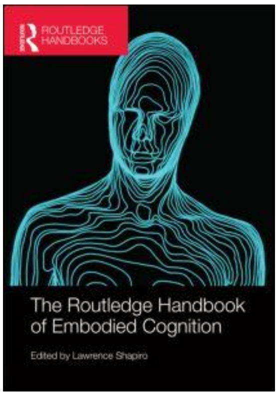

The Routledge Handbook of Embodied Cognition

Lawrence Shapiro

Embodied Emotion Concepts

Publication details
https://www.routledgehandbooks.com/doi/10.4324/9781315775845.ch23
Paula Niedenthal, Adrienne Wood, Magdalena Rychlowska
Published online on: 01 May 2014

23

EMBODIED EMOTION CONCEPTS

Paula Niedenthal, Adrienne Wood, and Magdalena Rychlowska

What are emotion concepts? The answer to this question is the topic of the present chapter. We begin with the observation that people possess the concepts of "joy," "sadness," and "fear," among others, as indicated by their language use and their behavior (e.g. Russell, Lewicka, and Nitt, 1989). They also recognize perceptual input from other people, such as their faces and bodies, as meaning that those people feel "joy" and "sadness" and "fear." This chapter is about the representation of emotion concepts. What allows individuals to judge a face as expressing "disgust," and what happens when they identify the word "cruel" in a text?

The first section of the chapter reviews ways in which these kinds of everyday, non-scientific emotion concepts have been characterized in the psychological literature (Niedenthal, 2008). After briefly describing dimensional, semantic primitives and prototype accounts and the semantic network model, as well as the assumptions upon which these accounts are based, we present an alternative account – embodied emotion concepts. An embodiment account and supporting empirical evidence will be discussed in greater detail. We conclude that an embodied or simulation account of emotion concepts provides solutions to a number of problems, or at least open questions, specific to the issue of how emotion concepts are represented, which prior accounts do not adequately address.

Semantics of emotions

Theories of emotion concepts have developed along two different lines. One line focuses on the conceptual structure of emotions as represented by words used to describe them (e.g. Ortony, Clore, and Foss, 1987; Shaver, Schwartz, Kirson, and O'Connor, 1987). The questions that arise there include: What are the dimensions of similarity that bind emotion knowledge? What are the underlying factors? The most well-known account of emotion concepts in this line is the dimensional approach, in which the underlying structure of emotion concepts is derived from peoples' judgments about their subjective feeling states. By analyzing such judgments with statistical scaling methods, researchers have hypothesized two bipolar dimensions (e.g. Barrett and Russell, 1999; Lang, Bradley, and Cuthbert, 1990; Mayer and Gaschke, 1988; Reisenzein, 1994). The two dimensions are the degree to which an emotional state is *pleasant* versus *unpleasant* (or positive versus negative) and the degree to which an emotional state is *activated* versus *deactivated* (roughly, having high versus low arousal). Thus, the fundamental understanding that people have about emotions involves the degrees of pleasantness and activation that typically characterize them. For example, "anger" is conceptualized as highly unpleasant and moderately activated, and "fear," as moderately unpleasant and highly activated (e.g. Russell and Barrett, 1999).

Importantly, analysis of judgments of emotions with methods of scaling does not reveal anything about representation. A passive assumption is that emotion knowledge is represented as lexical entries, or words that stand for experienced information. Two other approaches, the semantic primitives and the prototype analyses, attempt to explain difference, rather than similarity, in conceptual content between emotions. Rather than identifying the fundamental dimensions underlying the structure of emotion knowledge, these two additional accounts try to specify the conceptual content for a theoretically predetermined set of differentiated emotions.

The construction of lists of semantic primitives for emotions is a bootstrapping, bottom-up activity that involves the generation of possibilities and the attempt to define as many concepts as possible, independent of a specific language, and without adding more concepts. According to Wierzbicka (1992), for instance, while the words "anger" and "sadness" are culture bound and language specific, semantic primitives such as "'good' and 'bad' and 'want' and 'happen'" are not. These primitives can describe some of the basic themes that characterize emotion (Johnson-Laird and Oatley, 1989). For example, emotions involve good and bad things that happen to us and to other people, and that we and other people actively do. Emotions also comprise others' and our own evaluations of ourselves and our actions, and the relationships that can be constructed on the bases of these evaluations. Using semantic primitives to build emotion concepts seems to provide enough nuance to characterize many different emotions. But, despite its power the semantic primitives approach also has some shortcomings. Although the definitions seem to contain something about the antecedents of and situations for emotions, the "hot" or bodily aspects of the emotion are not contained in the definition. This problem might be addressed by calling a set of basic emotions, such as fear, anger, happiness, sadness, and disgust, themselves, semantic primitives (Johnson-Laird and Oatley, 1989). However, neither use of the semantic primitives approach addresses the way in which semantic primitives are represented and processed. Although the assumption must be that the primitives are innate, it is still not clear what is being used when they are activated.

Although it focuses on conceptual structure and differences between emotions, the prototype approach to emotion concepts does not solve these problems either. In the prototype approach (Rosch, 1973), emotion concepts are hierarchically organized and fuzzy, such that boundaries between related categories are not strict. Emotion concepts refer to events described in terms of temporally structured prototypes or scripts that comprise components of emotions, such as antecedents, situations, and bodily characteristics (Russell, 1991). Such elements of the prototypes are probabilistic and not all-or-none in nature. One element, such as a facial expression or a behavior, can be classified as an instance of a particular emotion and these classifications reveal graded structure.

The semantic network model of emotion (Bower, 1981, 1991; Lang, 1984) is the only representational model of emotion concepts proposed in the literature to date. In this approach, knowledge about emotion is represented in a network of units of representations called "nodes." Basic emotions are conceptualized as central organizing nodes. Units that represent beliefs, antecedents, and physiological patterns associated with a given emotion are linked to the central nodes by connecting pathways. When an emotion unit is activated above some threshold, activation spreads throughout the network to associated information. Autonomic reactions, expressive behaviors, emotion-related events, and personal memories are thereby excited and may enter consciousness. For instance, when one is feeling happy the material in memory related to happiness becomes activated. As a consequence, one may experience an increase in heart rate and in blood pressure, an activation of the zygomaticus major muscle, and a heightened accessibility to the words and memories associated with happiness. The semantic network model generates hypotheses regarding the structure and content of emotion concepts (Niedenthal, Setterlund, and Jones, 1994, for discussion); however, it fails as an explanatory account, which the following section will discuss.

All models described above are based on a general view of cognition that assumes that higher-order mental content is *amodal* and abstract in format. Thus, it does not preserve analogical information about the low-level perceptual experience of objects, events, or states. The underlying assumption is that representation and initial sensory experience do not take place in the same system and that information taken from the initial experience needs to be redescribed in mental symbols to represent emotion concepts (Bower, 1981; Johnson-Laird and Oatley, 1989; Ortony *et al.*, 1987). Yet, an accumulating body of evidence is often more consistent with a view according to which the activation in the body's sensorimotor and affective systems in many cases constitutes the conceptual content itself.

Embodied simulation of emotion

Unlike amodal accounts of emotion concepts, theories of embodied or simulated concepts hold that perception and action are tightly coupled (Barsalou, 1999; Damasio, 1999; Gallese, 2003; Glenberg, 1997; Miellet, Hoogenboom, and Kessler, 2012; Niedenthal *et al.*, 2005; Smith and Semin, 2007). These basic principles are not new and have long roots in the philosophy of Merleau-Ponty and Heidegger, and the psychology of Vygotsky and Piaget (see also Prinz, 2002). By these accounts, the modality-specific states that represent perception, action, and introspection when one experiences a particular object also serve to represent the object later, offline. Emotion concepts then would refer to bodily states situated in the causal context (Barrett, 2006). For example, embodied emotions theorists suggest that the meanings of emotion words are grounded in their associated behaviors, such as facial expressions and gestures (Hietanen and Leppänen, 2008; Niedenthal, 2007). Because an emotional experience involves a complex interplay between the autonomic nervous system, behavior, facial expressions, cognition, and the limbic area of the brain, embodied representations of emotions themselves are distributed across modality-specific regions of the brain.

Behavioral and neuroimaging evidence supports an embodied emotion account of emotion concepts. In the next section we review findings of studies using language to probe emotion concepts. Then we review work on the face and the body. There are both experimental and correlational tests of the basic predictions of the embodiment of emotion concepts. The former rely on strategies for blocking or facilitating the involvement of the body's emotion systems in order to test their causal role in emotion concept use. Correlational studies use behavioral and neuroimaging methods to assess the occurrence of emotion simulation during emotion concept use. We review both types of evidence in order to evaluate the functional role of the sensorimotor and affect systems in executing tasks that rely on emotion concepts, such as the identification or use of emotion nouns, and the recognition or classification of facial or bodily expression of emotion.

Verbal probes to emotion concepts

A number of inventive methods have been used to block emotion processes during emotional language processing. Havas and colleagues (Havas, Glenberg, Gutowski, Lucarelli, and Davidson,

2010) looked at the function of facial activity in the processing of emotion language by taking advantage of the beauty industry's response to ageing: Botox. Botulinum toxin-A (BTX) is a neurotoxin that paralyzes muscles, reducing the appearance of wrinkles caused by preventing the underlying facial muscles from contracting. Havas *et al.* invited women who were about to receive BTX injections in the corrugator supercilii – which furrows the brows and can cause frown lines – to read happy, sad, and angry sentences and answer comprehension questions. Two weeks later, the same women (now wrinkle-free) returned to read more sentences. Results showed that the BTX injections significantly slowed the women's reading speed for angry and sad, but not happy, sentences. Thus, the denervation of facial muscles blocks facial expressions and seems to hinder emotion-specific language processing.

Foroni and Semin (2009) also found that embodied simulation plays a role in non-conscious processing of emotion words. In this study Dutch students were exposed subliminally to either positive or negative verbs (e.g. "to smile"; "to frown") and then were invited to rate the funniness of cartoons. During the cartoon-rating task, half of the participants held a pen between their lips in order to block facial responding. Subliminally presented positive verbs primed people to rate the cartoons as funnier when compared with exposure to negative verbs. This effect disappeared, however, for participants holding the pen between their lips. It appears that because these participants were unable to use the muscles involved in a smile while holding the pen, no motor resonance occurred in response to the positive subliminal emotion primes. Thus, in this condition the emotion words could not moderate later behavior, namely, the ratings of the funniness of cartoons.

In a recent neuroimaging study, Moseley, Gallace, and Spence (2012) had eighteen participants read emotion-related action words (such as "dread") while recording their brain activity in an fMRI scanner. The abstract emotion words activated not only limbic regions of the brain, which are involved in the experience of emotions, but also the motor cortex, suggesting that bodily and facial movements play a fundamental role in emotion concept comprehension. This suggests that we learn what it means to feel "angry" by connecting the gestures and facial expressions we see in others labeled as "angry" with how *we* feel when we are making those gestures and expressions. Thus, the meaning of "anger" is inevitably embedded in behaviors and internal states associated with the experience of anger.

Importantly, embodied simulation may not always be necessary, such as when emotion-knowledge tasks can be performed by recourse to lexical associations in memory or when emotional meaning is not central to task completion (Niedenthal, Winkielman, Mondillon, and Vermeulen, 2009). When reactivation of the modality-specific neural states associated with a given emotion is necessary for a task, such as emotion-expression recognition or deeper emotion concept processing, behavioral expressions of the somatic activation may occur. For instance, when activating an internal representation of the emotion "disgust," the facial muscles involved in the expression of disgust (picture yourself smelling a carton of sour milk) will become slightly active.

Niedenthal and her colleagues (2009) took advantage of this feature of embodied simulation in order to examine when people do and do not rely on embodied representations of emotions. Specifically, they showed participants sixty concrete nouns, half of which were related to an emotion (e.g. "smile," "vomit," "torturer") and half of which were emotionally neutral (e.g. "chair," "pocket," "cube"). Participants were randomly assigned either to judge if the nouns were associated with an emotion, or to indicate whether they were written in capital or small letters, while facial muscle activity was assessed with EMG (electromyogram). Results showed that participants who judged association to emotion, but not the way the words were printed, demonstrated emotion-specific activation of facial muscles while processing the emotion nouns.

When judging nouns associated with "joy," muscles that formed the smile were activated, and judging "anger"- and "disgust"-related nouns was accompanied by the activation of the emotion-specific muscles as well. Niedenthal and colleagues then replicated this study using nouns that refer to emotion states such as "delighted" and "repelled" and more abstract neutral words like "programmed" and found largely the same pattern of results. These two studies provided evidence for the importance of embodying emotion concepts when the meaning of the concepts is needed for the task. However, the findings are correlational in nature.

To test the causal role of embodiment in emotion concept processing Niedenthal and colleagues conducted a third study using a task similar to the previous two studies, except all participants made the emotion-focused judgment and half of the participants held a pen between their lips throughout the experiment. Holding the pen prevents movement of the zygomaticus major, the muscle that pulls your mouth into a smile, as well as of the levator labii superioris, which allows you to curl your upper lip up in an expression of disgust. They predicted that, for emotion words that relate to joy or disgust, participants holding the pen between their lips would not be able to simulate the appropriate emotions. In fact, the pen significantly reduced accuracy in labeling joy- and disgust-related words as emotional or non-emotional, but had no effect on labeling of anger or neutral concepts. Similar findings have been reported in studies using other physiological indicators of emotion, such as skin conductance (e.g. Oosterwijk, Topper, Rotteveel, and Fischer, 2010).

While associative network models of emotion concepts could be altered and in a sense made unconstrained in order to accommodate any component of emotion and the priming of the concept by each of these, the studies just presented seem more consistent with an account by which emotion concepts are the ability to simulate complex emotional experience as needed. A complete account of emotion concepts might indeed be that the parts of an emotional experience that are relevant to a task are peripherally and centrally re-enacted and matched to or reasoned over, and this modality-specific activation is what emotion concept use actually is. This idea is further suggested by recent work on the processing of emotion from the face and body.

Face probes to emotion concepts

Theories of embodied simulation hold that the body's periphery – especially the face – as well as the brain's affective and motor areas are used in tasks of recognition and identification of facial expression of emotion (Niedenthal, 2007; Niedenthal, Mermillod, Maringer, and Hess, 2010; Pitcher, Garrido, Walsh, and Duchaine, 2008). In a recent behavioral study Ponari, Conson, D'Amico, Grossi, and Trojano (2012, study 1) found that blocking mimicry on the lower half of perceivers' faces compromised the recognition of happiness and disgust expressions, while blocking mimicry on the upper half of perceivers' faces compromised the recognition of anger expressions. Both manipulations decreased the recognition of fear. Neither the recognition of surprise nor that of sadness was affected. These findings support the embodiment hypothesis because they link the use of muscles involved in a facial expression (e.g. Smith, Cottrell, Gosselin, and Schyns, 2005) to its processing. Similar findings were reported by Maringer, Krumhuber, Fischer, and Niedenthal (2011) in a study of the processing of different types of smiles. In that study, half of the experimental participants were able to freely mimic dynamically "true" and "false" smiles, whereas the remaining half held pencils in their mouths such that facial mimicry was functionally blocked. Participants' task was to rate each smile on a scale of genuineness. Findings revealed that participants in the mimicry condition judged true smiles as more genuine than false smiles, consistent with previous validation studies. However, in the mimicry-blocked condition, participants' judgments of genuineness did not vary by smile type. Instead, all smiles were rated as equally genuine. This result was consistent with the hypothesis that the ability to mimic smiles is essential for distinguishing among their subtle meanings.

A recent line of study inspired by research on mirror-touch synaesthetes (MTS) also provides evidence in favor of an embodied account of the processing of facial expression. Individuals with MTS report the vicarious sensation of touch and show increased activation of sensorimotor cortex when they observe others being touched (Blakemore, Bristow, Bird, Frith, and Ward, 2005). Interestingly, MTS individuals also show better recognition of emotion in others than controls (Banissy, Walsch, and Muggleton, 2011). The extant research on MTS led Maister, Tsiakkas, and Tsakiris (2013) to predict that when somatosensory resonance between the bodies of self and other is enhanced, emotional expression recognition is facilitated. They used a procedure for inducing resonance in which a participant sees the face of an unfamiliar other being stroked on the cheek with a cotton swab. If the participant experiences simultaneous strokes of a swab on their own cheek, they experience a type of self-other blurring called the "enfacement illusion." This simultaneous visuotactile experience causes individuals to perceive another's face as more similar to theirs, as indicated by several different tasks (Paladino, Mazzurega, Pavani, and Schubert, 2010). Thus the enfacement illusion seems to lead individuals to incorporate features of the other into their self-concepts. To test the hypothesis that the enfacement illusion increases interpersonal somatosensory resonance, and thereby increases emotion recognition, Maister and colleagues (Maister, Tsiakkas, and Tsakiris, 2013) measured emotion recognition before and after a period of synchronous (versus asynchronous versus control) visuotactile stimulation. On each trial of the emotion recognition task an emotional expression (fear, happiness, or disgust) manifest at one of seven intensity levels was presented and participants categorized the expression as representing one of the three categories. Prior synchronous visuotactile stimulation significantly enhanced recognition of fear (although not the other expressions) at all levels of intensity.

Studies using methods of transcranial magnetic stimulation (TMS) have also supported an embodied account of emotion concepts. TMS can be used to temporarily inhibit the use of a targeted brain region in order to identify its role in a mental process. To the extent that a process is compromised when TMS has been directed at a particular region, that location can be inferred to support that process. The results of several studies implicate somatosensory cortices in the accurate identification of facial expressions (Pitcher *et al.*, 2008; Pourtois *et al.*, 2004). Because the somatosensory system comprises the receptors and processing centers for the sense modalities, including proprioception from the face, this suggests that the body's perceptual experience, and not only visual input, contributes to processing emotion from the face.

Body probes to emotion concepts

The face can certainly communicate a large amount of complex emotion, but disembodied expressive heads are very unusual. Heads are attached to expressive bodies that gesticulate, cower in fear, stand proudly, and gloomily shuffle their feet. There is ample evidence for the role of bodily sensation in emotions (see Kreibig, 2010) and any complete emotion processing theory should take the role of body into account. Evidence suggests that facial expressions and body postures are processed holistically – that is, perceiving congruent emotion expressions of the face and body facilitates emotion recognition, while incongruency (such as a happy face on an angry body) hinders it (Aviezer, Trope, and Todorov, 2012a; Meeren, van Heijnsbergen, and De Gelder, 2005).

A series of studies showed that emoting bodies influence the perceived emotions of ambiguous faces and voices (Van den Stock, Righart, and De Gelder, 2007). Flack, Laird, and Cavallaro (1999) manipulated people's facial and bodily emotion expressions by giving them precise directions without naming specific emotions: for instance, for a smile, they instructed participants to push the corners of their mouths up and back. After each position, participants completed mood measures. Both facial and bodily feedback influenced the participants' moods, and emotion ratings were most intense when the emotions of the face and body were congruent.

Bodily expressions may sometimes do more than simply supplement the information provided by the face. Aviezer, Trope, and Todorov (2012b) showed that some expressions, such as anger and joy, become difficult to discriminate at their "peak intensities," because they all resemble a wide-mouthed scream. Thus, the body – slumped in sadness or standing triumphantly tall – provides perceivers with better information about the person's emotion. Other studies demonstrate that people can reliably infer emotion from others' gait patterns (Karg, Kühnlenz, and Buss, 2010; Michalak *et al.*, 2009), movement during dialogue (Clarke, Bradshaw, Field, Hampson, and Rose, 2005), dynamic and static postures (Atkinson, Dittrich, Gemmell, and Young, 2004), and movement to music (Burger, Saarikallio, Luck, Thompson, and Toiviainen, 2012). While it may be unsurprising that the body provides affective information, less clear is how others process this information.

Insight into this question comes from human and non-human research into "mirror neurons," which become active both during the completion of a particular action and during the observation of somebody else performing that action (Rizzolatti, Fogassi, and Gallese, 2001). If our brains simulate bodily actions of others, it is logical to assume that this applies to emotional bodily actions. Indeed, an fMRI study by Grèzes, Pichon, and de Gelder (2007) showed that areas involved in action representation activated more when participants observed fearful, as opposed to neutral, dynamic bodies. This difference might be due to the unique importance of emotional movements: it is highly adaptive to quickly react to the fearful displays of others, so the brain may simulate such emotional actions more than neutral actions. Importantly, Oosterwijk, Rotteveel, Fischer, and Hess (2009) found that generating words related to pride or disappointment alters how upright people sit in their chairs, suggesting that using emotion knowledge changes the bodily emotion expression. Such findings suggest that mirror neurons and action representations facilitate the processing of emotional information. Making that claim, however, requires experimental manipulation; therefore, Stepper and Strack (1993) administered a bogus achievement test to male participants positioned into slumped or upright postures. All participants were informed that they performed "far above the average" on the tests and then completed a mood questionnaire. The slumped participants reported feeling significantly less proud than the upright or control participants, but only if they were moved into the position directly before receiving feedback on their achievement tests. This provided preliminary evidence that bodily feedback while in a slumped posture reduces feelings of pride. Interestingly, an inverse relationship was observed for women (Roberts and Arefi-Afshar, 2007). This finding may be due to gender differences in social dominance. Women, who typically experience less social dominance than men, may be less able to recognize the proprioceptive feedback involved in a proud, upright posture. While the moderation by gender complicates the story, it does not discount an embodied simulation explanation. Still, the extent to which action representation of body movements aids in the recognition of others' emotional states remains unclear.

The theory and evidence summarized above suggest that mimicking another's gestures and postures may facilitate understanding of their emotional states. This suggests that embodied states are more than merely reflexive or associated responses. Rather, they may constitute the core of conceptual knowledge about emotion.

Conclusions

The present chapter reviewed evidence that when probed with language and facial and bodily expressions of emotion, emotion concepts seem to be embodied. Behavioral and neuroimaging results are consistent with the view that emotion concepts can be viewed as involving the capacity for emotional re-enactment. The findings are also consistent with a view of emotion as a complex, loosely coordinated experience involving the autonomic nervous system, behavior, facial expressions, cognition, and the limbic areas of the brain. As such, embodied representations of emotions are distributed across modality-specific regions of the brain. A probe to one of these systems may generate simulation in others, as needed for the task.

It is important to note that embodied theories are evolving theories. There is strong evidence for the involvement of motor and somatosensory cortices and peripheral body parts in the processing of emotional information, but it is time to move from binary questions (such as whether embodiment is causal to information processing or not) to more precise statements about how and when the body's central sensorimotor, affective, and peripheral mechanisms are necessarily involved. In addition, important components of the theories require more precise definition. For instance, while facial mimicry seems to be important for identification of facial expression in some cases, both the definition of mimicry and its measurement in real time await substantial progress.

A growing body of evidence suggests that the body's reproduction of parts of an emotional experience constitute conceptual content for emotion. The words "disgust" and "interest" are not mentally grounded by disembodied symbols but are grounded by parts of the bodily state that are re-enacted to support perception and thought.

References

Atkinson, A. P., Dittrich, W. H., Gemmell, A. J., and Young, A. W. (2004). Emotion perception from dynamic and static body expressions in point-light and full-light displays. *Perception, 33*, 717–46.

Aviezer, H., Trope, Y., and Todorov, A. (2012a). Holistic person processing: Faces with bodies tell the whole story. *Journal of Personality and Social Psychology, 103*(1), 20–37.

——(2012b). Body cues, not facial expressions, discriminate between intense positive and negative emotions. *Science, 338*(6111), 1225–29.

Banissy, M. J., Walsh, V., and Muggleton, N. G. (2011). Mirror-touch synaesthesia: A case of faulty self-modelling and insula abnormality. *Cognitive Neuroscience, 2*(2), 114–15.

Barrett, L. F. (2006). Are emotions natural kinds? *Perspectives on Psychological Science, 1*(1), 28–58.

Barrett, L. F., and Russell, J. A. (1999). The structure of current affect controversies and emerging consensus. *Current Directions in Psychological Science, 8*(1), 10–14.

Barsalou, L. W. (1999) Perceptual symbol systems. *Behavioral and Brain Sciences, 22*(4), 577–660.

Blakemore, S. J., Bristow, D., Bird, G., Frith, C., and Ward, J. (2005). Somatosensory activations during the observation of touch and a case of vision–touch synaesthesia. *Brain, 128*(7), 1571–83.

Bower, G. H. (1981). Mood and memory. *American Psychologist, 36*(2), 129–48.

——(1991). Mood congruity of social judgments. *Emotion and social judgments*. Oxford: Pergamon Press.

Burger, B., Saarikallio, S., Luck, G., Thompson, M. R., and Toiviainen, P. (2012). Emotions move us: Basic emotions in music influence people's movement to music. In E. Cambouropoulos, C. Tsourgas, P. Mavromatis, and C. Pastiadis (Eds.), *Proceedings of the 12th International Conference on Music Perception and Cognition (ICMPC) and 8th Triennial Conference of the European Society for the Cognitive Sciences of Music (ESCOM)*. European Society for the Cognitive Sciences of Music website. Retrieved from http://icmpc-escom2012.web.auth.gr/sites/default/files/papers/177_Proc.pdf

Clarke, T. J., Bradshaw, M. F., Field, D. T., Hampson, S. E., and Rose, D. (2005). The perception of emotion from body movement in point-light displays of interpersonal dialogue. *Perception, 34*(10), 1171–80.

Damasio, A. R. (1999). *The feeling of what happens: Body and emotion in the making of consciousness*. New York: Harcourt.

Flack, W. F., Laird, J. D., and Cavallaro, L. A. (1999). Separate and combined effects of facial expressions and bodily postures on emotional feelings. *European Journal of Social Psychology, 29*(2), 203–17.

Foroni, F., and Semin, G. R. (2009). Language that puts you in touch with your bodily feelings: The multimodal responsiveness of affective expressions. *Psychological Science, 20*(8), 974–80.

Gallese, V. (2003). The shared manifold nature of interpersonal relations: The quest for a common mechanism. *Philosophical Transactions of the Royal Society B: Biological Sciences, 358*(1431), 517–28.

Glenberg, A. M. (1997). What memory is for: Creating meaning in the service of action. *Behavioral and Brain Sciences, 20*(1), 41–50.

Grèzes, J., Pichon, S., and de Gelder, B. (2007). Perceiving fear in dynamic body expressions. *NeuroImage, 35*(2), 959–67.

Havas, D. A., Glenberg, A. M., Gutowski, K. A., Lucarelli, M. J., and Davidson, R. J. (2010). Cosmetic use of botulinum toxin-A affects processing of emotional language. *Psychological Science, 21*(7), 895–900.

Hietanen, J. K., and Leppänen, J. M. (2008). Judgment of other people's facial expressions of emotions is influenced by their concurrent affective hand movements. *Scandinavian Journal of Psychology, 49*(3), 221–30.

Johnson-Laird, P. N., and Oatley, K. (1989). The language of emotions: Analysis of a semantic field. *Cognition and Emotion, 3*(2), 81–123.

Karg, M., Kühnlenz, K., and Buss, M. (2010). Recognition of affect based on gait patterns. *IEEE Transactions on Systems, Man, and Cybernetics B: Cybernetics, 40*(4), 1050–61.

Kreibig, S. D. (2010). Autonomic nervous system activity in emotion: A review. *Biological Psychology, 84*(3), 394–421.

Lang, P. J. (1984). Cognition in emotion: Cognition in action. In C. E. Izard, J. Kagan, and R. B. Zajonc (Eds.), *Emotions, cognition, and behavior*. New York: Cambridge University Press.

Lang, P. J., Bradley, M. M., and Cuthbert, B. N. (1990). Emotion, attention, and the startle reflex. *Psychological Review, 97*(3), 377–95.

Maister, L., Tsiakkas, E., and Tsakiris, M. (2013). I Feel your fear: Shared touch between faces facilitates recognition of fearful facial expressions. *Emotion, 13*(1), 7–13.

Maringer, M., Krumhuber, E. G., Fischer, A. H., and Niedenthal, P. M. (2011). Beyond smile dynamics: Mimicry and beliefs in judgments of smiles. *Emotion, 11*(1), 181–87.

Mayer, J. D. and Gaschke, Y. N. (1988). The experience and meta-experience of mood. *Journal of Personality and Social Psychology, 55*(1), 102–11.

Meeren, H. K., van Heijnsbergen, C. C., and De Gelder, B. (2005). Rapid perceptual integration of facial expression and emotional body language. *Proceedings of the National Academy of Sciences of the United States of America, 102*(45), 16518–23.

Michalak, J., Troje, N. F., Fischer, J., Vollmar, P., Heidenreich, T., and Schulte, D. (2009). Embodiment of sadness and depression – Gait patterns associated with dysphoric mood. *Psychosomatic Medicine, 71*(5), 580–87.

Miellet, S., Hoogenboom, N., and Kessler, K. (2012). Visual and embodied perception of others: The neural correlates of the "Body Gestalt" effect. *Journal of Vision, 12*(9), 824.

Moseley, G. L., Gallace, A., and Spence, C. (2012). Bodily illusions in health and disease: Physiological and clinical perspectives and the concept of a cortical "body matrix." *Neuroscience & Biobehavioral Reviews, 36*(1), 34–46.

Niedenthal, P. M. (2007). Embodying emotion. *Science, 316*(5827), 1002–5.

——(2008). Emotion concepts. In M. Lewis, J. M. Haviland-Jones, and L. F. Barrett (Eds.), *Handbook of emotion* (3rd ed.). New York: Guilford.

Niedenthal, P. M., Barsalou, L. W., Winkielman, P., Krauth-Gruber, S., and Ric, F. (2005). Embodiment in attitudes, social perception, and emotion. *Personality and Social Psychology Review, 9*(3), 184–211.

Niedenthal, P. M., Mermillod, M., Maringer, M., and Hess, U. (2010). The simulation of smiles (SIMS) model: Embodied simulation and the meaning of facial expression. *Behavioral and Brain Sciences, 33*(6), 417–33.

Niedenthal, P. M., Setterlund, M. B., and Jones, D. E. (1994). Emotional organization of perceptual memory. In P. M. Niedenthal and S. Kitayama (Eds.), *The heart's eye: Emotional influences in perception and attention* (pp. 87–113). San Diego, CA: Academic Press.

Niedenthal, P. M., Winkielman, P., Mondillon, L., and Vermeulen, N. (2009). Embodiment of emotion concepts. *Journal of Personality and Social Psychology, 96*(6), 1120–36.

Oosterwijk, S., Rotteveel, M., Fischer, A. H., and Hess, U. (2009). Embodied emotion concepts: How generating words about pride and disappointment influences posture. *European Journal of Social Psychology, 39*(3), 457–66.

Oosterwijk, S., Topper, M., Rotteveel, M., and Fischer, A. H. (2010). When the mind forms fear: Embodied fear knowledge potentiates bodily reactions to fearful stimuli. *Social Psychological and Personality Science, 1*(1), 65–72.

Ortony, A., Clore, G. L., and Foss, M. A. (1987). The referential structure of the affective lexicon. *Cognitive Science, 11*(3), 341–64.

Paladino, M., Mazzurega, M., Pavani, F., and Schubert, T. W. (2010). Synchronous multisensory stimulation blurs self-other boundaries. *Psychological Science, 21*(9), 1202–7.

Pitcher, D., Garrido, L., Walsh, V., and Duchaine, B. C. (2008). Transcranial magnetic stimulation disrupts the perception and embodiment of facial expressions. *Journal of Neuroscience, 28*(36), 8929–33.

Ponari, M., Conson, M., D'Amico, N. P., Grossi, D., and Trojano, L. (2012). Mapping correspondence between facial mimicry and emotion recognition in healthy subjects. *Emotion, 12*(6), 1398–1403.

Pourtois, G., Sander, D., Andres, M., Grandjean, D., Reveret, L., Olivier, E., and Vuilleumier, P. (2004). Dissociable roles of the human somatosensory and superior temporal cortices for processing social face signals. *European Journal of Neuroscience, 20*(12), 3507–15.

Prinz, J. J. (2002). Consciousness, computation, and emotion. In S. C. Moore and M. Oaksford (Eds.), *Emotional cognition: From brain to behaviour*. Amsterdam: John Benjamins.

Reisenzein, R. (1994). Pleasure-arousal theory and the intensity of emotions. *Journal of Personality and Social Psychology, 67*(3), 525–39.

Rizzolatti, G., Fogassi, L., and Gallese, V. (2001). Neurophysiological mechanisms underlying the understanding and imitation of action. *Nature Reviews Neuroscience, 2*(9), 661–70.

Roberts, T.-A., and Arefi-Afshar, Y. (2007). Not all who stand tall are proud: Gender differences in the proprioceptive effects of upright posture. *Cognition and Emotion, 21*(4), 714–27.

Rosch, E. H. (1973). Natural categories. *Cognitive Psychology, 4*(3), 328–50.

Russell, J. A. (1991). In defense of a prototype approach to emotion concepts. *Journal of Personality and Social Psychology, 60*(1), 37–47.

Russell, J. A., and Barrett, L. F. (1999). Core affect, prototypical emotional episodes, and other things called emotion: Dissecting the elephant. *Journal of Personality and Social Psychology, 76*(5), 805–19.

Russell, J. A., Lewicka, M., and Nitt, T. (1989). A cross-cultural study of a circumplex model of affect. *Journal of Personality and Social Psychology, 57*(5), 848–56.

Shaver, P., Schwartz, J., Kirson, D., and O'Connor, C. (1987). Emotion knowledge: Further exploration of a prototype approach. *Journal of Personality and Social Psychology, 52*(6), 1061–86.

Smith, E. R., and Semin, G. R. (2007). Situated social cognition. *Current Directions in Psychological Science, 16*(3), 132–35.

Smith, M. L., Cottrell, G. W., Gosselin, F., and Schyns, P. G. (2005). Transmitting and decoding facial expressions. *Psychological Science, 16*(3), 184–89.

Stepper, S., and Strack, F. (1993). Proprioceptive determinants of emotional and nonemotional feelings. *Journal of Personality and Social Psychology, 64*(2), 211–20.

Van den Stock, J., Righart, R., and De Gelder, B. (2007). Body expressions influence recognition of emotions in the face and voice. *Emotion, 7*(3), 487–94.

Wierzbicka, A. (1992). Defining emotion concepts. *Cognitive Science, 16*, 539–81.