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Conceptualizing the Role of Early Experience: Lessons from the Minnesota Longitudinal Study

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Abstract

We draw upon data from a prospective, longitudinal study to evaluate the role of typically occurring variations in early experience on development from birth to adulthood. Such an evaluation is complex for both methodological and conceptual reasons. Methodological issues include the need to control for both later experience and potentially confounding third variables, such as IQ or temperament. Conceptual complexity derives from the fact that the effects of early experience can be both direct and indirect, can interact with other factors, and because whether an effect is found depends on what early experience and what outcomes are assessed. Even direct effects are probabilistic and are more in evidence with cumulative than with single measures. Often early experience has its effect indirectly by initiating a chain of events, by altering the organism in some way, and/or by promoting the impact of later experience. We provide examples where early experience is moderated and mediated by other factors and where it shows latent effects following developmental change. We illustrate developmental processes through which early experience has its effect and conclude that despite the complexity of development variations in early experience retain a vital place in the study of development.

When we began our longitudinal studies in the 1970s there was great skepticism regarding the lasting role for early experience in human development (e.g., Clarke & Clarke, 1976). Early longitudinal work, such as the Fels study, had indeed shown only modest continuity and virtually none from the first 3 years of life to later periods (Kagan & Moss, 1962). This and other findings led Kagan (1984) to argue that life was like a tape recorder with the record button always on, such that new experiences would write over and replace earlier experiences. However, early studies were based on linear, homotypic models of continuity and/or focused on rather robust aspects of cognitive development. The question remained whether more developmentally appropriate assessments, more complex models, and assessments that included social and emotional aspects of development would be more successful.

Recently, of course, due to advances in neuroscience, there has been an upsurge of interest in early experience and persuasive demonstrations of its power to impact development, primarily based on animal studies. Studies have now shown that normal brain development requires relevant experience ("experience expectant" brain development; Greenough, Black & Wallace, 1987) and that variations in experience can produce notable differences in brain structure and even the expressions of genes (e.g., Black, Jones, Nelson, & Greenough, 1998; Kaffman &

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Meaney, 2007; Nelson & Bosquet, 2000; Marshall & Kenney, 2009; Stiles, 2008). The human data currently available are limited, speculative regarding specific brain systems, and based almost solely on quite extreme variations in experience, such as institutionalization (e.g., Gunnar, 2001; Rutter, Kreppner, & Sonuga-Barke, 2009). Still, at this point no one doubts that human brain development depends upon the experience of the individual (e.g., Schore, 2002).

Despite the outpouring of work in neuroscience, there remains considerable skepticism in developmental psychology that more typical variations in early human experience significantly influence the course of development, with arguments often centering on the transformative effects of subsequent experience (e.g., Harris, 1998; Lewis, 1998). In addition, little has been heretofore known about specific kinds of linkages that might be more pronounced, about the mechanisms of change, about the fate of early experience following developmental change, or about developmental processes that promote continuity when it is found. These were all issues we were able to address to some extent in our longitudinal study.

The Minnesota longitudinal study of parents and children has followed 180 individuals from 3 months before birth to now age 34 years (e.g., Erickson, Sroufe, & Egeland, 1985; Sroufe, Egeland, & Kreutzer, 1990; Sroufe, Egeland, Carlson, & Collins, 2005b; Vaughn, Waters, & Egeland, 1979). The children were born into poverty, leading to a substantial range in quality of care and developmental outcome. The study was well cast to assess the impact of early experience, as well as a host of other features of development, because measures were detailed, comprehensive, and densely gathered in all age periods. Direct observation, as well as formal assessments and parent interviews, were utilized age by age, including 8 assessments in the first 18 months. The study tapped all domains of development (cognition, language, socio-emotional) and multiple arenas (home, school, laboratory, and peer group). Beginning early, we were able to assess temperament in infancy, as well as quality of care over time. Many aspects of parenting were examined, including provision of a secure base for attachment, structure and limit setting, and cognitive stimulation. Finally, the broader developmental context was assessed (e.g., parent characteristics, family life stress, and social support), for purposes of statistical control and to provide factors that might influence continuity and change in child development.

Evaluating the role of variations in early human experience turns out to be more complicated than first meets the eye. There are a number of complexities. First, it is clearly not always the case that early experience is most critical. Prenatal development provides excellent examples of both early and later events being important (DeHart, Sroufe, & Cooper, 2004). Numerous teratogens, including many drugs and viruses, have dramatically more profound affects in the first trimester of pregnancy when basic organ systems are first forming. Often the timing is exquisite, wherein a teratogen with devastating effects in the early weeks has no effect whatsoever a week or two later. The presumption is that this is due to the disruption of normal differentiation. For example, brain neurons can migrate, interconnect, and organize into systems only if the neurons are formed in the first place. This is compelling. However, maternal nutrition during pregnancy is a dramatic contrary example. While certain nutrients like folic acid are critically important in the early embryonic period, poor *general* maternal nutrition has almost no demonstrable effects in the first trimester, because the tiny developing organism can simply take many of the nutrients it needs from maternal stores. However, in the third trimester, when rapid fetal size and weight gain is occurring, adequate maternal nutrition is crucial to prevent babies born too small for gestational age, a serious risk for compromised development.

A classic study by Schaffer and Callender (1959) provides an interesting example from postnatal life. Infants hospitalized in the first few months of life showed few negative reactions or readjustment problems. In contrast, babies older than 7 months protested mightily, were

negative toward the hospital staff, and needed a period of readjustment upon returning home. Likewise, a group of infants who experienced early caregiving instability, but were adopted by age 4 months, showed no decrease in security of attachment (Singer, Brodzinsky, Ramsay, Steir, & Waters, 1985). These examples call attention to the more general issue of timing. Systems appear to be most vulnerable when they are emerging. Thus, "early" is a relative concept, being anchored by developmental considerations. We will provide other such examples later in the paper.

Second, it is often the case that the consequences of earlier and later experience are cumulative or are seen primarily in the context of other risk factors. For example, experimental deprivation studies with rhesus monkeys showed that those deprived in the first 6 months of life (equivalent to more than a year in human terms) later were more socially handicapped than those isolated for the second 6 months (Sackett, 1968; Suomi, 1977). However, those monkeys that were deprived for the *entire* first year were clearly more handicapped than those monkeys deprived for just the first 6 months, important as that was. A classic study by Cadoret and colleagues (Cadoret, Troughton, Merchant, & Whitters, 1990) found that an early experiential risk factor (number of placements prior to adoption or age of permanent placement) by itself had rather little power in predicting later depression; however, in concert with a genetic risk factor (biological mother diagnosed with depression) there was notable predictive power. The genetic risk factor also had little impact by itself. In our own research we found that disorganized attachment in infancy predicted later dissociative symptoms, but it did so much more strongly if there was subsequent abuse (Ogawa, Sroufe, Weinfield, Carlson, & Egeland, 1997). These are just a few of many possible examples. It should be noted, however, that such considerations do not negate the role of early experience; to the contrary, they suggest that its role might be best appreciated when considered within a broader view of development.

Third, and related to the above, the potential impact of early experience may at times be transformed by subsequent experience; that is, there may be change away from an early trajectory. As one example, the observation that premature birth did not have negative consequences in the context of middle class environments spurred development of the widely influential "transactional model" of Sameroff and Chandler (1975). Research documented that premature infants tend to catch up over the first year or two of life in a supportive, middle class context (Crockenberg, 1981; Sigman, Cohen, Beckwith, & Parmelee, 1981), apparently because parents in supportive contexts are prompted to increase their responsiveness to such needy infants (Cohen & Beckwith, 1979). This is a case where a negative early event leads to subsequent corrective experience. In our work we find that changes in parental life stress, social support, or depression are frequently associated with changes in early developmental trajectories (Sroufe, Egeland, Carlson, & Collins, 2005b). Other, more complex examples will be presented below.

Many specific outcomes of interest are likely sensitive to particular experiences at varying points in time. Sometimes what is happening during or just before a period of development may be as much or more important than what happened years earlier. At the least, the particular outcome, the particular kind of experience under study, and age will all be relevant.

Beyond all of these issues, there are important process questions surrounding the role of early experience; that is, *how* does early experience have its impact? And how does it interact with later experience to produce developmental outcomes? A related question concerns why what appear to be similar early experiences have apparent consequences for only some individuals. These issues currently are often discussed in terms of moderation and mediation. Thus, the primary question is not whether early experience is more important than later experience, but, rather, what is the (and when is there a) particular role for early experience in development? In general, early experience can be conceptualized in terms of creating vulnerabilities or

strengths with regard to later experience, including what experiences are sought and how they are interpreted, rather than as directly producing particular outcomes.

Thus, certain patterns of adaptation may be established early in development and then have their power because of their impact on the subsequent environment. That is, at times early experience sets in motion a chain of experiences each impacting the next, such that if at any time forestalled, the impact of early experience would no longer be seen. In this way, for example, a child who has adopted an understandable strategy of withholding emotional expression due to rejection in the face of expressed need may later isolate himself from others and thereby preclude the corrective experiences that could alter the early pattern (Sroufe, 1983). From a non-linear process view, early experience often would have its affect indirectly through an on-going transaction between child and environment.

Our prospective longitudinal study from prenatal life to adulthood provided an opportunity to wrestle with these complexities, as well as to examine the power of early experience for predicting an array of outcomes. In conducting this research we were guided by a transactional, hierarchical, and "cumulative pathways" model of development (e.g., Bowlby, 1973; Sameroff & Chandler, 1975; Werner, 1948). Bowlby (1973, p.412) summarized a core feature of this viewpoint in the following way: "Development turns at each and every stage of the journey on an interaction between the organism as it has developed up to that moment and the environment in which it then finds itself." In this perspective, development is not determined by early experience, but by the cumulative history of the child interacting with the environment. The early years merit special attention because the initial adaptations they promote become the starting place for subsequent transactions, framing how new experiences are engaged. Thus, again, the primary question concerns not the relative importance of early experience but the particular nature of its role in development. Moreover, in this view early experience may be transformed but is not erased by subsequent experience, as is argued by some theorists (e.g., Kagan, 1984; Lewis, 1998). It remains in force. Thus, the position is unique in simultaneously postulating that early experience is not deterministic yet always remains a part of the developmental landscape.

On subsequent pages we will provide empirical examples to illustrate each of the issues outlined above. At the same time, our detailed, comprehensive study allowed us to resolve a number of methodological problems that plague efforts to demonstrate any role for typical variations in early experience. Even with prospective, longitudinal data, numerous controls are needed to infer any kind of causal connection between an early obtained measure and a later outcome. For example, correlations between early rejecting care and later school problems or conduct problems could be due to a variety of factors. The question of common genetic factors could be raised. Perhaps, for example, parent low IQ accounts for both rejecting parenting and child problems. Alternatively, perhaps irritable child temperament leads to the rejecting care in the first place and indirectly (or directly) to later child problems. Finally, rejecting care may be a pattern that is continued from the early years to the later years, and it may be care at the later time is actually responsible for the child behavior problems, not the early care at all. Comprehensive, age by age assessments of parenting, child factors, IQ of parent and child, life stress, and social support, among other things, are required to begin addressing these potential confounds. Our array of empirical examples will illustrate how we coped with these methodological problems.

Evaluating Early Experience

Early Experience and Later Behavior

In our longitudinal study some of the most theoretically meaningful and empirically clear links between early experience and later behavior were based on patterns of attachment assessed at

12 and 18 months of age (e.g., Sroufe, 1983; Sroufe, Egeland, & Carlson, 1999; Sroufe et al., 2005b). We first demonstrated that these assessments were related to earlier measures of caregiver sensitive responsiveness but, as predicted, were not related to measures of early infant temperament. Both of these findings are supported by meta-analyses and other reviews (e.g., deWolff & van Ijzendoorn, 1997; Vaughn, Bost, & van Ijzendoorn, 2008), by the definitive NICHD child-care study, which is based on more than 1200 participants in multiple sites (e.g., NICHD, 1997) and by studies using contemporary physiological measures of temperament. Gunnar and colleagues, for example, found that neither cortisol reactivity at 9 months, nor the observation-based Louisville temperament assessment procedure predicted attachment classifications at 13 months (Gunnar, Mangelsdorf, Larson, & Hertsgaard, 1989). Cortisol reactivity predicted crying in the caregiver's absence but not crying during reunions with the caregiver that is more pertinent to assessing attachment quality. To date, not a single study has shown that Ainsworth attachment patterns are due to temperament variations. Thus, Ainsworth attachment assessments are reasonably interpreted as summaries of interactive experience with the primary caregiver.

In our study, these attachment assessments were robustly related to later aspects of individual characteristics, such as dependence/independence, self-esteem, self-management and school achievement, and are consistent predictors of later social relationships, from engaging preschool play partners, to forming close friendships in middle childhood, negotiating the complexities of the mix-gender adolescent peer group, and dealing with the intimacy of adult romantic relationships (Sroufe et al., 2005b). When based on comprehensive, observational data, the linkages were at times quite strong (e.g., correlations of .50).

At times, these linkages demonstrate complex, heterotypic continuity, as when avoidant attachment in infancy predicts greater *dependence* on teachers and counselors in preschool and middle childhood (Sroufe, 1983Urban et al., 1991), in accord with Bowlby's (1973) theory. Thus, rather than concluding that dependency is unstable, as was done in the Fels report (Kagan & Moss, 1962), there is strong continuity from failure to form an effective attachment in infancy and dependency later.

At other times the findings illustrate the unique features of particular developmental issues. For example, our infant attachment measures predicted certain adolescent peer outcomes as strong or more strongly than they predicted to middle childhood. The links were especially notable for certain emotional features of relationships, such as the capacity to experience vulnerable feelings (Sroufe, Egeland, & Carlson, 1999). We interpret this in terms of the salience of core issues of emotional closeness and trust in both infancy and adolescence.

Finally, at times predictions from infant attachment were uniquely strong. Disorganized attachment in infancy, the most anomalous attachment pattern, was related to numerous indicators of psychopathology in adolescence and adulthood, often beyond any other measure in the first years of life (with correlations in the .40 range; Carlson, 1998). Disorganized attachment has been proposed and confirmed to be predicted by frightening parental behavior (Abrams, Rifkin, & Hesse, 2006; Main & Hesse, 1990; Jacobvitz, Hazen, & Riggs, 1997; Schuengel, Bakermans-Kranenburg, & van IJzendoorn, 1999). When the parent is simultaneously the source of fear and the available "haven of safety" the infant faces an impossible dilemma that can only be resolved by segregating experience and by a collapse of behavioral organization. Liotti (1992) reasoned that these were micro-dissociative experiences, serving as a prototype for later dissociation. As predicted, it was related in our data to dissociative symptoms at multiple time points (Carlson, 1998). Likewise, in our study we found that infant disorganized attachment was an early predictor of young adult self-injurious behavior (Yates, 2005). We now find that disorganized attachment is related to adult borderline personality disorder symptoms more generally (Carlson, Egeland, & Sroufe, 2009).

The Need for Interpretive Restraint

In this and the following section we will point out some of the challenges in reaching causal conclusions from the above findings, especially concluding that attachment variations, for example, have unique predictive power. At best, establishing the role of any early feature in development is an incremental process.

Despite the impressive links between infant attachment assessments and later behavior described above, which are greater than that for any other behavioral predictor, it must also be noted that linkages between infant attachment and theoretically relevant outcomes, while virtually always significant, in some cases were small. Moreover, and of great importance, these relationships were quite often enhanced when infant attachment assessments were combined with other measures of both early and later experience (Sroufe, Egeland, Carlson, & Collins, 2005a; see also Belsky & Fearon, 2002). For many analyses in our study we combined attachment security scores from 12 and 18 months with other measures of quality of parental care obtained from infancy to age three years, all based on direct observation (Sroufe et al., 2005b). In most cases this early care composite predicted later social outcomes notably more strongly than did attachment alone. As one example, the correlation between attachment security and counselor-rated global social competence in middle childhood was . 18, whereas that for the early care composite was .39. (When preschool peer competence was added to the regression, the correlation rose to .62, accounting for 40% of the variance; Sroufe, Egeland, & Carlson, 1999.)

In a similar manner, we have shown the cumulative power of multiple early risk factors. The five factors we considered were child maltreatment, witnessing violence, family disruption, general family life stress and SES (Appleyard, Egeland, van Dulmen, & Sroufe, 2005). We found that each of these five variables predicted adolescent behavior problems. More importantly, and consistent with the general literature on risk and psychopathology (e.g., Rutter, 1979, 2000; Sameroff, 2000), we found a linear relationship between number of risk factors and outcome. Predictive power was significantly enhanced with each risk variable entered. Also of note, measures of each of these variables were also available in middle childhood, allowing comparative analyses. We found that for maltreatment and for witnessing violence, as well as for the cumulative risk index, risk in early childhood was more powerfully related to adolescent behavior problems than was risk in middle childhood, even though it is closer in time to the outcome. Moreover, risk in early childhood remained a significant predictor of behavior problems even when risk in middle childhood was controlled. This is an important example of the power of early experience.

Necessary Controls

Numerous controls generally are required to even begin approaching causal inferences regarding early experience and later behavior. Such controls involve both contemporary and later correlates, individual characteristics and features of the surround. Different potential confounds are more or less obvious in different cases.

Consider first, for example, the association between attachment relationship variation in infancy and later school achievement or dropping out of school. As with other associations, both of these outcomes were stronger when the predictor was the early care composite. By age 3 years dropping out of high school was predicted with 77% accuracy (Jimerson, Egeland, Sroufe, & Carlson, 2000). Nonetheless, one cannot conclude from these relations alone that early experience has any role in bringing about the school outcome. Immediately, roles for IQ and social class come to mind. Not only must IQ be controlled because it is well established to relate to school outcomes, but, as some would argue, it may also be related to quality of parenting or other experiential variables. Perhaps parents with lower IQ provide less adequate

care as well as lower genetic potential to their offspring, and perhaps it is inherited low mental functioning that accounts for the school failure. Or perhaps inadequate parenting and poor school performance are the result of lower SES and its attendant stresses. Such variables are consistently related to school outcomes, and they were in our sample as well (Jimerson et al., 2000). However, when they and even elementary school achievement test scores were statistically controlled, the early care composite continued to predict these school outcomes. In fact, with the drop out outcome, child IQ did not survive as a significant predictor in a discriminant function analysis that included the early care variable, which rivaled elementary school achievement measures and behavior problems in predictive power.

Our work on early witnessing of parental violence further illustrates the importance of controlling for third variables (Yates, Dodds, Sroufe, & Egeland, 2003). Witnessing violence was related to later behavior problems, as has been found by others. It is, of course, inappropriate to infer a causal link from this association. While it is again important to control for IQ, other variables seem more critical in this case. For example, witnessing violence is associated with direct abuse of the child, general life stress, and social class. Each of these variables also was related to behavior problems in our study. Nonetheless, using regression techniques we were able to show that witnessing violence in the preschool years did remain a significant predictor of later behavior problems with all of these other variables controlled. This provides beginning support, but only beginning support, for a causal role.

Similarly, efforts to provide evidence for intergenerational continuity between early experiences of care and subsequent parenting must cope with a number of potential confounding variables and alternative interpretations. Our most compelling analysis began with correlations between directly observed quality of parental support in a toddler tool problem situation and quality of parenting in the same situation in the next generation, again directly observed at age two years (Kovan, Kempner, & Carlson, 2004; Kovan, Chung, & Sroufe, 2009). Such a relationship could be due to early-acquired patterns of dyadic engagement and affect regulation (and the neurobiological systems that underlie them) that are carried forward at a preverbal level across time. This is what we hypothesized. However, it could also be because early care received is related to later care received, and one's pattern of parenting results from this later care. Or it could be due to similarities in the life stress experienced by the parents across generations, commonalities in social class, or as in the school examples above, variations in IQ. Our analyses showed that the intergenerational correlation was not substantially due to any of these alternative factors. In fact, for example, care experienced at age two predicted care provided for one's toddler better than did care experienced at age 13 (our latest direct measure of parenting quality).

Studies with non-human primates often can evaluate the role of early experience with tighter controls than is readily feasible with humans. As one example, Lynn Fairbanks (1989), using vervet monkeys, carried out an inter-generational parenting study much more compelling than our own. Her parenting measure was the amount an infant was held by its mother in very early life, and the outcome was the amount those individuals held their own infants when they became adults. She found a substantial correlation. In this case, she was also able to show that this relationship was stronger than the prediction based upon the average amount of holding the mother showed across all her infants (a stand-in for a genetic effect). How much holding the particular baby experienced was most relevant. Further, since first offspring regularly reach age of childbearing before their mothers stop being fertile, she also examined the amount the original mother held her current infant (a modeling explanation). Again, experience as an infant was more powerful. Even with both of these controls entered into a regression analysis, amount of holding experienced as an infant continued to predict this parenting behavior.

Before concluding this section, it must be pointed out that there are also examples in which early experience loses its predictive power when relevant controls are in place (and thus the need for such controls). In one representative analysis we found that both infant secure attachment and parent emotional support at age 13 predicted the capacity of young adult couples to resolve conflict. However, when both predictor variables were entered into a regression analysis, the attachment predictor was no longer significant, and a mediation effect was confirmed (Sroufe et al., 2005a). It is interesting to note that when other aspects of couple relationships served as the outcome (emotional aspects such as observed hostility), both attachment and 13-year parent-child interaction measures accounted for significant variance and there was no evidence of mediation. As we will discuss in the later section on developmental process, we also had examples where measures of childhood peer relationships mediated links between attachment and later outcomes or served as independent predictors.

Experience/Temperament Interactions

Another way to illustrate an important role for early experience is to consider it in interaction with other factors, such as temperament. While we have often controlled for infant temperament variation in our assessments of early experience, the interplay of temperament and experience also merits attention. There are some promising leads. In terms of predicting attachment variations, Mangelsdorf, Gunnar, Kestenbaum, Lang, and Andreas (1992) found that infant proneness-to-distress interacted with parent "need for control" in predicting anxious attachment. Neither variable alone predicted attachment status. Crockenberg (1981) reported that when mothers had low social support (but not when they had adequate support) infant irritability predicted anxious/resistant attachment. We likewise found that an infant temperament variable (irritability at age 3 months), while not predictive by itself, interacted with caregiver sensitivity in predicting attachment insecurity (Susman-Stillman, Kalkoske, Egeland, & Waldman, 1996).

Several studies have also shown attachment and temperament variation to interact in meaningful ways in predicting outcomes (see Vaughn et al., 2008, for a review). In our own work, we found that habituation to startle in the newborn period interacted with resistant attachment to predict anxiety problems in late adolescence (Warren, Huston, Egeland, & Sroufe, 1997). Thus, although anxious attachment predicted anxiety even with the temperament measure controlled, it was nonetheless the case that the interaction with temperament accounted for additional variance. Other studies have looked at experience or temperament as moderating the impact of the other. Kochanska (1997), for example, found that fearful infants had better outcomes in the context of gentle parenting. Schieche and Spangler (2005) showed that another temperament dimension, behavioral inhibition, predicted elevated adrenal-cortical reactivity but only for children with insecure attachment. As a different kind of example, Stright, Gallagher, and Kelley (2008), using the NICHD data set, found that while high parenting quality predicted better adjustment outcomes across temperament groups, the effect was stronger for the most temperamentally difficult group of infants.

Following their own review, Bates and McFadyen-Ketchum (2000) concluded that two findings from the literature on experience-temperament interaction are most robust: fearful or difficult infants have better outcomes with responsive, gentle parenting and infants high on resistance to control have more problems if parents are low on control. The two points we take from all of this work is that temperament and experience need not be thought of as antagonistic explanations, and that a role for temperament would not trivialize the importance of early experience but may actually highlight it.

The Broader Significance of Developmental Timing

One way to consider early experience is within the broader issue of timing. We propose, along with other developmental researchers, that early experience shows predictive power in our study because of critical processes that are unfolding in the early years, including rapid development of brain systems (Marshall & Kenney, 2009). Many core issues for individual adjustment, such as a sense of interpersonal connection, emotion regulation, and the capacity for behavioral control, begin and progress substantially in the early years. Other developmental issues may come to the fore in later periods of life, and particular experiences at those times may have special salience. Erikson (1950), for example, suggested that one's basic sense of competence or effectance ("industry") in the real world was consolidated in middle childhood. Sullivan (1953) argued that major advances in peer relationships also occur at this same time and are crucial for the capacity for intimacy.

In our study we found that indeed powerful, theoretically grounded relations exist between certain middle childhood variables and outcomes in early adulthood. For instance, middle childhood teacher ratings of initiative, defined as self-direction in task completion, organization, initiative in class activities, and perseverance, predicted work ethic in early adulthood (Hyson, 2002). Work ethic was defined as the amount one values work and the level of responsibility one shows at work. We also found that peer competence in middle childhood was a powerful predictor of adult work competence (Collins & Van Dulmen, 2006). In this case, peer competence in middle childhood partially mediated the significant relation between early caregiving quality and adult work. In other cases, combining middle childhood variables with infant attachment ratings strengthened predictions to adult outcomes.

In accord with Sullivan (1953), middle childhood peer competence measures had consistent implications for later social relationships. For example, ratings of peer competence predicted the ability to negotiate conflicts in one's early adult romantic relationship, and its contribution was independent of the contribution from infant attachment security (Sroufe et al., 2005a). In this case, the middle childhood predictor was stronger than that from infant attachment variation, although for other aspects of adult close relationships (again, those such as trust or hostility), attachment history was a stronger predictor. As an example of theoretically driven heterotypic continuity, we found that individual differences in maintaining gender boundaries in middle childhood (a normative phenomenon at that age) was among the strongest predictors of the capacity to engage in opposite-gender relationships and to function in the mixed-gender peer group in adolescence (Sroufe, Egeland, & Carlson, 1999).

A further example from our study that underscores the significance of middle childhood comes from our data on the role of social and biological fathers. Men come and go with considerable frequency in a lower SES sample such as ours, and when they are present they provide notably varying degrees of direct support to the child. We were able to create father support variables in both early childhood and middle childhood based on interview data collected at those times (e.g., Kroeten-Bue, Pierce, Pfaffinger, Kringle, & Sroufe, 1999; Pierce, 2003). We found that these variations were important predictors of adolescent externalizing problems, especially variations from middle childhood. While behavior problems were predictable from support in early childhood, predictions from middle childhood remained significant even when controlling for father variation in early childhood as well as numerous other variables (current SES, current life stress, infant and toddler maternal care, early adolescent maternal relationship quality). On the other hand, early childhood father support was no longer significant once middle childhood variation was entered into the regression. We would, of course, not reach a definitive conclusion from this single study; nonetheless, an important hypothesis for future research is that fathering experience is especially important in the preadolescent years with regard to reducing adolescent conduct problems.

Other findings from our project highlight the years between infancy and school entry. Two examples will suffice. The first involves an observation of parent and child in a series of teaching tasks at age 42 months: building towers to match a model from blocks of various shapes and sizes; naming things with wheels; completing a multi-dimensional form board; and tracing a maze (see Block & Block, 1980). The parent's abilities to structure the task and to guide and support the child were rated on various scales. These ratings have proven to be uniquely powerful (and clearly stronger than attachment variations) in predicting school related outcomes throughout development, including number of years of school completed by age 26 (Englund & Collins, 2007). These parent ratings continue to have an effect on educational attainment at age 26 when mother's education level is controlled.

A second finding concerns the link between separation and loss experiences in early childhood (60 months to grade 2) and self-injurious behavior in early adulthood. We mentioned above that one infant measure (disorganized attachment) predicted self-injurious behavior. And separation and loss experiences during the infant-toddler period are related to certain outcomes in our study (e.g., depression; Coffino, 2007). But in this instance, separation and loss experiences in infancy were not related to self-injurious behavior, whereas similar measures in this later early childhood period consistently were. We did not predict this and will restrain ourselves from coming up with a post hoc explanation of this particular timing influence, but it is a further example of earliest experience not always having the most powerful influence on a particular outcome.

Early Experience and the Process of Development

Developmental Change

Our study has been as much a study of change as a study of continuity. Even when there are clear relationships between early experience and some later outcome, this relationship is probabilistic, not deterministic. There is abundant evidence that individuals can in many cases overcome the potential consequences of early experience, and that when they do such change is predictable. For example, in an early study, Rutter and colleagues (Quinton, Rutter, & Liddle , 1984; Rutter & Quinton,1984) found generally negative consequences of institutional rearing for the later quality of parenting of a group of young women. However, such effects were moderated by participation in a satisfactory adult relationship. Understanding developmental processes underlying continuity and change is more important than simply understanding that early experience often predicts later behavior. Again, we will use attachment variations as our primary example.

Even in the preschool period we found evidence for change (e.g., Erickson, Sroufe, & Egeland, 1985; Vaughn, Waters, Egeland, & Sroufe, 1979). While we found significant stability in attachment assessments and a significant link between anxious attachment and behavior problems in kindergarten, we found exceptions as well. Some children who had been anxiously attached were later without significant problems. Such changes themselves were associated with reductions in family life stress and increases in social support. Thus, early experience was offset by these changes in family circumstances.

Over longer periods of time we found even more evidence of change. For example, with our lower SES sample we found only a modest relationship between observed infant attachment and representation of attachment as assessed by the Adult Attachment Interview (Sampson & Carlson, 2005; Weinfield, Sroufe, & Egeland, 2000). Again, however, this change was lawful, being accounted for in part by subsequent maltreatment, by changes in family life stress, by changed parent-child relationships at age 13, or by quality of adult romantic relationships. Changing circumstances and new opportunities apparently may alter the individual's attachment representation.

A final example concerns conduct problems. We have found such problems in childhood and adolescence to be related to avoidant and disorganized attachment history and, especially, to the early care composite, findings that held even when controlling for infant temperament and early neuropsychological measures (Aguilar, Sroufe, Egeland, & Carlson, 2000). And, consistent with massive literature, we also found that once conduct problems appeared they were quite stable (e.g., Dodge, 2000; Eron & Huesman, 1990; Farrington, 1995; Koko, & Pulkkinen, 2005). Nonetheless, even in this domain change occurs. Notably, the strongest predictors of desistance between adolescence and adulthood for early onset conduct problem individuals in our study were (1) formation of a positive romantic relationship and (2) involvement in satisfactory work (Roisman, Aguilar, & Egeland, 2004). Again, early experience is not destiny. Change often remains possible. When evidence suggests that change is extraordinarily difficult, as in some of the Romanian orphan studies, it is because the deprivation has been extreme and prolonged (e.g. Gunnar, 2001; Rutter, 2009). Both continuity and change are lawful.

The Fate of Early Experience Following Change

If development truly entails the cumulative history of the organism, as Bowlby (1973) suggests, then even following changes in adaptation early experience is not erased. Our longitudinal data afforded several opportunities to demonstrate this (e.g., Sroufe, Egeland, & Kreutzer, 1990; Sroufe, Carlson, Levy, & Egeland, 1999; Sroufe et al., 2005b). In the first illustration, we began by defining two groups of children that showed consistently poor adaptation across 3 assessments in the preschool period (Sroufe et al., 1990). In fact, from one point of view, if early experience were erased, they constituted a single group because levels of adaptation were comparable. What distinguished the groups was that one of them had experienced consistent secure attachment and parent emotional support during the infant-toddler period, while the other had not. The prediction was that the group with a history of support would be more likely to rebound (would show fewer behavior problems) when assessed in early elementary school. The prediction was clearly confirmed, and is not likely due to simple regression to the mean or measurement error, because of the consistency in the prior multiple assessments. We replicated this basic finding later using positive change between middle childhood and adolescence as the outcome (Sroufe, Carlson, et al., 1999). Likewise, we have found that those who met criteria for depression or conduct disorder in adolescence but do not go on to show clinically significant problems in adulthood, compared to those who do, were more likely to have had early positive care. More generally, we argue that resilience is commonly a product of both earlier positive foundations and current supports (Yates, Egeland, & Sroufe, 2003; see also Luthar, 2006; Masten, 2001).

Another hypothesis we are just beginning to pursue is that early positive experience potentiates later change by allowing individuals to better capitalize on opportunities or turning points that arise. For example, does early positive experience differentiate those individuals who profit from a relationship or from a job opportunity from those who do not? This can be looked at in terms of the unique power of the joint occurrence of these events, or a statistical interaction effect. As above, we have considered, for example, change away from depression or conduct problems in adolescence to non-clinical status in adulthood. We obtained statistically significant evidence of such an effect for depression; that is, those depressed individuals who began a significant relationship *and* had been securely attached as infants showed a greater decline in symptoms than those in relationships who had not been secure in infancy. The numbers here are small, so we reach no definitive conclusion. We urge much more work on this developmental process kind of question.

How and Why Early Experience Relates to Later Behavior

Process considerations have been implied in many of the examples above. But in this final section, we want to discuss more specifically some of the ways in which early experience may exercise its influence. The basic model we follow is that early experience often has its impact because, in helping to shape the adaptation of the individual, it impacts subsequent experience (Carlson, Sroufe, & Egeland, 2004; Sroufe et al., 2005b). The individual adapts to current circumstances and this adaptation is carried forward as the individual engages and creates new experiences, adapts to these, and so on over the course of development. Much research in the field currently is being devoted to how early experience alters brain structure and functioning, which then impacts on how the individual engages subsequent experience (e.g., Black et al., 1998; Dawson, Hessl, & Frey, 1994; Nelson & Bosquet, 2000), which has been referred to as "experience-adaptive programming" (Marshall & Kenney, 2009). We fully embrace this notion, but in our work we have focused on two other levels of analysis, the level of behavior and the level of representation.

When, for example, one considers the complex social behavior of adolescents, such as coordinating the demands of same- and other-gender friendships, same-gender and mixed-gender group functioning and intimate relationships, it is clear that multiple capacities are required. It is our view that these complex capacities are built up and organized in a logical way over the course of development (Sroufe, Egeland, et al., 1999). One cannot get all of this from early experience, however positive. Moreover, it seems likely that certain capacities must be acquired in the give-and-take symmetrical world of peers. Learning to sustain interactions with an immature partner and to negotiate conflicts with an equal, for example, is not part of early attachment relationships. What then is the role of early attachment experiences?

We believe that attachment experiences provide certain core attitudinal, motivational, and emotional components that are a platform for entering the world of peers and coping with the challenges that arise. As we have previously summarized (Sroufe et al., 2005b), infants that have experienced responsive care will have positive expectations concerning relationships with others, beginning capacities for emotion regulation, and object mastery skills, because of how secure attachment promotes exploration. In brief, they will be enjoyable play partners. John Gottman (e.g., 1983) in his descriptive research on preschool peer friendships, for example, showed that the very first ingredient is what he called "amity", the capacity to have fun together. We documented using direct observation that those preschoolers with secure histories more frequently initiate and respond to peer overtures with positive affect (Sroufe, Schork, Motti, Lawroski, & LaFreniere, 1984). This is the kind of thing that comes forward from early attachment experiences. Such emotional components are the reason we argued above that infant attachment predicts so well to adolescent relationships and even on into adulthood.

However, practicing social interactions and having rewarding experiences in early peer relationships also are critically important as the child moves forward. In the preschool period, children learn to sustain interactions even in the face of difficulties and with partners with the same limited scaffolding skills as themselves. They also begin learning to function in a group of children. These capacities can't be acquired in relationships with caregivers, and they are crucial for negotiating the organized groups and friendship demands of later periods. We find that peer competence at each age predicts peer competence at the next, even though such relationships are increasingly complex and entail new issues (Sroufe, Egeland, et al., 1999). At times, infant attachment variation continues to predict, even after taking into account peer competence at the prior steps. At other times, with more interactive and less clearly emotionally toned outcomes, attachment fails to predict the outcome when pertinent prior peer measures are taken into account (Sroufe et al., 2005a). In one complex analysis, our coworkers confirmed a "double mediation" model, wherein secure attachment in infancy predicted early elementary school social competence, which predicted adolescent friendship security, which, finally,

predicted daily positive emotional experiences and less negative affect in conflict negotiation in young adult romantic relationships (Simpson, Collins, Tran, & Haydon, 2007). Our major point is that none of these findings trivialize the importance of early experience. Rather, they illustrate that a major way early experience is of importance is as part of a developmental process.

Another way we conceptualize the role of early experience is through its influence on representation, the set understandings and expectations of the social world the individual constructs; that is, early experience is internalized and carried forward and thereby in part structures later experience. Later experiences, in turn, may alter representations, and these altered representations provide a new framework for subsequent experience, in an ongoing cyclical way. “Individuals actively participate in processes of constructing experience congruent with their relationship history by interpreting and selecting experiences and behaving in ways that are consistent with earlier experience (Carlson, Sroufe, & Egeland, 2004, p. 67).”

Beginning to test this process notion is challenging. It requires at the least multiple, independently obtained measures of representation at multiple ages and multiple independent measures of social behavior at comparable points in time. Our measure of early experience was based on attachment assessments and toddler parental care. Then we obtained measures of social competence in early childhood, middle childhood, and early adolescence, along with temporally parallel measures of representation, based on story completions, family drawings, projective tests (sentence completions, TAT stories, a moral fable) and narratives. Social functioning in late adolescence (age 19) was an ultimate outcome. The links between infant experience and both preschool behavior and representation were quite strong (path coefficients of .60 and .54). Later representation measures and social behavior measures showed continuity across time. Moreover, at each subsequent step from early childhood forward we were able to show that when representation at a given age was controlled, experience at that age predicted representation at the next. Reciprocally, when experience was controlled, representation at that age predicted social behavior at the next age (Carlson et al., 2004). The structural equation model including the total set of variables was highly significant, with an overall goodness of fit index of .92. Interestingly, the only path in the total model that was not significant was the link from infant experience *directly* to the late adolescent outcome. Again, rather than calling into question the role of early experience, we believe these findings highlight its place in initiating a complex developmental process.

Future Research Directions

We did not hypothesize nor did we prove that early experience is more important than later experience. This is not even a meaningful developmental question, anymore than one would say a foundation is more important than the roof for a house. Moreover, this was not an experiment; we had no control over the variations in experience we measured. In addition, it is obviously the case that with other, better, or more comprehensive measures of later experience, or other measures of temperament, our results may have been somewhat different, with such alternative measures shown to have more power than the measures we used. Given the developmentally salient, integrative nature of our attachment assessment, however, and the developmental perspective and methodology utilized, we doubt that alternative measures would show early experience to be unimportant.

There is another notable lack in our study. Were such assessments available when we began, we certainly would have incorporated cortisol measures of HPA activity or other neurobiological measures throughout. (We are now collecting DNA that can, of course, be collected after the fact.) Such biological variables would have been an important addition, not because they have a privileged status and would provide by themselves a superior explanation

for the individual variations in adaptation that we tracked, but because their addition would provide a more comprehensive developmental picture. The task for the future is to describe the interplay of individual adaptation and experience across time using multiple levels of analysis from neural substrates to behavior to representation. A part of this will involve understanding, for example, how differences in stress-reactivity develop (especially in the context of more typical variations in experience), how they are maintained or altered over time, and how they interact with other aspects of functioning. We know they are important, but we know little of their vicissitudes over a wide sweep of time. Comprehensive longitudinal studies will be needed to address this.

Conclusion

At first glance, it may seem remarkable that experience in the first years of life could predict outcomes in adolescence and adulthood, given the span of ages and the complexity of life. Yet, there are now empirical examples showing that it is so. Such a situation is less remarkable, though no less profound, when considered in developmental perspective. A persuasive case can be made that development is hierarchical or cumulative, with later functioning building on what was there before. Moreover, many writers have suggested that the young child may be especially vulnerable to developmental insults. As Siegel (2003) put it, for example: “Trauma during the early years may have lasting effects on developing brain structures responsible for such processes as the response to stress, the integration of information, and the encoding of memory (p. 9).” Even modern physics uses similar concepts to explain why crystals such as snowflakes take unique forms even though formed from the same elements and following the same process (Ball, 2004). “History” (chance early events) provides the initial starting point and the rest of the form builds upon that.

An effect of early experience on later functioning has at times been difficult to discern for both methodological and conceptual reasons. Conceptual reasons include the complexity and frequent indirectness of such linkages and the many different ways that early experience may have its impact. Not only is heterotypic continuity common, in addition early experience often has its impact by setting in motion a chain of events or by perhaps potentiating the impact of later experiences. Still, despite the complexities and challenges of investigating early experience, it clearly has earned its place in continued developmental study. In particular, our review of research suggests that it is now time to move beyond the question of whether early experience is important to an increased focus on the role of early experience within the process of development.

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