Effortful Control Development in the Face of Harshness and Unpredictability

Shannon M. Warren*
Melissa A. Barnett

Norton School of Family & Consumer Sciences, University of Arizona, Tucson, AZ 85721-0078, USA.

*Corresponding Author swarren6@email.arizona.edu

Abstract Using psychosocial acceleration theory, this multimethod, multi-reporter study examines how early adversity adaptively shapes the development of a self-regulation construct: effortful control. Investigation of links between early life harshness and unpredictability and the development of effortful control could facilitate a nuanced understanding of early environmental effects on cognitive and social development. Using the Building Strong Families national longitudinal data set, aspects of early environmental harshness and early environmental unpredictability were tested as unique predictors of effortful control at age 3 using multiple regression. Early harshness variables were financial harshness, mothers' and fathers' observed parenting, mothers' and fathers' reported use of harsh discipline, and harsh neighborhood conditions. Early unpredictability was measured by number of paternal transitions. Cues of harshness, specifically observed unresponsive parenting, observed harsh parenting, and neighborhood harshness, did significantly negatively predict effortful control. Paternal transitions also significantly predicted effortful control, but in the opposite (i.e., positive) direction. The results corroborate previous research linking quality of parenting to the development of children's effortful control and place it within an evolutionary-developmental theoretical framework. Further, the results suggest that neighborhood harshness may also direct developmental trajectories of effortful control in young children, though the mechanisms through which this occurs are still unclear. This is the first study to explicitly investigate effortful control development in early childhood within the harshness and unpredictability framework.

Key words: effortful control, psychosocial acceleration theory, life history strategies, early childhood, harshness, unpredictability

Investigation of early cues from the environment that direct developmental trajectories within an evolutionary-developmental perspective could reframe how adaptive variations in self-regulation are understood (Bjorklund and Ellis 2014; Cabeza de Baca and Ellis 2017; Ellis and Del Giudice 2014; Frankenhuis and de Weerth 2013). More specifically, research on the links between early life harshness and unpredictability and the development of self-regulation could facilitate a more nuanced understanding of early environmental effects on cognitive and social development. Using Belsky, Steinberg, and Draper's (1991) evolutionary theory of socialization and lifespan interpersonal development, also known as psychosocial acceleration theory, this multimethod, multi-reporter study examines how early adversity adaptively shapes the development of a self-regulation construct, effortful control (EC). Using the Building Strong Families national longitudinal data set, we explore evidence of early experiences with harshness and unpredictability being unique predictors of EC, which is well established in developmental research as an important aspect of early development that is tied to an individual's social and

academic success (Rothbart and Bates 2006; Rothbart and Rueda 2005; Zhou et al. 2012), with early adverse experiences linked to lower levels of EC (Lengua 2012).

Effortful Control

EC, a future-oriented self-regulation construct, includes processes such as attentional shifting, attentional focusing, and inhibitory control (Rothbart et al. 2001). These processes allow an individual to manage attention and goal-directed behaviors over time and across changing contexts (Karoly 1993; Rothbart and Derryberry 2002). EC has the aim to align attention and behavior toward a desired, hypothetical future in the face of competing internal and external demands and stimuli (Barkley 2001; Del Giudice 2015; Karoly 1993). EC involves a shift from behavior regulation based on the immediate, temporal now toward regulation of behavior based on internal representations of a projected, hypothetical future (Barkley 2001). These projections are based on repeated cause-and-effect experiences (Barkley 2001). Thus, individuals high in EC will be more successful in future-oriented behavior strategies.

EC has been identified as an indicator of subsequent social and academic success, with specific aspects of EC (e.g., inhibitory control) observable in children as young as 12 months old (for review see Rothbart and Rueda 2005). Higher EC has been associated with a host of developmental outcomes, including increased prosocial behaviors, conscience and moral development, as well as academic outcomes, such as increased math and language competencies, grade point average, and overall school competence (Diamond 2006; Rothbart and Bates 2006; Rothbart and Rueda 2005; for review see Zhou et al. 2012). EC plays a role in the thoughts, actions, and emotions involved in complex social interactions. Rothbart, Ahadi, and Hershey (1994) found that 6- and 7-year-olds high in EC were also high in empathy and guilt/shame, and low in aggressiveness. Individuals who inhibit antisocial responses in complex social interactions likely are considering future impacts of their behavior. Thus, individuals high in EC likely propagate cooperative, nonhostile social interactions, particularly if those interactions are considered advantageous to future needs and goals. Individuals lower in EC have shown increased internalizing behaviors (i.e., behaviors focused inward, such as social withdrawal) and externalizing behaviors (i.e., behaviors focused outward, such as aggression) across multiple studies (for review see Diamond 2006; Rothbart and Bates 2006; Zhou et al. 2012). Disparities in EC development based on early experiences are evident even in preschool (e.g., Lengua et al. 2007). Thus, EC development carries implications across developmental domains.

EC as a specific construct primarily emerged from temperament research. It has recently been suggested that EC is synonymous or overlapping with aspects of executive functions (Bridgett et al. 2013; Diamond 2013; Rothbart and Rueda 2005; Zhou et al. 2012), which have traditionally been a focus of cognitive psychology. In this paper, the term “EC” is used under the assumption that EC and executive functions are overlapping, but with independent histories of research, measurement, and terminology (Diamond 2006). Since this study focuses specifically on attention assessed using a behavioral measure developed in the tradition of temperament and EC research (discussed in Methods), the term “EC” is used for consistency.

Influences on Ontogeny: An Evolutionary-Developmental Perspective

According to psychosocial acceleration theory, early experiences influence development such that various characteristics across different levels of organization (e.g., physiology, cognition, behavior) converge to create a coordinated suite of traits called *life history strategies* (Belsky et al. 1991). Experiences in the immediate environment, such as the household, give the child a sense of what the world is like and how it works. Based on these environmental cues, the child

develops strategies and associated traits that could benefit the child's social navigation and reproductive fitness in the anticipated context (Belsky et al. 1991, 2012; Blair and Raver 2012; Cabeza de Baca and Ellis 2017; Del Giudice et al. 2011; Ellis et al. 2009; Hartman et al. 2018). Life history strategies are purported to lie along a slow-fast developmental continuum reflecting individual differences in how bioenergetic and material resources are allocated (i.e., among somatic, mating, and parenting effort) and aim to best match the developing individual to the anticipated environment for the ultimate purpose of increased fitness (i.e., successful passing on of one's genes in future generations; Belsky et al. 1991; Ellis et al. 2009). Slower life history strategies are typified by slower growth and development and have the advantages of longer periods of growth resulting in increased somatic and neurological maturity (Ellis et al. 2009), as well as more time for accumulating skills and resources prior to reproduction. Developmental traits associated with slower life history strategies are theorized as those that foster enduing pair-bonds and greater parental investment (Belsky et al. 1991). The suite of traits that characterize slow life history strategies are generally future-oriented (e.g., higher inhibitory control and delay of gratification, such as in EC) and developed in anticipation of lower levels of local morbidity-mortality and thus may maximize fitness in this context (Belsky et al. 1991).

On the opposite end of the continuum lie fast life history strategies typified by faster growth and development, in preparation for earlier reproduction (Belsky et al. 1991). Populations that experience relatively higher extrinsic morbidity-mortality rates (but still have adequate levels of nutrition) may experience better fitness outcomes by employing faster life history strategies (Ellis et al., 2009). Employing increased delay of gratification by exchanging immediate rewards for future rewards (i.e., future-oriented; Ross and Hill 2002) may prove fruitless in an environment where the morbidity-mortality risks are high or unpredictable. In environments of high morbidity-mortality, one is less likely to live long enough to reach those future rewards; hence, time is of the essence. In environments of unpredictable levels of morbidity-mortality, it may be more advantageous to produce more and varied offspring to increase fitness (e.g., bet-hedging; Ellis et al. 2009); hence, a fast-track of reproduction prioritizing quantity over quality may be beneficial. Traits associated with fast life history strategies that are more likely advantageous in environments high in harshness include higher impulsivity (vs. self-regulation), opportunistic behaviors, and a preference for immediate gratification (i.e., present- vs. future-oriented; Belsky et al. 1991; Chisholm 1999).

Effortful Control from an Evolutionary-Developmental Perspective

No one set of life history strategies or associated suite of traits is universally superior over another. Instead, an individual's development, physiology, and behavior are coordinated in context-specific ways that aim to enhance fitness under specific conditions (i.e., opportunities and constraints; Cabeza de Baca and Ellis 2017). EC, as a goal-oriented aspect of self-regulation integral to managing thoughts, actions, and emotions, may have a key role in directing and implementing these adaptive strategies (Wenner et al. 2013). Impulsivity (i.e., behavioral disinhibition and lack of future orientation; Ross and Hill 2002) systematically correlates with fast life history strategies and correlates (e.g., earlier intercourse and larger number of sexual partners; Copping et al. 2014; for review see Del Giudice 2014). Individuals favoring short- vs. long-term gains, and thus those lower in EC, may more effectively maximize fitness in environments with high rates of morbidity-mortality (Del Giudice 2015). Conversely, individuals who have developed slower life history strategies based on an anticipated environment with low morbidity-mortality, and thus whose behaviors are more future-oriented, are expected to be higher in EC. These individuals may be likely to favor larger future gains over smaller

immediate gains and therefore are more likely to inhibit goal-hindering behaviors and maintain focus and attention on future goals. Thus, natural selection for EC malleability and development in response to one's proximal environment—in particular, the early environment—could contribute to fitness outcomes (Blair and Raver 2012). Cues from the early childhood environment play a particular role in shaping the stress response system and areas of the brain related to EC, namely the prefrontal cortex, in context-specific ways (Blair 2010; Finegood and Blair 2017). EC develops rapidly in early childhood, beginning in toddlerhood and continuing through the early childhood years, with continued yet slower improvement through adolescence and young adulthood (Finegood and Blair 2017; Spinrad and Eisenberg 2015). Evidence for overall self-regulation stability into adulthood has been demonstrated in studies linking measures of childhood self-regulation (e.g., self-restraint, undercontrol, and delay of gratification) with related measures of self-regulation in adulthood (e.g., executive functions, self-control, and attentional control; for review see Spinrad and Eisenberg 2015). Thus, it is important to explore EC as a facultative trait in response to early experiences with a critical role in the implementation of life history strategies in adulthood.

It is well established across developmental science that early experiences affect development and later outcomes. Psychosocial acceleration theory suggests that early experiences serve as cues to the levels of morbidity-mortality in the anticipated environment that will host both opportunity and constraint (e.g., availability/scarcity of resources, and levels of selection and competition for mates) on future reproduction. The developing individual theoretically tracks these cues through an evolved physiological mechanism that then adjusts the individual's developmental trajectory (i.e., through allocating limited resources to aspects of bodily maintenance, growth, and reproduction), to best match him/her to the anticipated environment (Ellis et al. 2009). Thus, early experiences shape development to best match the individual to one's anticipated environment through trade-offs during development that likewise give rise to associated traits and behaviors (Belsky et al. 1991).

Influences on Development: Harsh and Unpredictable Environments

Two environmental characteristics that have emerged as distinct and unique predictors of development are levels of harshness and unpredictability (Ellis et al. 2009; Belsky et al. 2012). These cues regarding expected levels of morbidity-mortality in an anticipated environment (Ellis et al. 2009) are integral in the calibration of the stress response system (Del Giudice et al. 2011; Ellis and Del Giudice 2014) and play a role in the canalization of self-regulation (e.g., EC; Blair and Raver 2012). Although environments characterized by both harshness and unpredictability may predict life history strategies on the same side of the continuum, recent research suggests that harshness and unpredictability are unique predictors of development (Belsky et al. 2012; Blair and Raver 2012; Brumbach et al. 2009; Ellis et al. 2009; Hartman et al. 2018). Thus, harshness and unpredictability are potential predictors of life history strategies and related traits with implications for the development of EC. Yet, no studies to date explicitly investigate the link between experiences of harshness and unpredictability and EC development in early childhood.

Cues of harshness. Environments high in harshness may require a unique set of life history strategies to optimize development. EC, as an internal executive system of behavior control, may play a role in implementing such strategies (Wenner et al. 2013). Accelerated life history strategies, being present-oriented, and increased impulsivity and surgency (i.e., lower EC) may be adaptive given the opportunities and constraints of a harsh environment. Having a present vs. future orientation (i.e., associated with lower EC) may be advantageous, since delay

of gratification toward future goals may result in missed opportunities. In this context, lower inhibitory control and the inclination for impulsivity (e.g., a reactive vs. reflective approach to self-regulation; Blair and Raver 2012) may actually increase one's ability to be more competitive, resourceful, and opportunistic and, consequently, better secure available resources (Del Giudice 2015; Wenner et al. 2013).

Though economic harshness (i.e., SES) has been used in evolutionary-developmental research as a proxy of both early harshness and unpredictability, in recent studies SES has often been used as a proxy specifically of harshness alone (e.g., Belsky et al. 2012; Hartman et al. 2018; Mittal et al. 2015). Use of economic status in this way aligns with previous conclusions that even beyond a lack of resources (i.e., harsh survival conditions), economic harshness also seems to undermine the functionality and coping capabilities of the family and thus may be correlated with harsh family interactions and violence (Belsky et al. 1991, 2012; Ellis et al. 2009).

Beyond economic status, the most salient early cues come from the parent-child relationship. The developmental impact of harsh and neglectful parenting (and, conversely, responsive and sensitive parenting) in early childhood is well documented across disciplines, including as it is related to early EC development (e.g., Karreman et al. 2008; Kochanska et al. 2000; Lengua et al. 2007). Harsh and neglectful parenting may reflect low levels of parental investment in offspring (Belsky et al. 1991), which is also characterized by a lack of supportive, sensitive parenting. This fast parental life history strategy is theorized in turn to influence the development of offspring life history strategies and associated traits. Psychosocial acceleration theory suggests that children are particularly sensitive to parental investment efforts that serve to forecast the level of harshness (or supportiveness) of the local environment and direct life history strategies accordingly (Belsky et al. 1991; Chisholm 1999; Del Giudice et al. 2011; Ellis et al. 2009). This moves beyond the view that harsh environments simply undermine parenting and development. Instead, harsh early experiences may be facilitative in shaping development in ways aimed to best maximize fitness in anticipated harsh environments.

In addition to proximal experiences with harsh or neglectful parenting, harshness cues are also theorized to come from neighborhood characteristics, including observed high levels of local morbidity-mortality and exposure to violence (Brumbach et al. 2009; Ellis et al. 2009). Although previous studies have investigated the relationships between neighborhood disorder or neighborhood hazards and life history strategies and traits in adolescence and adulthood (e.g., timing of puberty, age at sexual debut, family size, parenting efforts; for review see Ellis et al. 2009), studies have not yet looked at the role of cues from neighborhood harshness in early childhood within an evolutionary-developmental framework. Understanding whether these cues are salient early in life would help guide future research questions.

Cues of unpredictability. Environments high in unpredictability impose a sense of uncertainty on the developing individual (e.g., unpredictability schema; Cabeza de Baca et al. 2016), which interferes with one's ability to solve the adaptive problem of avoiding risk (Brumbach et al. 2009) and may be an overlooked predictor of development (Ross and Hill 2002). A unique challenge to the development of life history strategies and associated traits that best optimize development specific to context is when the context itself is unpredictable (Ellis et al. 2009). Therefore, cues of unpredictability may have unique impacts on the early development of EC. Empirically, adults with early experiences higher in unpredictability responded to uncertain situations more impulsively, expressed a lower sense of control, and exhibited a lower rate of persistence as compared with individuals with more predictable early experiences (Mittal

and Griskevicius 2014). Delay of gratification and persistence are related to and mediated by sense of control (Mittal and Griskevicius 2014), and both are also self-regulatory aspects associated with EC (Rothbart and Bates 2006). In the face of unpredictability, accelerating reproduction—maintaining a present vs. future orientation in which impulsivity is favored over delay of gratification and inhibitory control (e.g., a reactive vs. reflective approach to self-regulation; Blair and Raver 2012)—may increase one's fitness (Wenner et al. 2013). This would include more risk-taking behaviors since future opportunities and rewards cannot be counted on, and therefore risks that may lead to immediate reward may be more appealing (Ross and Hill 2002). In childhood, parent reports of children's behavioral, emotional, and attention problems are associated with increased family unpredictability (Ross and Hill 2002). Therefore, accelerated life history traits, a present-orientation, and increased impulsivity and lower EC may also be adaptive given the opportunities and constraints of an unpredictable environment.

As for harshness, one of the most salient cues of unpredictability comes from parenting, such as with parental transitions (Ellis et al. 2009). Parental transitions early in life may be prompted by separation/divorce, death, remarriage/cohabitation, reconciliation, adoption, or removal of the child from the home (Ellis et al. 2009). Early experiences with parental instability may provide cues that people and the world are unpredictable or chaotic (Ross and Hill 2002). With parental transitions may come inconsistencies in rearing and attending to a child's needs, leading to an overall sense of unpredictability (Ross and Hill 2002). Specific to EC in early childhood, links have been found between inconsistent and chaotic rearing environments and lower EC and more present-oriented behaviors (Hardaway et al. 2012; Li et al. 2017; Martin et al. 2012), though research on these specific pathways is sparse. Accordingly, parental transitions as measured by father figures' transitions in and out of the home (i.e., paternal transitions) are included as independent variables in the current study.

In sum, the current study investigates variables representing cues of harshness (i.e., income-to-poverty ratio, harsh parenting, and neighborhood harshness) as well as a variable representing cues of unpredictability (i.e., paternal transitions) during the first 3 years of life as unique predictors of EC at 36 months. Investigating the impact of specific early cues of harshness and unpredictability on the development of EC may provide important information on which cues of adversity in the environment are particularly salient for this early-developing aspect of self-regulation.

Methods

The Building Strong Families Project (BSF; Wood et al. 2012) recruited couples from eight US communities. Eligibility requirements for participation included that couples were romantically involved but unmarried and were either expecting a baby together or had a baby born within the past 3 months. A total of 5,102 eligible couples were randomly assigned to the treatment or control group, in which the treatment aimed to increase couples' relationship skills. (For a full description of recruitment, assignment, and treatment procedures see Wood et al. 2012).

Information was collected from mothers and fathers at three time points: baseline (T_0) and 15 months (T_1), and 36 months (T_2) post-intervention. Direct assessments of EC along with parenting of mothers and fathers were collected at 36 months (T_2) during home visits in five of the original eight sites.

Sample

The present study used data from the 1,745 couples for whom both partners participated in direct observations of parenting (T_2). The intervention did not affect individual or family functioning

(Wood et al. 2012), and thus in the present study the intervention and control groups are combined, with intervention status used as a control variable.

In terms of demographic characteristics, 65% of fathers and 62% of mothers identified as black/African American, and 21% of fathers and 26% of mothers identified as white, while 16% of both mothers and fathers identified as Latina/o or Hispanic. Regarding education level, 59% of fathers and 61% of mothers reported having earned a high school diploma or equivalent certificate. Although there was no income-level requirement for participating in BSF, the aim of the program was to improve relationship skills of low-income, unmarried couples (Wood et al. 2012). Thus, the majority of the participants in the current study sample were low income. This is a particularly important population for the theoretical perspective outlined above since many studies tend to be biased with more economically advantaged samples. In the current sample, median income for fathers reported at T_0 was $10,000–14,999, whereas for mothers it was $1,000–4,999. Low income level for mothers at T_0 represents a high rate of unemployment (reported as 64% at T_0), likely explained by unpaid maternity leave or unemployment at the birth of their child. See Table 1 for study variable descriptive statistics.

Treatment of Missing Data

As with most longitudinal studies, not all participants provided all information at all time points. Across the 12 study variables used in the analyses, the missing data proportions ranged between 11 and 57%. Based on missing data analyses, data were determined to be missing by race/ethnicity and parent gender. Therefore, data were determined to be missing at random. In order to preserve all couples' data and maintain statistical power, missing data were treated with multiple imputation using a chained equation method using the Mice package in R version 3.3.2 (Enders 2010).

Multiple imputation using chained equations is an iterative process that uses regression to estimate missing data (Enders 2010). Multiple imputation is "state of the art" in handling missing data because it not only preserves all data but also addresses biased (co)variances, *p* values, and confidence intervals, and improves the power of the analyses compared with other missing data techniques (Enders 2010; Schafer and Graham 2002; van Ginkel et al. 2019), particularly when imputation is done at the item level for measures using questionnaires (Gottschall et al. 2012), as in the current study. Baseline covariates, survey responses from the other partner, along with the data provided by the individual for related variables were used to calculate a predictor matrix within the imputation model to produce estimates. Predicted values plus random disturbance terms were used to impute values for missing data so that all cases were complete. Twenty plausible replacement values were imputed for each missing value as recommended by Enders (2010), and then analyses were conducted on all 20 plausible data sets. Final estimates for study analyses were obtained by pooling the results from the 20 analyses using Rubin's (1987) formulas.

Measures

Harshness. Cues of harshness measures include aspects of economic harshness, harsh parenting, and neighborhood harshness. First, an income-to-poverty ratio (i.e., the ratio of household income to poverty threshold determined by total number of household dependents) was calculated using monthly income data collected from mothers and fathers at $T_1$and T_2 for the child's primary household. We considered using a composite of the two time points, but given the notable decrease in the income-to-poverty ratio from T_1 to T_2 in the current sample, T_1 and T_2 values were preserved as individual predictors in the analyses. Further, from a developmental standpoint, it is possible that poverty as an environmental cue experienced at 15 months may

have different effects than poverty at 36 months (National Institute of Child Health and Development Early Child Care Research Network 2005). If mothers and fathers reported living together all or most of the time, monthly income was combined. Monthly income calculations were consistent with the US Census Bureau (2013) definitions of income in the supplemental poverty measure. Monthly income was then divided by the poverty guidelines for the years of data collection and for the appropriate family size (US Department of Health and Human Services 2008).

Next are the three measures used for harsh parenting: observed unresponsiveness for mothers and fathers, observed harsh parenting for mothers and fathers, and self-reported use of harsh discipline by mothers and fathers. Observed unresponsiveness and harsh parenting for mothers and fathers was independently coded by 18 trained coding staff based on videotaped parent-child interactions during a Two-Bags Task semi-structured play session in the child's home at 36 months with 90% interrater reliability. Mother-child and father-child semi-structured play sessions were conducted and coded separately using a coding schema consistent with other studies of economically disadvantaged mothers and fathers (Cabrera et al. 2007). Observed unresponsiveness consisted of the average of five items coded on a 7-point scale (from *very low* to *very high*): (1) parental positive regard (reversed), (2) quality of the relationship (reversed), (3) parental sensitivity (reversed), (4) parental cognitive stimulation (reversed), and (5) parental detachment (α = .86, .73 for mothers and fathers, respectively). Observed harsh parenting consisted of the average of two items coded on a 7-point scale: (1) parental negative regard and (2) parental intrusiveness. Mothers' and fathers' reported use of harsh discipline were based on seven self-report items at T_2 from the Conflict Tactic Scale: Parent Child Version (Straus et al. 1998) used to calculate a total score (range 0–7) for mothers and fathers (α = .71, .69, respectively). The seven items correspond to seven self-reported yes/no questions regarding harsh discipline tactics used within the past month (e.g., child was slapped on face, head, or ears) by the mother or father (α = .63, .58, respectively).

Finally, eight interviewer-rated items were summed to create a total neighborhood harshness score. These items were independently rated by the interviewer following the direct assessment home visit at T_2. Sample items and scaled responses include "How would you rate the general condition of most of the housing units or other buildings in the face-block?" (1 = Well kept, good repair; 2 = Fair condition; 3 = Poor condition; 4 = Badly deteriorated) and "Are there drug-related paraphernalia, condoms, beer or liquor containers or packaging, cigarette butts or discarded cigarette packages in the street or on the sidewalk?" (1 = None, or almost none; 2 = Yes, but not a lot; 3 = Yes, quite a bit; 4 = Yes, just about everywhere). Since the items did not use a consistent response scale, the item responses were first standardized and then summed to arrive at a total neighborhood harshness score (α = .82).

Unpredictability. Cues of unpredictability are represented in the current study by a measure of paternal transitions, measured as father figures' (i.e., biological father, mother's new partner) coresidential transitions into and out of the child's home. The number of father-figure coresidential transitions was based on coresidence information collected from mothers at T_0, T_1, and T_2 regarding their current coresidence with the child's biological father and/or mother's new partner. Possible responses to questions regarding coresidence (e.g., Do you currently live in the same household as the father?) were on a 4-point scale which consisted of *all of the time, most of the time, some of the time,* or *never/none of the time*. Unpredictability resulting from paternal transitions at each time point was created as a binary variable for which 0 represents no change in response between consecutive time points (i.e., predictable) and 1 represents a change in

response between time points (i.e., unpredictable). These scores for mother/father and mother/new partner were then summed across time points, with possible unpredictability scores ranging from 0 to 4.

Effortful control. The dependent variable was calculated as a composite score of four interviewer-rated items measured during the direct observation portion of data collection at T_2: task persistence, attention span, body movement (reversed), and attention to directions. Interviewers were instructed upon completing the direct observation visit to rate the child's behavior and overall attitude during the Peabody Picture Vocabulary Test (a language assessment not included in the present study) and Walk the Line (a behavioral assessment within a multitask battery that is used to assess EC; Zhou et al. 2012) assessments. These items were adapted by the original BSF evaluation team from items included in the Leiter-R Social-Emotional Examiner Rating Scales (Roid and Miller 1997). Each item was scored on a 4-point scale specific to the item. For example, possible ratings for attention span were 1, *easily distracted*, 2, *some distraction with noise or movement of others*, 3, *attends with assessor direction*, and 4, *focuses attention voluntarily*. To create a composite score, all four items were averaged ($\alpha = .86$).

Analyses

To investigate the independent effects of each cue of harshness and unpredictability on EC, a multiple regression model using ordinary least squares was estimated. Using multiple regression allows for entering each individual predictor simultaneously, and therefore results represent the independent effect of each predictor controlling for all other predictors. Given the potential relationships among cues of harshness and cues of unpredictability, multicollinearity was tested. Specifically, variance inflation factors (*VIF* for all variables < 4; mean *VIF* = 1.54) and tolerance tests (*Tolerance* for all variables > .2) were conducted on the model and indicated that the model is unlikely to be confounded by multicollinearity (Bowerman and O'Connell 1990; Menard 2002).

Results

Bivariate correlations are presented in Table 1. Among the selected predictors, EC showed small but statistically significant correlations in the expected (i.e., negative) direction with observed unresponsive parenting for both mothers ($r = -.25$, $p < .001$) and fathers ($r = -.15$, $p < .001$), observed harsh parenting for both mothers ($r = -.19$, $p < .001$) and fathers ($r = -.13$, $p < .001$), and neighborhood harshness ($r = -.13$, $p < .001$). The majority of harshness variables were statistically significantly correlated with one another. Interestingly, though mother's and father's reported harsh discipline was positively correlated ($r = .27$, $p < .001$), harsh discipline for mothers and fathers was not significantly correlated with the majority of the other harshness variables. In terms of the variable representing cues of unpredictability, paternal transitions, there was a statistically significant positive correlation with mother's and father's harsh parenting, and a statistically significant negative correlation with father's harsh discipline. In other words, more paternal transitions were associated with less harsh discipline from fathers.

The summary of the multiple regression analysis is shown in Table 2. The model explained about 15% of the variation in EC ($R^2 = .15$). Multiple independent cues of harshness were statistically significant predictors of EC. Specifically, observed unresponsiveness for mothers ($\beta = -0.17$, $p < .001$) and fathers ($\beta = -0.07$, $p < .001$) negatively predicted EC. Observed harsh parenting from mothers ($\beta = -0.09$, $p < .001$) predicted EC, but this was not the case for harsh parenting from fathers, which did not statistically significantly predict EC.

Neighborhood harshness (β = −0.09, $p < .001$) also negatively predicted EC. Paternal transitions (i.e., cues of unpredictability) also statistically significantly predicted EC at 36 months (β = 0.08, $p < .05$), but the effect was not in the expected direction, such that experiencing more paternal transitions was associated with higher EC scores.

Discussion

Based on psychosocial acceleration theory, the current study hypothesized that early cues of harshness and unpredictability shape individuals along a continuum of higher to lower EC (i.e., higher impulsivity) depending on what is more adaptive given the expected proximal environment. This study investigated early cues of harshness and unpredictability independently to identify which cues in early childhood take part in adaptively shaping EC. Cues of harshness from parenting and neighborhood statistically significantly predicted EC in the expected direction (i.e., predicted lower EC), while cues of unpredictability from paternal transitions statistically significantly predicted EC in the opposite direction (i.e., predicted higher EC).

Observed Unresponsive and Harsh Parenting Predicts Effortful Control

The results corroborate previous research linking unresponsive and harsh parenting and the development of children's self-regulation, including EC, and place it within an evolutionary-developmental framework. In the current study, observed unresponsive parenting from both mothers and fathers, and harsh parenting from mothers (though not harsh discipline), predicted lower EC in children at age 3. Caregiving from parents is proposed as the most direct communication to children about the levels of supportiveness and harshness in the surrounding environment (Belsky et al. 1991; Chisholm 1999; Ellis et al. 2009). Unresponsive and harsh parenting may direct developmental trajectories toward traits that better equip the individual for successful future reproduction in an environment higher in risk and lower in support and resources (Belsky et al. 1991; Chisholm 1999; Ellis et al. 2009). Regarding aspects of self-regulation, higher impulsivity and being present- (vs. future-) oriented may be more adaptive in such environments than having higher EC. Importantly, the findings regarding unresponsive parenting were consistent for mothers and fathers tested within the same model, suggesting that both parents are providing independent cues of environmental harshness and supportiveness to their young children. The effect sizes were larger for mothers than for fathers, likely reflecting that mothers were the residential parent in all families in the sample. This more-consistent exposure to mothers' parenting may also speak to the statistically significant results for mothers' harsh parenting but not fathers; however, more work in this area is needed.

Whereas observed unresponsive and harsh parenting both emerged as statistically significant predictors for EC, self-reported use of harsh discipline did not. One explanation may be the self-report measure itself and the potential for parents to be inaccurate reporters of their use of socially undesirable discipline practices (e.g., slapping their child). In addition, harsh discipline may represent relatively rare behaviors whereas observed harsh and unsupportive parenting likely represent consistent parenting behaviors or styles to which children are regularly exposed, and therefore these behaviors may be more pervasive and salient environmental cues. When the associations between reported use of harsh discipline and observed measures of unresponsive and harsh parenting are inspected, only mother's reported use of harsh discipline had a statistically significant relationship with mother's observed unresponsive parenting, but in the inverse direction. In other words, the more unresponsive a mother was observed to be in her interactions with her child, the less likely she reported using harsh discipline with the child. However, there was a significant positive association between mother's observed unresponsiveness and mother's observed harsh parenting.

Neighborhood Harshness Predicts Effortful Control

Aspects of neighborhood harshness may serve as important cues early in development that aim to direct developmental trajectories in ways to best match the individual to the environment through a process of conditional adaptation (Belsky et al. 1991; Ellis et al. 2009). In the current study, neighborhood harshness (e.g., condition of the housing block) surfaced as a statistically significant predictor of EC at 36 months even when controlling for aspects of parenting and income, though the mechanisms through which this occurs are unclear. Beyond SES, no other line of research has investigated the impact of neighborhood harshness itself on young children's development of self-regulation. In addition to directing lower levels of parental investment (Nettle 2010), these cues may serve to provide information to the developing individual about the levels of local morbidity-mortality (Ellis et al. 2009). In harsh and unsupportive environments, impulsivity (rather than higher EC) may be more adaptive (Del Giudice 2015). Thus, theoretically, these cues of neighborhood harshness may take part both directly and indirectly in shaping individual trajectories toward higher impulsivity and, therefore, lower EC. Investigating the potential mediating relationship of parenting behaviors between neighborhood harshness and children's EC could further explain the mechanisms connecting cues from neighborhood and children's early development. Although beyond the scope of the present study, this is an important area for future research.

Although studies explicitly investigating harshness and unpredictability in relation to outcomes in early childhood have yet to emerge, there is abundant research examining the impact of cumulative risk on early childhood development using models of allostatic load (for review see Lengua 2012). The finding that environments with lower SES are associated with lower levels of self-regulation in children is well documented. However, in contrast to the existing literature (Lengua 2012), in the current study neighborhood harshness emerged as a significant predictor of EC whereas financial harshness (i.e., income-to-poverty ratio) did not. Given the income levels in the current sample are somewhat homogeneous (Wood et al. 2010), there may be insufficient variation to detect a significant relationship with EC. One additional important detail that needs to be acknowledged is that both EC and neighborhood harshness were rated by the interviewer at the T_2 direct observation visit. This raises the concern of common method variance. Importantly, there were significant negative correlations between income-to-poverty rates at both T_1 and T_2 (as reported by parents) and interviewer-rated neighborhood harshness (i.e., higher income-to-poverty ratios correlated with lower neighborhood harshness, as expected).

Cues of Unpredictability and Effortful Control

Emerging research suggests that cues from unpredictable environments may be distinct from cues of harshness and may uniquely influence phenotypic development of life history strategies and associated traits (Belsky et al. 2012; Ellis et al. 2009; Hartman et al. 2018). In the current study, cues of unpredictability from paternal transitions emerged as a statistically significant predictor of EC, albeit in the opposite direction. Transitions in and out of the residential home by father figures were expected to indicate higher levels of unpredictability and consequently lower EC. Hartman et al. (2018) found paternal transitions over a child's first 5 years to be the most consistent predictor (as compared with residential transitions and parent occupational changes) of life-history-strategy-related traits and behaviors, including self-reported present- (vs. future-) orientation among adolescents. There are, however, key differences between the current study and that of Hartman and colleagues. First is the frequency and total number of data collection time points: paternal unpredictability in the study by Hartman and colleagues was measured in 3-

month intervals for 5 years, whereas the current study only allowed for three collection points through the child's third year. This difference may contribute to a lack of ability to see the true pattern of unpredictability via paternal transitions which may be experienced more frequently for some children than was measured. Next, whereas frequency of paternal transitions in the Harman and colleagues' study significantly predicted weaker future orientation for economically and ethnically diverse adolescents, the current study sample measures outcomes during early childhood, a distinctly different time in child development, in a more economically homogenous sample of children born into unmarried, low-income families. These developmental and sample differences may explain differences in effects.

In addition, paternal figures transitioning out of the household may actually represent a shift in harshness. A study on interparental conflict by Kopystynska et al. (2017) using the same BSF data indicated that couples at greatest risk for ending their relationships were those that included mothers who used destructive conflict behaviors with her partner, or where both mothers and fathers used destructive behaviors during conflict with their partners. In the BSF sample, children in homes with destructive conflict behaviors from both partners also exhibited less emotional insecurity (i.e., a child's feeling of security and safety; Kopystynska et al. 2017). Thus, the impact of paternal transitions within this population may be indicating a shift to lower interparental destructive conflict (i.e., harshness) in the residential environment, and thus a potential shift in environmental cues. Given the multiple questions raised by these results, further work investigating paternal transitions in early childhood across multiple, frequent time points would help unpack the impact of this early environmental cue for this population.

Another potential explanation for the lack of significant negative associations between unpredictability and EC in the current study may be related to the measurement of EC itself. A recent study by Sturge-Apple et al. (2017) found statistically significant associations between family instability (i.e., caregiver changes, residential changes, caregiver intimate relationship changes, job/income loss, and family member deaths) and EC at ages 4 and 6. However, these associations were only found with "hot EC" (e.g., delay of gratification) and not with "cool EC" (e.g., inhibitory control). Sturge-Apple and colleagues interpret these results as indicating that early environments characterized by unpredictability are more salient to hot EC. These results reinforce the importance of present vs. future orientation such that impulsivity, as opposed to EC, might be more adaptive in an environment where future reward opportunities are not reliable. In the current study, no distinctions were made between these types of EC processes. Delineating between hot and cool EC, in addition to operationalizing an objective measure of the construct, may yield different results.

Limitations and Future Directions

This study reframed the relationship between early adverse experiences and EC development within an evolutionary-developmental framework—namely, psychosocial acceleration theory (Belsky et al. 2012). Further, this study used a sample from a large national longitudinal data set with a multimethod, multi-reporter approach that contributed information on the role of parenting by both mothers and fathers in children's development.

Despite these considerable strengths, there are also some limitations to the current study that should be acknowledged and that serve as recommendations for future studies. The current study sample was somewhat homogenous in income (Wood et al. 2012), with the majority of families experiencing financial harshness at the US Census poverty level. Studying this population of families under the harshness and unpredictability framework provides an important opportunity to understand how early environmental cues are "communicated" to young children

growing up in circumstances with potentially higher aspects of both harshness and unpredictability. However, this does provide a limitation in terms of generalizability whereby cues of harshness and unpredictability in other contexts may be relayed differently and may impact EC in context-specific ways. Future studies would benefit from having a more diverse sample with greater variation in financial harshness and EC to better investigate aspects of early harshness as predictors of EC. Further, a recent study by Li et al. (2018) suggests that exploring the effects of harshness by unpredictability interactions (e.g., financial harshness × financial unpredictability) on young children's development, including young children's social skills, may be important to explore further. Additional limitations of the current study relate to the dependent variable. EC was potentially biased in its measurement since it was interview-rated based on overall observations at T_2. Further, as noted previously, using objective assessment of both hot and cold EC processes would improve the methodological rigor in future studies.

Finally, though unresponsive and harsh parenting observed for mothers and fathers, as well as neighborhood harshness, were significant predictors in the current study, they each only weakly predicted EC. Psychosocial acceleration theory makes a case for environmental influences on development, but one must consider the genetic components of EC, and the argument that much (or most) of the predictive power of harsh parenting and neighborhoods was actually attributable to genetic predisposition (Friedman et al. 2008). Future studies investigating environmental cues and development will benefit from considering the role of environment and genetics in phenotypic development.

Future studies should aim to build on the current findings linking parenting and neighborhood harshness with children's EC. For example, future investigations should consider potential mechanisms that link sensitive, responsive parenting (or the lack thereof) and the development of children's self-regulatory strategies. Testing potential mediators that link neighborhood harshness and EC would provide further explanations on how these early cues shape development.

Conclusion

Using psychosocial acceleration theory, this multimethod, multi-reporter study sought to demonstrate which specific indicators of early harshness and unpredictability are involved in shaping the development of EC to best match the individual to the environment, thereby conceptualizing EC as a facultative trait with implications for adult life history strategies. Results suggest that during early childhood, cues about environmental harshness and unpredictability come from mothers' and fathers' observed unresponsive parenting, mothers' harsh parenting, neighborhood harshness, and paternal transitions, specifically when investigating EC development among US children from low-income families. Based on psychosocial acceleration theory, cues from the environment (e.g., from parenting and the neighborhood) in early childhood provide information to the developing individual regarding local levels of morbidity-mortality. These cues then have an impact on development, which is malleable and subject to conditional adaptation (Belsky et al. 1991). Although we might expect the cues present in the family environment to be strongest in early childhood given the consistent direct exposure, the findings suggest that young children may be sensitive to environmental cues beyond the family, such as neighborhood harshness. Importantly, neighborhood conditions are a salient aspect of the local ecology even to young children who may rarely be unaccompanied in the neighborhood environment, but who may read parental cues regarding fear or safety or be given neighborhood safety rules to follow. In fact, this tangible ecological context may be a stronger cue for children than less-tangible aspects of the harsh environments such as actual morbidity and mortality rates.

Whereas previous empirical studies used an evolutionary-developmental framework to investigate the relationship between early cues of harshness and unpredictability and outcomes in adolescence and adulthood, few studies to date use this perspective to focus on developmental outcomes in early childhood. The current study contributes to the literature by identifying salient cues of environmental harshness and unpredictability during early childhood that serve as predictors of life-history-related traits (i.e., EC/impulsivity), particularly in a low-income population. Future studies should investigate the specific mechanisms underlying these early cues of harshness during early childhood further to continue to probe their potential in shaping adaptive self-regulatory strategies in young children.

Acknowledgments We want to thank Tomàs Cabeza de Baca for his helpful feedback on a previous version of this manuscript. Preliminary results from this research were presented during the 2018 National Research Conference on Early Childhood in a poster titled “Early Life Harshness & Unpredictability: Adaptively Shaping Young Children’s Effortful Control.”

References

Barkley, R. A. (2001). The executive functions and self-regulation: An evolutionary neuropsychological perspective. *Neuropsychology Review*, *11*(1), 1-29.

Belsky, J., Schlomer, G. L., & Ellis, B. J. (2012). Beyond cumulative risk: Distinguishing harshness and unpredictability as determinants of parenting and early life history strategy. *Developmental Psychology*, *48*(3), 662-673.

Belsky, J., Steinberg, L., & Draper, P. (1991). Childhood experience, interpersonal development, and reproductive strategy: An evolutionary theory of socialization. *Child Development*, *62*(4), 647-670.

Blair, C. (2010). Stress and the development of self-regulation in context. *Child Development Perspectives*, *4*(3), 181–188.

Blair, C., & Raver, C. C. (2012). Individual development and evolution: Experiential canalization of self-regulation. *Developmental Psychology*, *48*(3), 647-657.

Bowerman, B. L., & O'Connell, R. T. (1990). *Linear statistical models: An applied approach*. Grove: Brooks/Cole.

Bjorklund, D. F., & Ellis, B. J. (2014). Children, childhood, and development in evolutionary perspective. *Developmental Review*, *34*(3), 225-264.

Bridgett, D. J., Oddi, K. B., Laake, L. M., Murdock, K. W., & Bachmann, M. N. (2013). Integrating and differentiating aspects of self-regulation: Effortful control, executive functioning, and links to negative affectivity. *Emotion*, *13*(1), 47-63.

Brumbach, B. H., Figueredo, A. J., & Ellis, B. J. (2009). Effects of harsh and unpredictable environments in adolescence on development of life history strategies: A longitudinal test of an evolutionary model. *Human Nature*, *20*(1), 25-51.

Cabeza de Baca, T., & Ellis, B. J. (2017). Early stress, parental motivation, and reproductive decision-making: applications of life history theory to parental behavior. *Current Opinion in Psychology*, *15*, 1-6.

Cabeza de Baca, T., Barnett, M. A., & Ellis, B. J. (2016). The development of the child unpredictability schema: Regulation through maternal life history trade-offs. *Evolutionary Behavioral Sciences*, *10*(1), 43.

Cabrera, N. J., Shannon, J. D., & Tamis-LeMonda, C. (2007). Fathers' influence on their children's cognitive and emotional development: From toddlers to pre-K. *Applied Developmental Science*, *11*(4), 208-213.

Chisholm, J. S. (1999). *Death, hope and sex: Steps to an evolutionary ecology of mind and morality*. New York: Cambridge University Press.

Copping, L. T., Campbell, A., & Mincer, S. (2014). Conceptualizing time preference: A life-history analysis. *Evolutionary Psychology*, *12*(4), 829-847.

Del Giudice, M. (2014). An evolutionary life history framework for psychopathology. *Psychological Inquiry*, *25*(3–4), 261–300.

Del Giudice, M. (2015). Self-regulation in an evolutionary perspective. In G. H. E. Gendolla, M. Tops, & S. L. Koole (Eds.), *Handbook of biobehavioral approaches to self-regulation.* (pp. 25–41). New York: Springer Science + Business Media.

Del Giudice, M., Ellis, B. J., & Shirtcliff, E. A. (2011). The Adaptive Calibration Model of stress responsivity. *Neuroscience and Biobehavioral Reviews*, *35*(7), 1562-1592.

Diamond, A. (2006). The early development of executive functions. In E. Bialystok & F. I. M. Craik (Eds.), *Lifespan cognition: Mechanisms of change.* (pp. 70–95). New York: Oxford University Press.

Diamond, A. (2013). Executive functions. *Annual Review of Psychology*, *64*, 135-168.

Ellis, B. J., & Del Giudice, M. (2014). Beyond allostatic load: Rethinking the role of stress in regulating human development. *Development and Psychopathology*, *26*(1), 1-20.

Ellis, B. J., Figueredo, A. J., Brumbach, B. H., & Schlomer, G. L. (2009). Fundamental dimensions of environmental risk: The impact of harsh vs. unpredictable environments on the evolution and development of life history strategies. *Human Nature*, *20*(2), 204-268.

Enders, C. K. (2010). *Applied missing data analysis*. New York: Guilford Press.

Finegood, E. D., & Blair, C. (2017). Poverty, parent stress, and emerging executive functions in young children. In K. Deater-Deckard & R. Panneton (Eds.), *Parental stress and early child development: Adaptive and maladaptive outcomes.* (pp. 181–207). Cham: Springer International.

Frankenhuis, W. E., & de Weerth, C. (2013). Does early-life exposure to stress shape or impair cognition? *Current Directions in Psychological Science, 22*(5), 407-412.

Friedman, N. P., Miyake, A., Young, S. E., DeFries, J. C., Corley, R. P., & Hewitt, J. K. (2008). Individual differences in executive functions are almost entirely genetic in origin. *Journal of Experimental Psychology: General, 137*(2), 201-225.

Gottschall, A. C., West, S. G., & Enders, C. K. (2012). A comparison of item-level and scale-level multiple imputation for questionnaire batteries. *Multivariate Behavioral Research, 47*(1), 1–25.

Hardaway, C. R., Wilson, M. N., Shaw, D. S., & Dishion, T. J. (2012). Family functioning and externalizing behaviour among low-income children: Self-regulation as a mediator. *Infant and Child Development, 21*(1), 67–84.

Hartman, S., Sung, S., Simpson, J. A., Schlomer, G. L., & Belsky, J. (2018). Decomposing environmental unpredictability in forecasting adolescent and young adult development: A two-sample study. *Development and Psychopathology*, 30(4), 1321-1332.

Karoly, P. (1993). Mechanisms of self-regulation: A systems view. *Annual Review of Psychology, 44,* 23-52.

Karreman, A., van Tuijl, C., van Aken, M. A. G., & Deković, M. (2008). Parenting, coparenting, and effortful control in preschoolers. *Journal of Family Psychology, 22*(1), 30–40.

Kochanska, G., Murray, K. T., & Harlan, E. T. (2000). Effortful control in early childhood: Continuity and change, antecedents, and implications for social development. *Developmental Psychology, 36*(2), 220–232.

Kopystynska, O., Paschall, K. W., Barnett, M. A., & Curran, M. A. (2017). Patterns of interparental conflict, parenting, and children's emotional insecurity: A person-centered approach. *Journal of Family Psychology, 31*(7), 922–932.

Lengua, L. J. (2012). Poverty, the development of effortful control, and children's academic, social, and emotional adjustment. In V. Maholmes & R. B. King (Eds.), *The Oxford handbook of poverty and child development.* (pp. 491–511). New York: Oxford University Press

Lengua, L. J., Honorado, E., & Bush, N. R. (2007). Contextual risk and parenting as predictors of effortful control and social competence in preschool children. *Journal of Applied Developmental Psychology*, *28*(1), 40–55.

Li, Z., Liu, S., Hartman, S., & Belsky, J. (2018). Interactive effects of early-life income harshness and unpredictability on children's socioemotional and academic functioning in kindergarten and adolescence. *Developmental Psychology, 54*(11), 2101–2112.

Li, M., Riis, J. L., Ghazarian, S. R., & Johnson, S. B. (2017). Income, family context, and self-regulation in 5-year-old children. *Journal of Developmental and Behavioral Pediatrics*, *38*(2), 99–108.

Martin, A., Razza, R. A., & Brooks-Gunn, J. (2012). Specifying the links between household chaos and preschool children's development. *Early Child Development and Care*, *182*(10), 1247–1263.

Menard, S. (2002). *Applied logistic regression analysis* (Vol. 106). Sage.

Mittal, C., & Griskevicius, V. (2014). Sense of control under uncertainty depends on people's childhood environment: A life history theory approach. *Journal of Personality and Social Psychology*, *107*(4), 621-637.

Mittal, C., Griskevicius, V., Simpson, J. A., Sung, S., & Young, E. S. (2015). Cognitive adaptations to stressful environments: When childhood adversity enhances adult executive function. *Journal of Personality and Social Psychology*, *109*(4), 604-621.

National Institute of Child Health and Human Development Early Child Care Research Network. (2005). Duration and developmental timing of poverty and children's cognitive and social development from birth through third grade. *Child Development*, 76(4), 795-810.

Nettle, D. (2010). Dying young and living fast: Variation in life history across English neighborhoods. *Behavioral Ecology*, *21*(2), 387-395.

Roid, G. H., & Miller, L. J. (1997). *Examiners' manual: Leiter International Performance Scale, revised.* Chicago: Stoelting.

Ross, L. T., & Hill, E. M. (2002). Childhood unpredictability, schemas for unpredictability, and risk taking. *Social Behavior and Personality*, *30*(5), 453-473.

Rothbart, M. K., & Bates, J. E. (2006). Temperament. In N. Eisenberg, W. Damon, & R. M. Lerner (Eds.), *Handbook of child psychology: Social, emotional, and personality development* (Vol. 3, sixth ed., pp. 99–166). Hoboken, NJ: John Wiley & Sons.

Rothbart, M. K., & Derryberry, D. (2002). Temperament in children. In C. von Hofsten & L. Bäckman (Eds.), *Psychology at the turn of the millennium, vol. 2: Social, developmental, and clinical perspectives* (pp. 17–35). Florence, KY: Taylor & Frances/Routledge.

Rothbart, M. K., & Rueda, M. R. (2005). The development of effortful control. In U. Mayr, E. Awh, & S. W. Keele (Eds.), *Developing individuality in the human brain: A tribute to Michael I. Posner* (pp. 167–188). Washington, DC: American Psychological Association.

Rothbart, M. K., Ahadi, S. A., & Hershey, K. L. (1994). Temperament and social behavior in childhood. *Merrill-Palmer Quarterly*, *40*(1), 21-39.

Rothbart, M. K., Ahadi, S. A., Hersey, K. L., & Fisher, P. (2001). Investigations of temperament at three to seven years: The Children's Behavior Questionnaire. *Child Development, 72*(5), 1394-1408.

Rubin, D. B. (1987). *Multiple imputation for nonresponse in surveys*. Hoboken, NJ: Wiley.

Schafer, J. L., & Graham, J. W. (2002). Missing data: Our view of the state of the art. *Psychological Methods, 7*(2), 147-177.

Spinrad, T. L. & Eisenberg, N. (2015). Effortful control. In R. A. Scott & S. M. Kosslyn (Eds.), *Emerging Trends in the Social and Behavioral Sciences* (pp. 1-11). Hoboken: Wiley.

Straus, M. A., Hamby, S. L., Finkelhor, D., Moore, D. W., & Runyan, D. (1998). Identification of child maltreatment with the Parent–Child Conflict Tactics Scales: Development and psychometric data for a national sample of American parents. *Child Abuse & Neglect, 22*(4), 249–270.

Sturge-Apple, M. L., Davies, P. T., Cicchetti, D., Hentges, R. F., & Coe, J. L. (2017). Family instability and children's effortful control in the context of poverty: Sometimes a bird in the hand is worth two in the bush. *Development and Psychopathology*, 29(3), 685-696.

US Census Bureau. (2013). *How census measures poverty*. Retrieved from https://www.census.gov/content/dam/Census/library/visualizations/2014/demo/poverty_measure-how.pdf

US Department of Health and Human Services. (2008). *Federal Register*, Vol. 73, No. 15 (FR Doc. 08-256), pp. 3971-3972. Washington, DC: US Government Printing Office.

van Ginkel, J. R., Linting, M., Rippe, R. C. A., & van der Voort, A. (2019). Rebutting existing misconceptions about multiple imputation as a method for handling missing data. *Journal of Personality Assessment*. https://doi-org.ezproxy2.library.arizona.edu/10.1080/00223891.2018.1530680.

Wenner, C. J., Bianchi, J., Figueredo, A. J., Rushton, J. P., & Jacobs, W. J. (2013). Life history theory and social deviance: The mediating role of executive function. *Intelligence, 41*(2), 102-113.

Wood R. G., Moore Q., Clarkwest A., Killewald A., Monahan S. (2012). *The long-term effects of Building Strong Families: A relationship skills education program for unmarried parents* (OPRE Report # 2012-28A). Washington, DC: Office of Planning, Research and Evaluation, Administration for Children and Families, US Department of Health and Human Services (OPRE).

Zhou, Q., Chen, S. H., & Main, A. (2012). Commonalities and differences in the research on children's effortful control and executive function: A call for an integrated model of self-regulation. *Child Development Perspectives*, *6*(2), 112-121.

Shannon M. Warren, MS, is a doctoral student in the Family Studies and Human Development at The University of Arizona. Her research interests are in early childhood development with specific focus on adaptive self-regulatory processes and building adult capacities to support early childhood development. She brings an evolutionary theoretical perspective on development to her work with an interest in informing intervention, policy, and educational practices.

Melissa A. Barnett, PhD, is an associate professor in the Family Studies & Human Development and the Norton Endowed Chair in Fathers, Parenting and Families in the Norton School of Family & Consumer Sciences at the University of Arizona. Her program of research aims to identify strengths and sources of resilience that bolster the development of young

children from economically disadvantaged and other marginalized communities. She focuses on the relationships young children engage in with caregivers, including parents, grandparents and teachers.

Table 1. Descriptive Statistics and Bivariate Correlations (Post-Imputation).

	M (SD)	1	2	3	4	5	6	7	8	9	10	11
1. Child's sex												
2. Income:poverty, T_1	0.99 (1.81)	.01										
3. Income:poverty, T_2	0.77 (0.75)	.00	.16***									
4. Unresponsive parenting (M)	4.14 (0.86)	−.06*	−.07	−.15***								
5. Unresponsive parenting (F)	3.88 (0.76)	−.02	−.06	−.12**	.26***							
6. Harsh parenting (M)	2.72 (0.97)	−.08**	−.05	−.11***	.49***	.13***						
7. Harsh parenting (F)	2.62 (0.97)	−.06	−.04	−.02	.16***	.50***	18***					
8. Harsh discipline (M)	1.53 (1.52)	−.04	.04	.09**	−.06*	−.02	.02	.01				
9. Harsh discipline (F)	1.38 (1.51)	−.10***	.05	.10***	−.04	−.03	.00	.05	.27***			
10. Harsh neighborhood[a]	6.50 (1.80)	.01	−.07**	−.15***	.14***	.12***	.11***	.04	−.08**	−.04		
11. Paternal Transitions	1.09 (0.99)	−.06*	−.10***	−.13***	.04	.05	.12***	.08*	.00	−.13***	.03	
12. Effortful control	2.93 (0.76)	.21***	.02	.05	−.25***	−.15***	−.19***	−.13***	.00	−.04	−.13***	.05

Multiple imputation of study variables may result in out-of-range values. M = mother, F = father, T_1 = 15 months, T_2 = 36 months.
* $p < .05$. ** $p < .01$. *** $p < .001$.
a Sums of standardized values are displayed.

Table 2. Summary of Hierarchical Regression Results.

Predictor	*b*	SE	β
Constant	2.17	0.22	—
Controls			
Child's sex	0.31***	0.04	0.20
Race, white (M)	−0.18*	0.07	−0.12
Race, white (F)	−0.02	0.08	−0.02
Race, other (M)	−0.14	0.10	−0.04
Race, other (F)	−0.04	0.10	−0.01
Hispanic (M)	0.11	0.08	0.06
Hispanic (F)	0.13	0.08	0.07
Site 2	−0.03	0.05	−0.02
Site 3	−0.33***	0.09	−0.12
Site 4	−0.15*	0.07	−0.07
Site 5	−0.01	0.06	−0.00
Intervention	0.01	0.03	0.01
Harshness			
Income:poverty (T_1)	0.00	0.01	0.00
Income:poverty (T_2)	0.02	0.03	0.02
Unresponsive parenting (M)	−0.15***	0.02	−0.17
Unresponsive parenting (F)	−0.07*	0.03	−0.07
Harsh parenting (M)	−0.07**	0.02	−0.09
Harsh parenting (F)	−0.04	0.02	−0.05
Harsh discipline (M)	−0.00	0.01	−0.00
Harsh discipline (F)	−0.01	0.01	−0.02
Neighborhood harshness	−0.04***	0.01	−0.09
Unpredictability			
Paternal transitions	0.04*	0.02	0.08
R^2	.15		

African American is the reference category for race. Site 1 is the reference category for site. M = mother, F = father, T_1 = 15 months, T_2 = 36 months. * $p < .05$. ** $p < .01$. *** $p < .001$.