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Reported History of Childhood Abuse and Young Adults' Information-Processing Biases for Facial Displays of Emotion

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The primary goal of this study was to examine the relations between young adults' reports of childhood abuse and their current attention and interpretation biases for facial displays of emotion. Consistent with prediction, individuals reporting a history of moderate to severe childhood abuse exhibited preferential attention to angry faces and increased sensitivity in the detection of angry expressions at lower levels of emotional intensity. Both the attention and interpretation biases were specific to angry rather than happy or sad faces. These results are consistent with the hypothesis that experiences of childhood abuse may contribute to the development of experience-specific information-processing biases.

Keywords: *abuse; maltreatment; attention; interpretation; facial expression*

Faces convey a wealth of information for guiding social interactions and are central for regulating these interactions (Alley, 1988; Marsh, Adams, & Kleck, 2005). Indeed, the ability to accurately process emotions from faces is fundamental for successful social interactions (Hampson, van Anders, & Mullin, 2006). Deficits in the ability to accurately process facial expressions have been linked to numerous forms of psychopathology (for reviews, see Edwards, Jackson, & Pattison, 2002; Golarai, Grill-Spector, & Reiss, 2006; Mathews & MacLeod, 2005).

Theorists (e.g., Cicchetti, Toth, & Maughan, 2000; Pollak, 2003; Rose & Abramson, 1992) have proposed that negative experiences in childhood, particularly childhood abuse, may contribute to the development of experience-specific information-processing biases. For example, theorists have suggested that childhood abuse may contribute to the development of information-processing biases specific to facial displays of anger (see Pollak, 2003). It may be adaptive for children to develop increased sensitivity to signals of anger, as this may facilitate attempts to avoid the abuse (Cicchetti et al., 2000; Pollak, 2003). Specifically, quick detection of mild signals of anger may facilitate the child leaving a situation that has the potential for violence. Consistent with these hypotheses, studies have suggested that children with a history of abuse exhibit attentional biases for angry faces (Pine et al., 2005; Pollak & Tolley-Schell, 2003). There is also evidence that abused children are more likely to interpret ambiguous facial expressions as angry (Pollak & Kistler, 2002). Notably, these attention and interpretation biases appear to be specific to angry faces rather than other emotions (e.g., sad or happy). Although results are somewhat mixed as to whether a history of abuse is related to preferential attention (Pollak & Tolley-Schell, 2003) versus attentional avoidance (see Pine et al., 2005) of angry faces, Pollak and his colleagues have suggested, based on both behavioral and event-related potential data, that a history of abuse is related to difficulty disengaging attention from angry faces (for a review, see Pollak, 2003).

Although it may initially be adaptive for children in abusive situations to selectively process signals of anger,

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theorists have suggested that these processing biases may become maladaptive if they develop into relatively trait-like processing styles that are applied rigidly to a broader range of (objectively safer) interpersonal contexts (see Cicchetti et al., 2000; Crick & Dodge, 1994; Gotlib & MacLeod, 1997; Pollak, 2003; Rose & Abramson, 1992). To the extent that childhood abuse contributes to the development of relatively stable information-processing biases, one would hypothesize that young adults with a history of childhood abuse would continue to display attention and interpretation biases for facial displays of anger. To our knowledge, however, no studies have tested this hypothesis in young adults. In addition, we are not aware of any studies examining the relations of childhood abuse with both attention and interpretation biases within the same study.

The primary goal of this study was to examine the relation between reports of childhood abuse and the presence of attention and interpretation biases for facial displays of emotion among young adults. We hypothesized that young adults reporting a history of childhood abuse, compared with those with no abuse history, would exhibit an attentional bias toward angry faces. We also predicted that these individuals would exhibit an interpretation bias such that they would be more likely to interpret ambiguous facial expressions as depicting anger. Finally, we predicted that these attention and interpretation biases would be specific to angry rather than sad or happy faces.

Method

Participants

Participants were 217 undergraduates (162 women, 55 men). Of these, 153 (70.5%) were Caucasian, 28 (12.9%) were Asian, 12 (5.5%) were Hispanic, 9 (4.2%) were African American, and the remaining 15 (6.9%) participants were from other ethnic groups or did not report their ethnicity. The mean age of the participants was 19.24 years ($SD = 2.76$). Because of a programming error, only a subset of participants ($n = 95$; 71 women, 24 men) had data available for the attention bias task. Participants with and without available data from the attention task did not differ significantly on any demographic or study variables.

Measures

The Childhood Trauma Questionnaire (CTQ; Bernstein et al., 2003; Bernstein & Fink, 1998) was used to assess participants' histories of emotional, physical, and sexual abuse in childhood. Each item is rated on a 5-point Likert-type scale, with response options ranging from *never true* to *very often true*. Subscale scores are calculated by summing responses within each abuse type. Scores on each scale can range from 5 to 25, with higher scores indicating more severe abuse. The CTQ has demonstrated excellent psychometric properties in both clinical and nonclinical samples, including high levels of concurrent validity with therapists' ratings of abuse (Bernstein et al., 2003; Bernstein & Fink, 1998). Each of the three abuse subscales also demonstrated good internal consistency in the current study (αs = .82, .80, and .89 for emotional, physical, and sexual abuse, respectively). Because of the extreme skew of each of the abuse variables in our sample ($z = 9.70$ to 32.61), dichotomous classifications were created for reported histories of abuse (abuse history vs. no abuse history). Consistent with previous research (e.g., Bradley et al., 2008), to be classified as having a history of abuse, the participant must have scored in the moderate to severe range for at least one type of abuse. Following Bernstein and Fink (1998), scores on the Emotional, Physical, and Sexual Abuse subscales greater than 12, 9, and 7, respectively, indicate moderate to severe abuse. Using these criteria, 47 of the participants (21.7%; 36 women, 11 men) were classified as having a history of at least one type of childhood abuse.[1] Of those reporting at least one form of childhood abuse, 12 (25.5%) reported emotional abuse only, 7 (14.9%) reported physical abuse only, 9 (19.1%) reported sexual abuse only, 8 (17.0%) reported emotional and physical abuse, 6 (12.8%) reported emotional and sexual abuse, 1 (2.1%) reported physical and sexual abuse, and 4 (8.5%) reported all three abuse types.

Participants' current symptoms of depression and anxiety were assessed with the Beck Depression Inventory–II (BDI-II; Beck, Steer, & Brown, 1996) and the Beck Anxiety Inventory (BAI; Beck, Epstein, Brown, & Steer, 1988), respectively. Studies have supported the psychometric properties of both measures (e.g., Beck et al., 1988; Beck et al., 1996; Creamer, Foran, & Bell, 1995). In this study, the BDI-II and BAI exhibited good internal consistency (αs = .91 and .85, respectively).

Computer-Based Assessments

Attentional biases for facial displays of emotion were assessed using a modified dot-probe task (cf. MacLeod, Mathews, & Tata, 1986). Stimuli for the dot-probe task consisted of pairs of facial expressions that contained one emotional (i.e., angry, happy, and sad) and one neutral photograph from the same actor. These stimuli were developed using color pictures from a standardized stimulus set of actors displaying emotional expressions (NimStim Face

Stimulus Set; Tottenham et al., in press). Photographs from each actor (16 males, 16 females) were used to create angry–neutral, happy–neutral, and sad–neutral pairs (96 pairs total). The 96 stimuli were presented in random order during the course of two blocks. Stimuli were presented for 1,000 ms, followed by a dot replacing one of the pictures. A 1,000 ms stimulus duration was chosen because a history of childhood abuse is hypothesized to be related to difficulty disengaging attention from angry faces (Pollak & Tolley-Schell, 2003), and studies examining this aspect of attentional bias have found stronger evidence at relatively longer presentation durations (i.e., 1,000 ms; see Mathews & MacLeod, 2005). Following presentation of the dot probe, participants were asked to indicate the location of the dot as quickly as possible using a response box. In each pair, the emotional face was presented with equal frequency on each side of the screen and the probe occurred with equal frequency in the location of the emotional and neutral faces. The intertrial interval was 1,000 ms. Trials with response errors were excluded (0.8%) as were trials with response times less than 150 ms or greater than 1,500 ms (0.6%). The number of trials excluded because of inaccurate responses or because of excessively short- or long-response latencies was not significantly related to participants' abuse histories or symptoms of depression or anxiety. Mean bias scores (cf. Bradley, Mogg, & Lee, 1997) were calculated separately for each emotion type by subtracting the mean response time for trials in which the probe appeared in the location of the emotional face from mean response times for trials in which the probe appeared in the same location as the neutral face. Positive values represent preferential attention toward emotional faces, whereas negative scores indicate attentional avoidance of the emotional faces.

To assess participants' interpretation biases for facial displays of emotion, prototype images of facial expressions were taken from a different standardized stimulus set (Matsumoto & Ekman, 1988). Stimuli for the interpretation task were created by morphing emotional and neutral faces from each actor to form a continuum of 10% increments, resulting in nine morphed images for each actor (e.g., 90% neutral, 10% angry; 80% neutral, 20% angry). Each emotion was represented by 4 continua (2 male and 2 female actors) for a total of 12 continua. Prototype images (e.g., 100% neutral or emotional) were not presented to equate the images for naturalness. Therefore, there were a total of 108 morphed facial stimuli. The pictures were presented, one at a time, in random order in two blocks (total presentations = 216) and participants were asked to indicate which emotion was being presented (angry, happy, sad, or neutral). The variable of interest in this experiment was the proportion of times the participant indicated the target emotion (angry, happy, or sad) per level of morph (cf. Pollak & Kistler, 2002).

Procedure

Participants were recruited from undergraduate psychology classes and received course research credit for their participation. The questionnaires were completed in small groups and the computer tasks were administered in individual testing rooms. The order of questionnaire and computer task administration was counterbalanced for all participants.

Results

Descriptive statistics for the full sample and for the two abuse groups individually is presented in Table 1. Results of the between-group comparisons (abused vs. nonabused) are presented as $r_{\text{effect sizes}}$. Following Cohen's (1988) guidelines, $r_{\text{effect size}}$ values of .10 represent a small effect, .30 represents a medium effect, and .50 represents a large effect. As can be seen in the table, participants in the abused group reported, on average, moderate levels of each of the three abuse types (see Bernstein & Fink, 1998). The levels of abuse reported in the full sample are similar to those observed in other nonclinical samples, whereas the levels of abuse reported by participants in the abused group are similar to those found in outpatient samples (Bernstein et al., 2003; Gibb, Chelminski, & Zimmerman, 2007; Scher, Stein, Asmundson, McCreary, & Forde, 2001). As can be seen in the table, participants reporting a history of abuse, compared with nonabused participants, also exhibited significantly higher scores on the BDI-II and BAI. This said, on average, participants in both groups scored in the minimal to mild range of depressive and anxious symptoms. Also all significant relations based on abuse history were maintained even after statistically controlling for participants' symptoms of depression and anxiety. Furthermore, participants' current symptoms did not moderate any of the links between reports of abuse and information-processing biases, suggesting that any abuse history differences observed were not due solely to participants' current symptoms of depression or anxiety.

To test our hypothesis regarding attentional biases, we conducted a 2 (abuse history: yes, no) × 3 (facial expression: angry, happy, sad) repeated measures ANOVA with attentional bias scores as the dependent variable. Although the main effect for abuse history was nonsignificant, $F(1, 93) = 2.49$, $p = .12$, there was a significant main effect for facial expression, $F(2, 186) = 6.49$,

Table 1 Descriptive Statistics for Abuse Groups

	Total Sample (n = 217)	Abused (n = 47)	Nonabused (n = 170)	$r_{\text{effect size}}$
Sex (% women)	74.7	76.6	74.1	.02
CTQ-EA	8.57 (3.87)	13.78 (4.44)	7.15 (2.08)	.71**
% reporting moderate/ severe abuse	13.8	63.8	0.0	
CTQ-PA	6.25 (2.60)	9.00 (4.35)	5.50 (0.97)	.55**
% reporting moderate/ severe abuse	9.2	42.6	0.0	
CTQ-SA	5.65 (2.33)	7.74 (4.38)	5.07 (0.31)	.48**
% reporting moderate/ severe abuse	9.2	42.6	0.0	
BDI-II	9.44 (8.26)	14.00 (9.28)	8.20 (7.53)	.29**
BAI	9.59 (7.85)	11.72 (8.94)	9.00 (7.44)	.14*

Note: CTQ-EA = Childhood Trauma Questionnaire–Emotional Abuse subscale; CTQ-PA = Childhood Trauma Questionnaire–Physical Abuse subscale; CTQ-SA = Childhood Trauma Questionnaire–Sexual Abuse subscale; Percentage of moderate/severe abuse = percentage of participants in each group reporting moderate to severe levels of emotional (CTQ-EA score > 12), physical (CTQ-PA score > 9), or sexual (CTQ-SA score > 7) abuse. Participants were classified in the abused group if they scored in the moderate to severe range for at least one type of abuse. BDI-II = Beck Depression Inventory–II. BAI = Beck Anxiety Inventory. $r_{\text{effect size}}$ = effect size of comparison (?^{2} or t test) of abused versus nonabused participants.
*$p < .05$. **$p < .01$.

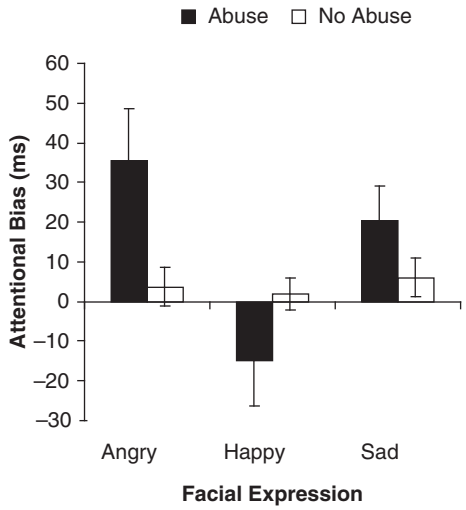
$p = .002$. Importantly, there was also a significant Abuse History × Facial Expression interaction, $F(2, 186) = 5.29$, $p = .006$ (see Figure 1). Tests of simple main effects within emotion type revealed significant abuse history differences for angry faces, $t(93) = 2.72$, $p = .008$, $r_{\text{effect size}} = .27$, but not happy, $t(93) = –1.74$, $p = .08$, $r_{\text{effect size}} = –.18$, or sad, $t(93) = 1.34$, $p = .18$, $r_{\text{effect size}} = .14$, faces. To determine whether the significant abuse group differences for angry faces were due solely to participants in the abused group exhibiting preferential attention toward angry faces, we conducted 2 one-sample t tests to examine whether each group's bias score for angry faces differed significantly from zero. Consistent with our hypothesis, this test was significant among participants reporting a history of abuse, $t(19) = 2.68$, $p = .01$. In contrast, nonabused participants' bias scores for angry faces did not differ significantly from zero, $t(74) = 0.76$, $p = .45$. These results suggest that the significant between-group difference was because of a biased attention toward angry faces specifically among participants reporting a history of abuse.

Next, interpretation biases were examined using hierarchical linear modeling (HLM; Raudenbush & Bryk, 2002; Raudenbush, Bryk, Cheong, & Congdon, 2004). A benefit of HLM over other procedures (e.g., repeated measures ANOVA) is that HLM allows one to model within-subject differences in response patterns across morph levels (i.e., trajectories in response accuracy with increasing signal strength) as well as whether variability in these accuracy trends can be predicted by participants' reported history of abuse. Another benefit is that one can explicitly model nonlinear patterns of response accuracy along the morph continua. Indeed, based on previous research (e.g., Pollak & Kistler, 2002; Young, Rowland, Calder, & Etcoff, 1997), we predicted that participants would generally exhibit a cubic (S-shaped) pattern of emotion-labeling accuracy for each emotion type, reflecting low levels of endorsement of the target emotion at the lower morph levels and near perfect endorsement at the highest morph levels. For the angry continuum, but not the happy or sad continua, we predicted that this pattern would be moderated by abuse history such that participants reporting a history of abuse would be more likely to endorse faces at the lower end of the angry morph continuum as being angry (cf. Pollak & Kistler, 2002).

Because our primary interest was in participants' interpretation of ambiguous faces rather than their ability to accurately label prototype emotions, participants were excluded from these analyses if they correctly labeled less than 75% of the emotion type being examined at the 90% morph level. This resulted in the exclusion of 35 (16.1%), 1 (0.5%), and 26 (12.0%) participants from the analyses focused on angry, happy, and sad faces, respectively. Participants excluded from these analyses did not differ significantly from those included in terms of abuse history, sex, or depressive or anxious symptoms.

The Level 1 (within-subject) model used to assess the proportion of facial expressions labeled as the target emotion at each morph level was the following:

Figure 1
Mean Attentional Bias Scores (in milliseconds) Across the Three Facial Expression Types as a Function of Abuse History. Error Bars Represent One Standard Error



$$\text{Accuracy}_{ij} = \pi_{0j} + \pi_{1j}\,(\text{Morph}_{\text{linear}}) + \pi_{2j}\,(\text{Morph}_{\text{quadratic}}) + \pi_{3j}\,(\text{Morph}_{\text{cubic}}) + e_{ij}$$

In this model, Accuracy_{ij} represents the proportion of faces correctly classified as being part of the angry, happy, or sad continuum at morph level i for participant j; π_{0j} represents the intercept term; and π_{1j}, π_{2j}, and π_{3j} represent the slopes for the linear, quadratic, and cubic trends in facial morph level, respectively. As noted above, we expected cubic trends in the accuracy data for each emotion type.

The Level 2 (between-subject) model was the following:

$$\pi_{0j} = \beta_{00} + \beta_{01}\,(\text{Abuse History}) + r_{0j},$$

$$\pi_{1j} = \beta_{10} + \beta_{11}\,(\text{Abuse History}) + r_{1j},$$

$$\pi_{2j} = \beta_{20} + \beta_{21}\,(\text{Abuse History}) + r_{2j},$$

$$\pi_{3j} = \beta_{30} + \beta_{31}\,(\text{Abuse History}) + r_{3j}.$$

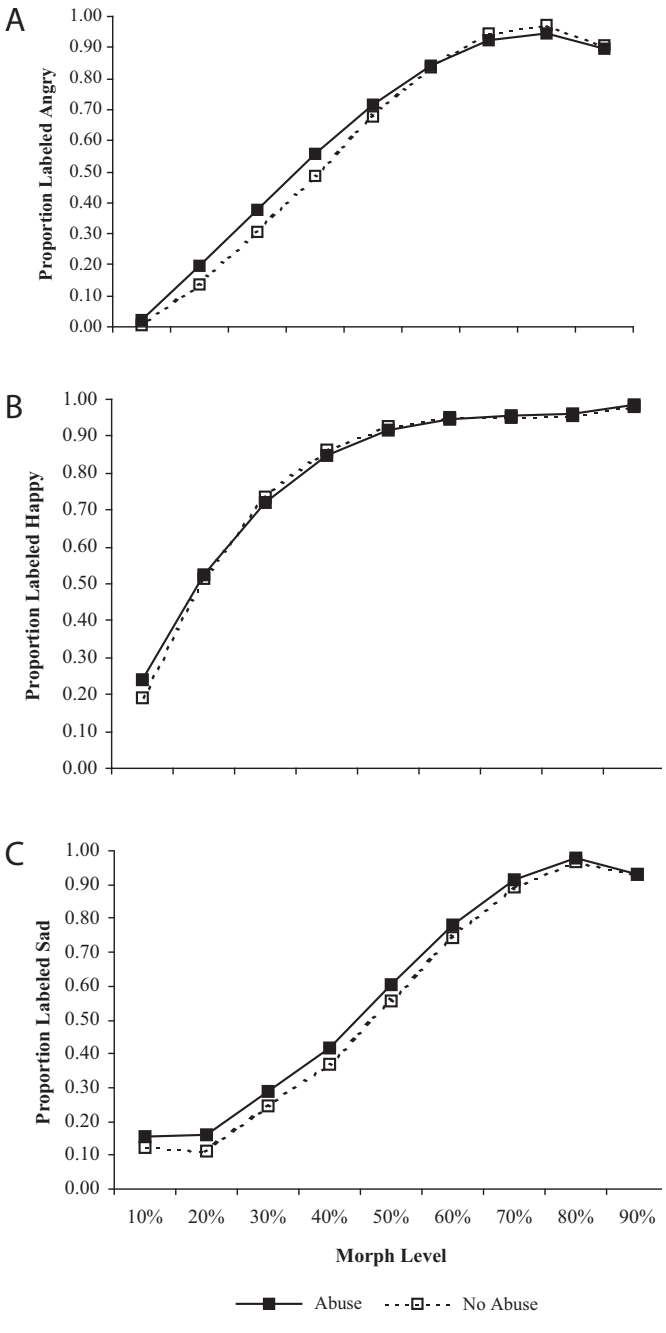
At this level of the model, β_{00} to β_{30} represent the intercepts for their respective equations and β_{01} to β_{31} represent the cross-level interaction of abuse history (yes vs. no) with their respective Level 1 variables. Finally, r_{0j} to r_{3j} represent the error terms for their respective equations.

As expected, preliminary analyses (with no Level 2 predictors) revealed significant cubic trends in labeling accuracy for each of the emotion continua (all ps < .001). Importantly, there was also significant variability in these trends (all ps < .001), indicating the presence of between-person variability in response patterns across the morph levels. Therefore, we next examined whether variability in these patterns was related to participants' reports of childhood abuse. Consistent with our hypotheses, analyses revealed significant effects of abuse history for the angry continuum. Specifically, we found significant effects of abuse history on the linear, $t(180) = -3.14$, $p = .002$, $r_{\text{effect size}} = .23$, and cubic, $t(180) = 2.90$, $p = .005$, $r_{\text{effect size}} = .21$, morph slopes. In contrast, the effects of abuse history on the intercept, $t(180) = 1.36$, $p = .18$, $r_{\text{effect size}} = .10$, and quadratic morph slope, $t(180) = -1.56$, $p = .12$, $r_{\text{effect size}} = .12$, were not significant. Solving these equations for the abused and nonabused groups separately, Figure 2 presents the predicted accuracy rates per level of morph. Consistent with our hypothesis, group differences were most evident at the lower end of the morph continuum (i.e., within the 20% to 40% morph range). Indeed, compared with nonabused participants, participants reporting past abuse were significantly more likely to endorse faces in the 20% to 40% morph range as being angry, $t(180) = 2.60$, $p = .01$, $r_{\text{effect size}} = .19$. There were no other significant abuse history differences at any other morph levels.

The abuse history differences for the angry continuum could have been because of (a) a general bias to identify any ambiguous expression as angry or (b) an increased sensitivity to detect anger at lower thresholds. The occurrence of faces labeled as angry along the happy and sad continua was quite rare (5.9% and 4.3%, respectively, compared with 88.4% for the angry continuum), and abuse history did not significantly moderate any of the Level 1 effects (intercept or linear, quadratic or cubic slope) for the happy or sad continua (lowest $p = .23$). Therefore, the pattern of results was more consistent with the hypothesis that participants reporting a history of childhood abuse were more sensitive to detect anger at lower levels of emotional intensity rather than exhibiting a general bias to interpret any ambiguous expression as anger.

For the happy continuum, the only significant abuse history effect was on the quadratic morph slope, $t(215) = 2.04$, $p = .04$, $r_{\text{effect size}} = .14$. However, follow-up analyses revealed no significant abuse history differences at any of the morph levels for the happy continuum. For the sad continuum, there were no significant abuse history effects on the intercept or any of the morph slopes (lowest $p = .12$). The patterns of results from these analyses are depicted in Figure 2.

Figure 2
Proportion of Faces Endorsed as Angry (top panel), Happy (middle panel), and Sad (bottom panel) Along the Three Neutral to Emotion Continua as a Function of Morph Level and Abuse History



The possibility of reporting bias exists in any study focused on self-reported histories of childhood abuse. Research has suggested that participants' reports of childhood experiences are more accurate when specific behavioral experiences are assessed (for a review, see Brewin, Andrews, & Gotlib, 1993), and the CTQ includes items assessing specific behavioral experiences of abuse (e.g., "I got hit or beaten so badly that I had to go to the doctor or go to the hospital") as well as more global reports of abuse (e.g., "I believe that I was physically abused"). To address the possibility that the results reported were due solely to participants' global beliefs that they were abused, we repeated all analyses using abuse classifications based solely on reports of specific behavioral experiences (i.e., with items assessing global reports of abuse excluded). To provide more conservative tests in these analyses, we also statistically controlled for participants' global belief that they were abused. Specifically, we created a dummy-coded variable indicating whether participants reported any belief of being emotionally, physically, or sexually abused (i.e., response of anything other than *never* on any of the three global belief questions). The results of each of these analyses were virtually identical to those obtained using the full CTQ. Also, in no instance, did global beliefs of abuse significantly interact with abuse classifications based on specific behavioral experiences to predict attention or interpretation biases, suggesting that the results were not due solely to participants' global beliefs of abuse history.

Finally, two sets of exploratory analyses were conducted. First, we examined whether there were any significant relations between participants' attention and interpretation biases within each emotion type. In these analyses, participants' attentional biases were not significantly related to emotion-congruent interpretation biases for the emotion accuracy intercept or the linear, quadratic, or cubic morph trends, nor did participants' abuse history significantly moderate any of these relations. Second, we examined whether any of the abuse history effects on attentional or interpretation biases was moderated by participant sex. None of these analyses was significant.

Discussion

The primary goal of this study was to replicate and extend previous findings suggesting a relation between childhood abuse and information-processing biases for facial displays of emotion (e.g., Pine et al., 2005; Pollak & Kistler, 2002; Pollak & Tolley-Schell, 2003). We found that a self-reported history of childhood abuse was related

to the presence of both attention and interpretation biases for angry faces among young adults. Specifically, young adults reporting a history of moderate to severe childhood abuse preferentially allocated their attention to angry, but not happy or sad, faces. In addition, these individuals exhibited increased sensitivity in the detection of angry expressions at lower levels of emotional intensity. We should note that there was also a nonsignificant trend for participants with a history of childhood abuse to exhibit attentional avoidance of happy faces. Also abuse history significantly moderated the quadratic morph trend for happy faces, although this was not reflected in significant abuse group differences at any specific point along the neutral to happy morph continuum. Future studies should continue to examine whether a history of childhood abuse is related only to young adults' information-processing biases for angry expressions or whether it may also be related to biases for other emotional expressions.

The current results are the first of which we are aware to examine the link between young adults' reported histories of childhood abuse and the presence of attention and interpretation biases for facial displays of emotion. Although, as with previous studies of childhood abuse and information-processing biases (e.g., Pine et al., 2005; Pollak & Kistler, 2002; Pollak & Tolley-Schell, 2003), no causal conclusions can be drawn given the study's cross-sectional design, the results are consistent with the hypothesis that early abusive experiences may contribute to the development of experience-specific attention and interpretation biases (cf. Pollak, 2003; Rose & Abramson, 1992). Supporting this hypothesis, there is evidence from previous research that experiences of emotional abuse and verbal peer victimization do contribute to prospective changes in a specific form of interpretation bias (depressive inferential styles) in children (e.g., Gibb & Abela, 2008; Gibb et al., 2006). A limitation of this earlier work is that experiences of abuse and cognitions were assessed through participants' self-report, which may have inflated the relations between them. Therefore, future studies should examine whether experiences of abuse also contribute to prospective changes in computer-based measures of information-processing biases such as those used in the current study. Future research is also needed to examine potential moderators (e.g., characteristics and timing of abuse, social support, and genotype; cf. Kaufman et al., 2006; Manly, Kim, Rogosch, & Cicchetti, 2001) and mediators (e.g., victimization later in life; cf. Bolger & Patterson, 2001; Kimerling, Alvarez, Pavao, Kaminski, & Baumrind, 2007; Thornberry, Ireland, & Smith, 2001) of the link between childhood abuse and information-processing biases in adulthood.

Despite the significant links between reports of childhood abuse and the presence of attention and interpretation biases, the biases themselves were not significantly related. The reason for this is unclear and previous studies have yielded mixed support for the relations among measures of different information-processing biases (or different measures of the same bias; see Gotlib et al., 2004; Hirsch, Clark, & Mathews, 2006). The lack of significant relations between the two information-processing tasks in the current study may reflect the fact that the biases are relatively independent, despite the relation of each with a history of childhood abuse. Another possibility is that some aspect of our design dampened or obscured the relation between the biases. For example, future studies of attentional biases may benefit from procedures that allow a more fine-grained analysis of attentional patterns across an entire stimulus trial (e.g., eye-tracking; cf. Garner, Mogg, & Bradley, 2006). A second measurement concern is that a number of participants were excluded from the interpretation bias task because of a failure to accurately identify the target emotion at the 90% morph level. Therefore, although the stimuli were salient enough to reveal significant abuse group differences for angry faces, it is possible that the use of a different experimental task or stimulus set would have resulted in a stronger relation between interpretation and attention bias for angry faces.

In contrast to previous studies (e.g., Pine et al., 2005; Pollak & Kistler, 2002; Pollak & Tolley-Schell, 2003), we focused on participants' self-reports of childhood abuse rather than documented cases. A benefit of our approach is that focusing solely on documented cases may result in an underestimate of abuse experiences because many cases of childhood abuse are not documented (U.S. Department of Health and Human Services, 1996). However, self-reports of childhood abuse might be subject to recall or response biases, and it is possible that individuals who believe they were abused are more likely to exhibit information-processing biases. To partially address this possibility, we showed that each of our significant findings was maintained even after focusing on reports of specific behavioral examples of abuse, statistically controlling for the influence of more global beliefs of perceived abuse. We should also note that the criteria for abuse used in this study were fairly liberal, and included participants who reported at least "moderate" levels of any type of abuse (cf. Bernstein & Fink, 1998), which may have contributed to the rather modest findings for our interpretation bias task in comparison to previous studies (e.g., Pollak & Kistler, 2002). This said, the consistency of our results with previous studies of children with documented histories of abuse (Pollak & Kistler, 2002; Pollak & Tolley-Schell, 2003) adds confidence to the validity and robustness of the association between childhood abuse and information-processing biases and suggests that effects of childhood abuse may not be limited to the most severe examples of these experiences.

Other potential limitations of this project should be mentioned. First, a number of participants were missing data for the attention task, resulting in less statistical power for these analyses. Second, our focus on university undergraduates may limit the generalizability of the current findings, and future research should seek to replicate the findings in a more representative sample of adults. Third, given the nature of our sample, conclusions must be limited to individuals reporting any form of abuse (emotional, physical, or sexual) and future research is needed to determine whether certain forms of abuse may be more strongly linked to information-processing biases for angry faces than other forms of abuse. This said, however, comorbidity among forms of abuse is common, so identifying "pure" groups may be difficult (Cicchetti et al., 2000). Fourth, although we observed significant abuse group differences in attention and interpretation biases, the size of these effects were relatively modest ($r_{\text{effect sizes}}$ = .27 and .19, respectively), particularly for the interpretation task. For this latter task, however, differences were only expected at the lower end of the morph continuum, among pictures reflecting more ambiguous displays of anger. Our observation of significant abuse group differences specific to this lower end of the angry morph continuum is consistent with previous research suggesting increased sensitivity in detecting anger at lower levels of signal strength rather than a general tendency to interpret any facial expression as depicting anger (cf. Pollak & Kistler, 2002; Pollak & Sinha, 2002). We should also note that we focused exclusively on the link between reports of childhood abuse and young adults' current information-processing biases, and it is likely that a number of factors occur between these periods to either exacerbate or mitigate any long-term effects of childhood abuse on adult functioning (e.g., effective treatment, changes in social support, revictimization, and additional negative life events). Future research should examine the potential moderating impact of these factors on the link between childhood abuse and information-processing biases.

In summary, these results add to the growing body of research supporting the link between experiences of childhood abuse and the presence of attention and interpretation biases for expressions of anger. The current results extend previous findings by demonstrating that these biases are also observed in young adults reporting a history of childhood abuse. Future research is needed to determine whether negative experiences in childhood contribute to prospective changes in these information-processing biases. In addition, it will be important to determine whether, once developed, the biases remain relatively stable and serve as trait-like risk factors for the development of psychopathology.

Notes

1. Of the subset of 95 participants with attention bias data, 20 (21.1%; 16 women, 4 men) were classified as having a history of at least one type of childhood abuse.

2. Among the subset of participants with attention bias data, abuse group was significantly related to scores on the Beck Depression Inventory–II, $t(92) = 2.92$, $p = .004$, $r_{\text{effect size}} = .29$, but not Beck Anxiety Inventory, $t(93) = 1.76$, $p = .08$, $r_{\text{effect size}} = .18$, or sex, $\chi^2(1, N = 95) = 0.37$, $p = .54$, $r_{\text{effect size}} = .06$.

References

Alley, T. R. (1988). *Social and applied aspects of perceiving faces.* Hillsdale, NJ: Lawrence Erlbaum.

Beck, A. T., Epstein, N., Brown, G., & Steer, R. A. (1988). An inventory for measuring clinical anxiety: Psychometric properties. *Journal of Consulting and Clinical Psychology*, *56*, 893-897.

Beck, A. T., Steer, R. A., & Brown, G. K. (1996). *Beck Depression Inventory manual* (2nd ed.). San Antonio, TX: Psychological Corporation.

Bernstein, D. P., & Fink, L. (1998). *Childhood Trauma Questionnaire: A retrospective self-report*. San Antonio, TX: Psychological Corporation.

Bernstein, D. P., Stein, J. A., Newcomb, M. D., Walker, E., Pogge, D., Ahluvalia, T., et al. (2003). Development and validation of a brief screening version of the Childhood Trauma Questionnaire. *Child Abuse & Neglect*, *27*, 169-190.

Bolger, K. E., & Patterson, C. J. (2001). Developmental pathways from child maltreatment to peer rejection. *Child Development*, *72*, 549-568.

Bradley, B. P., Mogg, K., & Lee, S. C. (1997). Attentional biases for negative information in induced and naturally occurring dysphoria. *Behaviour Research and Therapy*, *35*, 911-927.

Bradley, R. G., Binder, E. B., Epstein, M. P., Tang, Y., Nair, H. P., Liu, W., et al. (2008). Influence of child abuse on adult depression: Moderation by the corticotrophin-releasing hormone receptor gene. *Archives of General Psychiatry*, *65*, 190-200.

Brewin, C. R., Andrews, B., & Gotlib, I. H. (1993). Psychopathology and early experience: A reappraisal of retrospective reports. *Psychological Bulletin*, *113*, 82-98.

Cicchetti, D., Toth, S. L., & Maughan, A. (2000). An ecological-transactional model of child maltreatment. In A. J. Sameroff, M. Lewis, & S. M. Miller (Eds.), *Handbook of developmental psychopathology* (2nd ed., pp. 689-722). New York: Kluwer Academic/Plenum.

Cohen, J. (1988). *Statistical power analysis for the behavioral sciences* (2nd ed.). Hillsdale, NJ: Lauren Erlbaum.

Creamer, M., Foran, J., & Bell, R. (1995). The Beck Anxiety Inventory in a non-clinical sample. *Behaviour Research and Therapy*, *33*, 477-485.

Crick, N. R., & Dodge, K. A. (1994). A review and reformulation of social information-processing mechanisms in children's social adjustment. *Psychological Bulletin*, *115*, 74-101.

Edwards, J., Jackson, H. J., & Pattison, P. E. (2002). Emotion recognition via facial expression and affective prosody in schizophrenia: A methodological review. *Clinical Psychology Review*, *22*, 789-832.

Garner, M., Mogg, K., & Bradley, B. P. (2006). Orienting and maintenance of gaze to facial expressions in social anxiety. *Journal of Abnormal Psychology*, *115*, 760-770.

Gibb, B. E., & Abela, J. R. Z. (2008). Emotional abuse, verbal victimization, and the development of children's negative inferential

styles and depressive symptoms. *Cognitive Therapy and Research*, *32*, 161-176.
Gibb, B. E., Alloy, L. B., Walshaw, P. D., Comer, J. S., Shen, G. H. C., & Villari, A. G. (2006). Predictors of attributional style change in children. *Journal of Abnormal Child Psychology*, *34*, 425-439.
Gibb, B. E., Chelminski, I., & Zimmerman, M. (2007). Childhood emotional, physical, and sexual abuse and diagnoses of depressive and anxiety disorders in adult psychiatric outpatients. *Depression and Anxiety*, *24*, 256-263.
Golarai, G., Grill-Spector, K., & Reiss, A. L. (2006). Autism and the development of face processing. *Clincial Neuroscience Research*, *6*, 145-160.
Gotlib, I. H., Kasch, K. L., Traill, S., Joormann, J., Arnow, B. A., & Johnson, S. L. (2004). Coherence and specificity of information-processing baises in depression and social phobia. *Journal of Abnormal Psychology*, *113*, 386-398.
Gotlib, I. H., & MacLeod, C. (1997). Information processing in anxiety and depression: A cognitive-developmental perspective. In J. A. Burack & J. T. Enns (Eds.), *Attention*, *development*, *and psychopathology* (pp. 350-378). New York: Guilford.
Hampson, E., van Anders, S. S., & Mullin, L. I. (2006). A female advantage in the recognition of emotional facial expressions: Test of an evoluntionary hypothesis. *Evolution and Human Behavior*, *27*, 401-406.
Hirsch, C. R., Clark, D. M., & Mathews, A. (2006). Imagery and interpretations in social phobia: Support for the combined cognitive biases hypothesis. *Behavior Therapy*, *37*, 223-236.
Kaufman, J., Yang, B.-Z., Douglas-Palumberi, H., Grasso, D., Lipschitz, D., Houshyar, S., et al. (2006). Brain-derived neurotrophic factor-5-HTTLPR gene interactions and environmental modifiers of depression in children. *Biological Psychiatry*, *59*, 673-680.
Kimerling, R., Alvarez, J., Pavao, J., Kaminski, A., & Baumrind, N. (2007). Epidemiology and consequences of women's revictimization. *Women's Health Issues*, *17*, 101-106.
MacLeod, C., Mathews, A., & Tata, P. (1986). Attentional biases in the emotional disorders. *Journal of Abnormal Psychology*, *95*, 15-20.
Manly, J. T., Kim, J. E., Rogosch, F. A., & Cicchetti, D. (2001). Dimensions of child maltreatment and children's adjustment: Contributions of developmental timing and subtype. *Development and Psychopathology*, *13*, 759-782.
Marsh, A. A., Adams, R. B., Jr., & Kleck, R. E. (2005). Why do fear and anger look the way they do? Form and social function in facial expressions. *Personality and Social Psychology Bulletin*, *31*, 73-86.
Mathews, A., & MacLeod, C. (2005). Cognitive vulnerability to emotional disorders. *Annual Review of Clinical Psychology*, *1*, *167-195.*
Matsumoto, D., & Ekman, P. (1988). *Japanese and Caucasian facial expressions of emotion and neutral faces* [slides]. San Francisco State University, San Francisco.
Miller, G. M., & Chapman, J. P. (2001). Misunderstanding analysis of covariance. *Journal of Abnormal Psychology*, *110*, 40-48.
Pine, D. S., Mogg, K., Bradley, B. P., Montgomery, L., Monk, C. S., McClure, E., et al. (2005). Attention bias to threat in maltreated children: Implications for vulnerability to stress-related psychopathology. *American Journal of Psychiatry*, *162*, 291-296.
Pollak, S. D. (2003). Experience-dependent affective learning and risk for psychopathology in children. In J. A. King, C. F. Ferris, & I. I. Lederhendler (Eds.), *Roots of mental illness in children* (pp. 102-111). New York: Annals of the New York Academy of Sciences.
Pollak, S. D., & Kistler, D. J. (2002). Early experience is associated with the development of categorical representations for facial expressions of emotion. *Proceedings of the National Academy of Sciences*, *99*, 9072-9076.
Pollak, S. D., & Sinha, P. (2002). Effects of early experience on children's recognition of facial displays of emotion. *Developmental Psychology*, *38*, *5*, 784-791.
Pollak, S. D., & Tolley-Schell, S. A. (2003). Selective attention to facial emotion in physically abused children. *Journal of Abnormal Psychology*, *112*, 323-338.
Raudenbush, S. W., & Bryk, A. S. (2002). *Hierarchical linear models: Applications and data analysis methods* (2nd ed.). Thousand Oaks, CA: Sage.
Raudenbush, S. W., Bryk, A. S., Cheong, Y. F., & Congdon, R. (2004). *HLM 6: Hierarchical linear and nonlinear modeling*. Lincolnwood, IL: Scientific Software International.
Rose, D. T., & Abramson, L. Y. (1992). Developmental predictors of depressive cognitive style: Research and theory. In D. Cicchetti & S. Toth (Eds.), *Rochester symposium of developmental psychopathology*, *Vol. IV* (pp. 323-349). Rochester, NY: University of Rochester Press.
Scher, C. D., Stein, M. B., Asmundson, G. J. G., McCreary, D. R., & Forde, D. R. (2001). The Childhood Trauma Questionnaire in a community sample: Psychometric properties and normative data. *Journal of Traumatic Stress*, *14*, 843-857.
Thornberry, T. P., Ireland, T. O., & Smith, C. A. (2001). The importance of timing: The varying impact of childhood and adolescent maltreatment on multiple problem outcomes. *Development and Psychopathology*, *13*, 957-979.
Tottenham, N., Tanaka, J. W., Leon, A. C., McCarry, T., Nurse, M., Hare, T. A., et al. (in press). The NimStim set of facial expressions: Judgments from untrained research participants. *Psychiatry Research*.
U.S. Department of Health and Human Services. (1996). *Third national incidence study of child abuse and neglect: Final report*. Washington, DC: Author, Administration for Children and Families.
Young, A. W., Rowland, D., Calder, A. J., & Etcoff, N. L. (1997). Facial expression megamix: Tests of dimensional and categorical accounts of emotion recognition. *Cognition*, *63*, 271-313.

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