Reduced Electrodermal Activity in Psychopathy-Prone Adolescents

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This study tests the hypothesis that psychopathy-prone adolescents show reduced anticipatory skin conductance responding. Electrodermal activity was recorded while participants anticipated and responded to a 105dB signaled or unsignaled white-noise burst. Using an extreme groups design, the authors used Child Psychopathy Scale (D. R. Lynam, 1997) scores from a community sample of 335 male adolescents (age 16) to form control (n = 65) and psychopathy-prone (n = 65) groups. Significantly more psychopathy-prone participants were nonresponders in the signaled anticipatory (p = .014), signaled responsivity (p = .037), and unsignaled responsivity (p = .003) conditions compared with controls. Anticipatory hypersponsivity of psychopathy-prone adolescents similar to the electrodermal hypersensitivity found in psychopathic adults suggests that this autonomic impairment is present by adolescence and may predispose individuals to adult psychopathy.

The behavioral and criminal consequences of psychopathy may be the most remarkable and ostensibly harmful to society, but personality features are at the crux of the classic definition of the disorder (Arieti, 1967; Cleckley, 1964) and may hold the key to early identification and intervention. Personality is highly stable across time, and thus a logical approach to adult psychopathy is to consider its antecedent forms (Lynam, 1997). The study of an earlier manifestation of psychopathy, prior to the influence of harmful sequelae (e.g., time spent in prison, substance abuse) may allow more successful early intervention (Frick, Bodin, & Barry, 2000). Several researchers have begun to examine the construct of juvenile, or fledgling, psychopathy. For example, Frick, O’Brien, Wootton, and McBurnett (1994) found that adolescents with psychopathic traits were more likely to be diagnosed with conduct disorder and oppositional defiant disorder and to score higher on indices of aggression and delinquency. Lynam (1997) replicated this pattern of aggression and delinquency results in a larger sample and found that juvenile psychopathy was related to serious and stable offending across time and that psychopathy-prone individuals were more impulsive on a multitask impulsivity battery, relatively more prone to externalizing disorders, and relatively more immune to internalizing disorders. Moreover, Lynam et al. (in press) have demonstrated that juvenile psychopathy bears the same relations to a model of general personality as adult psychopathy.

Increasingly, research has sought to demonstrate that juvenile psychopathy is related to the same core processes that underlie adult psychopathy. For example, juvenile psychopathy is associated with deficits in moral and emotional processing (Blair, 1997; Blair, Colledge, Murray, & Mitchell, 2001). Psychophysiological functioning, however, is one area that has been studied at length in psychopathic adults but has received very little attention with respect to their juvenile counterparts. In the adult literature, no consistent differences have been found between psychopathic and nonpsychopathic individuals on tonic measures in a resting state,
such as skin conductance level and nonspecific fluctuations (Fowles & Furuseth, 1994; Hare, 1978a; Siddle, 1977). In contrast, a relatively robust finding with adult psychopathic individuals is that of reduced skin conductance responsiveness in anticipation of punishment (Fowles, 2000; Hare, 1965; Tharp, Maltzman, Syndulko, & Ziskind, 1980) and others’ pain (Aniskiewicz, 1979; House & Milligan, 1976). Siddle and Trasler (1981) concluded that psychopathic individuals exhibit attenuated electrodermal activity (EDA) when anticipating signaled aversive stimuli. Similarly, Hare (1978a) reviewed eight studies and concluded that, in comparison to nonpsychopathic individuals, psychopathic individuals show smaller increases in EDA in anticipation of a stressor. These findings appear relatively consistent across punishments and paradigms (Fowles, 2000). Reduced anticipatory fear has implications for both behavioral and interpersonal manifestations of psychopathy; it may index characteristics such as emotional deficits and impulsivity that underlie or heighten the psychopathic individual’s propensity for antisocial behavior and negative interpersonal relationships.

A second, associated psychophysiological outcome is the responsivity of psychopathic adults to the aversive stimulus itself, whether signaled or unsignaled. Psychopathic individuals are electrodermally hyporesponsive to an unsignaled 120dB tone (Hare, 1978b) and the insertion of a hypodermic needle (Hare, 1972). However, a more recent review of eight studies found only two that reported decreased responsivity in antisocial individuals (although not psychopathic individuals in particular) to aversive stimuli (Raine, 1993). As with tonic skin conductance, it is still unclear as to whether psychopathic individuals show an autonomic deficit when responding to an aversive stimulus.

If a pattern of attenuated electrodermal activity similar to that observed in psychopathic adults can be shown in psychopathic juveniles, it would provide evidence for the presence of the construct of psychopathy at both developmental levels. Specifically, if psychopathy-prone adolescents show the same hyporesponsivity as psychopathic adults in anticipation of an aversive stimulus, it might be argued that this autonomic deficit predisposes an individual to the adult manifestation of psychopathy.

Attention-deficit/hyperactivity disorder (ADHD) has also been linked to reduced EDA (Rosenthal & Allen, 1978; Schmidt, Solant, & Bridger, 1985) and may constitute a confound when it presents comorbidly with psychopathic tendencies. However, some studies have examined the EDA of antisocial children with and without ADHD and indicated that ADHD is not a confound. For example, Delameter and Lahey (1983) found that learning-disabled children characterized by both hyperactivity and conduct problems showed lower autonomic arousal on skin conductance measures than hyperactive children rated low on conduct problems. More recently, boys with the combination of ADHD and conduct disorder have exhibited smaller electrodermal orienting responses to aversive tones than boys with ADHD alone (Herpertz et al., 2001). Nevertheless, the question still remains as to whether the attenuated EDA found in psychopathy-prone adolescents is related to ADHD comorbidity; this question is thus addressed in the current study.

Presently, at the adult level, antisocial behavior is inextricably linked to the assessment of psychopathy and the disorder itself. Historically, the construct of psychopathy has been viewed as comprising two (Hare et al., 1990; Harpur, Hakstian, & Hare, 1988), three (Cooke & Michie, 2001), or, most recently, four (Hare, 2003) factors, with antisocial behavior consistently represented in the factor structure. Prior studies showing links between psychopathy and attenuated EDA may not have explicitly addressed the antisocial behavior of the psychopathic individuals and its relation to EDA, and thus it may be possible that the antisocial elements, and not the personality aspects of psychopathy, are responsible for the significant findings. A secondary goal of this study was to address this possibility by examining whether antisocial psychopathy-prone individuals differ from antisocial non-psychopathic individuals on skin conductance responding.

The central goal of the present study, involving both a rest period and a countdown stressor task, was to determine whether the reduced anticipatory skin conductance and hyporesponsivity to aversive stimuli that are characteristic of psychopathic adults are present in an adolescent sample.

We predicted that psychopathy-prone boys would be most likely to show hyporesponsivity on the countdown stressor (in which a white-noise burst was signaled by the countdown). The unsignaled anticipatory condition, without a countdown to signal the white-noise burst, most resembles a baseline condition and thus was predicted to yield results similar in direction to the tonic measures of the rest period. On the basis of the adult literature, psychopathy-prone boys were predicted to show no difference from control participants in resting states but possible hyporesponsivity in response to aversive stimuli. In addition, subsequent analyses examining ADHD with the same electrodermal variables would be expected to show that ADHD is not related to skin conductance responding in this sample. Among participants who exhibit serious delinquent behavior, analyses comparing the EDA of psychopathy-prone versus non-psychopathy-prone participants may be expected to show that hyporesponsivity is common to both psychopathic and nonpsychopathic antisocial individuals. The emergence of a pattern of attenuated EDA in a sample of psychopathy-prone boys would confirm that this psychophysiological deficit of psychopathic adults is present in an adolescent form of psychopathy.

Method

Participants

Participants comprised the youngest of three cohorts from the Pittsburgh Youth Study, a prospective, longitudinal study of antisocial behavior. A complete description of the participants and data collection is available elsewhere (Loeber, Farrington, Stouthamer-Loeber, & Van Kammen, 1998). In brief, 868 boys in first grade were recruited in the spring of 1987. The participants were then screened, and 250 boys with the highest risk of antisocial behavior were selected at random. An additional 253 (low risk) boys were randomly selected from the remaining participants, bringing the total number of participants to 503. One hundred sixty-eight participants were lost over the 10-year interval between recruitment and the current study for the following reasons: 45 refused to continue participation in the Pittsburgh Youth Study, 35 refused to participate in the psychophysiological deficit of psychopathic adults is present in an adolescent form of psychopathy.

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1 The participants at highest risk of antisocial behavior were those of the original cohort sample who scored in the upper third on a risk score that drew from teacher, parent, and self-reports of antisocial and delinquent-like acts (e.g., fire setting, shoplifting, gang fighting, and arrests). The remainder of the sample (the lower two thirds) was considered at low risk of antisocial behavior.
ADHD. To identify participants with ADHD symptoms as defined by the Diagnostic and Statistical Manual of Mental Disorders (DSM–III–R 3rd ed., rev.; American Psychiatric Association, 1987), we administered the revised Diagnostic Interview for Children (DISC–P; Costello, Edelbrock, Kalas, Kessler, & Klaric, 1982) to the mothers when the participants were age 7. Participants presenting with at least 8 out of 14 behaviors, lasting at least 6 months, were identified as meeting criteria for ADHD in this sample. A significantly greater proportion of psychopathy-prone participants met criteria for ADHD than control participants (43% vs. 9%), χ²(1, N = 129) = 18.871, p < .001.

Antisocial behavior. Parent, teacher, and self-ratings of delinquency were used to construct delinquency categories based on severity and type of behavior. Self-ratings were taken from the Self-Report Delinquency Form (Elliott, Huizinga, & Ageton, 1985), while parent and teacher ratings were obtained from respective forms of the CBCL (Achenbach, 1991a, 1991b). The categories comprised no delinquency or only minor delinquency in the home (e.g., vandalism or theft); other minor delinquency (e.g., shoplifting, theft at school, or fire-setting with minor damage); moderately serious delinquency (e.g., vandalism resulting in more than $100 worth of damage; theft from a car, gang fighting, or carrying a weapon); serious delinquent acts (e.g., stealing cars, breaking and entering, or selling drugs); or multiple serious delinquent acts. Participants were placed in the category that included the most serious offense reported by any of the informants. A dichotomy was created wherein the low delinquency category included no delinquency, minor delinquency in the home, and other minor delinquency; and the high delinquency category included moderately serious, serious, and multiple serious delinquency. A significantly greater proportion of psychopathy-prone participants fell into the high-delinquency group than control participants (54% vs. 25%), χ²(1, N = 130) = 11.648, p = .001.

Tasks and Procedure

Electrodermal activity. Recordings were made in a light- and sound-attenuated room. Testing took place between 9:30 and 11:00 a.m. for all participants, who were seated in a comfortable chair. Ambient room temperature was held at a constant 72°F.

SensorMedics (Yorba Linda, CA) silver/silver chloride electrodes (0.9-cm diameter) were placed on the distal phalanges (Scherbo, Freedman, Raine, Dawson, & Venable, 1992) of the first and second fingers of the nondominant hand with adhesive tape. A Med Associates (St. Albans, VT) adhesive electrode collar (Model TD-23) established the effective skin area (0.45-cm diameter) in contact with the electrode. The electrolyte medium consisted of Unibase cream combined with 0.9% physiological saline. In accordance with the recommendations of Fowles et al. (1981), a constant 0.5 V DC excitation was applied to the skin. Skin conductance was amplified with a Colbourn Instruments (Allentown, PA) skin conductance coupler (ST1–22) using a 20-Hz low-pass filter and sampled at 5 Hz in the rest period and at 20 Hz in the countdown stressor task, with data scored digitally. Application of the skin conductance electrodes was followed by application of electrodes to gather heart rate and electroencephalography data, which was not analyzed in the present study.

Rest period. In the resting state, participants were instructed to sit still for 3 min while fixating on an “X” displayed on a computer monitor positioned 1 m in front of them. Following the rest period but before the countdown task, participants completed some minor tasks (e.g., saliva collection), an orienting paradigm, and a social stressor. These tasks were not addressed in the present study.

Countdown task. The countdown stressor, modeled after a similar task used by Iacono and colleagues (see Iacono, 1998; Taylor, Carlson, Iacono, Lykken, & McGue, 1999), included both signaled and unsignaled trials. Participants were instructed to observe the computer monitor while wearing Optimus Pro 40 (KOSS, Milwaukee, WI) headphones. The task consisted of five trials. In Trials 1, 3, and 5 (signaled trials), a numeric countdown running from 12 to 0 was displayed in the center of the screen...
at the rate of one number per second. When 0 appeared, a 1-s burst of 105-dB white noise with a 50-ms rise and fall time was presented binaurally through the headphones. On Trials 2 and 4 (unsigned trials), no numeric countdown was visually displayed prior to the noise burst. The mean intertrial interval was 45 s (range = 40–50 s). Before the recording began, the participant was given the following instructions:

In this situation you will see numbers counting down on the computer screen from 12 to 0. One number will appear every second. When you see the number 0, you will hear a loud noise for 1 s. Sometimes this loud noise will come on without any warning, however. There is nothing you need to do in this task apart from keeping your head and body as still as you can. Do you have any questions?

Participants were not made aware of the number of trials or the alternating nature of the trials.

Data Reduction

Rest period. Skin conductance level was averaged over the 3 min of the rest period. In addition, the number of nonspecific fluctuations greater than 0.05 microsiemens was recorded.

Countdown stressor. For both signaled and unsigned trials, electrodermal activity was continuously recorded for 12 s (either the 12-s countdown signal or no signal) prior to the white-noise onset (anticipatory phase) and for 20 s following the white noise (responsivity phase). A skin conductance response (SCR) was defined as an increase in conductivity exceeding 0.05 microsiemens in amplitude. Given the signed/unsigned trials and the anticipatory/responsivity phases of each trial, SCR frequency was measured in four conditions: (a) unsignaled anticipation, (b) signaled anticipation, (c) unsignaled responsivity, and (d) signaled responsivity. Analysis of the SCR frequencies revealed somewhat low rates of responding in the four conditions (31.5%, 47.7%, 64.6%, and 76.9%, respectively). Recent statistical literature (Wilcox, 2002) refuted the classic assumption that with large and equal cell sizes, standard parametric procedures such as multivariate analysis of variance are robust to violations of normality (Mardia, 1971). The positively skewed distributions of the present frequency data brought into question the appropriateness of such parametric statistical tests, as even the most successful data transformation resulted in moderately non-normal distributions. Thus, we elected to use nonparametric tests to meaningfully analyze the data. The use of responder–nonresponder dichotomies taps into an important concept in clinical psychophysiological research (Dawson, Schell, & Filion, 2000). In the present study, SCR frequency was used to dichotomize participants as “responders” and “nonresponders,” emulating the procedure of Raine and Venables (1984) in their study of antisocial children. Participants were categorized as responders within a condition if they did not exhibit an SCR in any trials of that condition (i.e., total number of SCRs = 0), whereas participants were categorized as responders within a condition if they exhibited at least one SCR in at least one trial in that condition (i.e., total number of SCRs > 0). For purposes of comparison to prior studies in the literature, mean SCR amplitudes are also reported for responses scored in each of the four conditions.

Results

Tonic Arousal

During the 3-min rest period, psychopathy-prone participants did not significantly differ from control participants on (a) average skin conductance level, \( t(127) = 1.249, p = .214 \) (psychopathy-prone participants: \( M = 1.33, SD = 1.00 \); control participants: \( M = 1.55, SD = 1.02 \)), or (b) number of nonspecific fluctuations, \( t(127) = 0.733, p = .465 \) (psychopathy-prone participants: \( M = 1.09, SD = 2.33 \); control participants: \( M = 0.83, SD = 1.70 \)).

Anticipatory SCRs Prior to White Noise

Unsigned trials. While awaiting the white-noise burst without the countdown, psychopathy-prone and control participants did not differ on responding, \( \chi^2(1, N = 130) = 0.321, p = .571 \). Sixty-six (66.2) percent of psychopathy-prone participants were nonresponders, whereas 70.8% of control participants were nonresponders (see Figure 1). A \( t \) test of mean SCR amplitude did not indicate a significant group difference, \( t(39) = 1.209, p = .234 \) (psychopathy-prone participants: \( M = 0.115, SD = 0.082 \); control participants: \( M = 0.162, SD = 0.160 \)).

![Figure 1. Responding classification of psychopathy-prone and control participants in unsigned anticipatory and signaled anticipatory conditions.](image-url)
Participants. While awaiting the white-noise burst with the countdown, psychopathy-prone participants exhibited significantly greater rates of nonresponding than the control participants, $\chi^2(1, N = 130) = 6.044, p = .014$. Among psychopathy-prone participants, 63.1% were nonresponders whereas only 41.5% of control participants were nonresponders (see Figure 1). A $t$ test of mean SCR amplitude did not indicate a significant group difference, $t(60) = 0.649, p = .519$ (psychopathy-prone participants: $M = 0.153, SD = 0.115$; control participants: $M = 0.173, SD = 0.127$).

**SCRs to White Noise**

*Unsignaled trials.* After the presentation of the white-noise burst when it was not signaled by a countdown, psychopathy-prone participants exhibited significantly greater rates of nonresponding than the control participants, $\chi^2(1, N = 130) = 8.613, p = .003$. Forty-eight (47.7%) percent of psychopathy-prone participants were nonresponders compared with 23.1% of control participants (see Figure 2). A $t$ test of mean SCR amplitude did not indicate a significant group difference, $t(82) = 0.591, p = .556$ (psychopathy-prone participants: $M = 0.243, SD = 0.226$; control participants: $M = 0.271, SD = 0.206$).

*Signaled trials.* After the presentation of the white-noise burst when it was preceded by the countdown, psychopathy-prone participants exhibited significantly greater rates of nonresponding than the control participants, $\chi^2(1, N = 130) = 4.333, p = .037$. Among psychopathy-prone participants, 30.8% were nonresponders whereas only 15.4% of control participants were nonresponders (see Figure 2). A $t$ test of mean SCR amplitude did not indicate a significant group difference, $t(98) = 1.188, p = .238$ (psychopathy-prone participants: $M = 0.211, SD = 0.198$; control participants: $M = 0.265, SD = 0.248$).

**Possible Confounds**

The psychopathy-prone and control groups differed significantly on ADHD, IQ, and SES. To rule out these variables as confounds of the electrodermal differences between groups, we further examined their relations to skin conductance nonresponding. If the variable in question was unrelated to nonresponding, it was not considered to be a confound of the major findings reported above.

**ADHD.** To perform a stringent test of the relationship between responder status and ADHD in the full sample, we used a symptom count to identify those boys who exhibited eight or more DSM–III–R symptoms ($n = 53$) and a similar number of boys who exhibited the least amount of symptoms (0 symptoms, $n = 57$). There were no significant differences found between those participants with eight or more ADHD symptoms and those with no ADHD symptoms in any of the four conditions, $\chi^2(1, N = 110) = 0.001–2.873, p = .090–.983$.

**IQ.** Differences between responding groups were not found on IQ across the four conditions, $t(128) = 0.805–1.465, ps = .145–.422$.

**SES.** Responder status was unrelated to SES level in three of the four conditions, $\chi^2(1, N = 127) = 0.131–2.631, ps = .124–.717$. A significant association was found in the signaled anticipatory condition, which indicated that participants in the low SES group were more likely to be nonresponders than those in the high SES group (68% vs. 47%), $\chi^2(1, N = 127) = 4.131, p = .042$. Consequently, to further assess whether group differences in social class accounted for the group differences in signaled anticipatory responding, we conducted a logistic regression predicting psychopathy group classification while controlling for social class. SES was entered in Step 1, and skin conductance responding was entered in Step 2. A significant effect was obtained for skin conductance responding, Wald’s $\chi^2(1, N = 127) = 3.875, p = .049$, indicating that a significant relationship between psychopathy grouping and signaled anticipatory skin conductance responding remained after controlling for SES.

2 The relationship between responder status and ADHD diagnosis (meeting criteria for ADHD or not) was also examined within only the psychopathy-prone and control groups and was found to be nonsignificant in all four conditions, $\chi^2(1, N = 129) = 0.004–0.536, ps = .070–.952$.

![Figure 2. Responding classification of psychopathy-prone and control participants in unsignaled responsivity and signaled responsivity conditions.](image-url)
Habituation

Electrodermal responding in the first (signaled) trial was examined separately, to ensure that the greater rates of nonresponding seen in the psychopathy-prone group were not a result of differential habituation to the multiple presentations of the white-noise blast across several trials. The results for the first trial were identical to that of the aggregated signaled trials, with the psychopathy-prone group showing significantly greater rates of nonresponding than the control group in both the anticipatory (79% vs. 60%), $\chi^2(1, N = 130) = 5.200, p = .023$, and responsivity (40% vs. 19%), $\chi^2(1, N = 130) = 7.288, p = .007$, conditions. These analyses indicate that the attenuated responsivity EDA exhibited by psychopathy-prone participants was consistent throughout the countdown stressor task, rather than being an effect of rapid habituation after the initial presentation of the white-noise stimulus.

Antisocial Behavior

Four chi-square analyses were conducted to determine whether SCR was associated with antisocial behavior, operationalized as delinquency group status. Three of the four analyses produced significant findings: signaled anticipation, $\chi^2(1, N = 130) = 12.153, p < .001$; unsignaled responsivity, $\chi^2(1, N = 130) = 5.857, p = .016$; and signaled responsivity, $\chi^2(1, N = 130) = 6.425, p = .011$. In each of these conditions, a greater proportion of delinquent participants were nonresponders than were non-delinquent participants (68% vs. 36%, 73% vs. 13%, and 67% vs. 25%, respectively). There was no significant association between delinquency and responder status in the unsignaled anticipatory condition, $\chi^2(1, N = 130) = 0.444, p = .505$. This pattern of results is identical to that of the initial analyses conducted between psychopathy group and responder status.

Subsequent analyses were conducted to further explore the association between delinquency and nonresponding and to determine whether it was linked to psychopathy in particular or antisocial behavior in general. To compare antisocial psychopathy-prone and antisocial nonpsychopathy-prone boys, we subdivided each of the control and psychopathy-prone groups into low and high delinquency groups, thus producing a non-psychopathy-prone high delinquency group ($n = 16$) and a psychopathy-prone high delinquency group ($n = 35$). A $t$ test revealed no difference between the two groups on the dimensional delinquency measure, $t(49) = 0.129, p = .898$ (non-psychopathy-prone: $M = 3.625, SD = 0.806$; psychopathy-prone: $M = 3.657, SD = 0.838$).

Chi-square analyses were conducted crossing the delinquent psychopathy-prone and delinquent non-psychopathy-prone groups with skin conductance responding in the three conditions of interest. Results in all three conditions were nonsignificant: signaled anticipation, $\chi^2(1, N = 51) = 0.407, p = .524$ (nonresponders: delinquent psychopathy-prone 71% vs. delinquent nonpsychopathy-prone 62%); unsignaled responsivity, $\chi^2(1, N = 51) = 0.544, p = .461$ (49% vs. 37%); and signaled responsivity, $\chi^2(1, N = 51) = 0.182, p = .670$ (31% vs. 38%). Thus, hyporesponsivity in these three conditions was not specific to psychopathy but applied to nonpsychopathic forms of antisocial behavior as well.

Discussion

This study aimed to extend findings of electrodermal hyporesponsivity in psychopathic adults, particularly in anticipation of an aversive event, downward to an adolescent sample of psychopathy-prone boys. Differences in skin conductance level and nonspecific fluctuations between psychopathy-prone and control groups during the rest period were negligible, suggesting similar tonic arousal. In addition, no difference in anticipatory SCRs was found between groups in the countdown task when the white-noise burst was not signaled by a countdown. However, the psychopathy-prone group was significantly less likely than the control group to show anticipatory SCRs when the white-noise burst was signaled, as well as in response to the white-noise burst for both the signaled and unsignaled conditions. Though psychopathy-prone participants exhibited smaller SCR amplitudes in all conditions, these differences were small and nonsignificant. Analyses examining the relationships between skin conductance and IQ, SES, and ADHD show that psychopathy-prone adolescents are more likely to meet criteria for ADHD and to be characterized by lower IQ and lower SES but that these factors were largely unrelated to skin conductance responding. It appears that adolescents with psychopathic tendencies are electrodermally indistinguishable from other, nonpsychopathic adolescents at rest or when the threat of an aversive event is not salient, and like their adult counterparts, they are less responsive to the signaled threat of an aversive stimulus and to the stimulus itself.

These results indicate that, for the most part, psychopathy-prone adolescents exhibit reduced electrodermal activity in anticipation of, and in response to, an aversive stimulus. Evidence for this hyporesponsivity in psychopathic individuals has steadily emerged from research with adults (Fowles, 2000; Hare, 1978a; Siddle & Trasler, 1981), but the current findings show for the first time (to our knowledge) that it is present before adulthood. The blunted electrodermal functioning of the psychopathy-prone participants prior to the signaled white-noise burst possibly indexes a lack of anticipatory fear, whereas their decreased responsivity after the burst suggests reduced responsivity to punishment (Arnett, 1997; Hare, 1978a), which may hinder fear conditioning and socialization. Other psychophysiological paradigms used with adults yield results that index a similar fear deficit. For example, Patrick, Bradley, and Lang (1993) found inhibited startle blink responding in psychopathic individuals to emotionally valenced pictures compared with neutral pictures, whereas nonpsychopathic individuals typically show greater startle potentiation to negative images. Patrick (2001; Patrick et al., 1993) suggested that this finding is consistent with a deficit in anxiety or fear also hypothesized by others (e.g., Fowles, 1990; Lykken, 1957).

That the two groups did not differ in the unsignaled anticipatory condition is of interest, as differences were also absent in the rest period. The instructions given prior to the task were such that participants were not aware that they were in an unsignaled trial until the noise actually occurred. There was likely the underlying anticipation of another white-noise blast; however, without the knowledge that it was imminent or a countdown to signal its arrival, the salience of this anticipatory state was minimal. In addition, it is possible that any heightened anticipation attributable to the impending white noise was diffused over not only the defined anticipatory window (12 s immediately preceding the
noise) but also the period following the presentation of the previous noise. As such, and in light of the instructions given to the participants, this condition bore the most resemblance to a baseline state. The significance of the absence of group differences in this condition and in the rest period is twofold. First, it replicates and extends the finding that psychopathic and nonpsychopathic individuals do not differ on tonic electrodermal arousal (Hare, 1982; Hare & Quinn, 1971; Raine & Venables, 1988; Siddle, 1977). That is, when not under palpable stress or anticipation of predictable punishment, the two groups appeared electrodermally indistinguishable. Second, the psychopathy-prone participants’ unresponsiveness to the threat of an aversive stimulus and to the stimulus itself evidenced here is not due to some general autonomic arousal deficit (as would be indicated if they were also tonically hypoaroused) but seems to be specific to a situation involving a salient, imminent stressor. Under circumstances, psychopathic individuals may electrodermally resemble those who are nonpsychopathic, but in stressful situations such as the commission of punishable criminal or deceitful acts, their autonomic activity is minimized and they remain electrodermally calm.

It is interesting to note that Kelsey, Ornduff, McCann, and Reiff (2001) examined electrodermal reactivity during a countdown to an aversive (white-noise) stimulus in a sample of young men scoring high on a measure of narcissism. High scorers on the Narcissistic Personality Inventory (NPI; Raskin & Terry, 1988) showed less SCR reactivity than low NPI scorers, although this effect was only found in an “active coping task,” in which participants were able to circumvent the aversive stimulus by pressing a button during the last second of the countdown. NPI groups did not differ significantly during the “passive coping task,” similar in procedure to the signaled anticipatory trials conducted in the present study. A difference was found, however, when the authors examined habituation over repeated trials. Given the similarities between narcissism and psychopathy, such as shared features of grandiosity, blunted empathy, aggression, and impulsivity, narcissism has been hypothesized as the core of psychopathy (Kernberg, 1989), and the findings of Kelsey et al. (2001) provide general support for this theoretical link. However, they did not find a difference between groups during the passive coping task, which was demonstrated in the present study and is well-replicated in the extant adult literature (Fowles, 2000; Hare, 1978b). Future psychophysiological research might seek to further explore the relationship between psychopathy and narcissism, as the many interpersonal similarities between the two constructs seem to imply some etiological commonality.

The psychopathy-prone adolescents in the present study had higher rates of ADHD than the rest of the sample, a finding in keeping with Lynam’s (1996) profile of the fledgling psychopath and the reported association between conduct problems and ADHD (Farrington, Loebere, Van Kammen 1990; Frick & Loney, 1999; Lahey, Loebere, Burke, & Rathouz, 2002; Loebere, 1988). However, the reduced autonomic nervous system functioning seen here in psychopathy-prone individuals seems to be unrelated to ADHD itself, an outcome that is consistent with the findings of Delamater and Lahey (1983) and Herpertz et al. (2001). The implication, which requires further replication, is that the electrodermal results are attributable to psychopathy and not the comorbid ADHD symptoms. Many researchers have posited that a more severe form of delinquency can be found at the intersection of antisocial behavior and hyperactivity/attention problems than those linked to either alone (e.g., Loebere, Brinthaupt, & Green, 1990; Lynam, 1996, 1998; Walker, Lahey, Hynd, & Frame, 1987). The results of this study provide tentative support for this proposed association between the two disorders and also highlight the need to assess the correlates of psychopathy independent of ADHD.

Not unexpectedly, and in parallel to previous adult studies, serious delinquency was more prevalent among psychopathy-prone participants than control participants. Antisocial behavior is an integral aspect of the psychopathy construct as measured by the PCL-R, and, accordingly, the majority of previous studies of psychopathy and electrodermal activity have been conducted with incarcerated or otherwise antisocial individuals (e.g., Arnett, Howland, Smith, & Newman, 1993; Hare, 1982; House & Milligan, 1976; Lykken, 1957). Some studies report findings of electrodermal hyporesponsivity among antisocial individuals in general (Buikhuijzen, Bontekoe, Plas-Korenhoff, & Buuren, 1985; Raine & Venables, 1984; Raine, Venables, & Williams, 1990; Schmidt et al., 1985), and thus it is not entirely surprising that differences in skin conductance nonresponding did not emerge when antisocial nonpsychopathic boys were compared with antisocial psychopathy-prone boys in the present study. Unlike factors such as SES or intelligence, antisocial behavior is fundamentally embedded in the psychopathy construct as it is currently measured and thus cannot be considered a confound in the usual sense of the term. As such, these results imply that it may be the antisocial behavior component of psychopathy that is associated with skin conductance nonresponding. Future investigations of psychopathy might seek to further replicate and explore this association.

This study also supports previous research that has shown that high scores on the CPS (Lynam, 1997) correspond to serious and stable offending, impulsivity, proneness to externalizing disorders, and immunity to internalizing disorders (Lynam, 1997) and that they are uniquely related to proactive rather than reactive aggression (Raine et al., 2003). A potential limitation of the use of the CPS in this study is that scale scores were based on the responses of a single informant. Although it is possible that several sources of information would beget a more complete profile of the participants’ psychopathy proneness, the mother reports are valid for several reasons. First, the CPS was designed to evaluate general patterns of behavior rather than specific acts, which obviates the need for multiple informants. Second, the ratings by the mothers were for research purposes and had no practical influence on the boys, reducing concerns about dishonest responses or “faking good.” Third, mothers generally know their children well, the prerequisite for any report on personality characteristics. Fourth, previous research has documented the superior reliability of mother reports over self-reports and the generally low correlations among multiple sources (Frick et al., 2000; Lynam et al., in press; Pardini, Lochman, & Frick, 2003). Finally, as noted above, numerous studies have provided evidence for the validity of the mother-reported CPS.

Another issue that requires further attention is the relatively high rate of nonresponding found in this sample. A possible explanation is that the 105-dB white-noise burst was not truly aversive. On a scale ranging from 1 (not at all unpleasant) to 7 (extremely unpleasant), the average tone rating given by the participants was 4.01 (4 = moderately unpleasant). No difference in tone rating
was found between groups, suggesting that as a whole, they did not consider the stimulus to be very aversive. Increasing sensitivity to human-participant considerations precluded the use of a more intense, aversive stimulus such as the 120-dB white noise that has been used in past psychopathy research (e.g., Hare, 1978b; Ogloff & Wong, 1990). In comparison to early studies, elevated levels of electrodermal nonresponding to innocuous tones have been found more recently in community samples (Dawson, Neuchterlein, & Schell, 1992; Iacono, Ficken, & Beiser, 1993; Raine, Benishay, Lencz, & Scarpa, 1997), although a convincing explanation for these higher rates of nonresponding has not been forthcoming. In the present study, it is also likely that the lack of differences between groups on SCR amplitude, historically found between psychopathic and nonpsychopathic adults, is accounted for by the increased nonresponding in this sample.

Though focus has long been on the psychopathic adult, researchers have begun to seek out and identify the correlates and underpinnings of psychopathy in childhood and adolescence. Newman, Widom, and Nathan (1985) found passive-avoidance behavior deficits in adolescents that resemble those characteristic of psychopathic adults. Raine, O’Brien, Smiley, Scerbo, and Chan (1990) were able to replicate in psychopathic adolescents the attenuated lateralization for linguistic processes found by Hare and McPherson (1984) in psychopathic adults. Blair, Colledge, and Mitchell (2001) found that boys with psychopathic tendencies had similar performance impairments on a gambling task to psychopathic adults as well as individuals with amygdala dysfunction. These examples, together with the findings from the present study, offer convergent evidence for the existence of an adolescent form of psychopathy.

The establishment of juvenile psychopathy as a valid disorder could have significant implications for its treatment and intervention. Though treatment methods have been found ineffective in rehabilitating psychopathic adults (Ogloff, Wong, & Greenwood, 1990) and have even resulted in exacerbated symptomatology (Rice, Harris, & Cormier, 1992), intervention at an earlier age could prove to be more successful, particularly when targeted at the well-replicated psychophysiological risk factor of reduced autonomic functioning. For example, an experimental nutritional, physical exercise, and educational enrichment program from ages 3 to 5 years has been shown to increase autonomic functioning at age 11 years, particularly for aversive tone stimuli (Raine et al., 2001). Early intervention and prevention provide the opportunity to intervene in multiple areas (e.g., nutritional, educational, and psychophysiological) before the various negative correlates of antisocial behavior (e.g., arrests, school dropout, drug addiction) preclude behavioral change.

In conclusion, psychopathy-prone adolescents do not differ from control participants in electrodermal activity at rest, but they are less electrodermally responsive both when anticipating and reacting to a loud burst of white noise. This electrodermal deficit, which has been repeatedly observed in psychopathic adults, therefore appears to be present during adolescence and does not seem to be related to comorbid ADHD. Apparently, however, the deficit is associated with antisocial behavior in general and perhaps emerges as a correlate of psychopathy because of the fundamental entrenchment of antisocial behavior in the psychopathy construct. Such a lack of psychophysiological reactivity in the face of punishment and stress may facilitate the physically and psychologically reckless behavior of the fledgling psychopath and may support his or her future criminal career. Continued efforts to identify and characterize the psychopathic juvenile could have potentially important implications for the prevention and management of adult psychopathy.

References


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