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Attachment Discontinuity in a High-Risk Sample

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Abstract

In this study, we evaluated complex patterns of attachment discontinuity across time in 133 individuals from the Minnesota Study of Risk and Adaptation. In addition to individuals who were either insecure or secure across infancy, late adolescence, and adulthood (Stably Insecure and Stably Secure, respectively), we found three additional groups: Infant/Adolescent Secure, Infant/Adult Secure, and Infant-only Secure. Changes in attachment representations in these groups across time corresponded to stresses and supports in the socio-emotional context. The two groups classified as secure in adulthood (Stably Secure and Infant/Adult Secure) experienced more positive relationship-based outcomes than the other three groups. Our results (1) suggest that continuity may be a reflection of a stable social context as much as it is an artifact of early working models, and (2) illustrate “homeorhetic” pathways of development, in which not only the direction but the length of a developmental pathway can constrain future developmental trajectories.

Keywords

attachment; discontinuity; multi-finality; strange situation; adult attachment interview

According to attachment theory, the infant’s early experiences with the primary caregiver shape his or her conceptualization of close relationships during development (Bowlby, 1969/1982, 1973, 1980). Expectations and beliefs about relationships form during repeated interactions with the caregiver in infancy and serve as the framework through which the developing child interprets other relationship experiences across the life course (Sroufe, 1983). Attachment theorists hypothesize that these expectations and beliefs are carried forward in development as a network of cognitive representations known as internal working models (Bretherton, 2005; Sroufe & Fleeson, 1986). These working models are elaborated over time via emotional involvement in interpersonal relationships outside of the original caregiving dyad (Sroufe, 1983).

Advancing our understanding of internal working models requires an investigation of factors related to continuity and change over time (Bretherton & Munholland, 1999; Main, Kaplan, & Cassidy, 1985). In some research, infant attachment representations (as assessed via observation of infant behaviors in the Strange Situation) were found to be significantly related to adolescent or adult representations (as assessed via the Adult Attachment

Interview; Hamilton, 2000; Main, Hesse, & Kaplan, 2005; Waters, Merrick, Treboux, Crowell, & Albersheim, 2000). Other empirical studies, however, have failed to find significant continuity over time (Lewis, Feiring, & Rosenthal, 2000; Weinfield, Sroufe, & Egeland, 2000; Weinfield, Whaley, & Egeland, 2004). Weinfield and colleagues (2000, 2004), using a high-risk sample, noted that a number of individuals classified as secure in the Strange Situation in infancy had transitioned to insecurity in late adolescence and found that factors from childhood and early adolescence, such as maternal life stress, the home environment, and family functioning, were related to attachment state of mind in late adolescence. Thus, changes in attachment representations from infancy to late adolescence were seen to be lawfully associated with experiences with caregivers in childhood and early adolescence.

Researchers have noted other factors later in adolescence that may also contribute to attachment change or discontinuity. For example, Allen and colleagues (2004) hypothesized that middle and late adolescence is a time of greater vulnerability to change in attachment because increased behavioral and emotional autonomy from parents requires a re-negotiation of parent-adolescent boundaries and roles. If adolescents can negotiate these changes while maintaining positive interactions with parents and continuing to value attachment relationships, then an autonomous or secure attachment state of mind in adulthood is more likely. In contrast, a difficult transition marked by a high degree of parental and/or adolescent life stress may strain parent-adolescent relationships, reducing parents' capacity to act as a secure base and prompting adolescents to defensively exclude distressing experiences from awareness; over time, this may lead to less secure working models of attachment. This is particularly true when parents themselves are the source of the stress, as when they fail to acknowledge or purposefully limit adolescents' emerging autonomy (Allen & Hauser, 1996). External sources of stress, such as health issues (Feeney, 2000; Minde, 1999) and financial difficulties (Allen, McElhaney, Kuperminc, & Jodl, 2004) can also interfere with close relationships and may be associated with a move toward attachment insecurity. Finally, major relationship disruptions, such as the loss of a significant other (Bowlby, 1980) or parental divorce (Lewis et al., 2000) can also spur a transition to attachment insecurity. Thus, in addition to more distal factors from earlier in childhood, more proximal factors such as stress or loss may impact attachment state of mind in adolescence and adulthood.

Although many factors have been identified as contributing to attachment security or insecurity, other factors are seen to derive *from* attachment security or insecurity. For example, Sroufe (1983; Sroufe & Fleeson, 1986) has linked early attachment security with enhanced peer competence in elementary school. According to theory, secure children are more empathic with others, more able to regulate emotion, more skilled at resolving conflicts and sharing positive affect, and, in turn, better able to establish and maintain friendships when compared to insecure children (Sroufe, Carlson, & Shulman, 1993; Sroufe, Egeland, Carlson, & Collins, 2005). In addition, Simpson and colleagues (2007) found that infant attachment security and security in adolescent friendships were linked via early peer competence, and research has found that attachment representations in late adolescence mediated the link between parent-child interaction patterns in early adolescence and behavior in romantic relationships in early adulthood (Roisman, Madsen, Henninghausen, Sroufe, & Collins, 2001). Thus, attachment representations and experiences in interpersonal relationships seem to have a reciprocal association, with each influencing the other across time (Carlson, Sroufe, & Egeland, 2004).

In this study, we wished to examine attachment across time in the context of interpersonal relationships. However, unlike previous research that either focused on continuity in attachment or examined discontinuity between two time points, we wished to consider more

complex forms of discontinuity. Using a high-risk sample, we examined patterns of attachment security across three time points: (1) attachment behavior in infancy, as assessed by the Strange Situation; and, attachment representations in (2) late adolescence and (3) adulthood, as assessed by the Adult Attachment Interview. We grouped individuals according to their patterns of change across time, which included individuals who were consistently secure (i.e., Stably Secure) or insecure (i.e., Stably Insecure) across all three time points, as well as individuals who were considered secure in infancy and adolescence and subsequently transitioned to insecurity in adulthood (i.e., Infant/Adolescent Secure), those secure in infancy and insecure in adolescence and adulthood (i.e., Infant-only Secure), and those secure in infancy, insecure in adolescence, and secure in adulthood (i.e., Infant/Adult Secure). These groups were not defined *a priori* but rather emerged during preliminary analysis. For more details, refer to the section below on Group Membership.

After defining the groups, we then examined group differences in the constructs discussed above, i.e., peer and romantic relationship competence, maternal stress, maternal perceived social support, maternal caregiving, family processes, and personal stress associated with health, financial problems, autonomy strivings, parental divorce, the loss of a close relationship, and conflict in family relationships, friendships, and romantic relationships. Based upon the research discussed above, all of these factors should play a role in attachment continuity and/or discontinuity; however, because we did not know *a priori* the types of attachment patterns we would find, we did not develop more specific hypotheses. Thus, our study can be viewed as exploratory in nature.

Method

Participants

Participants were 133 individuals and their mothers drawn from the Minnesota Study of Risk and Adaptation, a longitudinal study of children from low SES households at risk for poor developmental outcomes (Egeland & Brunquell, 1979). Mothers were initially recruited for participation in the study while receiving prenatal care at Minneapolis public health clinics. At time of recruitment, mothers ranged in age from 12 to 34 years ($M = 20.78$ years; $Med = 20$; $SD = 3.58$; $N = 267$). All of the mothers were living below the poverty level, and 59% were single. Eighty-three percent of the mothers were Caucasian, 12% were African American, and 5% were Native American or Hispanic. Mothers and children were assessed at regular intervals throughout childhood and adolescence. The sample for the current study was comprised of individuals with codeable AAI data at age 19 and 26 and at least one codeable Strange Situation assessment whose pattern of attachment security over time fell into one of the five groups defined below (see section below on Group Membership).

Measures

Strange Situation—At ages 12 and 18 months, participants were seen with their mothers in the Strange Situation (Ainsworth, Blehar, Waters, & Wall, 1978), a standardized procedure for assessing quality of attachment in infancy. This 21-minute laboratory procedure involves brief separations and reunions with the mother, exposure to an unfamiliar adult, and a period of time alone. Infant behavior in the Strange Situation was coded for exploratory behaviors, visual orientation, response to reunion with the mother, and response to the unfamiliar adult. Based on these ratings, infant-mother dyads were classified into one of three major categories: secure, insecure-avoidant, or insecure-resistant.

Strange Situation procedures were videotaped and coded by two independent raters. Different raters coded the Strange Situation procedures at 12 and 18 months; raters for the

18-month Strange Situation were blind to classifications assigned to dyads at 12 months. Inter-rater agreement was 89% for the 12-month Strange Situation and 93% for the 18-month Strange Situation; disagreements at both time points were resolved via discussion. Additionally, attachment disorganization in the Strange Situation procedure was coded according to Main and Solomon's (1990) classification scheme. A trained coder who had established reliability with Mary Main rated all available videotapes of Strange Situation procedures for attachment disorganization. A second coder rated a subset of videotapes to establish reliability. Inter-rater agreement for attachment disorganization was 86% ($\kappa = .72$). See Carlson (1998) for additional details regarding the coding of infant attachment disorganization.

Given that our hypotheses were focused on the secure/insecure dichotomy rather than specific classifications, and in keeping with much of the previous research on attachment continuity (e.g., Allen et al., 2004; Roisman et al., 2001), we created two dichotomous variables representing individuals classified as secure and insecure at 12 and 18 months. Disorganized infants were classified as insecure regardless of their primary classification.

Adult Attachment Interview—The Adult Attachment Interview (AAI; George, Kaplan, & Main, 1996), a semi-structured clinical interview about childhood attachment experiences, was administered to participants shortly following their 19th and 26th birthdays as part of larger assessment batteries. Interviews were audio-taped and transcribed verbatim. During the transcription process interviews were blinded for all identifying information. Using Main and Goldwyn's (1998) coding system for the AAI, transcripts were assigned one of four major classifications: secure-autonomous, insecure-dismissing, insecure-preoccupied, or insecure-unresolved. All AAI coders were trained by certified AAI trainers and had achieved reliability with Mary Main and Erik Hesse. For the age 19 AAIs, inter-rater agreement on 49 randomly selected cases was 82% across the three major classifications ($\kappa = .67$) and 90% for unresolved status ($\kappa = .65$). For age 26 AAIs, inter-rater agreement on 44 randomly selected cases was 87% across the three major classifications ($\kappa = .70$), and 93% for unresolved status ($\kappa = .78$). As above, we created two secure/insecure dichotomous variables representing attachment state of mind at 19 and 26, and unresolved individuals were considered insecure regardless of their primary classification.

Maternal life stress—From child infancy to adolescence (i.e., 3, 12, 18, 30, 42, 48, 54, and 64 months, grades 1, 2, 3, and 6, and 16 years), mothers of participants completed the Life Events Inventory (Cochrane & Robertson, 1973) adapted for use with the longitudinal sample (Egeland, Breitenbucher, & Rosenberg, 1981). The Life Events Inventory (LES) consists of 41 items that describe occurrences such as life changes or stressful events. The measure yields a total score (total count of items endorsed) and total weighted score based on the self-reported degree of disruption associated with individual events. Disruption ratings ranged from 0 [*no disruption*] to 3 [*highly disruptive*]. The total weighted score was used in this study. Scores from infancy and early childhood were combined in the following manner: first two years (3, 12, and 18 months), years 2-4 (30, 42, and 48 months), and years 4-6 (54 and 64 months). Maternal life stress has been linked to less sensitive caregiving (Vaughn, Egeland, Sroufe, & Waters, 1979).

Maternal support perceptions—Perceived maternal emotional support was derived from maternal interviews when study participants were in middle and late childhood and adolescence (i.e., grades 1, 2, 3, and 6, and 16 years). Overall emotional support received by the mother from their social networks was rated from an interview transcript on a 7-point scale. A rating of 7 indicated consistent support available when needed; a rating of 1 indicated virtual isolation and lack of support. Exact agreement or 1-point discrepancy

between independent raters averaged 84%. In previous research, ratings have been linked to quality of maternal caregiving, which in turn can influence child adjustment (Carlson, Jacobvitz, & Sroufe, 1995; Sroufe et al., 2005).

Tool task—At 24 months, mothers and children performed a series of tool problems in the laboratory adapted from the research of Bill Charlesworth (see Matas, Arend, & Sroufe, 1978). Quality of experience was the most integrative rating from this assessment, capturing the caregiver's overall degree of support for the child reflected in encouragement, structuring of the task, and aid in regulating affect. Inter-rater reliability was .87. In previous research, this rating has been shown to correlate with attachment security as assessed via the Strange Situation (Sroufe et al., 2005).

Home environment—Based on a semi-structured interview and observations in the home, trained observers assessed the stimulation, quality, and organization of the home environment using the Inventory of Home Stimulation at 30 months and in 1st grade (HOME; Caldwell & Bradley, 1978). For current analyses, the total HOME score was used. Scale items related to caregiver support, disciplinary methods, and structure (e.g., use of physical punishment and derogation toward the child, interference with child's initiatives). All items are scored either 1 ("yes") or 0 ("no"). For the total sample, the total HOME score was correlated significantly with parental support and quality of instruction at 42 months ($r = .43$ and $r = .50$, respectively) and discriminated preschool groups with and without behavior problems (Erickson, Sroufe, & Egeland, 1985). Kuder-Richardson-20 index of internal consistency for the total scale was .89.

Family processes—At 13 years, adolescents and their mothers were videotaped in a laboratory situation (because only 44 "fathers" were living with the children at age 13, triadic data are not reported here). The dyads were asked to complete four structured interaction tasks based on Block and Block (1980): 1) create an antismoking campaign, 2) assemble a puzzle together while the parent was blindfolded, 3) discuss the potential effects of imaginary events, and 4) complete a Q-sort of the characteristics of the ideal person.

Videotaped interactions were coded using 11 dyadic rating scales of Emotional Engagement, Anger, Conflict, Conflict Resolution, Confrontation, Hostility, Negative Affect, Positive Affect, and three Balance scales assessing the degree of comfort the family members showed in their respective roles, the level of support the relationships provided for the individuals, and the extent to which the relationships promoted harmonious and effective collaboration on the tasks (Sroufe, 1991). In addition, ratings were assigned for dimensions of Boundary Dissolution, Adultlike Child, Childlike Adult, Childlike Child, and Seductive Parenting. Inter-rater intraclass correlations for ranged from .60 to .70 ($p < .001$).

As in Roisman et al. (2001), a principal components factor analysis with Varimax rotation was applied to the assessment ratings using the sample from the current study. We removed items with substantial cross-loading ($< .20$ difference in loadings) and four factors emerged: Family Process (Emotional Engagement, Positive Affect, Negative Affect [negative loading], Conflict Resolution, and Balance I, II, and III), Negative Affectivity (Anger, Confrontation, and Conflict), Boundary Problems (Seductiveness, Childlike Child), and Role Reversal (Childlike Parent and Adultlike Child). The four factor scores were used in the analysis.

Peer competence—Peer competence rank-order assessments across childhood and adolescence (i.e., grades 1, 2, 3, and 6, and 16 years) employed a teacher nomination procedure developed by project staff as a means of calibrating the hundreds of teacher ratings and classroom setting variations (i.e., one project child in a given classroom).

Teachers were asked to rank order students based on a written behavioral description of middle childhood and adolescent adaptive relationship qualities with the child most closely resembling the criterion description ranked at the top. Criteria for high rankings included observed sociability, wide acceptance and respect among peers (i.e., his or her ideas and actions were followed, others chose to be with the child), clearly identifiable friendships (e.g., special companions), social skills (e.g., perspective taking and interpersonal communication skills), and leadership qualities.

Peer competence rankings were recorded as the ratio of the inverse of the child's rank divided by the number of students in the class [i.e., the child ranked 11th in a class of 30 received a score of $(30 - 11 + 1)/30 = .66$]. Reliability and validity of this procedure were supported by findings of Connolly and Doyle (1981). In addition, peer competence rankings have been correlated with concurrent teacher ratings of leadership, cooperation, and social skill (TRF, Achenbach & Edelbrock, 1986; DESB II, Spivack & Swift, 1982), and with camp counselor social competence rankings (Hiester, Carlson, & Sroufe, 1993). The teacher rankings showed moderate stability from year to year within the total sample (r 's from .45 to .55, $p < .001$).

Personal life stress—At ages 16 and 19, participants were administered the Adolescent Life Events Scale (ALES), an adaptation of the Adolescent Perceived Events Scale (APES; Compas, Davis, Forsythe, & Wagner, 1987). The ALES consists of a list of 96 negative, stressful events, ranging from relatively minor to major events, drawn from the APES. Participants were asked to endorse events that had occurred in their lives within the past twelve months, and to indicate the degree of impact of each event. Since not all aspects of the survey were meaningful in the context of this study, we selected the following components: health, finance, familial restrictions, familial conflict and instability, parental divorce, conflict/instability in relationships with friends, and conflict/instability in relationships with romantic partners. These scores were calculated by multiplying the self-reported severity and the frequency of occurrence of each stressor. The scores for health, finance, familial restrictions, and parental divorce were calculated using a single set of severity/frequency ratings, while the scores related to conflict/instability in relationships were an additive combination of ratings for conflict, relationship change, and loss (i.e., death in the family).

At ages 23 and 26, participants were administered the Life Events Inventory (Egeland & Deinard, 1975). This measure, adapted from Cochrane and Robertson's (1973) Life Events Inventory for use with a high risk sample, consisted of 41 items describing a variety of stressful life experiences (including financial stressors, occupational problems, instability of living situation, and legal difficulties). The inventory was administered to participants in an interview format, and participants were asked to endorse events that had occurred in their lives in the past six to 12 months. Coding of the scale was based upon the number of stressful life events and degree of disruption experienced. This scale possessed pre-defined subscales, and we used those for stress related to health, finance, marital problems, family conflict, and loss/death in the family.

Romantic relationship competence—At age 23, participants were interviewed about their personal relationships. Participants were asked about their current romantic relationship, if they were involved in one, and their relationship history. Questions related to behavior during relationship conflicts, feelings about the partner and about the relationship, and the level of relationship satisfaction. Participants' responses to interview questions were rated according to 5-point scale of the quality of engagement in their romantic relationships. Transcripts were coded by multiple raters, and final ratings represented conferenced scores. Higher ratings were assigned to participants whose interview responses reflected positive

feelings about the relationship, comfort relying on the partner for emotional support, and deep emotional caring for the partner. Low ratings were assigned to participants whose interview responses reflected primarily negative feelings about the relationship, discomfort relying on the partner for emotional support, and very few positive features in the relationship. Inter-rater reliabilities (intraclass correlation) was .94. This variable has been linked to peer competence in childhood (ages 7-9) as well as global adjustment and functioning at ages 26 and 28 (Englund & Collins, 2009).

At age 26, we again conducted interviews of individuals in romantic relationships, and used self-reported levels of relationship satisfaction [rated from 1 (*very dissatisfied*) to 5 (*very satisfied*)] as well as coder-rated skill at conflict resolution [rated from 1 (*poor*) to 5 (*superior*)]. Inter-rater reliabilities (intraclass correlation) for the conflict resolution rating was .83; this measure demonstrated significant correlations with romantic relationship competence at age 23, teacher-rated peer competence in grade 6 and at age 16, and Family Process at age 13 (see above; r 's between .19 and .27, $p < .05$).

Group membership

Since our intention was to examine patterns of discontinuity in attachment across time, the first step was to examine the patterns that existed in our sample. As discussed above, we had already categorized individuals as secure or insecure at 12 and 18 months (Strange Situation) and at ages 19 and 26 (AAI). We wished to combine the two Strange Situation measures in infancy and, unlike previous research with this sample, we preferred to rely solely on the Strange Situation data and did not wish to use the 24-month tool task to resolve discrepancies (i.e., situations where an infant was secure at one time point and insecure at another). Preliminary analyses indicated that individuals secure at one versus both time points in infancy did not differ in terms of their propensity to be classified as secure on the AAI at age 19 [$\chi^2(1) = .04, ns$] and 26 [$\chi^2(1) = .01, ns$], so these individuals were grouped together. In other words, individuals who were secure at either 12 or 18 months (or both) were considered to be secure in infancy for the purposes of this study. Overall, we had 148 individuals considered to be secure in infancy, and 72 who were insecure (i.e., insecure at both 12 and 18 months).

Overall, the AAI was administered to 165 individuals at age 19 and 163 individuals at age 26; 151 individuals had data at both time points. Of these, 71 possessed an insecure state of mind at both 19 and 26 years of age; of these, 32 were insecure at both infant Strange Situation assessments and were thus labeled as Stably Insecure, while 39 were secure at either or both of the Strange Situation assessments in infancy and were labeled Infant-only Secure.

Of the remaining 80 individuals, 21 transitioned from a secure state of mind at age 19 to an insecure state of mind at age 26, and of these, 17 were secure at either or both of the Strange Situation assessments and thus were labeled Infant/Adolescent Secure (the four remaining individuals were excluded). Of the 37 individuals who possessed an insecure state of mind at age 19 and a secure state of mind at age 26, 28 were secure at either or both of the Strange Situation assessments and thus were labeled Infant/Adult Secure (the nine remaining individuals were excluded). Of the 22 individuals who possessed a secure state of mind at both age 19 and age 26, 17 were secure at either or both of the Strange Situation assessments and thus were labeled Stably Secure (the five remaining individuals were excluded).

The final group compositions (total $N = 133$) were as follows: Stably Insecure ($n=32$, 10 female), Infant-only Secure ($n=39$, 22 female), Infant/Adolescent Secure ($n=17$, 10 female), Infant/Adult Secure ($n=28$, 14 female), and Stably Secure ($n=17$, 8 female). The relationship between sex and group membership was not significant [$\chi^2(4) = 5.55, ns$] and there was no

relationship between group membership and the race of the mother [$\chi^2(12) = 12.62, ns$], father [$\chi^2(12) = 13.99, ns$], or child [$\chi^2(16) = 19.77, ns$]. No group differences were found in maternal age at the birth of the child, $F(4,128) = .87, ns$.

As explicated above, our grouping mechanism combined individuals who were classified as secure at one time point in infancy with those who were secure at both; this group was then divided into four (i.e., Stably Secure, Infant/Adult Secure, Infant/Adolescent Secure, and Infant-only Secure) based upon patterns of security on the AAI. We examined whether these four groups differed in terms of secure/insecure classification at 12 or 18 months and did not find any significant differences [$\chi^2(3) = 3.13, ns$, and $\chi^2(3) = 1.93, ns$, respectively]. We also did not find any significant group differences in the overall pattern of security at 12 and 18 months [$\chi^2(3) = .51, ns$]. Thus, we argue that our grouping mechanism was not systematically biased in terms of the relative likelihood of infant attachment security among the four groups that possessed at least some measure of security in infancy. We note that this analysis did not include the Stably Insecure group, who were insecure at both time points in infancy.

Our sample also contained some missing data (5-15% depending on the measure), so we explored whether the missing data could potentially bias the results. We found that Little's test (Little, 1988) was not significant [$\chi^2(1271) = 1336.10, ns$], suggesting that the missing data mechanism was MCAR (Missing Completely At Random) and did not introduce bias.

Analysis plan

We applied a variety of analysis techniques, depending on the nature of the data. For repeated-measures data in which the outcome measures were roughly normally distributed (i.e., peer competence and maternal perceived social support), we used linear mixed models (LMM). With LMM, we evaluated the mean trajectory of change across time and determined whether the groups specified above (i.e., Stably Secure, Infant/Adolescent Secure, etc.) demonstrated significant differences in either their starting point (the intercept) or their rate of change across time (the slope). We designated the Stably Insecure group as comparison group and created a set of dummy codes representing group differences between the comparison group and the other four groups (i.e., Stably Secure, Infant/Adolescent Secure, Infant/Adult Secure, and Infant-only Secure). The choice of the Stably Insecure group as the comparison group enabled us to clearly differentiate among the trajectories of the other four groups which, in terms of infant Strange Situation classification, did not differ.

Using an exploratory approach for our LMM, we initially fit a linear and quadratic term in each model, as well as the group-by-linear and group-by-quadratic interactions. Guided by fit indices such as AIC, BIC, and -2-log-likelihood, we proceeded in a backwards-elimination fashion, removing model terms in an iterative fashion until we achieved the best-fitting model. For example, we initially compared models with and without the group-by-quadratic interaction terms; if the more parsimonious model demonstrated better fit, we retained it and continued the process by removing the group-by-linear interaction terms. To maintain the integrity of the inferences, the dummy codes were entered into and/or removed from each analysis in a single block. When we achieved optimal model fit, we halted the process and reported the results. In the interest of brevity, the details of model fitting are not provided, but can be obtained from the first author.

For the longitudinal data where the outcome variables demonstrated severe deviation from the normal curve (i.e., maternal stress), we used generalized estimating equations (GEE). GEE enabled us to estimate a mean growth curve under the assumption that the data followed a Poisson distribution, which was appropriate for the maternal stress data. A log-

based link function was used, so significant coefficients were exponentiated before they were interpreted. In general, a negative coefficient, when exponentiated, is less than one, which (through multiplication with other model terms) implies a reduction in the count of the dependent variable; in contrast, a positive coefficient, when exponentiated, is greater than one and serves to increase the overall count. Thus, in our analysis, negative coefficients implied lower levels of maternal stress, while positive coefficients implied higher levels. Similar to the LMM, we used a set of dummy codes to represent group differences from the comparison group (i.e., Stably Insecure) and followed a backwards-elimination approach. GEE can be sensitive to model specifications, so when an optimal solution was obtained, we conducted sensitivity analysis by substituting different model specifications (i.e., different covariance structures and different methods for calculating standard errors) and examined whether model results changed.

For longitudinal data that did not represent true repeated measures or that only included two time points (i.e., the measures of the tool task, home environment, and romantic relationships), we used a series of planned comparisons in which we again used the Stably Insecure group as the comparison group and evaluated group differences with the other four groups (i.e., Stably Secure, Infant/Adolescent Secure, Infant/Adult Secure, and Infant-only Secure). Since the number of planned comparisons in each analysis (4) was less than the total number of groups (5), and the planned comparisons were orthogonal, no adjustments to *p* values were necessary (McDonald, 2009). To control family-wise error rate, however, we initially conducted three MANOVAs using the (1) tool task and home environment data, (2) the family process data, and (3) the romantic relationship data. Since some of these data demonstrated mild deviations from normality (i.e., kurtosis > 2.0), we also tested for homogeneity of variance (i.e., Levene's tests) for each set of planned comparisons and reported the results.

Finally, we originally planned to analyze the personal life stress data using Poisson regression, but our data demonstrated overdispersion (i.e., the variance was substantially larger than the mean in most cases), so we substituted a negative binomial distribution, which is not sensitive to overdispersion. As in the GEE model above, a log-based link function was used, so significant coefficients were exponentiated before they were interpreted. As in other analyses, we used a set of dummy codes as predictors, with the Stably Insecure group as the comparison group. Thus, in this analysis, a significant positive coefficient associated with a dummy code indicated that the specified group experienced higher levels of personal life stress than the Stably Insecure group, while a negative coefficient indicated the opposite. To control our familywise error rate, we conducted omnibus tests by age (19, 23, and 26) and within age by stress category (i.e., health, finance, etc.). The omnibus tests by age were done using a trimmed-means ANOVA (20% trimming; Keselman, Algina, Lix, Wilcox, & Deering, 2008) with the sum total of all categories of stress within that age as the dependent variable. The omnibus tests by stress category within age were likelihood-ratio chi-square tests using the regression results.

Results

Descriptive statistics for each variable can be obtained from the first author. Our analyses proceeded in chronological order (i.e., childhood to adolescence to adulthood), and started with measures that could be seen as resulting from attachment security (i.e., competence in interpersonal relationships), followed by the measures that could be expected to contribute to attachment security/insecurity (i.e., caregiving, stress, etc.). Thus, our first analysis involved peer competence in childhood and adolescence (see Table 1). The Infant/Adolescent and Infant/Adult Secure groups demonstrated significantly higher intercepts when compared to the Stably Insecure group, and the Stably Secure group, while not

demonstrating a significantly higher intercept, did possess a marginally more positive linear slope, suggesting that this group gained in peer competence over time at a higher rate than the Stably Insecure group. The effect for sex was significant, indicating that girls demonstrated superior peer competence, at least at the intercept. Group-by-sex and group-by-quadratic interactions did not contribute significantly to model fit and were removed; the quadratic term itself similarly did not contribute to model fit.

We then turned to maternal stress and maternal perceptions of support in childhood and adolescence (see Table 1). With regards to maternal stress, the Infant/Adolescent and Infant/Adult Secure groups possessed significantly lower intercepts, suggesting that mothers in these groups experienced significantly less stress than those in the Stably Insecure group. The Stably Secure and Infant-only Secure groups did not demonstrate any significant differences with the Stably Insecure group, and there were no significant group interactions with linear or quadratic slopes; thus, the lower levels of maternal stress evidenced by the Infant/Adolescent and Infant/Adult Secure groups were maintained, on average, across time. The significant negative linear term suggests that all groups experienced decreasing levels of maternal stress across time. To examine whether our decision to group the early stress measures created some degree of bias, we re-examined the data using the individual measures from 3 months to 64 months (8 data points), and again from grade 1 to age 16 (5 data points). In both cases, the results suggested that maternal stress at the intercept was lower for the Infant/Adolescent and Infant/Adult Secure groups. We also conducted a sensitivity analysis and found that the results did not vary.

With regards to maternal support perceptions, the Infant/Adolescent and Infant/Adult Secure groups again differentiated themselves, with significantly higher initial perceptions of support than the Stably Insecure group (see Table 1). As above, the Stably Secure and Infant-only Secure groups did not demonstrate any significant differences, and there were no significant findings related to group interactions with linear or quadratic slopes. The significant positive linear term suggests that all groups experienced increasing maternal perceptions of support across time.

We next examined maternal caregiving as measured by the 24-month tool task and the HOME measures at 30 months and 1st grade, as well as the measure of family processes at age 13 (see Table 2). In the tool task, three groups (Infant/Adolescent Secure, Infant/Adult Secure, and Infant-only Secure) were significantly higher than the Stably Insecure group; the fourth group (Stably Secure) possessed a group mean very close to the Infant-only Secure group, but the difference was not significant, perhaps due to the small cell size. Levene's test was significant, suggesting that the variances among the groups were not homogeneous. With regards to the Home measures, the Infant/Adult Secure group demonstrated a significantly higher mean on both measures (30 months and 1st grade) than the Stably Insecure group. The Infant/Adolescent Secure group was significantly higher on the 1st grade measure but only marginally higher on the 30 month measure, while the Stably Secure group was marginally higher on the 1st grade measure. Levene's test was not significant in either case. The MANOVA for family processes was not significant, so we did not pursue our analysis.

We then turned to the measures from adulthood, starting with the romantic relationships measures (see Table 2). At age 23, all four groups demonstrated significantly higher relationship effectiveness when compared to the Stably Insecure group, although the Infant/Adolescent Secure group was only marginally higher. Levene's test for this analysis was significant. At age 26, the Infant/Adult Secure group was significantly more skilled at conflict resolution and significantly higher in relationship satisfaction, while the Stably Secure group was significantly more skilled at conflict resolution. The Infant/Adolescent

Secure and Infant-only Secure groups did not demonstrate any significant differences, and Levene's tests were not significant for either analysis.

Finally, we turned to the measures of personal stress, which includes both adolescence (ages 16 and 19) and adulthood (ages 23 and 26). These results are presented in Table 3. At age 16, the omnibus test was not significant. At age 19, the groups demonstrate no significant differences in stress related to health, finances, or parental restrictions. However, the Stably Secure and Infant-only Secure groups demonstrated significantly lower stress related to family issues when compared to the Stably Insecure group (although the omnibus test was not quite significant at $p < .06$). With regards to stress related to parental divorce and friendships, the Infant/Adult Secure group was significantly higher than the Stably Insecure group, while the other groups did not demonstrate any significant differences (the Stably Secure group was removed from the analysis of parental divorce because it did not have any variance; all scores were zero). With regards to romantic relationships, the Infant-only Secure group demonstrated significantly lower stress when compared to the Stably Insecure group, although again the omnibus test was not quite significant ($p = .06$). At age 23, the omnibus test was not significant. At age 26, however, we found significant results for both health-related stress and stress related to the death of a family member. In both cases, the Infant/Adolescent Secure group was significantly higher than the Stably Insecure group, while both the Infant/Adult and Infant-only Secure groups demonstrated higher levels of health-related stress (although the Infant/Adult Secure finding was only marginally significant).

Discussion

Most longitudinal attachment research to date has focused on continuity in attachment across time or, in some cases, discontinuity between two points. In this paper, we focused on complex patterns of discontinuity in attachment and examined issues relating to the timing of discontinuity and the surrounding social context. In our sample, we found two types of continuity (i.e., Stably Secure and Stably Insecure) as well as three types of discontinuity: (1) individuals who demonstrated some degree of attachment security in infancy and in late adolescence but insecurity in adulthood (the Infant/Adolescent Secure group); (2) individuals who demonstrated some degree of security in infancy, insecurity in late adolescence, and security in adulthood (the Infant/Adult Secure group); and, (3) individuals who demonstrated some degree of security in infancy and insecurity in both late adolescence and adulthood (the Infant-only Secure group). We discuss each group in turn, beginning with the groups demonstrating some form of discontinuity. In each case, to be consistent with our analytical approach, we use the Stably Insecure group as a reference point.

The Infant/Adolescent Secure group was clearly distinct from the Stably Insecure group across childhood and adolescence. Measures of maternal stress, support perceptions, and caregiving all demonstrated that the Infant/Adolescent Secure group experienced more sensitive, responsive care and a more stable caregiving context when compared to the Stably Insecure group. This was reflected in the group's childhood and adolescent peer competence, which was significantly higher than the Stably Insecure group. The Infant/Adolescent Secure group was also not found to experience significantly higher levels of stress in middle or late adolescence (ages 16 and 19) nor early adulthood (age 23). At age 26, in contrast, this group experienced significantly higher degrees of stress related to health and the death of a family member, which implies increased vulnerability to insecure attachment. Indeed, the Infant/Adolescent Secure group was found to have an insecure state of mind regarding attachment at age 26. This time period also represented a clear departure from earlier periods in terms of competence in interpersonal relationships. Whereas the Infant/Adolescent Secure group demonstrated superior peer competence in childhood and

adolescence when compared to the Stably Insecure group, the groups were not significantly different in terms of romantic relationship functioning at age 26. At age 23, where we found no significant group differences in personal stress, we found only marginal differences in relationship effectiveness when comparing the Infant/Adolescent Secure and Stably Insecure groups, suggesting that the Infant/Adolescent Secure group may have already experienced some level of vulnerability by age 23. It is possible that sources of stress that were outside of our scope were exerting an impact on this group during this period.

When considering the Infant/Adult Secure group, we found that this group was also clearly distinct from the Stably Insecure group across childhood and adolescence. As with the Infant/Adolescent Secure group, the Infant/Adult Secure group experienced more sensitive, responsive care and a more stable caregiving context when compared to the Stably Insecure group and demonstrated superior peer competence across childhood and adolescence. At age 19, however, the Infant/Adult Secure group experienced significantly higher levels of stress related to parental divorce and conflict with friends, and this group was also found to possess insecure frame of mind regarding attachment at the same time. Interestingly, this group appeared to recover in adulthood. Not only did the Infant/Adult Secure group demonstrated significantly higher levels of relationship competence and satisfaction at ages 23 and 26, but also possessed a secure state of mind regarding attachment at 26. We can speculate that stable, supportive caregiving experiences early in life, combined with positive experiences in peer relationships in childhood and adolescence and a relative dearth of significant life stresses in adulthood (outside of the marginal effect for health at age 26) provided the opportunity for this group to re-attain a high degree of social functioning in adulthood.

In contrast to the Infant/Adolescent and Infant/Adult Secure groups, the Infant-only Secure group did not generally distinguish itself from the Stably Insecure group. There were no significant differences in maternal stress or support perceptions between the Infant-only Secure and Stably Insecure groups, whereas both the Adult and Infant/Adult Secure groups had demonstrated both lower levels of stress and higher levels of perceived support. With regards to maternal caregiving, the Infant-only Secure group was significantly higher than the Stably Insecure group in the 24 month tool task, but this advantage had disappeared by the time of the 30 month HOME assessment and there continued to be no significant differences in 1st grade. Similarly, the Infant-only Secure group did not demonstrate any significant differences in peer competence. At age 19, the Infant-only Secure group did demonstrate significantly lower levels of stress related to family issues and, interestingly, romantic relationships. However, this lower level of stress did not permit the Infant-only Secure group to re-attain a secure state of mind regarding attachment at 19. In adulthood, the Infant-only Secure group demonstrated superior functioning in romantic relationships at age 23 when compared to the Stably Insecure group, but by age 26 this advantage had again disappeared, perhaps due in part to health-related stress, but perhaps also due to their combined history of somewhat inferior caregiving and lower levels of skill in peer relationships.

The Stably Secure group, interestingly, also did not differentiate itself from the Stably Insecure group in terms of maternal stress or support perceptions, but did demonstrate some differences in the caregiving measures. The HOME measure from Grade 1 was marginally higher, and the group mean for the 24 month tool task was very close to the mean for the Infant-only Secure group, which was itself significant, so the lack of a significant finding may have been a function of low power due to small cell size. The Stably Secure group did not demonstrate a significant difference in peer competence at the intercept, but did have a marginally higher slope, suggesting that this group made gains in peer competence across childhood and adolescence. Importantly, this group seemed to have a relatively low-stress

transition to adulthood, with significantly lower levels of family-related stress, no divorce-related stress (mean and variance were zero), and, unlike the Infant/Adult Secure group, the Stably Secure group did not have higher levels of stress related to conflicts and instability in friendships. In adulthood, the Stably Secure group demonstrated superior functioning in romantic relationships at both ages 23 and 26 when compared to the Stably Insecure group, and did not experience significantly higher levels of health- or relationship-related stress, both of which likely played a role in this group's ability to maintain a secure state of mind regarding attachment.

The most notable aspect of these results is the diversity of attachment pathways across time and their associations with the social context. Although we had four groups that began life with similar levels of infant attachment security (i.e., the Stably Secure, Infant/Adolescent Secure, Infant/Adult Secure, and Infant-only Secure groups), these groups diverged markedly across adolescence and adulthood. Although these pathways are diverse, they are understandable when viewed in the context of interpersonal relationships. The Infant/Adolescent and Infant/Adult Secure groups seemed to have the most positive caregiving across infancy and childhood and seemed to be the most consistently socially competent groups across childhood and adolescence, but differed in terms of their attachment state of mind at 19. The two groups then took dissimilar paths with regards to romantic relationships and again differed in terms of attachment state of mind at age 26, having moved in opposite directions between 19 and 26. In both cases, high degrees of relationship-related stress seemed to accompany an insecure state of mind. In contrast, the Stably Secure group did not have as positive of a profile across infancy and childhood, in some cases failing to differentiate itself from the Stably Insecure group. However, this group did appear to eventually diverge from the Stably Insecure group in terms of peer competence, and more importantly, this group did not experience significantly higher relationship-related stresses at 19 and 26, which may have enabled the group to maintain a secure attachment state of mind at both time points. At the same time, the Infant-only Secure group also did not experience significantly higher levels of relationship-related stress at 19 (and only health-related stress at 26), but was unable to attain a secure attachment state of mind despite having experienced a secure attachment to a caregiver in infancy. It may be that the more negative relationship history of this group in childhood, in terms of maternal caregiving and peer competence, was too much to overcome.

One implication of this diversity of pathways across time is that early attachment security does not imply invulnerability to later insecurity; rather, the pathways in our sample illustrate the concept of multi-finality, in which a single starting point can be linked via a network of branching pathways to a wide variety of outcomes. A second implication of this diversity of pathways is that continuity in attachment over time is not only a function of the power of early caregiving in shaping the developing infant's conception of close relationships; continuity across time would also seem to require stability in the caregiving environment. Such stability could be expected in more normative samples (e.g., Waters et al., 2000), but in our high-risk sample we might expect a more unstable social context and thus a greater diversity in outcomes. Indeed, the most notable aspect of our Stably Secure group was not its high degree of infant security or early social competence but rather its lower degrees of relationship-related stress in adolescence and adulthood. In other words, continuity across time did exist in our sample for a group whose social context was more akin to that of a normative sample.

Our results can also be viewed as an illustration of Bowlby's (1973) hypothesis regarding "homeorhetic" pathways of development, in which not only the direction but the length of the developmental pathway can constrain future developmental trajectories. Despite a stressful transition to adulthood, the Infant/Adult Secure group demonstrated a tendency to

return to their earlier, well-adjusted trajectory of development; in contrast, the Infant-only Secure group, which was mostly indistinguishable from the Stably Insecure group across childhood and adolescence, continued to experience some difficulties in close relationships in adulthood.

Interestingly, the two concepts discussed above (i.e., the role of the social context and the idea of homeorhetic pathways of development) could be viewed as working at cross-purposes, with one concept highlighting vulnerability to change and the other emphasizing increasing continuity. Are attachment representations more stable as individuals age, as suggested by the contrast of the Infant-only vs. Infant/Adult Secure groups, or are individuals always vulnerable to a disruption in the social context, as seen in our Infant/Adult and Infant/Adolescent Secure groups at ages 19 and 26, respectively? Our results suggest that the absence or removal of relationship-related stress may promote security, but only in those with more stable early histories. The presence of stress, on the other hand, seems to imply vulnerability toward insecurity, even in those with a relatively stronger early history. In general, this echoes findings from Waters and colleagues (2000), who noted that significant life stress was an agent of change in attachment classification only among individuals who were secure in infancy; among those who were insecure, stress did not play a role. Our results extend those findings by emphasizing that such vulnerability to stress is not only relevant in childhood and adolescence but continues well into adulthood.

This study does possess some limitations, particularly with regards to non-normal data. For example, the 24-month tool task and 23-year relationship effectiveness analyses violated the assumption of homogeneity of variance; thus, the results pertaining to these variables must be viewed with caution; however, the ratio of variances did not exceed 5:1, and a common rule of thumb is that significant bias is not present unless the ratio exceeds 10:1 (McDonald, 2009). In other cases (i.e., stress data), our choice of statistical methods explicitly accounted for non-normal distributions, so no bias should be present. We also had a degree of missing data, but Little's test indicated that the data were missing completely at random, suggesting that no systematic bias was introduced. In addition, some of our results were only marginally significant, but we argue that the presentation of these results was appropriate in the context of an exploratory study with a small sample size, as long as the appropriate cautions are emphasized. Finally, we did not examine more specific types of insecurity (i.e., resistant vs. avoidant vs. disorganized on the Strange Situation, and dismissing vs. preoccupied vs. unresolved on the AAI). The relative degree of continuity of the various types of insecure attachment would be an intriguing topic for future research. Overall, our results must be viewed as suggestive rather than conclusive, and they would benefit greatly from further corroboration and extension. It is hoped that our somewhat unorthodox approach and atypical statistical methods will inspire further research in a similar vein.

In sum, our findings are a confirmation of Bowlby's (1969/1982, 1973, 1980) contention that current attachment state of mind represents the lawful integration of distal as well as proximal experiences in close relationships. In this study, it was only when we examined the entire trajectory of interpersonal relationships across childhood, adolescence and adulthood did we understand why the various groups in our sample demonstrated such divergent patterns of attachment security.

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Table 1

Results from LMM (peer competence, maternal support perceptions) and GEE (maternal stress)

	Peer Competence		Maternal Support Perceptions		Maternal Stress	
	<i>B</i>	<i>SE</i>	<i>B</i>	<i>SE</i>	<i>B</i>	<i>SE</i>
Intercept	24.06 ^{***}	(5.54)	3.88 ^{***}	(.24)	3.15 ^{***}	(.11)
Sex	8.70 ^{**}	(3.17)	-.08	(.14)	.09	(.07)
Stably Secure	9.02	(6.18)	-.01	(.24)	-.11	(.13)
Infant/Adolescent Secure	20.23 ^{**}	(6.21)	.52 [*]	(.24)	-.31 ^{**}	(.10)
Infant/Adult Secure	17.59 ^{**}	(5.32)	.57 ^{**}	(.20)	-.30 ^{**}	(.10)
Infant-only Secure	3.22	(4.95)	.13	(.19)	-.05	(.08)
Linear	.58	(.51)	.51 ^{***}	(.05)	-.09 ^{**}	(.03)
Linear*Stably Secure	1.55 [†]	(.86)	-	-	-	-
Linear*Infant/Adol Secure	-1.10	(.87)	-	-	-	-
Linear*Infant/Adult Secure	-.21	(.74)	-	-	-	-
Linear*Infant-only Secure	1.00	(.69)	-	-	-	-
Quadratic	-	-	-.05 ^{***}	(.01)	-.01 [*]	(.01)

[†] $p < .08$.

* $p < .05$.

** $p < .01$.

*** $p < .001$.

Table 2

Group means, cell sizes, and results from planned comparisons

	Stably Insecure	Stably Secure	Infant/Adol Secure	Infant/Adult Secure	Infant-only Secure	Levene's Test
Maternal Caregiving (MANOVA: Pillai's Trace: $F = 2.44, p < .01$)						
24 Month Tool Task	2.69	3.14	3.79**	3.72**	3.18*	$F = 6.30, p < .05$
(n)	29	14	14	25	38	
30 Month HOME	62.38	67.53	69.07†	69.04*	62.11	$F = 1.34, ns$
(n)	29	17	15	24	38	
Grade 1 HOME	29.77	33.83†	34.88*	35.89**	32.38	$F = .61, ns$
(n)	31	17	17	28	37	
Family Functioning (MANOVA: Pillai's Trace: $F = 1.01, ns$)						
Romantic Relationships (MANOVA: Pillai's Trace: $F = 1.77, p < .05$)						
Competence (23)	1.77	3.35***	2.24†	3.30***	2.44*	$F = 3.24, p < .05$
(n)	30	17	16	27	36	
Conflict Resolution (26)	2.94	4.00**	2.92	3.63*	3.04	$F = .82, ns$
(n)	18	11	13	19	24	
Satisfaction (26)	4.21	4.36	4.54	4.74*	4.24	$F = 1.25, ns$
(n)	19	11	13	19	25	

Note. Statistical tests represent planned comparisons between each group and the Stably Insecure group.

† $p < .07$.

* $p < .05$.

** $p < .01$.

*** $p < .001$.

Table 3

Negative binomial regression results

	Stably Secure		Infant/Adol Secure		Infant/Adult Secure		Infant-only Secure	
	B	SE	B	SE	B	SE	B	SE
Age 16 (ANOVA <i>statistic</i> = 1.18, <i>ns</i>)								
Age 19 (ANOVA <i>statistic</i> = 3.17, <i>p</i> < .05)								
Health $\chi^2(4) = 6.71$, <i>ns</i>	-	-	-	-	-	-	-	-
Finance $\chi^2(4) = 2.76$, <i>ns</i>	-	-	-	-	-	-	-	-
Restrictions $\chi^2(4) = 8.05$, <i>ns</i>	-	-	-	-	-	-	-	-
Family $\chi^2(4) = 9.20$, <i>p</i> < .06	-.80*	(.38)	.45	(.37)	-.03	(.30)	-.63*	(.29)
Divorce $\chi^2(3) = 20.73$, <i>p</i> < .001	-	-	.35	(.82)	1.58**	(.61)	4.83	(1.14)
Friends $\chi^2(4) = 9.40$, <i>p</i> = .05	-.39	(.38)	.14	(.36)	.64*	(.30)	1.89	(.29)
Romantic $\chi^2(4) = 8.90$, <i>p</i> = .06	-.28	-	.05	-	.16	-	-.63*	.53
Age 23 (ANOVA <i>statistic</i> = 2.52, <i>ns</i>)								
Age 26 (ANOVA <i>statistic</i> = 4.94, <i>p</i> < .01)								
Health $\chi^2(4) = 9.00$, <i>p</i> = .06	.44	(.39)	-.99**	(.37)	2.68	(.34)	1.89	(.31)
Finance $\chi^2(4) = 5.21$, <i>ns</i>	-	-	-	-	-	-	-	-
Marital $\chi^2(4) = 4.43$, <i>ns</i>	-	-	-	-	-	-	-	-
Family Conflict $\chi^2(4) = 2.37$, <i>ns</i>	-	-	-	-	-	-	-	-
Loss/Death $\chi^2(4) = 14.15$, <i>p</i> < .01	-.28	(.66)	1.27**	(.49)	3.55	(.61)	.14	(.48)

Note. Analysis on stress relating to divorce did not include the Stably Secure group because that group demonstrated no variance.

† *p* < .06.

* *p* < .05.

** *p* < .01.