Adolescent Attachment Insecurity and Parasympathetic Functioning Predict Future Loss Adjustment

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Abstract

Losing a close relationship is highly stressful and a robust predictor of major depression in adolescents. The current study examined relationships between attachment insecurity, parasympathetic nervous system activity, indexed by respiratory sinus arrhythmia (RSA), and adolescent adjustment to the loss of a close social partner. Adolescents with more attachment anxiety to their mother at age 14 were more likely to report poorer adjustment to a subsequent loss than adolescents with less attachment anxiety. Attachment avoidance interacted with stress-induced changes in RSA to predict loss adjustment. Among adolescents with higher RSA in response to the stressor, those with more attachment avoidance reported better loss adjustment, whereas among adolescents with lower RSA in response to the stressor, those with more attachment avoidance reported poorer loss adjustment. In sum, the combination of attachment insecurity and stress-induced changes in RSA predicted how well adolescents adjusted to a loss.

Keywords

attachment, RSA, loss, adolescence, stressful life events, heart rate variability

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Losing a close relationship is a highly stressful event (Briscoe & Smith, 1975; Katherine Shear & Clayton, 2008; Mearns, 1991). Whether it is the loss of a parent, spouse, or a romantic partner, loss experiences can be highly distressing. In adolescence, the mere experience of a romantic breakup is a strong predictor of first onset of major depressive disorder (Monroe, Rohde, Seeley, & Lewinsohn, 1999). Obviously, not all individuals experience such difficulties. In fact, individuals react in markedly different ways after a loss. Some exhibit prolonged preoccupation and distress about the loss, whereas others exhibit no short- or long-term disruption in functioning (Bonanno, 2004; Bonanno, Goorin, & Coifman, 2008; Bonanno, Papa, Lalande, Westphal, & Coifman, 2004; Sbarra & Emery, 2005). Given this variation, a critical direction for loss research is to identify who is most at risk for poor loss adjustment.

Researchers have suggested that it is not the type of loss experienced that predicts these differential outcomes; rather, it is the type of individual who experiences the loss (Bonanno et al., 2002). Hallmarks of poor loss adjustment include perseverate thoughts about the loss and emotional distress when thinking about the loss, which are generally distinct from general depressive symptomatology (Burnett, Middleton, Raphael, & Martinek, 1997). The few notable prospective studies on loss have shown a relationship between pre- and postloss adjustment (Bass, Bowman, & Noelker, 1991; Bonanno et al., 2002; Folkman, Chesney, Collette, Boccellari, & Cooke, 1996). Yet the vast majority of research on predictors of loss-related outcomes has relied exclusively on retrospective data, making it difficult to differentiate characteristics of the individual from characteristics specific to the event by not controlling factors such as preloss depressive symptoms.

One's capacity for dealing with a loss experience develops long before the loss actually occurs (Fraley & Bonanno, 2004; Fraley & Shaver, 1999). It has been suggested that an individual's capacity to cope with stressful life events is primarily established in childhood at both the psychological and physiological level (reviewed in Repetti, Taylor, & Seeman, 2002). Adolescence may represent a critical developmental stage for the maturation of these capacities

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(Diamond & Fagundes, 2008; Keating, 1990). An adolescent loss experience may mark the first time individuals employ these consolidated regulatory strategies (Furman, Feiring, & Brown, 1999). In this article, we examined how attachment insecurity and respiratory sinus arrhythmia (RSA), two factors that have been linked to individuals' capacities for coping and self-regulation, were associated with adolescent loss adjustment.

Individual Differences in Attachment Style

The present research adopted an attachment theoretical framework for understanding individual differences in capacities for coping with loss experiences (Davis, Shaver, & Vernon, 2003). Bowlby (1982) argued that infants exhibit a strong propensity to seek and maintain contact to a specific primary caregiver, usually their mother. He called this person their *attachment figure*. He hypothesized that this behavior is governed by an evolved motivational system that regulates proximity to the caregivers to facilitate infant survival. Bowlby observed that when an attachment figure is close by, infants feel safe and secure, which allows them to confidently explore their environment, knowing that they will be protected. Ainsworth and her colleagues extended Bowlby's early studies by observing that children develop different patterns of attachment—anxious, avoidant, or secure—depending on the way in which the caregiver provides security-provision and distress-alleviation to the infant when distressed (Ainsworth, Blehar, Waters, & Wall, 1978). These patterns are crucial in understanding individual differences in emotion regulation (reviewed in Diamond & Fagundes, 2008; Shaver & Mikulincer, 2007).

In general, if the attachment figure is not consistently available or responsive when the child seeks them out, particularly in times of distress, the child develops an anxious attachment style (Thompson, 1999). Anxious individuals seek to minimize distance from their attachment figure, especially during times of distress, and try to elicit their attachment figure's support through clinging and controlling responses. A child develops an avoidant attachment style if the attachment figure consistently neglects or rejects the child's bids for attention. Avoidant individuals attempt to keep somewhat distant from their attachment figure to avoid dependence and remain self-reliant. Finally, if a child's attachment figure is generally warm, responsive, and available, the child develops a secure working model of attachment. Securely attached individuals are comfortable with closeness and are confident that their attachment figure will be there for them no matter what (Thompson & Calkins, 1996).

Bowlby (1979) argued that both the features and functions of attachment relationships are the same from the "cradle to the grave." The parent–child bond indexes stable capacities and strategies for emotion regulation across the life span (Cassidy, 1994; Diamond & Fagundes, 2008; Main, Kaplan, & Cassidy, 1985; Shaver & Mikulincer, 2007; Thompson, 1994). Anxiously attached individuals' preoccupation with closeness from their attachment figure in childhood is manifested in adolescence and adulthood by exaggerating the presence and seriousness of threats (Thompson, 2000). They also remain hypervigilant to the potential unavailability of attachment figures (Thompson, 1999). Given that anxiously attached individuals did not receive reliable distress-alleviation early in life, they do not master self-regulatory strategies, leaving them vulnerable to chronically heightened stress reactivity (Shaver & Mikulincer, 2002). Alternatively, avoidantly attached individuals strive to suppress the pain and distress caused by failed bids for proximity and support from cool, distant, and rejecting attachment figures (Kobak & Sceery, 1988). Given that an avoidantly attached individual's attachment figure was unavailable, he or she learns to respond to stressful experiences by suppressing and denying negative emotions (Fraley & Shaver, 1997).

Attachment Style and Implications for Loss

Because an infant's attachment style is primarily based on the accessibility of his or her caregivers, individual differences in attachment style should have notable effects on how individuals adjust to the loss of a close relationship. Considerable studies have shown this to be the case in adulthood. In the adult attachment literature, romantic relationships are thought to be functionally analogous to infant/caregiver attachments (Fraley, 2002; Hazan & Shaver, 1987). Consistent with the tenets of attachment theory, individuals who are anxiously attached to their romantic partners show poorer adjustment to the loss of this relationship (Davis et al., 2003; Fagundes, 2011; Fraley & Bonanno, 2004). This is not surprising given that the loss of a romantic partner represents the realization of an anxious individual's worst fears.

In contrast to individuals with more attachment anxiety, individuals with more attachment avoidance do not reliably report poorer adjustment to the loss of a romantic partner. Some research suggests the emotional distancing strategies used by avoidantly attached individuals may enhance their capacity to cope with relationship loss (Davis et al., 2003; Fraley & Bonanno, 2004). Yet other research suggests that the classic distancing strategies of more avoidant individuals—who often function adequately in the face of day-to-day stressors—might break down in the case of relationship loss, given the magnitude of this form of stress (Birnbaum, Orr, Mikulincer, & Florian, 1997). One unexplored possibility is that avoidant people's capacity to cope successfully with relationship loss is moderated by their self-regulatory capacity. A growing body of research in the social psychophysiology literature suggests that individual differences in parasympathetic nervous system

functioning may be associated with basic self-regulatory capacities.

Parasympathetic Nervous System Functioning and Loss Adjustment

The variability in heart rate that is attributable to respiration (known as RSA) is directly mediated by the vagus nerve and serves as a marker for parasympathetic activity (Berntson, Cacioppo, & Quigley, 1993). RSA has been posited to be associated with self-regulatory capacity because brain structures involved in self-regulation and the autonomic nervous system have considerable overlap—especially in the prefrontal cortex (Hagemann, Waldstein, & Thayer, 2003; Thayer & Lane, 2000).

Previous research has investigated relationships between RSA and emotion regulation in two ways: by examining tonic levels of RSA or stress-induced *changes* in RSA. Individual differences in tonic RSA have been found to be associated with measures of temperamental reactivity and emotionality (Beauchaine, 2001). Increased RSA during stress has been associated with active regulatory effort and strength (Segerstrom & Nes, 2007) and is likely more relevant for examining stressful life events than tonic levels given that stressful life events test people's capacity to cope when under stress. Butler, Wilhelm, and Gross (2006) demonstrated that women who actively attempted to suppress their emotional reactions to sad films exhibited increases in RSA. In a study examining basic self-regulation, Segerstrom and Nes (2007) gave two groups of individuals cookies and carrots. One group was told to resist the cookies and eat the carrots, whereas the other group was told to resist the carrots and eat the cookies. The group that was asked to resist the cookies and eat the carrots showed increased RSA, whereas those instructed to eat the cookies and resist the carrots (an "easier" task to accomplish from a self-regulatory perspective) did not.

On the basis of these findings, we expected that individual differences in stress-induced changes in RSA might moderate the ability of more avoidantly attached individuals to cope with relationship loss. Recall that when confronted with a relationship loss, highly avoidant individuals use suppression to avoid thoughts and memories that evoke distress and feelings of vulnerability. Hence, these individuals' ability to cope with the loss should depend on their success in emotional suppression. In other words, it may depend on whether or not an avoidant individual has the *regulatory strength* to use this strategy in the face of an extremely stressful and emotionally taxing loss experience. If increased levels of RSA during stress is linked with regulatory effort and strength, then we might expect that more avoidant individuals would show poorer loss adjustment than their less avoidant counterparts if they had low regulatory strength (specifically, less stress-induced increases in RSA); however, more avoidant individuals may show better adjustment to a loss experience if they have higher regulatory strength (specifically, greater stress-induced increases in RSA).

The current study examined how individual differences in adolescents' attachment style and parasympathetic functioning, assessed at age 14, were associated with how well adolescents adjusted to the most difficult loss they experienced between the ages of 16 and 18, at age 18. In sum, we expected that those who were more anxiously attached to their mothers at age 14 would experience poorer loss adjustment compared with those who were less anxiously attached. We also expected that avoidance would interact with stress-induced changes in RSA to predict loss adjustment. We expected that among those with higher levels of RSA to a stressor, attachment avoidance should be associated with better loss adjustment, whereas among those with lower levels of RSA to a stressor, attachment avoidance would be associated with poorer loss adjustment.

Method

Participants

The current study used data from a longitudinal study of adolescent relationships and development. Announcements about the study were mailed to parents of all 9th graders in a large urban school district in the United States, and were distributed to local charter and private schools. Approximately 20% of families responded to the announcements by contacting our office to request additional information about the study. Potential participants were screened for health status (youths with major psychiatric illness, who had endocrine or cardiovascular disorders, or who were taking medications with cardiovascular or endocrine side effects were excluded from the study). In addition, all participants were required to be living with their (natural or adopted) mother. The first wave of the study consisted of 110, 14-year-old adolescents (54 boys and 56 girls). In all, 82% of the sample was White, and 40% came from families with a household income less than US$50,000. At age 14, participants completed the initial laboratory assessment.

At age 18, the same participants either came back to the lab to fill out a self-report questionnaire on their loss experiences or filled out a self-report questionnaire on their loss experiences via mailings. Of the total number of participants, 35% did not complete this assessment. Participants filled out a series of questionnaires including questions about the most significant loss they experienced between the ages of 16 and 18. Respondents were not limited in their selection of what type of loss they experienced (e.g., breakup, death, etc.) or the type of relationship partner they lost (friend, significant other, grandparent, parent). When asked to describe the type of loss experienced, 51.4% reported a romantic breakup, 15.3% reported the end of a friendship, 2.8% reported that someone close to them moved away, 23.6% reported the death of someone close to them, and 6.9% reported "other."

The "other" category consisted of a stepparent leaving the family. None of the adolescents lost their mother. On average, adolescents knew the person they lost for 59 months (M = 59.6, SD = 63.3 months). Of the total participating adolescents, 70% reported a loss that they experienced at age 17 (specifically, within 1 year of assessment), 21% reported a loss experience that occurred at age 16 (within 2 years of assessment), an additional 9% reported loss experiences that occurred at the age of 15. Although these individuals did not follow study directions regarding timing of the loss, given that they did not differ on any measure, and results did not differ when they were taken out, we decided to keep them in the analyses.

Procedure

All participants were instructed to refrain from eating, smoking cigarettes, or consuming caffeinated beverages 2 hr before the assessment (verified at the laboratory). The adolescent was fitted with the physiological equipment (described in the following section) and seated alone on a small couch. Participants were instructed to sit quietly and relax for 5 min to get adjusted to the physiological equipment, after which they spent 3 min rating their liking of landscape photographs (to engage their attention in a restful, pleasant task, following the study by Jennings, Kamarck, Stewart, & Eddy, 1992). They spent the last 3 min of the baseline period breathing slowly (4 s for inhalation and 4 s for exhalation) in time with a prerecorded tape. This 3-min period served as the formal measure of resting RSA (indexing vagal tone). Having participants pace their breathing during the baseline assessment is recommended to standardize respiratory parameters and yields more accurate assessments of between-person differences in tonic RSA (Grossman, Stemmler, & Meinhardt, 1990). The research assistant said the following:

> Okay, this is the tape that we want you to breathe along with, so that each breath is 4-seconds in, 4-seconds out. It usually takes a minute or so before you get used to it, and if you get off track periodically, that's fine, just do your best to keep along. It isn't a test or anything, and it doesn't have to be perfect. If you get out of sync with the tape, don't worry or anything, just listen to the tape and try and get back on track. You'll be breathing like this for about 5 minutes.

For the adolescent to get used to the paced respiration, the research assistant let 3 min elapse and then recorded the physiological event for an additional 3 min.

In the next step, the researcher who had interacted with the adolescent up until then, left the room and a new male research assistant entered the room wearing a lab coat to administer a modified version of the Trier Social Stress Test (TSST; Kirschbaum, Pirke, & Hellhammer, 1993), a well-validated laboratory stressor that provokes reliable changes in autonomic functioning (Kudielka, Schommer, Hellhammer, & Kirschbaum, 2004). After adjusting various cameras, the new research assistant read the following:

> For the next 10 minutes or so we will be conducting an evaluation of your verbal and mathematical skills. We have two tasks for you to do. As you can see, we'll be videotaping your performance. We're going to need you to look up and directly at the camera, because part of how we evaluate your performance—especially the verbal section—is by having trained raters code the videotapes, and they will be evaluating not only your words, but your overall demeanor. So please look directly at the camera. First we will conduct the mathematical task. It is important that you listen carefully to the instructions. This is a task that assesses your ability to form and utilize abstract notions of numbers. You will perform a series of mental subtractions, without using pen or paper. Specifically, you will begin by subtracting the number 13 from the number 9,000, and then you will keep subtracting 13 again and again from the numbers that you end up with. You will perform these subtractions in your head, without speaking, but every 20 seconds, you'll hear a buzzer and you have to report out loud the last number that you reached. Then go immediately back to subtracting in your head until you hear the next beep. Your performance score will be based on how quickly and how accurately you can do the subtractions. Do you have any questions? Okay, now we can begin. The starting number is 9,000. Begin subtracting the number 13 now.

This marked the beginning of the "stress task." During this task, the research assistant constantly reminded the participant that he or she needed to go faster and be more accurate. After 5 min had elapsed, the research assistant asked the adolescent to fill out various forms that asked how stressed they were during the task. Then, the research assistant proceeded to say the following:

> Okay (Subject name), now we'll start the verbal task. We would like you to spend several minutes discussing, as honestly and as clearly as you can, three of your *best* qualities and three of your biggest *weaknesses*. We'll give you a few minutes to think before starting. These tapes will be scored by trained raters who will be rating how thoroughly, clearly, and honestly you present yourself, compared with other adolescents your age. These raters are trained to detect any verbal or facial signs of lying, so be *completely honest*. Remember to look directly into the camera. Do you have any questions? Okay, so you can have the next minute or so to think about the strengths and weaknesses you want to discuss.

Based on the experimenter's prompts, the adolescent discussed his or her positive and negative qualities for approximately 4 min. The research assistant periodically told the participant that he or she needed to do a better job. After 4 min, the experimenter left the room, and the original experimenter who had greeted the adolescent and hooked him or her up to the physiological equipment reentered the room, unhooked the adolescent from the physiological equipment, and asked him or her to fill out another round of questionnaires. After the participants completed the laboratory assessment, adolescents received US$90.

Measures

RSA. At age 14, measures of RSA were collected. Individual differences in RSA are calculated by recording electrocardiogram (ECG) and respiration. These readings were amplified and filtered through a James Long Company four-channel bioamplifier, model LMD-04 with the ECG channel high-pass filter set to 0.1 Hz and a low-pass filter set to 1,000 Hz. Respiration depth and frequency were measured by a latex rubber pneumatic bellows girth sensor that was fitted around the participants' chest. These signals were transmitted into an analog/digital (A/D) interface box and stored on a Windows-compatible Intel-based PC. The sampling rate is 1,000 Hz for all channels. Data analysis is implemented with James Long Company PHY General Physiology Analysis System software, which is designed to allow for visual inspection and manual editing of artifacts. RSA was assessed with ECG and respiration data. Interbeat intervals (IBIs) were calculated as the time in milliseconds between successive R-waves in the ECG using the "peak-to-valley" method (Grossman & Svebak, 1987). Using this method, differences (in milliseconds) were calculated between the heart period at inspiration onset and expiration onset. The sum of these "peak-to-valley" measurements was divided by the total number of breaths. RSA values were logged before analysis, which is standard practice to normalize skewed distributions (Grossman & Kollai, 1993; Salomon, 2005). Baseline RSA consisted of the previously mentioned paced respiration period. The RSA stress task consisted of combining both the math task and the speech task into a single index as is standard in the literature to improve reliability (Kamarck, 1992). The reliability across assessments was .89.

Attachment style. At age 14, adolescents' attachment anxiety and attachment avoidance to their mother were assessed using Miller and Hoicowitz's (2004) revised Adolescent Attachment Scale. We chose to assess adolescents' attachment style to their mother because adolescents are most likely to use their mother as their primary attachment figure at this age (Doyle, Lawford, & Markiewicz, 2009; Waters & Cummings, 2000). This scale is based on the widely used Experiences in Close Relationships Inventory, designed to assess attachment anxiety and avoidance (Fraley, Waller, & Brennan, 2000). It was modified to assess adolescent/parent attachment. The Anxiety subscale includes items such as "I sometimes wonder if my mother really loves me," and "I worry about losing or being left by my mother." The Avoidance subscale includes items such as "I don't usually talk about my problems with my mother" and "I don't mind asking my mother for advice or help" (reverse scored). Reliability was .65 for the 8-item anxiety dimension and .87 for the 7-item avoidance dimension.[1]

Loss adjustment. Poor loss adjustment was assessed using modified versions of highly endorsed items from the Expanded Texas Inventory of Grief (Zisook, Devaul, & Click, 1982). Items were measured on a 5-point scale (1 = *very untrue*, 2 = *untrue*, 3 = *neutral*, 4 = true, and 5 = *very true*). Items were as follows: "Even now, when I think about losing this relationship, I feel just as upset as I did when it happened," "I feel like I still have a relationship with this person, except only in my mind," "Sometimes I think no one will ever care for me as much as this person," "I still think about this person all the time," "After this happened, I was never quite the same," "I am a more unhappy person now than I was before this relationship ended." Reliability for this scale was .86.

General depressive symptoms. At ages 14 and 18, adolescents filled out the 12-item version of the Center for Epidemiologic Studies Depression Scale (CES-D; Radloff, 1977; Roberts & Vernon, 1983). This questionnaire asked participants to fill out 12 questions in reference to the depressive symptoms they experienced during the past 2 weeks. This scale is a reduced version of the full CES-D originally designed for the National Longitudinal Study of Children and Youth. Cronbach's alpha was .83 at age 14 and .70 at age 18.

Analytic Strategy

We performed multiple linear regression by examining how attachment style and RSA contributed to poor loss adjustment at age 18. All independent variables were grand mean centered. In all of our analyses, we adjusted for baseline levels of RSA (to reflect changes in stress-induced changes in RSA), gender (1 = *female*, 0 = *male*), type of loss (dummy coded breakup, death, or other), depressive symptoms at age 14, depressive symptoms at age 18, and time since loss. Main effects were entered in the first step, and then interactions between attachment style and stress-induced changes in RSA were entered in the second step. In additional ancillary models, we also included all other two- and three-way interactions.

We utilized full information maximum likelihood estimation to fit all regression models. Full information likelihood is superior to listwise deletion for handling attrition (Jeličić, Phelps, & Lerner, 2009). It performs well when data are missing at random and improves nonrandom circumstances over ignoring cases entirely (Schafer & Graham, 2002). It is robust against departures from normality assumptions and performs well even with low sample sizes (Graham, 2009).

Table 1. Means and Standard Deviations of All Study Variables

Variables	*M*	*SD*
1. Attachment anxiety	2.89	0.95
2. Attachment avoidance	3.30	1.34
3. Depressive symptoms age 14	0.46	0.40
4. RSA base	4.25	0.59
5. RSA stress	4.23	0.53
6. Depressive symptoms age 18	0.41	0.28
7. Time since loss	12.33	12.14
8. Poor loss adjustment	2.30	0.97

Note: RSA = respiratory sinus arrhythmia.

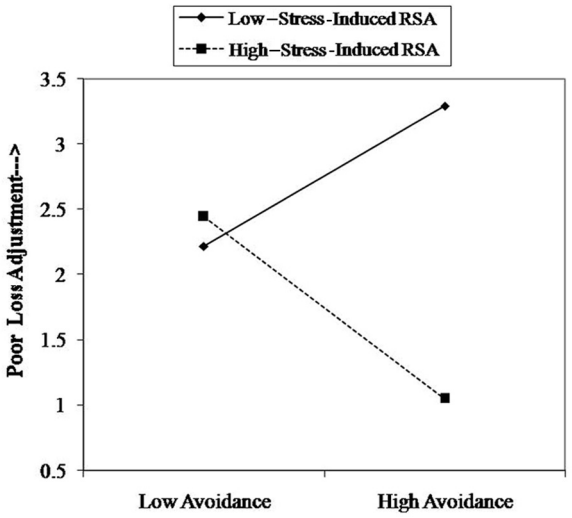

Figure 1. The moderating role of stress-induced change in RSA in the relationship between attachment avoidance and poor loss adjustment
Note: We plotted regression lines for individuals scoring 1 *SD* above and below the sample means on each of the predictor variables.

There are two notable differences between ordinary least squares and maximum likelihood that should be mentioned for those not familiar with this procedure. First, when variables are entered in steps using full information maximum likelihood, rather than entering them as new variables, they are "freed" rather than "fixed" at 0 (Enders, 2001). This is equivalent to actually entering them when using an ordinary least squares approach (Schumacker & Marcoulides, 1998). Furthermore, the *F* test is not appropriate. However, chi-square differences tests can be employed to examine differences between two overidentified models. Importantly, all analyses presented in the following section were also conducted using an ordinary least squares regression approach with listwise deletion; the significant relationships presented in the following section were unchanged.

Results

Means and standard deviations (*SD*s) for all study variables are presented in Table 1.

Zero-order correlations of all study variables are presented in Table 2.

All continuous variables were centered before inclusion (Aiken & West, 1991). Adolescents who returned for the follow-up did not significantly differ on any measure used in the current investigation from adolescents who did not return. An omnibus test was conducted by regressing poor current loss adjustment on type of loss experience. For this test, loss type was dummy coded across each loss category (specifically, romantic breakup, end of a friendship, death of a close someone, someone moved away, or other). Results indicated that type of loss was not associated with differential adjustment, $F(1, 70) = 2.16$, $p = ns$.

Table 3 summarizes the analyses that assessed relationships among attachment style, stress-induced changes in RSA, and poor loss adjustment.

Those with more attachment anxiety at age 14 reported poorer loss adjustment at age 18 than those with less attachment anxiety. Neither attachment avoidance nor stress-induced changes in RSA were associated with poor current loss adjustment. Yet when the interactions were entered into the model, attachment avoidance interacted with stress-induced changes in RSA to predict poor current loss adjustment. As confirmed by a simple slope test (1 *SD* above and below the mean), the association between attachment avoidance and poor current loss adjustment was positive for those who had lower stressed induced changes in RSA ($b = .40$, $t = 3.17$, $p < .001$). However, the association between attachment avoidance and poor current loss adjustment was negative for those with higher levels of stress-induced changes in RSA ($b = -.52$, $t = -3.66$, $p < .001$; see Figure 1).

Ancillary analyses revealed that the interaction between stress levels of RSA and attachment avoidance remained significant when baseline RSA was removed from the regression model ($B = .86$, $p < .001$). No other higher order interactions reached significance.

Discussion

Loss experiences may tax an individual's capacity to adjust more than any other life experience (Holmes & Rahe, 1967). Poor loss adjustment is particularly worrisome during the adolescent years because it may become a template for how individuals adjust to subsequent loss experiences in adulthood. Adolescents with more attachment anxiety to their mother at age 14 were more likely to report poorer adjustment to a loss than those with less attachment anxiety. Attachment avoidance interacted with RSA to predict poor subsequent loss adjustment. Specifically, the association between attachment avoidance and poor loss adjustment was positive for those who had less elevated RSA in response to the stressor; however, the association between

Table 2. Zero-Order Correlations of All Continuous Study Variables Using Full Information Maximum Likelihood Estimation

	1	2	3	4	5	6	7
1. Attachment anxiety							
2. Attachment avoidance	.03						
3. Depressive symptoms at age 14	.08	.42***					
4. RSA base	−.02	.25*	.02				
5. RSA stress	−.11	.10	.15	.46**			
6. Depressive symptoms at age 18	.08	.04	.26*	−.04	.03		
7. Poor loss adjustment	.30**	.04	.27*	−.16	−.05	.37***	
8. Time since loss	−.14	.01	−.04	−.05	−.16	−.15	−.14

Note: RSA = respiratory sinus arrhythmia.
*$p < .05$. **$p < .01$. ***$p < .001$.

Table 3. Regressions Predicting Poor Loss Adjustment

	Step 1			Step 2		
Predictors	β	*B*	*SE*	β	*B*	*SE*
Attach avoidance	−.04	−.04	.10	−.08	−.06	.09
Attach anxiety	.25*	.26	.12	.16	.16	.114
RSA stress	−.11	−.20	.29	−.52***	−.95	.27
RSA base	−.08	−.15	.27	−.08	−.14	.24
Sex	−.05	−.10	.23	−.23	−.44	.23
Breakup	.15	.29	.26	.16	.31	.25
Death	.11	.26	.31	.19	.45	.30
Depression at age 14	.22	.55	.35	.26+	.65	.34
Depression current	.28*	.94	.41	.44***	1.45	.40
Time since loss	−.08	−.01	.01	−.22	−.02	.01
Attach avoidance × RSA stress	—	—	—	−.60***	−.87	.19
Attach anxiety × RSA stress	—	—	—	−.03	−.07	.28
R^2	.09			.25		

Note: RSA = respiratory sinus arrhythmia.
$p < .05$. **$p < .01$. ***$p < .001$

attachment avoidance and poor loss adjustment was negative for those who had more elevated RSA in response to the stressor.

The finding that more attachment anxiety was associated with poorer loss adjustment replicates previous work in the adult attachment literature illustrating that individuals who report greater attachment anxiety to their romantic partner also report more distress after a breakup, divorce, or death of a spouse (Birnbaum et al., 1997; Sbarra, 2006; Stroebe, Schut, & Stroebe, 2005). This is the first study to show this association among adolescents. Furthermore, this is the first study, to our knowledge, that focuses on individual differences in attachment style to parents rather than romantic partners when predicting future loss adjustment. It should be noted that this association was attenuated when the interaction terms were entered into the model. However, attachment anxiety was significantly positively associated with poor loss adjustment at the zero-order level and in the adjusted model before the interaction terms were included.

Previous studies examining the association between attachment avoidance and emotional adjustment after a loss have produced conflicting results. Although some studies show that highly avoidant individuals exhibit poorer adjustment (Birnbaum et al., 1997; Wayment & Vierthaler, 2002), other studies show the opposite (Davis et al., 2003; Fraley & Bonanno, 2004). When coping with a threatening situation, avoidant individuals' primary coping strategy is to suppress their feelings (Davis et al., 2003). This has been illustrated in both open-ended, self-report, and functional magnetic resonance imaging (fMRI) studies (Edelstein, 2006; Fraley & Shaver, 1997; Gillath, Bunge, Shaver, Wendelken, & Mikulincer, 2005). Furthermore, in the psychophysiology literature, adults who used deactivating strategies (specifically, avoidant strategies) when describing their attachment relationships with their parents had elevated electrodermal reactivity (a physiological marker associated with behavioral inhibition) when resolving a relationship conflict with their romantic partner (Roisman, Tsai, & Chiang, 2004).

The current investigation demonstrated that the association between attachment avoidance and poor loss adjustment was moderated by stress-induced changes in RSA. Because stress-induced changes in RSA have been associated with self-regulatory effort/strength (Segerstrom & Nes, 2007), the findings may suggest that individuals who are more avoidantly attached are only vulnerable to poor loss adjustment if they also have low self-regulatory strength. Indeed, as can be seen in Figure 1, based on the 5-point Loss Adjustment Scale, those who were more avoidantly attached and had lower levels of RSA during stress indeed crossed the threshold for poor loss adjustment (above the neutral midpoint), whereas those who were more avoidantly attached and had higher levels of RSA during stress reported almost no adjustment problems. This may be because individuals with high levels of stress-induced changes in RSA, who presumably have a stronger self-regulatory capacity, are better able to effectively suppress their negative emotions. This finding may help explain the discrepancies in the literature regarding the postloss emotional trajectories of highly avoidant individuals. Our findings are consistent with recent work suggesting that individual differences in physiological reactivity render some youths differentially sensitive to the ramifications of environmental conditions and events (Belsky & Pluess, 2009; Boyce & Ellis, 2005; Steinberg & Avenevoli, 2000). It should be noted that the interaction between avoidance and RSA existed when we examined *levels* of RSA in response to the stressor rather than *changes* in RSA in response to the stressor suggesting that both measurements may be associated with the same underlying psychological construct.

The notion that avoidance is maladaptive has a long and controversial history. Early work by Freud and his psychoanalytic decedents suggested that avoidance is always maladaptive and will eventually result in greater long-term preoccupation and grief over a loss (Deutsch, 1994; Feldman, 1955; Freud, 1920; Hewison, 2008; Siegman, 1970). Although, to a certain extent, this view is still in vogue among clinicians and mental health professionals (Bonanno et al., 2008), recent empirical work suggests avoidance is not always maladaptive—and is sometimes adaptive (Bonanno et al., 2002; Bonanno, Galea, Bucciarelli, & Vlahov, 2007; Bonanno & Singer, 1995).

Although avoidance in combination with higher stress-induced RSA may be associated with better adjustment to the loss, it is possible that it still has long-term consequences. Those who effectively use avoidance may not learn from the loss experience to the same degree as those who process the loss. There is work to suggest that processing loss experiences can facilitate long-term growth. Self-reported growth is common following romantic breakups (Tashiro & Frazier, 2003). People who effectively use avoidant strategies may also be less able to empathize and therefore support others going through difficult loss experiences. Indeed, attachment avoidance is inversely related to empathy (Mikulincer et al., 2001).

Limitations and Future Directions

Although this study provides significant advantages for understanding what factors predict future loss adjustment over other studies by using a design that examined adolescents' biological and psychological capacities for emotion regulation *before* the loss experience, there are a few notable limitations that could serve as a catalyst for future research. First, we allowed the adolescents to pick the loss experience that most impacted them in the past 2 years rather than limiting them to a certain type of loss experience such as a romantic breakup. We did this because we wanted to understand how adolescents dealt with a loss experience they deemed particularly challenging. It is notable that we did not find significant differences between the type of loss experienced and poor loss adjustment. Yet our power to detect group differences was small. We surmise that a larger sample size would allow us to detect differences between type of losses, a promising direction for future work. Another limitation of the current study is that there was considerable variation between time since loss and time of assessment (Davis et al., 2003; Fraley & Bonanno, 2004).

A major strength of the current research design is that it examined predictors of poor loss adjustment *before* the loss experience occurred. Thus, we were able to make stronger directional inferences compared with both retrospective and cross-sectional studies. Furthermore, this design allowed for us to control for general initial depressive symptoms, which is one notable disadvantage of almost every study in the loss literature (Bonanno et al., 2002).

There was considerable variability in how well the adolescents in our sample adjusted to the loss, a notable strength of the study, with those who were 1 *SD* above the mean still reporting distress. It is notable that the results did not change when we controlled for time since loss experience. Furthermore, time since loss experience did not moderate the reported associations. Although it would be very difficult methodologically (especially in an adolescent population), it would be ideal to assess individuals before the loss occurred, immediately after the loss occurred, and then periodically over the course of many years after the loss to obtain a comprehensive understanding of how attachment style and parasympathetic functioning are related to loss adjustment.

Future research should also examine whether these findings extend to other stressful life events. In general, people who exhibit resilience in the face of loss, also exhibit resilience when faced with a variety of traumatic life events such as catastrophic disasters and the diagnosis of a major illness (Bonanno, 2004; Bonanno et al., 2007; Rodin et al., 2007; Schmidt, Nachtigall, Wuethrich Martone, & Strauss, 2002).

Finally, caution is warranted when inferring one-to-one relationships between psychophysiological markers, such as RSA, and a specific psychological construct such as self-regulatory strength (Cacioppo & Tassinary, 1990). Indeed,

there is work to suggest that stress-induced changes in RSA are associated with regulatory effort/strength; however, we cannot say for certain that it *indexes* regulatory strength. Psychophysiological responses are multiply determined, and can be sensitive to a variety of different elements (Cacioppo & Tassinary, 1990). Nevertheless, our findings are theoretically consistent with the attachment literature.

Conclusions

One of the foundational tenets in psychology is that individuals' capacity to cope with stressful life events develops in childhood (Bowlby, 1958, 1988; Finkelstein, Donenberg, & Martinovich, 2001; Johnson & Flake, 2007; Poobalan et al., 2007; Repetti et al., 2002; Simpson & Rholes, 1994). This research demonstrates that attachment insecurity and individual differences in parasympathetic activity are associated with future loss adjustment. By helping explain why some adolescents are better at adjusting to a loss than others, this research could contribute to the efforts of mental health professionals in identifying and supporting adolescents who are particularly vulnerable to poor loss adjustment.

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Note

1. We found that adolescent attachment anxiety is significantly correlated with perceptions of maternal unpredictability and maternal psychological control, assessed with Schludermann and Schludermann's (1983) measure of parenting style. These correlations are consistent with the notion that attachment anxiety stems from inconsistency and noncontingency in caregiver responsiveness, along with caregiver intrusiveness. Yet, attachment anxiety was not associated with adolescents' ratings of conflict with their parents, nor was it related to ratings of companionship or support, assessed with the Networks of Relationships Inventory (Furman & Buhrmester, 1985). Avoidance was negatively correlated with companionship and support, consistent with the notion that avoidance develops as a result of parental emotional distance and noninvolvement, and was also negatively correlated with maternal warmth. Notably, these findings are highly consistent with findings from published research using similarly adapted measures of adolescent attachment style.

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