

The Enduring Predictive Significance of Early Maternal Sensitivity: Social and Academic Competence Through Age 32 Years

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This study leveraged data from the Minnesota Longitudinal Study of Risk and Adaptation ($N = 243$) to investigate the predictive significance of maternal sensitivity during the first 3 years of life for social and academic competence through age 32 years. Structural model comparisons replicated previous findings that early maternal sensitivity predicts social skills and academic achievement through midadolescence in a manner consistent with an enduring effects model of development and extended these findings using heterotypic indicators of social competence (effectiveness of romantic engagement) and academic competence (educational attainment) during adulthood. Although early socioeconomic factors and child gender accounted for the predictive significance of maternal sensitivity for social competence, covariates did not fully account for associations between early sensitivity and academic outcomes.

One long-standing question in developmental science is whether early relationship experiences leave an enduring or merely transient mark on adaptation. Recently, Fraley, Roisman, and their colleagues (Fraley, Roisman, & Haltigan, 2013; Haltigan, Roisman, & Fraley, 2013; Roisman & Fraley, 2012a, 2013) described and formalized two theoretical models that offer competing accounts of the legacy of early interpersonal experiences. According to a revisionist model of development, relationship experiences during the first few years of life have a direct effect on children's early development but are only indirectly associated with subsequent adaptation due to the stability in adjustment across time. As a result, the predictive effects of early relationship experience are expected to dissipate across time in light of subsequent developmental experiences (Bauer, 2002; Clarke & Clarke, 2000; Kagan, 1980; Lewis, 1997). In contrast, the enduring effects model of development predicts that early relationship experiences not only organize early

developmental adaptation but continue to shape adjustment across development via mechanisms that are consolidated during early childhood (Grossmann, Grossmann, & Waters, 2006; Sroufe, Coffino, & Carlson, 2010; Sroufe, Egeland, & Kreutzer, 1990).

Importantly, these models differ in their predictions regarding the *pattern of associations* between early relationship experiences and developmental adaptation across time, but not in the magnitude of the associations expected between a given early experience and subsequent developmental adaptation measured at any given time point following the focal experience (see Fraley et al., 2013, for a formal explication). In short, the enduring effects model anticipates that the association between early interpersonal experiences and later outcomes will be relatively stable across various time intervals. In contrast, the revisionist model predicts that the association between early experiences and later outcomes will get increasingly small over time, approaching zero as the temporal lag increases.

One way these theoretical models can be tested is through the use of nested structural model comparisons. As depicted in Figure 1a, the enduring

This research was supported by a grant from the National Institute of Child Health and Human Development to W. Andrew Collins (R01HD054850), a grant from the National Institute of Mental Health to Dante Cicchetti (T32MH015755-33), and a doctoral dissertation fellowship from the University of Minnesota to K. Lee Raby.

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© 2014 The Authors
Child Development © 2014 Society for Research in Child Development, Inc.
All rights reserved. 0009-3920/2015/8603-0004
DOI: 10.1111/cdev.12325

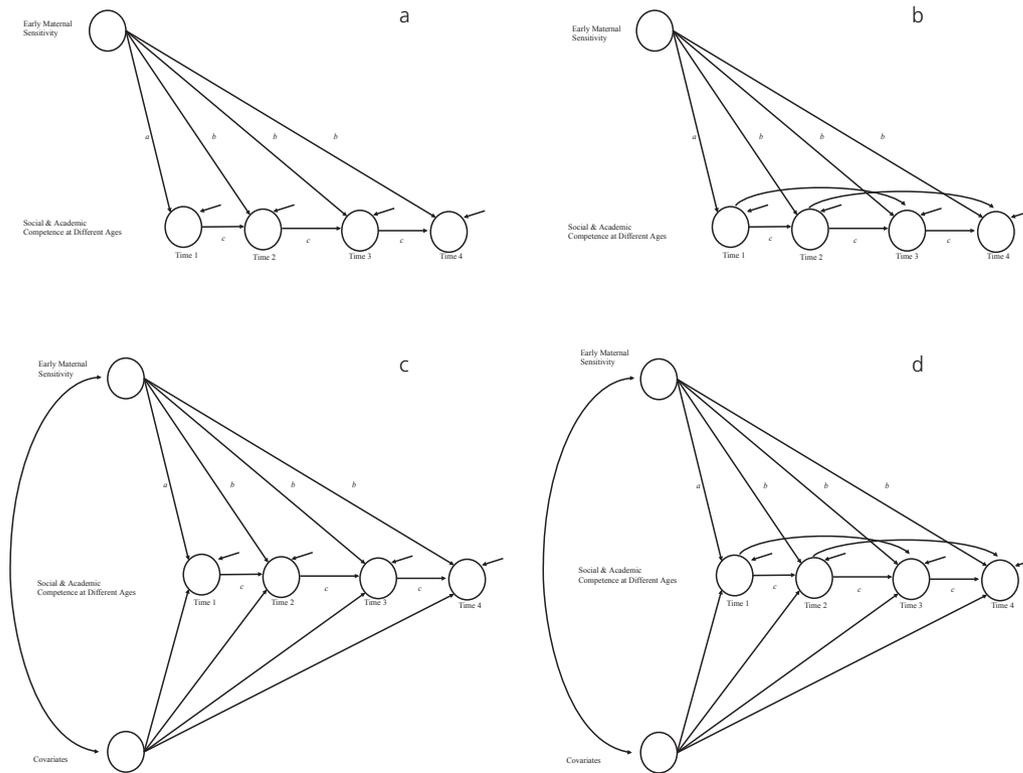


Figure 1. (a) The most basic model analyzed in the study, which assumes that early maternal sensitivity has enduring effects on the outcome of interest. (b) Builds on the previous model by including second-order stability paths to represent the ways in which early processes may be carried forward via transactional mechanisms. (c) Builds on the initial model by considering potential enduring effects of early covariates. (d) Inclusive model.

effects and revisionist models both assume that early relationship experiences influence early outcomes (path *a*) and that those outcomes have some degree of stability over time (*c* paths). However, the enduring effects model also posits that early relationship experiences continue to have ongoing effects on outcomes across time (*b* paths), whereas a revisionist model assumes that early relationship experiences do *not* have direct effects on children's development once autoregressive processes associated with the outcomes of interest are taken into account (i.e., $bs = 0$).

Although there is a great deal of research on the predictive significance of variation in the quality of early parent-child relationship experiences (e.g., Grossmann et al., 2006; Repetti, Taylor, & Seeman, 2002; Sroufe, Egeland, Carlson, & Collins, 2005), most published reports focus on developmental adaptation at only one or two time points and, therefore, are unable to evaluate whether associations between early relationship experiences and adaptation are relatively stable over increasingly longer temporal lags. This is noteworthy because, as Fraley et al. (2013) demonstrated, early

experiences can have positive associations with subsequent outcomes across any two time points under both theoretical models. In other words, even long-term associations between early experiences and later developmental outcomes do not provide unambiguous support for the enduring effects hypothesis. For this reason, it is valuable to address not only the basic question of whether early experience predicts various outcomes over time, but whether these predictive associations are relatively stable or diminish across increasing time intervals.

To examine this issue, Fraley et al. (2013) used data from the normative-risk National Institute of Child Health and Human Development (NICHD) Study of Early Child Care and Youth Development (SECCYD) to test whether maternal sensitivity during the first 3 years predicted children's social competence and academic skills through midadolescence in a manner compatible with the enduring effects or revisionist model of development. Fraley et al. found that the predictive significance of early maternal sensitivity was consistent with an enduring effects model of development, given that early maternal sensitivity stably predicted children's social

and academic competence at multiple time points across childhood and adolescence, even after accounting for stability in the outcomes across development.

In the present study, we attempted to replicate the findings of Fraley et al. (2013) showing that early maternal sensitivity plays an enduring role in children's social and cognitive development using an independent investigation of a higher risk cohort. In addition, we sought to extend previous research by examining whether the predictive significance of early maternal sensitivity extends into adulthood. This is important to attempt because previous research has not examined the pattern of predictive associations from early childhood into adulthood, and on the basis of existing work, it is unclear what patterns might be found. On one hand, some scholars have argued that early maternal sensitivity continues to shape adaptation during the years of maturity, not just during childhood and adolescence (e.g., Grossmann et al., 2006; Sroufe et al., 2005). If so, we should find enduring patterns of associations between early experiences and subsequent outcomes across time. On the other hand, it might be reasonable to expect that revisionist processes predominate during early adulthood because this developmental period is characterized by increased autonomy and identity exploration, which may allow for novel opportunities for change in individual development (e.g., Arnett, 2000; Masten et al., 2004). If so, we might expect the predictive significance of early experiences to dissipate considerably as individuals enter adulthood.

To test whether the enduring effects of early maternal sensitivity extend into adulthood, it was necessary in the present study to identify developmentally appropriate (i.e., "heterotypic"; Sroufe, 1979) indicators of social and academic competence in adulthood. These decisions were guided by a developmental tasks perspective, which observes that there are salient developmental issues upon which adaptation to life can be evaluated (e.g., Erikson, 1968; Sroufe, 1979; Waters & Sroufe, 1983; for an overview, see McCormick, Kuo, & Masten, 2011). Within the domain of social competence, for example, functioning in romantic relationships is conceptualized as a salient developmental task of adulthood (Roisman, Masten, Coatsworth, & Telleen, 2004). According to this account, the primary context in which successful social adaptation is assessed shifts from the peer group to relationships with romantic partners across the transition to adulthood. Consistent with these ideas, there is evidence that adult romantic relationship functioning can be predicted by an earlier history

of competence with peers during childhood and adolescence (Roisman et al., 2004; Simpson, Collins, Tran, & Haydon, 2007). For these reasons, effectiveness in romantic relationships was selected as a heterotypic marker of social competence during adulthood. Likewise, educational attainment was identified as an indicator of academic competence in young adulthood based on reliably identified associations between childhood and adolescent academic performance and eventual educational attainment (e.g., Roisman et al., 2004).

The first goal of this study was to test, in the most basic way, whether early maternal sensitivity is associated with children's competence in social and academic domains across childhood, adolescence, and adulthood in an enduring or transient manner. We also sought to expand the basic models in order to test whether any enduring effects of early interpersonal experience continued to be observed within the context of more complex developmental models. The first extension involved including *transactional processes* between children's functioning and their environment, whereby children create or evoke certain responses from their environment and, in turn, are influenced by the resulting experiences. One way of modeling these transactional processes is with second-order stability paths that represent the possibility that competence at Time 1 might have an influence on competence at Time 3 via mechanisms other than what is captured by competence at Time 2 alone (see Figure 1b; Sameroff & MacKenzie, 2003). Indeed, Fraley et al. (2013) found that including these second-order stability paths improved the overall fit of the models. For this reason, we also examined the enduring predictive significance of early maternal sensitivity after accounting for these transactional processes.

A second extension involved examining the degree to which key covariates had lasting implications for social and academic competence and whether these covariates could account for the enduring significance of early maternal sensitivity. Although there are a large number of potential control variables that could be used to improve causal inference within this domain, we selected the four potential correlates of maternal sensitivity and social and academic outcomes examined by Fraley et al. (2013): child gender, child ethnicity, socioeconomic status, and maternal education. Although we had no a priori expectations that these covariates would have enduring effects on children's social and academic outcomes, we modeled the effects of the potential confounds as if they were

enduring to provide the most conservative test of the enduring effects of early maternal sensitivity (see Figure 1c). Importantly, this approach also allowed us to test whether there were enduring associations between the covariates and children's developmental outcomes, a question that has not yet been addressed. Although this study focused on the role of early maternal caregiving in social and academic outcomes, there are reasons to believe these factors may also shape children's social and academic outcomes in enduring ways by organizing children's interactions with their proximal environments. For example, early socioeconomic factors may influence children's developmental outcomes via the availability of family resources, the quality of child care and later educational contexts, and influences within children's neighborhoods (Duncan & Magnuson, 2003; Magnuson, 2007; Vernon-Feagans, Cox, & FLP Key Investigators, 2013). Finally, we evaluated the enduring predictive significance of early maternal sensitivity using an inclusive model that included second-order stability paths and potential enduring effects of early covariates (see Figure 1d). This is a relatively stringent test of the enduring effects hypothesis, especially given that less unexplained variance in the outcome is available to be accounted for by early sensitivity.

In the current analysis, we drew on data from the Minnesota Longitudinal Study of Risk and Adaptation (MLSRA; Sroufe et al., 2005), a long-term investigation of approximately 200 individuals who have been followed from birth into adulthood. The MLSRA contains measures that closely parallel those collected by the NICHD SECCYD and used in Fraley et al.'s (2013) analysis, including observations of the quality of early mother-child interactions as well as measures of children's teacher-reported social competence and objective assessments of academic competence from childhood through midadolescence (age 16 in the MLSRA). In addition, MLSRA participants' effectiveness of romantic relationship engagement and educational attainment were repeatedly assessed during adulthood (through age 32 years). The MLSRA, therefore, affords a unique opportunity to attempt to replicate and extend the findings of Fraley et al. The current study also builds on prior analyses of the MLSRA, which have demonstrated that early relationship experiences predict children's social and academic outcomes (e.g., Jimerson, Ege-land, Sroufe, & Carlson, 2000; Simpson et al., 2007; Sroufe, Egeland, & Carlson, 1999) by testing whether these predictive effects are more consistent

with an enduring effects or a revisionist model of development.

Method

Participants

Participants were from the MLSRA (Sroufe et al., 2005), an ongoing longitudinal study of development from infancy to adulthood. Between 1975 and 1977, pregnant mothers who were living below the poverty line and receiving prenatal services through the local health department in Minneapolis, Minnesota were recruited. At the time of their child's birth, 48% of the mothers were teenagers, 65% were single, and 42% had completed less than a high school education. The current subsample consisted of 243 individuals (45% female) for whom any observational data on the quality of maternal caregiving during the first 3.5 years of life had been collected. This subsample did not significantly differ from the original sample ($N = 267$) with respect to maternal age, marital status, or maternal education at the time of the child's birth. In this subsample, 65% of the infants were White/non-Hispanic, 16% were multiracial, 14% were African American, and 5% were Native American, Hispanic, or Asian American.

Measures

Measures are presented in three sets corresponding to their function in the analytic plan: (a) variables used to create a composite measure of the observed quality of each participant's experience with caregivers during the first 3.5 years of life; (b) measures of social competence, assessed by teachers during childhood and adolescence and by interviews with each participant during young adulthood; and (c) measures of academic competence, assessed using standardized tests during childhood and adolescence and by interviews with each participant during young adulthood. For all variables, we selected measures collected at multiple time points using standard assessment protocols.

Early Maternal Sensitivity

Mother-child interactions were videotaped during semistructured tasks when participants were 3, 6, 24, and 42 months old. At 3 months, infant-mother pairs were observed in their homes during a feeding situation. Mothers were instructed to interact with their infant as they normally did.

When infants were 6 months old, two feeding situations and one play interaction were observed in the home on two different days. During the play interactions, mothers were instructed to play with the child, first without using any toys and then using a standard set of toys. At 24 and 42 months, children and mothers were observed in a laboratory setting while attempting to solve a series of problem-solving and teaching tasks. At each age, the tasks gradually increased in complexity, ultimately becoming too difficult for the child to complete on his or her own. Mothers were instructed to first allow the child to try to independently solve each task, and then to give the child any help they thought was needed (for more information, see Erickson, Sroufe, & Egeland, 1985; Matas, Arend, & Sroufe, 1978).

When children were 3 and 6 months old, maternal sensitivity was operationalized using Ainsworth's sensitivity scale (Ainsworth, Blehar, Waters, & Wall, 1978). This rating assesses each mother's ability to perceive and accurately interpret her infant's signals and respond appropriately and promptly. At 6 months, the separate ratings of maternal sensitivity during feeding and play sessions were averaged ($\alpha = .87$). Maternal sensitivity at 24 and 42 months was evaluated with a rating of each mother's supportive presence. This rating captured the extent to which each mother provided a secure base for her child (i.e., helped the child feel comfortable with the task) as well as each mother's positive involvement during the interaction. At 3 months, interrater agreement was calculated using the Lawlis-Lu index (Tinsley & Weiss, 1975), with agreement defined as a discrepancy of 2 points or less on the 9-point rating scale. The Lawlis-Lu chi-square was significant at $p < .05$, with a T value of .75, indicating moderate to high agreement. For the 6-, 24-, and 42-month assessments, interrater reliability estimates (intraclass correlations) were .89, .84, and .87, respectively. There was moderate stability in maternal sensitivity during the first 3.5 years of life as intercorrelations (r_s) among the ratings collected at 3, 6, 24, and 42 months ranged from .18 to .51 ($M = .34$; see Pianta, Sroufe, & Egeland, 1989, for more information about stability and change in early maternal sensitivity in this sample). An exploratory factor analysis (maximum likelihood estimation) indicated that a one-factor solution adequately accounted for the ratings of maternal caregiving quality. Specifically, only the first factor (explaining 50.2% of the variance) had an eigenvalue in excess of 1.0 and all four ratings loaded on the factor in excess of .40. Based on these results, a composite measure of early maternal

sensitivity was created by standardizing and averaging the four maternal sensitivity ratings (standardized $\alpha = .67$).

Social Competence

Social competence during childhood and adolescence was assessed using teachers' rankings of each child's competence with peers during kindergarten, Grades 1–3, and 6, and at age 16. Teachers were asked to rank all the students in their classrooms according to how well each one matched developmentally appropriate behavioral descriptions of social competence. Children most closely resembling the criterion description were ranked near the top. Children's rankings in the various classrooms were then standardized by dividing their rank by the number of students in their class (see Sroufe et al., 1999, for more information).

Competence in romantic relationships was chosen as a heterotypic marker of social competence during young adulthood. At age 23 and 32 years, each participant completed a semistructured interview focused on his or her recent history of romantic relationships. All participants responded to questions about the length and status of their recent relationships, why the relationships ended, and the presence of physical violence in their romantic relationships. Those participants in a current relationship also responded to questions about times when they felt especially close to their partner, whether they could completely be themselves and share anything with their partner, how the couple resolved conflicts, and how committed the relationship was.

Trained coders listened to each audiotaped interview and rated the degree to which each participant had attained developmentally appropriate competence in romantic relationships. Higher scores indicated that the participant had a history of relationships characterized by mutual caring, trust, and emotional closeness; concern for, and sensitivity to, the needs and wishes of others; sharing of experiences and enjoyment with others; and valuing faithfulness, loyalty, and honesty. Participants who received lower scores either reported relationships in which these qualities were absent or were unable to maintain romantic relationships for more than a short period of time. Interrater reliability estimates (intraclass correlations) at ages 23 and 32 were .93 and .94, respectively. These ratings have been used in prior studies of the developmental antecedents of romantic relationship functioning within the MLSRA (e.g., Englund, Kuo, Puig, & Collins, 2011).

Academic Competence

Objective measures of each child's academic competence were repeatedly collected across childhood and adolescence. During Grades 1–3 and 6, each child completed the Peabody Individual Achievement Test (Dunn & Markwardt, 1970). Subtests for math, reading comprehension, reading recognition, and spelling were administered in Grades 1–3 and 6, and a subtest for general information was also administered in Grades 1–3. Within each age, the subtest scores were highly correlated (alphas ranged from .86 to .91), so the total age-standardized score was used as an indicator of overall academic competence at each age. At age 16, each adolescent completed the passage comprehension and calculation subtests of the Woodcock–Johnson Tests of Achievement (Woodcock, 1990; Woodcock & Johnson, 1989). The age-standardized scores for these two subtests were averaged to create a measure of overall academic functioning at age 16 ($\alpha = .74$). During young adulthood, academic competence was operationalized as each participant's educational attainment at ages 23, 26, 28, and 32 years. At each age, interview responses were coded on a 6-point scale, ranging from *no GED or high school diploma* to *a postbaccalaureate degree*.

Control Variables

We included the four potential control variables examined by Fraley et al. (2013): child gender, child ethnicity, socioeconomic status, and maternal education. Because most of the children in the sample were White/non-Hispanic, a binary variable was created to represent ethnicity (1 = *White/non-Hispanic*, 0 = *otherwise*). Socioeconomic status was assessed with Duncan's Socioeconomic Index, a widely used indicator of occupational ranking (Stevens & Featherman, 1981). Scores were based on the mother's occupational status at the time of the 42-month assessment. Finally, maternal education was operationalized as the number of years of education each mother had completed. This information was collected at three assessments during early childhood (3 months before the child's birth, at birth, and at 42 months) and was averaged to create a composite measure of maternal education.

Missing Data

Participants were included in analyses if they had any observational data on the quality of

maternal caregiving during the first 3.5 years of life ($N = 243$). Among this subsample, the amount of missing data for outcome variables ranged from 23.5% to 36.2%, with a mean of 30% over all variables and all time points. To determine whether missing outcome data were systematically associated with early experience, we calculated the average of the correlations between early maternal sensitivity and missingness on the eight social competence measures and the nine academic competence measures. For both outcomes, the correlations were trivial to small in magnitude (mean r s = $-.06$ and $-.09$, respectively, across assessments). In addition, the correlations between missingness on the outcome variables and the four control variables also were trivial to small in magnitude (mean r s between $-.04$ and $-.13$ across assessments). To address missing data, all analyses used full information maximum likelihood with raw case-level analytic data as input, which produces less biased and more efficient and consistent parameter estimates than techniques such as pairwise or listwise deletion for missing data (Little & Rubin, 1987).

Results

We present our analyses in two major sections. In the first section, we analyze the most basic form of the enduring effects model with respect to the two outcome domains of interest: children's social and academic competence. Our goal in conducting these analyses is to determine whether an enduring effects model is capable of explaining the longitudinal data better than a model that allows for only indirect effects of early experiences on subsequent outcomes (i.e., a revisionist model). In the second section, we compare the relative fit of the enduring effects and revisionist models after a number of extensions to the basic model, including models that incorporate transactional processes and models that include covariates. All variables were standardized prior to conducting the analyses. As a result, all beta coefficients represent standardized effects.

Basic Comparisons of the Enduring Effects Revisionist and Models

The first set of analyses was designed to test the most basic question of interest—whether an enduring effects or a revisionist model best explains the data. It is important to note that the revisionist model is nested within the more inclusive enduring effects model (see Figure 1a). Specifically, by fixing

paths from the early experience to the later outcome variables to 0.00 (the paths labeled *b*), this model tests whether early experience directly shapes the outcome of interest early in life, but not thereafter. In addition, when evaluating the enduring effects models, the enduring effect paths (i.e., the *b* paths) were constrained to be equal to one another. Although this constraint is not a theoretical necessity, adding it provides the most conservative test of the enduring effects model because it prevents the model from overfitting natural variation in the data (see Fraley et al., 2013). The parameter *a* was not constrained to equal the *b* paths because the association between early maternal sensitivity and the first assessment of the outcome is exclusively a direct effect, whereas the association between early maternal sensitivity and subsequent outcomes is a combination of direct and indirect effects.

Social Competence

The correlations among the variables used in these analyses are reported in Table 1. It is important to note that the correlations between early maternal sensitivity and teacher reports of social competence at each age are fairly constant (average $r = .17$). Moreover, there is no evidence that the associations are approaching zero in the limit. In other words, the associations between early sensitivity and social competence are largely invariant across varying time intervals.

The formal model comparisons of the enduring effects and revisionist models are presented in Table 2 in the section labeled "Basic model." As can be seen, the enduring effects model fit the data better than the revisionist model did ($\Delta\chi^2 = 17.18$, $p < .01$). The estimate of the direct path from early sensitivity to subsequent measures of social competence was .12 ($p < .01$).

Academic Competence

The correlation matrix for the relevant variables associated with academic competence is reported in Table 3. Similar to social competence, the correlations between early sensitivity and academic competence at each age were fairly constant (average $r = .35$). Moreover, there was no evidence that the associations approach zero as the temporal distance between assessments increases. Model comparisons indicated that the enduring effects model fit the data better than the revisionist model did ($\Delta\chi^2 = 15.03$, $p < .01$). The estimated direct effect of early experiences on academic competence was .06 ($p < .01$).

Extensions of the Basic Model

In the next set of analyses, we again contrasted enduring effects and revisionist processes, but now in the context of increasingly complex models: models that include second-order stability paths and models that include variables potentially confounded with maternal sensitivity.

Table 1
Zero-Order Correlations Between Early Maternal Sensitivity, Covariates, and Social Competence Over Time

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13
1. Early maternal sensitivity	—												
2. Child gender	0.07	—											
3. Child ethnicity	0.26	0.01	—										
4. Maternal education	0.45	-0.07	-0.03	—									
5. Socioeconomic status	0.21	-0.06	0.08	0.45	—								
6. Social competence kindergarten	0.16	0.04	0.13	0.11	0.10	—							
7. Social competence Grade 1	0.26	0.12	0.06	0.20	0.08	0.45	—						
8. Social competence Grade 2	0.19	0.12	0.08	0.19	0.06	0.41	0.48	—					
9. Social competence Grade 3	0.20	0.19	0.13	0.18	0.13	0.41	0.54	0.55	—				
10. Social competence Grade 6	0.21	0.21	0.00	0.31	0.16	0.31	0.40	0.33	0.40	—			
11. Social competence age 16	0.14	0.18	0.00	0.31	0.16	0.25	0.29	0.23	0.36	0.35	—		
12. Social competence age 23	0.07	0.14	0.09	0.09	0.05	0.22	0.32	0.18	0.09	0.26	0.23	—	
13. Social competence age 32	0.16	0.00	0.11	0.18	0.12	0.21	0.24	0.26	0.23	0.25	0.19	0.42	—
<i>M</i>	0.00	0.45	0.65	11.76	18.83	49.51	47.81	46.51	48.42	54.52	51.09	2.63	3.49
<i>SD</i>	1.00	0.50	0.48	1.76	10.35	28.96	27.96	27.76	27.73	29.08	25.91	1.26	1.34

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

Table 2
Estimates of the Influence of Early Sensitivity on Social Competence Across Childhood, Adolescence, and Adulthood

Model	Model fit						Nested model comparisons		
	χ^2	<i>df</i>	<i>p</i>	CFI	RMSEA	SRMR	χ^2_{diff}	<i>df</i>	<i>p</i>
Basic model									
Enduring effects	89.91	27	< .001	.80	.10	.12	—	—	—
Revisionist	107.09	28	< .001	.75	.11	.15	B–A 17.18	1	< .001
Model with second-order paths									
Enduring effects	33.17	21	.04	.96	.05	.07	—	—	—
Revisionist	44.71	22	.003	.93	.07	.09	B–A 11.54	1	< .001
Model with covariates									
Enduring effects	110.41	51	< .001	.87	.06	.09	—	—	—
Revisionist	112.13	52	< .001	.87	.07	.09	B–A 1.72	1	.189
Model with covariates and second-order paths									
Enduring effects	59.49	45	.072	.97	.04	.06	—	—	—
Revisionist	60.31	46	.08	.97	.03	.06	B–A 0.82	1	.365

Note. CFI = comparative fit index; RMSEA = root mean square error of approximation; SRMR = standardized root mean square residual.

Table 3
Zero-Order Correlations Between Early Maternal Sensitivity, Covariates, and Academic Competence Over Time

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1. Early maternal sensitivity	—													
2. Child gender	0.07	—												
3. Child ethnicity	0.26	0.01	—											
4. Maternal education	0.45	–0.07	–0.03	—										
5. Socioeconomic status	0.21	–0.06	0.08	0.45	—									
6. Academic competence Grade 1	0.41	0.10	0.21	0.28	0.13	—								
7. Academic competence Grade 2	0.40	0.09	0.21	0.29	0.18	0.89	—							
8. Academic competence Grade 3	0.38	0.10	0.17	0.24	0.20	0.86	0.92	—						
9. Academic competence Grade 6	0.38	0.13	0.12	0.36	0.27	0.81	0.83	0.86	—					
10. Academic competence age 16	0.42	0.10	0.20	0.42	0.28	0.68	0.64	0.68	0.71	—				
11. Academic competence age 23	0.24	0.19	0.04	0.35	0.18	0.32	0.29	0.35	0.35	0.42	—			
12. Academic competence age 26	0.28	0.12	0.04	0.40	0.20	0.44	0.36	0.44	0.43	0.47	0.73	—		
13. Academic competence age 28	0.31	0.13	0.04	0.39	0.20	0.43	0.34	0.42	0.40	0.52	0.66	0.90	—	
14. Academic competence age 32	0.30	0.14	0.05	0.37	0.22	0.42	0.36	0.44	0.45	0.54	0.59	0.83	0.85	—
<i>M</i>	0.00	0.45	0.65	11.76	18.83	99.69	100.63	99.29	98.09	100.88	1.94	2.55	2.60	2.63
<i>SD</i>	1.00	0.50	0.48	1.76	10.35	12.03	11.94	12.65	10.67	12.77	1.10	1.19	1.19	1.26

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

Second-Order Stability

As previously discussed, second-order paths were included to capture potential transactional processes (see Figure 1b). This specification enabled us to evaluate the enduring effects and revisionist processes under a more complex set of assumptions. The formal model comparisons of the enduring effects and revisionist models are reported in the section of Tables 2 and 4 labeled “Model with second-order paths.” For social competence outcomes, the

enduring effects model fit the data better than the revisionist model did ($\Delta\chi^2 = 11.54, p < .01$). The estimated path from early sensitivity to subsequent measures of social competence was .09 ($p < .01$). For academic outcomes, model comparisons indicated that the enduring effects model fit the data better than the revisionist model did ($\Delta\chi^2 = 9.96, p < .01$). The estimated effect of early experiences on academic competence was .05 ($p < .01$).

In addition, the absolute fit indices of these models were more favorable than those that did not

Table 4
Estimates of the Influence of Early Sensitivity on Academic Competence Across Childhood, Adolescence, and Adulthood

Model	Model fit						Nested model comparisons		
	χ^2	<i>df</i>	<i>p</i>	CFI	RMSEA	SRMR	χ^2_{diff}	<i>df</i>	<i>p</i>
Basic model									
Enduring effects	101.96	35	< .001	.96	.09	.12	—	—	—
Revisionist	116.98	36	< .001	.95	.10	.16	B–A 15.03	1	< .001
Model with second-order paths									
Enduring effects	51.97	28	.004	.99	.06	.06	—	—	—
Revisionist	61.93	29	< .001	.98	.06	.09	B–A 9.96	1	.002
Model with covariates									
Enduring effects	154.03	63	< .001	.95	.07	.10	—	—	—
Revisionist	159.43	64	< .001	.95	.08	.11	B–A 5.40	1	.020
Model with covariates and second-order paths									
Enduring effects	105.81	56	< .001	.97	.06	.06	—	—	—
Revisionist	109.77	57	< .001	.97	.06	.07	B–A 3.96	1	.047

Note. CFI = comparative fit index; RMSEA = root mean square error of approximation; SRMR = standardized root mean square residual.

include transactional processes. For example, the root mean square error of approximation (RMSEA) values (i.e., .04–.06) were within the range suggesting a reasonable error of approximation (.05–.08; Browne & Cudeck, 1993). Because the basic models are nested within the models containing the second-order paths, we compared the relative fit of the basic enduring effects model, in which second-order paths were constrained to be zero, with the enduring effects models that included second-order paths. For both social and academic competence outcomes, there was a significant improvement in model fit when second-order paths were included (for social competence, $\Delta\chi^2 = 56.74$, $p < .01$; for academic competence, $\Delta\chi^2 = 49.99$, $p < .01$). Taken together, these analyses indicate that the inclusion of transactional processes is necessary to model the data well, but also that a transactional model that assumes enduring effects of early maternal sensitivity is superior to a transactional model that does not include a unique role for the enduring effects of early interpersonal experiences.

Modeling Covariates

We next examined whether early sensitivity has enduring effects on social and academic outcomes after controlling for four potential confounds: child sex, child ethnicity, maternal education, and maternal socioeconomic status. In these analyses, we modeled the effects of the potential confounds as if they were enduring in the way assumed by the enduring effects model (see Figure 1c). We did so *not* because we assumed a priori that these

covariates have enduring effects on the outcomes of interest, but because the most conservative test of the enduring effects model for early sensitivity assumes that the potential confounds have enduring effects as well. In addition, the tests of the enduring effects versus revisionist models involved constraining the value of the paths from early sensitivity to later outcomes to zero for the revisionist model, while continuing to allow enduring effects paths for each of the covariates. Thus, this specification of the revisionist model is only revisionist with respect to the way it treats the effects of early sensitivity; the model allows for the possibility that the various covariates have unique and enduring effects on the outcome. The enduring effects paths for each of the covariates were treated in the same way that sensitivity was treated previously. Namely, each covariate had separate *a* and *b* parameters and the *b* parameters were constrained to be equal across time for each covariate in both the enduring effects and revisionist models. (We note that each of the covariates was modeled simultaneously, along with the covariation between them. The illustration shown in Figure 1c includes only one covariate to make the diagram less complex.)

The formal model comparisons of the enduring effects and revisionist models for social competence are reported in the section of Tables 2 and 4 labeled “Model with covariates.” For social competence outcomes, the enduring effects model no longer fit the data better than the revisionist model after including the covariates ($\Delta\chi^2 = 1.72$, $p = .19$). The estimated path from early sensitivity to subsequent measures of social competence was .04 ($p = .19$). In

contrast, the estimated paths for the enduring effects of gender ($b = .11, p < .01$) and maternal education ($b = .13, p < .01$) were significant, although the paths for socioeconomic status ($b = .03, p = .38$) and ethnicity ($b = .02, p = .39$) were not. For academic outcomes, the enduring effects model continued to fit the data better than the revisionist model after including covariates ($\Delta\chi^2 = 5.40, p = .02$). The estimated effect of early experiences on academic competence was .04 ($p = .02$). The estimated paths for the enduring effects of gender ($b = .03, p = .02$), maternal education ($b = .04, p = .03$), and maternal socioeconomic status ($b = .03, p = .05$) were also significant; the path for ethnicity was not ($b = -.00, p = .98$).

Modeling Covariates and Second-Order Stability

We finally examined the most inclusive model possible within this framework: one that accounts for transactional processes and the influence of covariates (see Figure 1d). The formal model comparisons of the enduring effects and revisionist models are reported in the section of Tables 2 and 4 labeled "Model with covariates and second-order paths." For social competence, the enduring effects model did not fit the data better than the revisionist model ($\Delta\chi^2 = 0.82, p = .37$). The estimated path from early sensitivity to subsequent measures of social competence was .03 ($p = .37$). The paths from gender ($b = .10, p < .01$) and maternal education ($b = .12, p < .01$) were significant, but the paths from ethnicity ($b = .02, p = .48$) and socioeconomic status ($b = .02, p = .46$) were not. For academic outcomes, the enduring effects model fit the data better than the revisionist model did ($\Delta\chi^2 = 3.96, p < .05$). The estimated effect of early experiences on academic competence was .04 ($p < .05$). The paths from gender ($b = .03, p = .02$) and maternal socioeconomic status ($b = .03, p = .05$) were also significant; the paths for ethnicity ($b = -.00, p = .64$) and maternal education ($b = .03, p = .08$) were not.

Discussion

Using data from the MLSRA, a prospective longitudinal investigation of individual development in a high-risk cohort, the central aim of the current study was to determine whether early maternal sensitivity predicts social and academic development in an enduring or merely transient manner. Consistent with an enduring effects model of development, the associations between early maternal

sensitivity and children's competence in social and academic domains were relatively constant across childhood, adolescence, and adulthood. Moreover, the results from the basic model comparisons indicated that for both social and academic competence, the predictive significance of early maternal sensitivity could not be fully explained by the stability of developmental adaptation over time.

We also examined whether enduring predictive effects of early sensitivity were observed under a more complex set of assumptions. One extension was to include second-order paths to capture potential transactional processes. For both social and academic outcomes, these models improved overall fit of the models to the data, a finding that is consistent with developmental theories that highlight bidirectional influences between children and their environments (Sameroff & MacKenzie, 2003). However, early maternal sensitivity continued to have an enduring association with both social and academic competence, even after accounting for these transactional dynamics.

In addition, we examined whether the enduring predictive associations between early maternal sensitivity and children's developmental adaptation continued to be observed after controlling for potential enduring influences of characteristics related to the child and early socioeconomic factors. These analyses were designed to improve causal inference regarding the role of maternal sensitivity in predicting developmental adaptation into adulthood. Indeed, child gender, maternal education, and socioeconomic status revealed enduring associations with children's competence in both social and academic domains. However, early maternal sensitivity continued to predict academic competence outcomes in enduring ways after including these controls and after accounting for transactional processes. Considered together, this represents robust evidence for an enduring predictive significance of early maternal sensitivity for academic outcomes from early childhood to adulthood.

When predicting *social competence*, however, the enduring effects and revisionist models were not empirically distinguishable after including controls. One interpretation for this finding is that early socioeconomic factors, such as maternal education and socioeconomic status that are moderately correlated with maternal sensitivity, are confounding factors. As a result, models that do not include these variables may overattribute to maternal sensitivity associations, which are actually being driven by other enduring factors. That said, prevention and intervention research designs that experimen-

tally manipulate aspects of early experience would be informative about whether early relationship experiences exert an enduring and causal influence on later social development outcomes.

Taken together, the present results are remarkably consistent with those of Fraley et al. (2013), who investigated the predictive significance of early maternal sensitivity for social and academic competence through midadolescence in the NICHD SECCYD. In both studies, the best fitting model contained enduring predictive effects of early maternal sensitivity in addition to paths representing autoregressive and transactional processes. Although Fraley et al. (2013) found enduring associations for social competence outcomes even after accounting for control variables, the findings from both studies indicate that enduring effects models provide a better fit to the data than basic revisionist models and transactional models. These convergent findings are incompatible with a purely revisionist perspective on developmental adaptation, suggesting instead that early interpersonal experiences (or, more precisely, their stable embodiment or representations) have lasting implications for adaptation from early childhood through adulthood (Grossmann et al., 2006; Sroufe et al., 1990, 2010).

Additionally, as previously demonstrated in the NICHD SECCYD (Fraley et al., 2013), the overall predictive significance of early maternal sensitivity in the MLSRA was larger for academic competence than it was for social competence. Specifically, the average bivariate correlations between early maternal sensitivity and academic competence were .35 and .44 in the MLSRA and the NICHD SECCYD, respectively. In contrast, the average bivariate correlations between early maternal sensitivity and social competence were .17 and .27 in the MLSRA and the NICHD SECCYD, respectively. This pattern of findings appears to be quite robust, as other longitudinal studies have also found that early maternal sensitivity is more strongly associated with later academic as compared to social competencies (e.g., Roisman & Fraley, 2012b; Stams, Juffer, & Van IJzendoorn, 2002). One possible explanation for this pattern of results is that assessments of maternal sensitivity reflect how well caregivers support their children in the context of problem-solving tasks designed to be just beyond the child's developmental capabilities (i.e., at the zone of proximal development; Vygotsky, 1978), which is a key developmental resource for later academic success.

Perhaps even more importantly, the results of the current study extend findings from Fraley et al. (2013) by indicating that the enduring predictive

significance of early maternal sensitivity extends into the years of maturity. Indeed, in the MLSRA, the legacy of early maternal sensitivity for children's academic and possibly social competence outcomes extends across three decades. As noted earlier, these associations cannot be entirely attributable to the stability of the outcomes themselves (as claimed by revisionist accounts; Kagan, 1980), a finding that is consistent with the theoretical claim that early relationship experiences continue to shape adaptation during the years of maturity, not just during childhood and adolescence (e.g., Grossmann et al., 2006; Sroufe et al., 2005).

To study the predictive significance of early maternal sensitivity into adulthood, it was necessary to operationalize competent social and academic functioning during adulthood. In the current study, we selected measures of how effective adult participants were in romantic relationships and their educational attainment based on the theoretical expectation that these are developmentally appropriate indicators of social and academic competence during adulthood (McCormick et al., 2011; Sroufe, 1979; Waters & Sroufe, 1983). Although these theoretical ideas have a long history in developmental science and are widely accepted, less attention has been paid to empirically evaluating whether social competence with peers during childhood and adolescence and the effectiveness with which adults engage in romantic relationships during adulthood are, in fact, developmentally specific assessments of the same construct (but see Roisman et al., 2004). That said, the correlations among the indicators of social and academic competence used in this study support the conceptualization of romantic relationship effectiveness and educational attainment as heterotypic indicators of social and academic competence (respectively) in adulthood. More specifically, the test-retest correlations among the measures of childhood and adolescence peer social competence at the various ages are similar in magnitude to the correlations between the childhood and adolescent measures of peer social competence and the measures of adults' romantic relationship effectiveness (see Table 1). The same is true for academic achievement and educational attainment (see Table 3).

Although these findings extend our understanding of the long-term developmental sequelae of early relationship experiences, questions remain about the precise mechanisms that explain the enduring predictive associations of early maternal sensitivity observed in this and other studies. Some scholars have argued that correlations between early interpersonal experience and later outcomes

are attributable to the stability of caregiving experiences over time (e.g., Lamb, Thompson, Gardner, Charnov, & Estes, 1984; Lewis, 1997). According to this account, there are no unique effects of early experience on later outcomes *per se*, but such associations may appear to persist because maternal sensitivity itself is relatively stable and can have ongoing, concurrent influences on the outcomes of interest. The present study is not well suited to test this possibility because maternal sensitivity was not assessed regularly after early childhood. However, Fraley et al. (2013) found that including measures of later maternal sensitivity in their modeling of the NICHD SECCYD data actually resulted in *poorer* absolute fit of their models. In addition, the current study includes measures of developmental adaptation through age 32, which is arguably beyond the point in development when variation in maternal sensitivity has contemporaneous effects on individuals' academic achievement and social functioning.

A second possibility is that the enduring predictive effects of early maternal sensitivity are attributable to unmeasured genetic variation shared between mothers and their children. In the present study, we cannot rule out this possibility because the caregivers and target participants in this sample were genetically related. Future genetically informed, longitudinal research making use of the kinds of nested models presented here would be especially valuable in clarifying the degree to which enduring (and transient) effects of early maternal sensitivity are environmentally or genetically mediated. That said, available behavioral-genetic research indicates that (a) genetic variation among infants is largely irrelevant in accounting for the observed quality of infant-caregiver relationships (Fearon et al., 2006; Roisman & Fraley, 2008); (b) there is some evidence that the heritability of children's cognitive abilities is lower in more impoverished families, such as those in this sample (Nisbett et al., 2012); and (c) the associations between early sensitive caregiving and children's academic and social adjustment are not entirely attributable to shared genetic factors (Roisman & Fraley, 2012b; Stams et al., 2002).

A third and final possible explanation for the enduring predictive effects of early maternal sensitivity is that early interpersonal experiences shape the development of biologically based mechanisms that become consolidated during early childhood and exert a persistent, prototype-like influence on developmental adaptation across time. We have implicitly emphasized this potential explanation throughout this article because this hypothesis undergirds the enduring effects model of development

(Grossmann et al., 2006; Sroufe et al., 1990). Even though there is much evidence that sensitive care during the first several years of life plays an important role in shaping the child's mental representations of relationships, broad capabilities of emotional, attentional, and behavioral self-regulation, and neurobiological systems (Cassidy, 1994; Repetti et al., 2002; Schore, 2000; Sroufe et al., 2005), further multilevel research is needed to identify the specific mechanisms underlying the enduring predictive significance of early maternal sensitivity, which has now been shown to extend into adulthood.

Another question that deserves further inquiry is whether the enduring effects of early maternal sensitivity are especially pronounced for particular subsets of children. For example, the long-term implications of early interpersonal experiences for children's development might be amplified or attenuated by contextual stressors or by temperamental or genetic characteristics of the child. Indeed, there is a growing body of evidence that supports these ideas (e.g., Belsky & Fearon, 2002; Belsky & Pluess, 2009; Roisman et al., 2012). Although we believe it was important to first establish the presence of enduring effects of early maternal sensitivity that continue through adulthood before investigating potential multilevel processes that may moderate these associations, motivated by the request of a reviewer, we found no evidence that any of the covariates explored in this article reliably moderated the predictive significance of early maternal sensitivity for either social or academic competence through age 32 years. Nevertheless, there are clear methodological challenges associated with pursuing these questions with the MLSRA sample, including the moderate sample size and the restricted range of early contextual risk. For these reasons, we encourage additional research in this area.

In conclusion, we set out to test whether early relationship experiences with primary caregivers leave an enduring or merely transient mark on social and academic adaptation in adulthood. Our results replicated the Fraley et al. (2013) finding that maternal sensitivity during the first 3 years of life has relatively persistent associations with social and academic competence through midadolescence and also provided new evidence that the enduring predictive significance of early maternal sensitivity extends into adulthood. That said, within the social domain, predictive associations may be confounded with other early risk factors. More generally, the current study also provides further support for the value of examining the patterns of associations between developmental experiences and adaptation across multiple ages (see also Fraley et al., 2013;

Haltigan, Roisman, & Fraley, 2013; Roisman & Fraley, 2012a, 2013). This analytic approach advances our understanding of the *developmental course* of the effects of earlier experiences and offers tests of the broad developmental mechanisms by which experiences are carried forward across time. We hope that these findings will motivate other developmental scientists to implement these techniques in an attempt to enrich our understanding of the legacy of a variety of experiences across development.

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