CULTURAL CONTRIBUTORS TO NEGATIVE EMOTIONALITY: A MULTILEVEL ANALYSIS FROM THE JOINT EFFORT TODDLER TEMPERAMENT CONSORTIUM

Abstract

This study advances the cross-cultural temperament literature by comparing temperament ratings of toddlers from 14 nations. Multilevel modeling procedures were utilized to regress Negative Emotionality and component subscales on Hofstede's cultural values dimensions while controlling for age and gender. More individualistic values were associated with lower Negative Emotionality, and component discomfort, fear, motor activity, perceptual sensitivity, and soothability scales. The discomfort subscale was negatively associated with power distance and positively associated with masculine cultural values. Higher ratings of shyness were related to a more long-term cultural orientation. Results illustrate the feasibility of a multilevel modeling approach to cross-cultural research and provide a new perspective on the intersection of culture and temperament development. Limitations and future implications are discussed.

Keywords: Cross-cultural, Negative Emotionality, Cultural Values, Early Childhood

Introduction

Rothbart's psychobiological model defines temperament as individual differences in reactivity and regulation produced by biological underpinnings, experience, and maturation (Rothbart & Derryberry, 1981). Structurally, temperament is composed of overarching factors, each encompassing fine-grained dimensions (Rothbart et al., 1994), documented across cultures (Cozzi et al., 2013; Krassner et al., 2016; Slobodskaya et al., 2012). Negative Emotionality (NE) is linked conceptually and empirically to the personality trait of neuroticism (Evans & Rothbart, 2007), and consists of fear, sadness, frustration, discomfort, and low falling reactivity – a child's ability to lower their own arousal/distress. NE has been studied most extensively in developmental science and cross-cultural comparisons largely because of the risk it poses for a range of symptoms/psychopathology (Eisenberg et al., 2005), and is the focus herein.

Cross-Cultural Comparisons

A variety of cross-cultural temperament differences have been reported. Infants in the United States (US) were rated higher in NE, sadness, distress to limitations, fear, and lower in falling reactivity (which loads negatively onto NE) than their Dutch counterparts (Sung et al., 2015). Similarly, in comparisons of US and Finnish infants, children, and adults, US participants were consistently more fearful than their Finnish counterparts (Gaias et al., 2003). Slobodskaya et al. (2013) found Japanese children higher in NE, fear, sadness, and shyness, compared to those from the US and Russia. Japanese infants were also higher in distress to limitations and fear, and Russian infants higher in sadness than US children. Gartstein et al. (2006) reported higher distress to limitations for infants from China compared to US and Spain, and greater fearfulness compared to US children. Similarly, Chinese infants were more behaviorally inhibited than Canadian infants (Chen et al. 1998).

Most cross-cultural temperament studies compare between two and four cultures; however, Putnam and Gartstein (2017) aggregated data from 18 nations, assessing relations between temperament across the lifespan and cultural values. As this study potentially confounded age and culture-related effects, Gartstein and Putnam (2018) subsequently reported Joint Effort Toddler Temperament Consortium (JETTC) findings, focusing on a period critical with respect to a number of developmental processes (e.g., increasingly effective modulation of distress, more definitive risk for psychopathology; Campbell et al., 2006; Caspi et al., 1996). JETTC included data from 14 nations: US, Brazil, Spain, Mexico, Italy, Russia, Finland, Romania, Belgium, the Netherlands, China, South Korea, Turkey, and Chile, also represented in this study. Regarding NE, toddlers from China, Korea, Brazil, Turkey, and Chile were rated higher than those from the US, Finland, Netherlands, Italy, Mexico, and Belgium. Children from China, Korea, and Brazil additionally scored higher than those from Russia and Romania, and Chinese toddlers were rated higher than their Spanish counterparts (Slobodskaya et al., 2018). The present investigation relies on JETTC data, addressing an important gap in research, as we focus on fine-grained dimensions of NE (along with the overarching factor), while using a more robust statistical procedure— multilevel modeling, to address limitations of the prior research and further explore the role of cultural mechanisms in shaping individual differences.

The Role of Cultural Values

Although variance within cultures is often greater than variance between them (Fischer & Schwartz, 2011), consistent patterns of differences continue to emerge in comparative research. In fact, effect sizes associated with culture are often greater than those for age and gender, themselves significant factors in shaping social-emotional development (Achenbach & Rescorla, 2007). Thus, individuals vary substantially within their culture, yet their shared experience

profoundly influences their development (Bornstein, 2013).

Multiple cultural mechanisms have been implicated in these divergent developmental pathways, and cultural values are among the most frequently cited, with Hofstede's framework, describing cultural orientation along six dimensions: individualism/collectivism, power distance, masculinity/femininity, uncertainty avoidance, indulgence/restrain, and long-/short-term orientation, typically invoked (Hofstede et al., 2010). Individualism/collectivism describes a cultural emphasis on either self-interest/preservation, relatively loose social networks, or group success and strong social connectedness (i.e., collectivistic; Weng, 2015). The US has been rated the most individualistic culture (Hofstede et al., 2010), consistent with a cultural expectation of striving for personal success. Regarding temperament, differences in individualism/collectivism are cited most frequently (Cozzi et al., 2013; Desmarais et al., 2017; Gaias et al., 2012; Gartstein et al., 2006; Krassner et al., 2017; Slobodskaya et al., 2013), with higher NE linked to more collectivistic values (Putnam & Gartstein, 2017). However, to our knowledge, no previous studies have empirically assessed the relationship between the culture-level values and individual differences in early childhood temperament, or within a multi-level modeling framework. Additionally, other cultural orientation dimensions are rarely referenced, despite their potential importance.

Hofstede et al. (2010) define the masculinity/femininity dimension as the degree to which a culture is driven for competition and success versus cooperation and consensus. Uncertainty avoidance is described as the degree to which a culture tolerates ambiguity and lack of structure. An indulgent culture is one in which society allows pursuit of gratification with little judgement, whereas a firm moral code prevents these behaviors in a restrained society. Long-term orientation describes a culture in which adaptability and preparation for the future (e.g., saving

money) is emphasized, whereas short-term orientation emphasizes satisfaction of immediate desires (Hofstede et al., 2010). The power distance dimension refers to societal expectations regarding distribution of power and influence. Putnam and Gartstein (2017) reported positive associations between masculinity, as well as uncertainty avoidance, and NE.

Aims/Hypotheses

Most of the cross-cultural temperament literature has relied on an analysis of variance (ANOVA) or closely related statistical techniques. Yet, these traditional methods assume individuals within each culture are no more similar to each other than they are to individuals reared in other cultures (i.e., insofar as within-level variance is considered "error" variance). Failing to account for the shared experience of individuals within cultures could be conceptually problematic, increases the probability of Type I error when the data are nested in cultures and ignored (e.g., Misangyi et al., 2006) and does not allow for the separation of within and between variance associated with cultures. That is, it does not allow us to investigate within culture and between culture differences simultaneously.

The present study addresses these limitations by utilizing multilevel modeling (MLM). Unlike traditional methods, MLM considers both individual- and culture-level variables simultaneously. For the present study, JETTC data (Gartstein & Putnam, 2018) provided an opportunity to examine relations between cultural values and NE among 14 cultures, which can be considered a sample of a much larger population of cultures. Additionally, we focus on toddlers because this period is characterized by rapid development of regulatory processes and is associated with reliable early predictions of later psychopathology (Campbell et al., 2006; Caspi et al., 1996). Importantly, fine-grained dimensions of NE were considered, as these have

demonstrated differential ability to predict important outcomes such as internalizing and externalizing difficulties (Gartstein et al., 2012; Muhtadie et al., 2013; Scheper et al., 2017).

Our models will include age and gender covariates in addition to Hofstede's cultural values in order to assess the unique influence of culture-level variables while controlling for individual-level demographics. Toddlers in more collectivistic cultures were expected to demonstrate higher NE. We hypothesized that fine-grained temperament scales would function consistently with this overall factor, as for example, prior research has repeatedly found higher ratings of fear in more Eastern, collectivistic cultures relative to the US and other individualistic cultures (e.g., Chen et al., 1998; Slobodskaya et al., 2013). Positive associations between masculinity, uncertainty avoidance, NE and component scales were also anticipated, with analyses considering additional cultural orientation dimensions deemed exploratory.

Method

Participants

Each of the Joint Effort Toddler Temperament Consortium (JETTC) sites recruited an average of 61 families, with only one child represented per family. Samples from each country ranged from 49 (Chile) to 112 (the Netherlands) for a total sample of N = 865 families. Children ranged between 17 and 40 months of age (M = 26.88 months, SD = 5.65 months), with approximately equal distribution of ages across this developmental period, as well as approximately equal representation of genders (52% male). Although the Early Childhood Behavior Questionnaire (ECBQ) is optimally designed for use with children 18- to 36-months of age, a small subset of children between 15- and 18-months (n = 22, ~2% of overall sample) and 37- and 40-months of age (n = 13, ~1% of overall sample) were included in the study. Mild expansion of age ranges is typical for childhood temperament instruments, as items remain

developmentally appropriate (Putnam et al., 2014). For all but two of the JETTC nations, data were collected in a single site. In the Netherlands and the US, data from two locations were combined following analyses demonstrating no significant differences between sites on the variables examined in this study ($p > .05$). Importantly, each culture is assigned a single "score" for each cultural value, thus individuals from different sites within the same culture will not vary from one another with respect to cultural values. Overall, families in this study represent a range of occupations, primarily reflecting middle socio-economic status (sample demographics provided in supplemental materials).

Measures

Temperament

Temperament was assessed via the Early Childhood Behavior Questionnaire (ECBQ; Putnam et al., 2006), an established parent-report instrument. We focused on the NE factor and component subscales (discomfort, fear, motor activation, sadness, perceptual sensitivity, shyness, soothability, and frustration) because of widely documented differences in the existing cross-cultural literature (e.g., Ahadi et al., 1993; Chen et al., 1998; Farkas & Vallotton, 2016), and consistent links between this factor, its components, and risk for psychopathology (Eisenberg et al., 2005).

Scale scores represent the arithmetic mean of scale items. Internal consistency for all scale scores was estimated separately for each culture via Cronbach's alpha coefficient. The soothability scale is comprised of 9 while discomfort contains 10 items. Fear and motor activity each contain 11 items, and sadness, perceptual sensitivity, and frustration tolerance are represented by 12 items each. One item was removed from the shyness scale, resulting in 11 retained items, to maximize internal consistency without significant change to the content

represented by the scale. The NE factor was calculated via the mean of all subscales. The NE factor and all subscales demonstrated appropriate reliability for research purposes (Nunnally & Bernstein, 1994). Table 1 contains the estimates by subscale and total domain across cultures and descriptive statistics are provided in supplemental materials. Reliability values ranged from .60 to .90 for all subscales and the overall NE domain, with an average of approximately .80. All analyses were completed using STATA® version 14. A review of QQ plots, distributions, and skew and kurtosis values for all factors and scales did not indicate a significant departure from normality to compromise the assumptions of MLM.

[Table 1 about here]

Cultural values

Values for Hofstede's cultural dimensions for each of the JETTC cultures were obtained from Cultures and Organizations: Software of the Mind (Hofstede et al., 2010), which aggregates results of research from Hofstede and colleagues to generate scores for various cultural groups and regions. Importantly, although these data were initially collected at the individual level, the resulting aggregate scores represent the shared overarching cultural climate. Thus, while all individuals vary with respect to their own values, the scores provided by Hofstede et al. (2010) are designed to reflect the shared experience of cultural values. As such, these culture-level scores do not vary at the individual level (i.e., are the same for each member of a given culture/nation). For example, every participant from the US was assigned an individualism/collectivism score of 91. For individualism/collectivism, higher ratings indicate greater individualism. Higher power distance indicates acceptance of hierarchical power structures. Higher masculinity/femininity ratings reflect prioritizing competition/success (i.e., more masculine values), whereas higher uncertainty avoidance indicates less ambiguity

tolerance. Cultures high in indulgence/restraint value hedonistic pursuits with little restriction. Higher ratings of long/short-term orientation indicate an emphasis on preparation/planning.

Analytic Strategy

Modelling procedures

Data were analyzed using a linear MLM approach, including child age and gender as covariates. Data for cultural values were grand-mean centered to enhance interpretability, and because of the primary interest in culture-level predictors (Enders & Tofighi, 2007). Models were constructed in three phases, starting with a null model that partitions within- and between-level variance, providing a baseline for comparing subsequent models. A second model included age and gender covariates, and the final model introduced Hofstede dimensions, noted as

$$Temperament_{ij} = \gamma_{00} + \gamma_{10}(\text{Age}_{ij}) + \gamma_{20}(\text{Gender}_{ij}) + \gamma_{01}(\text{Individualism}_{0j}) \ldots + \gamma_{06}(\text{Indulgence}_{0j}) + u_{0j} + r_{ij} \quad (1)$$

where $Temperament_{ij}$ is the estimated temperament rating for individual *i* in culture *j*, γ_{00} is the sample grand-mean, u_{0j} is the variation of culture *j* from the grand mean, and r_{ij} is the residual term associated with individual *i* in culture *j*. $\gamma_{01} - \gamma_{06}$ denote regression coefficients for each of Hofstede's six cultural dimensions.

Models were compared via various fit indices (i.e., AIC, BIC, chi-square). Of note, while all models were estimated using REML in order to accommodate the relatively low number of level-2 groups (i.e., cultures, $J = 14$), they were also estimated using full maximum likelihood for the purposes of the chi-square difference test. Models were also compared in terms of variance accounted for by cultural values. The intraclass correlation (ICC) reflects the proportion of variance occurring at the culture-level in comparison to the total model variance. Similarly, models were also compared based upon reduction of between-level variance explained by

cultural values in comparison to models with only age and gender covariates utilizing equation 1 as described by Hox (2018):

$$\Delta R^2 = (\text{Model 1 Estimate} - \text{Model 2 Estimate}) / (\text{Model 1 Estimate}) \quad (1)$$

Models which did not explain more between-level variance than those including only age and gender covariates were not deemed worth pursuing, as this indicated that culture-level variables were not aiding in understanding between culture differences.

Results

Table 2 summarizes the changes in between-level variance for the null, covariate-only (i.e. model 1), and cultural values models (i.e., model 2). Detailed model comparison tables are provided as supplemental materials. ICC values indicate the ratio of between-level variance to total variance and they ranged from 3.99% (shyness) to 28.30% (discomfort). While all ICC values indicate that the majority of variance in temperament occurs at the individual level (as would be expected), the average ICC value was approximately 13.82%, shows that, on average, about 13% of the total variance in NE and component subscales occurs at the cultural level.

Decreases in the ICC from model 1 to model 2 indicate that cultural values explain culture-level differences in NE and component subscales. For example, 20.88% of variance in NE occurred at the cultural level (i.e., null model ICC). The inclusion of age and gender covariates (i.e., model 1) reduced the ICC by .46%, and adding cultural values (i.e., model 2) reduced the ICC by an additional 10.75%, leaving only 9.71% of the between-level variance unexplained.

In multilevel modeling, ΔR^2 is often used in addition to the ICC. Whereas the ICC reflects a ratio of between-level to total variance, ΔR^2 reflects the relative (i.e., proportional) difference in between-level variance statistic from one model to another by directly comparing

between-level variance estimates. Thus, the change in R^2 values discussed herein reflect the percentage reduction in between-culture variance when adding cultural values to the previous model, which included only age and gender covariates. For example, inclusion of cultural values reduced the between-culture variance in NE by 58.62% compared to the model including only age and gender covariates. In other words, cultural values explained over half of the between-culture variance that remained in the model after accounting for age and gender effects. Similarly, inclusions of cultural value variables reduced between-level variance for discomfort (88.53%), fear (56.82%), shyness (35.29%), motor activity (50.00%), perceptual sensitivity (41.61%) and soothability (33.73%) relative to models including only age and gender covariates. Importantly, although between level variance for sadness was reduced by 27.66%, the inclusion of cultural values did not significantly improve fit for this model. Similarly, model fit was not improved for frustration via the inclusion of cultural values, nor was between-level variance reduced. For all other temperament variables model fit was improved according to deviance statistics (i.e., $\Delta\chi^2(6) > 12.59$), indicating that the final model more accurately described the data, compared to those including age and gender only.

[Table 2 about here]

Table 2 also demonstrates that, for all temperament variables except sadness and frustration, there was at least one statistically significant relationship with a cultural value variable, with individualism/collectivism emerging as the most consistent predictor of temperament ratings. Additionally, Table 3A and 3B provide the coefficients, confidence intervals, and effect sizes associated with each cultural value and temperament variable. Greater individualism was associated with lower NE, discomfort, fear, motor activity, and perceptual sensitivity; and higher ratings of soothability. The discomfort subscale was also negatively

associated with power distance and positively associated with masculine cultural values. Higher shyness was associated with long-term cultural orientation.

[Tables 3A and 3B about here]

Discussion

Results were generally consistent with hypotheses and prior cross-cultural comparisons wherein children from nations such as China and Russia were higher in NE and the component subscales relative to their US counterparts (Chen et al., 1998; Gartstein et al., 2010; Rubin et al., 2006; Slobodskaya et al., 2013). Collectivistic cultures may be accepting of certain NE manfestations (e.g., fearfullness/shyness) because these promote social reservation and attention toward perspective of others (Chen et al., 1998; Keller et al., 2004).

NE in early childhood increases the risk for behavior problems/psychopathology (Gartstein et al., 2012; Mäntymaa et al., 2012; Scheper et al., 2017), and internalizing difficulties could be more common in collectivistic cultures (Chung et al., 2013; Crijnen et al., 1997), although these results are not uniform. Thus, greater prevalence of NE in collectivistic cultures does not universally incur risk for anxiety/depression-related symptoms, typically observed in individualistic settings, perhaps because behaviors viewed as “disordered” in the more individualistic/western cultures are considered functional and adaptive in collectivistic contexts. For example, behavioral inhibition is valued in the traditional Chinese culture, but discouraged in many western, more individualistic societies (Rubin et al., 2006). Future research should seek to assess cross-cultural differences in relations between temperament and psychopathology, and protection potentially afforded by the collectivistic cultural context.

In addition to individualism/collectivism, discomfort was associated with masculine values and lower power distance. That is, individuals from cultures which value

competition/success as well as equality of power distribution described their children as displaying more discomfort, possibly because displays of discomfort-related distress are more readily accepted. Long-term cultural orientation, including an appreciation for a "sense of shame" (Hofstede & Minkov, 2010), was associated with greater shyness, and greater propensity for social reticence in these cultures may be a result of selective reinforcement of shyness in service of this culturally-valued shame induction.

Importantly, while effects of power distance, masculinity/femininity, and long/short-term orientation were identified, these were not as robust as those associated with individualism/collectivism. Moreover, no significant relationships were identified for uncertainty avoidance and indulgence/restraint. As such, while these results appear to be the first to empirically support previously theorized connections between individualism/collectivism and cross-cultural differences in toddler NE (e.g., Cozzi et al., 2013; Desmarais et al., 2017; Gaias et al., 2012; Gartstein et al., 2006; Krassner et al., 2017; Slobodskaya et al., 2013), they also indicate that other cultural values may not be as relevant to distress proneness. This finding may be somewhat surprising, as Putnam and Gartstein (2017) reported positive correlations between NE and masculinity/femininity and uncertainty avoidance. Additionally, in an assessment of relationship between adult personality constructs and cultural values, Hofstede and McCrae (2004) reported that masculine values were associated with more neurotic personality characteristic.

One possibility is that cultural values may play a more influential role in later stages of development, as Hofstede and McCrae utilized an adult sample and Putnam and Gartstein aggregated temperament ratings across infants, children, and adults. It is also possible that interactions between cultural values may account for additional variance and reveal more

nuanced relationships with NE. While the assessment of such relationships is certainly possible within an MLM framework, the large number of potential interactions terms (i.e., 57 possible interaction terms) would be impossible to accommodate within a single model. As such, additional research and theoretical development is necessary in order to form a priori hypotheses regarding specific models to be tested, and we hope that the present study serves as a foundation for this future work.

By appropriately accounting for the nested structure of the data, the current study was also able to assess variance at both the cultural and individual level, thereby increasing confidence in the observed relationships (i.e., through more robust standard error estimation). Additionally, previous cross-cultural temperament research has relied on categorizing cultures as either collectivistic or individualistic, primarily because inclusion of two and four cultures precludes the use of a dimensional framework. Using the multilevel framework, the dimensional nature of cultural value domains can be captured, elucidating related effects.

The present study also demonstrates the utility of MLM in assessing cross-cultural differences in temperament. Although MLM has been applied in other areas of cross-cultural research, it has only recently emerged within the cross-cultural developmental literature (e.g., Deater-Deckard et al., 2018; Scherr et al., 2019). This project illustrates that, even with a relatively limited number of represented cultures, important similarities and differences both between- and within-cultures can be explored and understood.

Limitation and Future Directions

Perhaps the most critical limitation of this study is the relatively small number of compared cultures. Although 14 cultures represent a much broader basis of comparison that is typical in the current temperament literature, it is nonetheless limiting in terms of power. This

study was also cross-sectional, and longitudinal work is necessary to capture developmental processes. Additionally, the present study relied on parent-report measures from a single caregiver. Future research should include alternative assessment approaches, such as laboratory measures, as well as reports from fathers or other caregivers. Similarly, our study focused on the culture-level influence of cultural values; however, it is also conceivable that individual variations in values might influence temperament developmental. As such, we recommend that future studies assess values at both the individual- and culture-level.

Conclusions

The present study is the first to apply multilevel modeling to explore the role of culture in the development of temperament, demonstrating the feasibility and advantages of such an approach. Despite several limitations, these findings provide support for existing theories regarding relationships between broad cultural value dimensions and individual differences in child temperament and provide new insights into the unique contributions of cultural values beyond the individualism/collectivism, considering these from a dimensional perspective.

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Table 1
Internal consistency reliability (Cronbach's alpha) for ECBQ Negative Emotionality and subscales.

Factor/Scale	**Brazil**	**South Korea**	**Spain**	**Mexico**	**Russia**	**Italy**	**Belgium**	**Finland**	**Netherlands**	**Romania**	**China**	**United States**	**Turkey**	**Chile**
Negative Emotionality	**.93**	**.89**	**.89**	**.90**	**.88**	**.91**	**.90**	**.87**	**.89**	**.89**	**.85**	**.90**	**.92**	**.89**
Discomfort	.81	.61	.71	.67	.59	.82	.74	.77	.62	.76	.50	.71	.79	.67
Fear	.70	.78	.76	.65	.67	.71	.84	.63	.73	.73	.78	.69	.77	.69
Frustration	.84	.78	.70	.81	.76	.73	.76	.80	.75	.79	.74	.84	.75	.74
Sadness	.84	.71	.76	.81	.81	.83	.85	.72	.79	.72	.82	.76	.80	.85
Shyness	.86	.80	.78	.78	.78	.83	.82	.79	.82	.82	.67	.82	.87	.77
Perceptual Sensitivity	.80	.77	.83	.80	.84	.86	.79	.78	.79	.82	.75	.85	.89	.83
Motor Activity	.81	.82	.65	.56	.67	.56	.78	.64	.71	.68	.69	.62	.77	.81
Soothability	.76	.81	.78	.74	.84	.78	.84	.87	.83	.77	.68	.78	.75	.60

Notes: *N* (total number of cases) = 865, *J* (total number of cultures) = 14.

Table 2
Variance accounted for by cultural values.

Factor/Scale	**Null ICC[1] (%)**	**Model 1 ICC[1] (%)**	**Model 2 ICC[1] (%)**	**ΔR^2 Between[2] (%)**	**Relationships with Cultural Values[3] (-, +, NS)** IDV	PDI	MAS	UAI	IND	LTO
Negative Emotionality	**20.88**	**20.46**	**9.71**	**58.62**	-	NS	NS	NS	NS	NS
Discomfort	28.30	27.69	4.15	88.53	-	-	+	NS	NS	NS
Fear	19.12	18.89	9.09	56.82	-	NS	NS	NS	NS	NS
Frustration	8.06	7.99	13.26	.00	NS	NS	NS	NS	NS	NS
Sadness	6.98	6.81	5.03	27.66	NS	NS	NS	NS	NS	NS
Shyness	3.99	3.92	2.65	35.29	NS	NS	NS	NS	NS	+
Motor Activity	11.53	12.88	6.76	50.00	-	NS	NS	NS	NS	NS
Perceptual Sensitivity	13.45	12.72	7.82	41.61	-	NS	NS	NS	NS	NS
Soothability	12.14	11.79	8.19	33.73	+	NS	NS	NS	NS	NS

Notes: *N* (total number of cases) = 865, *J* (total number of cultures) = 14.
ICC = interclass correlation, IDV = Individualism/Collectivism, PDI = Power Distance, MAS = Masculinity/Femininity, UAI = Uncertainty Avoidance, IND = Indulgence/Restraint, and LTO = Long-/Short-Term Orientation
"Model 1" reflects ICC for models with age and gender covariates.
"Model 2" reflects the ICC after including all cultural values.
[1] The ICC is calculated as the ratio of between-level variance to total variance.
[2] Between-culture variance (ΔR^2 Between) reflects reduction in between-level variance attributed to cultural factors while controlling for age and gender covariates. This value is calculated using the following equation: ΔR^2 = (Model 1 Estimate – Model 2 Estimate) / (Model 1 Estimate).
[3] Relationships with cultural values indicates if a cultural value has a statistically significant (i.e., $p<.05$) negative (-), positive (+), or non-significant (NS) relationship with the associated temperament variable.

Table 3A
Coefficients, confidence intervals, and effect sizes for individualism/collectivism, power distance, and masculinity/femininity.

	Individualism/Collectivism			**Power Distance**			**Masculinity/Femininity**		
Factor/Scale	γ	95% CI	δ	γ	95% CI	δ	γ	95% CI	δ
Negative Emotionality	**-.010**	**-.016 - -.005**	**-.471**	-.005	-.014 - .003	-.176	.002	-.004 - .008	.067
Discomfort	**-.022**	**-.028 - -.016**	**-.604**	**-.013**	**-.022 - -.003**	**-.267**	**.007**	**.000 - .014**	**.137**
Fear	**-.015**	**-.023 - -.007**	**-.451**	-.008	-.022 - .005	-.180	.007	-.003 - .016	.150
Frustration	-.003	-.013 - .008	-.089	-.004	-.021 - .013	-.089	-.001	-.013 - .012	-.021
Sadness	-.004	-.011 - .003	-.122	.001	-.010 -.012	.023	-.001	-.009 - .007	-.022
Shyness	-.005	-.011 - .001	-.136	-.004	-.014 - .006	-.081	.004	-.003 - .011	.077
Motor Activity	**-.010**	**-.016 - -.004**	**-.362**	-.004	-.014 - .005	-.108	-.004	-.012 - .002	-.103
Perceptual Sensitivity	**-.015**	**-.025 - -.005**	**-.357**	-.011	-.027 - .005	-.195	.001	-.010 - .013	.017
Soothability	**.009**	**.001 - .018**	**.268**	.000	-.013 - .013	.000	-.004	-.014 - .005	-.085

Notes: *N* (total number of cases) = 865, *J* (total number of cultures) = 14.
γ = unstandardized coefficient, δ = standardized coefficient.
Significant results presented in **bold** ($p<.05$).

Table 3B
Coefficients, confidence intervals, and effect sizes for uncertainty avoidance, indulgence/restraint, and long-/short-term orientation.

	Uncertainty Avoidance			**Indulgence/Restraint**			**Long-/Short-Term Orientation**		
Factor/Scale	γ	95% CI	δ	γ	95% CI	δ	γ	95% CI	δ
Negative Emotionality	-.002	-.007 - .004	-.074	-.001	-.006 - .005	-.040	.003	-.003 - .008	.129
Discomfort	-.002	-.008 - .004	-.043	-.006	-.012 - .000	-.141	.000	-.005 - .006	.000
Fear	-.003	-.011 - .005	-.071	.000	-.008 - .009	.000	.005	-.002 - .013	.137
Frustration	.002	-.008 - .013	-.046	.003	-.008 - .014	.077	.003	-.008 - .012	.081
Sadness	-.004	-.010 - .003	-.095	-.001	-.008 - .006	-.026	.004	-.002 - .011	.111
Shyness	-.004	-.010 - .002	-.085	.003	-.004 - .009	.070	**.006**	**.000 - .011**	**.148**
Motor Activity	-.004	-.010 - .003	-.113	.000	-.006 - .007	.000	.001	-.005 - .007	.033
Perceptual Sensitivity	.004	-.006 - .014	-.074	-.005	-.015 - .006	-.102	.001	-.008 - .010	.022
Soothability	.004	-.004 - .012	-.093	-.001	-.009 - .008	-.026	.000	-.008 - .008	.000

Notes: *N* (total number of cases) = 865, *J* (total number of cultures) = 14.
γ = unstandardized coefficient, δ = standardized coefficient.
Significant results presented in **bold** ($p<.05$).

Sample demographics by culture.

	Child Gender		Child Age (in months)			Family Socio-Economic Status (RDSI)[1]			Marital Status (in percent)[2]				Maternal Education (in years)			Maternal Age (in years)			# of Children in the Household		
Culture	**Female**	**Male**	**Range**	***M***	***SD***	**Range**	***M***	***SD***	**Ma**	**Lt**	**Di**	**Si**	**Range**	***M***	***SD***	**Range**	***M***	***SD***	**Range**	***M***	***SD***
US	49	39	17-36	25.6	5.8	10-97	50.3	26.2	92	7	1	0	9-24	17.2	2.3	23-46	33.1	4.47	1-6	1.7	1
Belgium	21	27	17-41	25.7	5.3	10-97	63.8	21.1	56	38	12	4	10-32	18.0	2.9	27-38	32.26	2.67	1-5	1.9	1
Brazil	23	28	18-38	29.4	5.6	15-96	56.9	24.2	82	12	0	6	11-37	18.3	4.9	22-43	32.90	4.55	1-3	1.4	1
Chile	21	28	17-41	27.3	7.2	10-97	49.7	28.3	62	15	2	21	12-28	18.1	4.9	17-41	28.54	7.11	1-4	1.8	1
China	30	24	19-36	26.4	4.7	15-97	58.7	29.9	87	13	0	0	8-23	15.6	3.6	21-40	30.11	3.99	1-2	1.2	1
Finland	24	31	18-40	27.6	5.7	10-97	61.6	20.8	62	30	2	6	12-26	17.7	2.6	24-41	33.57	3.87	1-4	1.5	1
Italy	24	28	17-36	26.6	4.9	15-97	61.9	20.6	77	23	0	0	11-25	17.2	3.1	30-48	37.15	3.72	1-5	1.7	1
Mexico	25	29	18-36	26.4	5.6	10-97	38.3	29.8	69	24	6	1	9-25	16.8	3.8	17-43	32.35	5.89	1-5	1.6	1
Netherlands	55	64	16-40	26.6	5.8	10-87	56.6	22.3	53	40	2	5	5-25	17.7	3.7	20-41	31.99	4.27	1-3	1.6	1
Romania	30	28	17-38	21.2	6.4	15-97	72.4	19.4	98	2	0	0	12-29	18.1	6.4	23-41	32.91	3.93	1-3	1.4	1
Russia	26	25	17-36	27.0	5.6	15-93	62.8	19.0	77	21	2	0	10-22	14.9	2.1	21-43	29.37	5.20	1-8	1.6	1
Spain	27	35	18-35	26.1	5.1	10-97	58.2	27.3	74	18	1	7	8-21	15.6	4.2	29-43	35.88	3.55	1-4	1.8	1
S. Korea	26	27	17-35	28.0	4.8	15-96	51.6	24.5	100	0	0	0	7-18	15.3	2.2	29-44	34.58	3.45	1-3	1.9	1
Turkey	25	34	16-36	27.7	5.6	10-97	50.5	26.1	92	7	1	0	9-24	14.4	3.9	19-46	31.78	5.46	1-4	1.4	1

Notes: *N* (total number of cases) = 865, *J* (total number of cultures) = 14.

M = mean, *SD* = standard deviation

[1]RDSI: Revised Duncan Sociometric Index – An occupation based measure of social prestige, based on maternal occupations (Stevens & Featherman, 1981).

[2]Ma = Married, Lt = Living Together, Di = Divorced, Si = Single

Table adapted with permission from (Gartstein et al., 2018)

Descriptive statistics of the Early Childhood Behavior Questionnaire.

Factor/Scale	***M***	***SD***	**Skew**	**Kurtosis**	**Range**
Negative Emotionality	**2.98**	**.53**	**.35**	**3.19**	**1.60 – 4.85**
Discomfort	2.52	.91	.77	3.41	1.00 – 6.20
Fear	2.54	.83	.65	3.22	1.00 – 5.45
Frustration	3.47	.84	.27	3.05	1.17 – 6.42
Sadness	2.94	.82	.38	3.38	1.00 – 5.97
Shyness	3.19	.92	.27	2.75	1.09 – 6.09
Motor Activity	2.11	.69	1.00	4.90	1.00 – 5.45
Perceptual Sensitivity	4.41	1.05	-.07	2.72	1.42 – 7.00
Soothability	5.31	.84	-.70	3.57	1.33 – 6.89

Notes: *N* (total number of cases) = 865, *J* (total number of cultures) = 14.
M = Mean, *SD* = Standard deviation
Scores on the Early Childhood Behavior Questionnaire may range between 1 and 7.

JETTC values for Hofstede's cultural dimensions.

Culture	IDV[1]	PDI[2]	MAS[3]	UAI[4]	IND[5]	LTO[6]
Belgium	75	65	54	94	56.70	81.86
Brazil	38	69	49	76	59.15	43.82
Chile	23	63	28	86	68	31
China	20	80	66	30	23.66	87.41
Finland	63	33	26	59	57.37	38.29
Italy	76	50	70	75	29.69	61.46
Mexico	30	81	69	82	97.32	24.18
Netherlands	80	38	14	53	68.30	67.00
Romania	30	90	42	90	19.87	51.89
Russia	39	93	36	95	19.87	81.36
Spain	51	57	42	86	43.53	47.61
S. Korea	18	60	39	85	29.46	100
Turkey	37	66	45	85	49.11	45.59
US	91	40	62	46	68.08	25.69

Notes: IDV = Individualism/Collectivism, PDI = Power Distance, MAS = Masculinity/Femininity, UAI = Uncertainty Avoidance, IND = Indulgence/Restraint, and LTO = Long-/Short-Term Orientation.
Scores for Hofstede's cultural dimensions may range between 0 and 100.
[1]Higher ratings for individualism/collectivism indicate more cultural emphasis on self-interest and personal success; lower scores indicate emphasis on group success and strong social connectedness.
[2]Higher ratings for power distance indicates acceptance of hierarchical power structures; lower scores reflect a preference for equal distribution of power.
[3]Higher ratings for masculinity/femininity reflect prioritizing competition/success (i.e., more masculine values); lower scores indicate an emphasis on cooperation and consensus (i.e., more feminine values).
[4]Higher ratings for uncertainty avoidance indicate less ambiguity tolerance; lower scores indicate greater tolerance.
[5]Higher ratings for indulgence/restraint reflect a culture which values hedonistic pursuits; lower scores describe a culture which espouses a strong moral code characterized by restraint.
[6]Higher ratings for long/short-term orientation indicate an emphasis on preparation/planning (i.e., long-term orientation); lower scores reflect a culture which prioritizes immediate gratification (short-term orientation).

Model estimates for ECBQ Negative Emotionality Factor.

	Model 1		Model 2	
Fixed Components	Est.	*SE*	Est.	*SE*
Intercept	2.897	.114	2.869	.103
Age	.007*	.003	.007*	.003
Gender	-.042	.033	-.041	.033
Individualism/Collectivism			-.010**	.003
Power Distance			-.005	.004
Masculinity/Femininity			.002	.003
Uncertainty Avoidance			-.002	.002
Indulgence/Restraint			-.001	.003
Long-/Short-Term Orientation			.003	.003
Variance Components				
Within	.227	.011	.227	.011
Between				
Intercept	.058	.024	.024	.015
Slope				
Model Fit				
χ^{2a}	1206.48		1186.72	
AIC	1234.97		1291.19	
BIC	1258.78		1343.58	
R^2 within (%)[b]			0.00	
R^2 between (%)[b]			58.62	

Notes: *N* (total number of cases) = 865, *J* (total number of cultures) = 14.
Est = Estimate. *SE* = Standard Error
[a]χ^2 were estimated using full maximum likelihood.
[b] R^2 represents in the variance explained in comparison to model 1.
*p<.05, **p<.01.

Model estimates for ECBQ Discomfort Scale.

	Model 1		Model 2	
Fixed Components	Est.	*SE*	Est.	*SE*
Intercept	2.031	.194	1.949	.154
Age	.025**	.005	.025**	.005
Gender	-.061	.052	-.059	.052
Individualism/Collectivism			-.022**	.003
Power Distance			-.013*	.005
Masculinity/Femininity			.007*	.003
Uncertainty Avoidance			-.002	.003
Indulgence/Restraint			-.006	.003
Long-/Short-Term Orientation			.000	.003
Variance Components				
Within	.569	.028	.569	.028
Between				
Intercept	.218	.089	.025	.019
Slope				
Model Fit				
χ^{2a}	2007.96		1972.73	
AIC	2033.30		2074.09	
BIC	2057.11		2126.48	
R^2 within (%)[b]			0.00	
R^2 between (%)[b]			88.53	

Notes: *N* (total number of cases) = 865, *J* (total number of cultures) = 14.
Est = Estimate. *SE* = Standard Error
[a]χ^2 were estimated using full maximum likelihood.
[b] R^2 represents in the variance explained in comparison to model 1.
*p<.05, **p<.01.

Model estimates for ECBQ Fear scale.

	Model 1		Model 2	
Fixed Components	Est.	*SE*	Est.	*SE*
Intercept	2.459	.177	2.421	.161
Age	.014**	.005	.014**	.005
Gender	-.172**	.051	-.171**	.051
Individualism/Collectivism			-.015**	.004
Power Distance			-.008	.007
Masculinity/Femininity			.007	.005
Uncertainty Avoidance			-.003	.004
Indulgence/Restraint			.000	.004
Long-/Short-Term Orientation			.005	.004
Variance Components				
Within	.565	.027	.565	.027
Between				
Intercept	.132	.056	.057	.036
Slope				
Model Fit				
χ^{2a}	1995.70		1976.32	
AIC	2021.53		2072.98	
BIC	2045.35		2125.37	
R^2 within (%)[b]			0.00	
R^2 between (%)[b]			56.82	

Notes: *N* (total number of cases) = 865, *J* (total number of cultures) = 14.
Est = Estimate. *SE* = Standard Error
[a]χ^2 were estimated using full maximum likelihood.
[b] R^2 represents in the variance explained in comparison to model 1.
*p<.05, **p<.01.

Model estimates for ECBQ Frustration scale.

	Model 1		Model 2	
Fixed Components	Est.	*SE*	Est.	*SE*
Intercept	3.337	.172	3.343	.182
Age	.002	.005	.002	.005
Gender	.062	.055	.060	.055
Individualism/Collectivism			-.003	.005
Power Distance			-.004	.009
Masculinity/Femininity			-.001	.006
Uncertainty Avoidance			.003	.006
Indulgence/Restraint			.003	.006
Long-/Short-Term Orientation			.003	.005
Variance Components				
Within	.658	.032	.658	.032
Between				
Intercept	.057	.027	.101	.060
Slope				
Model Fit				
χ^{2a}	2114.77		2112.89	
AIC	2141.03		2205.52	
BIC	2164.85		2257.91	
R^2 within (%)[b]			0.00	
R^2 between (%)[b]			0.00	

Notes: *N* (total number of cases) = 865, *J* (total number of cultures) = 14.
Est = Estimate. *SE* = Standard Error
[a]χ^2 were estimated using full maximum likelihood.
[b] R^2 represents in the variance explained in comparison to model 1.
*p<.05, **p<.01.

Model estimates for ECBQ Sadness scale.

	Model 1		Model 2	
Fixed Components	Est.	*SE*	Est.	*SE*
Intercept	2.749	.167	2.740	.164
Age	.006	.005	.006	.005
Gender	.021	.055	.024	.055
Individualism/Collectivism			-.004	.003
Power Distance			.001	.006
Masculinity/Femininity			-.001	.004
Uncertainty Avoidance			-.004	.003
Indulgence/Restraint			-.001	.004
Long-/Short-Term Orientation			.004	.004
Variance Components				
Within	.637	.031	.637	.031
Between				
Intercept	.047	.023	.034	.024
Slope				
Model Fit				
χ^{2a}	2085.54		2073.10	
AIC	2112.04		2172.41	
BIC	2135.86		2224.80	
R^2 within (%)[b]			0.00	
R^2 between (%)[b]			27.66	

Notes: *N* (total number of cases) = 865, *J* (total number of cultures) = 14.
Est = Estimate. *SE* = Standard Error
[a]χ^2 were estimated using full maximum likelihood.
[b] R^2 represents in the variance explained in comparison to model 1.
*p<.05, **p<.01.

Model estimates for ECBQ Shyness scale.

	Model 1		Model 2	
Fixed Components	Est.	*SE*	Est.	*SE*
Intercept	3.551	.184	3.549	.182
Age	-.005	.005	-.005	.006
Gender	-.150*	.062	-.147*	.062
Individualism/Collectivism			-.005	.003
Power Distance			-.004	.005
Masculinity/Femininity			.004	.004
Uncertainty Avoidance			-.004	.003
Indulgence/Restraint			.003	.003
Long-/Short-Term Orientation			.006*	.003
Variance Components				
Within	.822	.040	.822	.040
Between				
Intercept	.034	.019	.022	.020
Slope				
Model Fit				
χ^{2a}	2299.61		2286.68	
AIC	2325.80		2386.99	
BIC	2349.61		2439.38	
R^2 within (%)[b]			0.00	
R^2 between (%)[b]			35.29	

Notes: *N* (total number of cases) = 865, *J* (total number of cultures) = 14.
Est = Estimate. *SE* = Standard Error
[a]χ^2 were estimated using full maximum likelihood.
[b] R^2 represents in the variance explained in comparison to model 1.
*p<.05, **p<.01.

Model estimates for ECBQ Motor Activity scale.

	Model 1		Model 2	
Fixed Components	Est.	*SE*	Est.	*SE*
Intercept	2.608	.144	2.604	.136
Age	-.019**	.004	-.020**	.004
Gender	.022	.044	.022	.044
Individualism/Collectivism			-.010**	.003
Power Distance			-.004	.005
Masculinity/Femininity			-.004	.004
Uncertainty Avoidance			-.004	.003
Indulgence/Restraint			.000	.003
Long-/Short-Term Orientation			.001	.003
Variance Components				
Within	.421	.020	.421	.020
Between				
Intercept	.062	.027	.031	.020
Slope				
Model Fit				
χ^{2a}	1736.15		1718.77	
AIC	1763.28		1820.02	
BIC	1787.10		1872.41	
R^2 within (%)[b]			0.00	
R^2 between (%)[b]			50.00	

Notes: *N* (total number of cases) = 865, *J* (total number of cultures) = 14.
Est = Estimate. *SE* = Standard Error
[a]χ^2 were estimated using full maximum likelihood.
[b] R^2 represents in the variance explained in comparison to model 1.
*p<.05, **p<.01.

Model estimates for ECBQ Perceptual Sensitivity scale.

	Model 1		Model 2	
Fixed Components	Est.	*SE*	Est.	*SE*
Intercept	3.907	.215	3.867	.206
Age	.021**	.006	.021**	.006
Gender	-.024	.066	-.024	.066
Individualism/Collectivism			-.015**	.005
Power Distance			-.011	.008
Masculinity/Femininity			.001	.006
Uncertainty Avoidance			.004	.005
Indulgence/Restraint			-.004	.005
Long-/Short-Term Orientation			.001	.005
Variance Components				
Within	.942	.046	.942	.046
Between				
Intercept	.137	.060	.080	.052
Slope				
Model Fit				
χ^{2a}	2431.66		2416.46	
AIC	2456.38		2509.48	
BIC	1480.20		2561.87	
R^2 within (%)[b]			0.00	
R^2 between (%)[b]			41.61	

Notes: *N* (total number of cases) = 865, *J* (total number of cultures) = 14.
Est = Estimate. *SE* = Standard Error
[a]χ^2 were estimated using full maximum likelihood.
[b] R^2 represents in the variance explained in comparison to model 1.
*p<.05, **p<.01.

Model estimates for ECBQ Soothability scale.

	Model 1		Model 2	
Fixed Components	Est.	*SE*	Est.	*SE*
Intercept	5.495	.173	5.527	.167
Age	-.011*	.005	-.010*	.005
Gender	.034	.054	.032	.054
Individualism/Collectivism			.009*	.004
Power Distance			.000	.007
Masculinity/Femininity			-.004	.004
Uncertainty Avoidance			.004	.004
Indulgence/Restraint			-.001	.004
Long-/Short-Term Orientation			.000	.004
Variance Components				
Within	.620	.030	.620	.030
Between				
Intercept	.083	.036	.055	.035
Slope				
Model Fit				
χ^{2a}	2068.69		2055.17	
AIC	2094.76		2151.68	
BIC	2118.57		2204.07	
R^2 within (%)[b]			0.00	
R^2 between (%)[b]			33.73	

Notes: *N* (total number of cases) = 865, *J* (total number of cultures) = 14.
Est = Estimate. *SE* = Standard Error
[a]χ^2 were estimated using full maximum likelihood.
[b] R^2 represents in the variance explained in comparison to model 1.
*p<.05, **p<.01.