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ATTACHMENT AND ATTENTIONAL BIASES FOR FACIAL EXPRESSIONS OF DISGUST

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Research on biological and psychological functions of disgust is increasing, yet relatively little is known about how people react to facial displays of disgust. This study used the dot probe task to examine attachment-related biases for emotional faces. Anxiously-attached individuals exhibited a significant tendency both to attend away from closed-mouth disgust faces, which have been associated with social rejection (social-moral disgust), and to attend toward open-mouth disgust faces, which are associated with visceral or core disgust. Consistent with theoretical proposals that there are two distinct sub-types of disgust, we propose that attentional avoidance of closed-mouth disgust faces represents an emotion-regulatory response to perceived social threat among individuals high in attachment anxiety. Future research examining attentional biases to disgust in clinical populations may shed light on interpersonal functions of disgust in psychopathology.

It is remarkable how little is known about disgust, despite its undisputed status as one of the five fundamental emotions first identified by Darwin (1872/1965). There was a surge of interest in disgust in the late eighties, particularly in the clinical domain (McNally, 2002;

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Phillips, Senior, Fahy, & David, 1998; Woody & Tolin, 2002) where evidence was generated that sensitivity to specific elicitors of disgust such as blood and spiders may be implicated in the etiology and maintenance of mental disorders (for a review, see Olatunji & Sawchuk, 2005). Compared to other emotions, however, disgust has received much less attention (Royzman & Sabini, 2001). Anthropologists have long suggested that disgust discourages moral transgressions and helps maintain collective boundaries (e.g., Douglas, 1966) and Freud (1905) argued that disgust serves defensive needs. These intriguing ideas are echoed by contemporary psychologists who described disgust as a gatekeeper emotion (Miller, 2004) and supported by experimental findings of a relation between disgust proneness and negative automatic moral evaluations (e.g., Inbar, Pizarro, Knobe, & Bloom, 2009; Wheatley & Haidt, 2005). In contrast, psychopathology research has been more concerned with individual differences in disgust sensitivity (i.e., the propensity to experience and express disgust) than with interpersonal facets of disgust.

The present study aimed to address this gap in the literature by examining attentional biases for disgust faces among persons high in insecure attachment. Our study was informed by Rozin and Fallon's (1987) conceptualization of disgust as consisting of two distinct sub-types, core disgust and social-moral disgust. According to this theory (Rozin & Fallon, 1987; Rozin, Haidt, & McCauley, 2000; Rozin, Lowery, & Ebert, 1994), disgust faces map onto eliciting situations, both in terms of their functionality and their communicative content. Core disgust represents a rudimentary visceral response to actual or imagined sensory offenses such as noxious smells, bitter tastes, or repulsive sights. Salient physiognomic features of core disgust are gape, tongue extrusion, and nose wrinkle—the face we draw when detecting a cockroach in the food cabinet or entering a reeking restroom. Core disgust is thought to have evolved from an adaptive food rejection response that protected humans against ingestion of toxic foods and contact with contaminating substances that may cause infection or disease (Rozin & Fallon, 1987; Marzillier & Davey, 2004; Rozin et al., 1994). Social-moral disgust constitutes a more complex form of disgust that emerged later in evolution and is elicited by a wider range of stimuli that vary across different ages, cultures, and subgroups (Haidt, Rozin, McCauley, & Imada, 1997). For example, people may express social-moral disgust to signal their disapproval of behaviors that violate social norms or to distance

themselves from people who are considered tainted, diseased, or strange. Facial movements characteristic of social-moral disgust include retraction of upper lip, dropping of mouth corners, and nose wrinkling—an expression on frequent display, for instance, among school bullies or NYC subway commuters. Because prior research has focused on disgust sensitivity, little is known about how people respond to disgust displayed by others. Specifically, no study has tested the possibility that open and closed-mouth disgust expressions may convey different messages. Although studies have found that closed-mouth expressions of emotions are especially threatening to individuals with social anxiety (Amir, Najmi, Bomyea, & Burns, 2010; Amir, Klumpp, Elias, Bedwell, Yanasak, & Miller, 2005), suggesting these expressions signal social disapproval, they have not included open-mouth disgust expressions. Given that closed-mouth disgust expressions have a wide range of possible interpretations, the inclusion of open-mouth expressions in the same study is important for establishing that the social evaluative threat conveyed by closed-mouth expressions is driving the effects observed in previous studies. If open-mouth and closed-mouth disgust faces represent different types of threat or aversion (sensory repulsion vs. interpersonal rejection), as suggested by Rozin et al.'s distinction between core disgust and social-moral disgust, they would elicit different patterns of attention.

These patterns of response to closed- and open-mouth disgust expressions should depend at least in part on constitutional vulnerabilities to social evaluative fears. For example, Berenson et al. (2009) found that highly rejection-sensitive individuals exhibit attentional avoidance of socially-threatening faces. These findings suggest that individuals who are dispositionally sensitive to rejection threat might be particularly likely to show attentional biases that lead them to selectively avoid stimuli associated with social threat. This hypothesis is further suggested by research demonstrating that after early, automatic stages in which threatening stimuli are attended toward, persons would demonstrate late stage avoidance of stimuli associated with their fears, in order to prevent detailed evaluation of the threatening stimuli.

To examine this possibility, we focused on two variables that are highly relevant to regulating emotional distress: attachment anxiety and attachment avoidance. Bowlby (1969, 1973, 1980) postulated that children internalize their attachment experiences into mental representations of self-in-relationship that guide their cognitive

and behavioral responses to stressful situations. Individuals scoring at the extremes of attachment anxiety or avoidance are thought to have a childhood history of unstable social interactions with primary caregivers that predisposes them to feel insecure in later close relationships. While securely-attached individuals process both positive and negative attachment-related stimuli in an open and flexible manner, insecurely-attached individuals are prone to filtering out information that may cause emotional distress (Bowlby, 1980; Fraley, Davis, & Shaver, 1998; Main, 2000; Mikulincer, Shaver, Cassidy, & Berant, 2009), and often deploy avoidant strategies (Dewitte & De Houwer, 2008; Dewitte, Koster, De Houwer, & Buysse, 2007; Edelstein & Gillath, 2008; Van Emmichoven, Van Ijzendoorn, de Ruiter, & Brosschot, 2003).

To the best of our knowledge, no published study has yet examined attachment-related attentional biases for disgust faces. Consistent with ideas regarding the emotion-regulatory functions of the attachment system (Dykas & Cassidy, 2011; Shaver & Mikulincer, 2007), disgust faces should elicit attentional biases to the extent that they present attachment-relevant information that has the potential to induce psychological pain. We hypothesized that facial expressions of core disgust and social moral disgust may elicit different attentional responses that reflect the level of interpersonal threat posed by each type of disgust. We assumed that open-mouth disgust expressions are likely to be perceived as involuntary visceral responses to a concrete source of threat that is external to both observer and expressor. In contrast, facial expressions of closed-mouth disgust present an ambiguous negative social signal in that the disgust expression may be directed at the observer—thus presenting a potential self-relevant threat to insecurely attached individuals.

In the present study, we used a pictorial version of the dot probe task to examine attentional biases for disgust compared to other emotions. In this task, attention is measured by comparing the speed at which participants detect a dot that is presented on a computer screen immediately following the presentation of a pair of photographs displaying a neutral face next to an emotional face. Response times to the dot probe are considered a snapshot of the distribution of participants' attention (Navon & Margalit, 1983) in that individuals tend to respond faster to probes presented in the attended location compared to probes that appear in the unattended location. Vigilance is inferred if participants consistently respond faster to probes appearing in the location of an emotional face. Con-

versely, if responses are slower when the probes appear in the location of emotional faces, attentional avoidance is inferred.

Research suggests that both anxious and avoidant individuals direct attention away from negative emotional stimuli (Kirsh & Cassidy, 1997; Van Emmichoven, Van Ijzendoorn, De Ruiter, & Brosschot, 2003). Thus, attachment insecurity, rather than the specific type of attachment orientation, appears to influence attention to potential threat. Therefore, if closed-mouth expressions of disgust signal rejection, it is likely that both anxiously and avoidantly attached individuals will exhibit attentional biases that protect against or minimize aversive feelings triggered by separation threats. Specifically, we hypothesized that insecurely attached individuals would avoid looking at disgust expressions that signal interpersonal rejection while showing no such attentional bias for disgust faces associated with more concrete visceral reactions and other emotional expressions that are unrelated to rejection.

METHOD

PARTICIPANTS AND PROCEDURE

Participants were 92 undergraduates (58 female, 34 male; mean age 20 years). All participants completed the 30-item Relationship Style Questionnaire (RSQ; Griffin & Bartholomew, 1994) as a measure of adult attachment style. This measure can be used both as a dimensional and as a taxonomical measure of attachment style as it contains items designed to tap each of Bartholomew's four prototypes (secure, fearful, preoccupied, and dismissing) as well as items drawn from the original Hazan and Shaver (1987) prototypes. Although some researchers continue to use the taxonomy approach, particularly in the study of infant attachment, in recent years, attachment researchers have moved from categorizing people with regard to four prototypes to scaling them on two dimensions of attachment-related anxiety and attachment-related avoidance. In the present study, we therefore used the RSQ items to scale participants on the two dimensions of attachment-related anxiety and avoidance following procedures that have been used in multiple previous studies (e.g., Fraley & Bonanno, 2004; Fraley & Waller, 1998). In our sample, these two scales were moderately correlated (r = .30) and

had acceptable internal consistency reliabilities (alphas = .85 and .83 for anxiety and avoidance, respectively).

To examine associations between anxious and avoidant attachment and performance on the dot-probe task, we divided participants into three groups using a tertile split on anxious attachment and avoidant attachment, respectively. This procedure (i.e., dividing subjects into extreme groups based on their scores on trait or state measures) is consistent with the way in which attentional biases have typically been measured in studies using the dot probe task and similar experimental paradigms. For example, previous studies on the relation between attentional biases for emotional stimuli and trait anxiety have tended to select comparison groups based on high and low scores on measures of trait anxiety, respectively (Bar-Haim, Lamy, Pergamin, & van Ijzendoorn, 2007; Coles & Heimberg, 2002). This is because differences in attentional biases as a function of individual difference variables may only become apparent when extreme groups are used, particularly in the case of samples drawn from nonclinical populations. Accordingly, in the current study we allocated participants to three groups using a tertile split on attachment anxiety and attachment avoidance, respectively. Individuals scoring below 2.73 were classified as low in attachment anxiety while those scoring above 3.64 were labeled as high in attachment anxiety. Similarly, individuals scoring above 3.80 were categorized as high in attachment avoidance while those scoring below 3.13 were considered as low on attachment avoidance.

Materials for the dot-probe task consisted of 64 pairs of photographs of faces from the NimStim set,[1] each consisting of one neutral and one emotional version of the same face. Sixteen face pairs were used for each emotion (happy, sad, angry, and disgust), including equal numbers of open- and closed-mouth expressions. In accordance with Rozin et al.'s (1994) operationalization of core disgust and derivative disgust faces, closed-mouth expressions of disgust involving the Action Units (AUs) L3 (nose wrinkle) and L4 (raised upper lip) were labeled "social-moral disgust" and open-mouth expressions of disgust involving L5 (gape) in addition to

1. The NimStim is a battery of 646 color pictures assembled by Nim Tottenheim that include actors of different races posing different emotional that have been categorized and validated by a large sample of college students. Development of the MacBrain Face Stimulus Set was overseen by Nim Tottenham and supported by the John D. and Catherine T. MacArthur Foundation Research Network on Early Experience and Brain Development. Please contact Nim Tottenham at tott0006@tc.umn.edu for more information concerning the stimulus set.

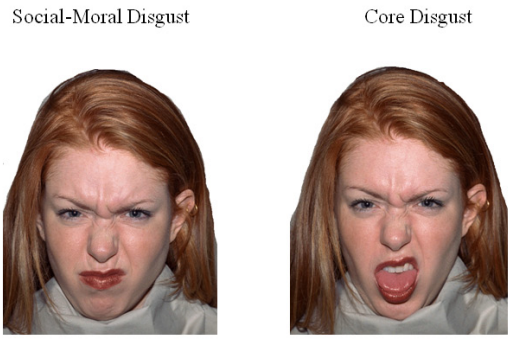

FIGURE 1. Examples of social-moral and core disgust faces used as stimuli in the attention task.

or without the AUs L4 and L3 were labeled core disgust (see Figure 1 for examples). Within each emotion face category, half of the pictures were of males and half were of females.[2] An additional 16 emotion-neutral face pairs (8 male, 8 female for each emotion) were used for practice trials.

Each trial started with a display of a white fixation cross in the middle of the screen for 500 ms, followed by a face pair for 1,000 ms. Following the offset of the pictures, a small gray dot appeared in the center of the screen location where one of the pictures had been and remained on the screen until the participant pressed one of two response keys on the keyboard to indicate the position of the dot—left or right side of the screen. The stimulus faces (angry, disgusted, sad, or happy) appeared in the right and the left positions with equal probability, with the matched neutral face of each pair appearing in the other position. The dot probe was presented in each position with equal probability. The computer recorded the accuracy and latency of each response. The inter-trial interval was 500 ms. Each picture pair was presented four times, for a total of 256 trials in a fully randomized order for each subject.

Participants first completed four practice trials of the simplified dot-detection task, in which the dot followed the fixation cross in the absence of the intervening face stimuli. After a brief break, participants were given further instructions on the screen informing

2. For the purposes of this study, only pictures of Caucasian faces were selected because the original battery did not contain enough non-Caucasian faces to include equal numbers of faces for each race in our stimuli set. Moreover, our sample consisted mainly of Caucasian students, so the effect of race might have confounded the effects of emotion category and open- versus closed-mouth.

them that the task would now be made more difficult and more interesting by briefly presenting a pair of photographs of a person's face between the presentations of the cross and the dot. As before, their task was to detect the dot as quickly and as accurately as possible. Participants completed 16 facial stimuli practice trial in the presence of the experimenter. Once the participant felt comfortable with the procedure, the experimenter left the room and the participant completed the 256 experimental trials.

RESULTS

Participants' response latency (RL) was used as an index of their deployment of attention. Only RL from correct responses were analyzed. The error rate was 1.18% out of 256 experimental trials. RLs less than 100 ms were considered anticipation or boredom errors and excluded from the analyses (error rate = 0.08%). Similarly, RLs greater than 1,000 ms were excluded because they were also extremely infrequent (error rate = 1%) and likely reflected lapses of concentration.

For each participant, attentional bias scores were calculated by subtracting the mean RL for probes appearing in the location of the emotional face (labeled same) from the mean RL for probes appearing in the location of the neutral face (labeled different). Positive values on this measure indicate a bias to attend to emotional faces and negative values indicate a bias to attend to neutral faces.

First, we conducted a one-sample *t*-test on the entire sample (N = 92) in order to analyze differential responses to closed- and open-mouth disgust relative to other emotional expressions. This allowed us to examine both the direction and magnitude of differences in attentional responses to open- and closed-mouth version of each emotion (see Gotlib, Krasnoperova, Yue, & Joormann, 2004; Mather & Carstensen, 2003, for a similar statistical approach). Results showed that participants tended to be significantly faster in detecting the dot-probe when it appeared in the same location as a photograph of a face expressing open-mouth disgust, $M = 8.06$, $t(91) = 2.01$, $p = .05$. There was also a marginal tendency to look away from expressions of closed-mouth disgust, $M = -5.72$, $t(91) = -1.77$, $p = .08$. No significant attentional bias was found for happy, sad, and angry faces in either open- or closed-mouth condition (all ps > .40).

TABLE 1. Inter-Correlations of Attachment Variables and Emotion Expression Attentional Biases

	1	2	3	4	5	6	7	8	9
Attachment variables									
1. Anxious attachment	—								
2. Avoidant attachment	**.302****	—							
Closed-mouth expressions									
3. Anger	.081	–.039	—						
4. Disgust	**–.206**†**	–.169	.179	—					
5. Sad	–.098	–.087	.170	.098	—				
6. Happy	.066	.037	.065	–.030	**.286****	—			
Open-mouth expressions									
7. Anger	–.036	.052	.163	**.289****	.019	.203	—		
8. Disgust	.063	–.089	.021	.128	–.055	–.029	–.040	—	
9. Sad	–.120	–.016	.159	.154	.028	.029	.091	**.336****	—
10. Happy	–.112	.033	.009	.001	–.066	.051	.011	.196	.052

Note. Correlations in bold are significant at $p < .06$; † $p = .053$; ** $p < .01$.

To test whether individuals scoring high in attachment anxiety are differentially affected by facial expressions of closed-mouth disgust relative to open-mouth disgust and other emotional expressions, we first examined simple correlations (Table 1). These revealed a significant inverse correlation between attachment anxiety and attentional bias scores for closed-mouth disgust expressions, indicating that higher attachment anxiety was associated with a tendency to look away from closed-mouth disgust expression. No other correlations between the attachment variables and emotion expressions were significant.

Next we allocated participants to extreme high and extreme low groups using a tertile split on attachment anxiety and attachment avoidance (see method section). In the present study, differences in the attentional allocation of individuals scoring high or low on attachment anxiety and attachment avoidance, respectively, were considered with respect to both emotion category (disgust, happiness, sadness, and anger) and type of facial expression (open- versus closed-mouth), resulting in a 4×2 matrix. To examine the differential effect of emotion category and expression type as a function of attachment anxiety, we conducted a repeated measures analysis of variance with attachment anxiety group (high tertile versus middle and lower tertiles) as the between participants factor, and emotion and expression type as the within subjects factors. Main ef-

TABLE 2. Differences in Attentional Bias (in Milliseconds) as a Function of Expression Type (Open or Closed) and Emotion Category in High Anxiously Attached Individuals (*n* = 33)

Variable	*M*	*SD*	*t*
Open-mouth			
Happy	.93	37	.14
Sad	–8.53	32	–1.55
Angry	–2.29	27	–.48
Disgust	15.83	36	2.53*
Closed-mouth			
Happy	7.27	27	1.52
Sad	–5.11	26	–1.11
Angry	1.32	38	.20
Disgust	–15.07	30	–2.91**

Notes. Attentional bias scores are compared against a hypothetical mean of zero (zero = no bias). Negative scores indicate attention away from an expression and positive scores indicate attention toward an expression. *$p < .05$; **$p < .01$.

fects for emotion and expression type (ps >.20) were nonsignificant. There was a significant two-way interaction between emotion and expression type $F(3, 85) = 4.79$, $p = .004$, $\eta p^2 = .15$. These results were qualified by the predicted three-way interaction among emotion, expression type, and attachment anxiety group, $F(3, 85) = 3.53$, $p = .02$, $\eta p^2 = .11$.[3]

To decompose this interaction, we first divided the sample and examined the two-way interaction of expression and mouth in the high and lower anxious groups. Because persons high in attachment anxiety should be particularly sensitive to closed-mouth disgust expressions, we predicted that they would be biased away from the closed-mouth disgust expressions. Consistent with this prediction, the two-way interaction of expression type and mouth was significant for the high anxious group, F (3, 30) = 8.12, $p = .000$, $\eta p^2 = .45$. By contrast, we predicted that the low anxious group would not be differentially responsive to expression type and mouth. Consistent with this prediction, the two-way interaction of expression and mouth was not significant for the low anxious group, F (3, 53) = 1.12, $p = .35$, $\eta p^2 = .06$.

3. We examined whether the results were modified when we covaried general distress, depression, and rejection sensitivity. When these variables were included in the model, the strength of the three-way interaction was slightly reduced, becoming marginal ($p < .06$). However, because these variables are typically correlated with anxious attachment and their influence on our results was small, we elected not to include them in our final model.

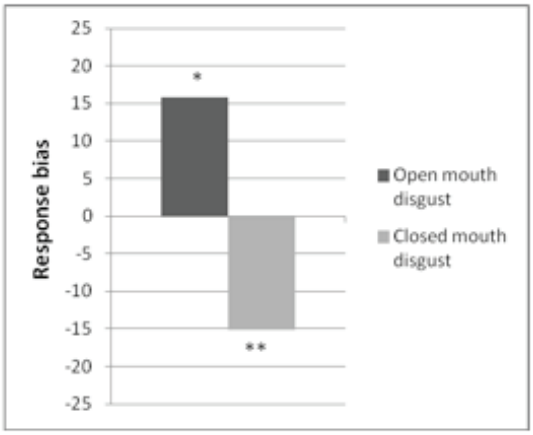

FIGURE 2. Response bias scores (in milliseconds) for the high anxious attachment group in response to open- and closed-mouth disgust faces. *p = < .05; **p = < .01.

Next we examined simple effects in the high anxious attachment group by conducting one-sample t-tests in which we compared attentional bias scores against a hypothetical mean of zero (no bias). As shown in Table 2 and Figure 2, high anxiously-attached individuals were significantly slower in detecting the dot probe when it appeared in the same location as closed-mouth disgust faces, M = -15.07, t (32) = -2.91, p = .01, indicating that they were attentionally biased away from the location of the closed-mouth disgust face. The reverse pattern was found for open-mouth disgust: High anxiously-attached individuals were significantly faster in detecting the dot probe when it appeared in the same location as the open mouth disgust face, M = 15.83, t (32) = 2.54, p = .02 (i.e., they were attentionally biased toward the open-mouth disgust face). In contrast to attachment anxiety, repeated measures analysis of variance using tertiles on attachment avoidance as the between participants factor did not reveal a three-way effect (p = .90). Therefore, we conducted no further analyses on avoidant attachment.

DISCUSSION

The present study extends the literature on disgust by identifying distinct attachment-related biases for open- and closed-mouth expressions of disgust. Anxiously-attached individuals exhibited a

strong and highly significant tendency to attend away from closed-mouth disgust faces, which have been associated with social rejection (social-moral disgust). Anxiously-attached individuals also showed an attentional bias toward open-mouth disgust faces, which have been associated with visceral or core disgust. The opposite response pattern for open- and closed-mouth disgust expressions provide support for Rozin et al.'s conceptualization of disgust as consisting of two distinct sub-types, core disgust and social-moral disgust (Rozin & Fallon, 1987; Rozin et al., 2000; Rozin et al., 1994), and points to potential differences in their respective communicative contents.

Notably, open-mouth disgust was the only facial expression of emotion that elicited significant attentional biases in the sample as a whole. Vigilance for open-mouth disgust is congruent with evolutionary accounts of disgust as an adaptive food-rejection response (Rozin & Fallow, 1987; Marzillier & Davey, 2004). The finding of an attachment-anxiety related attentional bias toward open-mouth disgust also fits with results from a recent eye tracking study that demonstrated a disgust-specific attentional bias in individuals with high levels of contamination fear (Armstrong, Olatunji, Sarawgi, & Simmons, 2010). However, this study only included open-mouth disgust faces and thus did not allow exploration of responses to closed-mouth disgust faces.

An alternative explanation for the attentional bias for open-mouth disgust concerns the prominent perceptual features or comic visual aspects of these expressions. Participants may have felt compelled to look at open-mouth disgust faces because of curiosity or amusement, rather than due to their survival value. It is interesting to note, however, that high-avoidant individuals showed a significant attentional bias away from closed-mouth disgust but no significant bias for open-mouth disgust faces, whereas low-avoidant individuals showed the typical attentional bias toward open-mouth disgust but no attentional bias for closed-mouth disgust. We speculate that open-mouth disgust faces may be less threatening or relevant to avoidantly-attached individuals because they are more likely to be perceived as an involuntary visceral response to concrete aversive stimuli such as bitter taste. By contrast, one of the characteristic facial movements of closed-mouth disgust, upper lip raise, does not have any obvious physiological functions and is associated with a range of negative emotions, including anger and contempt. As a result, determining the nature and function of closed-mouth disgust

expressions may be more difficult and hence more likely to activate cognitive-emotional schemata such as internal working models of attachment that guide responses to ambiguous social stimuli (Dykas & Cassidy, 2011).

In the present study, anxiously-attached individuals showed a significant tendency to look away from closed-mouth disgust faces that was not present in securely attached individuals. The most striking finding was that the attentional bias score of high-anxious individuals for open-mouth disgust faces was the almost exact reverse of their attentional avoidance of closed-mouth disgust faces. This opposite response pattern supports our hypothesis that closed-mouth disgust and open-mouth disgust expressions convey different levels of social threat that may be particularly salient to individuals with attachment histories involving conflict around proximity and distance. High levels of attachment anxiety may predispose individuals to perceive social-moral disgust as carrying negative self-relevant meanings such as rejection or denigration, which in turn activates attentional avoidance to prevent or reduce emotional distress arising from those meanings.

The design of the dot probe version used in the present study has a number of limitations that affect the interpretation of our findings as reflecting a pattern of attentional avoidance that fulfills emotion-regulatory functions in response to perceived social threat. The dot probe design did not allow us to specify which attentional operations are responsible for the delayed responses to closed-mouth disgust faces exhibited by individuals high in attachment anxiety. We argued that longer response latencies reflect attentional avoidance of stimuli that represent interpersonal threat. As the 1000 ms face-probe onset asynchrony allows for more than one shift of attention, it is possible, however, that the response times observed in our study did not reflect volitional control processes such as attentional avoidance. Attentional bias scores may reflect difficulty with disengaging from old stimuli, shifting between stimuli, or engaging with new stimuli, or are the result of factors that are unrelated to the valence and meaning of emotional expressions (Amir, Elias, Klumpp, & Przeworski, 2003). Using eye-tracking technology, Mogg, Millar, and Bradley (2000) found an orienting bias that was not reflected in dot probe RTs at a 1000 ms onset asynchrony, suggesting that 500 ms asynchrony likely reflects initial orienting of attention, whereas the 1,000 ms asynchrony reflects maintenance of attention. To clarify the nature and time course of attentional biases to disgust faces,

future studies will need to compare short and long exposure times as well as measure eye movement.

It would also be important to examine whether our findings of attachment-related differences in attention to disgust faces generalizes to clinical populations. Information conveyed by open- and closed-mouth disgust expressions may vary for different clinical populations (e.g., individuals with social anxiety vs. contamination concerns). For instance, there is evidence that individuals with borderline personality disorder are more likely to interpret neutral faces as personally relevant and carrying bad intentions, but do not differ from controls in encoding accuracy for emotional faces (Levine, Marziali, & Hood, 1997).

On a methodological level, our findings suggest that using low- and high-intensity expressions of different emotions may present a more sensitive measure of cognitive biases than exclusively relying on extreme expressions that are likely to over-represent biases resulting from bottom-up or feature-driven processing of emotional stimuli. To explore clinical implications of disgust-specific attentional biases, it would be interesting to investigate, for example, whether looking away from closed-mouth disgust faces is related to disgust sensitivity or increases the tendency to interpret ambiguous interpersonal events in a negative manner.

Examining attention to closed-mouth disgust as a function of attachment and exploring related emotional and socio-cognitive variables (e.g., shame, social attributions) may illuminate mechanisms by which attachment insecurity influences interpersonal experiences across the life-span. For example, longitudinal research has shown that attachment predicts psychosocial adjustment in adolescence (Allen, Porter, McFarland, McElhaney, & Marsh, 2007). Although the literature on attachment and bullying has tended to focus on perpetrators of bullying rather than victims (e.g., Eliot & Cornell, 2009; Walden & Beran, 2010), it is conceivable that insecurely attached children may interpret and respond to disgust expressions differently from securely attached controls. Such differences may form part of developmental pathways from bullying victimization to psychopathology. Anybody listening to (or remembering) some of the cruel and graphic expressions kindergarten and middle school children use to communicate their dislike of certain peers will agree that "you stink!" or "you're fat!" is one of the most dreaded derogatory labels a child may receive.

Perceiving oneself as disgusting is likely to have adverse psychological long-term effects. For example, Power and Dalgleish (1997) proposed a major role for self-disgust in depression: "The chronic activation of this self-disgust may provide one of the bases of mood disorders such as that found in depression in which the automatic processing of material is biased in a negative way" (p. 353). Empirical findings that sexually-abused women display more disgust (Bonanno et al., 2002) suggest that disgust may also play a role in emotional repercussions of childhood adversity. As Miller (2004) has argued "'one of the great complications for abuse survivors is that the self becomes part of the class of disgusting things because of its contact with the perpetrator and its inescapable involvement in awful moments" (p. 94).

In summary, examining selective allocation of attention to disgust faces may present a promising avenue to studying the interface between attachment, emotion, and social adjustment in normal and clinical populations. Disgust serves protective functions by physically or symbolically establishing distance to offensive objects perceived to be contagious and potentially harmful. Attachment theory's ethological framework for explaining interpersonal behaviors puts the hypothesized functions of disgust into a social-biological context. To the extent that avoidance of negative self-relevant information serves protective or maladaptive functions, attachment-related attentional biases away from closed-mouth disgust may help predict vulnerability to emotional disorders and social impairments across the life span.

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