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Language and Emotion

Hypotheses on the Constructed Nature of Emotion Perception

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Throughout much of daily life, humans detect emotional "expressions" in the faces of our loved ones, friends, colleagues, babies, pets—even in certain machines (see Fig. 22.1). Traditionally, the science of emotion assumed that these "expressions" are broadcast on the faces of others for perceivers to automatically and reflexively "recognize." However, growing evidence suggests that facial "expressions" are not merely "recognized" during perception—they are instead *psychologically constructed* when processes in the mind of the perceiver, such as emotion concept knowledge, impact how visual sensations are made meaningful as instances of different emotions (as occurs when the features of both the car and the face in Fig. 22.1 are made meaningful as an instance of happiness). We begin by introducing two different approaches to understanding the perception of emotion on faces: the basic emotion model versus the psychological constructionist model. We then propose three key psychological constructionist hypotheses about facial emotion perception. Our first hypothesis is that on the "experiencer's" end, facial muscle movements do not automatically communicate emotion. Our second hypothesis is that on the "perceiver's" end, conceptual knowledge that is supported by language is used to make meaning of others' facial muscle movements to construct perceptions of emotion. Finally, our third hypothesis is that language enables perceivers to see emotion on faces by reactivating sensorimotor representations of prior

Figure 22.1 Many perceivers make meaning of the features of this car (citizen of the deep, 2009) as an instance of happiness, just as they do with this smiling face (Gendron, Lindquist, & Barrett, unpublished data).

experiences that shape perception of the present sensory array in a top-down manner. We discuss each of these hypotheses in turn and present growing evidence that supports them.

MODELS OF EMOTION PERCEPTION: BASIC EMOTION VERSUS PSYCHOLOGICAL CONSTRUCTIONIST THEORIES

The commonsense view of emotion perception is that facial "expressions" are broadcast on the faces of experiencers for perceivers to automatically and reflexively "recognize." This idea is consistent with the family of basic emotions approaches (Izard, 2009; Levenson, 2003; Panksepp, 2011; Shariff & Tracy, 2011). In the basic emotion view, all cultures share a set of emotion categories (e.g., anger, disgust, fear, happiness, sadness, etc.) that are biologically given responses to social and environmental stimuli that were once "adaptive in our evolutionary past" (Ekman & Cordaro, 2011, p. 368). It was originally assumed that a specific mechanism called a facial affect program "links each primary emotion to a distinctive patterned set of neural impulses to the facial muscles" (Ekman, 1972, p. 216). Today, the idea of facial affect programs is considered a "metaphor" as opposed to a specific biological mechanism (cf. Ekman & Cordaro, 2011). However, it is still largely assumed that emotions are linked to facial expressions in a 1:1 manner such that the face consistently and specifically produces clear and unambiguous signals during the experience of certain emotions (e.g., experiencing anger results in a scowl across almost all instances, barring times that facial expression is regulated). Correspondingly,

specific facial muscle movements (e.g., a scowl) are thought to necessarily denote to perceivers that the experiencer is experiencing a specific emotion (e.g., anger) (Ekman & Friesen, 1971; Izard, 1971; Tracy & Matsumoto, 2008).

An alternate approach to understanding the nature of facial emotion is the psychological constructionist family of approaches, which proposes that specific emotions such as anger, disgust, fear, and so on are constructed in the minds of perceivers based on perceptions of general affective facial movements and concept knowledge about emotions (Barrett, 2006; James, 1890/1998; Lindquist & Barrett, 2008; Russell, 2003; Schachter & Singer, 1962). In psychological constructionist views, all cultures share the experience of basic affective feelings that can be described as having some degree of positive versus negative valence and high versus low arousal (Russell, 1980; Russell & Barrett, 1999). Individuals communicate valence and/or arousal to some extent in automatic facial muscle movements, but the specific emotion categories "recognized" on the faces of others are the result of categorization when a perceiver uses his or her knowledge about emotion categories to make meaning of another person's facial muscle movements. It has been long known that people play active roles in constructing perceptions of the world around them based on their motivations, expectations, and category knowledge (Bruner, 1957; for a more recent discussion, see Bar, 2009), and emotion perception is no exception (see Barrett et al., 2011; Hassin et al., 2013; Lindquist & Gendron, 2013; Lindquist, MacCormack, & Shablack, 2015; Lindquist, Satpute, & Gendron, 2015; Nelson & Russell, 2013). The psychological constructionist view predicts that a perceiver sees another person as emotional when he or she makes meaning of facial muscle movements as an instance of emotion using concept knowledge that differs across cultures (Gendron, Roberson, van der Vyver, & Barrett, 2014; Jack et al., 2012) and perhaps even within individuals of the same culture (see Nook et al., 2015, for a discussion).

According to our particular psychological constructionist model, the theory of constructed emotion (TCE) (Barrett, in press), formerly the conceptual act theory (Barrett, 2006), language is integral to emotion perception because it helps individuals acquire, organize, and use the concept knowledge that guides emotion perception (Barrett, Lindquist, & Gendron, 2007; Lindquist & Gendron, 2013; Lindquist, MacCormack, & Shablack, 2015; Lindquist, Satpute, & Gendron, 2015). Of course, not all research hypothesizing a role of language in emotion perception takes the TCE approach (for other reviews on the role of language in emotion perception, see Roberson, Damjanovic, & Kikutani, 2010; Russell, 1991; Widen, 2013). Nor does all research on the constructed nature of emotion perception focus on the role of language (for reviews on how other forms of context construct the perception of emotion on faces, see Barrett et al., 2011; Fernandez-Dols, 1999; Hassin, Aviezer, & Bentin,

2013). The TCE is thus unique in that it offers mechanistic predictions of how emotion concepts supported by words help construct perceptions of emotion. The TCE proposes that language scaffolds emotion concept knowledge because it enables perceivers to group perceptually dissimilar facial muscle movements together as instances of the same emotion category (Lindquist, MacCormack, & Shablack, 2015; see Barrett, Wilson-Mendenhall, & Barsalou, 2015, for a discussion). For example, the word "anger" might cohere together an individual's embodied knowledge about the causes and consequences of the emotion concept *anger*, as well as stored representations of what others' angry facial "expressions" have looked like across different contexts in the past. This knowledge, in turn, allows a person to see a face as angry when encountering strained smiles between colleagues in the boardroom or a person scowling at a puppy with a half-eaten shoe in its mouth. The word "anger" allows an individual to store both representations as instances of the same category and link them to representations of the context, even when the facial muscle movements associated with "anger" share no perceptual similarities (i.e., smiles are visually distinct from scowls). The role of language in emotion perception can be described by three key hypotheses. We introduce these hypotheses in turn and discuss evidence in support of each.

HYPOTHESES ON THE CONSTRUCTED NATURE OF EMOTION PERCEPTION

Hypothesis 1: The Face Automatically Communicates Affect and Moves During Adaptive Behaviors but Does Not Automatically and Specifically Express Discrete Emotions

To understand emotion perception, it is first necessary to know what the face does and does not do during experiences of emotion. We hypothesize that although the face moves in emotion (as well as in other mental phenomena, e.g., concentration), facial muscle movements do not correspond to specific discrete emotional experiences in a 1:1 manner. What is being perceived during emotion perception is thus not likely to be a clear and universal signal for emotion.

Evidence for this hypothesis comes from objective measurements of facial muscle movements such as facial electromyographical readings (facial EMG). There have been few studies using facial EMG to compare patterns of facial muscle movements across multiple specific discrete emotion categories, but a set of older meta-analyses (Cacioppo & Gardner, 1999; Cacioppo et al., 2000) failed to reveal configurations of specific facial muscle movements that correspond to specific emotional experiences. Instead, these findings suggest

that the face at most expresses the valence (pleasantness vs. unpleasantness) of an experiencer's affective state (Tassinary, Cacioppo, & Vanman, 2007). Of course, it remains a possibility that EMG is methodologically limited in its ability to detect discrete emotion from facial actions. The face contains a considerable number of muscles (Tassinary et al., 2007), so activity from a given muscle might spread to others, impeding accurate detection of discrete emotion from electrical activity (cf. van Boxtel, 2010). In contrast to the findings of EMG, experts trained in facial emotion recognition can reliably code facial actions (e.g., FACS; Ekman & Friesen, 1978) that are hypothesized to be associated with specific discrete emotion categories; yet these findings cannot rule out the possibility that the human observer is actually adding something to the perception (i.e., using context or emotion concepts to disambiguate the meaning of otherwise ambiguous facial muscle configurations).

A second source of evidence for this hypothesis stems from observational studies of emotional facial expressions. Based on these studies, it is not clear that facial muscle movements occur in a consistent and specific pattern in relation to a specific emotion experience. Studies tend to find variability in which facial muscle configurations are present on a person's face during emotional experiences, and variability in whether the predicted facial muscle movements occur at all (see Lindquist & Gendron, 2013; Reisenzein, Studtmann, & Horstmann, 2013; Russell, Bachorowski, & Fernández-Dols, 2003, for discussions). A review of naturalistic studies of emotion and facial expressions revealed only weak correlations between emotion experience and the predicted corresponding facial muscle movements (Fernández-Dols & Crivelli, 2013). In some cases, the experience of specific emotions corresponds to facial muscle movements that are completely inconsistent with the stereotype for that emotion, such as frowns on the faces of Olympic gold medalists (Fernández-Dols & Ruiz-Belda, 1995) and grimaces during other sports wins (Aviezer, Trope, & Todorov, 2012). Naturalistic, as opposed to posed, facial expressions seem not to correspond to the predicted emotional facial configuration (Naab & Russell, 2007).

It is possible that we assume that the face consistently and specifically produces configurations associated with certain emotions due to stereotypes about the configurations that are associated with certain contexts and emotions. It is often claimed that facial muscle movements are adaptations that took on a communicative function (Allport, 1924; Ekman, 1972; Sharif & Tracy, 2011; Susskind et al., 2008), and so we often assume that emotional experiences correspond to specific adaptive facial muscle movements. Of course, it is clear that people move their faces in ways that may be adaptive—we open our mouths to scream, we scrunch up our eyes to cry, we open our mouths to gasp or growl, and we blink when objects approach our eyes. For

instance, it has been shown that a by-product of widening the eyes during high attentional demand is an increase the receptive visual field (Susskind et al., 2008). Similarly, nasal passages may close to protect a person from inhaling noxious fumes (Susskind et al., 2008). However, it is far from clear that these facial muscle movements are linked to the experience of discrete emotions in a consistent and specific manner (e.g., the eyes do not always widen in fear and the nose does not always scrunch up in disgust). Rather, it may be that humans have constructed concepts about the stereotypical facial expressions that correspond to specific emotions *because* of these adaptive facial muscle movements. Emotion concepts may thus include facial muscle movements that are a by-product of other processes such as attention (widening eyes) or pathogen aversion (closing nasal passages), and those facial muscle movements may have become stereotypical of certain emotion categories, even if they occur in a small number of emotional instances, both within a given category or between categories. For instance, because we associate experiences of fear with startle and increased vigilance in Western cultures, our conceptual script for the category *fear* involves widened eyes and a screaming mouth. Of course, not all instances of *fear* involve wide eyes because not all instances of *fear* involve startle. By contrast, our concept for the category *sadness* involves scrunched-up eyes and a pouting, frowning mouth—two facial muscle movements that result from crying. However, crying occurs across multiple types of emotional experiences (joy, fear, awe, gratitude, etc.) and is not unique to sadness. The relevant ethnographic data have not been collected to demonstrate whether individuals consistently and specifically make the types of facial muscle movements associated with our English-language emotion stereotypes in daily life, but existing evidence suggests that consistency and specificity are not likely to be found. For instance, in the case of the *fear* stereotype, individuals report seeing facial expressions with widened eyes and mouths agape (stereotypical fearful expressions) at very low base rates in daily life (Whalen et al., 2001). More generally, when raters are asked to judge the meaning of naturalistic images of spontaneous, unposed facial muscle movements (which do not typically include stereotypical facial muscle movements), their "accuracy" at guessing the presumed emotion (see Ekman & Friesen, 1975) is quite low (Aviezer et al., 2012, 2015; Fernández-Dols, Carrera, & Crivelli, 2011; Motley & Camden, 1988; Naab & Russell, 2007). Moreover, the people most likely to associate stereotypical facial muscle movements with culture-specific emotion categories are the individuals who have received the most formal education (Russell, 1994). These findings suggest that the facial muscle movements associated with English emotion categories are learned via formal schooling rather than mere experience with other humans. Indeed, we mime exaggerated versions of these facial muscle movements when teaching our children

about emotions, culture-specific stereotypes of facial expressions appear as cartoons in children's books (Tsai et al., 2007), are used as stimuli in studies at universities, and appear in textbooks throughout formal social science education. Stereotypes of facial muscle movements are now even displayed in the emoticons used in online communication.

A novel prediction of the constructionist view is thus that our English-language conceptual stereotypes of facial muscle movements may have been formed around facial muscle movements that we have linked conceptually to certain discrete emotions (even if they are not actually prototypical of those emotional experiences). In this view, adaptive facial muscle movements did not become linked to certain emotional feelings via evolution (e.g., Ekman & Cordaro, 2011; Sharif & Tracy, 2011) but became linked to those feelings via the powers of the human ability to create concepts (also a great evolutionary feat). A separate question, then, is why do humans "see" discrete emotions on others' faces if facial muscle movements are ambiguous and unreliably related to specific discrete emotions? This brings us to the next novel hypothesis of a psychological constructionist approach: that the emotion concepts people know as a result of their language and culture shape how they see the facial muscle movements of others as instances of specific emotions.

Hypothesis 2: Conceptual Knowledge That Is Supported by Language Is Used to Categorize Facial Muscle Movements Into Perceptions of Discrete Emotion

Our second hypothesis is that perceptions of specific emotions—for instance, seeing sadness on another person's face—are constructed in the minds of perceivers when linguistic concept knowledge about emotion categories is used to make meaning of facial muscle movements.

Concept knowledge about emotion refers to what someone "knows" about emotion categories. According to the TCE, such knowledge is stored as representations of prior experiences that become partially reactivated when used to make meaning of sensations in the present environment (Barrett & Lindquist, 2008; Wilson-Mendenhall et al., 2011). In the case of emotion concept knowledge, sensorimotor representations can include modality-specific information about the facial muscle movements, vocal sounds, and bodily actions associated with given emotion categories. Individuals might also possess conceptual knowledge related to who tends to experience and express which types of emotions (of course, this conceptual knowledge may be accurate or inaccurate, in the case of social stereotypes; see Hess, this volume). Critically, conceptual knowledge is always situated and is associated with the types of situational contexts that are related to certain sensorimotor representations (see Aviezer,

this volume, for evidence of how knowledge of the context shapes emotion perception). It is possible to have multiple sensorimotor representations for a single emotion category, even if those perceptual representations share few perceptual similarities (cf. Lindquist, MacCormack, & Shablack, 2015). For instance, a person might possess a perceptual representation of fearful facial expressions on a roller coaster versus on a podium versus in a dark alley. When perceiving the world around them, perceivers are always automatically and nonconsciously relying on their conceptual knowledge to make predictions of the meaning of the present sensory array (Bar, 2009; Barrett & Simmons, 2015; Friston, 2012). In the case of emotion perception, perceivers are relying on their concept knowledge of emotion to make predictions about the meaning of experiencers' facial muscle movements as instances of specific emotion categories (e.g., a sensorimotor representation of a smile when someone was offended at the office).

Concepts shape emotion perception through an automatic and effortless process; the role of emotion categories on emotion perception is thus likely to go unnoticed in most contexts. In fact, the covert role of emotion concepts may have contributed to the appearance of strong universality in emotion perception because many studies that find evidence for universal emotion perception actually prime emotion concepts by including emotion word labels and/or vignettes about emotional scenarios in their experiments (e.g., Ekman & Friesen, 1971). Evidence suggests that this conceptual influence in turn constrains how participants make meaning of the posed affective facial muscle movements they are viewing (see Lindquist & Gendron, 2013, for a discussion).

Indeed, recent studies formally investigated the hypothesis that including English-language concepts in studies produces evidence more consistent with so-called universal emotion perception (see Gendron, Roberson, & Barrett, 2015, for a discussion). The researchers asked a group of Himba participants from a remote village in Namibia, Africa, to sort posed facial emotion stimuli into piles anchored by emotion word labels that were translated from English (i.e., anger, disgust, fear, happiness, sadness, neutral). By contrast, a second group of Himba participants was asked to freely sort the faces, which required participants to rely on their own emotion category knowledge to guide sorting (Gendron et al., 2014). Himba participants in the word-anchored condition were more likely than Himba participants in the free-sorting condition to adhere to the so-called universal (Ekman & Friesen, 1971) pattern of emotion perception.

Perhaps most notably, in the absence of emotion words, there were even clearer cultural differences in emotion perception (Gendron et al., 2014). In particular, Himba participants consistently made piles consisting of multiple different emotion categories (e.g., included happy, neutral, disgusted, angry,

and sad faces in one pile; included disgusted, angry, and sad faces in another pile). One interpretation of these findings is that Himba participants performed differently than Western participants because they possess different concept knowledge about which emotion categories are depicted on people's faces or which facial muscle movements are associated with which categories. Although this hypothesis has yet to be addressed with Himba participants, data from a separate study are suggestive.

Chinese and English speakers were presented with videos of computerized facial muscle movements that changed over time in random patterns. Participants were asked to indicate when the facial muscle movements were consistent with their representation of the categories *happy, surprised, fearful, disgusted, angry*, or *sad* (Jack et al., 2012). The authors then determined which facial muscle movements were on average most associated with each emotion category across cultures using a reverse correlation technique that identified the facial actions that were most associated with the emotion words participants chose across trials. Whereas English speakers represented each of the six so-called universal categories with a distinct configuration of facial muscle movements, Chinese speakers did not, showing considerable overlap in the facial muscle movements they considered to be indicative of *surprise, fear, disgust*, and *anger*. There was less agreement among Chinese participants about which facial muscle movements corresponded to each category, perhaps because the response options included in the task were translations of English emotion words, rather than the emotion category words used most frequently by Chinese speakers. Presumably, English-speaking participants would perform more poorly if the categories in the task were translations of the emotion categories deemed most important in Chinese culture.

Of course, concepts and language are linked but not necessarily identical constructs (see Lupyan, 2012, for a discussion). The TCE uniquely predicts that language shapes emotion perception because language helps individuals initially acquire and then use conceptual knowledge about emotion during online perceptions (for reviews, see Lindquist, MacCormack, & Shablack, 2015; Lindquist, Satpute, & Gendron, 2015; Lindquist, Gendron, & Satpute, 2016). We suggest that language is especially important to the domain of emotion because the phonological form of a word helps perceivers acquire concept knowledge about categories (Lupyan, Rakison, & McClelland, 2007) and, in particular, abstract categories that do not have strong statistical regularities within the visual, auditory, and interoceptive modalities (Barsalou, 1999). Because instances of facial muscle movements may share few perceptual regularities (e.g., people can smile, frown, scowl, and have a slack face during experiences of anger), emotion categories are particularly likely to be abstract categories (cf. Lindquist, MacCormack, & Shablack, 2015).

We predict that over time, using emotion words to label facial actions as depicting discrete emotions helps a person acquire and expand upon his or her emotion concept knowledge. For instance, it is thought that language helps children acquire the emotion categories specific to their culture over the early years of life. Before children learn from adults to reliably use emotion labels such as "anger," "fear," "sadness," and "disgust," they can only differentiate between different facial muscle movements based on valence (i.e., whether faces depict a positive or negative emotion; Widen & Russell, 2008; for a review, see Roberson et al., 2010). It is presently unknown to what extent language is instrumental in the acquisition of emotion concept knowledge, or to what extent directed instruction from adults is important in this process, but there are several reasons to suspect that words learned from adults help children develop the emotion concept knowledge that is important for perceiving emotions on faces. First, there is evidence that children whose parents speak to them more about emotions have greater understanding of emotion concepts (see Halberstadt & Lozada, 2011, for a discussion). Second, there is evidence that language guides acquisition of novel categories in adults (Lupyan et al., 2007) and induces "categorical perception" (Goldstone, 1994), the ability to perceive categories within a continuous dimension of sensory information.

The classic evidence for categorical perception is participants' superior ability to distinguish between pairs of stimuli that cross a perceptual category boundary (e.g., see an angry face as different from a fearful face) and inferior ability to distinguish between pairs of stimuli that do not cross a perceptual category boundary (e.g., see one fearful face as different from another fearful face) (Fugate, 2013; Harnad, 1987). Experimental evidence suggests that language helps adults achieve categorical perception within arrays of affective facial movements because linguistic categories help participants impose categories on perceptual stimuli (Fugate, Gouzoules, & Barrett, 2010). In the first phase of an experiment, adults simply viewed pictures of unfamiliar chimpanzee facial actions (e.g., a "bared teeth" or "scream" face) or viewed the faces while learning to associate them with nonsense words. Participants were later shown two images taken from a continuous morphed array of two facial expressions (e.g., an image of a face containing a percentage of both the bared teeth expression and scream expression) and were asked to indicate whether two faces from random points throughout the array were similar to one another or different. On some trials, participants compared faces that did not cross the learned category boundary (e.g., they compared an 86% bared teeth, 14% scream expression with a 71% bared teeth, 29% scream expression), whereas on others, they compared faces that *did* cross the learned category boundary (e.g., compared a 43% bared teeth, 57% scream expression with a

29% bared teeth, 71% scream expression). If participants demonstrated categorical perception, they would see the first set of faces as similar but the second set of faces as different. Yet, only participants who learned to associate the faces with words in the first phase of the experiment demonstrated such categorical perception. Participants who did not learn to associate faces with labels did not perceive a categorical distinction between the faces.

The TCE suggests that once conceptual knowledge is acquired via language, it helps a perceiver to make meaning of novel visual sensations. The human conceptual and linguistic systems become linked over the course of adulthood, such that the activation of concepts activates language and vice versa (Lupyan, 2012). Thus, when a perceiver is accessing concept knowledge to make meaning of visual sensations, the phonological form of the word may become active and cue the perceiver to use specific conceptual representations to make meaning of another person's facial muscle movements. Consistent with this argument, much research has amassed to suggest that access to linguistic concepts is necessary during online perception of emotion in faces.

For instance, temporarily impairing participants' access to the meaning of emotion words impairs categorical perception (see Roberson et al., 2010). A classic study demonstrated that verbal interference impaired participants' advantage at detecting differences between faces that crossed a category boundary (Roberson & Davidoff, 2000). On a given trial, participants saw a target face followed by interference that was either visual (i.e., participants looked at pictures of facial features) or verbal (i.e., participants repeated adjectives describing facial expressions aloud), or they received no interference. Participants then saw two faces, one of which matched the target face. Critically, the pairs of faces either belonged to the same or different emotion categories, and participants were asked to indicate which face matched the target face they initially saw. Verbal interference uniquely hindered participants' advantage at identifying the target face in pairs of faces that ostensibly conveyed different emotions (i.e., they crossed a category boundary; Roberson & Davidoff, 2000). This finding suggests that perceivers regularly access concept knowledge that is supported by language when making meaning of facial muscle movements as instances of emotion.

Semantic satiation of emotion words also impairs emotion perception. Semantic satiation renders concepts temporarily inaccessible through the repetition of a relevant word (Jakobovits, 1962). When participants are asked to repeat an emotion word (e.g., "anger") 30 times and are subsequently presented with a relevant emotional face (e.g., a scowl), they are temporarily unable to categorize the face as depicting that particular emotion, even when asked to merely judge whether two faces (e.g., two scowls) match in emotional content,

a task that does not explicitly require access to emotion words (Lindquist, Barrett, Bliss-Moreau, & Russell, 2006). Semantic satiation has also been shown to disrupt simple perceptual priming of emotional faces, a process that should operate without access to language (Gendron, Lindquist, Barsalou, & Barrett, 2012). These studies demonstrate that access to conceptual information that is supported by language is necessary for perceivers to make meaning of the information provided by affective facial muscle movements. Consistent with these findings, patients with semantic dementia, who have permanently impaired access to the meaning of concepts due to a neurodegenerative disease, perceive emotional faces in terms of valence rather than discrete emotion categories (Lindquist et al., 2014).

Although growing evidence is consistent with the role of concept knowledge and language in emotion perception, questions remain about the specific mechanisms by which language influences the perception of visual sensations during emotion perception. This brings us to our final hypothesis, that the modality-specific concept knowledge supported by language might interact with external visual sensations from the present sensory array to allow perceivers to "see" emotions on others' faces.

Hypothesis 3: Language Allows Perceivers to See Emotion on Faces by Reactivating Sensorimotor Representations of Prior Experiences

Our third hypothesis is that language allows a person to access the concept knowledge associated with certain emotion categories during visual perception, which may in turn shape how visual sensations are attended to and encoded in the first place. We refer to the process by which reenactments of prior experience shape how meaning is made of the present sensory array as the "sensory inference hypothesis" (cf. Barrett et al., 2007).

The sensory inference hypothesis suggests that the role of language runs "deeper" in emotion perception than might be assumed by commonsense, because a concept word (e.g., "anger") reactivates the sensorimotor representations that became associated with that concept across prior experiences. Sensorimotor representations of prior experiences then serve as a source of prediction about the meaning of incoming visual information from faces. Evidence for the sensory inference hypothesis comes from studies of nonemotional visual perception. One study found that expectations created by the presence of a word facilitate the detection of objects in the visual field that would otherwise not be selected for conscious awareness (Lupyan & Ward, 2013). Participants were cued with either a verbal label (e.g., the word "pumpkin") or auditory noise, after which they were either shown an object (e.g., a pumpkin or a chair) masked by continuous flash suppression (CFS), or the

mask in the absence of an object. CFS is a technique in which a static stimulus is presented to one eye, while a series of rapidly changing stimuli are simultaneously presented to the other eye. Under normal circumstances, the dynamic stimuli render the static stimulus "invisible" by suppressing the conscious representation of those visual sensations (Tsuchiya & Koch, 2005). However, despite the presence of CFS, participants were more likely to actually detect the stimulus on trials where participants heard a cue (e.g., "pumpkin") that matched the suppressed stimulus (e.g., an image of a pumpkin), compared to trials in which there was no cue, or when the cue did not match the stimulus (Lupyan & Ward, 2013). Language likely brings online concept knowledge about object categories, thereby making information about those categories more salient during visual perception and helping the brain select category-consistent visual sensations for conscious experience. In some cases, the brain might even be "filling in" sensations that were not present, as is observed in studies where participants are asked to detect emotional facial "expressions" in random visual noise (Gosselin & Schyns, 2003). Despite there being no emotional signal present in visual noise, participants use their conceptual knowledge to "fill in" the presence of specific emotional faces, and a reverse correlation technique reveals patterns resembling stereotypical facial movements (e.g., a smiling face across trials in which participants expected to see a facial expression of "happiness").

Similarly, emotion words may serve as a sort of prime to help individuals fill in missing details about the information presented on a face. For instance, Halberstadt and Niedenthal (2001) demonstrated that labeling faces with words actually shifted participants' perceptions of those faces toward more stereotypical portrayals of the emotion category. Specifically, labeling morphed happiness-anger faces as depicting *anger* led participants to remember the faces as more intensely angry (e.g., closer to anger on the happiness-anger continuum). This may be because emotion words activate representations of the most stereotypical facial muscle movements that are associated with a given emotion category (Roberson, Damjanovic, & Pilling, 2007). Consistent with this hypothesis, individuals were more sensitive to quickly pair a face with an emotion word compared to a same-category face in a sequential priming paradigm (Nook et al., 2015). Words likely helped individuals narrow in on category-prototypical features to guide their judgments, whereas other faces did not cue category-prototypical features as readily. More extremely, the presence of emotion words in studies can even lead to the false recognition of emotion on faces (e.g., Fernández-Dols, Carrera, Barchard, & Gacitua, 2008; see Lindquist & Gendron, 2013), perhaps because words cause participants to attend to facial features consistent with the named category and ignore other facial features.

CONCLUSIONS

In sum, this chapter outlines growing evidence that faces do not unambiguously signal specific emotions and that conceptual knowledge supported by language is necessary for perceiving categories of emotions (*anger, disgust, fear*, etc.) on others' faces. We also discussed a new hypothesis for the mechanism by which language influences emotion perception. In particular, we considered the sensory inference hypothesis, in which language reactivates sensorimotor representations of emotion from prior experiences, changing how affect is seen on the faces of others and enabling the perceiver to "fill in" visual details with information from his or her conceptual knowledge about emotion categories.

What is clear from these findings is that language has a much stronger role in emotion perception than predicted by commonsense or by other models of emotion. However, many questions still remain about how words interact with concepts and visual sensations to influence perception of emotions on faces. For instance, it is still unclear to what extent concepts can override information present on the face to shape perception, how the context might prime concept knowledge to shape perceptions of emotion, or how the activation of different concepts might compete to shape perception. We look forward to continued research examining the mechanisms by which language helps construct the perception of facial emotion in others.

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