A. M., Sato, M., Cattaneo, L., Riggio, L., Palumbo, D., & Buccino, G. (in press). Processing abstract language modulates motor system activity. *Quarterly Journal of Experimental Psychology*.

Goldberg, R. F., Perfetti, C. A., & Schneider, W. (2006). Perceptual knowledge retrieval activates sensory brain regions. *The Journal of Neuroscience*, 26, 4917-4921.

Goodwin, R.D., et al. (2003). Major depression, physical illness, and suicidal ideation in primary care. *Psychosomatic Medicine*, 65(July/August).

Grady, J. (1997). *Foundations of meaning: Primary metaphors and primary scenes.* Unpublished PhD dissertation, University of California at Berkeley.

Grayson, J. B. (1982). The elicitation and habituation of orienting and defensive responses to phobic imagery and the incremental stimulus intensity effect. *Psychophysiology*, 19, 104-111.

Grossberg, J. M., & Wilson, H. K. (1968). Physiological changes accompanying the visualization of fearful and neutral situations. *Journal of Personality and Social Psychology*, 10, 124-133.

Haidt, J. (2000). The positive emotion of elevation. *Prevention & Treatment*, 3.

Haidt, J. (2003). The moral emotions. In R. J. Davidson, K. R. Scherer, and H. H. Goldsmith (Eds.) *Handbook of Affective Sciences*. Oxford, UK: Oxford University Press; 852 -870.

Hale, B. D. (1982). The effects of internal and external imagery on muscular and ocular concomitants. *Journal of Sport Psychology*, 4, 379-387.

Haney, J. N., & Euse, F. J. (1976). Skin conductance and heart rate response to neutral, positive and negative imagery. *Behavior Therapy*, 7, 494-503.

Harnad, S. (1990). The symbol grounding problem. *Physica D*, 42, 335-346.

Hauk, O., Johnsrude, I., & Pulvermüller, F. (2004). Somatotopic representation of action words in human motor and premotor cortex. *Neuron*, 41, 301-307.

Izard, C. E. (1971). *The Face Of Emotion*. New York: Century-Crofts.

Izard, C. E. (1993). Four systems of emotion activation: Cognitive and non-cognitive processes. *Psychological Review*, 100, 68-90.

Jacobson, E. (1931). Electrical measurements of neuromuscular states during metnal activities: V. Variation of specific muscles contracting during imagination. *American Journal of Physiology*, 96, 115-121.

James, W. (1884). What is an emotion? *Mind*, 9, 188-205.

Jeannerod, M., & Frak, V. (1999). Mental imaging of motor activity in humans. *Current Opinion in Neurobiology, 9*, 735–739.

Johnson, C. (1997). Metaphor vs. conflation in the acquisition of polysemy: The case of SEE. In Hiraga, Masako K., C. Sinha, and S. Wilcox (Eds.), *Cultural, Typological and Psychological Issues in Cognitive Linguistics*. (Current Issues in Linguistic Theory, 152.) Amsterdam: John Benjamins, 155-169.

Johnson, J. (1991). Developmental versus language-based factors in metaphor interpretation. *Journal of Educational Psychology*, 83(4), 470-483.

Johnson, M. (1987). *The Body in the Mind: The Bodily Basis of Meaning, Imagination, and Reason*. Chicago: The University of Chicago Press.

Johnson, M., & Lakoff, G. (2002). Why cognitive linguistics requires embodied realism. *Cognitive Linguistics*, 13-3, 245-263.

Kable, J. W., Lease-Spellmeyer, J., & Chatterjee, A. (2002). Neural substrates of action event knowledge. *Journal of Cognitive Neuroscience*, 14, 795-805.

Kalin, N. H., & Shelton, S. E. (2000). The regulation of defensive behaviors in Rhesus monkeys: Implications for understanding anxiety disorders. In R. J. Davidson (Ed,), *Anxiety, depression and emotion* (pp. 50-68). New York: Oxford University Press.

Kohler, E., Keysers, C., Umiltá, M. A., Fogassi, L., Gallese, V., & Rizzolatti, G. (2002). Hearing sounds, understanding actions: Action representation in mirror neurons. *Science,* 297, 846-848.

Kojo, I. (1985). The effects of mental imagery on skin temperature and skin temperature sensation. *Scandinavian Journal of Psychology*, 26, 314-320.

Kojo, I. (1990). Temporal relationships between warmth imagery and associated changes in digital pulse amplitude, skin temperature and skin temperature sensation. Activitas Nervosa Superior, 32(3), Sep 1990, pp. 161-166.

Kosslyn, S. M. (1994). *Image and brain: The resolution of the imagery debate*. Cambridge, MA: MIT Press.

Kosslyn, S. M., Alpert, N. M., Thompson, W. L., Maljkovic, V., Weise, S. B., Chabris, C. F., et al. (1993). Visual mental imagery activates topographically organized visual cortex: PET investigations. *Journal of Cognitive Neuroscience*, 5, 263–287.

Kosslyn, S. M., Pinker, S., Smith, G. E., & Shwartz, S. P. (1979). On the demystification of mental imagery. *The Behavioral and Brain Sciences*, 2, 535-581.

Kövecses, Z. (1990). *Emotion Concepts*. New York: Springer-Verlag.

Kövecses, Z. (2000). *Metaphor and Emotion: Language, Culture, and Body in Human Feeling*. Cambridge University Press: Cambridge.

Kövecses, Z. (2005). *Metaphor in Culture: Universality and Variation*. Cambridge University Press: Cambridge.

Krolak-Salmon, P., Henaff, M. A., Isnard, J., Tallon-Baudry, C., Guenot, M., Vighetto, A., Bertrand, O., & Mauguiere, F. (2003). An attention modulated response to disgust in human ventral anterior insula. *Ann. Neurol.* **53**, 446-453.

Lakoff, G. (1987). *Women, Fire, and Dangerous Things: What Categories Reveal About the Mind*. Chicago: The University of Chicago Press.

Lakoff, G. (1993). The contemporary theory of metaphor. In A. Ortony (Ed.), *Metaphor and Thought*, 2nd edition. Cambridge University Press.

Lakoff, G., & Johnson, M. (1980). *Metaphors We Live By*. Chicago and London: The University of Chicago Press.

Lakoff, G., & Johnson, M. (1999). *Philosophy In the Flesh: The Embodied Mind And Its Challenge To Western Thought*. New York, NY: Basic Books.

Lakoff, G., & Núñez, R. (2000). *Where Mathematics Comes From: How the Embodied Mind Brings Mathematics into Being*. Basic Books.

Lakoff, G., & Turner, M. (1989). *More Than Cool Reason: A Field Guide to Poetic Metaphor*. Chicago and London: The University of Chicago Press.

Lambie, J. A., & Marcel, A. J. (2002). Consciousness and the varieties of emotion experience: A theoretical framework. *Psychological Review*, 109(2), 219-259.

Lang, P. J. (1979). A bio-informational theory of emotional imagery. *Psychophysiololgy*, 16, 495-512.

Lang, P. J. (1984). Cognition in emotion: Concept and action. In C. Izard, J. Kagan, & R. Zajonc (Eds.), *Emotion, Cognition, and Behavior* (pp. 192-225). New York: Cambridge University Press.

Lang, P. J., Kozak, M. J., Miller, G. A., Levin, D. N., & McLean, A. Jr. (1980). Emotional imagery: Conceptual structure and pattern of somato-visceral response. *Psychophysiology*, 17, 179-192.

Lazarus, R. S. (1966). *Psychological stress and the coping process*. New York: McGraw-Hill.

Lazarus, R. S. (1994). Universal antecedents of the emotions. In P. Ekman & R. J. Davidson (Eds.), *The Nature of Emotion: Fundamental Questions* (p 164). New York: Oxford University Press.

Lazarus, R. S. (2001). Relational meaning and discrete emotions. In K. R. Scherer, A. Schorr, & T. Johnstone (Eds.), *Appraisal Processes in Emotion* (pp. 187-201). New York: Oxford University Press.

Lazarus, R. S., Opton, E. M., Jr., Nomikos, M. S., & Rankin, N. O. (1965). The principle of short-circuiting of threat: Further evidence. *Journal of Personality*, 33, 622-635.

LeDoux, J. E. (1996). *The emotional brain: The mysterious underpinnings of emotional life*. New York: Simon & Schuster.

Levenson, R. W. (1994). Human emotions: A functional view. In P. Ekman & R. J. Davidson (Eds.), *The nature of emotion: Fundamental questions*. New York: Oxford University Press.

Levitt, H., Korman, Y., & Angus, L. (2000). A metaphor analysis in treatments of depression: Metaphor as a marker of change. *Counselling Psychology Quarterly*, 13(1), 23-35.

Lewis, M. (2000). Self-conscious emotions: Embarrassment, pride, shame, and guilt. In M. Lewis & J. M. Haviland-Jones (Eds.), *Handbook of Emotions*, 2nd edition, (pp. 631-632). New York: Guilford.

Lewis, M. D. (2005), Linking emotion theory and neurobiology through dynamic systems modeling. *Behavioral and Brain Sciences*, 28, 105-131.

Li, S., Kamper, D. G., Stevens, J. A., & Rymer, W. Z. (2004). The effect of motor imagery on spinal segmental excitability. *Journal of Neuroscience, 24*(43), 9674-9680.

Linehan, M.M., Dimeff, L., Waltz, J., & Koerner, K. (2000). *DBT Skills Training Video: Opposite Action*. Seattle: The Behavioral Technology Transfer Group.

MacDonald, G., & Leary, M. R. (2005). Why does social exclusion hurt? The relationship between social and physical pain. *Psychological Bulletin, 131*, 202-223.

MacWhinney, B. (1995). The CHILDES Project: Tools for Analyzing Talk. Hillsdale, N.J.: Erlbaum.

Mandler, G. (1984). *Mind and body: Psychology of emotion and stress*. New York: Norton.

Maner, J. K., Kaschak, M. P., & Jones, J. L. (unpublished manuscript). Social power and the advent of action.

Marks, I. M., & Huson, J. (1973). Physiological aspects of neutral and phobic imagery. *British Journal of Psychiatry*, 122, 567-572.

Martin, J., Cummings, A. L., & Hallberg, E. T. (1992). Therapists' intentional use of metaphor: Memorability, clinical impact, and possible epistemic/motivational functions. *Journal of Consulting and Clinical Psychology*, 60, 143-145.

May, J. R. (1977a). Psychophysiology of self regulated phobic thoughts. *Behavior Therapy*, 8, 150-159.

May, J. R. (1977b). A psychophysiological study of self and externally regulated phobic thoughts. *Behavior Therapy*, 8, 849-861.

McNeil, D. W., Vrana, S. R., Melamed, B. G., & Lang, P. J. (1985, November). *Affective response to fear imagery: Individual differences in phobic populations.* Paper presented at the meeting of the Association for the Advancement of Behavior Therapy, Houston, Texas.

Meteyard, L., Bahrami, B. & Vigliocco, G. (2007) Motion detection and motion words: language affects low level visual perception. *Psychological Science*, 18(11).

Miller, G. A., Levin, D. N., Kozak, M. J., Cook, E. W., III, McLean, A., Jr., & Lang, P. J. (1987). Individual differences in imagery and the psychophysiology of emotion. *Cognition and Emotion*, 1, 367-390.

Moll, J., de Oliveira-Souza, R., Eslinger, P., Bramati, I., Mourao-Miranda, J., Andreiuolo, P., et al. (2002). The neural correlates of moral sensitivity: A functional magnetic resonance imaging investigation of basic and moral emotions. *Journal of Neuroscience, 22*, 2730-2736.

Moll, J., de Oliveira-Souza, R., Moll, F. T., Ignacio, F. A., Bramati, I. E., Caparelli-Daquer, E. M., et al. (2005). The moral affiliations of disgust: A functional MRI study. *Cog Behav Neurol, 18*(1).

Muran, J. C., & DiGiuseppi, R. A. (1990). Towards a cognitive formulation of metaphor use in psychotherapy. *Clinical Psychology Review*, 10, 69-85.

Narayanan, S. (1997). Embodiment in language understanding: Sensory-motor representations for metaphoric reasoning about event descriptions. Unpublished Ph.D. dissertation, Department of Computer Science, University of California, Berkeley.

Nayak, N., & Gibbs, R. (1990). Conceptual knowledge in the interpretation of idioms. *Journal of Experimental Psychology: General*, 116, 315-330.

Newell, A. (1980). Physical symbol systems. *Cognitive Science*, 4, 135-183.

Niedenthal, P. M., Barsalou, L. W., Winkielman, P., Krauth-Gruber, S., & Ric, F. (2005). Embodiment in attitudes, social perception, and emotion. *Personality and Social Psychology Review*, 9, 184-211.

Niedenthal, P. M. (1992). Affect and social perception: On the psychological validity of rose-colored glasses. In R.F. Bornstein and T.S. Pittman (Eds.), *Perception without awareness*. New York: Guilford Press.

Niedenthal, P. M. (2007). Embodying emotion. *Science*, 316, 1002-1005.

Öhman, A. (1997). As fast as the blink of an eye: Evolutionary preparedness for preattentive processing of threat. In P. J. Lang, R. F. Simons, & M. T. Balaban (Eds.), *Attention and orienting: Sensory and motivational processes* (pp. 165-184). Mahwah, N.J. : Lawrence Erlbaum Associates.

Öhman, A. (1999). Distinguishing unconscious from conscious emotional process: Methodological considerations and theoretical implications. In T. Dalgleish & M. Power (Eds.), *Handbook of Cognition and Emotion* (pp. 321-352). Chichester: John Wiley & Sons.

Öhman, A., Flykt, A., & Lundqvist, D. (2000). Unconscious emotion: Evolutionary perspectives, psychophysiological data and neuropsychological mechanisms. In R.D. Lane, L. Nadel, & G. Ahern (Eds.), *Cognitive Neuroscience of Emotion* (pp. 296–327). New York: Oxford University Press.

Ortony, A., & Fainsilber, L. (1989). The role of metaphors in descriptions of emotions. In Yorick Wilks (Ed.), *Theoretical issues in natural language processing*. Lawrence Erlbaum Associates, Inc: Hillsdale, NJ.

Parkinson, B. & Manstead, A. S. R. (1992). Appraisal as a cause of emotion. In M. S. Clark (Ed.), *Emotion. Review of personality and social psychology*, Vol. 13. Newbury Park, CA: Sage, 122-149.

Parkinson, B. (1995). Emotion. In B. Parkinson and A. M. Coleman (Eds.), *Emotion and Motivation*. Longman Publishing: New York.

Parkinson, B. (1997). Untangling the appraisal-emotion connection. *Personality and Social Psychology Review*, 1, 62-79.

Parsons, L. M., Fox, P. T., Downs, J. H., Glass, T., Hirsch, T. B., Martin, C. C., Jerabek, P. A., & Lancaster, J. L. (1995). Use of implicit motor imagery for visual shape discrimination as revealed by PET. *Nature*, 375, 54-58.

Pecher, D., Zeelenberg, R., & Barsalou, L. W. (2003). Verifying different-modality properties for concepts produces switching costs. *Psychological Science*, 14, 119-124.

Pecher, D., Zeelenberg, R., & Barsalou, L. W. (2004). Sensorimotor simulations underlie conceptual representations: Modality-specific effects of prior activation. *Psychonomic Bulletin & Review*, 11, 164–167.

Peiper, A. (1963). *Cerebral functions in infancy and childhood*. New York: Consultants Bureau.

Penfield, W., & Faulk, M. E. (1955). The insula: Further observations on its function. *Brain*, 78, 445-470.

Phillips, M. L., Young, A. W., Senior, C., Brammer, M., Andrew, C., Williams, S. C. R., Gray, J., and David, A. S. (1997). A specific neural substrate for perceiving facial expressions of disgust. *Nature*, 389, 495-498.

Pinker, S. (1997). *How the Mind Works*. New York: W. W. Norton.

Pratt, D., Cooper, M. J., Hackmann, A. (2004). Imagery and its characteristics in people who are anxious about spiders. *Behavioural & Cognitive Psychotherapy*, Vol 32(2), April 2004, pp. 165-176.

Price, D. D. (2000). Psychological and neural mechanisms of the affective dimension of pain. *Science*, 288, 1769–1772.

Pulvermüller, F. (1999). Words in the brain's language. *Behavioral & Brain Sciences*, 22(2), 253-336.

Putnam, H. (1960). Minds and machines. In S. Hook (Ed.), *Dimensions of Mind: A Symposium*. New York University Press. Reprinted in A. R. Anderson (Ed.), 1964. *Minds and Machines*. Prentice-Hall: 77.

Rakova, M. (2002). The philosophy of embodied realism: A high price to pay? *Cognitive Linguistics*, 13, 215-244.

Reddy, M. I. (1993). The conduit metaphor: A case of frame conflict in our language about language. In A. Ortony (Ed.), *Metaphor and Thought*, 2nd ed. Cambridge University Press.

Reisberg, D. (Ed.) (1992). *Auditory imagery*. Hillsdale, NJ: Erlbaum.

Rizzolatti, G., Fadiga, L., Gallese, V., & Fogassi, L. (1996). Premotor cortex and the recognition of motor actions. *Cognitive Brain Research, 3*, 131–141.

Rizzolatti, G., Fogassi, L., & Gallese, V. (2000). Cortical mechanisms subserving object grasping and action recognition: A new view on the cortical motor functions. In M. S. Gazzaniga (Ed.), *The Cognitive Neurosciences* (2nd ed., pp. 539–552). Cambridge, MA: MIT Press.

Rizzolatti, G., Fogassi, L., & Gallese, V. (2001). Neurophysiological mechanisms underlying the understanding and imitation of action. *Nature Neuroscience Reviews*, 2, 661–670.

Rizzolatti, G., Fogassi, L., & Gallese, V. (2002). Motor and cognitive functions of the ventral premotor cortex. *Current Opinion in Neurobiology, 12*, 149–154.

Robertson, C. (1998). Berkeley wants student out of town. *The Daily Texan*. University of Texas-Austin.

Rohrer, T. (2001). The neurophysiology of cognitive semantics. Talk presented at the Seventh International Cognitive Linguistics Conference, Santa Barbara, California.

Roseman, I. J. (1991). Appraisal determinants of discrete emotions. *Cognition and Emotion*, 5, 161-200.

Roseman, I. J., & Smith, C. A. (2001). Appraisal theory: Overview, assumptions, varieties, controversies. In K. R. Scherer, A. Schorr, & T. Johnstone (Eds.), *Appraisal Processes in Emotion: Theory, Methods, Research* (pp. 11-12). New York: Oxford University Press.

Roth, G. (1992) *When Food Is Love: Exploring the Relationship Between Eating & Intimacy*. New York: NAL-Dutton.

Rozin, P., & Fallon, A. E. (1987). A perspective on disgust. *Psychological Review*, 94, 23-41.

Rozin, P., Fallon, A. E., & Augustoni-Ziskind, M. (1985). The child's conception of food: The development of contamination sensitivity to "disgusting" substances. *Developmental Psychology*, 21, 1075-1079.

Rozin, P., Haidt, J., & McCauley, C. R. (1993). Disgust. In M. Lewis & J. M. Haviland (Eds.), *Handbook of emotions* (pp. 575-594). New York: Guilford.

Rozin, P., Hammer, L., Oster, H., Horowitz, T., & Marmora, V. (1986). The child's conception of food: Differentiation of categories of rejected substances in the 16 months to 5 year age range. *Appetite*, 7, 141-151.

Rozin, P., Lowery, L., & Ebert, R. (1994). Varieties of disgust faces and the structure of disgust. *Journal of Personality and Social Psychology*, 66, 870-881.

Sanfey, A. G., Rilling, J. K., Aronson, J. A., Nystrom, L. E., & Cohen, J. D. (2003). The neural basis of economic decision making in the ultimatum game. *Science, 300*, 1755-1757.

Schacter, S., & Singer, J. E. (1962a). Cognitive, social and physiological determinants of emotional state. *Psychological Review*, 69, 379-399.

Schacter, S., & Singer, J. E. (1962b). Pain, fear, and anger in hypertensives and normatives: A psychophysiological study. *Psychosomatic Medicine*, 69, 379-399.

Scherer, K. R. (1993). Studying the emotion-antecedent appraisal process: An expert system approach. *Cognition and Emotion*, 7, 325-35.

Schnall, S. (2001). Embodied emotion, embodied cognition: The influence of bodily states on metaphor comprehension and self-reports of emotional feelings. Dissertation Abstracts International...

Schubert, T. W. (2005). Your highness: Vertical positions as perceptual symbols of power. *Journal of Personality and Social Psychology*, 89, 1-21.

Schwarz, N., & Clore, G. L. (2003). Mood as information: 20 years later. *Psychological Inquiry*, 14, 296-303.

Searle, J. R. (1980). Minds, brains, and programs. *Behavioral & Brain Sciences*, 3, 417-457.

Shepard, R. N. (1984). Ecological constraints on internal representation: Resonant kinetics of perceiving, imagining, thinking, and dreaming. *Psychological Review*, 91, 417-447.

Simmons, W. K., Martin, A., Barsalou, L.W. (2005). Pictures of appetizing foods activate gustatory cortices for taste and reward. *Cereb Cortex*, 15, 1602–1608.

Sinclair, R. C., Mark, M. M., & Clore, G. L. (1994). Mood-related persuasion depends on (mis)attributions. *Social Cognition*, 12, 309-326.

Smith, C. A., & Kirby, L. D. (2001). Toward delivering on the promise of appraisal theory. In K. R. Scherer, A. Schorr, & T. Johnstone (Eds.), *Appraisal Processes in Emotion: Theory, Methods, Research* (pp. 187-201). New York: Oxford University Press.

Sohn, Y. H., Dang, N., & Hallett, M. (2003). Suppression of corticospinal excitability during negative motor imagery. *Journal of Neurophysiology, 90*, 2303-2309.

Stanfield, R. A., & Zwaan, R. A. (2001). The effect of implied orientation derived from verbal context on picture recognition. *Psychological Science*, 121, 153-156.

Steiner, J. E. (1979). Human facial expressions in response to taste and smell stimulation. In H. W. Reese & L. P. Lipsitt (Eds.), *Advances in child development and behavior* (Vol. 13, pp. 257-295). New York: Academic Press.

Tettamanti, M., Buccino, G., Saccuman, M. C., Gallese, V., Danna, M., Scifo, P., Fazio, F., Rizzolatti, G., Cappa, S. F., & Perani, D. (2005). Listening to action-related sentences activates fronto-parietal motor circuits. *Journal of Cognitive Neuroscience*, 17, 273-281.

Thelen, E., Schoner, G., Scheier, C., & Smith, L.B. (2001). The dynamics of embodiment: A field theory of infant perservative reaching." *Behavioral and Brain Sciences* 24: 1-86.

Tomaka, J., Blascovich, J., Kibler, J., & Ernst, J. M. (1997). Cognitive and physiological antecedents of threat and challenge appraisal. *Journal of Personality and Social Psychology*, 73, 63-72.

Toobey, J., & Cosmides, L. (1990). The past explains the present: Emotion adaptations and the structure of ancestral environment. *Ethology and Sociobiology*, 11, 375-424.

Ulich, E. (1967). Some experiments on the function of mental training in the acquisition of motor skills. *Ergonomics, 10*, 411-419.

Van Egeren, L. F., Feather, B. W., & Hein, P. L. (1971). Desensitization of phobias: Some psychophysiological propositions. *Psychophysiology*, 8, 213-228.

Vosniadou, S. (1987). Children and metaphors. *Child Development*, 58, 870-885.

Vrana, S. R. (1993). The psychophysiology of disgust: Differentiating negative emotional contexts with facial EMG. *Psychophysiology*, 30, 279-286.

Wicker, B., Keysers, C., Plailly, J., Royet, J. P., Gallese, V., & Rizzolatti, G. (2003). Both of us disgusted in my insula: The common neural basis of seeing and feeling disgust. *Neuron*, 40, 655-664.

Wiener, B. (1985). An attributional theory of achievement motivation and emotion. *Psychological Review*, 92, 548-573.

Wierzbicka, A. (1986). Human emotions: Universal or culture-specific? *American Anthropologist*, 88, 584-594.

Witztum, E., Van der Hart, O., & Friedman, B. (1988). The use of metaphors in psychotherapy. *Journal of Contemporary Psychotherapy*, 18(4), 270-290.

Wolpe, J. (1958). *Psychotherapy as reciprocal inhibition*. Stanford, CA: Stanford University Press.

Yue, G., & Cole, K. (1992). Strength increases from the motor program: Comparison of training with maximal voluntary and imagined muscle contractions. *Journal of Neurophysiology, 67*, 1114–1123.

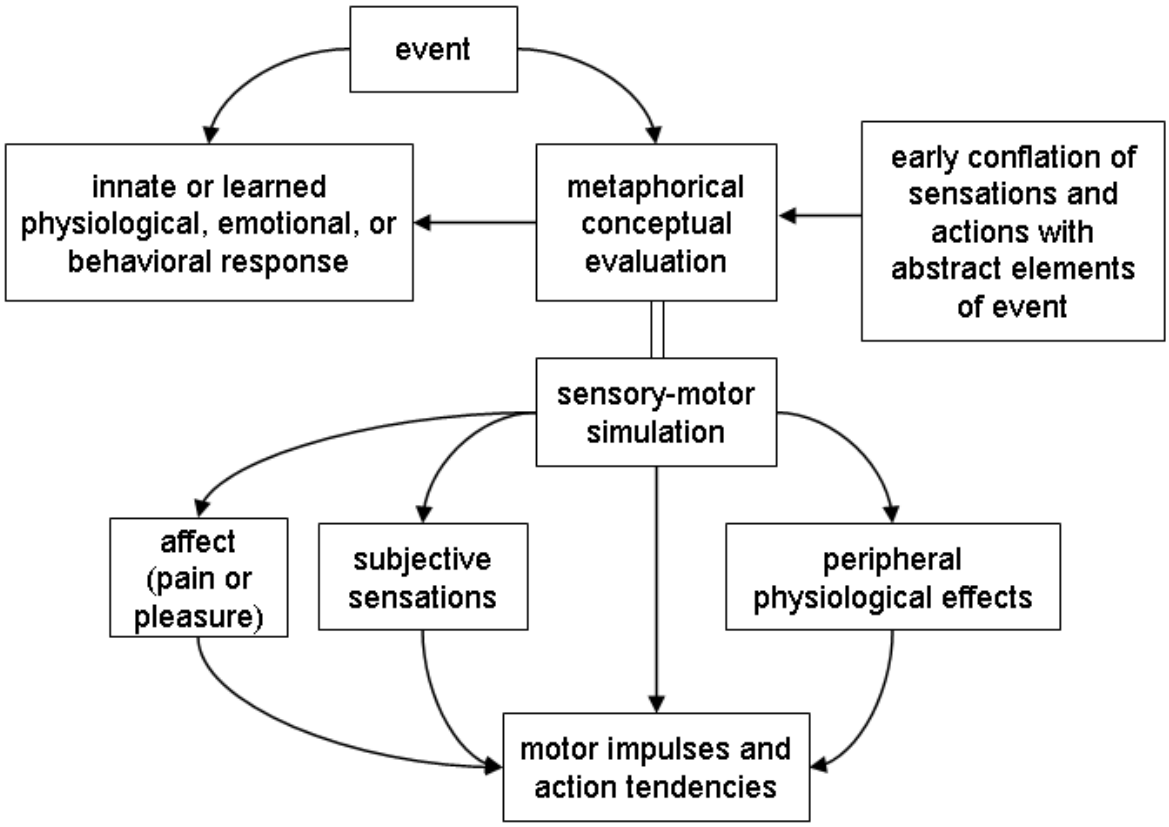
Zhong, C. B., & Liljenquist, K. (2006). Washing away your sins: Threatened morality and physical cleansing. *Science*, 313, 1451-2.

Table 1

Expressions illustrating the concept of argument as physical combat

The politician attacked his opponent's position.
The defendant lost ground in the dispute.
In an argument, you must stand up for yourself.
Her argument was knocked over, and she took a tumble in the debate.
Take a stand and hold to your beliefs.
He changed his mind, because he was a push over.
Don't give in during the debate. Stand your ground.
He had a firm footing with his reliance on the facts.
The politicians were butting heads and locking horns in the debate.

Figure 1


event
innate or learned physiological, emotional, or behavioral response
metaphorical conceptual evaluation
early conflation of sensations and actions with abstract elements of event
sensory-motor simulation
affect (pain or pleasure)
subjective sensations
peripheral physiological effects
motor impulses and action tendencies