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BRIEF REPORT

Putting "Context" in Context: The Effects of Body Posture and Emotion Scene on Adult Categorizations of Disgust Facial Expressions

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Affective face perception is influenced by nonfacial contextual elements. However, investigations often conflate body posture and emotion scene, making it unclear whether posture or the combination of posture and scene produces perception-altering effects. This study examined adults' categorizations of disgust facial expressions superimposed onto isolated emotion postures or postures embedded in emotion scenes. Results indicated that emotional postures exerted a significant contextual effect on adults' emotion categorizations of disgust faces. Of note, postures in emotion scenes exerted a stronger contextual effect than isolated postures for sadness and fear contexts. These findings suggest that contextual elements exert varying degrees of influence on emotion perception and produce combinatorial effects.

Keywords: context, emotion perception, emotion, facial expression recognition

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Recent research suggests that nonfacial cues, including body posture (e.g., Meeren, van Heijnsbergen, & de Gelder, 2005) and emotional scene (e.g., Righart & de Gelder, 2006, 2008), are rapidly integrated and produce influential effects on face perception (Wieser & Brosch, 2012; see Kret, Roelofs, Stekelenburg, & de Gelder, 2013). Such studies have challenged the long-held notion that affective facial perception is invariant to external (i.e., nonfacial) influences (e.g., Aviezer et al., 2008; Barrett, Mesquita, & Gendron, 2011). However, this research has suffered from an overly broad operationalization of "context," using the term to "denote any cue that is external to the face" (Hassin, Aviezer, & Bentin, 2013, p. 61). The present investigation examined the contextual effects of body posture and body posture within a scene on adults' emotional categorizations of disgust facial expressions.

One explanation of how nonfacial cues influence perception of facial affect is the notion of emotion seeds (see Aviezer et al., 2008; see also Fugate, 2013; Lindquist & Gendron, 2013). This theory posits that facial expressions are more likely to be miscategorized when accompanied by contextual cues corresponding to perceptually similar facial expressions. Such miscategorization has been referred to as the confusability effect (Hassin et al., 2013). For example, a disgust facial expression in an angry context is more likely to be categorized as anger than disgust because of the high physical similarity between anger and disgust facial expressions (see Susskind, Littlewort, Bartlett, Movellan, & Anderson, 2007). Conversely, a disgust facial expression in a fear context is less likely to be categorized as fear and more likely to be categorized as disgust because of the low perceptual similarity of fear and disgust facial expressions (Aviezer et al., 2008).

However, previous research has been inconsistent in operationalizing "context." For example, the stimuli in the seminal research by Aviezer and colleagues (2008) included four "contexts" comprising two isolated emotion body postures (i.e., anger and fear) and two emotion body postures embedded in emotion scenes (sadness: a sad posture in front of a tombstone; disgust: a pincer posture holding a soiled undergarment). The inclusion of extrapostural elements in some images but not others makes it impossible to determine whether the posture, scene, or their combination accounted for observed confusability effects (see also Aviezer, Bentin, Dudadev, & Hassin, 2011; Aviezer, Hassin, & Bentin, 2012; Aviezer et al., 2009).

This study further examined the confusability effect by comparing the effects of isolated emotion body postures and emotion body postures embedded in emotion scenes on adults' emotion categorizations of disgust facial expressions. A face-scene condition was omitted because the combination appeared unnatural and previous research indicates minimal confusability effects in such conditions (Righart & de Gelder, 2008). Consistent with previous research, we predicted that contextual emotion cues (i.e., posture or posture-scene) would influence participants' categorizations of disgust facial expressions as a function of the emotion expressed by each contextual cue. In addition, we predicted that posture-scene combinations would result in increased miscategorization of disgust faces than posture alone.

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Method

Stimuli

Stimuli components. Emotional elements consisted of facial expressions, emotion postures, and emotion scenes. All stimuli were validated independently to ensure that each component communicated the intended emotion.

Facial expressions. Six images of six actors (three female) from diverse racial backgrounds (two Asian, two Black, two White) conveying the facial expression of disgust were taken from the NimStim set of facial expressions (Tottenham et al., 2009; see Table 1 in the online supplementary materials). Using multiple well-validated facial expressions minimized familiarization effects and allowed us to collapse across actors in the analyses.

Emotion postures. Ten images of two actors (one female) posturally expressing five emotions (disgust, anger, sadness, fear, joy) were selected from a validated set of postural stimuli (Lopez, Reschke, Knothe, & Walle, 2017; see Table 2 in the online supplementary materials). In addition, two neutral postures (one female) were validated using dimensional ratings of valence and arousal (Russell, Weiss, & Mendelsohn, 1989; see Table 3 in the online supplementary materials).

Emotion scenes. Scene images consisted of 18 pictures depicting six emotions (disgust, anger, sadness, fear, joy, neutral) with three exemplars per emotion to minimize familiarization effects (see Table 4 in the online supplementary materials). All scene stimuli were accurately recognized as depicting the intended emotion (range: 76–100%). Scene stimuli within emotion categories were rated similarly in affective valence and arousal, thus allowing scenes to be collapsed by emotion category in the analyses.

Stimuli combinations. The previously mentioned emotional elements were used to create face-posture combinations and face-posture-scene combinations using Adobe Photoshop (see Figure 1).

Face-posture stimuli. Facial expressions were superimposed onto body postures in a white background, resulting in the creation of 36 distinct face-posture stimuli.

Face-posture-scene stimuli. Face-posture combinations were embedded into emotion scenes that were congruent with the posture (e.g., disgust face on a joy posture in a joy scene), resulting in 108 unique face-posture-scene composites (six posture-scene emotions × six actors × three scene exemplars).

Participants

Undergraduate students took part in the study in exchange for course credit. All participants were fluent English speakers. Separate samples were included to avoid familiarity effects that may have resulted from participants seeing the same face-posture image multiple times.

Face-posture ratings. The face-posture condition included 24 participants (11 female; M_{age} = 19.29 years, SD = 1.28). Nine

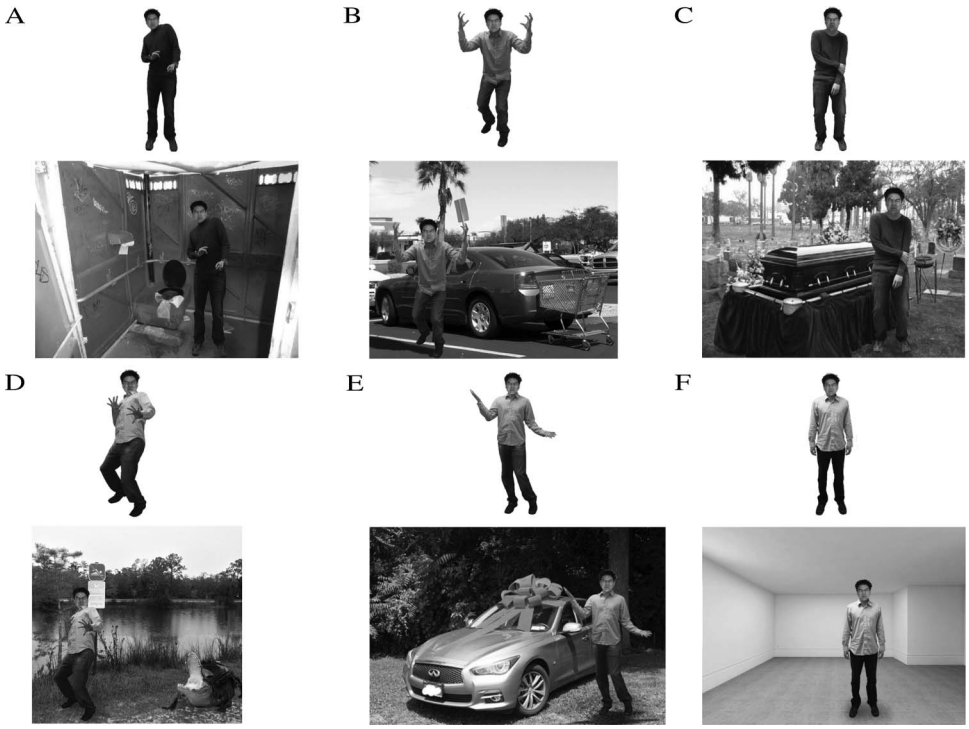

Figure 1. Examples of posture and posture-scene stimuli. All stimuli feature disgust facial expressions. (A) Disgust posture and posture-scene. (B) Anger posture and posture-scene. (C) Sadness posture and posture-scene. (D) Fear posture and posture-scene. (E) Joy posture and posture-scene. (F) Neutral posture and posture-scene. Facial expressions from the NimStim Set of Facial Expressions found at www.macbrain.org. Copyright by Nim Tottenham. Reproduced with permission.

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participants were Hispanic, five were Asian, two were African American, two were Caucasian, three were of mixed race, and one did not report information on race.

Face-posture-scene ratings. The face-posture-scene condition included 22 participants (8 female; M_{age} = 19.68 years, SD = 1.70). Fifteen participants were Hispanic, 4 were Asian, 1 was African American, 1 was Pacific Islander, and 1 was of mixed ethnicity.

Procedure

Stimuli were presented in grayscale. Participants were randomly assigned to the face-posture condition or face-posture-scene condition. Participants in the face-posture condition viewed all 36 face-posture stimuli (6 congruent, 30 incongruent). Participants in the face-posture-scene condition viewed 1 of 6 blocks of stimuli, each consisting of 36 of the 108 face-posture-scene stimuli (6 congruent, 30 incongruent) to ensure that any difference between conditions was due to the addition of scene and not the number or congruency of images rated. Each block of 36 face-posture-scene stimuli was counterbalanced by actor, posture-scene, and scene exemplar. This ensured that participants in both conditions saw each actor six times and each posture six times, with participants in the posture-scene condition seeing each scene exemplar only twice (once per actor gender).

The study took place in a campus computer laboratory with participants seated at separate computers with 20-in. monitors. Participants first completed a demographics questionnaire. Next, stimuli were displayed to each participant in a random order with the prompt, "Select the emotion that best describes the facial expression," with five options displayed vertically below the image: joy, sadness, fear, anger, and disgust. Participants could take as much time as needed to respond. The entire survey took approximately 10 min. Procedures were approved by the Institutional Review Board of the University of California, Merced.

Results

Participants' emotion categorizations organized by condition (Face-Posture and Face-Posture-Scene) are provided in Table 1.

Participants' categorizations of disgust facial expressions were analyzed using two distinct measures common in studies of face perception: (a) accuracy (i.e., the percentage of categorizations matching the face) and (b) contextual influence (i.e., the percentage of categorizations matching the posture or posture-scene). Accuracy and contextual influence were analyzed separately for each condition (i.e., Face-Posture, Face-Posture-Scene) using a repeated-measures analysis of variance with Emotion as a within-subjects factor. Subsequent Bonferroni-corrected pairwise comparisons (α = .003) examined differences between emotion contexts. Preliminary analyses revealed no significant effects of image gender or participant gender (Fs < 2.84, ps > .09); thus, subsequent analyses collapsed these factors.

Face-Posture Condition

Accuracy. Participants' disgust ratings varied significantly as a function of Emotion, $F(5, 858) = 20.52$, $p < .001$, $\eta_p^2 = .11$ (see Table 2). Pairwise comparisons revealed that participants were significantly more accurate in disgust contexts than other contexts (ps < .002) and significantly less accurate in anger contexts than other contexts (ps < .001). Participants' accuracy did not differ significantly between the other contexts (ps > .14).

Table 1
Proportion Agreement of Emotion Categorizations of Disgust Facial Expressions on Emotion Postures or Emotion Posture-Scene Combinations

	Emotion categorization				
Condition	Disgust	Anger	Sadness	Fear	Joy
Posture					
Disgust	.75	.05	.03	.17	.00
Anger	.20	.74	.04	.02	.00
Sadness	.49	.09	.36	.06	.00
Fear	.52	.06	.00	.42	.00
Joy	.47	.31	.13	.06	.03
Neutral	.56	.13	.26	.04	.01
Posture + Scene					
Disgust	.76	.14	.08	.01	.01
Anger	.17	.73	.08	.02	.00
Sadness	.36	.09	.52	.01	.02
Fear	.36	.04	.03	.57	.00
Joy	.43	.24	.16	.02	.15
Neutral	.40	.20	.35	.04	.01

Contextual influence. Participants' ratings matching the context varied significantly as a function of Emotion, $F(4, 715) = 73.99$, $p < .001$, $\eta_p^2 = .29$ (see Table 2). Pairwise comparisons revealed that participants' categorizations were influenced by postural elements significantly more in anger contexts than sadness, fear, and joy contexts (ps < .001) and significantly more in sadness and fear contexts than joy contexts (ps < .001). Contextual influence in sadness and fear contexts did not differ significantly (p = .17), nor did it differ significantly between anger and disgust contexts (p = .89).

Face-Posture-Scene Condition

Accuracy. Participants' disgust ratings varied significantly as a function of Emotion, $F(5, 786) = 22.85$, $p < .001$, $\eta_p^2 = .12$ (see Table 2). Pairwise comparisons revealed that participants were significantly more accurate in disgust contexts than all other contexts (ps < .001) and were significantly less accurate in anger contexts than other contexts (ps < .001). Participants' accuracy did not differ significantly between the other emotion contexts (ps > .24).

Contextual influence. Participants' ratings matching the context varied significantly as a function of Emotion, $F(4, 655) = 40.00$, $p < .001$, $\eta_p^2 = .20$ (see Table 2). Pairwise comparisons revealed that participants' categorizations were influenced by posture-scene elements significantly more in anger contexts than sadness and joy contexts (ps < .001) and significantly more in sadness and fear contexts than joy contexts (ps < .001). However, the influence of posture-scene in fear contexts did not differ significantly from anger (p = .004) or sadness contexts (p = .34). In addition, contextual influence did not differ significantly between anger and disgust contexts (p = .68).

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Table 2
Raw Mean Accuracy and Contextual Influence for the Face-Posture and Face-Posture-Scene Conditions

Context	Posture only	Posture + Scene	*t*	*p*	Cohen's *d*	95% CI LL	95% CI UL
Accuracy							
Disgust	$.75_a$	$.76_a$	0.15	.88	0.05	−.11	.10
Anger	$.19_b$	$.17_b$	0.59	.56	0.18	−.07	.12
Sadness	$.49_c$	$.36_c$	2.18	.03	0.66	.01	.25
Fear	$.52_c$	$.36_c$	2.65	.01	0.80	.03	.27
Joy	$.47_c$	$.43_c$	0.67	.51	0.20	−.08	.16
Neutral	$.56_c$	$.40_c$	2.58	.01	0.78	.03	.27
Contextual influence							
Disgust	$.75_a$	$.76_a$	0.15	.88	0.05	−.11	.10
Anger	$.74_a$	$.73_a$	0.16	.88	0.05	−.10	.12
Sadness	$.35_b$	$.52_b$	2.72	.01	0.82	−.28	−.04
Fear	$.42_b$	$.57_b$	2.42	.02	0.73	.02	.27
Joy	$.03_c$	$.14_c$	3.55	<.001	1.07	−.18	−.05

Note. Letters next to each proportion designate which Bonferroni-corrected vertical comparisons were significantly different ($p < .003$) within accuracy and contextual influence. CI = confidence interval; LL = lower limit; UL = upper limit.

Comparing Posture and Posture-Scene

Pairwise comparisons examined differences in accuracy and contextual influence between conditions (face-posture vs. face-posture-scene) for each context emotion (see Table 2).

Accuracy. Disgust categorizations were significantly lower in the posture-scene condition than the posture condition for contexts of sadness ($p = .03$), fear ($p = .01$), and neutral ($p = .01$). No other comparisons between conditions were statistically significant ($ps > .88$).

Contextual influence. Categorizations matching the nonface emotion were significantly enhanced by the addition of scene for contexts of sadness ($p = .01$), fear, ($p = .02$), and joy ($p < .001$). It is important to note that posture-scenes categorically shifted participants' perception of disgust faces in sadness and fear contexts from predominantly matching the face to matching the context. No other comparisons between conditions were statistically significant ($ps > .28$).

Discussion

In support of our hypotheses, participants' categorizations of disgust facial expressions varied as a function of the emotion depicted by the contextual elements in the face-posture condition. Specifically, posture alone was sufficient to elicit the confusability effect for anger contexts but not fear, sadness, or joy contexts. The addition of scene resulted in a stronger confusability effect than posture alone for the sadness and fear contexts but not for disgust, anger, or joy contexts. Notably, the addition of scene with posture resulted in a categorical shift in the perception of disgust faces embedded in fear and sadness contexts not previously documented.

These findings extend prior research on emotion perception in multiple ways. First, activating the confusability effect may require a sufficient amount of contextual information, with emotions lower in perceptual similarity with the target facial expression (e.g., sadness and fear in the case of disgust) requiring more contextual information (e.g., posture and scene) than emotions higher in perceptual similarity (e.g., anger; Susskind et al., 2007). It is interesting to note that disgust faces combined with joy posture-scenes were rarely miscategorized. This aligns with research suggesting that the perception of emotional valence shifts categorically across valence only when the observed facial expressions are of extremely high intensity (Aviezer, Trope, & Todorov, 2012).

Moreover, our findings suggest that emotion perception involves appreciating how emotional elements are interrelated. For example, the shift in sadness categorization necessitated a scene to push the viewer beyond seeing a face to instead seeing the relational significance of the individual with the environment. This lends support for emotion theory (e.g., Barrett & Campos, 1987), paradigms (e.g., Carstensen, Gottman, & Levenson, 1995), and coding approaches (e.g., Coan & Gottman, 2007) that contextualize emotional communication. Furthermore, the findings are informative for interventions typically emphasizing the face (e.g., Tanaka et al., 2012) that are designed to help individuals struggling with emotion perception, as well as future studies examining the role of contextual cues in emotion perception across different cultures (e.g., Masuda et al., 2008).

Limitations and Future Directions

There are myriad other nonfacial components involved in emotion perception not examined in the current study. These include vocal affect (e.g., de Gelder & Van den Stock, 2011), interpersonal relations (e.g., Mumenthaler & Sander, 2012), situational information (e.g., Carroll & Russell, 1996), personal history (e.g., Lagattuta, 2014), and implicit biases of the perceiver (e.g., Phelps et al., 2000). Research examining how such elements influence emotion perception, particularly with less caricatured expressions, is needed.

In addition, our use of congruent pairings of nonfacial cues limits our understanding of how various cues interact to influence emotion perception. Different combinations of emotion-related elements (e.g., face, posture, scene, voice) may differentially in-

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fluence emotion perception, particularly when such cues are incongruent (e.g., a disgust face on a fear posture in a sad scene; e.g., Kret & de Gelder, 2010). Furthermore, specific combinations of contextual elements may result in the perception of emotions not identified when the components are viewed in isolation.

Finally, it is possible that participants used processes of elimination to determine the expressed emotion (see Nelson & Russell, 2016) or were biased by the presence of specific emotion terms (see Lindquist & Gendron, 2013). Including additional emotion choices (e.g., pride) may have yielded different results. The emotion choices also may have prevented identification of shades of specific emotions or emotion blends (see Larsen, 2017; Plutchik, 2001), such as contempt or bittersweet. Allowing participants to free-label the images could capture such gradation and nuance in emotion perception.

Conclusion

As research moves toward understanding emotions in context, caution is needed to ensure that researchers do not fall into the trap that long ensnared the study of facial affect. Specifically, there is no single, all-important component of emotion perception. As evident in the present study, even the influence of context differs across contexts. We encourage future researchers to examine the interrelations between sources of contextual information to further improve our understanding of emotion perception.

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- To select the appropriate reviewers for each manuscript, the editor needs detailed information. Please include with your letter your vita. In the letter, please identify which APA journal(s) you are interested in, and describe your area of expertise. Be as specific as possible. For example, "social psychology" is not sufficient—you would need to specify "social cognition" or "attitude change" as well.
- Reviewing a manuscript takes time (1–4 hours per manuscript reviewed). If you are selected to review a manuscript, be prepared to invest the necessary time to evaluate the manuscript thoroughly.

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