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Attachment and Emotion in School-Aged Children

Jessica L. Borelli
Pomona College

Michael J. Crowley
Yale University Child Study Center

Daryn H. David
Yale University

David A. Sbarra
University of Arizona

George M. Anderson and Linda C. Mayes
Yale University Child Study Center

One of the primary functions of the attachment behavioral system is to regulate emotional experience under conditions of threat. Although research supports this association among infants and adults, few studies examine the relation between emotion and attachment in middle childhood. This study examined the concurrent associations among children's attachment organization and three indices of emotion reactivity/regulation: self- and parent-assessments of emotion, neuroendocrine reactivity, and fear-potentiated startle response. Ninety-seven 8- to 12-year-old children completed the Child Attachment Interview (CAI) and a fear-potentiated startle paradigm on separate occasions, with salivary cortisol assessed before and after each assessment. Greater attachment security was related to greater child-reported positive trait- and state-level emotion, lower pre-CAI cortisol levels, higher initial startle magnitude during threat, and a faster decrease in startle magnitude during threat. The findings provide initial support that attachment security is related to select measures of emotion, though different methods of assessment yielded discrepant findings. The findings are discussed in terms of their contribution to theory and research examining attachment and emotion.

Keywords: attachment, emotion, psychophysiology, cortisol, startle, middle childhood

Attachment theorists widely acknowledge the primacy of parent–child relationships for the development of emotion regulation (e.g., Cassidy, 1994), contending that self-regulated emotion emerges from the coregulation of emotion within the context of the infant-parent relationship (Beebe, 2000; Sroufe, 1989, 1996). Given the centrality of emotion dysregulation to mental illness (Cole, Michel, & Teti, 1994; Keenan, 2000), the link between attachment and emotionality is an important ingredient in an improved understanding of the development of psychopathology across childhood. Despite this proposition, surprisingly few studies examine the relations between children's primary attachment relationships and their developing emotion reactivity and emotion regulation (ER) (Kerns, 2008). The present study addresses this gap in the literature by examining attachment and ER in middle childhood using a multimethod approach. Specifically, we examine children's subjective reports of emotion, cortisol reactivity, and startle magnitude in response to conditions of safety and threat.

In childhood, attachment organization is closely tied to regulation of emotion in the service of promoting proximity to an attachment figure (Cassidy, 1994). Parents of a secure child behave more sensitively and responsively to the child's distress than parents of insecure children (Ainsworth, Blehar, Waters, & Wall, 1978; see De Wolff & van IJzendoorn, 1997, for a meta-analysis), which in theory enables the child to believe that his distress will be resolved effectively by a caregiver (Bowlby, 1973). The parents of insecure children are less sensitive, more interfering, and more avoidant of physical contact with their child in response to the child's bids of distress (Ainsworth et al., 1978), which, according to theory, prompts the child to believe that her distress cannot be resolved adaptively using others for support (Bowlby, 1973; Sroufe, 2005).

Over time, these experiences with caregiver responsivity and sensitivity become mentally internalized as an internal working model (IWM) of attachment, which is activated during times of stress and guides the individual's behavior (Bowlby, 1980). In

Jessica L. Borelli, Department of Psychology, Pomona College; Michael J. Crowley, George M. Anderson, and Linda C. Mayes, Yale University Child Study Center; Daryn H. David, Department of Psychology, Yale University; and David A. Sbarra, Department of Psychology, University of Arizona.

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Correspondence concerning this article should be addressed to Jessica L. Borelli, Department of Psychology, Pomona College, 647 N. College Way, Claremont, CA 91711. E-mail: Jessica.borelli@pomona.edu

these situations, dismissing individuals engage in deactivating strategies characterized by hyper self-reliance, preoccupied individuals engage in hyperactivating strategies characterized by repeated bids for reconnection with an attachment figure (Bowlby, 1980; Cassidy, 1994; Kobak, Cole, Ferenz-Gillies, Fleming, & Gamble, 1993; Main, 1981), while disorganized children are thought to exhibit a disintegration of coping strategies in the face of fear (Hertsgaard et al., 1995; Hesse & Main, 2000; Lyons-Ruth, Zoll, Connell, & Grunebaum, 1989; Shaw et al., 1996; Spangler & Grossman, 1993). Though effective and putatively adaptive in the short-term, the insecure ER strategies may result in a failure to regulate negative arousal when confronted with stress later in development. In contrast, secure individuals may be better able to rely on internal regulatory structures, contextual cues, and support from others to down-regulate their arousal (Bowlby, 1973; Sroufe, 2005).

Emotion and Attachment: Subjective Experience and Behavioral Correlates

Broadly speaking, emotions are both regulatory and regulated (Cole, Martin, & Dennis, 2004; Cole et al., 1994; Thompson, 1994) and manifest across experiential, expressive, and physiological domains, necessitating multimodal assessment (Lang, 1984; Lang, Rice, & Sternbach, 1972). In terms of behavioral markers of ER, preschoolers previously classified as secure in the Strange Situation (SS; Ainsworth et al., 1978) are rated by teachers as being able to "flexibly adjust expressions of feelings and impulses to suit situational requirements" (Sroufe, 2005, p. 357; Sroufe, Egeland, Carlson, & Collins, 2005). Independent "expert" raters see secure children as displaying more positive affect, less frustration and aggression in social interactions with peers (Sroufe, Schork, Motti, Lawroski, & LaFreniere, 1984), and as more well-regulated in interactions with a caregiver (Vondra et al., 2001). Among older children, secure attachment is related to a more nuanced understanding of mixed (Steele, Steele, Croft, & Fonagy, 1999) and negative emotions (Laible & Thompson, 1998), greater levels of constructive coping (Contreras, Kerns, Weimer, Gentzler, & Tomich, 2000; Kerns, Abraham, Schlegelmilch, & Morgan, 2007), and adaptive behavior in the classroom (Granot & Mayseless, 2001; Kerns, Tomich, Aspelmeier, & Contreras, 2000; Kerns et al., 2006; Kerns et al., 2007; Sroufe, Egeland, & Kreutzer, 1990). In contrast, insecure attachment is linked to aggressive behavior (e.g., Fagot & Pears, 1996; Lyons-Ruth, Alpern, & Repacholi, 1993; Shaw et al., 1996; Vondra et al., 2001) and psychopathology (Shaw & Vondra, 1995; Moss et al., 1998, 2004, 2006). Adults with dismissing attachment underreport emotional reactivity and emotional distress relative to others' assessments of them (Dozier & Lee, 1995; Kobak & Sceery, 1988; Pietromonaco, Greenwood, & Feldman Barrett, 2004). In the present study, we extend this body of work on emotion and attachment into middle childhood, expecting that children with greater attachment security will have higher self- and parent-rated positive emotional experience and ER capacities.

Emotion and Attachment: Physiological Correlates

In addition to subjective experience and observable behavior, ER can be inferred by contextually induced changes in central or peripheral physiology. Cortisol, the primary output of the Hypothalamic-Pituitary-Adrenal (HPA) axis, is a widely studied biomarker that covaries with psychological stress and emotional distress (Pollard, 1995). Though cortisol is influenced by many factors, including diurnal cycle, immune response, and dietary intake (Pollard, 1995), it is thought to be a robust index of stress reactivity and can be easily extracted and analyzed from samples of saliva. Infant attachment is related to elevations in salivary cortisol in response to novel and frightening situations (Nachmias, Gunnar, Mangelsdorf, Parritz, & Buss, 1996) and the SS (Gunnar et al., 1991; Gunnar, Mangelsdorf, Larson, & Hertsgaard, 1989; Hertsgaard, Gunnar, Erickson, & Nachmias, 1995; Spangler & Grossmann, 1993). Infants with insecure attachment behavioral patterns are more likely to show elevated neuroendocrine responses, which are in turn thought to be indicative of increased emotion reactivity and dysregulation. In addition, adults with insecure self-reported attachment styles (Diamond, 2001; Pietromonaco, Feldman-Barrett, & Powers, 2006; Powers, Pietromonaco, Gunlicks, & Sayer, 2006) and dismissing attachment on the Adult Attachment Interview (AAI; George, Kaplan, & Main, 1984, 1985, 1996; Rifkin-Graboi, 2008) show greater cortisol reactivity in response to stress. Indeed, some adult work suggests that administration of the AAI itself appears to induce stress-related regulatory changes in both cortisol (Scheidt et al., 2000) and also peripheral physiology (Dozier & Kobak, 1992). These findings make conceptual sense in that discussing attachment relationships, particularly those characterized by stress and insecurity, may reenact experiences (see Adam, 1999, for an inconclusive finding). In the current study, we seek to provide a conceptual replication of these findings in middle childhood. Specifically, we expect that children with greater attachment security will have lower initial cortisol levels and more rapid habituation to stress.

A few studies examine the association between attachment and other psychophysiological parameters of ER. Children's reactions to fear-inducing film clips is associated with relationship and temperamental factors—specifically, children who are both temperamentally fearful and have (a) less harmonious relationships with their parents (Gilissen, Koolstra, van IJzendoorn, Bakermans-Kranenburg, & van der Veer, 2007) or (b) insecure responses on the Attachment Story Completion Task evidence higher skin conductance (Verschueren & Marcoen, 1994; Gilissen, Bakersman-Kranenburg, van IJzendoorn, & van der Veer, 2008b). Another study finds an interaction between 7 year-olds' genetic vulnerability to stress and anxiety (the short allele of the serotonin transporter gene, 5-HTT) and attachment in their electrophysiological response to a social stress task; secure children are less stressed than insecure ones, and secure children with low genetic risk show the lowest levels of stress reactivity (Gilissen, Bakersman-Kranenburg, van IJzendoorn, & Linting, 2008a). Beyond these investigations, no other research has used psychophysiological methods to study ER and attachment in childhood.

A handful of studies examine attachment and autonomic nervous system responding in adulthood. Dozier and Kobak (1992) find that dismissing adults show the highest skin conductance responses while answering certain questions on the AAI. Roisman (2007) finds that adults high in dismissing qualities have higher skin conductance during a marital discussion about a conflict in the relationship and adults high in preoccupied qualities show increased in heart rate when interacting with their partners. In addition, adults with self-reported insecure attachment styles show greater cardiovascular reactivity (Feeney & Kirkpatrick, 1996; Mikulincer, 1998) and skin conductance (Diamond, Hicks, & Otter-Henderson, 2006) than secure adults.

In the present study, we use a fear-potentiated startle paradigm to probe ER in middle childhood. The startle reflex is a defensive response that occurs in reaction to intense stimuli with abrupt onset (Bradley, 2000). Measured using the eyeblink response, the startle reflex is heightened in the presence of unpleasant stimuli or frightening contexts (Bradley, Cuthbert, & Lang, 1990; Campeau & Davis, 1992; Davis, Falls, Campeau, & Kim, 1993; Lang, 1995; Lang, Greenwald, Bradley, & Hamm, 1993). Fear-potentiated startle is a paradigm that allows for a differentiated measurement of differences in ER across experimental conditions. It is measured in humans using anticipation of mildly aversive stimuli such as loud sounds or air puffs and permits the comparison of children's startle responses under experimentally induced conditions of "threat" and "safety" (Grillon et al., 1999). Fear-potentiated startle response is increased among patients with anxiety syndromes and symptoms (Grillon, Ameli, Foot, & Davis, 1993; Grillon, Ameli, Goddard, Woods, & Davis, 1994; Grillon & Morgan, 1999), and is also sensitive to ER manipulations (Lissek et al., 2007). We focus on ER during conditions of "safety" and "threat" in terms of differential mean responses and startle magnitude change over time (see Jackson et al., 2003). Based on the notion that children with insecure attachment are less able to use contextual cues of safety to down-regulate negative emotion, we expect to find that greater attachment insecurity is associated with lesser differentiation in magnitude of startle response to conditions of threat versus safety. Based on the assumption that insecure children will show poorer regulatory strategies over time, we predict that attachment insecurity will be related to slower decreases in startle response to both threat and safety.

Current Investigation

This study is the first to examine attachment and multiple measures of emotion in middle childhood. Because of the small number of children classified as preoccupied, we present data analyses using narrative coherence as a continuous measure of attachment security as opposed to attachment categories.[1] To summarize the hypotheses outlined above, we expect that greater attachment security (higher narrative coherence scores) will be related to the following outcomes: (a) higher self-reported positive emotional experience, higher self-reported emotion control, greater parent-reported behavioral ER ability, and lower parent-reported emotion negativity/lability; (b) faster decrease in negative affect over the CAI and startle paradigm; (c) faster decreases in cortisol levels over the CAI and startle paradigm; and, (d) greater initial differentiation in startle magnitude and a greater negative slope or decrease in negative physiological reactivity over time to threat and safety.

Method

Participants

Ninety-seven children between the ages of 8 and 12 participated in these tasks as part of a larger study on children's socioemotional development. Participants were recruited from the community through a variety of means, including a mass mailing, flyers, and Internet postings. Parents consented and children assented to participate in the study. Data collected on a subset of the population indicate that the sample was moderately educated (M = 1.85, SD = .67, where 1 = high school education, 2 = some college, 3 = postgraduate). The sample included 56.6% boys and 43.3% girls with a mean age of 10.01 years old (SD = 1.52), with 86.6% White, 3.1% Hispanic, 3.1% African American, and 7.2% biracial children. Two children (2%) failed to complete the second study session because of schedule conflicts. Experimenters informed children that they could refuse to participate in any part of the study if they wished. Accordingly, data were missing because of failure to attend the second session (n = 2) and insufficient data because of skipped questions (n = 1). The cross-sectional design involved two sessions ~1 week apart, each of which lasted 1.5 hr.

Procedure

Participants and their parents completed informed consent, assent, and demographic forms upon arrival at the laboratory. Most sessions occurred between 3 and 6 p.m. During this first session parents completed the Emotion Regulation Checklist (ERC; Shields & Cicchetti, 1995, 1997). In most cases, the child's mother filled out the ERC (n = 80); for some children, fathers (n = 14) or both parents together (n = 3) completed the ERC.

Child participants first completed a salivary cortisol sample and a measure of state affect (Positive and Negative Affective Scale for Children, PANAS-C), then the CAI, followed by another salivary cortisol sample and PANAS-C measure. During the second session, children provided a saliva cortisol sample and completed a PANAS-C, completed the startle psychophysiology paradigm, and then gave a final salivary cortisol sample and PANAS-C report. Children then completed the How I Feel self-report measure (Walden, Harris, & Catron, 2003). Additional self-report measures, not part of this report, were completed following these tasks. All questionnaires were administered to children in visual and auditory domains via computer using the Computerized Assessment and Presentation Engine (Fisher & Mayes, 2001).

Measures

Attachment interview. The CAI (Shmueli-Goetz, Target, Datta, & Fonagy, 2004), as downward extension of the AAI (George, Kaplan, & Main, 1984, 1985, 1996), is a semistructured interview for 8- to 13-year-olds that assesses the quality of children's attachment to each of their primary caregivers. It consists of 19 questions concerning the child's current and past experiences with primary caregivers and prompts the child to evaluate the qualities of these relationships. Each interview is coded on eight scales (e.g., Idealization, Preoccupying Anger, Balance of positive/negative references to attachment figures), each of which consists of nine points. "Overall Narrative Coherence" is considered a

[1] In this study, we analyze attachment data using the continuous security variable (narrative coherence) only. We organized our analyses in this way because of the small n of preoccupied children (6). Where applicable, group-based findings are presented in footnotes; given the small sample sizes, we interpret these findings as preliminary and with caution.

dimensional measure of attachment security (Shmueli-Goetz et al., 2004), and by definition children who are classified as in one of the three insecure categories (dismissing, preoccupied, disorganized) have low coherence scores.

Interviews were administered by two female doctoral students. Using videotapes and transcriptions, interviews were coded by researchers who had been certified as reliable. Each interview was coded by one person and difficult cases were discussed and resolved between the two coders. Interviews were rated on the nine scales and then were classified into one of four categories with respect to each caregiver: secure, dismissing, preoccupied, and disorganized. According to CAI protocol, interviews classified as disorganized were also given a secondary organized classification. Children's attachment to mother and father were rated independently. In this sample, prediscussion interrater reliability on 20 cases (21% of sample) was excellent (4-way: $\kappa = .86$, $p < .001$, 3-way: $\kappa = .83$, $p < .001$; Intraclass Correlation Coefficient for narrative coherence scale $= .97$, $p < .001$).

High test–retest reliability of both scale scores and attachment classifications is demonstrated at 3 months (α's .74 to 1.00) and 1 year later (α's .72 to .79). In addition, internal consistency (α's ranged from .84 to .92 for 2 way, .84 to .85 for 3 way, and .74 to .89 for 4 way) of the scale scores and classifications, interrater reliability (.92 for 2 way classifications, .84 for 3 way, and .83 for 4 way), and validity of the measure have been determined with both clinical and normative samples (Humfress, O'Connor, Slaughter, Target, & Fonagy, 2002; Shmueli-Goetz, Target, Datta, & Fonagy, 2008; Target et al., 2003). CAI classification is correlated with the child's attachment security as measured in the Separation Anxiety Test (Wright, Binney, & Smith, 1995), maternal AAI classification (Shmueli-Goetz et al., 2008; Target et al., 2003), and measures of social functioning (Shmueli-Goetz et al., 2008), and CAI classification is not associated with age, sex, socioeconomic status, ethnicity, verbal IQ, expressive language ability, or whether the child lives with one or two parents (Target et al., 2003).

How I feel. "How I Feel" (Walden et al., 2003) is a 30-item self-report measure assessing emotional experience in 8- to 12-year-olds. It consists of positive emotion (e.g., "I was happy very often"), negative emotion (e.g., "When I felt sad, my sad feelings were very powerful"), and emotion control (e.g., "When I felt scared, I could control or change how scared I felt") scales, which are rated on a scale of 1 to 5, with 1 signifying "not at all true of me" and a score of 5 signifying "very true of me." Internal consistency, longitudinal stability, and validity data on the measure have been reported (Walden et al., 2003). Cronbach's alpha in this sample was adequate (.80 and above for all three scales).

Positive and Negative Affect Scale for Children. The Positive and Negative Affect Scale for Children (PANAS-C; Laurent et al., 1999) is a 30-item self-report measure of affect for children between the ages of 8 and 13. Children rate the degree to which they feel emotion words (e.g., "nervous") on a scale of 1 to 5, with a score of 1 signifying "very slightly or not at all" and a score of 5 signifying "extremely." Reliability and validity data for the measure suggest that it is an appropriate measure for state affect in children (Laurent et al., 1999). In the current investigation, children were asked to rate how they felt "right now." Cronbach's alpha in this sample was excellent (.90 and above for both scales).

ERC. The ERC (Shields & Cicchetti, 1995, 1997) is a parent-report measure of affective intensity, valence, lability, flexibility, and situational appropriateness of emotions (Shields & Cicchetti, 1998). The 24-item measure has two scales, one measuring lability/negativity (e.g., "Seems sad or listless") and one measuring ER (e.g., "Can recover quickly from episodes of upset or distress"). All items are rated on a 4-point scale ranging from "almost always" to "never." The reliability and validity of the measure have been reported elsewhere (Shields & Cicchetti, 1997). Cronbach's alpha for the lability/negativity scale was .89, and .47 for the ER scale.

Cortisol. We measured salivary cortisol at two time points during each of the two study sessions. We collected samples before and after the administration of the CAI, and before and after the startle paradigm. Time of day of the sample collection was recorded for all participants. First participants were invited to rinse their mouths with water to reduce potential contaminants. Ten minutes elapsed and then saliva was collected using Salivette collection devices (Sarstedt, Newton, NC). With the assistance of the experimenter, cotton tubes were inserted and extracted from the child's mouth without human touch to avoid contaminants. Children kept the cotton in their mouths for ~5 min and the samples were then frozen, with long-term storage of centrifuged samples at −70 °C. Cortisol concentration was expressed as micrograms per deciliter (dl = 100 ml). Samples were analyzed in duplicate: high (1.52 μg/dl) and low (0.50 μg/dl) concentration quality assessment ("QC") samples were determined with interassay coefficients of variation of 2.9 and 13.5%, respectively. Some samples (timepoints) were excluded from statistical analyses because of insufficient saliva ($n = 8$) or inconsistent assay results ($n = 3$).

Fear-potentiated startle. In the fear-potentiated startle paradigm, children watched pictures come on a computer screen while headphones deliver auditory probes designed to elicit a startle reaction (Grillon, Dierker, & Merikangas, 1998). They were told that they may receive a puff of air to the neck (threat condition), which was delivered through a collar fastened around the neck, when a certain picture is displayed on the computer screen. Participants were also told that when another picture was on the computer screen (safe condition), they would not receive puffs of air. The entire paradigm consisted of 64 auditory startle probes delivered at different times following the onset of a safety or threat picture (i.e., at 1, 3, 7, and 9 s, the order of which was held constant across participants).

The startle assessment took place in a quiet, dimly lit room (60 W bulb). The child sat in a comfortable chair facing a color monitor at a distance of 50 cm and a visual angle of ~4 degrees. The threat and safety signals appeared as 15 × 22 cm colored images green/yellow and blue/purple against a black background. Signal identity color was counterbalanced across subjects. For each participant, this color-signal mapping was held constant throughout the course of the paradigm. Images were presented at random positions on the screen (random number generation of x, y coordinates in Eprime software).

The aversive stimulus (air puff) was an 80 psi burst of breathable air with variable duration (50, 100, 150 ms) directed at the larynx through rigid 8 mm nylon 11 tubing. The duration of the air puff varied across the experiment to influence the child's perceived intensity of the puff (5 puffs in total), but the pattern was consistent across subjects. Instructions conveyed that some puffs would be stronger than others. Acoustic startle probes were 40 ms long, 103 dB white noise bursts, with instantaneous rise time, presented binaurally through AERO ear-canal conforming earplugs.

After a four startle probes (baseline), the experimental portion of the task began. The paradigm consisted of five blocks of signals. Within each block, there were four safe and four threat signals, for a grand total of 20 safe and 20 threat signals. Each signal (picture on the computer screen) lasted 11 s, during which time one startle probe was presented (at 1, 3, 7, and 9 s). The intertrial interval (ITI), during which a black screen was presented, occurred between each signal and varied from 3 to 19 s (M = 12s). Air puffs were administered randomly on five of the 20 threat signals. In each block, only one air puff was given under one of five threat trials. If an air puff occurred during a threat trial, it always occurred between 2 and 10 s into the threat signal and after the startle probe for that trial had been presented. Startle sessions were videotaped and displayed on a screen behind a barrier in the startle lab room so that the experimenter could watch the child unobtrusively.

Electromyographic (EMG) activity of the left orbicularis oculi muscle was recorded via two miniature (contact area $<$4 mm) Ag/AgCl electrodes filled with Grass electrode cream. After exfoliation (using Nuprep), one electrode was positioned below the eyelid in line with the pupil in forward gaze. A second electrode was placed ~2 cm lateral to the first. A ground (reference) electrode was placed on the inner side of the left forearm. The startle system recorded EMG activity for 500 ms (sample interval 1 ms) beginning 200 ms before the onset of the startle stimulus. The amplification gain control for the EMG signal was kept constant for all subjects. Recorded EMG activity was band-pass filtered before digitizing; cut-off frequencies were set at 100 Hz and 1 kHz. A 60-Hz notch filter was used to eliminate the 60-Hz interference. Data were scored offline for response amplitude (in arbitrary analog to digit units) and latencies to response peak (in milliseconds). To be scored as a response, amplitude had to be 3 *SD*s greater than the baseline value. The scoring program contained a rolling average routine that smoothed the rectified EMG response. Latency to response peak was determined as the point of maximal amplitude that occurred within 120 ms from the startle stimulus (20 ms baseline).

Data Analytic Plan

All analyses considered attachment as a continuous measure using the narrative coherence scale. Associations between attachment and self- and parent-reports of trait emotion were evaluated using multiple regressions. For all analyses involving repeated assessment, we used multilevel modeling (see Singer & Willett, 2003), which accounts for the nonindependence of data when multiple assessments are nested under each participant, enabling us to consider initial levels and change across the CAI and the startle paradigm. Level 1 variables included time and the dependent variable of interest (e.g., cortisol values); there were no time varying covariates. Level 2 variables included age, sex, and narrative coherence. All continuous level-2 variables were centered before testing models with specified independent variables. In all analyses, the first measurement is treated as the intercept, and a time variable was included to represent participants' rate of change in the dependent variable across the task. Startle responses were standardized within participant before performing data analyses, which maximizes changes across conditions and within individuals, and also reduces disproportionate contribution by individuals with greater overall reactivity to group means (Crowley, Liu, Borelli, Mayes, & Zhang, 2010). For the multilevel models, we assessed two models for each outcome of interest. Model 1 included covariates of interest, time, and the change of the covariates over time. Model 2 included these same variables, children's narrative coherence scores, and the interaction of narrative coherence by time.[2]

Results

Descriptive Statistics

The attachment distribution (44% secure, 31% dismissing, 6% preoccupied, 19% disorganized) for this sample was similar to that found in a previous investigation of the CAI (Target et al., 2003) and to that of a meta-analysis examining AAIs among adolescents (Bakermans-Kranenburg & van IJzendoorn, 2009). By definition, dismissing (M = 3.10, SD = 0.88), preoccupied (M = 4.42, SD = 1.36), and disorganized children (M = 2.53, SD = 0.87) had low narrative coherence scores, whereas secure children (M = 6.80, SD = 1.01) had higher scores. A significant sex difference was observed for parent-reported ER, with boys having lower scores on the ER scale, as well as a significant reporter difference, with mothers characterizing their children as having higher ER relative to fathers' reports. Boys were more likely to be classified as insecure to mother, $\chi^2(1) = 4.93$, $p < .05$. With respect to the four category classification breakdown, no sex differences emerged for attachment to mother, $\chi^2(3) = 6.38$, *ns*. A significant attachment group differences emerged for age, $F(1, 95) = 3.64$, $p < .05$, with insecure-preoccupied children being older than secure, dismissing, and disorganized children. Because of these differences, age, sex, and reporter were used as covariates in subsequent data analyses. Table 1 reports means and standard deviations by attachment category.

Hypothesis 1: Subjective Reports of Trait-Like Child Emotional Experience

With respect to child-reports of trait-like emotion, after controlling for participants' age and sex, (R^2 = .05, p = .09, narrative coherence was entered on a second step of the model, ΔR^2 = .07, $p < .01$. Narrative coherence positively predicted positive emotion, β = .27, $p < .01$, indicating that as children's coherence increased, so did their report of positive emotion. Narrative coherence was unrelated the negative emotion and emotion control scales. With respect to parent-report of child's emotion on the

[2] We used startle magnitude, which entails the inclusion of nonresponses, as our dependent variables.

Table 1
Means (SDs) of Emotion Variables by Attachment Classifications

Variable	Dismissing	Secure	Preoccupied	Disorganized	ANOVA F
Child report					
Pos emotion (HIF)	30.27 (5.87)	33.38 (4.09)	29.33 (7.03)	31.19 (5.48)	2.59
Neg emotion (HIF)	27.38 (12.13)	23.38 (7.95)	24.00 (6.39)	26.75 (9.38)	0.35
Emot control (HIF)	33.69 (9.30)	34.51 (7.59)	34.83 (7.88)	33.50 (9.11)	0.96
Pre-CAI Pos Aff	50.27 (12.14)	53.74 (10.04)	48.50 (10.74)	52.11 (9.36)	0.85
Post-CAI Pos Aff	52.60 (13.60)	55.05 (10.17)	47.17 (10.85)	54.02 (11.45)	1.22
Pre-CAI Neg Aff	24.67 (11.70)	21.88 (8.26)	19.67 (3.93)	19.83 (5.58)	1.36
Post-CAI Neg Aff	24.13 (10.83)	20.53 (7.32)	20.33 (6.50)	19.59 (5.96)	1.52
Pre-startle Pos Aff	50.97 (13.81)	51.31 (11.45)	48.83 (12.70)	52.61 (11.20)	0.16
Post-startle Pos Aff	50.00 (13.61)	51.41 (12.30)	44.50 (9.54)	53.56 (12.31)	0.85
Pre-startle Neg Aff	22.17 (10.30)	20.40 (8.68)	17.67 (1.97)	19.11 (4.56)	0.78
Post-startle Neg Aff	22.59 (11.00)	19.82 (8.28)	17.17 (3.92)	20.18 (7.72)	0.88
Parent report					
Negativity/lability	26.20 (7.62)	24.59 (5.27)	27.17 (7.44)	27.89 (6.83)	1.11
Emotion regulation	25.60 (2.30)	27.02 (1.94)	27.17 (1.94)	26.72 (3.32)	2.34
Cortisol ug/dl					
Pre-CAI Cort	0.11 (0.05)[a]	0.15 (0.10)[a]	0.26 (0.14)[b]	0.12 (0.05)[a]	5.53**
Post-CAI Cort	0.11 (0.06)	0.10 (0.05)	0.14 (0.06)	0.08 (0.04)	2.43
Pre-startle Cort	0.16 (0.10)	0.14 (0.09)	0.18 (0.05)	0.15 (0.10)	0.47
Post-startle Cort	0.16 (0.13)[a]	0.12 (0.08)[a]	0.26 (0.26)[b]	0.11 (0.14)[a]	2.86**
Startle					
Mean startle Mag, safe	−0.22 (0.30)	−0.26 (0.29)	−0.24 (0.40)	−0.23 (0.44)	0.07
Mean startle Mag, threat	−0.01 (0.34)	0.06 (0.19)	0.09 (0.23)	0.09 (0.35)	0.63

Note. Groups with different superscripts in the same row differ significantly from each other. Pos = positive; neg = negative; aff = affect; cort = cortisol.
** $p < .01$.

ERC, narrative coherence was not a significant predictor in the multiple regression models.[3]

Hypothesis 2: Subjective Reports of State-Like Child Emotional Experience

Positive affect CAI. State affect was evaluated using multilevel modeling. Model 1 (without attachment) indicated that positive affect increased significantly over the course of the task, $b = 8.29$, $SE = 0.62$, $p < .01$, and that this change was moderated by participants' age, $b = -0.63$, $SE = 0.30$, $p < .05$, with older participants increasing more slowly than younger participants; no other significant effects were observed in Model 1. Model 2 indicated that participants with greater narrative coherence entered the study with significantly higher levels of positive affect, $b = 1.51$, $SE = 0.43$, $p < .001$, and that their positive affect increased more slowly over time, $b = -0.48$, $SE = 0.21$, $p < .05$. This coherence by time interaction can be understood in terms of a general significant increase in positive affect over time, $b = 9.74$, $SE = 3.27$, $p < .001$.[4] Fit statistics indicated that Model 2 fit the data significantly better than Model 1.

Negative affect CAI. Model 1 indicated that negative affect decreased significantly over the course of the task, $b = -6.18$, $SE = 1.97$, $p < .001$, and that younger children entered the study with significantly higher levels of negative affect, $b = -2.46$, $SE = 0.49$, $p < .001$. This change in reports of negative affect was moderated by participants' age, $b = 0.66$, $SE = 0.18$, $p < .001$, with younger participants' reports decreasing more quickly than older participants. Model 2 did not yield any additional findings.

Positive affect startle. Model 1 indicated that positive affect increased significantly over the course of the task, $b = 8.82$, $SE = 3.19$, $p < .01$, and that younger children, $b = -1.48$, $SE = 0.69$, $p < .05$, and girls, $b = 4.97$, $SE = 2.10$, $p < .05$, reported more positive affect at the beginning of session. The increase in positive affect was moderated by participants' age, $b = -0.64$, $SE = 0.29$, $p < .05$, and sex, $b = -1.92$, $SE = 0.89$, $p < .05$, with older participants and girls increasing more slowly over time. Model 2 did not yield any additional significant effects.

Negative affect startle. Model 1 revealed that age was related to reports of negative affect, $b = -1.50$, $SE = 0.48$, $p < .001$, such that younger children reported greater negative affect at the beginning of the session. Model 2 indicated that the reports of children with higher narrative coherence decreased more quickly over time, $b = -0.35$, $SE = 0.14$, $p < .01$. Fit statistics indicated that Model 2 fit the data significantly better than Model 1.

[3] Similar to a previous study documenting high concordance in child attachment with respect to mother and father (Shmueli-Goetz et al., 2008), 94.8% of children in this sample were classified in the same attachment category with respect to both parents in the 4-way attachment categorization system. Given the small number of children who had different classifications for mother and father, attachment classifications with respect to mother were used for remaining analyses and are reported here. Importantly, the analyses were repeated using attachment classification with respect to father and all findings remain intact.

[4] Analysis of covariance models using attachment groups indicated that the parents of secure children rated them as having significantly better emotion regulation than dismissing children, F (3, 96) = 3.67, $p < .05$, $\acute{\eta}^2 = .08$, and significantly lower affective negativity/lability than preoccupied and disorganized children, F (3, 96) = 2.81, $p < .05$, $\acute{\eta}^2 = .10$.

Hypothesis 3: Cortisol Reactivity

Prepost CAI cortisol. Because of the well-documented relation of diurnal variation on cortisol levels (e.g., Pollard, 1995), all 61 analyses were conducted while controlling for time of testing. As expected, Model 1 indicated that earlier time of day was related to higher cortisol levels at study entry, $b = -0.03$, $SE = 0.01$, $p < .001$. Model 2 revealed that greater narrative coherence was related to higher cortisol levels at study entry, $b = 0.01$, $SE = 0.00$, $p < .01$ (see Table 2).[5] Fit statistics indicated that Model 2 fit the data significantly better than Model 1.

Prepost startle cortisol. Model 1 indicated that earlier time of day was related to higher cortisol levels at study entry, $b = -0.06$, $SE = 0.01$, $p < .001$ (random effects: intercept, $z = 4.13$, $p < .01$, slope, $z = 2.44$, $p < .01$). Model 2 did not yield any additional findings.

Hypothesis 4: Fear-Potentiated Startle Data

Mean-level differences to threat versus safe condition. Model 1 indicated that younger children had higher startle magnitude, $b = -0.14$, $SE = 0.05$, $p < .01$, and that children showed greater startle magnitude to threat as opposed to safe, $b = -0.75$, $SE = 0.33$, $p < .05$, with younger children showing greater startle magnitude to threat versus safe, $b = 0.09$, $SE = 0.03$, $p < .01$. Model 2 did not yield additional significant effects.

Startle magnitude over time. Changes in startle magnitude over time were modeled separately for the safe and threat conditions. With respect to the safe condition, Model 1 revealed that younger children showed a slower decrease in startle magnitude over time, $b = -0.09$, $SE = 0.04$, $p < .05$. Model 2 did not yield additional significant effects.

With respect to threat, Model 1 did not reveal any significant effects. Model 2 indicated that children with greater narrative coherence scores showed larger startle magnitude at the beginning of the paradigm, $b = 0.22$, $SE = 0.07$, $p < .001$, and a faster decrease in startle magnitude over time, $b = 0.10$, $SE = 0.03$, $p < .001$ (see Table 3).[6] Fit statistics indicated that Model 2 fit the data significantly better than Model 1.

Discussion

Attachment theory suggests that relationships form the basis for the development of ER. Specifically, children who have insecure attachment relationships with their primary caregiver(s) are more likely to develop poor ER abilities. The association between attachment and emotion is documented in younger children and adults, and emerging evidence linking attachment, temperament, and ER is promising (Gilissen et al., 2007, 2008a, 2008b). The current study evaluated associations between attachment organization and subjective, neuroendocrine, and psychophysiological indices of ER in a sample of school-age children. The main findings provide mixed support for the link between attachment and ER in this age group.

Subjective Emotional Experience

Attachment security was largely unrelated to children's self-reported subjective experience. Higher narrative coherence was associated with greater self-reports of trait-like positive emotion, but no associations were found between narrative coherence and parent-reports of child ER. Children with greater attachment security showed a steeper increase in reports of positive affect from pre-to-post CAI and a faster decline in negative affect from pre-to-post startle, but no other attachment effects emerged.

Cortisol Reactivity

The greater the attachment security, the lower the child's pre-CAI cortisol levels. If we assume that cortisol levels are a neurohormonal index of stress (Pollard, 1995), then the findings indicate that children with greater attachment security began their participation in the research study with lower levels of stress. Indeed the participation in the research may have served as a stress or itself. Although the attachment group findings are presented in footnotes and considered ancillary to the main narrative coherence analyses, they suggest that dismissing children slower decreases in their cortisol levels from pre- to post-CAI, which may be indicative of slower habituation to stress. However, narrative coherence scores were not significantly associated with levels observed pre- and post-startle paradigm. This leads us to conclude that the association of narrative coherence with cortisol in middle childhood may be task-dependent or unstable. Future research ought to establish whether the association between attachment and cortisol varies by context, and specifically whether insecure attachment is linked with cortisol reactivity in response to relational and nonrelational stressors.

Startle Findings

Contrary to our expectations, attachment security was unrelated to differences in mean startle magnitude to conditions of safety versus threat, which fails to support the notion that insecure children are less able to use context cues of safety to regulate negative affect in this paradigm (Ainsworth et al., 1978; Bowlby, 1988; Cassidy & Berlin, 1994; Grossmann, Grossmann, & Zimmermann, 1999). However, when analyzing change over time in startle magnitude, we found that children with higher narrative coherence had higher initial startle magnitude during threat and a faster decrease in magnitude over time during the threat condition. This response pattern likely has adaptive value in that these children respond initially to conditions of threat with higher arousal and are then able to down-regulate once the threat stimulus is experienced and appraised. The ability to react and reduce negative affect during threat characterizes secure children. Group-based findings are consistent with this interpretation—dismissing chil-

[5] The results of a multilevel model using attachment categories showed that dismissing children's cortisol levels decreased more slowly over the course of the CAI, $b = 0.04$, $SE = 0.02$, $p < .05$. In addition, preoccupied children had higher pre-CAI levels of cortisol, $b = 0.12$, $SE = 0.03$, $p < .001$, and their cortisol levels decreased more quickly over the CAI, $b = -0.08$, $SE = 0.03$, $p < .01$. No attachment group-based differences were observed in pre- and poststartle cortisol levels.

[6] A multilevel model using categories revealed that, during threat, dismissing children started out with lower startle magnitude, $b = 0.94$, $SE = 0.37$, $p < .01$, and their startle magnitude decreased more slowly over time, $b = 0.40$, $SE = 0.18$, $p < .05$. No attachment group-based differences were observed during safe.

Table 2
Unstandardized Parameter Estimates From Two Multilevel Models Assessing Change in Pre- and Post-Child Attachment Interview Cortisol as a Function of Attachment Security

	Model 1				Model 2			
Predictors	B	*SE*	95% CI	*p*	B	*SE*	95% CI	*p*
Age	0.01	0.01	−0.01, 0.02	0.27	0.01	0.01	−0.01, 0.02	0.29
Gen	0.01	0.02	−0.02, 0.04	0.56	0.01	0.02	−0.02, 0.04	0.85
Time	0.02	0.05	−0.08, 0.13	0.15	0.04	0.05	−0.07, 0.15	0.45
Time of day	−0.03	0.01	−0.04, −0.01	0.00	−0.02	0.01	−0.04, −0.01	0.01
NC	—	—	—	—	0.01	0.00	0.00, 0.02	0.01
Age × time	−0.01	0.01	−0.01, 0.01	0.59	−0.00	0.001	−0.01, 0.01	0.62
Gen × time	−0.02	0.15	−0.05, 0.01	0.12	−0.02	0.15	−0.05, 0.01	0.19
NC × time	—	—	—	—	−0.01	0.003	−0.01, 0.01	0.11
Variance	z		*p*		z		*p*	
Intercept	6.40		0.001		5.87		0.001	
Slope	5.71		0.001		5.51		0.001	
Fit statistics			Value				Value	*p*
−2 LL			−507.41				−509.55	.03

Note. NC = narrative coherence; Time = change over assessment point; Time of day = the hour of the day when the pre-CAI cort sample was taken; Gen = gender; −2 LL = −2 Log Likelihood for the model; effects containing "× time" are cross-level interactions reflecting change across the study task as a function of the level-2 variable of interest; all other effects represent deviation scores on the initial intercept as a function of the level-2 variable of interest. Degrees of freedom for Model 1 = 8, Model 2 = 10.

dren started out with lower startle magnitude and decreased more slowly over time. No attachment effects emerged with respect to startle magnitude during cues of safety. Similar to the cortisol findings, this pattern suggests that the link between attachment and startle magnitude is context-specific—that is, it was only present during conditions of threat.

The findings of this study raise a number of additional questions for further investigation. The observed discrepancies between different measures of emotional experience are consistent with a growing body of work demonstrating that multiple assessment modalities do not necessarily converge on a single picture of affective experience (e.g., Kring & Neale, 1996; Mauss & Robinson, 2009). In this study, self-reports of emotion, for the most part, did not map onto attachment security in neuroendocrine or startle indices of emotion. The discrepancies in this and other studies underscore the importance of research that incorporates multiple assessments of emotion experience and expression into study designs. In addition, the study emphasizes the importance of evaluating the contributions of age to measurements of ER, as age was significantly associated with almost every index of ER. In general, younger children seemed to have more extreme affective responses. They reported higher levels of both positive and negative state affect, showed more rapid changes in affect, and had larger startle magnitude during safe. Additionally, our study provided a fairly stringent test of the associations between attachment and ER. Theoretically, the strongest association between attach-

Table 3
Unstandardized Parameter Estimates From Two Multilevel Models Assessing Change in Startle Magnitude During "Threat" as a Function of Attachment Security

	Model 1				Model 2			
Predictors	b	*SE*	95% CI	*p*	B	*SE*	95% CI	*P*
Age	0.18	0.11	−0.03, 0.40	0.09	0.17	0.10	−0.03, 0.37	0.09
Gen	0.23	0.33	−0.41, 0.87	0.48	0.07	0.31	−0.55, 0.69	0.82
Time	−0.33	0.23	−0.79, 0.13	0.15	−0.43	0.22	−0.88, 0.01	0.06
NC	—	—	—	—	0.22	0.07	0.07, 0.37	0.00
Age × time	−0.04	0.05	−0.14, 0.06	0.42	−0.04	0.05	−0.13, 0.06	0.48
Gen × time	−0.04	0.15	−0.34, 0.26	0.78	0.03	0.15	−0.26, 0.33	0.83
NC × time	—	—	—	—	0.10	0.03	−0.17, −0.03	0.00
Variance	z		*p*		z		*p*	
Intercept	2.47		0.01		2.10		0.05	
Slope	9.06		0.01		2.81		0.05	
Fit statistics			Value				Value	*p*
−2 LL			1603.44				−1612.01	.00

Note. NC = narrative coherence; Time = change over assessment point; Gen = gender; −2 LL = −2 Log Likelihood for the model; effects containing "× time" are cross-level interactions reflecting change across the study task as a function of the level-2 variable of interest; all other effects represent deviation scores on the initial intercept as a function of the level-2 variable of interest. Degrees of freedom for Model 1 = 8, Model 2 = 10.

ment and ER ought to be ER in relational contexts, but this study evaluated the use of a nonrelational stressor (the startle paradigm). Studies might yield more robust findings or multimeasure convergence if reactions to a relationally oriented stressor are evaluated.

Aspects of the study design deserve consideration as limitations. First, the study was correlational. Data were collected during two sessions ~1 week apart, representing a limited window into the interrelations of these constructs and precluding causal inference. Second, participants were primarily White (87%) and came from low-risk backgrounds, limiting the findings to this demographic grouping. The ethnic homogeneity provided a more stringent test of our initial hypotheses while at the same time possibly reducing their generalizability to clinical samples. Future research ought to evaluate these same questions in more diverse and high-risk samples, where rates of insecure attachment and clinical distress are likely to be higher.

A third caveat is the fact that all of the assessments used in this study are influenced by factors other than the constructs of interest. Cortisol assays are influenced by multiple factors that we were unable to control (e.g., whether the child had exercised or napped). Startle electromyography is affected by the weight of the child. This may be particularly important in the context of the current study because of the fact that we found that child age, which presumably is highly correlated with child weight, was negatively associated with startle magnitude. Although we took precautions to minimize the influence of weight by including age as a covariate and standardizing startle responses within participants, we did not collect data on child weight and are unable to rule this out as an alternative hypothesis for the startle finding. In addition, self- and parent-reports may be influenced by concerns of social desirability and attachment interviews may be influenced by a number of factors, including the child's mood. These measurement errors limit the external validity of the conclusions. In addition, although the inclusion of attachment increased the fit of multilevel models, examination of random effects indicates that additional between-subjects variance remains unexplained, suggesting that emotion outcomes are influenced by multiple factors. Future investigations should examine the link between these constructs using these and other modes of assessment to strengthen confidence in these findings.

We conclude that our findings provide validation for the contemporaneous association between attachment and select indices of ER in school-age children. Greater attachment security was associated with higher self-reports of positive trait- and state-level emotion, lower pre-CAI cortisol levels, and higher startle magnitude during threat, and a faster decline in startle response to threat.

References

Adam, E. (1999). Emotional and physiological stress in mothers of toddlers: An adult attachment model. *Dissertation Abstracts International: Section B: The Sciences and Engineering, 59,* 5595.

Ainsworth, M. S., Blehar, M. C., Waters, E., & Wall, S. (1978). *Patterns of attachment: A psychological study of the strange situation.* Oxford, England: Erlbaum.

Bakermans-Kranenburg, M. J., & van IJzendoorn, M. H. (2009). The first 10,000 Adult Attachment Interviews: Distributions of adult attachment representations in clinical and non-clinical groups. *Attachment and Human Development, 11,* 223–263.

Beebe, B. (2000). Coconstructing mother-infant distress: The microsynchrony of maternal impingement and infant avoidance in the face-to-face encounter. *Psychoanalytic Inquiry, 20,* 421–440.

Bowlby, J. (1973). *Attachment and loss: Vol. 2. Separation.* New York: Basic Books.

Bowlby, J. (1980). *Attachment and loss: Vol. 3. Loss.* New York: Basic Books.

Bowlby, J. (1988). *A secure base: Clinical applications of attachment theory.* London: Tavistock/Routledge.

Bradley, M. M. (2000). Emotion and motivation. In J. T. Cacioppo, L. G. Tassinary, & G. G. Bernston (Eds.), *Handbook of psychophysiology* (pp. 602–642). New York: Cambridge University Press.

Bradley, M. M., Cuthbert, B., & Lang, P. J. (1990). Startle reflex modification: Attention or emotion? *Psychophysiology, 27,* 513–522.

Campeau, S., & Davis, M. (1992). Fear potentiation of the acoustic startle reflex using noises of various spectral frequencies as conditioned stimuli. *Animal Learning & Behavior, 20,* 177–186.

Cassidy, J. (1994). Emotion regulation: Influences of attachment relationships. *Monographs of the Society for Research in Child Development, 59,* 228–283.

Cassidy, J., & Berlin, L. J. (1994). The insecure/ambivalent pattern of attachment: Theory and research. *Child Development, 65,* 971–981.

Cole, P. M., Martin, S. E., & Dennis, T. E. (2004). Emotion regulation as a scientific construct: Methodological challenges and directions for child development research. *Child Development, 75,* 317–333.

Cole, P. M., Michel, M. K., & Teti, L. O. (1994). The development of emotion regulation and dysregulation: A clinical perspective. *Monographs of the Society for Research in Child Development, 59,* 73–100, 250–283.

Contreras, J. M., Kerns, K. A., Weimer, B. L., Gentzler, A. L., & Tomich, P. L. (2000). Emotion regulation as a mediator of associations between mother–child attachment and peer relationships in middle childhood. *Journal of Family Psychology, 14,* 111–124.

Crowley, M. J., Liu, L., Borelli, J. L., Mayes, L. C., & Zhang, H. (manuscript submitted for publication). Parsing individual differences in negative emotionality: Growth curve modeling the chronometry of threat modulated startle in children.

Davis, M., Falls, W. A., Campeau, S., & Kim, M. (1993). Fear-potentiated startle: A neural and pharmacological analysis. *Behavioural Brain Research, 58,* 175–198.

De Wolff, M. S., & van IJzendoorn, M. H. (1997). Sensitivity and attachment: A meta- analysis on parental antecedents of infant attachment. *Child Development, 68,* 571–591.

Diamond, L. (2001). Contributions of psychophysiology to research on adult attachment: Review and recommendations. *Personality and Social Psychology Review, 5,* 276–295.

Diamond, L. M., Hicks, A. M., & Otter-Henderson, K. (2006). Physiological evidence for repressive coping among avoidantly attached adults. *Journal of Social and Personal Relationships, 23,* 205–229.

Dozier, M., & Kobak, R. R. (1992). Psychophysiology in attachment interviews: Converging evidence for deactivating strategies. *Child Development, 63,* 1473–1480.

Dozier, M., & Lee, S. W. (1995). Discrepancies between self- and other-report of psychiatric symptomatology: Effects of dismissing attachment strategies. *Development and Psychopathology, 7,* 217–226.

Fagot, B. I., & Pears, K. C. (1996). Changes in attachment during the third year: Consequences and predictions. *Development and Psychopathology, 8,* 325–344.

Feeney, B. C., & Kirkpatrick, L. A. (1996). Effects of adult attachment and presence of romantic partners on physiological responses to stress. *Journal of Personality and Social Psychology, 70,* 255–270.

Fisher, S., & Mayes, L. C. (2001). *Computerized assessment and presentation engine* (version 3.0) [Computer software]. New Haven, CT: Yale University.

George, C., Kaplan, N., & Main, M. (1984, 1985, 1996). *Adult attachment* *interview protocol.* Unpublished manuscript, University of California at Berkeley.

Gilissen, R., Bakersman-Kranenburg, M. J., van IJzendoorn, M. H., & Linting, M. (2008a). Electrodermal reactivity during the Trier Social Stress Test for Children: Interaction between the serotonin transporter polymorphism and children's attachment representation. *Developmental Psychobiology, 50,* 615–625.

Gilissen, R., Bakersman-Kranenburg, M. J., van IJzendoorn, M. H., & van der Veer, R. (2008b). Parent-child relationship, temperament, and physiological reactions to fear-inducing film clips: Further evidence for differential susceptibility. *Journal of Experimental Child Psychology, 99,* 182–195.

Gilissen, R., Koolstra, C. M., van IJzendoorn, M. H., Bakersman-Kranenburg, M. J., & van der Veer, R. (2007). Physiological reactions of preschoolers to fear-inducing film clips: Effects of temperamental fearfulness and the quality of the parent-child relationship. *Developmental Psychobiology, 49,* 187–195.

Granot, D., & Mayseless, O. (2001). Attachment security and adjustment to school in middle childhood. *International Journal of Behavioral Development, 25,* 530–541.

Grillon, C., Ameli, R., Foot, M., & Davis, M. (1993). Fear-potentiated startle: Relationship to the level of state/trait anxiety in healthy subjects. *Biological Psychiatry, 33,* 566–574.

Grillon, C., Ameli, R., Goddard, A., Woods, S. W., & Davis, M. (1994). Baseline and fear-potentiated startle in panic disorder patients. *Biological Psychiatry, 35,* 431–439.

Grillon, C., Dierker, L., & Merikangas, K. R. (1998). Fear-potentiated startle in adolescent offspring of parents with anxiety disorders. *Biological Psychiatry, 44,* 990–997.

Grillon, C., Merikangas, K. R., Dierker, L., Snidman, N., Arriaga, R. I., Kagan, J., . . . Nelson, C. (1999). Startle potentiation by threat of aversive stimuli and darkness in adolescents: A multi-site study. *International Journal of Psychophysiology, 32,* 63–73.

Grillon, C., & Morgan, C. A., III. (1999). Fear-potentiated startle conditioning to explicit and contextual cues in Gulf War veterans with posttraumatic stress disorder. *Journal of Abnormal Psychology, 108,* 134–142.

Grossmann, K. E., Grossmann, K., & Zimmermann, P. (1999). A wider view of attachment and exploration: Stability and change during the years of immaturity. In Cassidy, J., & Shaver, P. R. (Eds.), *Handbook of Attachment: Theory, Research, and Clinical Applications* (pp. 760–786). New York: Guilford Press.

Gunnar, M. R., Mangelsdorf, S., Larson, M., & Hertsgaard, L. (1989). Attachment, temperament, and adrenocortical activity in infancy: A study of psychoendocrine regulation. *Developmental Psychology, 25,* 355–363.

Hertsgaard, L., Gunnar, M., Erickson, M. F., & Nachmias, M. (1995). Adrenocortical responses to the strange situation in infants with disorganized/disoriented attachment relationships. *Child Development, 66,* 1100–1106.

Hesse, E., & Main, M. (2000). Disorganized infant, child, and adult attachment: Collapse in behavioral and attentional strategies. *Journal of the American Psychoanalytic Association, 48,* 1097–1127.

Humfress, H., O'Connor, T. G., Slaughter, J., Target, M., & Fonagy, F. (2002). General and relationship-specific models of social cognition: Explaining the overlap and discrepancies. *Journal of Child Psychiatry and Psychology and Allied Disciplines, 43,* 873–883.

Jackson, D. C., Mueller, C. J., Dolski, I., Dalton, K. M., Nitschke, J. B., Urry, H. L., . . . Davidson, R. J. (2003). Now you feel it, now you don't: Frontal brain electrical asymmetry and individual differences in emotion regulation. *Psychological Science, 14,* 612–617.

Keenan, K. (2000). Emotion dysregulation as a risk factor for child psychopathology. *Clinical Psychology: Science and Practice, 7,* 418–434.

Kerns, K. A. (2008). Attachment in middle childhood. In Cassidy, J., & Shaver, P. R. (Eds.), *Handbook of Attachment: Theory, Research, and Clinical Applications* (2nd ed., pp. 366–382). New York: Guilford Press.

Kerns, K. A., Abraham, M. M., Schlegelmilch, A., & Morgan, T. (2007). Mother-child attachment in later middle childhood: Assessment approaches and associations with mood and emotion regulation. *Attachment & Human Development, 9,* 33–53.

Kerns, K. A., Tomich, P. L., Aspelmeier, J. E., & Contreras, J. M. (2000). Attachment-based assessments of parent-child relationships in middle childhood. *Developmental Psychology, 36,* 614–626.

Kobak, R. R., Cole, H. E., Ferenz-Gillies, R., Fleming, W. S., & Gamble, W. (1993). Attachment and emotion regulation during a mother-teen problem solving: A control theory analysis. *Child Development, 64,* 231–245.

Kobak, R. R., & Sceery, A. (1988). Attachment in late adolescence: Working models, affect regulation, and representations of self and others. *Child Development, 59,* 135–146.

Kring, A. M., & Neale, J. M. (1996). Do schizophrenic patients show a disjunctive relationship among expressive, experiential, and psychophysiological components of emotion? *Journal of Abnormal Psychology, 105,* 249–257.

Laible, D. J., & Thompson, R. A. (1998). Attachment and emotional understanding in preschool children. *Developmental Psychology, 34,* 1038–1045.

Lang, P. J. (1984). Cognition in emotion: Concept and action. In C. lzard, C., Kagan, J., & Zajonc, R. (Eds.), *Emotion, cognition, and behavior* (pp. 193–226). New York: Cambridge University Press.

Lang, P. J. (1995). The emotion probe: Studies of motivation and attention. *American Psychologist, 50,* 371–385.

Lang, P. J., Greenwald, M. K., Bradley, M. M., & Hamm, A. O. (1993). Looking at pictures: Affective, facial, visceral, and behavioral reactions. *Psychophysiology, 30,* 261–273.

Lang, P. J., Rice, D. G., & Sternbach, R. A. (1972). The psychophysiology of emotion. In N. S. Greenfield & R. A. Sternbach (Eds.), *Handbook of psychophysiology* (pp. 623–643). New York: Holt, Rinehart, & Winston.

Laurent, J., Catanzaro, S. J., Joiner, T. E., Jr., Rudolph, K. D., Potter, K. I., Lambert, S., . . . Gathright, T. (1999). A measure of positive and negative affect for children: Scale development and preliminary validation. *Psychological Assessment, 11,* 326–338.

Lissek, S., Orme, K., McDowell, D. J., Johnson, L. L., Luckenbaugh, D. A., Baas, J. M., . . . Grillon, C. (2007). Emotion regulation and potentiated startle across affective picture and threat-of- shock paradigms. *Biological Psychology, 76,* 124–133.

Lyons-Ruth, K., Alpern, L., & Repacholi, B. (1993). Disorganized infant attachment classification and maternal psychosocial problems as predictors of hostile-aggressive behavior in the preschool classroom, *Child Development, 64,* 572–585.

Lyons-Ruth, K., Zoll, D., Connell, D., & Grunebaum, H. U. (1989). Family deviance and family disruption in childhood: Associations with maternal behavior and infant maltreatment during the first years of life. *Development and Psychopathology, 1,* 219–236.

Main, M. (1981). Avoidance in the service of proximity: A working paper. In K. Immelmann, G. Barlow, L. Petrinovitch, & M. Main (Eds.), *Behavioral development: The Bielefeld interdisciplinary project* (pp. 651–693). New York: Cambridge University Press.

Mauss, I. B., & Robinson, M. D. (in press). Measures of emotion: A review. *Cognition and Emotion.*

Mikulincer, M. (1998). Adult attachment style and individual differences in functional versus dysfunctional experiences of anger. *Journal of Personality and Social Psychology, 74,* 513–524.

Moss, E., Cyr, C., & Dubois-Comtois, K. (2004). Attachment at early school age and developmental risk: Examining family contexts and behavior problems of controlling- caregiving, controlling-punitive, and behaviorally disorganized children. *Developmental Psychology, 40,* 519–532.

Moss, E., Rousseau, D., Parent, S., St-Laurent, D., & Saintonge, J. (1998). Correlates of attachment at school age: Mother–child interaction, maternal self-reports, and teacher- reported behavior problems. *Child Development, 69,* 1390–1405.

Moss, E., Smolla, N., Cyr, C., Dubois-Comtois, K., Mazzarello, T., & Berthiaume, C. (2006). Attachment and behavior problems in middle childhood as reported by adult and child informants. *Development and Psychopathology, 18,* 425–444.

Nachmias, M., Gunnar, M., Mangelsdorf, S., Parritz, R. J., & Buss, K. (1996). Behavioral inhibition and stress reactivity: The moderating role of attachment security. *Child Development, 67,* 508–522.

Pietromonaco, P. R., Feldman Barrett, L., & Powers, S. I. (2006). In D. K. Snyder, J. A. Simpson, & J. N. Hughes (Eds.), *Emotion regulation in couples and families: Pathways to dysfunction and health* (pp. 57–74). Washington, DC: American Psychological Association.

Pietromonaco, P. R., Greenwood, D., & Feldman Barrett, L. (2004). Conflict in adult close relationships: An attachment perspective. In W. S. Rholes & J. A. Simpson (Eds.), *Adult attachment: New directions and emerging issues* (pp. 267–299). New York: Guilford Press.

Pollard, T. M. (1995). Use of cortisol as a stress marker: Practical and theoretical problems. *American Journal of Physical Anthropology, 7,* 265–274.

Powers, S. I., Pietromonaco, P. R., Gunlicks, M., & Sayer, A. (2006). Dating couples' attachment styles and patterns of cortisol reactivity and recovery in response to a relationship conflict. *Journal of Personality and Social Psychology, 90,* 613–628.

Rifkin-Graboi, A. (2008). Attachment status and salivary cortisol in a normal day and during simulated interpersonal stress in young men. *The International Journal on the Biology of Stress, 11,* 210–224.

Roisman, G. I. (2007). The psychophysiology of adult attachment relationships: Autonomic reactivity in marital and premarital interactions. *Developmental Psychology, 43,* 39–53.

Scheidt, C. E., Waller, E., Malchow, H., Ehlert, U., Becker-Stoll, F., Schulte-Monting, J., & Lucking, C. H. (2000). Attachment representation and cortisol response to the Adult Attachment Interview in idiopathic spasmodic torticollis. *Psychotherapy and Psychosomatics, 69,* 155–162.

Shaw, D. S., Owens, E. B., Vondra, J. I., Keenan, K., & Winslow, E. B. (1996). Early risk factors and pathways in the development of early disruptive behavior problems. *Development and Psychopathology, 8,* 679–699.

Shaw, D. S., & Vondra, J. I. (1995). Infant attachment security and maternal predictors of early behavior problems. *Journal of Abnormal Child Psychology, 23,* 335–357.

Shields, A., & Cicchetti, D. (1997). Emotion regulation among school-age children: The development and validation of a new criterion Q-sort scale. *Developmental Psychology, 33,* 906–916.

Shields, A., & Cicchetti, D. (1998). Reactive aggression among maltreated children: The contributions of attention and emotion regulation. *Journal of Clinical Child Psychology, 27,* 381–395.

Shields, A. M., & Cicchetti, D. (1995, March). *The development of an emotion regulation assessment battery: Reliability and validity among at-risk grade-school children.* Poster session presented at the biennial meeting of the Society for Research in Child Development, Indianapolis, IN.

Shmueli-Goetz, Y., Target, M., Datta, A., & Fonagy, P. (2004). *Child Attachment Interview (CAI) coding and classification manual, version V.* Unpublished Manuscript, The Sub- Department of Clinical Health Psychology, University College London.

Shmueli-Goetz, Y., Target, M., Datta, A., & Fonagy, P. (2008). The Child Attachment Interview: A psychometric study of reliability and discriminant validity. *Developmental Psychology, 44,* 939–956.

Singer, J. D., & Willett, J. B. (2003). *Applied longitudinal data analysis: Modeling change and event occurrence.* New York: Oxford University Press.

Spangler, G., & Grossmann, K. E. (1993). Biobehavioral organization in securely and insecurely attached infants. *Child Development, 64,* 1439–1450.

Sroufe, L. A. (1989). Relationships, self, and individual adaptation. In A. J. Sameroff, A. J., & Emde, R. N. (Eds.), Relationship disturbances in early childhood: A developmental approach (pp. 70–94). New York: Basic Books.

Sroufe, L. A. (1996). *Emotional development: The organization of emotional life in the early years.* New York: Cambridge University Press.

Sroufe, L. A. (2005). Attachment and development: A prospective, longitudinal study from birth to adulthood. *Attachment and Human Development, 7,* 349–367.

Sroufe, L. A., Egeland, B., Carlson, E., & Collins, W. A. (2005). *The development of the person: The Minnesota study of risk and adaptation from birth to adulthood.* New York: Guilford Press.

Sroufe, L. A., Egeland, B., & Kreutzer, T. (1990). The fate of early experience following developmental change: Longitudinal approaches to individual adaptation in childhood. *Child Development, 61,* 1363–1373.

Sroufe, L. A., Schork, E., Motti, F., Lawroski, N., & LaFreniere, P. (1984). The role of affect in social competence. In C. E. Izard, J. Kagan, & R. Zajonc (Eds.), *Emotions, cognition, and behavior* (pp. 289–319). New York: Plenum Press.

Stansbury, K., & Gunnar, M. (1994). Adrenocortical activity and emotion regulation. *Monographs of the Society for Research in Child Development, 59,* 108–134.

Steele, H., Steele, M., Croft, C., & Fonagy, P. (1999). Infant –mother attachment at one year predicts children's understanding of mixed emotions at six years. *Social Development, 8,* 161–178.

Target, M., Fonagy, F., & Shmueli-Goetz, Y. (2003). Attachment representation in school-age children: The development of the child attachment interview (CAI). *Journal of Child Psychotherapy, 29,* 171–186.

Thompson, R. A. (1994). Emotion regulation: A theme in search of definition. *Monographs of the Society for Research in Child Development, 59,* 250–283.

Verschueren, K., & Marcoen, A. (1994). *Adaptation of the Doll Stories Completion Task of Cassidy 1986.* Unpublished manual, Katholieke Universiteit Leuven, Center for Developmental Psychology, Louvain, Belgium.

Vondra, J. I., Shaw, D. S., Swearingen, L., Cohen, M., & Owens, E. B. (2001). Attachment stability and emotional and behavioral regulation from infancy to preschool age. *Development and Psychopathology, 13,* 13–33.

Walden, T. A., Harris, V. S., & Catron, T. F. (2003). How I feel: A self-report measure of emotional arousal and regulation for children. *Psychological Assessment, 15,* 399–412.

Wright, J. C., Binney, V., & Smith, P. K. (1995). Security of attachment in 8- to 12-year-olds: A revised version of the Separation Anxiety Test, its psychometric properties, and clinical interpretation. *Journal of Child Psychology and Psychiatry, 36,* 757–774.

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