Emotional Reactivity and the Emergence of Conduct Problems and Emotional Symptoms in 7- to 11-Year-Olds: A 1-Year Follow-up Study

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ABSTRACT

Objective: To determine whether individual differences in emotional reactivity predicted high levels of conduct problems and/or emotional (depressive and anxiety) symptoms at 1-year follow-up in a community sample of 7- to 11-year-old children ($N = 659$). **Method:** The study used a prospective design with picture perception methodology at baseline to elicit emotional responses from children. Conduct problems and symptoms of anxiety and depression were evaluated using repeated measures from self-, teacher, and parent report questionnaires completed at baseline and 1 year. **Results:** Children who reported decreased emotional arousal to unpleasant ($B = -0.069$; $p = .011$) and pleasant ($B = -0.134$; $p = .036$) pictures showed higher levels of self-reported and teacher-reported conduct problems at 1-year follow-up, respectively. Conversely, children who reported increased emotional arousal to neutral pictures ($B = 0.661$; $p = .030$) at baseline showed higher levels of anxiety symptoms at follow-up. These findings held when baseline level of problems and symptoms, sex, age, socioeconomic status, and IQ were taken into account. Findings were nonsignificant for symptoms of depression at the multivariate level of analyses. **Conclusions:** Although findings showed that symptom level at baseline remains the best predictor of symptom level at follow-up, these prospective findings extend previous reports in children and adults and provide predictive validity for decreased arousal correlating with high levels of subsequent conduct problems and increased arousal correlating with high levels of subsequent anxiety symptoms. Differences in emotional processing may constitute a risk process for the subsequent onset of conduct and anxiety disorder in middle childhood. *J. Am. Acad. Child Adolesc. Psychiatry,* 2008;47(5):565–573. **Key Words:** emotional reactivity, arousal, conduct problems, anxiety, depression.

Several authors[1–4] have proposed that emotion is fundamentally organized by two systems, one appetitive and one defensive, that have evolved to mediate

transactions in the environment. Lang and colleagues[5] developed the International Affective Picture System (IAPS) for use in experiments to determine individual differences in the emotional and attention processes involved in these two systems. The IAPS consists of a set of visual stimuli and has been used in several studies to investigate the nature of emotion that arises from the activation of basic motivational systems controlling approach/appetite or defense/withdrawal mechanisms subserving behavioral activity.

The IAPS measures two dimensions of response to emotionally laden pictures: valence, defined as the degree to which the visual stimuli are pleasant through to unpleasant, and arousal, defined as the degree to which the stimuli has resulted in a high through to a low level of intensity (arousal). As such, humans tend to approach stimuli with positive valence and high intensity while avoiding stimuli of high negative valence and high intensity (arousal). In normal populations of

adults and children, the relation between valence and arousal is best represented by a boomerang-shaped scatterplot indicating a quadratic association.[6,7] Physiological measures of affective arousal have been shown to be sensitive to picture content. Studies have shown that the subjective reports of the strongest emotional arousal are associated with the largest skin conductance responses, most pronounced cardiac deceleration, and the greatest modulation of the startle reflex when participants viewed pictures depicting highly unpleasant content (e.g., threat, violent death) versus neutral stimuli in both adults[1] and children.[6]

In psychiatric samples, the work of Lang and colleagues[4] and others[8] in adults have shown that psychiatric conditions differ importantly in patterns of arousal (emotional reactivity), perhaps reflecting variations in the neurophysiology that subserve psychiatric conditions. For instance, antisocial individuals with psychopathic traits react with probe startle inhibition and display underarousal in their psychophysiological reactions[9,10] to stimuli that most normally functioning people would find upsetting and emotionally arousing.[4] Similar findings for severely antisocial adolescents who have been excluded from mainstream schools have been reported.[11] None of these studies demonstrated differences in terms of valence ratings.

Variability in emotional reactivity (intensity or arousal) has been reported for anxiety and depressive symptoms. In contrast to antisocial individuals, patients with high state anxiety demonstrate increased arousal in response to unpleasant picture stimuli. Previous studies in adults have reported that participants with higher state anxiety show greater fear-potentiated startle in response to unpleasant stimuli,[12] larger increases in corrugator electromyographic activity, and a greater number of skin conductance responses both during and after exposure to unpleasant pictures compared to low scorers in a community sample.[13] Moreover, different anxiety disorders seem to relate to different patterns of emotional reactivity. For instance, simple phobia appears to be a cue-specific disorder, with defense responses readily activated by explicit phobic imagery, whereas panic disorder is characterized by a more general hyperreactivity, perhaps suggesting a temperamental sensitivity of the defense system.[4] Although increased emotional arousal to unpleasant stimuli seems to be a hallmark of anxiety disorders, it has been shown that depressed individuals demonstrate relatively decreased arousal to positive stimuli.[8,14,15]

To date, most of the above studies have been cross-sectional, and the predictive validity of individual differences in emotional reactivity for the emergence of clinically relevant conduct problems in either adults or children is not known. In addition, few studies have investigated the relation between psychopathology and emotional reactivity in children. Sharp and colleagues[7] reported that in a cross-sectional community sample of 7- to 11-year-old children IAPS pictures were effective in eliciting the same quadratic relation between valence and arousal ratings found for adults, girls rated unpleasant pictures with higher negative valence than boys, and children scoring high on conduct problems rated unpleasant pictures as less arousing than did low-scoring children. In that report, we demonstrated no relation between valence ratings in response to pleasant, neutral, or unpleasant pictures that distinguished groups on measures of child psychopathology. In the present study, we therefore focus solely on arousal ratings.

Our main objective was to investigate the predictive validity of emotional reactivity (arousal) for subsequent conduct problems and emotional symptoms (depression and anxiety), taking into account initial levels of behavior, age, general cognitive ability, and the known sex bias (males > females) for behavioral difficulties[16] and emotional symptoms, especially where depression is concerned (females > males[17]). Sex differences are particularly relevant because these differences have been reported for emotional reactivity to unpleasant pictures in children.[6,7]

We aimed to test three hypotheses. The first is that children who show lower reactivity (arousal) on the IAPS at baseline in response to unpleasant pictures would demonstrate higher levels of conduct problems at 1 year. We expected that arousal ratings would predict conduct problems at follow-up, even when controlling for the possible confounding effects of sex, age, socioeconomic status (SES), baseline level of conduct problems, and general cognitive ability. Second, we tested the hypothesis that increased subjective report of arousal in response to negative stimuli at baseline would be an independent predictor of high levels of anxiety at follow-up. Third, we tested the hypothesis that decreased subjective arousal at baseline in response to pleasant pictures would be predictive of high levels of depressive symptoms at 1-year follow-up.

METHOD

Participants

The present investigation forms part of a larger scale study of the social-cognitive and emotional processing correlates of antisocial behavior in community children (the Child Behaviour Study). An unselected sample of 7- to 11-year-old children (N = 659) were studied for 1 year. Full details on recruitment and strategies for determining the representativeness of the sample are described elsewhere.[7,18] The ascertained sample showed no evidence of participation bias and was representative of children attending elementary schools in the Cambridgeshire Education Area (England).

The mean age of the sample was 9 years, 3 months (SD 1 year, 2 months) and the mean IQ was 105 (SD 15); there were 319 boys (48%) and 340 girls (52%). The ethnic distribution in the sample was in line with U.K. regional statistics[19,20] for eastern England (97% white, 2% Asian [central Asia], 0.5% black, and 0.5% Oriental [e.g., Japan, China]). According to ACORN (see Measures section for description), our sample comprised the offspring of 40% wealthy achievers, 9% urban prosperous, 28% comfortably well-off, 9% moderate means and 14% hard pressed, typical for eastern England.

Measures

IAPS. Based on normative responses to the IAPS by 7- to 11-year-olds as published in the IAPS manual,[5] 27 pictures were selected to cover a wide range of emotional content. Pictures covered all nine categories of pleasure (high, medium, low) × arousal (high, medium, low), with three pictures in each category. Full details of the selected pictures are published elsewhere.[7] All of the pictures were mounted as A4 (210 × 297 mm) color photographs with high figure–ground contrast to facilitate discrimination of relevant features. Child psychologists reviewed the pictures for age appropriateness. Photographs were set in a fixed sequence, randomly determined in advance, and the same for all of the participants. Baseline data for this measure were complete for 649 (98%) of the full sample (N = 659). Ten children declined to do the task and were not required to explain why.

To subjectively report their emotional reactions, children used a paper-and-pencil version of the Self-Assessment Manikin (SAM).[21] This is a child-friendly approach that enables children to make dimensional ratings of arousal on a 9-point scale, with 1 indicating low arousal and 9 indicating high arousal. This approach has been shown to yield valid responses in children.[6,7] For determining indices of arousal, we followed standard convention in using IAPS subjective ratings[6,7] and calculated the mean of arousal ratings to unpleasant, pleasant, and neutral pictures.

IAPS photographs were mounted on a stand and shown for 10 seconds with a 10-second interval between photographs. As suggested by the manual, children were trained to use the SAM in a practice trial. Following McManis et al.,[6] words such as calm, relaxed, bored, or sleepy and excited, nervous, or wide-awake described the endpoints for the arousal scale. We have previously reported that administering the IAPS is effective for evaluating emotion response to affectively valent and arousing stimuli even in a school setting where rigorous experimental conditions could not be upheld.[7]

Measures of Conduct Problems

For all psychopathology measures, a higher score implied a higher level of symptoms.

Parent and Teacher Report. Parents and teachers completed the Strengths and Difficulties Questionnaire (SDQ).[22–24] The SDQ was specifically designed to screen for common psychiatric disorders in community samples. It makes separate predictions for three groups of disorders: conduct-oppositional disorders, hyperactivity-inattention disorders, and anxiety-depressive disorders.[25] The SDQ has been shown to identify individuals with psychiatric diagnoses with a specificity of 94.6% (95% confidence interval 94.1%–95.1%) and a sensitivity of 63.3% (95% confidence interval 59.7%–66.9%) and internal consistency of Cronbach α = .73.[24] Sensitivity for the SDQ has been demonstrated to be especially good (70%–90%) for identification of conduct-oppositional disorders. For the purposes of the analyses in this study, we used continuous scores on the Conduct Problems subscale of the SDQ.

Self- (Child) Report. Children were asked to complete 10 self-report questions on current disruptive behavior derived from the *DSM-IV* criteria for conduct disorder. The α coefficient for this measure was shown to be .75.[26]

Measures of Emotional Symptoms

Parent-and Teacher Reported Symptoms of Emotional Disorder. The Anxiety/Depression subscale of the SDQ[25] was used as an index of anxiety-depressive symptoms. This subscale was not designed to screen for either depression or anxiety in particular, but rather a combination of the two. For the purposes of this analysis, we used continuous scores on the Anxiety/Depression subscale of the SDQ.

Self- (Child) Reported Symptoms of Internalizing Disorder. The Mood and Feelings Questionnaire[27] is a widely used 33-item self-report questionnaire designed to cover the symptom areas specified by the *DSM-III-R*[28] for major depressive disorder.[29] The child form has good test-retest reliability (r = 0.78) and adequate internal consistency.[30] Using latent trait modeling, the short form of the Mood and Feelings Questionnaire was shown to have excellent psychometric properties for use in community samples of 7- to 11-year-old children.[31]

The Revised Manifest Anxiety Scale is a 37-item self-report questionnaire of current anxiety in children.[32] It produces a total score that is used in the present study. Test-retest reliability in primary school children has ranged from 0.98 over 3 weeks[33] to 0.68 over 9 months, and adequate internal consistency has been reported.[34]

IQ. A shortened version (Vocabulary and Block Design) of the WISC[35] was individually administered to children. This shortened method has been validated to be an adequate measure of IQ.[36] Sattler's[36] guidelines were used to score the measure.

SES. To determine SES, we used a geodemographic tool called ACORN, which is available on the Internet (*http://www.caci.co.uk/ acorn/default.asp*). ACORN categorizes all 1.9 million U.K. postal codes, which have been described using more than 125 demographic statistics within England, Scotland, Wales, and Northern Ireland, and 287 lifestyle variables, making it a powerful discriminator for social class. For our purposes, we used ACORN's five-class system to determine membership to one of the following: 0 for wealthy achievers, 1 for urban prosperity, 2 for comfortably well-off, 3 for moderate means, and 4 for hard pressed.

Procedures

Approval from the local ethics board for the present study was sought and obtained before data collection. School principals who consented to an invitation for their school to participate were given

information packets and consent forms to pass on to children and parents. Our research team did not have access to names and contact details of parents or children before consent. Mailed informed consent was obtained from all of the parents, and child assent was obtained in person before data collection. Parents were informed that part of the consent implied that their child's class teacher would complete the SDQ. IQs were obtained through individual assessments with the children at school. The IAPS was administered during the same individual testing session. These sessions took place in a quiet room at school with adequate lighting. At 1 year after baseline, teachers, parents, and children were asked to complete the psychopathology measures by mail. To increase retention rates, parents or head teachers were telephoned twice if follow-up questionnaires were not returned within 2 weeks of mailing.

Data Analysis Strategy

Bivariate correlational analyses were conducted to investigate the relations between main study variables. These analyses were followed by linear regression analyses in which measures of emotional reactivity were tested for their contribution to conduct problems and independently to anxiety and depression symptoms at follow-up together with baseline problems and symptoms. The putative effects of other covariates (age, sex, SES, and IQ) were also examined. In all of the analyses, the p value was set at .05.

We conducted analyses separately for self-, parent-, and teacher-reported scores because ample empirical evidence during the past 20 years testifies to the fact that correlations between parent, teacher, and self-reports are significant, but low, or low to moderate at best and that each provides a unique and independent perspective on the child's functioning.[37,38]

RESULTS

Response Rates and Attrition Analyses

The response rates for the parent report were 88% at baseline ($n = 570$) and 68% at 1-year follow-up ($n = 445$). The response rates for teacher report were 95% at baseline ($n = 617$) and 60% at 1 year ($n = 394$). The response rates for child report were 98% at baseline ($n = 649$) and 66% at 1-year follow-up ($n = 439$).

We used the child self-report conduct problems data to examine possible attrition effects. For these analyses, completers ($n = 439$) were defined as children who had self-report data at 1-year follow-up. Noncompleters ($n = 220$) were children whose self-report at 1 year was missing.

No significant differences were found for arousal ratings to pleasant or unpleasant pictures between completers and noncompleters. However, there was a marginally significant difference between completers and noncompleters for neutral pictures ($p = .04$). Noncompleters (mean 2.42) reported higher arousal ratings compared to completers (mean 2.15).

No significant differences were found for baseline self- or parent-reported conduct scores at either baseline or follow-up. Completers (mean 0.74) did, however, show higher teacher-reported conduct scores at baseline (mean 0.51) than noncompleters ($p = .0006$).

Completers and noncompleters did not differ in baseline or follow-up teacher- and parent-reported symptoms of anxiety and depression. However, noncompleters (mean 23.02) self-reported significantly higher anxiety scores than completers at baseline (mean 21; $p = .03$). Noncompleters (mean 20.64) also self-reported significantly higher symptoms of depression at baseline than completers (mean 18.82; $p = .02$).

Completers and noncompleters furthermore did not differ in terms of age or in terms of the amount of boys and girls who completed the study versus those who did not. However, a significant difference ($p < .001$) was detected for IQ between completers (mean 106.54) and noncompleters (mean 100.04). Despite the fact that this difference is statistically significant, we do not consider it clinically significant, with the mean IQ of both completers and noncompleters falling within normal range.

Finally, completers and noncompleters differed in terms of SES. We ran a χ^2 for differences in the five ACORN levels of SES by whether the child completed the study. Results showed that of those in the wealthy achievers category, 26.79% did not complete; 33.87% of those in the urban prosperity group did not complete; 36.26% of those in the comfortably well-off group did not complete; 35.71% of the moderate means did not complete; and 44.68% of those in the hard-pressed group did not complete at 1-year follow-up ($p = .02$). We further explored this by grouping the first four groups together to form two groups: a moderate to wealthy means group ($n = 565$) compared with the hard-pressed group ($n = 94$). A χ^2 analysis confirmed that families from the lower SES group (hard pressed) were more likely to be noncompleters than completers at follow-up ($p = .01$), with 31.50% of those in the higher SES group identified as noncompleters versus 44.68% of those in the hard-pressed group.

Emotional Reactivity at Baseline and Conduct Problems at 1-Year Follow-up

Table 1 summarizes Pearson correlations (uncorrected) between self-reported arousal ratings and measures of baseline and follow-up conduct problems as rated by multiple sources, age, and IQ.

TABLE 1
Correlations (Uncorrected) Between Self-Reported Arousal Ratings and Measures of Baseline and Follow-up Conduct Problems as Rated by Multiple Sources, Age, and IQ

	Unpl	Neut	Pleas	SR1	PR1	TR1	IQ	Age	SR2	PR2	TR2
Unpl	—	−0.11**	−0.09*	−0.05	−0.12**	−0.20**	0.17**	0.16**	0.15**	−0.12**	−0.05
Neut		—	0.17**	0.16**	0.08*	0.14**	−0.23**	−0.24**	0.05	−0.03	0.09
Pleas			—	0.01	0.04	0.07	−0.04	−0.07	0.11*	−0.02	−0.06
SR1				—	0.10**	0.24**	−0.23**	0.006	0.41**	0.10*	0.06
PR1					—	0.33**	−0.22**	−0.04	0.21**	0.35**	0.23**
TR1						—	−0.19**	−0.03	0.23**	0.29**	0.29**
IQ							—	−0.01	0.11*	−0.11*	−0.19**
Age								—	0.03	0.01	−0.01
SR2									—	−0.28**	0.0.04
PR2										—	0.28**
TR2											—

Note: Unpl = unpleasant pictures; Neut = neutral pictures; Pleas = pleasant pictures; SR1 = self-reported conduct problems at baseline; PR1 = parent-reported conduct problems at baseline; TR1 = teacher-reported conduct problems at baseline; SR2 = self-reported conduct problems at 1-year follow-up; PR2 = parent-reported conduct problems at 1-year follow-up; TR2 = teacher-reported conduct problems at 1-year follow-up.
* $p \leq .05$; ** $p \leq .01$.

Bivariate analyses show that arousal ratings to unpleasant pictures correlated negatively with teacher- and parent-reported conduct problems at baseline and self- and parent-reported conduct problems at 1-year follow-up. Arousal ratings to neutral pictures correlated positively with conduct problems rated by all sources at baseline. No correlations were significant for 1-year follow-up conduct problems. Although arousal ratings to pleasant pictures were not correlated with any baseline measures of conduct problems, they were positively correlated with self-reported conduct problems at follow-up.

From the linear regressions, we report only those findings that showed significance for arousal ratings as an independent predictor of conduct problems at 1-year follow-up. We organize the findings according to picture type.

Unpleasant Pictures. Table 2 contains the results of a linear regression with child self-report conduct problems at 1-year follow-up as the outcome. Sex, IQ, age, arousal ratings in response to unpleasant pictures, initial level of self-reported conduct problems, and the dichotomized SES variable that we used in the attrition analyses were predictor variables.

Sex (males > females), higher initial level of self-reported conduct problems, and decreased arousal ratings made independent contributions to levels of self-reported conduct problems at follow-up. The model accounted for 19% of the variance in outcome. Next, we considered the possibility that sex and arousal ratings

TABLE 2
Linear Regression With 1-Year Follow-up Child Self-Reported Conduct Problems as Outcome and Initial Level of Child Self-Reported Conduct Problems, Age, Sex, IQ, SES, and Arousal Ratings to Unpleasant Pictures as Predictor Variables

						95% CI for *B*	
Variable at Baseline	*B*	SE	β	*t*	*p*	Lower	Upper
Sex (male > female)	−0.312	0.126	−.111	−2.48	.013	−0.56	−0.07
IQ	−0.003	0.004	−.034	−0.727	.416	−0.01	0.005
Age	0.002	0.004	.023	0.518	.604	−0.006	0.011
Arousal (unpleasant pictures)	−0.069	0.027	−.115	−2.544	.011	−0.123	−0.016
Baseline self-reported conduct	0.218	0.026	.375	8.333	<.001	0.166	0.269
SES	0.096	0.193	.022	0.498	.618	−0.284	0.477
Constant	0.958	0.685		1.400	.162	−0.387	2.304

Note: R^2 = 0.192; SES = socioeconomic status; CI = confidence interval.

TABLE 3

Linear Regression With 1-Year Follow-up Teacher-Reported Conduct Problems as Outcome and Initial Level of Teacher-Reported Conduct Problems, Age, Sex, IQ, SES, and Arousal Ratings to Pleasant Pictures as Predictor Variables

Variable at Baseline	B	SE	β	t	p	95% CI for B	
						Lower	Upper
Sex (male > female)	−0.650	0.254	−.132	−2.562	.013	−1.149	−0.151
IQ	−0.026	0.008	−.173	−3.267	.001	−0.041	−0.010
Age	−0.004	0.009	−.025	−0.506	.613	−0.021	0.013
Arousal (pleasant pictures)	−0.134	0.064	−.106	−2.102	.036	−0.260	−0.009
Baseline teacher-reported conduct	0.327	0.085	.202	3.839	<.0001	0.159	0.494
SES	0.763	0.350	.111	2.179	.030	0.074	1.453
Constant	5.332	1.480		3.602	.000	2.421	8.244

Note: R^2 = 0.135. SES = socioeconomic status; CI = confidence interval.

may interact in the prediction of conduct problems. We reran our regression analyses with an interaction variable (arousal ratings to unpleasant pictures x sex) but found that the interaction variable was nonsignificant (B = 0.04; p = .44). This suggests that sex does not moderate the relation between arousal ratings and conduct problems but that sex and arousal ratings are indeed independent predictors of conduct problems.

Pleasant Pictures. Table 3 contains results of a linear regression with teacher-reported conduct problems as outcome. Sex, IQ, age, arousal ratings in response to pleasant pictures, initial level of teacher-reported conduct problems, and SES were predictor variables.

Increased conduct problems were predicted by lower arousal, sex (males> females), lower IQ, SES (hard pressed > moderate-wealthy) and higher initial level of conduct problems. The model accounted for 13% of the variance in outcome. As with the unpleasant pictures, we reran our regression analyses with an interaction variable (arousal ratings to pleasant pictures × sex) but, again, found that the interaction variable was non-significant (B = −0.19; p = .14), indicating no moderating effect of sex on the relation between arousal ratings and conduct problems.

Together, these two models indicate that decreased arousal at baseline in response to unpleasant and

TABLE 4

Correlations (Uncorrected) Between Self-Reported Arousal Ratings, Measures of Baseline, and Follow-up Symptoms of Anxiety and Depression as Rated by Multiple Sources, Age, and IQ

	Unpl	Neut	Pleas	SRM1	SRA1	TA/D1	PA/D1	Age	IQ	SRM2	SRA2	TA/D2	PA/D2
Unpl	—	−0.11**	−0.09*	−0.06	−0.05	−0.07	−0.01	0.16**	0.18**	−0.09	−0.04	0.00	−0.04
Neut		—	0.17**	0.10**	0.07	0.05	0.02	−0.24**	−0.23**	0.14**	0.15**	0.12*	−0.09
Pleas			—	0.04	0.07	0.06	0.03	−0.07	−0.04	0.03	−0.02	−0.05	−0.04
SRM1				—	0.84**	0.23**	0.20**	−0.05	−0.17**	0.46**	0.42**	0.02	0.13**
SRA1					—	0.22**	0.22**	−0.02	−0.11**	0.45*	0.46**	0.00	0.14**
TA/D1						—	0.23	−0.07	−0.20**	0.06	0.04	0.28**	0.12**
PA/D1							—	0.00	−0.06	0.15**	0.18**	0.17**	0.47**
Age								—	0.01	−0.02	−0.03	−0.11*	−0.02
IQ									—	−0.10*	−0.05	−0.20**	−0.09
SRM2										—	0.88**	0.03	0.20**
SRA2											—	0.002	0.21**
TA/D2												—	0.25**
PA/D2													—

Note: Unpl = unpleasant pictures; Neut = neutral pictures; Pleas = pleasant pictures; SRM1 = self-reported mood (depressive) symptoms at baseline; SRA1 = self-reported anxiety symptoms at baseline; TA/D1 = teacher-reported anxiety/depression symptoms at baseline; PA/D1 = parent-reported anxiety/depression symptoms at baseline; SRM2 = self-reported mood (depressive) symptoms at 1-year follow-up; SRM2 = self-reported mood (depressive) symptoms at 1-year follow-up; SRA2 = self-reported anxiety symptoms at 1-year follow-up; TA/D2 = teacher-reported anxiety/depression symptoms at 1-year follow-up; PA/D2 = parent-reported anxiety/depression symptoms at 1-year follow-up.

* $p \leq .05$; ** $p \leq .01$.

pleasant pictures contributed to high levels of conduct problems at follow-up.

Emotional Reactivity at Baseline and Symptoms of Internalizing Disorder at 1-Year Follow-up

Table 4 summarizes Pearson correlations (uncorrected) between age, IQ, self-reported arousal ratings, and measures of baseline and follow-up symptoms of anxiety and depression as rated by multiple sources. Results showed that more intense emotional reactions to neutral pictures at baseline were associated with higher levels of child self- and teacher-reported symptoms of anxiety and depression at 1-year follow-up.

Linear regressions with all follow-up measures of anxiety and depression were conducted. The only positive findings for arousal were with emotionally neutral pictures and self-reported anxiety symptoms at follow-up as outcome variable. These are shown in Table 5.

Increased arousal ratings together with higher initial level of anxiety symptoms to neutral pictures were independently associated with high levels of self-reported anxiety symptoms at follow-up. The model accounted for 21% of the variance in outcome. No significant results were found for depressive outcomes. No significant results were found for arousal to pleasant or unpleasant picture types.

DISCUSSION

This study provides the first evidence of a prospective relation between decreased arousal to unpleasant stimuli and subsequent conduct problems over a 1-year follow-up period. This was found independent of individual differences in general cognitive ability and the effects of sex. The findings are consistent with those suggesting that adults with antisocial personality disorder, specifically those with psychopathic features, show an abnormal psychophysiological response to aversive picture stimuli.[10,39,40] The findings may also fit with an emerging literature suggesting that within the group of children who show antisocial and aggressive behavior, there may be subgroups that differ in part as a consequence of their lowered emotional responsiveness to environmental stimuli and may be indifferent to the feelings of others and possess higher levels of callous-unemotional traits.[41,42] The present findings suggest that decreased emotional reactivity to aversive stimuli may be a component of these traits and a predictor of emerging clinically meaningful antisocial behavior.

The second main finding is the demonstration of a link between increased arousal to neutral pictures and the subjective report of subsequent anxiety symptoms in children. This, too, is a novel finding in a child sample that fits moderately well with similar findings for anxious adults,[13] which have shown increased arousal in relation to negative rather than neutral stimuli as in this study. Increased arousal to neutral stimuli may index increased and abnormal threat perception. For instance, it has been demonstrated that high levels of general and state anxiety are significantly related to increased threat perception and lower threat thresholds in children when subjects are presented with ambiguous stimuli.[43]

Although we expected to find a correlation between decreased arousal to pleasant pictures and concurrent or longitudinal reports of depressive symptoms, this was not confirmed. Two possible explanations exist for this negative finding. First, the relation between depression and emotional processing seems to be more consistent with regard to the valence rather than intensity or

TABLE 5
Linear Regression With Child-Reported Anxiety Symptoms at 1-Year Follow-up as Outcome Variable and Age, Sex, IQ, and Initial Level of Child-Reported Anxiety Symptoms, and Baseline Arousal Ratings to Neutral Pictures as Predictor Variables

Variable at Baseline	B	SE	β	t	p	95% CI for B Lower	Upper
Sex (male > female)	−0.148	0.876	−.007	−0.169	.866	−1.869	1.573
IQ	0.008	0.027	.012	0.278	.782	−0.046	0.061
Age	−0.015	0.032	−.021	−0.476	.634	−0.078	0.048
Arousal (neutral pictures)	0.661	0.303	.101	2.184	.030	0.066	1.256
Baseline self-reported anxiety	0.420	0.041	.447	10.289	.000	0.340	0.500
Constant	6.466	5.347		1.209	.227	−4.044	16.977

Note: R^2 = 0.215. CI = confidence interval.

arousal or emotional stimuli.[8] We ran bivariate correlational analyses with valence ratings against symptoms of depression. Findings were nonsignificant. Second, it is possible that a relation between decreased arousal to pleasant stimuli and depression is only apparent in more severely disturbed children such as those ascertained from clinical samples. Indeed, a positive relation between depression scores and decreased arousal has been demonstrated in clinically depressed adult patients.[8] This suggests that it is not until there are marked depressive features perhaps involving anhedonic mood that loss of arousal to pleasurable stimuli can be detected.

Overall, we provide the first preliminary predictive validity data that picture perception methodology is sensitive enough to delineate patterns of emotional processing associated with different disorders in childhood. The present findings are in agreement with those of Lang and colleagues[4] and others[8] who have shown that diagnoses differ importantly in patterns of arousal (emotional reactivity), perhaps reflecting variations in the neurophysiology that subserve psychiatric disorders.

Notwithstanding the above contribution to the field, there are a number of study limitations that deserve mention. First, the findings are limited by not incorporating direct psychophysiological or neurobiological measures at the time of stimulus presentation. A recent study combining picture perception methodology and measures of heart rate and skin conductance in adolescents with conduct disorder is consistent with those presented in this article in showing lower physiological arousal compared to never mentally ill controls.[44]

A further limitation of the present study is that the parent- and teacher-report measures for both internalizing and externalizing symptoms were global and cannot therefore speak to the clinical heterogeneity of the disorders indexed by symptom reports alone. Moreover, although the Conduct Problem subscale of the SDQ has been shown to be a strong predictor of clinically determined conduct disorder, the Anxiety/Depression (emotional) subscale has been shown to be more likely to miss cases, especially in community samples.[25]

A further methodological challenge that we were unable to address in the present study was the fact that multiple children were recruited from the same classroom and had the same teacher and would therefore constitute a case of nonindependent observations. Future studies in the community school setting with a larger sample size may be better prepared to address issues of nonindependent observations.

Despite the above limitations, the findings reported here suggest a possible new approach to prevention or decrease in risk for conduct and anxiety problems in prepubertal children. First, this may be achieved through detecting children with low emotional arousal and increased risk for conduct problems and implementing a training strategy to improve emotion recognition and normative emotional responses. For instance, a recent study showed that deficits in emotional (empathic) responses to faces could be temporarily corrected in children ages 8 to 17 with psychopathic tendencies by asking the children to pay attention to the eye region of faces.[45] Further studies on those with low emotional arousal are warranted.

Second, these findings may be used to inform detection of overaroused children who may be at increased risk for anxiety disorders and benefit from exposure training to feared stimuli for which there is an existing literature.[46] These approaches could be community based and implemented via a school-focused approach. Teaching emotion skills could be part of a personal and social curriculum in the preadolescent school years. This approach may be more acceptable to children and parents because it focuses on a positive approach to learning about the emotional self rather than a negative and potentially stigmatizing approach to identifying children with overt problems that need removal.

An essential next step in addressing the limitations of the present study and developing further relevance for clinical practice is the inclusion of comprehensive clinical assessments in preadolescent community samples ascertaining cases within the full range of severity within longitudinal designs. Adding measures of the autonomic nervous system and hypothalamic pituitary axis, two physiological systems involved in arousal, response, and adaptation to emotional stimuli, although complex, would enhance the validity of valence and arousal measurement. Investigating the biological basis of emotion processing in addition to cognitive factors may be of added value in characterizing the determinants of childhood emotional and behavioral disorders and targeting interventions in more specific ways.

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