

## Special Issue Article

# Environmental harshness and unpredictability: Do they affect the same parents and children?

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### Abstract

Differential susceptibility theory stipulates that individuals vary in their susceptibility to environmental effects, often implying that the same individuals differ in the same way in their susceptibility to different environmental exposures. The latter point is addressed herein by evaluating the extent to which early-life harshness and unpredictability affect mother's psychological well-being and parenting, as well as their adolescent's life-history strategy, as reflected in number of sexual partners by age 15 years, drawing on data from the National Institute of Child Health and Human Development (NICHD) Study of Early Child Care and Youth Development. Results indicated that mothers whose well-being and parenting proved more susceptible to harshness also proved somewhat more susceptible to environmental unpredictability, with the same being true of adolescent sexual behavior. Nevertheless, findings caution against overgeneralizing sample-level findings to all individuals.

**Keywords:** differential susceptibility, harshness, life-history theory, unpredictability

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The influence of early-life experiences and exposures on human development constitutes a primary focus of developmental science. It is widely appreciated that development is shaped by multiple environmental factors, including both proximate influences (e.g., parental sensitivity, harshness) and more distal ones (e.g., family income, parental mental health) (Belsky, 1984; Bronfenbrenner, 1979; Conger et al., 1990). Of note, however, there is ever increasing appreciation that some individuals – be they children or adult – prove more susceptible to such forces shaping developmental functioning than do others (Belsky, 1997; Belsky, Bakermans-Kranenburg, & van IJzendoorn, 2007; Belsky & Pluess, 2009, 2013; Boyce & Ellis, 2005; Ellis, Boyce, Belsky, Bakermans-Kranenburg, & van IJzendoorn, 2011).

Despite the fact that such differential susceptibility to environmental influence has often been cast in trait-like terms – as in typologies characterizing some individuals as “orchids” and others as “dandelions” (Boyce & Ellis, 2005) or as “hawks” and “doves” (Suor, Sturge-Apple, Davies, & Cicchetti, 2017) – there is ever more reason to appreciate that variation in susceptibility is continuous rather than categorically binary (Zhang, Widaman & Belsky, 2021). Perhaps the best evidence of this is to be found in Gen $\times$ Environment interaction research which relies on polygenic scores as moderators of environmental effects (e.g., Belsky & Beaver, 2011; Masarik et al., 2014; Rauscher, 2017); but

research on the contextual moderating effects of temperamental negative emotionality (e.g., Bradley & Corwyn, 2008) and positive emotionality (Tsotsi et al., 2019) reveals much the same thing.

Just as notable when it comes to characterizing variation in susceptibility to environmental effects is emerging evidence that, rather than individuals being *generally* more or less sensitive to the environment, such susceptibility is domain specific. That is, individuals are differentially susceptible to the effects of distinctive environmental factors (e.g., parent and peer effects) and/or with regard to different developmental phenotypes (e.g., externalizing problems, academic competence). Perhaps most compelling in this regard is recent work showing that two different and well-documented effects of child care tend to affect different children. More specifically, those children who benefited cognitively the most – or least – from exposure to high quality care in the National Institute of Child Health and Human Development (NICHD) Study of Early Child Care and Youth Development (NICHD Early Child Care Research Network [ECCRN], 2002) were not the most – or least – likely to manifest problem behavior in response to lots of time spent in care (Belsky, Zhang, & Sayler, 2021). In other words, at the individual level, these two childcare effects proved to be independent of one another. Sayler, Zhang, Steinberg and Belsky (submitted) also discovered, using the same large sample, that when it came to predicting the socioemotional adjustment of 15-year-olds, some proved especially susceptible to effects of parenting and particularly unsusceptible to the effects of peers, with the reverse being true of some other teenagers. Again, then, evidence emerged – at the individual level – that variation in susceptibility to one environmental exposure did not

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necessarily correspond to variation in susceptibility to another exposure.

In both cases, this evidence of what Belsky *et al.* (2021) referred to as “differential differential susceptibility” emerged from an influence-statistic analysis used to capture individual differences in susceptibility to environmental influences. Here we rely on this same methodology, again drawing on data from the large NICHD Study of Early Child Care and Youth Development, to consider variation of two features of the environment, harshness and unpredictability, and their effects on mothers and their children. The question posed, then, becomes: Are mothers or children who are most – or least – affected by environmental harshness similarly susceptible to the effects of environmental unpredictability?

### *The developmental environment in evo-devo perspective*

Central to the evolutionary–developmental (evo-devo) view of development is the claim that over evolutionary history, natural selection shaped humans to be sensitive to developmental experiences (e.g., sensitive parenting) and exposures (e.g., poverty), and to adjust their developmental trajectories accordingly. This was because such sensitivity and developmental calibration provided probabilistic “insight” into the future world in which the individual would find herself and, thereby, affect reproductive fitness (i.e., the dispersion of genes into future generations, the fundamental goal of all living things; Belsky, Steinberg, & Draper, 1991; Chisholm, 1999; Ellis, 2004; Ellis, Sheridan, Belsky, & McLaughlin, *in preparation*). Today this developmental process is often characterized as “predictive adaptive response” (PAR; Bateson, Gluckman, & Hanson, 2014) or “conditional adaptation” (Belsky, 2000; Boyce & Ellis, 2005).

Such an analysis raises the question as to what features of the environment might prove most informative when it comes to regulating development in the eventual service of reproductive fitness. In an elegant, cross-species analysis of this question, informed by evolutionary life-history (LH) theory (e.g., Belsky *et al.*, 1991; Ellis, Figueredo, Brumbach, & Schlomer, 2009; Roff, 2002; Stearns, 1992), Ellis *et al.* (2009) called attention to three fundamental environmental dimensions, two of which – harshness and unpredictability – are the focus of this report. LH theory is a branch of evolutionary biology focusing on how organisms allocate finite time and energy to various competing life functions, mainly, bodily maintenance (e.g., predation defenses, immune function), growth (acquisition of physical, social, and cognitive competencies), and reproduction (mating and parenting).

Central to LH thinking is the claim that natural selection has shaped organisms to make trade-offs involving these functions, as they all cannot be simultaneously maximized. For example, some species (e.g., prosimians) and individuals within species have relatively short periods of growth and begin to reproduce relatively early in life, whereas some others invest more time and energy in growth, thereby delaying reproduction. Essentially, these different patterns of trade-offs involving growth and reproduction made by species and individuals correspond to LH strategies that vary on a slow–fast continuum. A slower LH strategy is characterized by later reproductive development and behavior, more stable pair bonds, emphasis on the quality rather than the quantity of offspring and more parental investment, whereas a faster strategy is characterized by the opposite pattern.

It was this variation in developmental patterns that was highlighted by evolutionary theory of socialization of Belsky *et al.* (1991) and Belsky (2012), which additionally posited that

parenting and attachment security during early life, particularly in the first five to seven years, functioned as cues about the external world that the child would encounter in the future. It is by this mechanism that children’s somatic and behavioral development were regulated in ways that once, even if no longer, probabilistically enhanced fitness.

Guided by such LH thinking, Ellis *et al.* (2009) argued that exposure to high levels of harshness and unpredictability, individually and collectively, promoted a fast LH, with the opposite being true of the opposite developmental conditions. Environmental harshness refers to the rates at which external factors cause disability and death at each age in a population; environmental unpredictability constitutes levels of variation across time and space in environmental harshness. Given the nature of their definitions, these two environmental dimensions have been operationalized in multiple ways in previous empirical work. Whereas harshness has typically been indexed by family income and social–economic status (e.g., Belsky, Schlomer, & Ellis, 2012; Doom, Vanzomeren-Dohm, & Simpson, 2016; Li, Liu, Hartman, & Belsky, 2018), harsh parenting (Warren & Barnett, 2020), and exposure to violence from conspecifics (Brumbach, Figueredo, & Ellis, 2009), unpredictability has typically been indexed by changes in the family environment, including residential changes, paternal transitions, and parental job changes (e.g., Belsky *et al.*, 2012; Doom *et al.*, 2016), as well as by variability of family income over time (Li *et al.*, 2018).

In work just cited, distinct and additive effects of harshness and unpredictability have been chronicled. Of note, results prove generally consistent with LH expectations. Thus, greater harshness and unpredictability predicted faster LH-relevant traits in adolescence and young adulthood, including reduced health and resource accruing potential, reduced sexual restrictedness, greater social deviance (Brumbach *et al.*, 2009); reduced self-control and less harmonious parent–child relationship quality, family social support, friend social support and altruism (Chang *et al.*, 2019); as well as heightened externalizing behavior (Chang *et al.*, 2019; Doom *et al.*, 2016) and poor academic performance (Chang *et al.*, 2019). That said, not all studies converge in documenting such theoretically anticipated results. Consider first Li *et al.*’s (2018) evidence that income harshness – but not unpredictability – forecasted social–behavioral functioning and academic skills in kindergarten and adolescence (using NICHD Study of Early Child Care and Youth Development data) in a manner consistent with LH theory. Consider next Maranges, Hasty, Maner, and Conway (2021) findings which revealed the opposite when reduced moral concerns about harm and consequences for other people were the focus of inquiry. In this work, unpredictability was based on a child report and harshness was indexed by family income. As a final example of variation in results of studies testing the Ellis *et al.* (2009) LH predictions, Warren and Barnett (2020) found that whereas environmental harshness – indexed by unresponsive and harsh parenting, as well as dangerous neighborhood features – undermined the development of effortful control, unpredictability represented by multiple paternal transitions functioned in an opposite way. Quite conceivably, some of this variation in study findings may have resulted from how harshness and unpredictability have been operationalized, as well as the particular LH outcomes that have been the focus of inquiry.

Perhaps it is not surprising that the two environmental dimensions under consideration are not only theorized – and often found – to affect the development of children and adolescents,

but also their parents. After all, Belsky's (1984) model of the determinants of parenting and the family stress model of Conger et al. (1990) and Conger, Elder, Lorenz, & Simons (1994) both stipulate that parenting is shaped by both proximal and distal environmental factors. Of note, then, environmental harshness and unpredictability predict parental well-being and parenting. More specifically, in a study on which the current report is based, Belsky et al. (2012) reported that greater early-life harshness (indexed by family income) and unpredictability (indexed by residential changes, paternal transitions, and parental job changes) each uniquely predicted greater maternal depressive symptoms across children's early childhoods and, in turn, less sensitive mothering in middle childhood. Through these processes, as well as more directly, these environmental conditions also predicted greater offspring sexual behavior by age 15 years.

### The present study

In light of the findings just highlighted, attention is turned in this follow-up report to the question of whether mothers whose psychological well-being and parenting prove highly susceptible to effects of environmental harshness also prove highly susceptible to those of environmental unpredictability, with the same issue addressed in the case of adolescent sexual behavior. That is, are parents and children who prove very susceptible or unsusceptible to the influence of one of these contextual conditions similarly affected by the other? To address this issue we rely on an influence-statistics approach for assessing variation in susceptibility to environmental influence. As previously noted, this approach proved useful in a proof-of-principle study investigating two distinct child care effects (Belsky et al., 2021). Given the fact that environmental harshness and unpredictability are positively correlated in the NICHD Study data set, there is reason to expect that, *at the level of the entire sample*, those mothers and children most – or least – susceptible to the effects of one of these environmental dimensions will also prove similarly susceptible to the other. Having said that, we also predict that there will be clear exceptions to this rule *at the level of individuals*.

## Method

### Participants

Data for this study were drawn from the NICHD Study of Early Child Care and Youth Development (NICHD ECCRN, 2005), which recruited families through hospital visits to mothers shortly after the birth of a child in 1991 in 10 locations in the United States. During selected 24-hour intervals, 8,986 women giving birth were screened for eligibility. Among them, 1,364 families (boys = 705; white = 1,097; black = 176; other = 91) completed a home interview when the infant was 1 month old and became the study participants. Details of the sampling plan can be found in NICHD ECCRN (2005). In terms of demographic characteristics at study enrollment, 26% of the mothers had no more than a high school education; 21% had incomes no greater than 200% of the poverty level; and 22% were minority (i.e., not non-Hispanic European American).

Among the 1,364 mother–child dyads in the enrolled sample, 439 of them miss at least one of the predictor and outcome variables used in this report. Those with missing values, relative to children without missing values, were more likely upon entering the study to live in a household with lower income-to-needs

ratio ( $t(992.57) = 3.56, p < .001$ ) and fewer years of mother's education ( $t(875.10) = 2.90, p < .01$ ); yet they did not differ significantly in gender ( $X^2 = 1.51, df = 1, p = .22$ ), level of maternal depression ( $t(875.13) = -0.16, p = .87$ ), or whether the child lived with a father figure ( $t(858.02) = 0.05, p = .96$ ) upon study enrollment. By means of multiple imputation, the analysis sample remained 1,364.

### Study design and measures

Children were followed from one month to age 15 years for purposes of this report. The harshness and unpredictability predictor measurements were obtained from 1 to 54 months of age. The maternal outcomes of depressive symptoms and parenting sensitivity were measured repeatedly at the first and third grades (~6 and 8 years old). The adolescent LH outcome tapping sexual behavior was assessed at 15 years. We first describe predictors, then maternal and adolescent outcome variables, all of which were the focus of Belsky et al.'s (2012) report which the current study seeks to extend.

### Predictors

#### Harshness

Early-life environmental harshness was indexed by family income-to-needs ratio, assuming that limited economic resources reduce the coping capacities of families. When children were 1, 6, 15, 24, 36, and 54 months of age, mothers provided detailed information about family finances. The income-to-needs ratio was created by dividing family income by the official federal poverty line for the family size. A higher income-to-needs ratio represents greater financial resources per person in the household. To obtain an overall measure of environmental harshness, the repeated measurements of income-to-needs ratio were reverse coded and averaged across time, with higher values reflecting greater harshness.

#### Unpredictability

Three measurements indexed levels of unpredictability in and around the family in the first 5 years of child's life: (a) changes in the paternal figure, (b) residential moves, and (c) parental employment changes. The number of paternal transitions was based on information provided by mothers about household composition when children were 1, 3, 6, 9, 12, 15, 18, 21, 24, 30, 33, 36, 42, 46, 50, 54, and 60 months of age. The number of household moves was based on addresses provided by families for home visits across the first 5 years of life. Parental employment transitions were based on detailed data on the mother's and father's employment collected across the child's first 5 years in approximately 3-month intervals. An aggregate of the number of employment transitions for mothers and fathers was created by averaging together and standardizing the number of job changes from each time point. Finally, scores for each of the three measures were standardized and averaged to create a measure of environmental unpredictability in which higher values represented greater unpredictability.

### Outcome variables

#### Maternal depressive symptoms

Maternal depression was assessed when the target child was in the first and third grade, using the Center for Epidemiological Studies Depression Scale (CES-D; Radloff, 1977), a self-report measure of depressive symptomatology. Scores range from 0 to 60, with a

score of 16 or above considered to have clinical significance (Radloff, 1977). The average level of maternal depressive symptoms was 8.33 ( $SD = 8.42$ ) and 8.87 ( $SD = 8.51$ ) at the first and third grade, respectively. Cronbach's alphas were above 0.70 for each time point.

### Maternal sensitivity

To assess maternal sensitivity, Mother×Child interactions were videotaped in semi-structured, 15-min sessions when children were in first and third grades. In first grade, the interaction activities included two tasks that were too difficult for the child to carry out independently and required the parents' instruction and assistance, as well as a third activity that encouraged play between mother and child. When the child was in third grade, the interactions involved a discussion task of topics that were sources of disagreement between the mother and child, along with a planning task.

Videotapes from all data collection sites were shipped to a central location for coding. Trained coders who were unaware of other information about the families rated parenting behavior on a scale ranging from 1 to 7 in terms of (a) supportive presence, (b) respect for autonomy, and (c) hostility, with higher scores representing greater prevalence of each way of behaving. Internal consistency for these scales was high for both time points (first grade: Cronbach  $\alpha = .82$ ; third grade: Cronbach  $\alpha = .78$ ). The three average scores were themselves averaged (with hostility reverse coded) to create an overall measure of maternal sensitivity at each time point. Mean maternal sensitivity was 3.31 ( $SD = .50$ ) and 3.22 ( $SD = .42$ ) at first and third grades, respectively.

### Adolescence accelerated-LH strategy

The number of oral and sexual intercourse partners was used to proxy adolescents' LH strategy. When adolescents were approximately 15 years old, they were asked the following two questions: (a) "How many different partners have you had oral sex with in your entire life?" and (b) "How many different partners have you had sexual intercourse with in your entire life?" The average number of oral sex partners and sexual intercourse partners was 0.33 ( $SD = 0.92$ ) and 0.28 ( $SD = 0.89$ ), respectively. These two items were highly correlated ( $r = .70$ ,  $p < .001$ ) and were summed to create a score of accelerated-LH strategy. Since only a few adolescents had more than four oral ( $n = 21$ ) and sexual ( $n = 23$ ) intercourse partners, the LH strategy score was coded as 0, 1, 2, 3, and 4 and above.

### Statistical analysis

Analysis proceeded in a series of well-planned steps. First, we conducted multiple imputation to handle missing data, creating 30 imputed data sets, using multivariate imputation by chained equations (MICE; van Buuren & Groothuis-Oudshoorn, 2011) on all predictors and outcome variables, thereby allowing the missing data to be dependent on other variables in the data set (i.e., missing at random). All reported results are thus based on the 30 imputed data sets.

The second step of statistical analyses involved establishing the association of harshness and unpredictability with maternal and adolescent outcome variables by means of simple correlations. For statistically significant associations, we proceeded in a third step to assess the degree to which each mother and child proved susceptible to each effect documented in the prior correlation analysis. Toward this end, we relied on an influence statistic,

DFBETAS, a continuous and standardized statistic assigned to each and every observation for each regression coefficient; it reflects the *degree and direction* of change of the regression coefficients after removing an observation. DFBETAS is calculated using a "leave-one-out" approach, that is, re-estimating an association repeatedly (e.g., harshness:depression), each time dropping a single case, to measure how much such (minor) sample modification resulted in the association increasing (i.e., a negative influencer) or decreasing (i.e., a positive influencer), usually ever so modestly. The resultant change of the slope parameters attributed to each observation for the association of interest (e.g., unpredictability:maternal sensitivity) thus indicates how – and the extent to which – particular individuals affect the overall estimate of the association (e.g., Belsley, Kuh, & Welsch, 1980; Cook & Weisberg, 1982).

The interpretation of DFBETAS depends on the (anticipated) direction of an association. In the case of positive associations (e.g., harshness:depression), the less positive the association becomes when a case is dropped, the more positive the value of DFBETAS is for this case. This reflects greater susceptibility the child is to the effect in question (i.e., positive DFBETAS represents greater susceptibility when full-sample associations are positive). In the case of negative associations (e.g., harshness:sensitivity), however, the less negative the association becomes when a case is dropped, the more negative the value of DFBETAS for this case. This indicates the more susceptible the individual is to the effect in question (i.e., negative DFBETAS represents greater susceptibility when full-sample associations are negative). This can be illustrated by the fact that a regression line showing positive association will become (a little) steeper when adding an observation with positive DFBETAS, but one showing negative association will become (a little) flatter after adding an observation with positive DFBETAS. For sake of interpretation, the negative DFBETAS was reverse coded so that higher scores represent greater susceptibility to an effect in the present report.

In order to quantify individual susceptibility of each significant effect emerging from the original correlational analysis using the entire sample, a DEFEBETAS-based score was calculated for each participant for each predictor-outcome association for mothers and adolescents in the sample. This set the stage for the fourth step in the primary analyses. It involved determining whether mothers and their adolescents most and least affected by the effect of harshness or unpredictability on a particular outcome were similarly affected by the effect of the other contextual condition on the same outcome. This was accomplished by simply correlating the (DEFEBETAS-based) susceptibility scores. In a final, fifth step, the associations of DFBETAS were also examined after splitting each distribution into terciles to see what percentage of individuals might have scored highly susceptible to one environmental effect and highly unsusceptible to the other when the same outcome was the focus of attention.

## Results

Following simple correlation analyses for establishing associations of harshness and unpredictability with maternal functioning and adolescent LH-strategy, primary analyses were conducted to address two core issues: (a) whether mothers whose psychological well-being and parenting proved highly susceptible to environmental harshness also proved highly susceptible to environmental unpredictability; and (b) whether adolescents whose LH-strategy reflected by sexual behavior proved highly susceptible to

**Table 1.** Correlations of harshness, unpredictability, and outcomes

Variables	1	2	3	4
1. Harshness				
2. Unpredictability	0.32*			
3. Maternal depression	0.23*	0.22*		
4. Maternal sensitivity	-0.32*	-0.27*	-0.21*	
5. Adolescent accelerated LH	0.17*	0.14*	0.14*	-0.19*

\* $p < .001$ .

environmental harshness also proved highly susceptible to environmental unpredictability.

### *Preliminary analysis: Effects of harshness and unpredictability*

As indicated by **Table 1**, simple correlational analysis revealed that greater environmental harshness and unpredictability across the first five years of life were related to greater maternal depressive symptoms and less maternal sensitivity at first and third grades, as well as with accelerated LH strategy of adolescents, reflected by more sexual partners.

### *Primary analyses*

#### *Inter-correlation of susceptibility effects*

The inter-correlations of the DFBETAS-indexed susceptibility scores for effects of harshness and unpredictability on maternal depressive symptoms and parental sensitivity, as well as on adolescent accelerated LH-strategy are displayed in **Table 2**. Consideration of the modest positive correlations, indicative of medium effect sizes, indicates that mothers whose depressive symptoms and sensitive parenting proved (somewhat) more or less susceptible to effects of harshness also proved (somewhat) more or less susceptible, respectively, to effects of environmental unpredictability. In addition, and similarly, mothers who proved more or less susceptible to effects of environmental harshness and unpredictability on sensitive parenting also proved (somewhat) more or less susceptible to the effects of these environmental parameters on depressive symptoms. That said, we did not observe any relation between mothers' susceptibility to different environmental factors with regard to different outcomes. That is, mothers who proved more or less susceptible to effects of environmental harshness on sensitive parenting (or depressive symptoms) did not seem to be, respectively, more or less susceptible to effects of environmental unpredictability on depressive symptoms (or sensitive parenting).

For adolescents, modest positive correlations, also indicative of medium effect sizes, of susceptibility scores for sexual behavior indicated that adolescents who were (somewhat) more or less susceptible to effects of harshness were also, respectively, (somewhat) more or less likely to be susceptible to effects of unpredictability.

#### *Cross-classification of categorical susceptibility to environmental effects*

To gain further insight into the correlational findings, we also used tercile splits to cross-classify the just summarized significant associations among DFBETAS susceptibility scores. Inspection of

**Table 3**, and especially the numbers highlighted in bolded text, indicates that in a not insubstantial percentage of cases, mothers and adolescents who proved highly susceptible (top tercile) or highly unsusceptible (bottom tercile) to the effect of harshness proved the opposite in the case of their susceptibility to the effect of unpredictability. Note, for example, that such individuals represented between 16% and 18% of the sample for the three outcomes that are the foci of this report.

### **Discussion**

Informed by Ellis et al.'s (2009) evolutionary analysis of fundamental environmental dimensions regulating LH strategy, the primary goal of this report was to determine whether mothers or adolescents who proved more and less susceptible to effects of environmental harshness proved similarly susceptible to the effects of environmental unpredictability, thereby extending differential susceptibility research. We once again adopted an influence-statistic approach to address these issues, thus extending two prior studies. Whereas the first revealed anticipated effects of these two early-life environmental conditions on maternal depression and parenting, as well as on adolescent sexual behavior, all in a manner consistent with LH theory (Belsky et al., 2012), the more recent proof-of-principle study investigated the utility of using the influence-statistic method to determine whether children more and less susceptible to one childcare effect proved similarly susceptible to another; recall that they did not (Belsky et al., 2021).

Interestingly, here results proved different from the child care study in that mothers whose depressive symptoms and sensitive parenting proved more or less affected by effects of environmental harshness proved also more or less susceptible to effects of environmental unpredictability, with the same being true of adolescent LH strategy. These observations, consistent with expectations, are based on the moderate and positive correlations of influence-statistic-indexed susceptibility scores (see **Table 2**). Perhaps what makes this conclusion even more meaningful is the cross-tabulation of susceptibility terciles (see **Table 3**); it indicates that a full third of the sample (i.e., 32% to 34%) proved consistently most or least affected by both harshness and unpredictability, irrespective of whether the outcome predicted was maternal depressive symptoms, sensitive parenting, or adolescents' LH strategy.

Of additional interest is that the influence-statistic approach proved not only well suited for testing consistency of susceptibility to effects of different early-life conditions on the same predicted outcome but, at least in the case of mothers, to different outcomes as well. Recall that mothers who proved more or less susceptible to effects of harshness on depressive symptoms also proved similarly susceptible to its effects on parenting (see **Table 2**). This was also the case when these different outcomes were predicted by environmental unpredictability.

While the results most surely indicate that, in general, mothers and adolescents who are more or less susceptible to effects of environmental harshness also are similarly susceptible to effects of unpredictability, as revealed by the correlational analysis of susceptibility scores (**Table 2**), this overall pattern should not be overgeneralized to each and every individual. Recall in this regard that a not insubstantial proportion of both the mothers and adolescents (i.e., 16% ~ 18%) who proved *most* susceptible (i.e., top tercile) to the effect of one of the two contextual factors investigated

**Table 2.** Correlation of DFBETAS for harshness and unpredictability effects on maternal functioning and adolescent accelerated life-history (LH) strategy

DFBETAS	1	2	3	4	5
1. H <sup>^</sup> :mom depression					
2. U <sup>^</sup> :mom depression	0.34***				
3. H:mom sensitivity	0.35***	0.05			
4. U: mom sensitivity	0.02	0.20***	0.29***		
5. H:adolescent LH	0.25***	-0.01	0.36***	0.05	
6. U:adolescent LH	-0.01	-0.07**	0.06*	0.22***	0.35***

<sup>^</sup>H denotes Harshness; U denotes Unpredictability.

\* $p < .05$ , \*\* $p < .01$ , \*\*\* $p < .001$ .

**Table 3.** Cross-tabulation of number of mothers and adolescents classified as highly susceptible (top tercile), moderately susceptible (middle tercile) and highly unsusceptible (bottom tercile) to effects of harshness and unpredictability<sup>a</sup>

	Susceptibility to unpredictability		
	Low	Medium	High
Maternal depression			
Susceptibility to harshness			
Low	197	140	<b>118</b>
Medium	131	255	69
High	<b>127</b>	60	267
Maternal sensitivity			
Susceptibility to harshness			
Low	184	159	<b>112</b>
Medium	145	243	67
High	<b>126</b>	53	275
Adolescent LH-strategy			
Susceptibility to harshness			
Low	207	130	<b>118</b>
Medium	136	213	106
High	<b>112</b>	112	230

<sup>a</sup>Bolded numbers highlight all cases in which individuals proved highly susceptible to one environmental exposure (top tercile) and highly unsusceptible to the other exposure (bottom tercile).

(i.e., harshness or unpredictability) proved *least* susceptible (i.e., bottom tercile) to the effect of the other factor (Table 3).

Collectively, the findings presented herein would seem somewhat in line with the intriguing idea originally raised – but also questioned – by differential susceptibility theorists (Belsky et al., 2007; Belsky & Pluess, 2009, 2013; Ellis et al., 2011) that susceptibility might appear trait like, making some individuals very or not very susceptible to developmental experiences and environmental exposures. Having said that, we have elsewhere hypothesized – and found initial evidence – that there are likely to be very few generalists when it comes to susceptibility to environmental effects, as well as few extreme specialists, with most individuals falling between these two groups (Zhang et al., 2021). That is, while a small portion of the children in the NICHD Study appear highly susceptible to many family and childcare exposures on a diverse set of

developmental outcomes and another small proportion highly susceptible to very few, the actual distribution of susceptibility of exposures vis-à-vis multiple outcomes maps on to a bell curve.

This pattern of results – from a single data set, of course – raises the issue of whether developmental plasticity should be conceptualized as phenotype in and of itself, and thus one also with great variation across individuals. This would seem in line with the seemingly logical possibility that across human evolutionary history it sometimes proved beneficial, from a fitness standpoint, to be highly susceptible to a particular experience or exposure and other others times to be only somewhat susceptible or even not susceptible at all. If this were the case, this could have led to selection for genes for both more and less susceptibility to the particular exposure in question – and, when summed across many exposures, great variation in a trait of developmental plasticity.

Returning to the current study, it must be acknowledged that whatever its strengths, it is not without limits, including the speculative comments just offered. Perhaps the most notable empirical limit may be the analytic approach employed herein, as it did not take account of measurement error. Unlike the structural equation model used in Belsky et al.'s (2012) work that treated the same variables involved in our report as latent ones, thereby accounting for measurement error, we used composite scores in this report to index the environmental predictors and outcomes. The same issue applies to the susceptibility measure. That is, it is likely that the influence-statistic estimates of susceptibility reflect measurement error rather than precise assessment of such variation, at least to some degree. Another issue that should temper the conclusions is that the harshness and unpredictability measurements used here by no means cover all features of harsh and unpredictable exposures and experiences that merit consideration. The same is true of our adolescent index of LH strategy. As the last limit to be considered, the NICHD Study sample does not represent well the most economically disadvantaged children and families in contemporary American society, despite the efforts made to oversample such research participants. This makes it worth investigating whether the same findings would emerge in a more disadvantaged sample or fully demographically representative one.

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