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Emotion Perception: Putting the Face in Context

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Abstract and Keywords

Emotion perception research is dominated by the assumption that emotions are written on the face as particular arrangements of facial actions. This face-focused paradigm assumes that posed, static configurations of facial muscle movements provide sufficient cues to emotion, such that the study of context is secondary. As a result, it has been assumed that the mechanisms for perceiving posed, static facial actions reveal the mechanisms that support emotion perception outside of the laboratory setting. In this chapter, we review this face-focused paradigm in emotion perception and contrast it with experimental findings that place the face in context. Furthermore, we question whether a posed face is ever without context, even in a lab. We discuss how features of an experiment can serve (however unintentionally) as a context that influences performance in emotion perception tasks. Based on the literature reviewed, we conclude that the study of emotion perception is necessarily contextualized, such that context not only influences emotion perception, but it might be intrinsic to seeing an emotion in the first place.

Keywords: emotion, perception, facial expression, context

An iconic *fear* face looks startled—eyes wide, mouth agape, and eyebrows raised. An iconic *anger* face is scowling—brows furrowed, eyes glowering, and jaw tightened. An iconic *sad* face is frowning—lips pouting, brows pulled together. These posed, exaggerated faces dominate a research paradigm in the psychology of emotion perception. Simply exposing a perceiver to one of these faces is assumed to produce an automatic “recognition” that reflects some statistical regularity in the faces that populate the emotion category, and this automatic perception is taken as evidence that there is an evolutionarily preserved capability to “decode” facial actions for their psychological meaning. Several notable experiments (Ekman, 1972, 1973; Ekman & Freisen, 1971; Ekman, Sorensen, & Friesen, 1969; Izard, 1971) within this face-focused approach have captured the attention of textbook writers and have become part of the standard curriculum in psychology. These experiments have also captured the imagination of other academic disciplines. The face-focused approach to emotion perception (where emotional information is written on the face) guides cognitive neuroscience studies of emotion perception (e.g., Breiter, Etcoff, Whalen, Kennedy, Rauch, Buckner, et al., 1996; Phillips et al., 1997; Sprengelmeyer, Rauch, Eysel, & Przuntek, 1998; for a discussion, see Watson, 2004). Research investigating social and emotional deficits in people with mental disorders, brain lesions, and neurodegenerative disease almost exclusively relies on the face-focused approach (e.g., Kohler, Walker, Martin, Healey, & Moberg, 2010). The face-focused approach also informs government spending on security training. For example, over 3,000 TSA employees have received security training to “read” emotion in the face, in the hopes of keeping citizens safe (Weinberger, 2010). Even the popular media is enamored with this paradigm, (p. 540) as evidenced by television shows such as “Lie to Me” and popular science writing such as Malcolm Gladwell’s *The Naked Face* (2002).

The face-focused approach to emotion perception has several key features. First, this approach views the face as transmitting evolved signals that broadcast the internal state of a target person for perceivers to see (Keltner, Ekman, Gonzaga, & Beer, 2003). Data to support this view come in several varieties: (1) descriptions of facial behaviors that occur in emotion across cultures (e.g., Scherer & Wallbott, 1994); (2) cross-cultural production of facial behaviors during the experience of emotion (e.g., “negative” facial behaviors in Japanese and American students, Ekman, 1973; for review, see Matsumoto, Keltner, Shiota, Frank, & O’Sullivan, 2008, pp. 215–216); or (3) expressions produced by congenitally blind individuals as compared to sighted individuals (e.g., Matsumoto & Willingham, 2009). In this regard, “emotion perception” is redefined as “emotion recognition.”

A second aspect of the face-focused approach is that emotion perception is an innate psychological process (e.g., Schyns, Petro, & Smith, 2009). Data used to support this point come from (1) studies on cross-cultural recognition of emotion (for reviews, see Ekman, 1998; Izard, 1977; but see Russell, 1994), (2) work on the “efficiency” or automaticity of perception (e.g., Schyns et al., 2009; Tracy & Robins, 2008), (3) work on the categorical perception of emotion (e.g., Etcoff & Magee, 1992), and (4) emotion perception in infants (e.g., Hoehl & Striano, 2008; for review, see Hoehl & Striano, 2010).

A third aspect of this view is that context (i.e., information aside from the face) is not necessary for successful emotion perception. For example, seeing emotion in another person is assumed to proceed “automatically, silently, and without the benefit of language” (Izard, 1994, p. 289). In some views, emotion perception is even resistant to contextual influences (e.g., Nakamura, Buck, & Kenny, 1990). Emotion perception is assumed to proceed in a feedforward fashion, with more complex "cognitive" processing coming online relatively late and secondary to the perceptual processing of emotional faces (for a discussion, see Vuilleumier & Pourtois, 2007).

Because of these assumptions, the face-focused approach to studying emotion perception typically presents[1] perceivers with faces that are posing exaggerated facial actions that are devoid of a bodily, vocal, or situational context. Yet in everyday life, faces move in concert with bodies and vocalizations in a way that is typically calibrated to the situation at hand. Even proponents have noted the oddity of the face-focused experimental paradigm (e.g., Ekman & O'Sullivan, 1988). Unfortunately, much of the literature has yet to take these ecological concerns to heart—researchers routinely present posed, static faces like those from Ekman and Freisen's (1976) set to examine how accurately perceivers can categorize these disembodied, posed faces.

In this chapter, we discuss recent empirical challenges to a face-focused approach to emotion perception. We focus on research that places the face into context, demonstrating that context dramatically shapes how faces portraying emotion are processed. We also explore the idea that the typical laboratory paradigm serves as its own form of context, one that is often unintended (and unrecognized) by the experimenter. We close the chapter by discussing the implications of context-based modulation for the future of emotion perception research. We suggest that context does more than modulate emotion perception; instead, it might serve as a necessary source of information in emotion perception.

Putting the Face in Context

Early investigations of context effects in emotion perception were motivated by relatively low "accuracy" in experiments that relied exclusively on the face (Hunt, 1941; Landis 1934). Accuracy was (and still is) defined as seeing (1) what the target intended to portray (in posed facial actions), (2) what the stimulus developer intended (in directed facial actions often based on predetermined configurations that have been described in the literature, e.g., EMFACS; Ekman & Friesen, 1982), (3) the emotion associated with the stimulus "condition" in which a target's facial actions occurred (for spontaneous facial actions), or (4) the self-reported state of the target individual (again for spontaneous facial actions). Citing a number of experiments in which perceivers failed to agree on the emotion conveyed by faces, Hunt and Landis concluded that the face does not provide reliable information about emotion for the perceiver. This conclusion led researchers to explore what information, in addition to the face, is needed for perceptions of discrete emotions like anger, sadness, and fear. These experiments, published mainly between the 1920s and 1930s, examined whether contexts such as bodies, hands, vocalizations, and situational knowledge contributed to emotion perception over and above the facial actions that they were paired with. Although this research was criticized on methodological grounds (p. 541) (Ekman, Freisen, & Ellsworth, 1972), more recent, well-designed research has emerged to again raise the question of whether context is an important determinant in emotion perception. As we will see in the coming pages, this more modern research makes it clear that a face does not speak for itself, at least where emotion[2] is concerned.

Stimulus-Based Context

One of the most obvious sources of context in studies of emotion perception is the physical array in which a face is embedded, or what we refer to as “stimulus-based” context. Some stimulus-based context derives from the target person who produced the facial actions, such as bodily posture or movement, vocalizations, and even the target’s sweat. Other forms of context characterize the broader “event” in which a face appears. Studies investigating stimulus-based forms of context have examined both influence of congruent (e.g., a startled face on a fearful body) and incongruent contexts (e.g., a pouting face following an anger situation), demonstrating both facilitation and interference effects.

Bodies

In 1935, Kline and Johannesen demonstrated that perceivers are more accurate (i.e., to select the emotion category intended by the researcher) when a face portraying emotion was presented in a congruent bodily context (compared to when the face was presented alone). These data indicated that the body helps to increase interrater agreement about the feelings of a target over information derived from the face alone. In the last few years, there has been a spike of interest in the idea that body postures are a salient cue that perceivers use to understand others’ emotional states (see de Gelder, 2009). For example, when posed faces and bodies portray the same emotion category, emotion perception in the face is facilitated; when body and face are incongruent, emotion perception in the face is impaired (Meeren, van Heijnsbergen, & de Gelder, 2005). Perception of a wide-eyed face on a body adopting an angry posture was less accurate than when that same face was placed on a body adopting a fearful posture. Strikingly, event-related potential (ERP) recordings reflect the incongruence between facial and bodily portrayals of emotion as soon as 115 ms after stimulus onset. And, remarkably, bodies also provide information about emotion for nonhuman perceivers: A computer classifier trained separately on faces and bodies portraying emotion demonstrated higher classification accuracy for the two cues combined than with either one alone (Gunes & Piccardi, 2007). There are even times when bodies dominate over faces during emotion perception. A scowl (i.e., a portrayal of *anger*) is more likely to be perceived as disgusted when it is paired with a body posture involving a soiled object (Aviezer, Hassin, Ryan, et al., 2008, Study 1) and a face portraying disgust can even by perceived as displaying a positive emotion (i.e., pride) when paired with a muscled body whose arms are raised in triumph (Aviezer, Hassin, Ryan, et al., 2008, Study 2). Not all studies have found that bodies provide incremental information over faces during emotion perception, however (e.g., Rozin, Taylor, Ross, Bennett, & Hejnadi, 2005).

Hand gestures, too, can influence emotion perception in a face (Hietanen & Leppänen, 2008). Participants were more accurate to judge scowling faces as angry when paired with congruent hand gestures (a neutral sentence signed in Finnish Sign Language in an angry manner) and were least accurate to judge anger when scowls were paired with happy hand gestures (that same sentence signed in a happy manner). Perception of neutral faces was also biased toward "anger" when paired with angry hand gestures.

Vocalizations

The voice constitutes a second type of stimulus-based context for perception of emotion in facial actions. The voice alone is an important conduit of affective tone, most effectively conveying arousal (Bachorowski, 1999; Pittam, Gallois, & Callan, 1990) and valence to a lesser extent (Bachorowski & Owren, 2008; Pereira, 2000). Importantly, vocal depictions shape emotion perception based on facial actions (e.g., de Gelder & Vroomen, 2000; Massaro & Egan, 1996; for a review, see de Gelder et al., 2006).[3] For example, perceivers judge ambiguous facial actions (i.e., a morph between a smiling "happy" face and a frowning "sad" face) in line with the affective value conveyed by vocalizations (i.e., prosody conveying sadness or happiness) even when they are told to judge the face alone (de Gelder & Vroomen, 2000). The effect of prosody on emotion perception in a face is most robust when the face is ambiguous (i.e., does not portray a single emotion in a caricatured manner; de Gelder & Vroomen, 2000), neutral (Massaro & Egan, 1996), or visually noisy (Collignon et al., 2008), although prosody also primes judgments of faces portraying congruent emotional content (Pell, 2005). Additional work is needed to clarify whether the effects of vocal (p. 542) prosody reflect affect congruence or a more specific discrete emotion congruence effect. Future work could use stimuli that are controlled for valence and arousal (e.g., fear and disgust in Phillips et al., 1998) to evaluate whether congruence or interference effects occur when vocal portrayals matched in affect, but not emotion, accompany facial actions.

Neuroimaging studies suggest that facial and vocal information are integrated in a variety of brain regions involved in perception. For example, facial and vocal portrayals of fear and disgust separately produced an increase in activation within the superior temporal gyrus, inferior posterior temporal gyrus, middle temporal gyrus, and medial frontal cortex (Phillips et al., 1998). Congruent combinations of negative facial and vocal cues produced an increase in activation in the left amygdala and right fusiform and several other structures in the distributed face-processing network (Dolan, Morris, & de Gelder, 2001). However, positive facial and vocal congruency produced increases in a distinct network of regions (i.e., left superior parietal lobule, the left medial parietal cortex, the left superior frontal gyrus, and the right anterior cingulate cortex). In another study, brain activity in some of these same regions—the medial prefrontal cortex (MPFC) and left superior temporal sulcus (STS) was linked to the category of emotion being perceived, regardless of the modality in which the cues occured (Peelen, Atkinson, & Vuilleumier, 2010). The amygdala, on the other hand, appears to be particularly important to the processing of combined facial and vocal cues. When startled faces portraying fear were accompanied by a sentence spoken in a fearful tone, perceivers judged the face as more negative than when that same face was presented alone, and these judgments were correlated with amygdala activation, which the authors interpret as evidence that the amygdala computes affective meaning based on multiple cues (Ethofer et al., 2007). It is also possible, however, that the faces were unfamiliar and ambiguous (i.e., not clearly indicative of one discrete emotion) to perceivers (Somerville & Whalen, 2006) and the vocal cues made their psychological meaning even more uncertain. Similar effects have been demonstrated in nonhuman primates, such that the same neurons in the central nucleus of the amygdala fired to the presentation of vocalizations and facial actions representing aggressive threat, scream, or coo (Kuraoka & Nakamura, 2007), which are thought to be homologous with expressions in humans (Parr & Waller, 2006).

Some work has investigated the time course of vocalization context effects, with discrepant results. Research using magnetoencephalography (MEG) demonstrates that the integration of voices and faces portraying emotion occurs within 250 ms after stimulus onset in the superior temporal sulcus (Hagan et al., 2009).[4] Yet other data suggest that the time frame of prosody effects is much slower than 250 ms. In an implicit priming task where prosodic cues preceded faces, only vocalizations longer than 600 ms produced facilitation in judgments of a congruent emotional faces (Pell, 2005). It is unclear what this time constraint means, but one possibility is that despite early integration in the STS, behavioral facilitation will only occur with stimuli of sufficiently long duration, perhaps because conceptual knowledge based on vocalizations determines whether the emotion judgment will be affected. Alternatively, a longer presentation duration might only be important for instances when vocalizations and faces are not presented simultaneously. This would suggest that distinct mechanisms might be responsible for context effects based on simultaneous versus sequential presentation of cues.

Chemosignals

Even a target person's sweat can influence perception of emotion from the face (Zhou & Chen, 2009). For example, researchers collected sweat from target individuals while they viewed videos designed to induce fear or happiness. A second group of individuals then sniffed this sweat as they were completing an emotion perception task. Perceivers demonstrated better accuracy for the perception of startled "fear" faces when sniffing the "fearful" sweat compared to those sniffing the "happy" sweat. Interestingly, perceivers could not distinguish between the two types of sweat via self-report, suggesting this was not an explicit conceptual priming effect. This study did not investigate whether this facilitation might be driven by the quantity of sweat perceivers were exposed to (sweat was not measured, only collected on a gauze pad under the arms of participants). Furthermore, it is possible that sweat influences the perception of affect, rather than the perception of discrete emotion categories (given that happiness and fear differ in their basic affective quality).

Situations

In the 1910s and 1920s, Lev Kuleshov performed filmmaking "experiments" that famously demonstrated how situational context influences the emotion perceived in another person's facial actions. He spliced the same neutral expression with different (p. 543) scenes that were emotional in nature, leading audiences to believe that the expression on the actor's face was changing. With no "signal" present in the face, perceivers still saw emotion when the context called for it. In fact, audiences raved about the superb acting in the film. More recently, the "Kuleshov effect" has proved to be somewhat more complex. When neutral faces were paired with common causes of emotion, such as missing a train, participants made judgments that reflected either the situation or the face, in equivalent amounts (Carrera-Levillain & Fernández-Dols, 1994). When the situation was more extreme, such as brake failure on a mountain pass, the "neutral" facial behaviors tended to dominate the judgment—perceivers overwhelmingly saw that face as neutral.

Other experiments investigating the influence of situational effects on emotion perception are as old as the first studies on the Kuleshov effect. For example, two different sets of perceivers judged spontaneous facial actions in infants that were either isolated from the context or paired with the eliciting situation (Sherman, 1927). Perceivers generated up to 25 different emotion labels for a given set of spontaneous facial actions in infants when they were presented in isolation. Agreement was higher for the perceivers who judged the facial actions in their eliciting circumstances (e.g., without context 15% of perceivers saw “fear,” with context 65% did) (see also Munn, 1940). These experiments have been critiqued based on their methods (see Ekman et al., 1972), but more recent, better controlled, studies confirm that perceivers agree more on the emotion conveyed by a face when the facial actions are placed in a congruent context than when they are presented alone (Carroll & Russell 1996; Knudsen & Muzekari, 1983). Apparently, context can diminish the ambiguity (i.e., lack of interrater agreement about the emotional meaning) of posed facial actions, even when the actions depict highly caricatured expressions as in recent experiments.

A number of findings also point to a situational modulation of judgments when facial actions and the situation are “incongruent.” For example, participants asked to make emotion judgments based on combinations of incongruent situational descriptions and facial actions made 55.7% of judgments consistent with the situation and 31.6% consistent with the facial behaviors (Goodenough & Tinker, 1931). These data suggest that the situation may be a stronger cue when it is inconsistent with information from a face. This general finding was replicated using bodily and situational information conveyed by a visual scene (Munn, 1940), film clips (Goldberg, 1951), and video of the actual eliciting circumstances (Sherman, 1927). More recently, this finding has received further support (Fernandez-Dols, Sierra, & Ruiz-Belda, 1993; Fernandez-Dols, Wallbot & Sanchez, 1991, Study 2; Spignesi & Shor, 1981; Wallbott, 1988a, Study 2; Wallbott, 1988b). For example, portrayals of anger are more likely to be perceived as fearful when paired with the description of a dangerous situation (Carroll & Russell, 1996, Study 1). Yet other studies have failed to show that contextual information can override information in the face in driving emotion judgments (Fernandez-Dols et al., 1991, Study 1, 3; Nakamura et al., 1990; Wallbott, 1988a, Study 1; for a review see, Fernandez-Dols & Carroll, 1997).[5] Situational information tends to dominate perception of emotion in faces both when situations are common, everyday (Carrera-Levillain & Fernández-Dols, 1994) and even when situations are more ambiguous (i.e., contain less source clarity) than the exaggerated facial actions being perceived (Carroll & Russell, 1996, Study 3). This integration of situational context and facial actions also appears to develop over the lifespan, with children (ages 4–10) using situational over facial information for all emotions portrayals except surprise (Widen & Russell, 2010). Other data suggests that older children (third grade) are most accurate when both types of cues are present, and younger children (preschool) demonstrate advantages for stories (situational information) over faces portraying emotion (Reichenbach & Masters, 1983).

The use of situational context might be enhanced by the epistemic goal to perceive emotion as opposed to affect. For example, informationally irrelevant context is automatically encoded when perceivers were asked to judge the emotion in posed faces (i.e., “Is this person afraid or disgusted?”) but not when they were asked to perceive affect (i.e., “Would you approach or avoid this person?”), suggesting that the structural configuration of faces carries information about the affective state of the target, but processing a face in context is necessary for perceiving emotion (Barrett & Kensinger, 2010). (This is consistent with earlier work showing that perceivers use basic affective dimensions like valence and arousal rather than discrete categories of emotion to understand posed facial behaviors in isolation; Russell & Bullock, 1986; Schlosberg, 1952.) Interestingly, perceivers’ memory for the situational context was just as strong as memory for the focal face itself during emotion perception, suggesting (p. 544) that faces and contexts are processed configurally during emotion perception. (For related results, see Frühholz, Fehr, & Herrmann, 2009; Warner & Shields, 2009.)

The impact of situational context during emotion perception extends beyond explicit judgments of emotion to the gaze pattern used for faces. Perceivers’ visual fixations on a face reflect the larger context (including the body) in which that face is embedded (Aviezer, Hassin, Ryan, et al., 2008) suggesting that the context changes which facial features are visually salient.

The neural responses that realize emotion perception are also shaped by situational context. Neural activity associated with a surprised face preceded by a negative sentence was greater in ventral regions of the amygdala, in comparison to when a surprise face was preceded by a positive sentence (Kim et al., 2004). Amygdala activity was also modulated by the congruence of a situational context and facial actions in a recent demonstration of the Kuleshov effect (Mobbs et al., 2006). A network of regions associated with processing the “emotionality” of a face (i.e., ACC, left STS, right STS, right amygdala, and the bilateral temporal pole) was more engaged when a face was presented following an “emotional” video compared to a “neutral” video. Incongruent context revealed specific activity in the ventromedial prefrontal cortex, whereas the combination of a fearful face and negative context revealed activity in the right amygdala, fusiform gyrus, and bilateral temporal pole and insula. It is believed that this network of regions works together to instantiate an emotion percept based on both facial actions and the context that accompanies them. Similarly, visual regions such as bilateral inferior occipital, bilateral fusiform, right inferior frontal gyrus, as well as left amygdala were engaged when participants were asked to match an emotional face to a context (Sommer, Döhnel, Meinhardt, & Hajak, 2008), suggesting that these regions play a role in integrating situational context and facial actions when the goal is to produce a coherent emotional percept. Amygdala activation was related to the goal to perceive emotion based on context and facial actions, because when these same stimuli were presented but were incidental to a color-matching task, amygdala activity did not differ from a control condition. Taken together, these findings suggest that when the epistemic goal is to perceive emotion, neural activity in regions involved in the perceptual processing of faces is shaped by the context in which faces are embedded. Since context modulates the same regions that are typically associated with the formation of an emotional percept to begin with, it can be argued that context is integral to the emotional percept itself, rather than a postperceptual decision process.

Other Faces

Finally, other faces serve as another strong form of stimulus-based context in emotion perception, even when those other faces are irrelevant to the task at hand. For example, in an early study designed to examine "social context," perceivers were presented with a line drawing of two faces oriented toward one another (Cline, 1956). The faces depicted either a low-arousal negative emotion ("glum"), a high-arousal negative emotion ("frown"), or high-arousal positive emotion ("smile"). Participants assigned a different meaning to the face depending on the other face it was paired with. For example, participants perceived smiles as bolder when paired with the low-arousal "glum" expression than when paired with the high-arousal "frown" expression. In more recent experiments, perceivers judged faces as more intense when they followed with several faces of opposite valence (e.g., a frowning face following a smiling face) (Thayer, 1980). Similarly, perceived arousal level of anger and surprised facial portrayals can also be shifted based on the facial portrayal they follow (Russell & Fehr, 1987, Studies 5 & 6). Perception of a neutral face also shifted when it was presented concurrently with (Russell & Fehr, 1987, Studies 1 & 2) or following another face portraying emotion (Tanaka-Matsumi, Attivissimo, Nelson, & D'Urso, 1995). These effects occurred despite instructions for participants to judge the target face independently of the other stimuli. The size of the context effect produced by other faces appears to be culturally relative, however (Masuda, Ellsworth, Mesquita, Leu, & Veerdonk, 2008). Japanese perceivers' judgments of a target individual reflected the emotions conveyed by the other figures in a scene, but this was less true for Americans perceivers, who focused mainly on the target person.

The processing of surrounding nontarget faces is also evident in patterns of brain activity (Amtig, Miller, Chow, & Mitchell, 2009). Posterior regions of visual cortex are more engaged when all faces are consistent in affective content, whereas the amygdala response is selectively lessened for positive faces in the context of neutral or negative faces. Enhanced functional connectivity emerged between the amygdala and medial prefrontal cortex on trials where the target face was inconsistent (p. 545) in affective value with the nontarget faces, and this functional connectivity predicted longer reaction times. These data suggest that connectivity between the amygdala and medial prefrontal cortex reflects a process aimed at resolving competition between conflicting affective content (c.f. Lieberman et al., 2007). It is unclear based on these data whether this same connectivity would result from within valence competition, however.

Perceiver-Based Context

Whereas stimulus-based forms of context are driven by something in the external surroundings, perceiver-based forms of context are driven by the internal state of the perceiver. In this section, we focus on how emotion perception in the face is influenced by the perceiver's immediate psychological state. Other forms of context that might be categorized as "perceiver based," such as those based on personality, culture, ethnicity, gender, or psychopathology, are beyond the scope of the present review.

Cognitive Load

Emotion perception depends on the amount of executive attention that is available to a perceiver, and so attention becomes a relevant aspect of the perceiver-based context. Although researchers often believe that emotion perception is automatic (e.g., emotion recognition is above-chance under conditions of cognitive load; Tracy & Robins, 2008), there are often methodological circumstances that should constrain explanations for observed effects. For example, in the Tracy and Robbins study, perceivers were asked to judge the faces according to a single emotion word, which might have sufficiently constrained their perceptual choices (see later section on forced choice as an experimental context). Consistent with this interpretation, a recent study by Phillips, Channon, Tunstall, Hendenstrom, and Lyons (2008) found that placing participants under working memory load affected emotion perception judgments far less when the task was to choose between two labels (as opposed to four or six). Futhermore, perceivers under cognitive load still show performance decrements compared to when they are not placed under load (Phillips et al., 2008; Tomasik, Ruthruff, Allen, & Lien, 2009; Tracy & Robbins, 2008). For example, perceivers under cognitive load were less able to distinguish perceptually between scowling and smiling faces (Tomasik et al., 2009). This effect of load appears to be somewhat downstream in visual processing, however, given that early encoding of the visual input (indexed by early ERP components) remains intact when perceivers are placed under cognitive load at encoding (Holmes, Kragh Neilsen, Tipper, & Green, 2009).

Affective State

Several studies indicate that a perceiver's affective state shapes affect perception. Perceivers induced into an unpleasant affective state, compared to those feeling neutral, were more likely to see negative emotion in an ambiguous schematic (line drawing) face (Bouhuys, Bloem, & Groothuis, 1995). In a second study, perceivers in an unpleasant affective state were more likely to see "fear" in schematic faces that contained both positive and negative features. In contrast, perceivers in another study (Leppanen & Hietanen, 2003) who were induced to feel pleasant perceived happiness in low-intensity smiling faces more quickly than they perceived disgust in low-intensity disgust faces, although they had roughly equivalent reaction times to judge happiness and disgust in those faces following induction of unpleasant feelings. (Because this experiment did not include a neutral condition, it is unclear whether these were facilitation and interference effects.) The affective aspects of emotional experiences also shape affect perception, such that participants induced to feel the discrete state of disgust via audiotaped messages were more accurate at judging negatively valenced emotional faces generally (Schiffenbauer, 1974). These effects on emotion perception appear to be specific to momentary experiences of affect, however; retrospective ratings of emotion, as measured by the profile of mood states questionnaire, were unrelated to the perception of emotion (Harris & Synder, 1992).

The affective state of the perceiver not only influences the emotional content of what is perceived, but it also influences the dynamics of perception. Perceivers induced to feel an unpleasant affective state (i.e., sadness) perceived frowns, but not smiles, as lasting longer than they did, whereas the reverse finding was found for those induced to feel a pleasant (i.e., happy) state (Niedenthal, Halberstadt, Margolin, & Innes-Ker, 2000). Affective state also shapes how "believable" perceivers find portrayals of emotion. The experience of positive compared to negative affect leads perceivers to judge all facial portrayals (i.e., positive, negative, and neutral portrayals) as more believable (Forgas & East, 2008). Perceived *intensity* of emotional faces also appears to be influenced by the affective state of the perceiver. Participants in a pleasant affective state judged faces portraying positive, but not negative, emotion as (p. 546) more intense (Forgas & East, 2008). Taken together, these data indicate that the affective state of the perceiver is an important factor that contributes to emotion perception. Furthermore, changes in affective state might be a mechanism by which other context-based effects occur because odors, sounds, sights, and scenes all might shape ongoing perception by virtue of the fact that they have the potential to perturb a perceiver's affective state.

Embodiment

Embodiment refers to the various ways in which the body influences cognition. Embodiment is reflected, for example, in the idea that the brain systems used to represent the concept of an emotion (e.g., "anger") are also involved in seeing that emotion in another person and experiencing that emotion oneself (Niedenthal, Barsalou, Winkielman, Krauth-Gruber, & Ric, 2005). One implication of this work is that categorizing a face as "anger" versus "fear" might rely on the perceiver's ability to reenact the brain state that controls the relevant facial muscle movements associated with that emotion (cf. Niedenthal et al., 2005). Studies testing an embodiment hypothesis have a long history. As early as 1918, it was established that perceivers reported using facial mimicry as a strategy for emotion perception (Langfield, 1918b). Perceivers spontaneously mimic facial muscle movements in static portrayals of emotion (e.g., Dimberg, 1982, 1990) even when they are backwardly masked (Dimberg, Thunberg, & Elmehed, 2000). More recently, experimental studies have shown that facial mimicry is associated with perceptual accuracy (Wallbott, 1991), and with the ability to judge a smile as authentic versus faked (for review, see Niedenthal, Mermillod, Maringer, & Hess, 2010). Participants allowed to mimic facial behaviors saw the onset and offset of facial expressions sooner than participants who were unable to mimic because they were holding a pen in their mouth (Niedenthal, Brauer, Halberstadt, & Innes-Ker, 2001; see also Stel & van Knippenberg, 2008). Patients with "locked-in" syndrome, who have complete paralysis of voluntary (but not spontaneous) facial movements due to a brainstem lesion, have impaired accuracy for discrete emotion perception of negative faces (i.e., anger, fear, sadness) (Pistoia et al., 2010). Yet individuals with Mobius syndrome, who also have paralysis of facial muscles that results from the underdevelopment of the cranial nerves, do not show decrements in emotion perception (Rives Bogart & Matsumoto, 2010). These data suggest that central nervous system impairments disrupt emotion perception, whereas more peripheral causes of muscle impairments might not. Similarly, a central representation of how a set of facial muscle movements feels may also be necessary to emotion perception; transcranial magnetic stimulation (TMS) applied to somatosensory cortex leads to decrements in emotion perception (Pitcher, Garrido, Walsh, & Duchaine, 2008; see also Adolphs, Damasio, Tranel, Cooper, & Damasio, 2000; Pourtois et al., 2004). Embodied representations may have particular utility for understanding static faces, however, given that an increase in motor cortex activity was not observed for perception of emotion in *dynamic* facial movements (Kilts, Egan, Gideon, Ely, & Hoffman, 2003).

Experimental Context

Even with all the evidence that context routinely influences emotion perception, there are still experiments where faces are presented in isolation—no bodies or situational context—and emotion perception still proceeds. Some of the most well cited studies to make this point date from the early 1970s. This work demonstrated that even individuals from preliterate cultures have higher accuracy than would be expected by chance when perceiving emotion in static posed faces (e.g., Ekman & Friesen, 1971; Ekman et al., 1969, 1972; Izard, 1977). Yet these experiments, arguably some of the most visible and salient in all of psychology, contain certain contextual factors in the experimental setup that contributed to emotion perception in an important way.

Posed Facial Actions

Most studies in the face-focused paradigm (including our own) use faces that pose particular configurations of muscle movements to portray emotion instead of spontaneously elicited facial actions. Standard "facial expression" stimulus sets were created by either directing posers to move particular facial muscles according to a predetermined configuration (e.g., as prescribed by EMFACS) or by merely asking them to pose their faces to convey a particular emotion category. It is not clear how ecologically valid these particular configurations are with respect to actual spontaneous muscle movements during emotion experience (e.g., do people you know pout when they are sad or scowl when they are angry?). Facial electromyography, a direct measure of muscle activity, indicates that people do not always pout in sadness or scowl in anger; in fact, the electromyography data produce little differentiation beyond positive and negative affect (p. 547) (for a review, see Cacioppo, Berntson, Larsen, Poehlmann, & Ito, 2000). Photographs of posed facial actions thus introduce statistical regularities into emotion perception experiments that are not necessarily present in real life, and they have the potential to inflate emotion perception accuracy in the lab compared to what it would be in everyday life (if such perceptions were only based on a face). In fact, Landis (1924a, 1924b, 1929) observed that judgments of spontaneous expressions were at chance levels. More recent work is consistent with (although not as extreme as) these early findings (e.g., Yik, Meng, & Russell, 1998), even when the spontaneous facial actions were identified as emotional by "expert" coders (Naab & Russell, 2007). One argument, of course, is that target people are using display rules (see Ekman et al., 1969) to modify their spontaneous facial actions, making it harder to recognize expressions when they occur. To address this concern, it is instructive to compare emotion perception based on covertly acquired spontaneous facial actions (acquired in a social context that would not encourage the use of display rules) with actions that are posed. Accuracy rates are much lower for covert spontaneous facial actions, although they are still above chance levels (Hall, Gunnery, & Andrzejewski, 2011; Wagner, MacDonald, & Manstead, 1986; Zuckerman, Hall, DeFrank, & Rosenthal, 1976). Participants' accuracy to judge emotion drops even further when the target's facial behaviors occurred during conversation (Zuckerman et al., 1976; also see Motley & Camden, 1988).

In contrast to recognition advantages seen for posed facial actions, perceivers appear more willing to *attribute* emotional experience based on spontaneous expressions. Spontaneous facial actions are judged to convey emotions more clearly and reflect true feelings more than are posed facial actions (McLellan, Johnston, Dalrymple-Alford, & Porter, 2010). McLellan and colleagues also demonstrated that spontaneous facial actions serve as more effective affective primes than do posed actions. Even though posed facial actions do well in studies where the question is about the emotion displayed on the face, spontaneous facial actions appear to do well when the question is about the experience of the target individual (c.f. Aviezer, Hassin, Bentin, & Trope, 2008). The ability to explicitly distinguish between posed and spontaneous expressions (i.e., smiles) appears to be more developed in older adults, however (Murphy, Lehrfeld, & Isaacowitz, 2010; for review of aging and context in emotion perception, see Isaacowitz & Stanley, 2011). Future work should address whether judgments of "true feelings" and priming effects based on spontaneous stimuli are also enhanced with age.

Static Faces

The face-focused approach to studying emotion perception relies on face stimuli that are not only *posed* but also faces that are unmoving or *static*. In these stimuli, facial muscle movements are frozen in time with no temporal dynamics. The static stimulus is often the "apex" of the supposed expression—the most intense and caricatured instance of facial actions. Thus, all "sad" faces are pouting; all "angry" faces are frowning; all "happy" faces are smiling, and so on. When combined with other method choices (e.g., forced choice among a small set of words, discussed in the next subsection), perceivers are able to see the intended emotion with high accuracy (between 60% and 80%; Keltner et al., 2003, p. 415), and many scientists have interpreted these findings as evidence that information in the face is sufficient for emotion perception (e.g., Matsumoto et al., 2008). But it is important to ask whether the high accuracy rates are, in part, a function of using static faces. Like posed material, static faces might create statistical regularities that do not normally exist in the facial actions that are produced in the real world. Dynamic facial actions contain facial movements that have their own psychological meaning. Furthermore, a static display extends the length of an expression's "apex" beyond its typical duration in dynamic face, although exposure durations that are meant to mimic brief facial muscle movements (called "micro expressions"; Ekman & Friesen, 1969) may not do so.

Unfortunately, it is difficult to assess the consequences of presenting static compared to dynamic facial actions because there are few studies that directly compare the two within the same experiment. One study, although limited in its methods, is suggestive. Perceptions of spontaneous smiles were compared based on whether the smiles were dynamic or static. Perceivers had higher accuracy for perceiving happiness in static smiles than dynamic smiles (Miles & Johnston, 2007). In contrast, when using artificially constructed (posed) faces, perceivers are more accurate in judging the emotions conveyed by dynamic facial actions than those depicted in static faces. This dynamic advantage holds true for judgments based on video footage of posed facial muscle movements (Ambadar, Schooler, & Cohn, 2005; Cunningham & Wallraven, 2009, Study

(p. 548) 1), for synthetically created faces (Wehrle, Kaiser, Schmidt, & Scherer, 2000), and even for point light displays of motion created by facial muscle movements (Bassili, 1979). Developmental data, on the other hand, do not converge with these findings. Specifically, in preschoolers (3–5 years of age) there is no documented advantage for the perception of emotion from dynamic versus static expressions (Nelson & Russell, 2011), suggesting that use of dynamic cues may require learning that occurs over the lifespan.

In any case, the temporal dynamics of facial actions carry important information. When the speed of onset is manipulated either by changing the number of frames in a dynamic display (Kamachi et al., 2001) or the speed at which the individual frames are presented (Sato & Yoshikawa, 2004), some emotions are more easily perceived with slower onsets (e.g., sadness), whereas some (e.g., surprise) are more readily perceived with faster onsets. Importantly, this does not appear to be due to the duration of the "apex" (null findings for manipulating duration of static displays; Kamachi et al., 2001), but rather the dynamics of how the facial actions onset.

Emotion Words

Most experiments using a face-focused approach to emotion perception ask participants to match face stimuli to emotion words that are included as part of the experimental protocol. These words provide an important but hidden source of context that shapes emotion perception and increases accuracy (Barrett, Lindquist, &Gendron, 2007). A number of studies, dating back to the early years of psychology, provide evidence for the important influence of words in creating the high accuracy rates we are used to seeing in studies of emotion perception. Perceivers asked to judge emotion, but not provided with a list of emotion terms, had very low agreement on the meaning of a set of facial actions (Kanner, 1931). Providing perceivers with emotion words (vs. asking perceivers to free label) increases accuracy anywhere from 16% (Kline & Johannsen, 1935) to 26% (Izard, 1971), on average. Related, providing any label, even if it is not the correct one, can produce a false consenus in emotion perception. For example, participants presented with caricatured illustrations of emotional faces accompanied by incongruent labels tended to accept the labels as descriptors of the face more often if they previously had been unable to identify the emotion depicted on the face (Langfield, 1918a). More recent studies confirm this finding (e.g., Russell, 1993; Widen, Christy, Hewett, & Russell, 2010; Widen & Russell, 2008). Similarly, when participants were presented with a list of choices that contained a number of foils, they had generally low accuracy (Buzby, 1924). One interpretation is that even posed, static, highly caricatured portrayals of emotion are somewhat ambiguous as to their psychological meaning, and emotion words can narrow the range of responses. Thus, any time a study reports high accuracy rates for emotion perception (in any cue), it is important to consider whether the experiment explicitly included emotion words that could influence perceivers' performance (cf. Russell, 1994).

A number of experiments have now demonstrated language effects in emotion perception when words are not directly introduced as choices in the experimental paradigm. Emotion words produce biases in perceptual memory for a face, such that memory is shifted toward words that were presented at encoding (Halberstadt & Niedenthal, 2001). Furthermore, a completely false perceptual memory (i.e., remembering a smile) can be created based on a context that primes a specific semantic category (e.g., wining a sporting event) (Fernández-Dols, Carrera, Barchard, & Gacitua, 2008). Words also support categorical perception of facial expressions (Fugate, Gouzoules, & Barrett, 2010). Perceivers learned chimpanzee expressions (e.g., a *hoot*) either with an arbitrary label or without. Only those perceivers who learned the expressions with labels showed the hallmark of categorical perception—an advantage at discriminating morphs that crossed the categorical boundary between two expressions.

Emotion perception can be impaired by reducing the accessibility of emotion words, even when such words are not necessary to perform the experimental task. When emotion word meaning is made less accessible by semantic satiation[6] (for a review, see Black, 2003), accuracy on a perceptual matching task drops to just above chance levels (even though emotion words are not necessary to say whether two faces match in their emotional content; Lindquist, Barrett, Bliss-Moreau, & Russell, 2006). Furthermore, when participants are placed under verbal load categorical perception for posed, caricatured faces is wiped out (such that perceptual advantages for distinguishing between stimuli from two different emotion categories is no longer observed) (Roberson, Damjanovic, & Pilling, 2007). Given these data, it is difficult to conclude that the structural **(p. 549)** features of expressions drive categorical perception all by themselves.

Words also provide an advantage to young children's emotion perception. Specifically, young children are more accurate at matching emotional faces in a sorting task when the box they are sorting into is marked by a word, compared to when it is marked with a perceptually similar face (Russell & Widen, 2002).[7] Furthermore, emotion perception accuracy increases in parallel with children's vocabulary for emotion words (for a review of this work, see Widen & Russell, 2008). For example, in Widen and Russell's work, children acquire the term "disgust" relatively late, at a mean age of 56 months (4.6 years) and only around this time do children distinguish between high arousal fear and disgust portrayals.

Finally, the neural representation of an emotional face is also shaped by emotion words. Providing perceivers with emotion words significantly reduced amygdala response to posed faces depicting emotion (Lieberman et al., 2007). This result is likely due to the reduced uncertainty produced by helping to resolve competing “perceptual hypotheses” that arose from a structural analysis of the face alone. Furthermore, when perceivers judged a structurally neutral face as emotional, this engaged a network of regions (e.g., right superior temporal sulcus, bilateral orbitofrontal cortex, right anterior insula) (Thieschler & Pessoa, 2007) that are typically thought of as the distributed network for emotional face perception (Haxby, Hoffman, & Gobbini, 2000). In addition, evidence from a neural adaptation paradigm suggests that the representation of emotional faces, within this same neural network, is driven by perceiver conceptualization (i.e., judgments of the emotion category) rather than by structural features of the face alone (Fox, Moon, Iaria, & Barton, 2009). Even when repeated stimuli are changed so drastically that they are “perceptually” drawn from a different category, and theoretically should release the brain from adaptation (i.e., neural responses should go back up because the perceptual aspects of the stimuli have changed), they fail to do so when perceivers judge that the emotion category has not changed. Plainly, the neural representation of an emotional face involves conceptual processing and is not determined by the stimulus features of a face alone. The role of language in emotion perception is also evident in a meta-analysis comparing brain activity during the perception and experience of emotion; the analysis consistently showed activation in language-related regions, including inferior frontal gyrus (IFG), extending from the pars opercularis (Broca’s area, BA 44) through pars triangularis (BA 45) and pars orbitalis on the inferior frontal convexity (BA 47/12 l) (Wager et al., 2008).

Taken together, these studies indicate that emotion words (regardless of whether they are offered) constrain how people understand the psychological meaning of a face, even if that face is posing an intense, stereotyped set of muscle actions. Words provide a context that contributes to emotion perception and increases accuracy. In some ways, this is unsurprising, given how powerful words are in the economy of the mind (e.g., Mani & Plunkett, 2010).

Repeated Measures

A final form of context that is embedded in nearly all investigations of emotion perception is the use of a small set of faces presented repeatedly to the perceiver. This repetition allows (and perhaps encourages) perceivers to form ad hoc perceptual categories by extracting statistical regularities from these posed faces (e.g., all angry faces are scowling, all sad faces are pouting, all happy faces are smiling, and so on).[8] Indeed, attaching a label to an emotional face in an explicit emotion perception task may help overcome perceptual variation and support category formation as is seen for other types of stimuli (see Lupyan, Rakison, & McClelland, 2007). A careful look suggests that repeating faces over and over creates a strong form of experiment-based context in the face-focused approach to understanding emotion perception. For example, research investigating the impact of training on emotion perception indicates that participants demonstrate substantial accuracy increases (Guilford, 1929). These training effects are greater for more unfamiliar stimuli, such as faces portraying emotion posed by someone from another cultural group (Elfenbein, 2006).

Conclusions

To understand how humans perceive emotion, we must focus our research efforts on more than just the face. People rarely pose their faces into predetermined configurations when in an emotional state, and even when they do, facial actions often are moving targets, embedded in other facial actions, as well as the body movements, smells, and vocalizations that occur during conversation and other cognitively taxing events. In addition, other factors appear crucial to perceivers' emotion perception, including knowledge of the situation and their own internal (p. 550) state. And in the context of laboratory experiments, it is clear that scientists do many things that serve to contextualize emotion perception, often in ways that are unlike what occurs in everyday life.

Nevertheless, it is reasonable to ask what the face alone can tell us about a person's emotional state. Unfortunately, the published literature does not really answer this question because the experiments themselves usually contain hidden forms of context that contribute to emotion perception accuracy. The handful of studies that have attempted to strip away experimental forms of context from the face, with more or less success, almost always show notable decreases in accuracy. Most of these experiments remove only one form of experimental context, leaving the others intact. It is important to remember that every experiment involves some context, even if it is unintended by the experimenter.

More broadly, the context in which emotion perception unfolds might help explain how perceivers can routinely, and with little effort, perceive when another person is angry or afraid, despite the fact that the objective measures of the face (e.g., electromyographic measurements) and voice (e.g., acoustical measures) fail to reveal diagnostic patterns for each emotion (Barrett, 2006a). Barrett (2006b) has termed this the "Emotion Paradox": Instrument-based measures of the face do not reveal muscle movements that distinguish discrete emotions (Cacioppo et al., 2000; Mauss & Rpbinson, 2009), yet perceivers can readily look at someone's face and judge how that person is feeling. One hypothesis to solve the emotion paradox is that perceivers initially extract affective information from a face (whether to approach or avoid it, for example) and the context activates more nuanced conceptual knowledge that allows for the construction of discrete emotion percept of anger, sadness, or fear (for a similar view, see Roberson, Damjanovic, & Kikutani, 2010). The various forms of context reviewed in this chapter might help to shape broadly “affective” actions into discrete emotional percepts. Consistent with this hypothesis, perceivers routinely encode and remember the context better when they are asked to judge the emotion in a face than to judge whether to approach or avoid it (Barrett & Kensinger, 2010). Furthermore, the more readily a situation points to a single emotion category, the stronger its impact on subsequent emotion perception from the face (Fernández-Dols et al., 1991). As such, it might be that the forms of “context” reviewed here are vital to emotion perception as a highly constructive process.

Whatever the mechanisms by which context shapes emotion perception, the findings reviewed here should prompt us to reconsider long-held assumptions about emotion perception. They also suggest that we should question the experimental paradigms that dominate research based on these long-held assumptions. The field of emotion perception seems firmly rooted in the idea that a static, posed face is a useful cue for us to model the perception of discrete emotional states such as anger and sadness. The present review, in contrast, suggests that the face may not be “figure” and the context merely “ground.” After all, the epistemic goal in emotion perception in everyday life is not to determine what a *face* is displaying. The goal, instead, is to determine what the person is experiencing, based on whatever is most information relevant at the time. Thus, the processing of “context” is not a secondary consideration, but instead is routine when the goal is to understand the emotion that another person is experiencing (Barrett & Kensinger, 2010).

As perceivers, we are drawn to faces. Our attention rests on them. It is therefore no accident that scientists assume that faces must be the key source of information in emotion perception. To be sure, faces convey important psychological information, but they very likely do not provide sufficient information to a person’s emotional state (especially if the person himself or herself is using the context to construct that state; Barrett, 2006a, 2009). Future research that addresses emotion perception as a contextualized phenomenon will help build our understanding of how people see emotions in other people, and how they use those perceptions to get along and get ahead in the world.

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Notes:

(1.) The use of the forced-choice method has recently been extended to studies testing the sufficiency of nonverbal emotional vocalizations as cues to discrete emotion (Sauter, Eisner, Ekman, & Scott, 2009; Simon-Thomas et al., 2009) and has been used in studies examining whether posture/bodily movements convey discrete emotion to perceivers (e.g., Coulson, 2004; De Silva & Bianchi-Berthouze, 2004; Ekman, 1965; Ekman & Friesen, 1967; Pitterman & Nowicki, 2004; Schouwstra & Hoogstraten, 1995).

(2.) “Affect” versus “emotion” perception must be distinguished. This distinction rests on the judgment that perceivers are asked to make. When a perceiver is asked to judge the discrete emotion content of a face, for example, “Is this face angry?” the task is typically assumed to be an emotion perception. If, however, the perceiver is asked to make a judgment about how intense, positive/negative, aroused/unaroused a target person is, or whether to approach/avoid that target person, the task is categorized as affect perception. Nonetheless, it is often the case that effects are interpreted as emotion perception when they might, in fact, be affect perception. For example, presenting a facial depiction of “anger” within a “happy” context is incongruent both in terms of discrete emotion categories and also in terms of valence. Likewise, facilitation due to pairing a a scowling face with an anger-inducing situational description might be due merely to the affective value of the context instead of the match on discrete emotion category (if the effect is defined by comparing perception of the face in the absence of context or in a neutral context). Similarly, studies that compare the perception of started “fear” faces to neutral faces, or “happy” faces to “sad” faces, might be studies of affect (valence) perception rather than studies of emotion perception per se. A similar point can be made for comparisons of “fear” faces to “sad” faces because they differ in affective arousal.

(3.) There are additional data to suggest that context effects extend in the other direction: Facial behaviors serve as a context to emotion perception based on vocal cues (e.g., de Gelder, Böcker, Tuomainen, Hensen, & Vroomen, 1999; de Gelder, Pourtois, & Weiskrantz, 2002; de Gelder & Vroomen, 2000; Pourtois, de Gelder, Vroomen, Rossion, & Crommelinck, 2000; Pourtois, Debatisse, Despland, & de Gelder, 2002; Vroomen, Driver, & de Gelder, 2001). Furthermore, the influence of facial behaviors on the perception of emotion in the voice is maintained under a dual task, suggesting this effect is not dependent on attentional resources (Vroomen et al., 2001).

(4.) There are some data to suggest that these two sources of information can be integrated even earlier. When facial behaviors serve as a context for vocal cues, integration appears to occur very rapidly. For example, a mismatch negativity at 178 ms was detected for prosody following an incongruent face portraying emotion (de Gelder et al., 1999). When facial and vocal stimuli were presented simultaneously and were congruent, an enhancement of the N1 was demonstrated at 110 ms after onset (Pourtois et al., 2000). One possibility is that the time course of integration depends on which cue, face or voice, is the “object” of perception.

(5.) Interestingly, the Nakamura et al. (1990) paper is typically cited as some of the best evidence that the face is a stronger cue to emotion than is the situational context because the researchers matched each in its source clarity (i.e., the extent to which perceivers thought the cue was associated with a single emotion). Yet this research strikingly only looked at contexts and situations that differed in valence (e.g., a "pleasant" face paired with an "unpleasant" slide) so that a much more limited interpretation is warranted: situations fail to override facial information that differs in valence (although other work shows that bodies with props can over-ride valence; Aviezer et al., 2008, Study 2).

(6.) In semantic satiation, on a given trial, participants repeat a word 30 times (as compared to the typical control condition where they repeat the word three times). The massive repetition of the word produces a temporary functional equivalent of semantic dementia (characterized by impairments in the semantic representation of words).

(7.) Recent data suggest that the face can still be a relatively effective cue to a discrete emotion label. When young children (ages 2–4, a younger sample than the 2002 sample demonstrating the label superiority effect) are asked to generate a label in response to a face or a description of a cause or consequence for emotion, for some categories, faces were a better cue to the emotion label (Widen & Russell, 2010). These data suggest that facial actions may be one of the first types of content that "populate" emotion categories, perhaps given their relatively concrete nature.

(8.) In real life, it is unclear whether people routinely scowl when they are angry, or pout when they are sad, and so it is unclear whether emotion categories are, in fact, perceptual categories (cf. Barrett, 2006a; see also Mauss & Robinson, 2009).

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