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## Stability of Child Temperament:

### Multiple Moderation by Child and Mother Characteristics

#### Supporting Information

Here we amplify three introductory issues to the study: developmental stability, developmental stability of child temperament, child and maternal moderators of stability of child temperament, and caregiver report of temperament.

#### **Developmental Stability**

The study of stability is central to developmental science for several reasons. First, certain biological systems in humans require stability – physical, chemical, physiological, psychological, and environmental – to survive. (Temperament is thought to have genetic and biological roots.) Second, stability provides basic information about the overall ontogenetic course of a characteristic, insofar as individuals do or do not maintain their standing relative to others in their cohort over time. Stability therefore provides links between our practical understanding of individuals when younger and older. (Is the difficult infant the troubled child and eventually the externalizing adult?) Third, it is generally assumed that to be psychometrically as well as psychologically meaningful, a characteristic should be consistent across time, allowing antecedent assessments to serve as predictors of subsequent indicators of the same or different characteristics. (It is the presumably stable temperament that develops into personality.) Fourth, stability affects the social and physical environment and, so in turn, development; from the perspective of so-called evocative interactions, stable characteristics elicit responses that contribute to shaping later outcomes. Individuals with different stable characteristics also likely experience environments differently. (Consistently easy versus difficult children likely have very different childhoods.) Relative to change, biological forces

tend to reinforce homeostasis in the individual, and the consistent social network in which much of development normally transpires also contributes to constancy. Thus, individual  $\leftrightarrow$  environmental relational processes tilt toward stability. For these many reasons, stability has been a topic of theory and research across the history of developmental science (Lerner, Hershberg, Hilliard, & Johnson, 2015).

### **Developmental Stability of Child Temperament**

Temperament in childhood is considered meaningful because it is considered stable and viewed as an early foundation of personality (Chen & Schmidt, 2015). Stability is important for any individual-difference characteristic and is a gateway to later development. For example, children's enduring individuality influences their own development, and even small early differences in stable temperaments may have larger-than-expected later effects (Bornstein, 2014b). Temperament in childhood can affect children's interactions with the world and their learning, color the way children interpret their experiences, shape how children compare themselves to others and the way others (i.e., adults and peers) perceive and respond to them, guide the choices children make, and modify the ways children interpret and manipulate their environment. Parenting differs for children with different temperaments. Successful child adjustment likely depends on interactions between temperament and setting. By studying stable child temperaments vis-à-vis social interaction, cognition, behavioral problems, and other domains, researchers may reach a deeper understanding of the significant and complex roles played by child temperament in later development.

### **Moderators of Child Temperament Stability**

Here, we briefly review studies of the stability of child temperament as moderated by the child and maternal factors in the main study. Early temperamental characteristics may influence

children's developmental pathways and predict future development. However, environmental context may also shape or interact with infant temperament and indirectly contribute to developmental outcomes. We note that, although the extant literature may contain published studies that compare child temperament measures between levels of a moderator (e.g., temperament in girls vs. boys), precious few studies examine moderation of developmental stability of temperament.

**Stability of Child Temperament by Child Gender.** Is temperament equivalently stable in girls and boys? Girls and boys are biologically dissimilar, and they are often (but not always) thought about and treated dissimilarly from the start of life (Bornstein, 2013). Mondschein, Adolph, and Tamis-LeMonda (2000) found that mothers of boys overestimated sons' motor ability, whereas mothers of girls underestimated daughters', even when subsequent tests of ability revealed no gender differences between the girls and boys. Also, mothers may be closer to and more positively involved with their girls than their boys (Bornstein et al., 2008; Clarke-Stewart, 1973) and display higher levels of sensitive, warm, and nonintrusive behavior toward their girls than toward their boys (Atzaba-Poria & Pike, 2008; Bornstein et al., 2008; Lovas, 2005). Furthermore, parents respond differentially to their daughters and sons (Leaper, 2002), and mothers even respond differently to their "difficult" daughters than to their "difficult" sons, although the girls and boys may not differ on an independent assessment of temperamental difficulty (Else-Quest, Hyde, Goldsmith, & Van Hulle, 2006). On these accounts, then, the ontogenetic trajectories of temperament could follow different courses in girls and boys in childhood. However, there is also strong evidence that girls and boys, and parenting girls and boys, are also surprisingly similar in many respects (Bornstein et al., 2015; Hyde, 2014; Leaper, 2002), and temperaments in girls and boys normally show wide and overlapping distributions.

Thus, the ontogenetic trajectories of temperament may not differ in the two genders. Three stability studies (to our knowledge) have specifically considered gender, all were confined to the infancy period, and gender had small or no moderating effects (Bornstein et al., 2015; Garcia Coll, Halpern, Vohr, Seifer, & Oh, 1992; Gartstein, Putnick, Kwak, Hahn, & Bornstein, 2015). We therefore hypothesized that stability of temperament in later childhood would be mostly similar in children of the two genders.

**Stability of Child Temperament by Child Birth Order.** Is temperament equivalently stable in first- and laterborns? It has been argued on evolutionary grounds that the same parents maximize fitness by producing different types of children (“diversifying progeny”; Ellis, Boyce, Belsky, Bakermans-Kranenberg, & van IJzendoorn, 2011). Parents also often treat children in the same family differently because those children differ in age, gender, cognition, or other idiosyncratic characteristics or life events (Furman & Lanthier, 2002; Hallers-Haalboom et al., 2014), and parenting does not affect different children in the same way (Sutor et al., 2009). One sibling might elicit more positivity and less negativity than another (Jenkins, Rasbash, & O’Connor, 2003), and siblings’ different experiences (their nonshared real or perceived environments) contribute to making them temperamentally distinctive (Stoolmiller, 1999). Moreover, the presence of a sibling may alter the trajectory of either or both the older or younger sibling’s temperament, as siblings engender more diverse family experiences than singletons which might affect stability. Mothers may also rate the temperaments of firstborn children and laterborn children differently because mothers of laterborns have more parenting experience and may come to view children differently over time. In the two studies we found about birth-order moderation of infant temperament, stability was consistent across birth order (Bornstein et al., 2015; Gartstein et al., 2015). As a result, we hypothesized that first- and laterborn older children

would be similarly stable in their temperaments.

**Stability of Child Temperament by Child Term Status.** Is temperament equivalently stable in preterm and term children? Normal gestations of 38 to 42 weeks from conception are considered term (Howson, Kinney, & Lawn, 2012). However, 12% of roughly 4 million new births each year in the United States are preterm (Martin, Hamilton, Ventura, Osterman, & Matthews, 2013). The earlier a child is born, the more underdeveloped or medically compromised the child is likely to be (Behrman & Butler, 2006). Many preterm children experience regulation difficulties, and prematurity is associated with increased negative emotionality and behavior problems (Goldberg & DiVitto, 2002; Hwang, Soong, & Liao, 2009). Thus, prematurity might disrupt individual consistency in children, but some debate surrounds the term status moderation of stability correlations of temperament because extant research provides evidence of stability with respect to certain temperament structures but not others. Utilizing the Brazelton (1973) Neonatal Behavioral Assessment Scales, Tronick, Scanlon, and Scanlon (1985) assessed preterm newborns' emotional and behavioral repertoire twice 2 weeks apart and reported moderate to high stability correlations only for orienting, state regulation, and motor activation. Riese (1987a, 1987b) reported differential temperament stability from birth to 2 years in preterm and term children, and later (Riese, 1988) reported that degree of prematurity affects the stability of temperament from 12 to 24 months. Garcia Coll et al. (1992) reported that patterns of temporal correlations interacted with temperament structure and IVH risk in preterms. Korner (1996) evaluated weekly sensory responsivity and excitability reactions in neonates born preterm and concluded that preterms might be more stable than term children for some temperament dimensions. In a subsequent comparison of small-for-gestational-age (SGA) and appropriate-for-gestational-age (AGA) children, few group differences emerged in temperament

(Halpern, Garcia Coll, Meyer, & Bendersky, 2001), but, suggestively, when temperament was studied across the first year of life, AGA and SGA children exhibited distinct patterns of temperament stability and instability (Halpern & Garcia Coll, 2000). However, Bornstein et al. (2015) studied term status as a moderator of stability of infant temperament, finding no significant moderation. As the children in our sample were older than in other studies, we hypothesized that temperament might be similarly stable in children who were born preterm and term.

**Stability of Child Temperament by Maternal Age.** Is temperament equivalently stable in children of younger and older mothers? Younger maternal age independently predicts internalizing and externalizing behavior problems in early childhood (Edwards & Hans, 2015), and maternal age may affect stability of temperament ratings because younger mothers are less skilled at reporting on their child (Robert, Burchinal, & Durham, 1999). However, we were unable to locate any studies that compared and contrasted stability of temperament in children of mothers of different ages. For additional research on the role of maternal age in child temperament, see Camberis et al., (2016), Garcia-Blanco et al. (2017), Guedes and Carnavaro (2016), Lehr et al. (2015), McCullough et al. (2017), and Reis (1988). As a default, we hypothesized that older children of mothers of different ages would all be moderately stable in their temperaments.

**Stability of Child Temperament by Maternal Education.** Is temperament equivalently stable in children of mothers with different educational achievements? Four lines of argumentation suggest that maternal education might moderate the stability of child temperament. First, genetically influenced traits, such as temperament, are thought to be expressed differently and differently in different environments (Rowe, Jacobson, & Van den

Oord, 1999; Vandermeer et al., 2018). Second, more educated mothers may be more knowledgeable about child development and are likely to have more resources to buffer stress, thus buffering their children as well. Related to this point, mothers with low education might be less accurate in providing information on parental reports (Roberts, Burchinal, & Durham, 1999). Third, if the stability of child temperament is carried by stability in the child's environment, and different educational environments are differentially stable (Bradley & Corwyn, 2002), then maternal education could moderate the stability of temperament. Finally, highly educated parents may perceive and respond to children impatiently because of the relatively high opportunity cost of child care (Nelson, Kushlev, & Lyubomirsky, 2014). All that said, we were unable to locate any studies that compared and contrasted stability of temperament in children of mothers with different educational accomplishments. As a default, we hypothesized that older children of mothers of different ages would be only moderately stable in their temperaments.

**Stability of Child Temperament by Maternal Anxiety.** Is temperament equivalently stable in children of anxious and non-anxious mothers? Accumulating evidence suggests that maternal anxiety during pregnancy affects child outcomes (van den Heuvel, Johannes, Henrichs & Van den Bergh, 2015; Braithwaite et al., 2013): Maternal antenatal anxiety is associated with an increased risk of behavioral disturbances in offspring. Moreover, maternal trauma exposure is associated with increased infant distress to limitations and sadness (Bosquet Enlow, et al., 2017), maternal anxiety mediates the association between infant self-regulation problems and maternal mindfulness (van den Heuvel, Johannes, Henrichs & Van den Bergh, 2015), mother's prenatal anxiety predicts infant temperament negative reactivity (Davis, et al., 2007), and maternal postpartum anxiety predicts infant irritability (Jover et al., 2014). Anxiety in children is also related to their temperament (Lindhout, Markus, Hoogendijk, & Boer,

2009). However, we could identify no studies of mothers with anxiety and its effects on their children's temperament stability and therefore on this moderator withheld hypothesizing.

**Stability of Child Temperament by Maternal Depression.** Is temperament equivalently stable in children of depressed and non-depressed mothers? The depression distortion hypothesis (Richters, 1992) suggests that maternal depression leads mothers to overestimate their children's problems. Still, it is unclear whether depressed mothers' reports are biased (Gartstein, Bridgett, Dishion, & Kaufman, 2009) or more realistic than those of non-depressed mothers' reports (Dobson & Franche, 1989). Maternal depression is associated with children's emotionality and activity (Melchior, et al., 2012) and independently predicts early childhood internalizing and externalizing behavior problems (Najman et al., 2001). Maternal prenatal depression predicts infant temperament negative reactivity (Davis, et al., 2007), and maternal pre- and postpartum depressive symptoms predict infant's growth and motor development in rural Bangladesh (Nasreen, Nahar Kabir, Forsell, & Edhborg, 2013). For additional work on child temperament in families with maternal depression, see Leerkes and Crockenberg (2003), Crockenberg and Leerkes (2006), and Parade et al. (2016). We could identify no studies of mothers with depression and its effects on child temperament stability and therefore again withheld hypothesizing.

### **Maternal Report of Child Temperament**

Thomas and Chess instigated The New York Longitudinal Study and child temperament research by interviewing mothers who (they argued) are likely to provide the most insightful reports of child temperament based on their long-term, intimate, and broad experiences with their children. Caregiver reports are also convenient, relatively easy and inexpensive to administer and analyze, and allow the study of multiple dimensions of temperament (Bates, 1989; Bornstein,

2014a). The assessment of child temperament by report ineluctably filters its subject, however, and so a central endeavor in measurement has to be error minimization. Many concerns with parent reports are at least partially mitigated by careful construction and presentation of items, only asking about recently occurring events, and inquiring about concrete behaviors rather than requiring parents to make abstract, global, or comparative judgments (Rothbart & Goldsmith, 1985). For example, vaguely impressionistic items (such as “My child is always on the go.”) are less informative and predictive than are more objective items that more precisely describe specific behaviors and the spatial and temporal settings in which they occur (such as “My child sits still (moves little) during procedures like hair brushing or nail cutting.”).

No one measurement approach to child temperament is limitation-free, and parent-report instruments are no exception. However, parents are uniquely positioned to provide information regarding their child’s temperament, given that others do not have the necessary or long-term access to children to describe them as fully, especially in early childhood. Finally, maternal report is valuable *sui generis* insofar as caregiver perceptions (accessed via reports) constitute a prime social milieu of childrearing (Bornstein, 2014a). Overall, despite potential limitations, caregiver-report instruments offer developmentally appropriate assessment tools with strong reliability and superior predictive validity relative to other child temperament measures (Pauli-Pott, Mertesacker, Bade, Haverkock, & Beckmann 2003).

## **Method**

### **Participants**

ALSPAC is a prospective population-based longitudinal study investigating health and development across the life span. A total of 14,138 surviving live births were included in ALSPAC (< 80% of eligible births). The ALSPAC study website contains details of all the data

that are available through a fully searchable data dictionary (<http://www.bris.ac.uk/alspac/researchers/data-access/data-dictionary>). Ethical approval for the study was obtained from the ALSPAC Ethics and Law Committee and the Local Research Ethics Committees.

Because only 2.6% of the ALSPAC sample was non-white, and this group was heterogeneous (0.9% Asian, 1.0% Black, and 0.7% other), we focused on the majority group. From the 12,075 white British participants in the ALSPAC data, 306 twins were excluded. Of the remaining 11,769 children, 9,937 had temperament data at any of the 3 data collection waves. An additional 224 children were excluded because their questionnaires were filled out by various or multiple sources at any data collection waves.

## **Results**

First, variable distributions were examined for univariate normality (Tabachnick & Fidell, 2012), and transformations applied to improve distributions. Transformed variables were used in the analysis; for clarity, untransformed data are presented in descriptive statistics. Because of the range of child age at each assessment wave, we explored concurrent correlations of child age with EAS subscale scores to determine if age adjustment was warranted. None of the correlations emerged significant (absolute values of correlation coefficients ranged from .003 to .020).

For standardized path coefficients, we adopt conventional magnitudes of  $r$  corresponding to small, medium, and large effect sizes as  $\approx .10$ ,  $.30$ , and  $.50$ , respectively (Cohen & Cohen, 1983, p. 61).

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