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Affect recognition among adolescents in therapeutic schools: relationships with posttraumatic stress disorder and conduct disorder symptoms

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Abstract

Background—Posttraumatic stress disorder (PTSD) and conduct disorder (CD) symptoms often co-occur in adolescence, but little is known about whether they show common or distinct emotional processing deficits.

Method—We examined the effects of PTSD and CD symptoms on facial affect processing in youth with emotional and behavior problems. Teens enrolled in therapeutic day schools (N = 371; ages 13-19) completed a structured diagnostic assessment and the Diagnostic Analysis of Nonverbal Accuracy-2 facial affect recognition task.

Results—PTSD symptoms were associated with deficits in the recognition of angry facial expressions, specifically the false identification of angry faces as fearful. CD symptoms were associated with greater difficulty correctly identifying sadness.

Conclusions—Findings suggest specificity in the relationships of PTSD and CD symptoms with emotional processing.

Keywords

Facial affect recognition; DANVA; PTSD; CD; teens

Introduction

Emerging research suggests that trauma exposure confers risk for the development of both posttraumatic stress disorder (PTSD) and conduct disorder (CD) symptoms in adolescence (Greenwald, 2002; Romero et al., 2009; Widom, 1999). These disorders have an immense

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impact on the well-being and healthy developmental trajectories of adolescents, as they are associated with increased risk for self- and other-directed violence, delinquency, substance use disorders, and mental health problems in adulthood if untreated (Grella et al., 2005; Weierich and Nock, 2008; Wilcox et al., 2009). Youth with PTSD and CD display deficits in social, emotional, and behavioral functioning that often increase use of mental health services, placement in academic diversion programs, and juvenile justice involvement (Hinshaw, 1992; Kazdin, 1997; Lipschitz et al., 2000). Given that PTSD and CD also often emerge and co-occur in adolescence, particularly for mental-health seeking youth (Keane and Kaloupek, 1997), this is a critical developmental period for understanding the mechanisms that initiate and maintain these symptoms (Afifi et al., 2011; Greenwald, 2002). The present study sought to advance understanding of the aberrant psychological processes that are differentially and jointly associated with PTSD and CD symptoms by examining deficits in facial affect recognition in a sample of emotionally- and behaviorally-disordered adolescents.

Accurate perception of facial expressions is a central mechanism for communicating emotional states and is crucial for the development of adaptive social functioning (Eisenberg et al., 1998). Impaired facial affect recognition is associated with deficits in emotion regulation, information processing, and neurobiological abnormalities (Adolphs et al., 2002; Calder et al., 2000), which suggests that it confers risk for the development and maintenance of maladaptive cognitions, behaviors, and psychiatric symptoms (Guyer et al., 2007; Pollak, 2008). Of relevance to the present study, research finds that youth with PTSD and CD symptoms show emotional processing deficits that are associated with impaired social functioning and aggressive behavior (Hinshaw, 1992; Kazdin, 1997; Lipschitz et al., 2000). These deficits in interpersonal functioning may in part reflect the misinterpretation of social cues conveyed via facial expressions.

Maltreatment and affect recognition deficits

Consistent with a model of impaired affect recognition following trauma exposure, several studies have found associations between childhood maltreatment and affect recognition deficits. Children with a history of maltreatment are more likely to show attentional biases to angry faces (i.e., respond faster to angry faces and attend to them longer) and are more likely to misidentify ambiguous faces as angry (i.e., attribute anger to a face expressing little emotion) than non-maltreated children (Pollak, 2008). For example, studies indicate that abused children selectively misjudge angry faces, but do not differ from non-abused children when processing other emotions (Pollak and Kistler, 2002). Less research has been conducted with teens and adults exposed to maltreatment, though preliminary findings suggest similar biases (Gibb et al., 2009; Gulley et al., 2013). These attentional biases to, and impaired judgments of, angry faces in victimized children may reflect hypervigilance to threat and the saliency of angry facial expressions as predictive cues for re-victimization (Pollak and Sinha, 2002). Deficits in the perception of anger recognition may be particularly pronounced for victimized children who manifest symptoms of PTSD, although there is presently insufficient data on this topic.

Based on this previous work, impaired recognition of angry faces, but not the expression of negative affect more broadly, is likely one psychological consequence of maltreatment and trauma exposure. Whether the severity of psychopathological distress following trauma is related to deficits in facial affect recognition remains largely unknown. Our literature review identified only one study on the topic. On a morphed facial recognition task of fearful, neutral, and happy faces, maltreated children with and without PTSD showed faster recognition of fearful faces than non-maltreated children (Masten et al., 2008). Differences were not found in affect recognition accuracy as a function of maltreatment or PTSD, although anger recognition was not assessed. In combination with the maltreatment literature, these data suggest that PTSD symptoms may be associated with enhanced recognition of fearful and angry faces. Explicit examination of how youth with PTSD symptoms perform on a task that directly compares performance recognition for fearful and angry faces is an important research question that has not yet been addressed.

Affect recognition deficits in conduct disorder

Research has also investigated affect recognition deficits in youth with CD symptoms, due to their diminished empathetic concern, impaired affective bonding, and problems with anger recognition. Findings have been mixed, with some studies reporting null results, and others supporting impaired recognition of sadness, fear, anger, or none of these depending on the comparison group, operationalization of CD, and comorbid disorders (e.g., CD with or without callous/unemotional traits; early vs. late onset CD) (Cadesky et al., 2000; Dadds et al., 2006; Fairchild et al., 2009; Schepman et al., 2012). Comorbidity of CD with other disorders may partly explain the variability in affect recognition deficits across studies. For example, CD and PTSD are both associated with a history of trauma exposure and are characterized by angry outbursts and aggressive behavior (American Psychiatric Association, 1994). Hence, the over-identification of anger may be most apparent in youth with symptoms of both CD and PTSD. In contrast, diminished anger, sadness, and fear recognition may be more specific to youth without histories of trauma or those who do not develop PTSD symptoms following traumatic events. Research has yet to examine whether impairments in affect recognition are different for comorbid CD and PTSD symptoms than either symptom profile alone.

Present study

This study aimed to simultaneously examine PTSD and CD symptom severity in relation to affect recognition in youth with serious emotional and behavioral problems attending therapeutic day schools. These teens have higher rates of psychopathology and greater social, behavioral, and academic impairment than those in the general community (Vernberg et al., 2004), and compared to their non-therapeutic day school peers (Reddy, 2001). Thus, a focus on this clinical sample provided an opportunity to oversample teens with PTSD and CD symptoms, allowed us to examine whether, and to what extent, PTSD and CD are associated with similar or distinct facial affect recognition deficits, and directly compare relative deficits in fear, anger, and sadness recognition in the context of the same study.

Based on previous research, our first hypothesis was that PTSD symptom severity would be associated with relatively better identification of angry and fearful faces compared to sad

faces. In contrast, we hypothesized that greater CD symptom severity would be associated with relatively worse performance on angry, fearful, and sad faces (main effects of Emotion). We also examined the interactive effects of PTSD and CD symptoms, because these symptoms may influence affect recognition in non-additive ways. We did not have specific hypotheses about these relationships given the scarcity of previous work.

Methods

Sample

A sample of 417 teens were recruited from therapeutic day schools as part of a larger multi-site study, Project Balance, aimed at reducing risky sexual behavior and substance use among youth (Donenberg et al., 2012). Teens with a pervasive developmental disorder, active psychotic disorder, known to be HIV positive, currently pregnant, or wards of the state in Chicago (due to lack of institutional review board approval from the Illinois Department of Children and Family Services) were ineligible. The study was approved by relevant institutional review boards prior to data collection. Of the families invited to participate, 93% agreed and provided written informed consent and assent. Data were also used in Donenberg et al. (2012), which did not examine affect recognition.

To be included, participants must have completed the diagnostic assessment (17 excluded), skipped no more than one trial in each condition on the affect recognition task (22 excluded), and got at least 25% of the trials correct to ensure they were paying attention to the task (7 excluded). Excluded participants did not differ from included participants on any demographic variable measured. The final sample consisted of 371 boys ($n = 260$, 70%) and girls ($n = 111$, 30%) ages 13 to 19 ($M = 15.2$, $SD = 1.4$) who were enrolled in a therapeutic day school in either Chicago, IL or Providence, RI. Grade level ranged from 7th through 12th grade, with approximately 22% of the sample enrolled in middle school and the remaining in high school ($M_{grade} = 9.7$, $SD = 1.5$). The majority of the sample self-identified as White (45%) or Black/African-American/Haitian (25%), followed by biracial/multiracial (18%), White/Hispanic (7%), Black/Hispanic (4%), American Indian/Alaska Native (1%), and Native Hawaiian/Pacific Islander (<1%).

More teens met threshold or subthreshold criteria ("intermediate diagnosis") for an externalizing disorder alone (27.2%, CD, oppositional defiant) than an internalizing disorder alone (9.4%, generalized anxiety, major depression, dysthymia, PTSD), comorbid internalizing and externalizing disorders (10.2%), or mania/hypomania alone (8.4%) based on self-reported symptoms on the Computerized Diagnostic Interview Schedule for Children (C-DISC) (Shaffer et al., 2000). These rates are comparable to adolescents receiving outpatient and/or inpatient mental health services (e.g., 34% externalizing, 6% internalizing, 30% comorbid internalizing & externalizing in 840 treatment-seeking teens) (Brown et al., 2010). Furthermore, the prevalence rates of externalizing and internalizing disorders were higher in this sample than nationally-representative samples of teens from the general community (e.g., externalizing disorders = 4.4%; internalizing disorders = 4.6%) (Kessler et al., 2012).

Measures

Psychopathology—Teens completed a self-administered version of the Computerized Diagnostic Interview Schedule for Children (C-DISC), a structured clinical interview administered via automated voice prompts (Shaffer et al., 2000). It was used to assess current symptoms (in the 4 weeks prior to the assessment) of generalized anxiety, PTSD, major depression, mania, hypomania, dysthymia, oppositional defiant disorder, and CD based on the Diagnostic and Statistical Manual of Mental Disorders-IV criteria (APA, 1994). The DISC is a widely used and well-validated interview for assessing mental health in children and adolescents (Shaffer et al., 2000) and the computerized version has comparable reliability to other versions of the DISC (Lucas, 2003). The presence of a symptom was coded as one, and the absence of a symptom was coded zero. Seventeen percent of the sample endorsed at least one PTSD symptom, and 12.4% met threshold or subthreshold criteria for a diagnosis. Eighty-five percent of the sample endorsed at least one CD symptom, and approximately 30% met threshold or subthreshold criteria for a diagnosis. Seventeen percent of the sample had symptoms of both PTSD and CD. These diagnostic rates are comparable those observed in adolescents seeking mental health treatment (e.g., PTSD = 19%; CD = 44%) (Brown et al., 2010) and higher than those reported by teens in the general community (e.g., PTSD = 1.6%; CD = 1.5%) (Kessler et al., 2012). Total symptom counts for PTSD ($M = 1.5$, $SD = 3.7$, $Range = 0-16$) and CD ($M = 6.7$, $SD = 5.4$; $Range = 0-21$) were used as continuous independent variables, but were rank normalized using a Blom transformation to reduce skewness resulting in values ranging from .23 to 2.0 (also see data analysis section below).

Affect recognition task—Participants completed the Diagnostic Analysis of Nonverbal Accuracy-2, a computer-administered assessment of affect recognition using adult facial expressions and voices (DANVA-2) (Nowicki and Carton, 1993; www.psychology.emory.edu/clinical/interpersonal/danva.htm). The DANVA is a widely-used (Cadesky et al., 2000; Guyer et al., 2007) and well-validated measure of facial affect recognition (Nowicki and Duke, 1994). For each photograph presented, participants were asked to identify the emotion expressed on the face using a forced-choice format. The dependent variable was the total number of correct (1) versus incorrect (0) responses. Based on our hypotheses, only sad, angry, and fearful facial expressions were analyzed in this study for a total of 18 picture stimuli (total correct range = 0-18). Each emotion category (sadness, anger, fear) had a total of 6 picture stimuli (total correct range = 0-6 per emotion). Half of the photographs displayed low-intensity facial expressions and half displayed high-intensity expressions, which were collapsed across the emotion categories to increase power.

Data analysis

The number of correct responses was analyzed using a repeated-measures MANCOVA with Emotion (sad, angry, fearful) as repeated within-subject factor, and continuous PTSD and CD symptom counts, and their interaction as between-subjects predictors¹. Statistical tests were two-tailed. Age and gender were included as covariates because accuracy on the

¹We also examined adolescents' errors in identification of happy faces, and the potential moderating effects of PTSD, CD, and PTSD $\times$ CD. One significant effect emerged, suggesting that CD symptoms were associated with differential recognition of sad vs. happy

DANVA increases with age, (Nowicki and Duke, 1994), PTSD symptoms are more common in girls, and CD symptoms are more common in boys (Kessler et al., 2012).

To interpret significant effects of emotion, we examined the types of affect recognition errors youth made by calculating the number of false positive identifications that were associated with each emotion. We then correlated these error rates with the psychopathology symptoms using Pearson correlations to aid in the interpretation of significant psychopathology $\times$ emotion interactions. In addition to p-values, we also report an effect size estimate using partial eta squared (i.e., equivalent to R^2 from multiple regression models). Consistent with previous research (Krueger et al., 2002), PTSD and CD symptom counts were rank normalized using a Blom transformation to reduce skewness (resulting values ranged from .23 to 2.0). Data were examined for outliers and non-linear distributions. No clear univariate outliers were present. One bivariate outlier was removed from analysis. Analyses were conducted using SPSS version 20 (SPSS, Chicago, IL). All substantive analyses reported below were also conducted including gender as a potential moderator of affect recognition error, psychopathology symptoms, or their combined interactions (e.g., PTSD $\times$ CON). Results suggested no significant gender effects, such that all relationships between psychopathology and affect recognition errors were similar for boys and girls.

Results

Facial affect recognition

Descriptive statistics and results of the repeated-measures analysis are provided in Table 1. Neither age nor gender were significant predictors of affect recognition accuracy. Teens had more difficulty accurately identifying angry faces than fearful faces, and had more difficulty identifying angry than sad faces. Accuracy for sad and fearful faces did not differ.

Psychopathology and facial affect recognition

PTSD symptoms—Results of the repeated-measures analysis with psychopathology symptoms entered as moderators are displayed in Table 2. Unexpectedly, PTSD symptom severity was not associated with relatively better identification of angry and fearful faces compared to sad faces. Instead, higher levels of PTSD symptoms were associated with less accurate identification of angry faces relative to fearful faces and sad faces. Contrary to predictions, PTSD symptoms were not associated with relatively better performance on fearful than sad faces.

To help interpret these findings, we examined the types of facial recognition errors that were associated with PTSD and results are presented in Table 3. PTSD symptom severity was positively related to the total number of false positive identifications of fear such that youth with greater PTSD symptoms were more likely to misidentify sad and angry emotions as fearful. Specific emotion contrasts indicated that PTSD symptoms were positively associated

faces. Specifically, teens with higher levels of CD were more likely to misidentify sad faces than happy faces compared to those with lower levels of symptoms. This replicates previous research suggesting a pattern in which CD is associated with greater general over-identification of sad faces (e.g., Schepman, K., Taylor, E., Collishaw, S., & Fombonne, E. (2012). There were no other findings related to identification of happy faces, suggesting that teens in this study did not demonstrate a general impairment in facial affect recognition.

with the tendency to misidentify anger as fear and sadness, although only the former comparison reached statistical significance. Thus, PTSD severity was associated with the over identification of fear and, specifically, the misidentification of angry faces as fearful.

CD symptoms—CD symptoms were associated with differential recognition of sad vs. fearful faces. Specifically, teens with higher levels of CD were more likely to misidentify sad faces than fearful faces compared to those with lower levels of symptoms. CD symptoms were not associated with deficits in recognizing angry or fearful faces. As presented in Table 3, CD symptoms were specifically associated with the misidentification of sadness as anger, suggesting that youth with higher levels of CD tended to interpret sad faces as angry.

PTSD and CD symptom comorbidity—The interaction of PTSD and CD symptoms did not moderate the main effects of Emotion, suggesting that PTSD/CD comorbidity did not relate to wholesale deficits in facial affect recognition.

Discussion

Despite the high prevalence of PTSD and CD in adolescence, previous research on whether these symptoms show common or unique emotional processing deficits in youth remains largely unknown. Unexpectedly, our findings indicate that PTSD symptoms relate to deficits in anger recognition more than other displays of negative affect, specifically sadness or fear. Further, PTSD was associated with the over identification of other expressions of negative affect as fear. CD symptoms, in contrast, related to relative deficits in sadness recognition. Analysis of comorbidity suggested that CD symptoms and PTSD symptoms did not interact to predict facial affect recognition accuracy. These findings advance our understanding of emotional processing deficits differentially associated with PTSD and CD symptoms, and can be useful for developing interventions aimed at treating deficits in emotional processing in symptomatic youth.

Findings diverge from research on maltreated children's deficits in identifying angry faces (Pollak, 2008), suggesting instead that the tendency to misinterpret angry facial expressions is associated with a greater severity of PTSD trauma symptoms. Interestingly, deficits in facial affect recognition were specific to the misidentification of anger as fear, as PTSD symptoms were associated with comparable recognition of the fearful and sad faces. Fear is particularly relevant for understanding PTSD, as the disorder has been associated with a "survival mode" of functioning characterized by an overactive fight-flight response, heightened physiological reactivity, and increased threat perception (Chemtob et al., 1997). Research indicates that PTSD is associated with poor extinction of the fear response, attentional bias to threat, and overgeneralization of threat to safe contexts (Buckley et al., 2000). Present findings provide an alternative perspective to the affect recognition abnormalities observed in the maltreatment literature by showing that youth who develop PTSD symptoms show relatively better recognition of fearful faces than hostile and threatening (i.e., angry) facial expressions, which may reflect the tendency to try to use others' expressions of fear as cues for imminent threat. This finding is consistent with the one previous study on PTSD symptoms and facial affect in youth that demonstrated that maltreated youth with PTSD symptoms showed faster recognition of fearful faces than non-

maltreated children (Masten et al., 2008). This earlier study did not examine fear in relation to anger recognition and, thus, the present study extends this work by suggesting that youth with PTSD symptoms tend to misidentify angry faces and, more specifically, falsely identify angry faces as fearful. Thus, youth with PTSD symptoms may be particularly likely to scan their environments for fear cues even when this hypervigilance promotes misidentification of other negative emotions as fear. Similarly, youth with PTSD symptoms misidentify angry faces more often than sad faces, a more novel finding warranting further investigation. Misinterpretation of facial affect may contribute to the maintenance of PTSD symptoms or reflect sequelae of hypervigilant scanning for danger.

In contrast, CD symptoms were uniquely associated with relative deficits in recognizing sad faces, suggesting that youth with CD are less effective at recognizing others' sadness, pain, and suffering. Specifically, youth with CD symptoms were more likely to misidentify sadness as anger. The relation of CD to facial affect processing deficits has been mixed in previous studies and, unexpectedly, in this study CD symptoms were not associated with deficits in the recognition of angry faces as they have been in previous work (Fairchild et al., 2009) when analyzed in a model with PTSD symptoms. This preliminary finding suggests that problems with aggression in CD may not be a function of misinterpreting others' expressions of anger, but rather driven by different mechanisms, such as emotional dysregulation or callousness (Blair et al., 2001; de Wied et al., 2012). Displays of sadness are those that are most likely to stop behavior that is causing significant loss or hardship to others (e.g., loss of a person, money, etc.) and to motivate prosocial reactions like sympathy and helping behavior in response to the distress (Nesse, 1990). Thus, difficulty interpreting displays of sadness, and specifically misidentifying sadness as anger, may contribute to the impaired affective bonding, low empathy, and callous behavior observed in teens with CD (Frick and White, 2008). Research investigating how CD interacts with other traits, such as callous-unemotional tendencies and depression, to influence affect recognition deficits could provide further clarification to mixed findings.

Though more work is needed to better understand the translational implications of laboratory studies of facial affect recognition, these findings also generate testable hypotheses about potential treatment implications. For example, they suggest that enhancing accuracy of affect recognition may be important treatment targets for youth with PTSD and CD symptoms. One approach may be to implement training programs that increase accurate affect recognition in teens with deficits. Research has shown that emotion recognition can improve with computerized and interpersonal training exercises (Sachs et al., 2012), including in youth with callous-unemotional traits and autism (Dadds et al., 2012; Dadds et al., 2006; Golan et al., 2010). Implementing these programs in therapeutic schools may be particularly feasible and useful, given that daily contact with youth provides extensive opportunity for practice and staff feedback on affect recognition across social contexts. Investigating whether improving the accuracy of emotional expressions actually translates to improvements in the social, emotional, and behavioral functioning, and the feasibility of implementing such programs in therapeutic schools, is a potentially fruitful avenue for future research.

Examining the efficacy of treatments that focus on changing youth's relational contexts to promote opportunities to develop accurate affect recognition is another mechanism for testing the treatment implications of this type of work. For instance, parent training programs and family systems approaches have the potential to target maladaptive relational structures and pinpoint the ways in which youth affect recognition deficits create ineffective feedback loops (Kaminski et al., 2008). An exemplar of this work is advanced by the National Youth Traumatic Stress Network, which has identified therapeutic approaches effective for youth with histories of trauma and who report challenges with anger and sadness recognition in particular (Pynoos et al., 2008). Promising targets of parent and caregiver training relevant for facial affect recognition deficits include modeling prosocial versus hostile appraisal styles to reduce misidentification of anger (Root and Jenkins, 2005), using facilitative communication (e.g., active listening) to promote accurate identification of sadness (Sheeber et al., 2000), and using acceptance based interpersonal strategies to buffer the effects of fear related to trauma (Bailey et al., 2006).

Study limitations to consider include the use of cross-sectional data, which prevents drawing conclusions about causal relationships between impaired facial affect recognition and PTSD and CD symptoms. Future research employing prospective designs are needed to evaluate whether deficits in affect recognition represent vulnerability for, or consequences of, PTSD and CD symptoms, as this study did not know the time or nature of the trauma. Results can, however, speak to a common pathway to abnormal affect recognition in youth with PTSD symptoms. One barrier to interpreting the results is that we were not able to ascertain the type of misattribution error youth made on a particular trial, and thus, cannot say whether they were consistently interpreting sad faces as another emotional expression. Future research examining this topic is necessary to clarify if, for instance, youth with relatively higher PTSD symptoms were misidentifying angry faces as fearful. Null findings for youth with PTSD symptoms that suggest no difference in recognizing sad versus fearful faces also warrant further consideration, particularly in the context of research that can clarify whether youth conflate fearful and sad faces (Dolan, 2002). Null results should be interpreted with caution, and additional research with larger samples is needed to assess the reliability of the findings and potential moderators that were not explored (e.g., other types of psychopathology). Although consistent with the rates of PTSD reported in other studies of adolescents recruited from clinical settings (Brown et al., 2010), the proportion of the sample endorsing PTSD symptoms was modest. Additionally, correlations between psychopathology and relative deficits in affect recognition were low, indicating small to moderate effect sizes. Despite using a well-validated measure (Shaffer et al., 2000), psychopathology symptoms were assessed using self-report and collateral information from parents and clinicians were not available, which is a limitation. The study also has multiple strengths, including the sample of adolescents with elevated rates of PTSD and CD symptoms, a well-validated affect recognition task, and the novel analytic approach by examining comorbidity between disorders with overlapping symptoms. Findings advance knowledge of emotional processing deficits by elucidating the associations of PTSD and CD symptomatology with facial affect recognition in adolescents with emotional and behavioral problems.

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Key Practitioner Message

- Posttraumatic stress disorder (PTSD) and conduct disorder (CD) often co-occur.
- Impaired facial affect recognition has been associated with exposure to trauma.
- We examine PTSD and CD symptom severity in relation to affect recognition in youth with serious emotional and behavioral problems.
- PTSD symptoms were associated with false identification of angry faces as fearful.
- CD symptoms were associated with greater difficulty correctly identifying sadness.

Table 1

Descriptive Statistics for Correct Responses and Affect Recognition Effects Contrasts (N = 371)

Descriptive Statistics			
Emotion	M (SD)	Min/Max	Range
Sadness	4.4 (1.3)	0-6	0-6
Anger	3.6 (1.2)	0-6	0-6
Fear	4.2 (1.3)	0-6	0-6
Total Correct	12.2 (2.6)	5-18	0-18
Affect Recognition Contrasts			
Emotion	$F_{(2,369)} = 51.5$	$p < .001$	$\eta^2_p = .21$
Anger vs. Fear	$F_{(1,370)} = 57.2$	$p < .001$	$\eta^2_p = .13$
Anger vs. Sad	$F_{(1,370)} = 88.9$	$p < .001$	$\eta^2_p = .19$
Sad vs. Fear	$F_{(1,370)} = 3.6$	$p > .05$	$\eta^2_p = .01$

Note. Anger vs. Fear = number correct on angry trials – number correct on fear trials. Anger vs. Sad = number correct on angry trials – number correct on sad trials. Sad vs. Fear = number correct on sad trials – number correct on fear trials.

Table 2

Affect Recognition Effects by Psychopathology Symptoms (N = 371)

PTSD Symptoms × Emotion	$F_{(2,365)} = 3.54$	$p = .030$	$r^2_p = .02$
Anger vs. Fear	$F_{(1,366)} = 6.06$	$p = .014$	$r^2_p = .02$
Anger vs. Sad	$F_{(1,366)} = 3.93$	$p = .048$	$r^2_p = .01$
Sad vs. Fear	$F_{(1,366)} = 0.17$	$p > .68$	$r^2_p = .00$
CD Symptoms × Emotion	$F_{(2,365)} = 3.20$	$p = .042$	$r^2_p = .02$
Anger vs. Fear	$F_{(1,366)} = 2.32$	$p > .13$	$r^2_p = .01$
Anger vs. Sad	$F_{(1,366)} = 1.28$	$p > .26$	$r^2_p = .00$
Sad vs. Fear	$F_{(1,366)} = 6.35$	$p = .012$	$r^2_p = .02$
PTSD × CD Symptoms × Emotion	$F_{(2,363)} = 0.85$	$p > .43$	$r^2_p = .01$
Anger vs. Fear	$F_{(1,364)} = 1.10$	$p > .29$	$r^2_p = .00$
Anger vs. Sad	$F_{(1,364)} = 1.33$	$p > .25$	$r^2_p = .00$
Sad vs. Fear	$F_{(1,364)} = 0.01$	$p > .91$	$r^2_p = .00$

Note. Data are results from the repeated-measures MANCOVA. PTSD = Posttraumatic Stress Disorder. CD = Conduct Disorder. * $p < .05$

Table 3
Affect Recognition Errors Associated with Psychopathology Symptoms (N = 371)

	PTSD Symptoms	CD Symptoms
Total False Positives		
Anger	$r = -.04$	$r = .07$
Fear	$r = .11^*$	$r = .07$
Sad	$r = .10$	$r = -.02$
False Positive Emotion Contrasts		
Misjudged Anger as Fear	$r = .11^*$	$r = -.03$
Misjudged Anger as Sad	$r = .10$	$r = .02$
Misjudged Fear as Anger	$r = .00$	$r = .01$
Misjudged Fear as Sad	$r = .08$	$r = -.06$
Misjudged Sad as Fear	$r = .07$	$r = .09$
Misjudged Sad as Anger	$r = -.07$	$r = .11^*$

Note. PTSD = Posttraumatic Stress Disorder. CD = Conduct Disorder.

* $p < .05$