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Inherently Ambiguous

An Argument for Contextualized Emotion Perception

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Perhaps the most central distinction in emotion experience is that between positive and negative valence (Bradley & Lang, 1994; Mehrabian & Russell, 1974; Osgood, 1952). We approach ice cream stands and avoid dirty toilets, savor kisses from a loved one and suffer in agony when stubbing our toe. Knowing good from bad involves distinct brain networks (Barrett & Bliss-Moreau, 2009) and is automatic (Chen & Bargh, 1999; Fazio, Sanbonmatsu, Powell, & Kardes, 1986). Adults universally refer to valence as a central aspect of their affective experience (Barrett, 2006b), and newborns show clear behavioral preferences for positive versus negative tasting stimuli (Steiner, 1979). In short, in the world of emotional experience, the difference between positive and negative seems to be fundamental, robust, and omnipresent, the cornerstone of affective life.

As most psychological models posit that facial expressions faithfully convey affective states, telling apart positive from negative emotions in others should be a fairly easy task. In fact, it seems undeniable that we constantly read out affective states from faces—from the scowls of a grouchy boss to the wide smiles of children receiving their Christmas gifts. All we seemingly need to do is look at their facial expressions and presto! Their true emotions are revealed.

It is against this strongly ingrained and intuitive experience that we contest in this chapter (see also, Hassin, Aviezer, & Bentin, 2013). Although many

people believe that facial expressions are highly informative and reliable sources of affective information, we argue that, in fact, facial expressions are often quite baffling. Indeed, the phenomenological experience of reading emotions and affective states from faces is often but a compelling illusion. As we will argue, it is often the contextual information, not the face itself, which is critical for recognizing emotion. Ironically, though, the role of context in emotion perception is often underappreciated or even unnoticed.

VALENCE AMBIGUITY IN REAL-LIFE INTENSE FACIAL EXPRESSIONS

Jack loses his life savings in a stock market crash while Jill wins the national lottery. Imagine we were there, taking their photograph at the moment they heard the life-changing news. Taking a close look at their pictures, leading psychological models (as well as common intuition) would predict very distinct facial expressions of agony and ecstasy, respectively.

According to *basic* emotion models, positive (e.g., happiness) and negative (e.g., fear) emotions arise from distinct affect programs, each equipped with dedicated hardwired neurological systems and distinct universally recognized facial movements (Ekman, 1993; Ekman & Cordaro, 2011; Tracy & Matsumoto, 2008). According to this line of thought, positive and negative emotions are expressed with very different facial muscular activity (i.e., different Action Units of facial muscles) and thus rarely confused.

According to *dimensional* emotion models, there is no need to postulate discrete affect programs for separate emotions. Rather, this view holds that a small number of bipolar dimensions serve as the basic buildings blocks of affective experience and affect recognition (Fontaine, Scherer, Roesch, & Ellsworth, 2007; Russell, 1980). Specifically, the dimension of valence, ranging from pleasant to unpleasant, is crucial in defining emotional experience and expression. According to dimensional theorists, positive and negative affective states are located on opposite sites in affective space and consequently they are conveyed in a highly distinct manner (Carroll & Russell, 1996; Russell, 1997; Russell & Bullock, 1985). In fact, valence has been considered to be part of the "normative preeminence" of the face which is read out rapidly, effortlessly, and universally (Carroll & Russell, 1996).

Furthermore, both basic and dimensional models agree that positive and negative expressions should grow more distinct and recognizable as they become more intense. For example, basic emotion models predict that intense emotions activate maximally distinct facial muscles which increase discrimination (Calder et al., 2000; Hess, Blairy, & Kleck, 1997; Tracy, 2014). Similarly, dimensional emotion models predict that intense emotions are located on

more extreme and distant positions on the pleasure-displeasure axis, and thus their positivity or negativity should be easier to decipher (Carroll & Russell, 1996; Russell, 1997).

Notwithstanding these predictions, the models just described have mostly been based on research with lab-created stimuli. In an attempt to move beyond the popular but artificial sets of posed facial expressions (e.g., Ekman & Friesen, 1976; Matsumoto & Ekman, 1988), recent work has examined real-life affective displays of tennis players during professional matches (Aviezer, Trope, & Todorov, 2012a). In that study, Aviezer et al. (2012a) presented different groups of participants with images of tennis players winning or losing a critical point in a tennis match. Critically, the images were presented in one of three formats: face alone (with no body), body alone (with no face), or face with body (the original image). Participants were requested to rate the valence of the image on a scale ranging from very negative to very positive with a neutral midpoint. This type of judgment should be easy and straightforward according to both basic (Ekman, 1993) and dimensional (Russell, 1997) models of emotion.

Not surprisingly, participants successfully differentiated the valence of the winners and losers when they rated the full image with the face and body. However, a striking difference was revealed when comparing the ratings of the face versus the body (see Fig. 18.1a-b). Faceless bodies were almost as informative as the full pictures, with participants easily differentiating the valence of winners from losers. In contrast, when rating the face alone, participants utterly failed in differentiating the winners from losers. Specifically, the decontextualized faces resulted in similarly negative ratings irrespective of the actual situational valence of the faces (see Fig. 18.1c).

These findings are surprising because they clearly illustrate that intense facial expressions are actually uninformative to viewers when rating valence. Differentiating positive from negative valence is perhaps the most basic and simple task in emotion perception (also known as "mapping"; Aviezer, Hassin, Bentin, & Trope, 2008), yet viewers simply cannot do it based on the face alone. These results also pose a puzzle: If intense faces are so poorly recognized in isolation, why aren't viewers aware of this when they encounter such faces in real life?

We propose that objectively nondiagnostic facial expressions appear to viewers as informative due to a contextual illusion. For example, in the aforementioned tennis study, when participants rated the valence of faces together with bodies, roughly half of them reported that they based their judgment on specific idiosyncratic facial movements while giving little credit to the body. As the isolated faces were in fact not diagnostic—our previous experiments with faces in isolation show that people cannot identify the valence they express—this phenomenological report qualifies as illusory in nature.

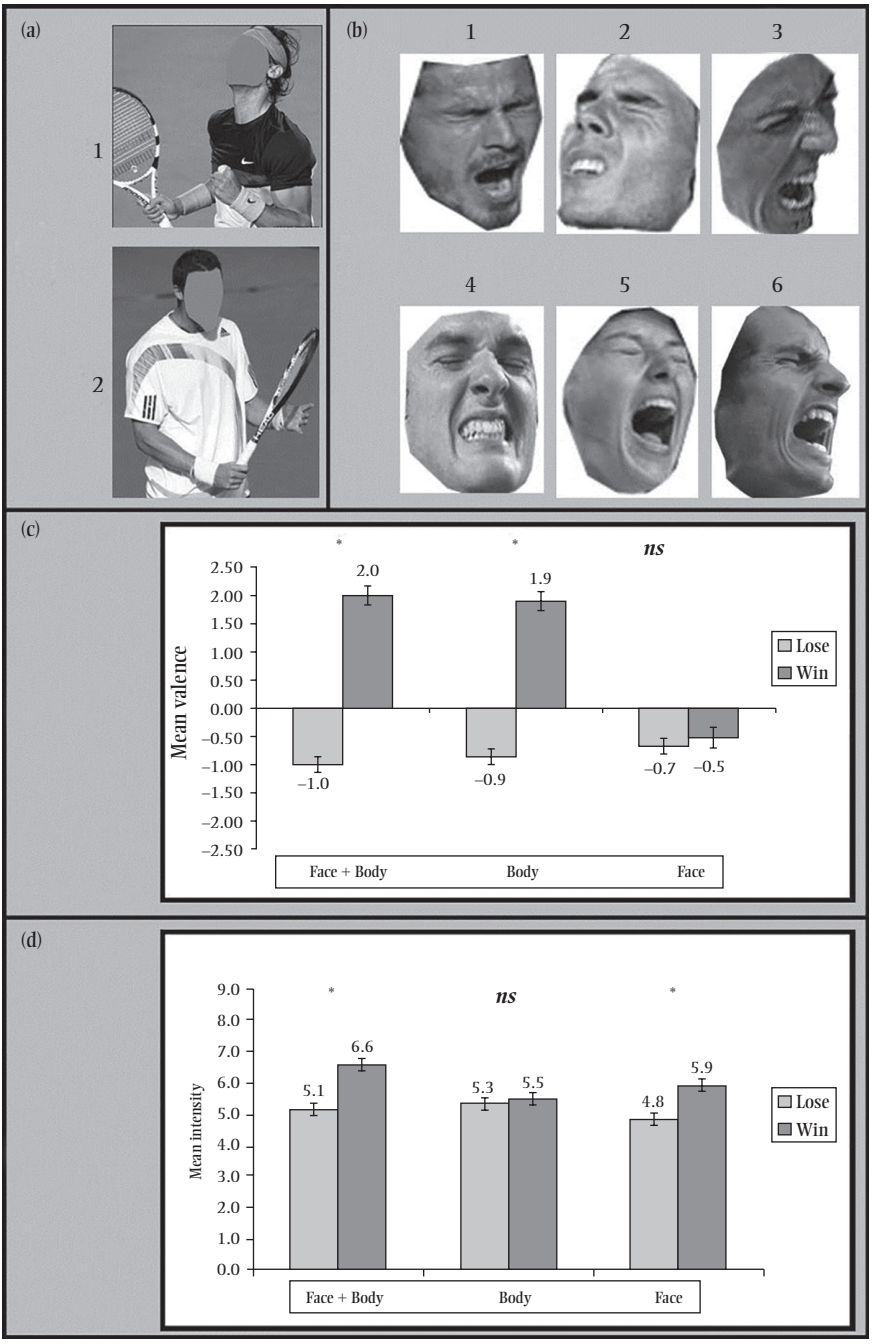

Figure 18.1 (*A*) Examples of reactions to (1) winning and (2) losing a point. (*B*) Examples of isolated faces (1, 4, 6 = losing point; 2, 3, 5 = winning point). (*C*) Mean valence ratings for face + body, body, and face. Results are converted from the original scale which ranged from 1 (most negative) to 9 (most positive), with 5 serving as a neutral midpoint. (*D*) Mean intensity ratings for face + body, body, and face. (Adapted with permission from Aviezer et al., 2012)

We hypothesized that the illusion arose because the valence from the body was accurately registered and then read into the highly intense faces, tainting their perceived valence. This was further demonstrated by seamlessly crossing the faces and bodies of winners and losers using Photoshop and asking participants to rate the facial valence (Fig. 18.2a). As predicted, the valence

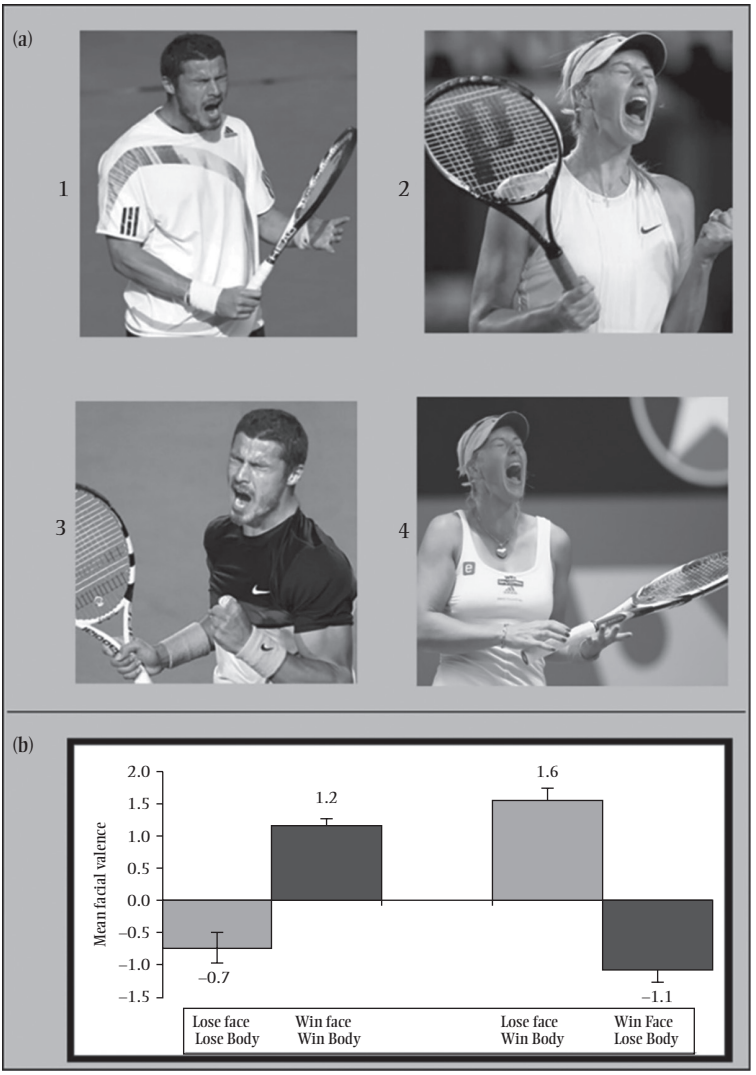

Figure 18.2 (*A*) Examples of original images of players (1) losing or (2) winning a point. The same faces combined with incongruent-valence bodies such as (3) a losing face on a winning body and (4) a winning face on a losing body. (*B*) Mean valence ratings of the facial expressions. (Adapted with permission from Aviezer et al., 2012)

of the contextual body had a strong influence such that identical faces were rated as conveying opposite valence as a function of their accompanying bodies (Fig. 18.2b; Aviezer et al., 2012a).

Importantly, these findings are not limited to the domain of victory and defeat in sports events. For example, facial expressions of extreme pain (e.g., nipple piercing) and extreme pleasure (e.g., experiencing an orgasm) are also poorly differentiated. Similarly, expressions of intense joy (e.g., during surprise soldier reunions) are poorly differentiated from expressions of intense anguish and fear (e.g., during funerals or while witnessing terror attacks) (Aviezer et al., 2012a; Wenzler, Levine, Dick, Oertel-Knöchel, & Aviezer, 2016). These examples demonstrate that contrary to common psychological dogma and human intuition, real-life intense facial expressions are highly ambiguous when perceived in isolation. Although viewers may think about and experience them as an informative source for valence, they are actually relying on contextual cues.

AMBIGUITY IN SPONTANEOUS AND INTENSE FACIAL EXPRESSIONS: A SELECTIVE HISTORICAL REVIEW

Our discussion so far focused on recent research covering a special class of face reactions that occur during intense emotional situations. Although the studies we reviewed expose novel findings, a review of the literature reveals an established line of studies showing that real-life intense facial expressions are highly ambiguous.

Consider, for example, the influential (and ethically dubious) work of Landis (1924, 1929), who photographed the facial expressions of participants while putting them through a series of emotionally evocative situations (reacting to surprise firecrackers exploding under their chair, exposure to pornography, being forced to decapitate a rat, to name a few). He then presented the decontextualized face images to a new group of participants and asked them to describe the photographed person's emotion. Landis's conclusions were unequivocal: "it is practically impossible to name accurately the 'emotion' being experienced by a subject when one has only a photograph of the face" (p. 69). In fact, the valence of the emotions assigned to the faces was often in contradiction with the actual valence of the situation.

Sherman (1927) examined the facial reactions of newborn infants undergoing various negative manipulations (e.g., experiencing hunger, being pricked by a needle, being dropped, etc.) and demonstrated that viewers greatly disagreed on the classification of the isolated faces. Furthermore, when facial reactions were contextualized by matching and mismatching them with the

eliciting situations, participants relied on the situations, but not on the faces, when judging the emotion of the infants.

More than a decade later, Munn (1940) used a different approach: He presented participants with candid pictures of intense emotional situations from magazines such as *Life*. In one condition the faces were presented in isolation (e.g., a fearful face), and in another they were embedded in a full visual scene (e.g., a fearful face displayed by a woman fleeing an attacker). His results, too, indicated significant influence of context on emotion perception, suggesting much ambiguity in the facial signal.

These and other studies were integrated in two highly influential reviews by Bruner and Tagiuri (1954), and Tagiuri (1969), who concluded that "All in all, one wonders about the significance of studies of the recognition of 'facial expressions of emotions', in isolation of context" (1954, p. 638).

Later studies examined intense expressions out of interest in the influence of social audience effects. Taking an ethological approach, Kraut and Johnston (1979) conducted a series of seminal studies comparing the facial reactions of individuals during various positive versus negative events. The most intense of these studies likely involved the reactions of hockey fans to various game events. Although fans were more likely to smile following positive than negative events, this effect was strongly modulated by whether a social interaction was taking place between the fans or not. In fact, social interactivity was a better predictor of smiling than the positivity or negativity of the situation.

One limitation of the hockey study was that the emotion of the fans was not known, but rather inferred from the situation. More recently, this study was replicated with soccer fans who also rated their affective experience while watching important matches (Ruiz-Belda, Fernández-Dols, Carrera, & Barchard, 2003). When situations did not involve direct social interaction between the fans, the correlation between reported emotion and facial behavior was weak. For example, self-reportedly happy fans displayed few smiles as well as facial expressions of surprise, sadness, and fear (Fernandez-Dols & Ruiz-Belda, 1997).

Surprisingly weak links between positive affective states and expressive behavior were also found for Gold medal winners whose smiles strongly depended on social interactions with others (Fernández-Dols & Ruiz-Belda, 1995). In a recent review of spontaneous facial behavior, Fernández-Dols and Crivelli (2013) concluded that the link between emotion and facial expressions is "weak, nonexistent, or unpredicted."

To summarize, a long line of research on intense real-life facial expressions suggests that they are far less informative than one would have thought.

AMBIGUITY IN STEREOTYPICAL BASIC FACIAL EXPRESSIONS

The fact that facial expressions may be highly ambiguous and prone to contextual influences stands in contrast to a long tradition of research stressing their importance as a diagnostic signal (Smith, Cottrell, Gosselin, & Schyns, 2005). Nevertheless, one may argue that perhaps the ambiguity of such facial reactions simply reflects the ambiguity of the affective episodes which are often poorly controlled.

By contrast, emotional expressions during pure prototypical basic emotions (e.g., disgust, fear, sadness, etc.) should be unambiguous and well recognized. While a set of spontaneous basic emotions has yet to be constructed, sets of posed basic facial expressions are available. In such sets, theoretically proposed muscular movements are modeled for each emotion (e.g., Ekman & Friesen, 1976; Langner et al., 2010; Matsumoto & Ekman, 1988; Van Der Schalk, Hawk, Fischer, & Doosje, 2011). The images in these sets are often selected based on their high recognition and classification to a specific emotional category. Thus, such faces would surely demonstrate a high diagnostic value.

We have shown, however, that this is not the case, and that significant ambiguity can be found even in the lab-made basic facial expressions that are carefully selected to convey specific emotions. Although basic facial expressions in standardized research sets are, by definition, well recognized in isolation, they are highly ambiguous in context.

THE BODIES OF FACES

In our own work we examined the effects of bodies and contextual paraphernalia on facial expression perception. We focused on bodies because we had an intuition that faces are usually accompanied by bodies, and that bodies, like faces, are expressive (see also Meeren, van Heijnsbergen, & de Gelder, 2005). We were also encouraged by the fact that face and body processing share many cognitive and brain characteristics (de Gelder, 2006; Peelen & Downing, 2007; Yovel, Pelc, & Lubetzky, 2010) and by the finding that affective face-body Stroop-like interferences occur very early (by 100 ms) during visual processing (Meeren et al., 2005).

We proposed two simple hypotheses. First, based on the arguments briefly presented earlier, we predicted that bodies would serve as powerful contexts. Second, we hypothesized that perceptual similarity—that is, the perceived similarity between facial expressions—is an important determinant of context effects. To take an example, the categorization of a smiling face is unlikely to be strongly affected by a context displaying disgust, because the two facial expressions (happiness, disgust) are very dissimilar. An angry face, however,

is more likely to be affected by disgust context because the facial expressions of anger and disgust are relatively similar (Susskind, Littlewort, Bartlett, Movellan, & Anderson, 2007).

In our first set of studies we seamlessly planted faces that in isolation are consensually categorized as conveying disgust on bodily postures that in isolation are consensually categorized as conveying other emotions (Aviezer, Hassin, Bentin, et al., 2008; Aviezer, Hassin, Ryan, et al., 2008) (see Fig. 18.3). This resulted in a design with four levels of perceptual similarity between the presented face and the body-expected face: low, medium, high, and an identity (disgust face on a disgust body). Participants in all experiments were asked to choose, among six options, which emotion is conveyed by *the face*.

Three experiments documented powerful effects of context on facial expression recognition and showed that the impact of context in the high-similarity condition was robust. For example, the categorization of "disgust facial expressions" as disgust-expressing dropped from 91% in the identity condition to a mere 11% in the high-similarity condition. Similarly, the categorization of "sadness expressions" dropped from 72% in the identity condition to a mere 17% in the high-similarity condition (Aviezer, Hassin, Bentin, et al., 2008; Aviezer, Hassin, Ryan, et al., 2008). Supporting our second hypothesis, these

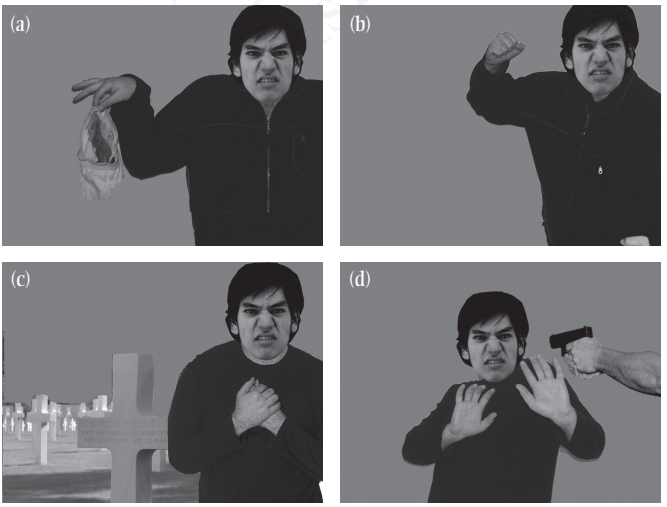

Figure 18.3 Stereotypical facial expression of disgust in context. (*A*) Disgust face on disgusted body (identity condition); (*B*) disgust face on angry body (high similarity condition); (*C*) disgust face on sad body (medium similarity condition); (*D*) disgust face on fear body (low similarity condition). (The facial expression in the figure has been adapted from Van Der Schalk et al., 2011)

experiments revealed that the magnitude of contextual influence was strongly correlated with the degree of perceptual similarity: The more similar the facial expressions, the stronger the influence of context. We refer to this finding as the *confusability effect*.

The categorization data do not tell us much about the underlying process: Does context affect late and relatively controlled stages of processing (e.g., the judgment) or relatively early and automatic ones? Support for the latter view emerged from an eye-tracking experiment, which demonstrated that initial fixations in the face space are systematically affected by the context (Aviezer, Hassin, Ryan, et al., 2008). Specifically, context shifts the scanning pattern of emotional expressions in context-congruent ways. To further examine this issue, we conducted a series of experiments in which we examined three markers of automaticity: intentionality, stoppability, and effortlessness (Bargh, 1994). In one of these experiments participants viewed the stimuli described earlier and were instructed in various ways, and motivated by means of a monetary prize, to avoid using the bodies. Neither motivation nor instructions made a difference. The results of another experiment showed that the effects of bodily context do not diminish under cognitive load (Aviezer, Bentin, Dudarev, & Hassin, 2011).

Additional research supports the notion that the face and body are perceived as an integrated, gestalt-like unit. One line of experiments used a face-body variant of the composite face effect, a measure of holistic processing (Aviezer, Trope, & Todorov, 2012b). Participants judged facial expressions combined with emotionally congruent or incongruent bodies which have been shown to influence the recognition of emotion from the face. Critically, the faces were either aligned with the body in a natural position or slightly misaligned in a manner that breaks the ecological person form. As predicted, spatially breaking the person form reduced the facilitating influence of congruent body context as well as the impeding influence of incongruent body context on the recognition of emotion from the face. Interestingly, such composite face-body effects emerge early and can be observed in 6- to 8-year-old participants (Mondloch, 2012), but not in 4-year-olds (Mondloch, Horner, & Mian, 2013). Taken together, the results suggest that faces and bodies are strongly and automatically integrated early on, a phenomenon that helps explain how the recognition of basic facial expressions can be influenced, at times dramatically so, by incongruent body context.

FACES IN NONBODY CONTEXT

Although the influence of the body on the face may be compelling, one may argue that the strength of the effects results from the body being a special

class of contextual information. After all, the body and face are both parts of the same individual. In such cases the context includes "within sender features" (Wieser & Brosch, 2012), and therefore its impact may be strengthened. However, contextual effects on prototypical facial expressions are not limited to body context. As next briefly reviewed, a large corpus of data suggests that also context that is external to the expresser has a robust influence on the recognition of basic facial expressions (for a more comprehensive review, see Wieser & Brosch, 2012).

Using an emotional visual context paradigm, participants were required to categorize facial expressions presented against backgrounds of natural scenes such as a garbage dump versus a field of flowers (Righart & de Gelder, 2008). The results showed a significant effect of context on facial expression perception. In a related set of experiments, Masuda et al. (2008) examined how the categorization of a target's facial expression is affected by the presence of surrounding individuals' faces. Participants viewed a cartoon image of a central figure displaying, for example, an angry face, while in the background a group of other individuals displayed happiness. The results indicated that Japanese were influenced by the surrounding context, whereas Westerners were not, thereby demonstrating two types of context effects: visual and cultural.

Additional work demonstrating the influence of social context on emotion perception can be seen in the work of Mumenthaler and Sander (2012). These authors showed how the functional relation between emotions serves as context influencing emotion perception. For example, the recognition of prototypical fear in a target is strongly facilitated when a contextual angry face is gazing at a fearful individual—presumably because the perceiver infers that the fearful response results from angry expression. Strikingly, this integration of social information occurs automatically, even when the contextual face appears below the threshold of conscious perception (Mumenthaler & Sander, 2015).

Barrett (2006a) proposed the *conceptual act model* in which facial muscles convey basic affective information (e.g., approach vs. avoid; positive vs. negative), and more specific emotions are inferred using accessible conceptual context (i.e., words). In one set of studies the role of accessibility was examined using a semantic satiation procedure. The results showed that participants' performance depended on conceptual satiation (Barrett, Lindquist, & Gendron, 2007; Lindquist, Barrett, Bliss-Moreau, & Russell, 2006). The importance of conceptual knowledge on emotion perception can also be seen in earlier work showing that short emotional vignettes strongly alter the recognition of emotion from basic facial expressions (Carroll & Russell, 1996).

FACIAL EXPRESSIONS REVISITED

In this chapter we challenged the modal views of emotion perception (see Hassin, Aviezer, & Bentin, 2013). We presented evidence from multiple projects in multiple labs, across dozens of years, which clearly shows that contexts in general—and bodily contexts more specifically—play a crucial role in face-based expression perception. In fact, what seems to us to be face-based expression perception is often just an illusion: We gather the information from other sources, but we misattribute it to the face.

Although, as the modal views suggest, some faces are unequivocal signals of emotion even in isolation, many others are either ambiguous, in that they strongly express more than one emotion, or rather vague, weakly expressing various emotions (Trope, 1986). In both types of faces, contexts automatically and generally without awareness imbue the face with emotional meaning. The basic expressions view does not easily allow for the documented effects (note that some of these findings were obtained using faces that were pretested using the toolbox of the basic expressions view). The dimensional views are more flexible in nature, but the findings reported here do not easily sit with them either.

The field's view of the importance of context has waxed and waned in the history of emotion perception, and we hope that what we see in recent years, and review here and elsewhere, is the beginning of a new and serious swing of the pendulum.

Although one conclusion to be drawn from this chapter is that emotion perception is contextual in nature, as we have done herein, we think that an even more extreme conclusion might be warranted. In fact, it is us scientists who devise experiments in which "context" and "text" are so clearly defined and easy to separate. Based on the data and arguments we developed earlier, we believe that emotion perception is a quintessential example of a set of processes in which this separation might be artificial and may hamper scientific progress. At least in the case of bodies and faces—two social stimuli that usually go places together, and if they don't, then one is in serious trouble—it seems that the whole is different from its constituents in important and meaningful ways.

Although parsimony favors simpler theories, we think that the data gathered so far are enough to seriously challenge the modal views and push us toward new theories (for an early attempt, see Aviezer et al., 2008). Developing these new theories will not only allow us to better account for existing data, it will also allow us to refrain from paying the price of sticking with the modal view. Consider, for example, the wide-scale attempts to link specific emotions to well-defined brain structures. In recent decades we experienced a few "highs" during which it seemed that research successfully identified brain regions that specialize in basic emotions (Adolphs, 2002; Adolphs et al., 2005; Phillips et al., 1998; Sprengelmeyer et al., 1996, 1997). Yet it seems fair to say that the

news about (some of) these identifications was premature, and that currently the picture seems more complex than it had appeared (Barrett, 2006a; Johnson et al., 2007; Lindquist, Wager, Kober, Bliss-Moreau, & Barrett, 2012; Pessoa & Adolphs, 2010; Touroutoglou, Lindquist, Dickerson, & Barrett, 2015). Given the centrality of this endeavor to social and affective neurosciences, and given the time and resources devoted to it, this state of affairs might be informative. It may suggest, for example, that our current techniques of probing the brain are not sufficiently developed, or that we use the wrong level of analyses. More relevant to our discussion, however, these difficulties may partly stem from assuming the basic expressions view, which leads us to look for brain areas (or neural patterns) specialized in the perception of basic facial expressions. But if the task of categorizing faces is not as simple as is suggested by this view, then performing it may require more complex processes, and maybe even (explicit) strategies. Hence, facial expression recognition may rely on more general mechanisms of inference and categorization, and prediction making, thereby rendering the difficulties in locating brain areas devoted to the processing of "basic expressions" less surprising (Barrett et al., 2007; Lindquist & Gendron, 2013).

CONCLUSIONS

Facial expressions of emotions are inherently ambiguous, so much so that many contexts easily shift how they seem to us. So although it seems to us that in "real life" we see *faces* as angry, fearful, and so on—it is often not the faces that we see, it is face-context combinations. We think that the right thing to do is to stop using terms such as "disgusted face" or "fearful face." These faces are disgusted or fearful in very specific contexts, most of which are unnatural and unlikely to capture many of the essences of emotion perception. The expression "disgusted face," for example, should be taken as a shorthand for *a face that, in isolation, and when one uses one of the frequently used categorization methods, is likely to be categorized as disgusted*. Alas, we are too old to be really hopeful. People, present company included, are unlikely to stop using these terms. They are way too natural for us, at this point in history and culture. But we should try. The reviewed evidence provides a strong incentive to expand the cognitive, social, and neuroscientific inquiry of the nature of emotion perception.

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