Early Interpersonal Antecedents of Physiological Reactivity in Adult Romantic Relationships

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Dedication

This thesis is dedicated to Nick and Danica.

Abstract

The current study drew on prospective, longitudinal data in order to investigate the long-term significance of early parent-child relationship experiences for adults' physiological responses in romantic relationships. Autonomic nervous system activity was recorded for 37 adults (ages 34-37 years) during a baseline task and while they were discussing a relationship conflict with their romantic partners. Results indicated that (a) observed maternal emotional support during childhood and early adolescence predicted lower skin conductance reactivity, a sign of inhibition and anxiety, and (b) maternal emotional support and infant attachment security predicted lower heart rate reactivity, a psychophysiological marker of behavioral approach, during romantic relationship interactions. Moreover, the predictive effects of early parent-child relationship experiences were not accounted by covariates related to child characteristic and early socioeconomic factors or indicators of adults' concurrent relationship quality. Results of more exploratory analyses regarding the role of adult attachment states of mind in mediating the predictive effects of early parent-child relationship experiences for adults' physiological responses were inconclusive. Altogether, the results of the current study indicate that interpersonal experiences with parents during childhood and adolescence assist in organizing adults' physiological responses during close relationship contexts. Findings are discussed with respect to our understanding of the long-term predictive effects of early interpersonal experiences for social and emotional development across the life-course.

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Early Interpersonal Antecedents of Physiological Reactivity in Adult Romantic Relationships

A longstanding idea in developmental science is that early relationship experiences help organize developmental adaptation across the life-course, especially functioning in later interpersonal contexts. One of the most provocative extensions of this idea is that early experiences with caregivers may have long-term effects not only on individuals' extra-familial relationships with peers during childhood and adolescence but also their relationships with romantic partners during adulthood (Bowlby, 1988; Collins & Sroufe, 1999; Hazan & Shaver, 1987). Indeed, there is converging evidence from multiple longitudinal studies that parent-child relationship experiences during childhood and early adolescence predict later competence with the task of forming and maintaining committed, high-quality romantic relationships (Caspi & Elder, 1988; Chen, Liu, & Kaplan, 2008; Conger, Cui, Bryant, & Elder, 2000; Franz, McClelland, & Weinberger, 1991; Rauer, Pettit, Lansford, Bates, & Dodge, in press; Simpson, Collins, Tran, & Haydon, 2007). Moreover, early parent-child relationships experiences predict relationship functioning across multiple levels of analysis, including objective indices of relationship status (e.g., Rauer et al., in press; Salvatore, Kuo, Steele, Simpson, & Collins, 2011), adults' behaviors during interactions with romantic partners (e.g., Conger et al., 2000; Roisman, Madsen, Hennighausen, Sroufe, & Collins, 2001; Salvatore et al., 2011), mental representations of adults' romantic relationships (e.g., Grossmann, Grossmann, & Kindler, 2005; Roisman, Collins, Sroufe, & Egeland, 2005), and self-

reported attachment security and relationship quality (Fraley, Roisman, Booth-LaForce, Owen, & Holland, 2013; Simpson et al., 2007).

In recent years, efforts have been made to extend our understanding of the origins of romantic relationship functioning by examining not only adults' thoughts, feelings, and behaviors during interactions with romantic partners but also the biological systems that underlie them. This expanding research agenda reflects the growing interest in both developmental and social psychological science in understanding how individual adaptation is shaped by the dynamic interplay of factors that exist at multiple levels of analysis (Cacioppo, Berntson, Sheridan, & McClintock, 2000; Cicchetti & Tucker, 1994; Cicchetti & Dawson, 2002; Gottlieb, 2006; Reis, Collins, & Berscheid, 2000; Shonkoff & Phillips, 2000).

More specifically, there are two interrelated motivations for incorporating biological measures into research on socioemotional development generally and close relationships in adulthood more specifically. First, emotional processes can be characterized at multiple levels since they include behavioral, psychological, and biological components. In this way, combining biological measures with behavioral and psychological data offers more comprehensive understanding of the emotional outcomes of interest. Importantly though, measures from each of these levels of analysis provide non-redundant information. In other words, physiological measures provide unique insights into individuals' internal experiences. One possible explanation for this is that physiological measures may provide a window into psychological processes that are automatic and operate outside conscious awareness. A second possibility is that

information based on self-report questionnaires or behavioral observations can be intentionally distorted by individuals' willingness to report or display their emotions. In attachment research, this is especially relevant for individuals who are characterized by high attachment avoidance (referred to as dismissingness in adulthood), since this attachment pattern is thought to be indicative of an intentional turning away from attachment-related distress. As a result, highly avoidant individuals may underreport or fail to display negative emotions in interpersonal situations. Physiological measures have the potential to detect when individuals are experiencing heightened emotional arousal even if they are not displaying or reporting it.

The second motivation for including biological indices is that it advances our understanding of the neurobiology of attachment and close relationships across development. This information, in turn, may yield insights into the mechanisms by which early relationship experiences are internalized, carried forward, and influence developmental adaptation. For example, it is commonly assumed that infant-caregiver interactions serve important regulatory functions for children's developing physiological system, and early interpersonally stressful experiences are thought to tune the neurobiological systems that underlie stress reactivity and emotion regulation in order to be hyper-responsive to future threatening situations (Cicchetti & Tucker, 1994; Gunnar & Donzella, 2002; Hofer, 2006; Obradović, 2012; Schore, 2000). Although the upregulation of these physiological systems is thought to be an adaptive response to early adversity as it facilitates a quicker behavioral response to future stresses, prolonged physiological vigilance and heightened reactivity to ambiguous or neutral situations can interfere with

competent developmental adaptation in academic, social, and emotional domains (Cicchetti & Rogosch, 2012; Gunnar & Vazquez, 2006; Pollak, 2008). This perspective parallels the ideas of Sroufe and others regarding the role of emotion regulation in the carry-forward of early caregiving experiences across development (Sroufe, 1996; Weinfield et al., 2008; see also Cassidy, 1994), but extends them to include a focus on neurobiological substrates of emotional responses and regulation. In addition, the chronic activation of stress responses systems can result in cumulative wear and tear on the body, a phenomenon known as an allostatic load (McEwen, 1998). In this way, a richer understanding of biological consequences of early caregiving experience may shed light on the processes by which early adversity gets "under the skin" and impacts physical health outcomes in adulthood (Miller, Chen, & Parker, 2011; Puig, Englund, Simpson, & Collins, 2013; Shonkoff, Boyce, & McEwen, 2009).

The benefits of a multilevel perspective have already inspired an ever-growing body of research examining the biological concomitants of adults' romantic relationship experiences. For example, there is increasing evidence that marital quality is associated with adults' physiological responses during conflict discussions (for a recent meta-analysis, see Robles, Slatcher, Trombello, & McGinn, 2014). However, there is a lack of long-term longitudinal studies investigating whether adults' physiological responses during romantic relationship interactions are predicted by earlier interpersonal experiences during childhood and adolescence. The current study represents an initial investigation of that nature. Specifically, the current study investigates the long-term

predictive effects of early maternal sensitivity and infant attachment security for adults' autonomic nervous system responses during conflict discussions with romantic partners.

Psychophysiological perspectives

Normatively speaking, caregivers play a critical role in regulating children's responses to threat, especially early in development when children are most vulnerable and dependent on others for care, protection, and survival (Bowlby, 1982; Gunnar & Donzella, 2002; Hofer, 2006). As a result, it has been theorized that individual differences in early parent-child relationship experiences may shape the development of neurobiological systems that mediate stress and affective reactivity (e.g., Cicchetti & Tucker, 1994; Gunnar & Donzella, 2002; Schore, 2000). Responses to stress are mediated by two distinct but interrelated systems. The first is the hypothalamic-pituitary-adrenal (HPA) axis, which is a sequence of neural events that result in the production of glucocorticoids that can cross the blood-brain barrier and cause changes to gene expression (Gunnar & Quevedo, 2007). Importantly, the production of glucocorticoids is relatively slow and is not activated by all stressors (e.g., Dickerson & Kemeny, 2004; see also Gunnar & Adam, 2012). In contrast, the autonomic nervous system (ANS) is part of the sympathetic adrenal medulla pathway which mediates a faster acting fight-or-flight response to threat. Because the ANS is relatively responsive to environmental stimuli and can be continuously assessed in a noninvasive manner, measures of ANS reactivity are particularly suitable when investigating responses to interpersonal situations.

Gray's (1975) motivational theory has guided much of the scientific research on the autonomic nervous system correlates of adult romantic relationships. In short, Gray

(1975) postulated the existence of two relatively independent motivational systems. The behavioral inhibition system is responsible for constraining behavior in response to threatening stimuli and is therefore considered the anxiety system. In contrast, the behavioral activation system is involved with energizing behavior in order to seek rewards or avoid punishment. Fowles (1980) extended these ideas by arguing that these two motivational systems have unique physiological signatures. In particular, the electrodermal activity is a physiological marker of the behavioral inhibition system, whereas heart rate is an indicator of the behavioral activation system. Psychophysiological investigations have supported this conceptualization, as heart rate activity is influenced by rewarding stimuli (Fowles, 1988; see also Berntson, Quiqley, & Lozano, 2007) and electrodermal activity increases are associated with deception (Pennebaker & Chew, 1985; see also Dawson, Shell, & Filion, 2007). Thus, these two physiological measures appear to be indicative of unique affective and motivational processes.

The psychophysiology of adult attachment

Although there is a lack of long-term longitudinal investigations of the early caregiving antecedents of adults' physiological responses in romantic relationships, developmental scientists have leveraged information about adults' attachment representations in order to investigate the potential developmental origins of adults' physiological responses in close relationship contexts. Attachment theory hypothesizes that individuals' mental representations, or internal working models, of close relationships originate in early parent-child relationship experiences and help to organize

individuals' responses to interpersonal situations (Bowlby, 1988). Within developmental psychology, adults' attachment representations are most commonly assessed using the Adult Attachment Interview (AAI; Main, Kaplan, & Cassidy, 1985). Indeed, longitudinal studies have demonstrated that adults' AAI states of mind are rooted in early attachment-relevant experiences (e.g., Beijersbergen, Juffer, Bakermans-Kranenburg, & van IJzendoorn, 2012; Haydon, Roisman, Owen, Booth-LaForce, & Cox, in press; Weinfield, Sroufe, & Egeland, 2004) and may mediate the associations between supportive parent-child relationships and romantic relationship functioning in young adulthood (Roisman et al., 2001).

The earliest investigations of the psychophysiological correlates of adult attachment states of mind focused on the associations between adults' attachment states of mind and their physiological responses during the AAI. In a groundbreaking study, Dozier and Kobak (1992) reported that the use of a deactivating strategy during the AAI (i.e., providing a generally positive description of childhood relationships but failing to provide supporting evidence or claiming to not remember past events) was associated with increases in electrodermal reactivity during the AAI. Because electrodermal reactivity is a psychophysiological indicator of behavioral inhibition and anxiety (Fowles, 1980, 1988; Gray, 1975), this finding supports the theoretical idea that dismissing/deactivating discourse during the AAI reflects a deliberate attempt to suppress feelings of conflict and distress. Importantly, subsequent studies have replicated this finding using culturally diverse samples of adults (Dias, Soares, Klein, Cunha, & Roisman, 2011; Roisman, Tsai, & Chiang, 2004), although this association was not

observed among sample of adolescents (Beijersbergen, Bakermans-Kranenburg, van IJzendoorn, & Juffer, 2008).

Attachment researchers have also examined the predictive significance of adults' attachment states of mind for their psychophysiological reactivity during interpersonal situations, including discussions with romantic partners about a relationship conflict. These investigations have produced consistent evidence that adults with less secure attachment representations—and more dismissing states of mind more specifically—manifest heightened electrodermal reactivity during conflict discussions with romantic partners (Haydon, Roisman, & Burt, 2012; Holland & Roisman, 2010; Roisman, 2007). When combined with the evidence that dismissing states of mind are also associated with less observed positive and negative affect (Haydon et al., 2012), these findings suggest that adults with more dismissing attachment representations are experiencing but inhibiting negative affect during attachment-relevant situations. Moreover, adult attachment states of mind continue to predict adults' electrodermal responses during these conflict discussions even after accounting for the observed and self-reported relationship quality (Roisman, 2007). Taken together, these findings suggest that adults' mental representations of childhood experiences with caregivers play a direct role in organizing adults' psychophysiological responses during stressful romantic relationship discussions.

According to attachment theory, preoccupied attachment states of mind represent a hyperactivated attachment system in which individuals are excessively vigilant towards attachment-relevant threats or cues. Based on this conceptualization, it has been

hypothesized that individuals with preoccupied states of mind respond to attachment-relevant experiences with increases in heart rate, a psychophysiological marker of behavioral approach (Fowles, 1980, 1988). Initial evidence for this was provided by Roisman (2007) who reported that preoccupied states of mind, as measured with the AAI, were associated with increases in heart rate while discussing an area of conflict with a romantic partner. In fact, heart rate increases were uniquely associated with preoccupation-related variation, as the association with dismissing states of mind was trivial in size and not statistically significant. That said, other studies have not observed reliable associations between adults' attachment representations and heart rate reactivity during the AAI (Beijersbergen et al., 2008; Dias et al., 2011; Roisman et al., 2004), when listening to infant vocalizations (Groh & Roisman, 2009), or during a conflict discussion with a parent (Beijersbergen et al., 2008). Thus, the evidence for an association between adult attachment states of mind and heart rate increases during attachment-relevant situations is inconsistent.

The present study

To summarize, research on the psychophysiological correlates of adults' attachment states of mind has produced consistent evidence that adults with less secure attachment representations respond to attachment related threats, including conflict discussions with romantic partners, with heightened electrodermal reactivity, a marker of anxiety and the effortful inhibition of behavior. These findings are suggestive of the possibility that earlier experiences with caregivers may organize adults' physiological responses during interactions with romantic partners. That said, adult attachment states of

mind are not a veridical assessment one's actual early relationship experiences but rather reflect the adults' mental representations of those experiences. Thus, the central aim of the current longitudinal study was to extend prior research on psychophysiology of adult attachment by investigating the predictive significance of children's early interpersonal experiences for psychophysiological responses in adult romantic relationships.

The first research question was whether early parent-child relationship experiences predict adults' physiological responses during romantic relationship interactions. The primary hypothesis was that a history of less supportive parent-child relationship experiences would predict greater electrodermal reactivity during conflict discussions with romantic relationship partners (Hypothesis 1). This was based on the theoretical ideas about electrodermal reactivity as a marker of behavioral inhibition (Fowles, 1988) and the research on psychophysiological correlates of adult attachment states of mind (e.g., Roisman, 2007). It was also hypothesized that individuals with a history of unsupportive parent-child relationships would experience more dysregulated emotional arousal, as indexed by heart rate reactivity, during conflict-centered interactions with romantic partners (Hypothesis 2). However, this hypothesis was considered less focal in light of the inconsistent evidence associating heart rate reactivity to adults' attachment states of minds. Observational measures of maternal emotional support and infant attachment security were used in the present study since both measures are commonly used in research on the predictive effects of early parent-child relationship experiences (e.g., Sroufe, Egeland, & Carlson, 1999). However, it was expected that the predictive effects of early maternal emotional support would be larger and more robust

than those involving infant attachment, since the maternal emotional support composite is a statistically more reliable measure that reflects individuals' parent-child relationship experiences from infancy to early adolescence.

The second research question was whether the longitudinal associations between early parent-child relationship experiences and adults' physiological responses were independent of covariates and concurrent relationship quality. The inclusion of covariates is an important step towards improving causal inference regarding the role of early relationship experiences in organizing adults' physiological responses during romantic relationship interactions. Similarly, it is important to account for the role of adults' concurrent relationship quality in light of the evidence of (a) associations between early parent-child relationship experiences and romantic relationship quality in adulthood (e.g., Roisman et al., 2005; Simpson et al., 2007) and (b) associations between concurrent romantic relationship quality and adults' physiological responses during conflict discussions (e.g., Robles et al., 2014). Based on the evidence that adult attachment states of mind predict adults' physiological responses during conflict discussion with romantic partners even after accounting for concurrent relationship quality (Roisman, 2007) and the evidence that early interpersonal experiences have enduring predictive effects for children's social development after accounting for covariates (Fraley, Roisman, & Haltigan, 2013), it was expected that the associations between adults' physiological reactivity and their developmentally earlier relationship experiences are at least partially independent of early covariates and current romantic relationship quality (Hypothesis 3).

The third research question was whether the associations between early parent-child relationship experiences and adults' physiological responses are mediated by adults' attachment states of mind. These analyses were considered more exploratory because the current study was underpowered for testing mediational processes. Nonetheless, these analyses were conducted in light of the theoretical idea that the individuals' mental representations of close relationships account for the long-term effects of early relationship experiences (Bowlby, 1988) as well as the evidence that adults' attachment states of mind can be predicted by early parent-child relationship experiences (e.g., Beijersbergen et al., 2012; Haydon et al., in press) and may mediate the predictive associations between supportive parent-child relationships in early adolescence and observed romantic relationship functioning in young adulthood (Roisman et al., 2001). It was hypothesized that the quality of early relationship experiences would shape adults' psychophysiological responses during close relationship interactions via their influence on adults' attachment representations (Hypothesis 4; see Figure 1). More specifically, adults' dismissing attachment states of mind were hypothesized to mediate the associations between early maternal emotional support and adults' electrodermal reactivity. This was based on the evidence that dismissing states of mind can be predicted from earlier supportive parenting (Haydon et al., in press) and are associated with greater electrodermal reactivity during close interpersonal interactions in adulthood (Haydon et al., 2012).

The current study drew on data from the Minnesota Longitudinal Study of Risk and Adaptation (MLSRA; Sroufe, Egeland, Carlson, & Collins, 2005), an ongoing 37-

year longitudinal study of development from infancy to adulthood. The MLSRA contains multiple assessments of children's early relationships with caregivers, including observations of maternal emotional support and infants' attachment security. Moreover, in-depth assessments of MLSRA participants' functioning within romantic relationships were completed beginning in young adulthood. Although information related to individuals' thoughts, feelings, and behaviors were collected in prior romantic relationship assessments, measures of adults' physiological responses during romantic relationship interactions were collected for the first time during a recent romantic relationship assessment completed when participants were between ages 34 and 37 years. In this way, the current study builds on prior analyses of the MLSRA (e.g., Roisman et al., 2001; Roisman et al., 2005; Salvatore et al. 2011; Simpson et al., 2007) by focusing on adults' physiological responses during interactions with romantic relationship partners.

Method

Participants

Between 1975 and 1977, pregnant mothers who were living below the poverty line and receiving prenatal services through the local health department in Minneapolis, Minnesota were recruited to participate in the MLSRA. At the time of their child's birth, 48% of the mothers were teenagers, 65% were single, and 42% had completed less than a high school education. The current subsample consisted of 37 individuals (46% female) who participated in a romantic relationship assessment when they were between the ages of 33 and 37 years. A relationship length criterion of 6 months was adopted to ensure that

all romantic relationships represented committed partnerships. However, the mean duration of participants' romantic relationships was 8 years 1 month at the time of the romantic relationship assessment (*SD* = 5 years 6 months; range = 8 months to 18 years). Importantly, this subsample did not significantly differ from the original sample (*N* = 267) with respect to maternal age, marital status, or maternal education at the time of the child's birth. In this subsample, 69% of the individuals were White/non-Hispanic, 4% were African-American, and 22% were multiracial.

Procedure

The children have been followed since birth and have participated in multiple assessments designed to assess the quality of the parent-child relationship. Specifically, observations of mother-child interactions were collected at seven ages spanning early infancy to adolescence. In addition, the Strange Situation was administered twice to assess the quality of the mother-child attachment relationship during infancy. Measures of maternal emotional support during interactions with the child and the infant's attachment security were included in this study since both measures are commonly used as indices of children's early relationship experiences. In addition, individuals' attachment states of mind were assessed using the Adult Attachment Interview at age 19 and age 26.

Between the ages of 33 and 37, participants were invited to participate in a romantic relationship assessment with their partners either in their homes or at a laboratory at the University of Minnesota. Participants and their partners separately completed a battery of self-report questionnaires regarding their perceptions of their

current romantic relationship, including a form on which they listed the top three sources of conflict in their relationship. Both individuals were instructed that this form would be the only questionnaire that their partner would see. Shortly after finishing the relationship problem questionnaire, the partners were reunited and physiological sensors were attached to both individuals. Following a brief habituation period, both partners participated in a non-talking baseline task for approximately 4 minutes. Afterward, couples were asked to identify an area of disagreement in their relationship using the problem-topic forms they had previously completed. Once couples decided on a problem to discuss they were given approximately 8 minutes to talk about and attempt to resolve this problem in their relationship.

Measures from the Romantic Relationship Assessment

Physiological reactivity. Surface sensors measuring electrodermal and cardiac activity were adhered to participants' torsos and fingers by a research assistant before the beginning of the relationship interaction. Physiological recordings were continuously monitored from an adjoining room during the baseline assessment and the conflict discussion. Electrodermal responses were measured by skin conductance levels (SCL). A constant-voltage device was used to pass a small voltage between electrodes attached to the palmar surface of the last phalanxes of the second and fourth fingers of the non-dominant hand. SCL was measured in microsiemens. In order to measure cardiovascular activity, electrode stickers were placed under the right clavicle and under the left rib cage (a ground lead was positioned on the sternum). Cardiac interbeat intervals are measured as time in milliseconds between successive R waves of the electrocardiogram. Heart rate

(HR) is calculated second by second and reflects beats per minute. In accordance with prior work (Holland & Roisman, 2010; Roisman, 2007), physiological reactivity measures for electrodermal and heart rate activity were created by subtracting mean levels of physiological activity during the resting baseline task from mean levels during the conflict portion of the romantic relationship interactions. Although physiological data were collected from both individuals, only data for the target participant were included in this study since information about earlier parent-child relationship experiences and attachment states of mind were available only for these individuals.

Observed romantic relationship quality. Couples' behaviors during the topic selection and conflict discussion tasks were coded from videotape using the Positive and Negative Affect rating scales developed by Markman and his colleagues (Kline et al., 2004) as part of the Interactional Dimensions Coding System. Both affect ratings were made separately along a 9-point scale for each partner, with lower scores reflecting less expressed affect and higher scores reflecting more expressed affect. Intraclass correlations (two-way mixed, average measures) were between .84 and .89. In accordance with prior work (Holland & Roisman, 2010; Roisman, 2007), a measure of the balance of positive to negative emotions exhibited by each person during the conflict discussion was created by subtracting negative from positive affect.

Perceived romantic relationship quality. Relationship quality was assessed using Fletcher, Simpson, and Thomas's (2000) Perceived Relationship Quality Components Scale (PRQC). This scale was designed to measure six interrelated components of perceived relationship quality: satisfaction, commitment, intimacy, trust,

passion, and love. Each component is assessed by three questions, and responses were made on 7-point scales, anchored at 1 (*not at all*) and 7 (*extremely*). Fletcher et al. (2000) confirmed that these components are correlated and tap a higher order relationship quality factor. Responses to all 18 items were averaged to form a global index of relationship quality, with higher scores indicating greater perceived relationship quality ($\alpha = .92$ for target participants; $\alpha = .89$ for their partners).

Developmental Antecedents

Adult attachment. Participants' attachment states of mind were assessed using the Adult Attachment Interview (AAI) when participants were age 19 and age 26. This semi-structured interview requires participants to describe their childhood relationships with their parents and recall specific incidents of separation or rejection. All interview transcripts were coded by raters who had completed reliability certification with the lab of Dr. Mary Main. Following Main and Goldwyn's (1998) guidelines, AAI narratives were rated on a series of 9-point scales designed to assess participants' "state of mind with regard to attachment". At age 19, this included ratings for coherence of mind, coherence of transcript, mother and father idealizing, lack of memory, mother and father anger, highest derogation, unresolved loss, and unresolved abuse (ICCs between .72 and .95). At age 26, ratings with interrater reliability (ICC) values greater than .60 included coherence of mind, mother and father idealizing, lack of memory, mother and father anger, passivity of thought, unresolved loss, and unresolved abuse (ICCs between .60 and .95).[1] The coherence of transcript rating was excluded from all analyses because it was highly redundant with the coherence of mind rating at age 19 and age 26 (*r*s = .95 and

.97, respectively). Not Applicable unresolved loss and abuse ratings were recoded to be equal to one. For all scales, Cannot Rate values were treated as missing data.

In order to reduce the data, exploratory factor analyses (maximum likelihood estimation, direct oblimin rotation) of the age 19 and age 26 AAI state of mind scales were conducted using all available data (n = 165 at age 19; n = 164 at age 26). At both ages, a two factor solution provided a parsimonious fit to the data (Table 1). Specifically, at age 19 the first factor contained ratings that traditionally are used by coders to make distinctions about adults' dismissing states of mind, including idealization-mother, idealization-father, and lack of recall. The second factor contained ratings that traditionally are used to make distinctions about preoccupied states of mind, including anger-mother and anger-father, as well as unresolved trauma. Highest derogation and unresolved loss did not substantially load on either factor. Results of the age 26 ratings were nearly identical. Once again, the first factor contained ratings that traditionally are used by coders to make distinctions about adults' dismissing states of mind, and the second factor contained ratings that traditionally are used to make distinctions about preoccupied and unresolved states of mind. As expected, coherence of mind substantially loaded on both factors at both ages.

Composites were created by averaging the relevant indicators. Composites for dismissing states of mind included idealization-mother, idealization-father, and lack of memory (α = .60 at age 19; α = .71 at age 26). Composites for preoccupied states of mind included anger-mother, anger-father, and unresolved trauma (α = .68 at age 19; α = .60 at age 26). Unresolved loss was not included in the preoccupied composite because the

loading was less than .50 at both ages. Moreover, passivity of thought was not included in the age 26 preoccupied composite in order to ensure that the composites at age 19 and 26 comprised identical indicators. Finally, coherence of mind rating was not included in either composite because of its high cross-loading. It is important to note that these composites are identical to the composites used in recent analysis of the AAI data from the Study of Early Child Care and Youth Development (SECCYD; Haltigan, Roisman, & Haydon, in press), with the exception of the exclusion of passivity of thought as an indicator of preoccupied states of mind.

Descriptive information and correlations among the attachment states of mind composites are reported in Table 2. Within each age, there was a small to moderate negative correlation between dismissing and preoccupied states of mind (r = -.16 at age 19; r = -.30 at age 26). In addition, there was evidence for moderate stability of attachment states of mind across this 7-year span, with test-retest correlations for dismissing and preoccupied states of mind equal to .41 and .52, respectively. Finally, there was evidence for age-related changes in overall mean levels of dismissing and preoccupied states of mind, with dismissing decreasing from age 19 to age 26 [$t(150) = 5.79$, $p < .001$] and preoccupied increasing from age 19 to age 26 [$t(149) = -2.36$, $p < .02$]. In order to form the most valid and reliable indices of adults' attachment states of minds, measures of overall dismissing and preoccupied/unsolved states of mind were created by averaging the relevant composites from age 19 and age 26. Because of the age-related differences in mean levels, composites were only created for individuals with AAI data available at both ages.[2]

Maternal emotional support. The MLSRA contains multiple assessments of parent-child relationship experiences during infancy, childhood, and early adolescence. Based on the idea that children's cumulative interpersonal experiences will more strongly predict their subsequent developmental adaptation (as compared to measures that reflect relationship experiences during only one development period; e.g., Sroufe et al., 2005), observational measures of emotionally supportive parenting from each of these assessments were combined for the present study.

During infancy, mother–child interactions were videotaped during semi-structured tasks when participants were 3 and 6 months. At three months, infant-mother pairs were observed in their homes during a feeding situation. Mothers were instructed to interact with their infant as they normally did. When infants were six months old, two feeding situations and one play interaction were observed in the home on two different days. During the play interactions, mothers were instructed to play with the child, first without using any toys and then using a standard set of toys. When children were three and six months old, maternal emotional support was operationalized using Ainsworth's sensitivity scale (Ainsworth, Blehar, Waters, & Wall, 1978). This rating assesses each mother's ability to perceive and accurately interpret her infant's signals and respond appropriately and promptly. At six months, the separate ratings of maternal sensitivity during feeding and play sessions were averaged ($\alpha = .87$). At three months, interrater agreement was calculated using the Lawlis-Lu index (Tinsley & Weiss, 1975), with agreement defined as a discrepancy of 2 points or less on the 9-point rating scale. The Lawlis-Lu χ^2 was significant at $p < .05$, with a T value of .75, indicating moderate-to-

high agreement. For the 6 month assessments interrater reliability (intraclass correlations) was .89.

During early childhood, children and mothers were observed in a laboratory setting while attempting to solve a series of problem-solving and teaching tasks when participants were 24 and 42 months, and 13 years. At each age, the tasks gradually increased in complexity, ultimately becoming too difficult for the child to complete on his or her own. Mothers were instructed to first allow the child to try to independently solve each task, and then to give the child any help they thought was needed. Maternal emotional support was evaluated with a rating of each mother's supportive presence. This rating captured the extent to which each mother provided a secure base for her child (i.e., helped the child feel comfortable with the task) as well as each mother's positive involvement during the interaction. Interrater reliabilities (intraclass correlations) were .84 and.87, respectively.

When participants were 30 months and 72 months, the Home Observation for Measurement of the Environment (HOME) inventory (Caldwell & Bradley, 1984) was completed. The HOME is a semi-structured interview and observation instrument designed to measure the quality of the child's home environment based on naturalistic observations in the home. This instrument yields several subscales, including one reflecting the mother's emotional and verbal responsivity. This sub-scale included 11 items at 30 months ($\alpha = .72$) and 6 items at 72 months ($\alpha = .68$) that assess the mother's emotional support for the child.

Finally, ratings of parents' supportive presence were completed when participants were age 13 based on laboratory observations of parent-child interaction during a set of collaborative problem-solving tasks. Paralleling the measure used at 24 and 42 months, a 7-point supportive presence rating was designed to assess how emotionally supportive and available the parent was to the child during the interaction. Inter-rater reliability (intraclass correlation) was .86.

PCA with all available data was used to reduce the measures of maternal emotional support. Results indicated that only a single component had an eigenvalue greater than 1. This one component accounted for 41% of the variance in the ratings of maternal emotional support collected at the seven ages, and component loadings were between .53 and .70. Moreover, internal consistency analysis indicated that none of the measures suppressed the internal consistency value for the overall composite. As a result, observations of sensitive, responsive, and emotionally supportive care from infancy to early adolescence were standardized and averaged to create a measure of cumulative maternal emotional support (standardized alpha = .74).

Infant attachment security. The security of the infant-caregiver attachment relationship was assessed when participants were 12- and 18-months-old using Ainsworth's Strange Situation Procedure (Ainsworth, Blehar, Waters, & Wall, 1978). During this laboratory procedure, infants' responses to a series of mildly stressful separations and reunions with their mothers were observed. The traditional system was used to classify infants according to the organized patterns of securely attached, insecure-avoidant, or insecure-resistant. The attachment assessments at 12- and 18-months were

coded by independent teams with high inter-rater agreement for both assessments (89% and 93% respectively). In addition, all Strange Situation tapes still available were coded at a later time for attachment disorganization/disorientation (k = .72, n = 35). In the current study, cases classified as disorganized were coded as insecure at that assessment, irrespective of their secondary classification. Consistent with recent longitudinal investigations of the predictive significance of infant attachment (e.g., Groh et al., in press; Raby, Cicchetti, Carlson, Egeland, & Collins, 2013), infant attachment information was aggregated by calculating the percentage of times the infant was classified as securely attached. Infants who were insecurely attached at both time-points received a score of 0%, those who were securely attached at one time-point received a score of 50%, and infants who were securely attached at both time-points received a score of 100%. When infant attachment data was available for only one assessment (i.e., observations were missing at either 12- or 18-months), the information from the one available assessment was used to sort the infant into the 0% or 100% securely attached groups.

Covariates. Although there are a large number of potential control variables to consider, four were selected that have been widely used in research on the long-term predictive effects of early interpersonal experiences (e.g., Fraley, Roisman, & Haltigan, 2013): child gender, child ethnicity, socioeconomic status, and maternal education. Because most of the children in the sample were White/non-Hispanic, a binary variable was created to represent ethnicity (1 = White/non-Hispanic, 0 = otherwise). Maternal education was operationalized as the number of years of education each mother had completed. This information was collected at eight assessments during childhood and

adolescence (3 months before the child's birth, birth, 42 months, grades 1-3, grade 6, and age 16) and was averaged to create a composite measure of maternal education. Finally, socioeconomic status was assessed with Duncan's Socioeconomic Index (Stevens & Featherman, 1981), a widely used indicator of occupational ranking. Scores were based on the mother's occupational status which was collected at seven assessments during childhood and adolescence (42 months, 54 months, grades 1-3, grade 6, and age 16). This information was averaged to create a composite measure of socioeconomic status.

Missing data. Participants were included in analyses if they participated in the adult romantic relationship assessment (n = 37). Two participants were missing electrodermal data, and six participants were missing cardiac data due to experimenter error. In addition, two participants were missing adult attachment data from at least one assessment. No participants were missing data related to current romantic relationship quality, early parent-child relationship experiences, or the covariates. To address missing data, all analyses used full-information maximum likelihood with raw case-level analytic data as input, which produces less biased and more efficient and consistent parameter estimates than techniques such as pairwise or listwise deletion for missing data (Graham, 2009). All statistical analyses were carried out using M*plus* (Muthén & Muthén, 1998-2012).

Results

Question 1. Do Early Parent-Child Relationship Experiences Predict Adults' Physiological Responses during Romantic Relationship Interactions?

Descriptive statistics and intercorrelations for all variables are presented in Table 3. As hypothesized, maternal emotional support during childhood and adolescence predicted lower electrodermal reactivity during conflict discussion with adult romantic partners (r = -.33, p = .046). Maternal emotional support also was a marginally significant predictor of heart rate reactivity (r = -.28, p = .088). Importantly, the association between skin conductance and heart rate responses was trivial in magnitude (r = -.04), indicating that their associations with maternal emotional support are relatively independent. Although there was a similar pattern of associations between infant attachment security and adults' physiological responses, only the association with heart rate reactivity was statistically significant (r = -.33, p = .043). In contrast to the associations with early parent-child relationship experiences, the associations between physiological reactivity and current relationship quality generally were low and not statistically significant. Although the association between adults' dismissing attachment states of mind and their skin conductance responses and the association between adults' preoccupied attachment states of mind and their heart rate responses were in the hypothesized directions, the associations were not statistically significant.

Question 2. Are the Predictive Effects of Early Parent-Child Relationship Experiences for Adults' Physiological Responses Independent of Early Covariates and Concurrent Relationship Quality?

In the second set of analyses, linear regression analyses were conducted to evaluate whether early parent-child relationship experiences predict adults' physiological responses after accounting for adult romantic relationship quality and covariates. This

was especially important in light of the significant bivariate correlations between the covariates and (a) early parent-child relationship experiences and (b) adults' physiological outcomes (see Table 3). For these analyses, indices of adults' early parent-child relationship experiences and current relationship quality were entered in an initial step, and covariates were added in a second step. In order to parallel the self-reported relationship measures, only the individual-level observational ratings were included in these analyses.[3] Separate linear regression analyses were conducted for adults' skin conductance and heart rate responses.

Regressions involving maternal emotional support during childhood and adolescence are presented in Table 4. Maternal emotional support continued to predict skin conductance reactivity after controlling for concurrent relationship quality (seen in Step 1) as well as early covariates (seen in Step 2). Although females had higher skin conductance responses, this did not account for the association between maternal emotional support and lower skin conductance responses in adulthood. When predicting heart rate reactivity, maternal emotional support continued to be a marginally significant predictor of lower heart rate reactivity after controlling for concurrent relationship quality (Step 1). This predictive association slightly increased in magnitude and became statistically significant after accounting for covariates (Step 2), suggesting the possible presence of a suppression effect (MacKinnon, Krull, & Lockwood, 2000).

Regressions involving infant attachment security are presented in Table 5. Although infant attachment security did not predict adults' skin conductance responses, infant attachment security did continue to predict later heart rate reactivity after

controlling for adults' relationship quality as well as covariates. Adults with histories of insecure infant-caregiver attachment relationships showed higher heart rate responses during conflict discussion with their romantic partners.

Question 3. Are the Predictive Effects of Early Parent-Child Relationship Experiences for Adults' Physiological Responses Mediated by Adults' Attachment States of Mind?

The final set of analyses explored whether adult attachment states of mind mediated the predictive effects of early parent-child relationship experiences for adults' physiological responses. There are several methods for assessing mediation. One of the most popular is the causal steps approach (e.g., Baron & Kenny, 1986), which involves four conditions: (1) a significant bivariate association between the predictor and outcome variable (i.e. the *c* path in Figure 1), (2) a significant bivariate association between the predictor variable and the mediator (i.e. the *a* paths in Figure 1), (3) a significant bivariate association between the mediator and the outcome variable (i.e. the *b* paths in Figure 1), and (4) a reduction in the overall magnitude of the association between the predictor and outcome variables after accounting for the mediator (i.e. c' vs. *c* in Figure 1). This approach was applied to test the hypothesis that adult attachment states of mind mediate the long-term predictive effects of parent-child relationship experiences for physiological responses during romantic relationship interactions; however, the bivariate correlations among the focal variables (Table 3) did not satisfy the second and third conditions. Specifically, adults' dismissing and preoccupied attachment states of mind were not significantly associated with either (a) maternal emotional support during childhood and

adolescence or infant attachment security or (b) adults' electrodermal or heart rate responses.

In recent years, statisticians have noted several limitations of the causal steps approach and have recommended the utilization of resampling methods for assessing mediation (MacKinnon, Fairchild, & Fritz, 2007; Preacher & Hayes, 2008). Resampling methods use the observed data to generate a reference distribution, which is then used for testing the statistical significance of a mediated effect. Importantly, these methods involve fewer assumptions, including the requirement that the mediator be significantly associated with the predictor or outcome variables. In other words, it is empirically possible to use these techniques for evaluating mediation, even in the absence of a non-significant association between the mediator(s) and the predictor or outcome variables (Hayes, 2009). For this reason, the indirect effects of early parent-child relationship experiences on adults' physiological responses through adult attachment states of mind were estimated using bootstrapping methods (1000 samples). Consistent with the conclusion from the causal steps approach, the results from these analyses did not provide support for mediation. For all four analyses (using maternal support and infant attachment security as predictors and skin conductance and heart rate reactivity as outcome variables), the estimates of the total indirect effect through adults' dismissing and preoccupied attachment states of mind were not statistically significant (*p*-values between .24 and .89).[4]

Discussion

The current study represents the first longitudinal investigation of the predictive significance of early parent-child relationship experiences for adults' physiological responses during romantic relationship interactions. As hypothesized, maternal emotional support during childhood and adolescence predicted less skin conductance reactivity, a psychophysiological marker of behavioral inhibition and anxiety, during conflict discussions with relationship partners. There also was a marginally significant negative association between maternal emotional support and adults' heart rate reactivity, a psychophysiological marker of behavioral approach. Moreover, the associations involving infant attachment security and adults' physiological responses were in the expected direction and were of similar magnitude, although only the association with heart rate reactivity was statistically significant. Taken together, these findings provide robust support for the idea that individuals with histories of unsupportive parent-child relationships manifest greater physiological arousal during conflict discussions with adult romantic partners.

Although early parent-child relationship experiences were associated with both psychophysiological outcomes, it is important to note that adults' electrodermal and heart rate responses were orthogonal to one another. This suggests that early parent-child relationships have unique predictive effects for these two psychophysiological outcomes. In other words, unsupportive early caregiving experiences predict greater anxiety and behavioral inhibition—as indexed by electrodermal reactivity—for some individuals and predict more dysregulated emotional arousal—as indexed by heart rate reactivity—for

others. One possible explanation for this pattern of findings is that these two psychophysiological outcomes are rooted in distinct aspects of early parent-child relationships not captured by the ratings of overall emotionally supportive care or infant attachment security. For example, electrodermal reactivity may be uniquely associated with a history of harsh, rejecting caregiving and insecure-avoidant attachments, whereas heart rate reactivity may be uniquely associated with intrusive, unpredictable caregiving and insecure-resistant attachments.

Although child characteristics and early socioeconomic factors were correlated with adults' electrodermal and heart rate responses, these associations did not account for the predictive effects of early maternal emotional support or infant attachment security. These results allow for greater confidence in the potentially causal role of early caregiving experiences in scaffolding patterns of autonomic reactivity in adult romantic relationships. In addition, early caregiving experiences continued to predict adults' psychophysiological responses after accounting for concurrent romantic relationship quality. Altogether, these results indicate that early parent-child relationship experiences uniquely contribute to adults' physiological responses during romantic relationship interactions.

The third set of analyses examined whether adult attachment states of mind mediated the predictive effects of early parent-child relationship experiences for adults' physiological responses were inconclusive. These analyses were admittedly exploratory because of the small sample size of the current study. Results provided no conclusive evidence as to whether the predictive effects of early caregiving experiences for adults'

physiological responses were mediated by adults' attachment states of mind. Specifically, adults' dismissing and preoccupied attachment states of mind were not significantly associated with early caregiving experiences or adults' physiological responses in the current study. That said, these non-significant finding may have been resulted from issues related to statistical power since the current study was underpowered to detect effect sizes that were not medium-to-large in overall magnitude (Cohen, 1992). Future large-sample, longitudinal investigations into the developmental processes that mediate that associations between early caregiving experiences and adults' physiological responses in romantic relationships are needed.

Altogether, the current study provides initial longitudinal evidence that early caregiving experiences may have long-term effects of adults' physiological responses to close relationship situations. The current study extends existing research on the psychophysiology of adult attachment by focusing on fully prospective data regarding individuals' actual early parent-child experiences. Given the potential importance of these findings as well as the small sample size of the current study, it is critical for the findings to be replicated with additional longitudinal data. Existing longitudinal studies with relatively larger samples sizes and observational assessments of early caregiving experience are particularly well-suited to replicate the associations documented in this study.

In light of the prior research on the psychophysiological correlates of adult attachment, the current study focused on adults' electrodermal and heart rate responses during romantic relationship interactions. However, this was not meant to be an

exhaustive list of the potential biological correlates of adults' early caregiving experiences. For example, there is consistent evidence that early parent-child relationship experiences have a role in regulating the functioning of the HPA axis, the other branch of the stress response system, during childhood and adolescence (Cicchetti & Rogosch, 2012; Dozier, Peloso, Lewis, Laurenceau, & Levine, 2008; Gunnar & Donzella, 2002; Roisman et al., 2009; Spangler & Zimmermann, 2014). Similarly, future investigations should consider including indices of heart rate variability, such as respiratory sinus arrhythmia (RSA), as these measures thought to reflect processes attentional and affective regulation (Beauchaine, 2001; Porges, 1995). This idea is further supported by the evidence that RSA reactivity is associated with adults' behaviors in close relationships, such as those with romantic partners or with their children (e.g., Mills-Koonce et al., 2009; Murray-Close, Holland, & Roisman, 2012; cf. Roisman, 2007).

Another issue that warrants future research is the degree to which the associations between early caregiving experiences and adults' physiological responses observed in this study would generalize to other interpersonal contexts. For example, adults' competence in the parental role is also hypothesized to be associated with their childhood experiences with their own parents (e.g., Belsky, 1984). Indeed, there is consistent longitudinal evidence for intergenerational continuities in parenting quality (e.g., Belsky, Hancox, Sligo, & Poulton, 2012; Kovan, Chung, & Sroufe, 2009; Raby, Lawler, Shlafer, Hesemeyer, Collins, & Sroufe, under review). Moreover, emerging evidence indicates that adult attachment security predicts adults' electrodermal reactivity in response to distressing parent-child situations (Ablow, Marks, Feldman, & Huffman, 2013; Groh &

Roisman, 2009). Based on these data, future research into the early caregiving antecedents of adults' physiological responses within parent-child relationships may prove fruitful.

Another question that deserves further inquiry is whether the enduring effects of early caregiving experiences are especially pronounced for particular subsets of children. For example, the long-term implications of early parent-child relationship experiences for later physiological reactivity might be amplified or attenuated by temperamental or genetic characteristics of the child (e.g., Belsky & Pluess, 2009; Raby et al., 2013; Roisman, Newman, Fraley, Haltigan, Groh, & Haydon, 2012). Another possibility is that non-familial relationships, such as those with romantic partners, may serve as turning points by creating opportunities for change in developmental trajectories (Laub & Sampson, 1993; see also Simpson & Overall, 2014). Indeed, there is evidence that romantic partners can compensate for individuals' developmental vulnerabilities, thereby influencing adults' subsequent adaptation (e.g., Kendler & Halberstadt, 2013; Salvatore, Haydon, Simpson, & Collins, 2013; Roisman et al., 2004) as well as the health of the relationship over time (Salvatore et al., 2011). The possibility that similar processes may be involved when predicting adults' physiological outcomes is supported by the evidence of an association between romantic relationship quality and adults' stress physiology (Robles et al., 2014).

The results of the current study may have implications for our understanding of the pathways by which early relationship experiences impact physical health outcomes in adulthood. For example, there is growing scientific interest in the childhood origins of

medical problems that appear in adulthood, especially the role of early caregiving experiences (Miller et al., 2011; Puig et al., 2013; Repetti, Taylor, & Seeman, 2002; Shonkoff et al., 2009). According to the biological embedding model (Miller & Chen, 2009; Miller et al., 2011), experiences within the family of origin influence contribute to chronic disease vulnerability by altering physiological processes. The findings from the current study are consistent with these ideas and suggest that individuals who experience emotionally unsupportive care during childhood and early adolescence may experience more chronic autonomic nervous system activation within adult romantic relationships which over time may lead to poorer health outcomes.

In conclusion, the current study provides initial longitudinal evidence for an association between adults' physiological responses within their romantic relationships and their earlier parent-child relationship experiences. These findings extend our understanding of the long-term significance of early caregiving experiences for romantic relationship functioning in adulthood by demonstrating that early supportive parent-child experiences and infant attachment patterns may organize not only adults' observed and self-reported thoughts, feelings, and behaviors during romantic relationship interactions —as other studies have found (e.g., Roisman et al., 2005; Salvatore et al., 2011; Simpson et al., 2007)—but also their psychophysiological responses. More generally, the current study also illustrates the potential utility of physiological measures for providing insights into basic questions at the heart of contemporary research on the long-term significance of early relationship experiences. By building on the concepts and methods that have been validated by attachment theory's rich tradition of behavioral research, investigations

of the physiological processes associated with attachment-related representations and experiences represent a promising area of future research.

Table 1

Factor Loadings for Exploratory Factor Analysis of Age 19 and Age 26 Adult Attachment Interview State of Mind Ratings

	Age 19		Age 26	
	Dismissing states of mind	Preoccupied states of mind	Dismissing states of mind	Preoccupied states of mind
Coherence of mind	**-.90**	**-.41**	**-.82**	**-.65**
Idealization - mother	**.75**	-.10	**.80**	-.15
Idealization - father	**.47**	-.06	**.57**	-.14
Lack of memory	**.60**	-.07	**.64**	-.09
Passivity[a]	-	-	-.11	**.70**
Anger - mother	-.23	**.68**	-.09	**.59**
Anger - father	-.23	**.64**	-.07	**.51**
Unresolved trauma	-.01	**.66**	.09	**.64**
Unresolved loss	.08	.18	-.03	**.40**
Highest derogation[b]	.17	.25	-	-
Eigenvalue	2.48	2.09	2.80	2.27
Percentage variance	27.19	23.27	31.15	25.24

Note. Loadings greater than |.30| appear in boldface type. [a]Passivity ratings were not completed at age 19. [b]Highest derogation at age 26 was excluded from analysis because the interrater reliability value was less than .60.

Table 2

Descriptive Statistics and Correlations among the Adult Attachment Composites at Age 19 Years and Age 26 Years

	1	2	3	4
1. Age 19: Dismissing states of mind	—			
2. Age 19: Preoccupied states of mind	-.16	—		
3. Age 26: Dismissing states of mind	.41	-.22	—	
4. Age 26: Preoccupied states of mind	-.25	.52	-.30	—
M	3.89	1.64	3.12	1.92
SD	1.45	1.09	1.68	1.33

Note: Composites for dismissing states of mind include idealization-mother, idealization-father, and lack of memory. Composites for preoccupied states of mind include anger-mother, anger-father, and unresolved trauma.

Table 3

Descriptive Statistics and Intercorrelations among Focal Variables

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Early Parent-Child Relationships															
1. Maternal emotional support	—														
2. Infant attachment security	.35*	—													
Covariates															
3. Child gender	-.10	-.12	—												
4. Child ethnicity	.22	.12	-.06	—											
5. Maternal education	.68***	.33*	-.28†	-.02	—										
6. Socioeconomic status	.55***	.25	-.18	.13	.69***	—									
Adult Attachment States of Mind															
7. Dismissing states of mind	-.18	.18	-.10	-.07	-.23	-.14	—								
8. Preoccupied states of mind	-.15	-.12	.17	-.19	.01	.11	-.18	—							
Romantic Relationship Quality															
9. Observed dyadic conflict res.	.10	.03	-.03	.06	.23	.14	-.46**	.11	—						
10. Target: observed emot. tone	.12	.16	-.25	.25	.13	-.06	-.11	.01	-.64***	—					
11. Partner: observed emot. tone	-.04	-.13	.01	-.13	.03	-.07	-.40*	-.02	-.61***	.27	—				
12. Target: perceived rel. quality	-.24	-.23	-.11	-.02	-.22	-.17	.11	-.16	.17	.37*	.30†	—			
13. Partner: perceived rel. quality	-.01	-.03	.07	.03	-.17	-.08	-.08	.26	.32†	.18	.39*	.10	—		
Physiological Reactivity															
14. Target: skin conductance	-.33*	-.14	.39*	-.30*	-.17	-.13	.19	.09	.13	.03	.12	.09	.08	—	
15. Target: heart rate	-.28†	-.33*	-.01	.35*	-.16	.18	-.20	.21	.20	.18	.02	.26	.09	-.04	—
M	-0.06	0.61	0.46	0.68	12.61	22.33	3.01	2.01	3.58	-1.82	-1.18	6.13	6.22	2.18	3.14
SD	0.66	0.40	0.51	0.47	1.54	8.49	1.30	1.15	1.45	2.49	2.57	0.77	0.55	1.80	3.62

Note: $n = 37$. †$p < .10$. *$p < .05$. **$p < .01$. ***$p < .001$. SC = skin conductance. HR = heart rate. Gender was coded 1 = female, 0 = male. Ethnicity was coded 1 = White/non-Hispanic, 0 = non-White.

Table 4

Predicting Physiological Reactivity during Adult Romantic Relationships from Early Maternal Emotional Support

	Skin conductance			Heart rate		
	β	*SE*	*p*	*β*	*SE*	*p*
Step 1						
Early maternal emotional support	**-.36**	**.16**	**.02**	**-.28**	**.17**	**.09**
Target: observed emotional tone	.07	.18	.70	.15	.20	.45
Target: perceived relationship quality	-.05	.18	.80	.11	.18	.55
Partner: observed emotional tone	.07	.18	.69	-.16	.19	.39
Partner: perceived relationship quality	.04	.17	.82	.21	.21	.31
Step 2						
Early maternal emotional support	**-.36**	**.18**	**.04**	**-.48**	**.13**	**<.01**
Target: observed emotional tone	.22	.16	.19	.19	.16	.23
Target: perceived relationship quality	-.02	.16	.92	.10	.13	.46
Partner: observed emotional tone	.01	.16	.96	-.04	.14	.75
Partner: perceived relationship quality	.02	.15	.88	.06	.16	.71
Gender	.39	.14	<.01	.05	.13	.71
Ethnicity	-.23	.15	.12	.26	.13	.04
Maternal education	.07	.25	.78	-.20	.22	.36
Socioeconomic status	.12	.20	.55	.54	.17	<.01

Note: Gender was coded 1 = female, 0 = male. Ethnicity was coded 1 = White/non-Hispanic, 0 = non-White.

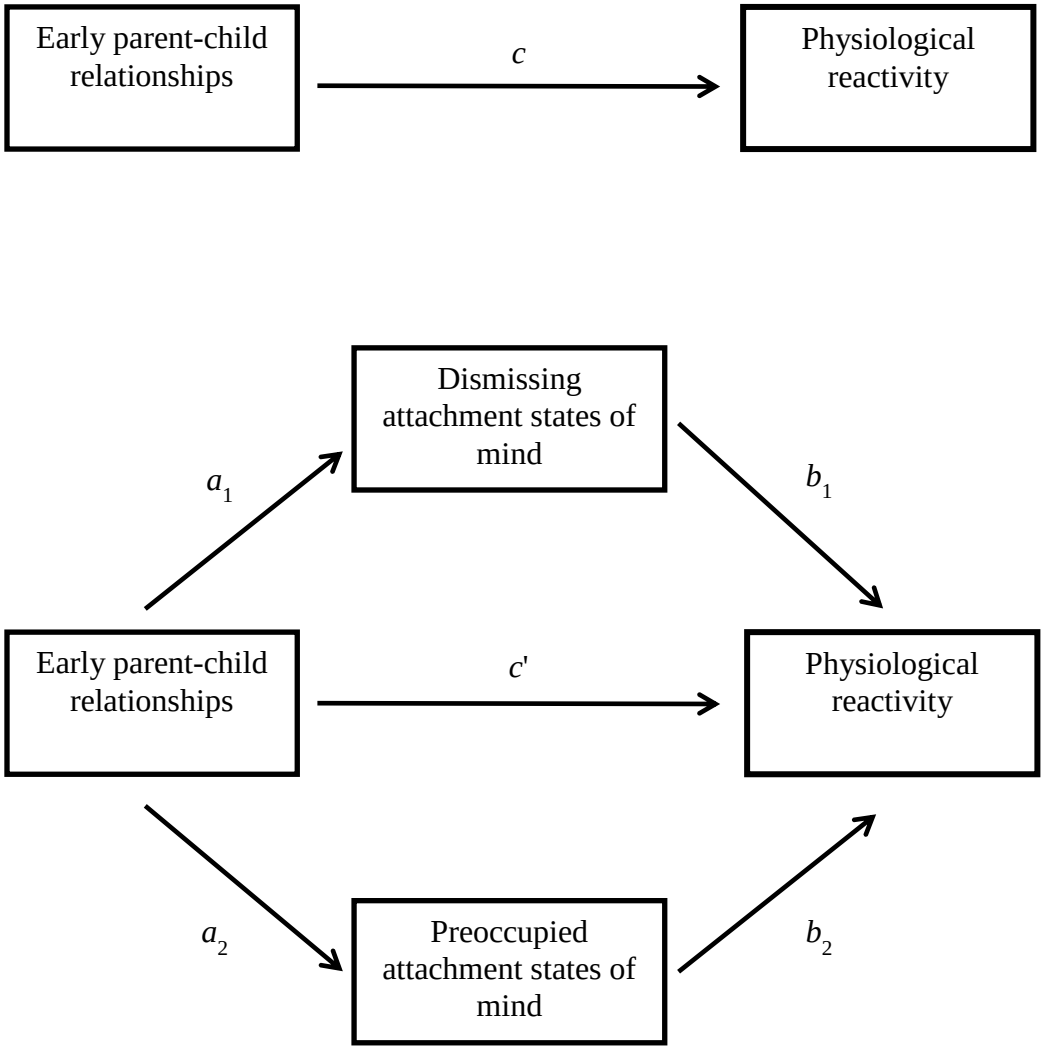
Table 5

Predicting Physiological Reactivity during Adult Romantic Relationships from Infant Attachment Security

	Skin conductance			Heart rate		
	β	*SE*	*p*	*β*	*SE*	*p*
Step 1						
Infant attachment security	**-.13**	**.17**	**.45**	**-.39**	**.15**	**.01**
Target: observed emotional tone	.02	.19	.92	.22	.19	.30
Target: perceived relationship quality	.03	.19	.89	.07	.18	.69
Partner: observed emotional tone	.07	.19	.71	-.14	.18	.45
Partner: perceived relationship quality	.05	.18	.80	.21	.20	.30
Step 2						
Infant attachment security	**-.08**	**.16**	**.62**	**-.45**	**.14**	**<.01**
Target: observed emotional tone	.22	.17	.19	.29	.16	.08
Target: perceived relationship quality	-.01	.17	.95	.06	.14	.70
Partner: observed emotional tone	.03	.17	.86	-.01	.15	.94
Partner: perceived relationship quality	-.02	.16	.89	.05	.17	.76
Gender	.36	.14	.01	.10	.13	.46
Ethnicity	-.31	.14	.03	.20	.13	.14
Maternal education	-.15	.22	.49	-.37	.20	.07
Socioeconomic status	.10	.21	.63	.58	.17	<.01

Note: Gender was coded 1 = female, 0 = male. Ethnicity was coded 1 = White/non-Hispanic, 0 = non-White.

Figure 1. Theoretical model of the indirect effects of supportive early parent-child relationship experiences on physiological reactivity in romantic relationships through adult attachment states of mind.



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Footnotes

[1] Highest derogation at age 26 was excluded from analysis because the interrater reliability value was less than .60. However, results did not substantially differ when derogation was included since derogation did not substantively load on either factor.

[2] Results did not substantially differ when measures from only age 19 or age 26 were used.

[3] Results did not substantially differ when the ratings of dyadic conflict resolution were used.

[4] Results did not substantially differ when the AAI coherence of mind ratings were used an index of overall attachment security. Specifically, the composite measure of AAI coherence of mind at age 19 and age 26 was not significantly associated with physiological reactivity during romantic relationship interactions (*r*s equal to -.10 and -.03 for electrodermal and heart rate responses, respectively) or early parent-child relationship experiences (*r*s equal to .27 and .01 for early maternal emotional support and infant attachment security, respectively) in this subsample, and all tests of mediation were not statistically significant (*p*-values greater than .10).