EUROPEAN JOURNAL OF DEVELOPMENTAL PSYCHOLOGY
2009, 6 (3), 337–364

Psychology Press
Taylor & Francis Group

A cross-cultural study of infant temperament: Predicting preschool effortful control in the United States of America and Russia

Maria A. Gartstein
Washington State University, Pullman, WA, USA

Helena R. Slobodskaya
Russian Academy of Medical Sciences (SBRAMS), Novosibirsk, Siberia, Russia

Samuel P. Putnam
Bowdoin College, Brunswick, ME, USA

Irina A. Kinsht
Russian Academy of Medical Sciences (SBRAMS), Novosibirsk, Siberia, Russia

Effortful control (EC) has been conceptualized as a dimension of temperament related to self-regulation and associated with the development of executive attention skills. Research has focused on documenting the development of EC, but there has been little systematic study of its precursors. The present study was designed to examine infant temperament characteristics as potential predictors of EC in the toddler/preschool period across two countries: Russia and the USA. Specifically, contributions of negative emotionality (NE), positive affectivity/surgency (PAS), and regulatory capacity/orienting (RCO) measured in the first year of life were expected to explain EC in the preschool

Correspondence should be addressed to Maria A. Gartstein, Department of Psychology, Washington State University, PO Box 644820, Pullman, WA 99164–4820, USA.
E-mail: gartstma@wsu.edu

This work was partly funded by the Behavioral Science Track Award for Rapid Transition (R3MH61831A) and the Washington State University International Research and Development award to the first author, and by grants of the Russian Foundation for Basic Research No. 04-06-80028-a, No. 05-06-80033-a, and the Russian Humanitarian Foundation No. 04-06-00-477-a to the second author.

The authors gratefully acknowledge the contributions of colleagues in Russia and the USA, including Gennadij Knyazev, State Research Institute of Physiology, SBRAMS, as well as the student research assistants at the University of Oregon, especially Jesse Chasman, Jennifer Greenberg, and Elizabeth White.

http://www.psypress.com/edp DOI: 10.1080/17405620701203846

period. For the US sample, toddler NE, infant PAS and RCO explained significant amounts of EC variance, whereas infant RCO was the single significant predictor of later EC in the Russian sample. Analyses with the combined sample provided an opportunity to evaluate temperament-by-culture interactions, one of which (PAS × Culture) reached statistical significance. Follow-up analyses indicated that higher levels of infant PAS were related to higher EC scores for US children only, whereas for the Russian youth preschool EC did not vary as a function of infant PAS. Results of this study support the importance of early appearing regulation in contributing to the development of EC and illustrate the value of cross-cultural longitudinal research.

Temperament approaches aimed at explaining the development of personality, on the surface, may seem incompatible with the cross-cultural orientation of the study of behavior. Temperament research tends to emphasize common biological underpinnings of individual differences in temperament characteristics. For example, the psychobiological approach proposed by Rothbart and Derryberry (1981) has conceptualized temperament as constitutionally based individual differences in reactivity and self-regulation, influenced by heredity, maturation, and experience. "Constitutionally" here refers to the relatively enduring biological make-up of the individual, with reactivity encompassing arousability of affect, motor activity, and attentional responses (i.e., orienting), assessed by threshold, latency, intensity, time to peak intensity, and recovery time of the reaction. Self-regulation refers to processes such as behavioral inhibition and self-soothing, serving to modulate reactivity (Rothbart & Bates, 1998). In so far as these biologically based reactive and regulatory factors are influenced by experience, cultural differences in their expression can be anticipated.

A number of characteristics related to self-regulation (i.e., voluntary attention, inhibitory control, and self-soothing) and attributed to temperament have been conceptualized as a broadband dimension widely referred to as effortful control (EC), and associated with the development of executive attention skills. More formally, EC refers to the ability to inhibit a dominant response in order to perform a subdominant response (Kochanska, Murray, & Harlan, 2000; Rothbart, Ahadi, & Hershey, 1994) which, to a significant extent, is a product of the executive attention system development beginning toward the end of first year of life (Rothbart et al., 1994). EC is generally conceptualized as including temperament attributes such as focusing and shifting attention, inhibiting a response as a situation necessitates it, and responding to low-intensity stimulation and reward (Rothbart, Ellis, Rueda, & Posner, 2003).

Early attentional attributes linked to temperament (e.g., duration of orienting) have important implications for the development of EC, and subsequently for the associated social competence and adjustment (Ruff & Rothbart, 1996). Duration of looking is thought to reflect the amount of

information processed by an individual (Cohen, 1972), and can be observed as early as the third month of life. Subsequently, sustained visual attention to stationary objects or visual displays begins to slowly but steadily decline (Lewis, Goldberg, & Campbell, 1969), presumably due to greater flexibility in the infants' orienting reactions. However, later in the first year of life increases in attentional persistence have been noted. For example, Carranza, Perez-Lopez, Gonzalez, and Martinez-Fuentes (2000) reported decreases in duration of orienting between 6 and 9 months, followed by an increase between 9 and 12 months of age. Toward the end of the first year, skills associated with development of the executive attention system likely contribute to the flexibility of orienting reactions (Posner & Rothbart, 1991). Interestingly, decreases in the duration of orienting have been typically demonstrated when infants were presented with a single object (Ruff, Saltarelli, Capozzoli, & Dubiner, 1992). Conversely, a simultaneous presentation of multiple objects (e.g., toys) for active manipulation resulted in duration of looking increases (Bakeman & Adamson, 1984).

It is not surprising that the development of attention is closely linked with the emergence of self-regulation, given that to attend to the environment effectively, infants must be able to regulate the balance between the needs of their internal systems (i.e., arousal) and the demands of external stimulation (Bornstein & Seuss, 2000). Even very young infants exhibit strategies that serve to control arousal and thus attention, such as self-stimulation and gaze aversion (Thompson, 1998). These self-regulatory abilities are enhanced in the second half of the first year of life with the emergence of executive attention skills, and are conceptualized as stable individual differences reflected in temperament attributes (Ruff & Rothbart, 1996; Rothbart et al., 1994).

The purpose of this study was to examine the attention-based regulatory domain of temperament, assessing its development cross-culturally in the context of a developmentally sensitive design, and focusing on early manifestations of EC. The developmental precursors of EC (i.e., regulatory capacity/orienting; RCO), that is, the regulation-related domain of temperament identified in infancy, prior to the coming "online" of the attentional skills associated with EC, were evaluated in samples of children from two cultures (USA and Russia) that were followed longitudinally. Our hypothesis that aspects of infant orienting/regulatory capacity would predict later EC was theoretically founded on concepts of "structural continuity" and "heterotypic continuity" (Caspi, 1998). Consistent with the latter, although manifestations of regulation in the infant and toddler period may be viewed as rather dissimilar, the measures addressing attention-based regulation during these periods were developed through rational means to assess a common underlying trait. Furthermore, continuity between infant and toddler regulation is exemplified by consistency of several domains

comprising the regulation-related factors (i.e., RCO and EC) across early childhood. Specifically, the definitions for cuddliness and low intensity pleasure are essentially identical across the infancy and toddler period instruments, sharing multiple items. Increasing voluntary control in toddlerhood necessitated the use of more narrowly differentiated scales assessing attentional abilities (e.g., attentional shifting, inhibitory control), however, the underlying focus on attention as enabling regulation implicates the possibility that these infancy and toddler age attributes ought to be connected longitudinally. Additional support for this contention is provided through empirical evidence demonstrating structural continuity of the RCO and EC factors. That is, factor analytic procedures have shown that in addition to the early childhood temperament instruments, namely the Infant Behavior Questionnaire-Revised (IBQ-R; Gartstein & Rothbart, 2003) and the Early Childhood Behavior Questionnaire (ECBQ; Putnam, Gartstein, & Rothbart, 2006), measures designed to assess analogous traits in older children and adolescents included scales addressing cuddliness/affiliation and low intensity pleasure that loaded primarily upon factors relevant to attentional, behavioral, and emotional control (Gartstein, Slobodskaya, & Kinsht, 2003; Putnam et al., 2006; Putnam, Ellis, & Rothbart, 2001).

Recent studies addressing manifestations of EC in early childhood have largely focused on the contributions of EC to adjustment, behavior problems, emotional difficulties and social competence. Studies of temperament incorporating aspects of EC have demonstrated that children experiencing difficulties regulating attention and emotion tend to score higher in externalizing and internalizing problem domains (Eisenberg et al., 2000; Hughes, White, Sharpen, & Dunn, 2000; Silk, Steinberg, & Morris, 2003) and demonstrate limited social competence (Hughes, Dunn, & White, 1998). These consequences of EC-related deficits make it imperative to closely study the development of EC, focusing on its precursors (e.g., RCO). Despite this recent increase in the researchers' interest in EC, there has been little systematic study of early antecedents of this regulatory domain of temperament.

Multiple assessment tools have been developed for the evaluation of temperament in childhood that can be characterized as either relying on parent report or structured observational techniques. Despite potential limitations of parent-report instruments noted in the literature (Kagan, 1994), recent evidence has shown parental report of child temperament to have a superior predictive validity relative to other sources of information addressing child temperament, including structured observations (Hart, Field & Roitfarb, 1999; Pauli-Pott, Mertesacker, Bade, Haverkock, & Beckmann 2003). Recently developed parent-report instruments, the Infant Behavior Questionnaire-Revised (IBQ-R; Gartstein & Rothbart, 2003) and the Early Childhood Behavior Questionnaire (ECBQ; Putnam et al., 2006), utilized in the present study, are advantageous because these offer

developmentally appropriate infancy and toddler age measures that, nonetheless, produce a parallel factor structure. That is, both instruments yield a three-factor structure, including factors addressing negative affectivity, positive emotionality/extraversion, and attentionally based regulatory capacity, which are parallel but not identical for developmental reasons.

Cross-cultural differences in childhood temperament can be expected in so far as the development of temperament is "open to experience." Super and Harkness (1986) conceptualized the interface between child and culture as a "developmental niche," that was described as a function of customs, especially those related to child rearing, settings available to the child, and caregiver psychosocial characteristics. According to these authors, each of the three factors that shape the developmental niche interact differently with other features of the larger ecology, yet operate in a co-ordinated manner. In addition, the organism (i.e., the child) and the niche are mutually adaptive. Whereas this conceptualization has been successfully applied in understanding relationships between customs, settings, parents' attitudes, and child-rearing practices in vastly different societies (e.g., rural East African communities and Western/industrialized countries), its applications to more similar cultures have not been widespread. Research conducted with Western cultures has demonstrated differences in "parental ethnotheories," or culturally derived belief systems regarding children, family, and parenthood (Harkness & Super, 1995), which may in turn translate into different approaches to parenting, and variability in child characteristics.

Distinct cultural values and corresponding patterns of child rearing tend to be relatively stable (Kohnstamm, 1989). Parents within cultural groups are generally motivated to reproduce temperament characteristics in their offspring that are consistent with their values, and those of the cultural group. Thus, individual children are socialized into phenotypical presentations that are desirable, appropriate, or at least tolerable within cultural norms (Kohnstamm, 1989). Thus, parents in different cultural groups vary in their child-rearing attitudes and behaviors, which in turn produce the "culturally preferred phenotypes" for the offspring. For example, there is evidence that parents' soothing efforts differ across cultures, especially in terms of their involvement of the infants' developing attention (Caudill & Frost, 1972). American caregivers frequently induced soothing by orienting their infants to external events, and spent more time stimulating their infants into positive expressions of emotion. Japanese caregivers, on the other hand, used rocking and soothing by contact more frequently, perhaps directing attention more toward internal events. This "culturally influenced" parenting can, in turn, be expected to impact the development of temperament in childhood, leading to cross-cultural differences.

More generally, systematic differences in parenting between individualistic and collectivistic societies have also been suggested. Triandis (1988) contrasted individualism and collectivism, noting that the former includes beliefs that: (1) the views, needs, and goals of the self are most important; (2) behavior can be explained by the pleasure principle and the computation of personal profits and losses; (3) emphasis on features that distinguish the individual from the in-group, allowing for an autonomous entity; (4) social behavior is independent of and emotionally detached from the collective; whereas the latter emphasizes: (1) views, needs, and goals of some collective; (2) explanations for behavior that focus on norms and duties imposed by the collective; (3) shared beliefs that the individual and the collective have in common; (4) social behavior that is dependent, emotionally attached, and involved with the collective, as well as co-operative and even self-sacrificing toward in-group members, but indifferent, possibly hostile, toward out-group members. Socialization contexts in infancy occurring in collectivistic cultures have been described as focusing on emotional warmth/proximity that foster acceptance of the group's norms and values (Keller, 2002; Keller et al., 2004). Caregivers in collectivistic societies often respond to their infants' needs in an anticipatory manner, blurring the self–other distinction. On the other hand, caregivers in individualistic cultures tend to use eye contact, object play, and contingency, encouraging the expression of positive emotions. The initiation of an individualistic developmental pathway also leads caregivers to focus on early self-regulation during infancy (Greenfield, Keller, Fuligni, & Maynard, 2003; Keller, 2002; Keller et al., 2004). Thus, the child's developmental niche and culturally preferred phenotypes accepted by the caregivers can be expected to vary as a function of the individualistic versus collectivistic orientation of a given society, leading to cross-cultural differences in the development of temperament and the relationships between different domains of temperament over time, central to the questions posed by the present investigation. For example, the emphasis on eliciting positive affect and facilitation of early self-regulation in individualistic countries, like the United States of America, is likely to create a developmental niche that leads to a preferred phenotype encompassing higher levels of these temperament attributes, as well as a relationship between these two aspects of temperament.

The study of cultural influences that shape the development of temperament has generally focused on comparisons among vastly different cultures (Ho, 1986; Ho & Kang, 1984; Hsu, Soong, Stigler, Hong, & Liang, 1981; Markus & Kitayama, 1994), and there has been little systematic study of Russian children's temperament from a cross-cultural perspective (Digman & Shmelyov, 1996; Slobodskaya, 1995), especially in infancy (Kolpakov, Makarov, Khryachkova, Chuguy, & Chepkasov, 1984; Kolpakov et al., 1987). The Russian culture derives its collectivistic

orientation from the communist regime, in power for a considerable portion of the 20th century, as well as longstanding Eastern influences. Historically, the Slavic people emerged in Central Europe, and the cross roads of Europe and Asia, which has shaped their communities, culture, and customs related to child rearing (Marganoff & Folwarski, 1996). Russians are considered to be Eastern Slavs, and have historically experienced more Eastern influences than the other Slavic groups, Northern (e.g., Czechs, Poles) and Western (e.g., Bulgarians, Croats) Slavs (Kerr, 1996). The Russian culture is similar to the East in stressing the importance of communal over individual values (Triandis, 1995), but unlike the Eastern cultures, children in Russia are not discouraged from independent activities, assertiveness, and competition. The United States of America, on the other hand, has been described as the "pinnacle of individualism" (Kemmelmeier, Jambor, & Letner, 2006), and consistently identified as one of the most individualist societies in the world (Hofstede, 2001; Oyserman, Coon, & Kemmelmeier, 2002). There is evidence that individualism in the USA is associated with less co-operation in experimental settings (McClintock & Lieberman, 1988), and with regarding traditional family arrangements as constraining (Waite, Godscheider, & Witsberger, 1986). More recent research has linked individualism in the USA with prosocial behaviors, such as volunteering and charitable contributions (Kemmelmeier et al., 2006).

A number of important findings have emerged in cross-cultural temperament research addressing differences in the structure of temperament across cultures, along with mean differences in the levels of temperament characteristics. Similarity in the structure of temperament and personality across cultures has been often concluded on the basis of factor-analytic research, which has provided evidence for three and five factor models of personality. Factors of Introversion–Extraversion, Neuroticism, and Psychoticism have been replicated across samples from 24 different countries for adults, and across samples from 10 countries for children (Eysenck & Eysenck, 1983, 1985). Ahadi, Rothbart, and Ye (1993) described a three-factor structure of temperament, including Surgency–Extraversion, Negative Affect, and Attentional Self-regulation/EC factors, for Chinese and American samples of preschool children. Four factors, labeled as sociability, anger, impulsivity, and fear, derived for a sample of Russian school-aged children, were considered to be consistent with the three/five factor personality models (Digman & Shmelyov, 1996). However, differences in the structure of temperament have also been noted in cross-cultural comparisons. Rothbart, Ahadi, Hershey, and Fisher (2001) noted that factor analyses performed with US and Japanese samples led to a regulatory/attentional factor that included indicators of positive affect, whereas for Chinese samples this relationship between regulatory attentional functions and positive emotionality was not observed. The authors

concluded that the cultural emphasis on presenting with positive affect (e.g., smiling when being introduced, while greeting, etc.) may be responsible for the observed difference. This investigation also noted cross-cultural differences in the relationships between temperament factors in the context correlational analyses, wherein a negative association between surgency and EC was observed for a Chinese sample, and a negative relationship between negative affectivity and EC emerged for US children only (Ahadi et al., 1993).

Recently, infant temperament development was investigated cross-culturally, examining differences between US and Russian samples (Gartstein et al., 2003). This cross-cultural study provided support for the reliability and validity of the Infant Behavior Questionnaire-Revised (IBQ-R) with a Russian sample, and yielded a number of significant mean differences between the two cultures. Parents of infants in the USA reported higher levels for Smiling/Laughter, High and Low Intensity Pleasure, Perceptual Sensitivity and Vocal Reactivity, compared to parents of infants in Russia. In addition, Russian infants' scores for Distress to Limitations were higher relative to their US counterparts, based on parent-report indicators. Further comparisons of the structure of infant temperament for the USA and Russia were conducted via the Confirmatory Factor Analysis (CFA) of the IBQ-R. A generally consistent pattern of factor loadings across the two cultures was obtained following model modification, indicating a three-factor structure: Positive affectivity/surgency (PAS), negative emotionality (NE), and RCO (Gartstein, Knyazev, Slobodskaya, 2005).

The present study represents the next phase of an ongoing longitudinal cross-cultural investigation of the development of temperament in early childhood. Specifically, infants whose parents had already provided information regarding temperament in the first year of life were followed-up when their infants were at least 18 months of age in order to assess parental perceptions of child EC. The main goal of this investigation was to examine infant temperament characteristics as predictors of toddler EC, after controlling for contribution of concurrent (i.e., preschool period) temperament attributes. The infancy temperament characteristics (PAS, NE, RCO) were expected to predict subsequent EC, accounting for variance above and beyond the contributions of the concurrent (i.e., toddler-age) temperament factors of NE and surgency/extraversion. The infancy RCO IBQ-R factor, in particular, was expected to make a significant contribution to predicting preschool EC because it was expected to reflect temperament regulatory characteristics that represent developmental precursors of EC. Cross-cultural differences in predictors of toddler EC were also anticipated. Specifically, a greater contribution of surgency/extraversion to the development of EC was hypothesized for the US sample. Further, cultural status

was considered as a moderator of the influence of infant temperament characteristics on subsequent toddler/preschool temperament. That is, we anticipated that cultural status (belonging to either US or Russian culture) could impact the nature of the relationships between the independent variables (infant PAS, NE, RCO; toddler NE, extraversion) and EC. For example, it is possible that because of differential cultural emphasis on positive emotional expression in the USA and Russia the impact of this temperament attribute on later EC may vary between these two cultures.

METHOD

Participants

US participants were initially recruited from the Eugene–Springfield, Oregon area, when their infants were between 3 and 12 months of age. This original recruitment was conducted on the basis of birth announcements in the local newspaper and through the parents' participation in local "Birth to 3" courses. Mothers of the 361 (181 female) children who participated in the infancy temperament evaluation were predominantly Caucasian, married, and employed in service-oriented professions (Gartstein & Rothbart, 2003). This group of 361 primary caregivers was subsequently asked to participate in the follow-up evaluation when their children were at least 18 months of age. Mothers of 252 (126 female) children (70% of the original sample) completed the subsequently administered temperament measure, providing indicators of EC. A comparison of those who did not participate with those who took part in the follow-up did not reveal significant differences in education level, occupation ratings, or any of the temperament variables assessed during infancy (Table 1).

A community sample of primary caregivers ($N = 102$) of infants between 3 and 12 months of age was recruited from healthy child clinics in Novosibirsk, Russia, with an equal number of parents of male and female infants participating. Novosibirsk is the third biggest city in Russia with 1.6 million population and is considered the business center of Siberia. This sample was recruited in a manner that ensured a broad age range within the first year and a homogeneous ethnic composition (99% of the Siberian sample were Caucasian). The majority of participating mothers were married, and employed in professional/technical positions (e.g., teachers, nurses). Primary caregivers of 93 (46 female; 47 male) children completed the follow-up assessment (91% of the original sample). Significant differences did not emerge between caregivers who only completed the infancy assessment and those who also participated in the follow-up on any of the infant temperament factors or background characteristics assessed at baseline (Table 1).

TABLE 1
Descriptive statistics and differences on baseline variables between participants who responded at follow-up and non-responders

	Responders (n = 93)		*Non-responders (n = 9)*		
Russian sample	*Mean*	*SD*	*Mean*	*SD*	*t*
Child's age (weeks)	29.02	11.41	30.49	12.02	0.96
Parental education[a]	3.59	0.68	3.46	0.76	−1.09
Parental occupation[b]	1.88	1.33	1.94	1.26	0.10
Rating					
Infant PAS	27.34	5.18	28.72	9.99	−1.23
Infant NE	5.49	3.44	6.23	3.81	−1.55
Infant RCO	19.31	3.07	19.40	4.13	0.19
Toddler Extraversion	22.93	4.15	–	–	–
Toddler NA	10.50	3.60	–	–	–
Toddler EC	25.83	3.22	–	–	–
	Responders (n = 252)		*Non-responders (n = 109)*		
US sample	*Mean*	*SD*	*Mean*	*SD*	*t*
Child's age (weeks)	30.32	10.05	29.08	9.75	1.56
Parental education (years)	14.51	2.39	14.25	2.32	−0.97
Parental occupation[c]	34.44	24.05	37.43	24.03	1.13
Rating					
Infant PAS	28.56	3.90	29.16	3.64	1.46
Infant NE	4.28	2.71	4.31	2.39	1.11
Infant RCO	19.71	2.42	19.62	2.35	−0.36
Toddler Extraversion	19.69	2.23	–	–	–
Toddler NA	10.95	3.73	–	–	–
Toddler EC	27.14	3.23	–	–	–

Notes: All temperament factor scores, for the IBQ-R and the ECBQ, represent sums of the respective subscales. [a]Parental education was scored in the following manner for the Russian Sample: 1 = eight years or less of formal schooling scored; 2 = ten years of schooling; 3 = two to three years of college, following school; 4 = five or six years of higher education in a university or institute; 5 = obtaining an academic degree. [b]For parental occupation in the Russian Sample, the following scores were applied: 0 = housewives and unemployed; 1 = unskilled or manual workers scored; 2 = "blue-collar" or technical workers (e.g., technician, accountant, nurse); 3 = "white-collar" workers (e.g., manager, research scientist, physician); 4 = university students. [c]Parental occupation ratings for the US sample were based on the Revised Duncan Sociometric Index (TSEI2; Stevens & Featherman, 1981), a widely used indicator of occupation ranking.

Measures

The Infant Behavior Questionnaire-Revised (IBQ-R; Gartstein & Rothbart, 2003). The IBQ-R represents a rationally derived, fine-grained assessment tool, based on the definition of temperament proposed by Rothbart and

Derryberry (1981), work with the Child Behavior Questionnaire (Rothbart et al., 1994), comparative studies, as well as other developmental research that had identified significant dimensions and associated behavioral tendencies. This 191-item parent-report instrument yields 14 scales that have been demonstrated to form three overarching factors: Positive Emotionality/Surgency (Activity Level, Smiling and Laughter, Vocal Reactivity, Approach, High Intensity Pleasure, and Perceptual Sensitivity); Negative Affectivity (Fear, Distress to Limitations, Sadness, and negatively loading Falling Reactivity); and RCO (Duration of Orienting, Soothability, Cuddliness/Affiliation, and Low Intensity Pleasure). Reliability and validity of the IBQ-R has been supported for samples from different cultures, with Cronbach's alphas ranging from .77 to .96 (Gartstein & Rothbart, 2003; Gartstein et al., 2003, 2005).

Early Childhood Behavior Questionnaire (ECBQ; Putnam et al., 2006). This instrument was originally developed for use as a supplement to the Toddler Behavior Assessment Questionnaire (TBAQ; Goldsmith, 1996), which has been utilized successfully in prior cross-cultural examinations with Japanese and Spanish samples (Gonzales, Hidalgo, & Carranza, 1999; Kusanagi, Chen, & Hoshi, 2000). The development of the ECBQ followed an iterative process similar to that used to develop the IBQ-R (Gartstein & Rothbart, 2003). To complement the TBAQ, items and scales applicable to toddlers were generated through the examination of the CBQ and IBQ-R. An initial version of the ECBQ, containing 11 new scales in addition to the five TBAQ scales, was administered to parents of 138 toddlers. Upon examination of these data, and in response to new measurement considerations, several changes were made. For example, items with low correlations with their intended scale or high correlations with other scales were dropped, while new items, including those for four additional scales, were devised. These changes resulted in a 267-item measure, which was administered to parents of 320 children between the ages of 16 and 30 months. Items that substantially lowered internal consistency or included excessive overlap with the content of other items were eliminated, resulting in the 18-scale, 201-item measure, yielding a three-factor structure: NE (Discomfort, Fear, Sadness, Frustration, Motor Activation, Perceptual Sensitivity, Shyness, and Soothability, loading negatively); Surgency/Extraversion (Impulsivity, Activity Level, High-intensity Pleasure, Sociability, and Positive Anticipation); and EC (Inhibitory Control, Attention Shifting, Low-intensity Pleasure, Cuddliness, and Attention Focusing).

The 18 scales were internally consistent across the entire sample and within three age-bound subsamples: 18 to 22 months ($N = 104$), 23 to 26 months ($N = 110$), and 27 to 30 months ($N = 100$). Monomethod

discriminant validity was indicated, in so far as the average absolute value of interscale correlations was .18, and only 1 of 153 correlations had an absolute value $> .50$. Validity of the ECBQ was additionally supported through cross-sectional associations of the scale scores with demographic variables of child age and gender. A recently completed investigation of 104 children, in which the ECBQ was administered at 18, 24, 30, and 36 months, provided further validation of the questionnaire (Putnam et al., 2006), indicating adequate internal consistency for all scales, and significant correlations between primary and secondary raters for 15 scales. Considerable stability for 17 scales from 18 to 36 months was demonstrated, and stability over shorter periods (6 months) exceeded 18-month stability, suggesting both the reliability of the measures and the presence of meaningful inter-individual change in parental perceptions. Relations between age and temperament in these longitudinal data also converge with the previous cross-sectional study. Additional evidence of construct validity for ECBQ fearfulness has been demonstrated, with preliminary results supporting prior findings (Arcus, Gardner, & Anderson, 1992; Park, Belsky, Putnam, and Crnic, 1997), indicating a relationship between high levels of parental warmth and protectiveness and increased levels of child fearfulness (Smith & Putnam, 2004).

Demographic questions. Several background characteristics of the respondents were also evaluated, with information regarding the participants' education and occupation being provided.

Procedure

Translation. All of the materials, including the questionnaires and consent forms, had to be translated into Russian before data collection for this study could begin. The IBQ-R, ECBQ, the Demographic Questionnaire and the consent form were translated from English to Russian by the first author (MAG), and back-translated by the second author (HRS). Subsequently, the original and the back-translated copies of these materials were compared, and the Russian translations were revised on the basis of the observed discrepancies. In addition, the education, occupation and income items of the Demographic Questionnaire for the Russian sample were modified to meet the Russian socio-economical reality. The reference to the Russian author and her institution was also included in the consent form for the Russian sample.

Data collection. US parents of infants between 3 and 12 month of age, whose births were reported in the Eugene–Springfield, Oregon, newspaper, were contacted by phone until 120 questionnaires were obtained for each of

the three infant age groups evaluated in the initial study (Group 1: 3–6 months old; Group 2: 6–9 months old; and Group 3: 9–12 months old). The study was described to each parent contacted by telephone. They were told that their participation would involve completing the IBQ-R and a demographic form, which would take about one hour. The parents were also informed that they would be receiving a check for $5.00, enclosed with the materials, in an effort to compensate them for their time. Each respondent was mailed a consent form with the questionnaire materials, which s/he signed and returned with the other information. Mothers who had completed the IBQ-R, were later contacted again by telephone (when their children were at least 18 months of age) and asked to participate in the follow-up assessment. Subsequently, the ECBQ and consent forms were mailed to the caregivers, who were offered $5 or a gift certificate to a local toy store for their time and effort in completing the measure. Reminder calls and letters were used to contact parents who did not return questionnaires within three weeks. A second reminder was given to those who had not returned forms six weeks after mailing, and a third reminder was sent one month after this.

Russian parents of infants between 3 and 12 month of age ($N = 102$), who visited the healthy child clinics in Novosibirsk for their regular examination, were asked to participate in the initial study. This group was recruited in a manner that provided an equivalent distribution of gender, as well as wide age range across the first year of life (3 to 12 months of age), in at attempt to match the US sample in terms of the gender/age composition. The study was described to each parent by the fourth author (IAK), a district child psychiatrist in Novosibirsk, who was responsible for making all of the contacts with the participating families. Parents of infants were told that their participation would involve completing the IBQ-R and a demographic form, which would take about one hour, and that they would be asked to complete the ECBQ once their infants were at least 18 months of age. The parents were also informed that upon completing participation, they would receive the final results of the study, with a doctor's consultation. Each respondent was given a consent form with the questionnaire materials, which s/he signed and returned with the other information. When the children were at least 18 months of age, parents were contacted either in person or by telephone and asked to complete the ECBQ.

RESULTS

First, descriptive statistics were computed for all of the follow-up evaluation temperament variables included in this study for the Russian and the US samples (Table 1). Next, internal consistency was evaluated for the ECBQ across the two cultures included in this study. For the US sample, the ECBQ

Cronbach's alphas ranged from .57 to .90. It should be noted that alphas lower than .80 were observed only for Impulsivity and Attention Shifting scales. For the Russian sample, Cronbach's alphas ranged from .74 to .94.

Pearson product moment correlation coefficients between the variables central to addressing the hypotheses of this study (i.e., temperament factor scores from the baseline and follow-up assessments) were examined next (Table 2).

Overall, a greater number of significant associations between the temperament factor scores were observed for the US sample. On the other hand, fewer significant relationships emerged for the Russian sample, with significant associations demonstrated between infancy PAS and RCO, PAS and Extraversion, as well as RCO and EC, from infancy to the toddler/preschool period. Formal comparisons among pairs of correlations between the US and Russian samples were also conducted, demonstrating significant differences for four of the 15 comparisons, conducted via Fisher r to z transformation procedure. Comparison of PAS-EC correlation coefficients showed that the US correlation (.441) was significantly larger than the Russian index (.046; $z = 3.60$, $p < .01$). The NE-NA stability correlation coefficient comparison yielded a similar pattern: the US correlation (.416) was significantly larger than the Russian one (.094; $z = 2.93$, $p < .05$). On the other hand, the correlation between PAS and RCO was larger for the Russian sample (.551), relative to the US sample correlation (.330; $z = -2.33$, $p < .05$). Similarly, the EXTRA-EC correlation (.161) was larger for the Russian sample when compared to the US statistic ($-.078$; $z = -2.02$, $p < .05$).

A series of hierarchical regression equations were examined next in an attempt to predict the emergence of EC for US and Russian children. First,

TABLE 2
Pearson product moment correlation coefficients between the infancy and toddler/preschool temperament factor scores

Scale	*1*	*2*	*3*	*4*	*5*	*6*
PAS	–	.120*	.330*	.036	.286**	.441**
NE	.130	–	−.244**	.416**	.074	−.033
RCO	.551**	−.085	–	−.099	.058	.372**
NA	.193	.094	−.083	–	.099	−.169**
EXTRA	.212*	−.067	.080	.295*	–	−.078
EC	.046	−.090	.242*	−.090	.161	–

Notes: US sample correlations above the diagonal; $df = 1, 252$. Russian sample correlations below the diagonal; $df = 1, 92$. PAS = Infant Positive Affectivity/Surgency; NA = Toddler Negative Affectivity; NE = Infant Negative Emotionality; EXTRA = Toddler Extraversion/Surgency; RCO = Infant Regulatory Capacity/Orienting; EC = Toddler Effortful Control. *$p < .05$; **$p < .01$.

EC was evaluated as a dependent variable for each of the two cultures individually. Thus, EC was predicted for the US sample, then for the Russian children, in separate hierarchical regression analyses. Subsequently, data from the two cultures were evaluated via a hierarchical multiple regression procedure performed with a combined sample, wherein a "dummy coded" culture variable identified children as belonging to either the US or the Russian sample. Demographic variables were included in the individual hierarchical regression analyses initially, controlling for their contribution in the prediction of EC for each of the two cultures. In general, these background characteristics did not account for a significant amount of variance in the dependent variable (i.e., EC) for either the USA or Russia, and were thus not retained in the subsequent hierarchical multiple regression analysis with a combined sample that included multiple interaction terms, making it imperative to trim non-essential/non-significant predictors (Peyrot, 1996). The toddler/preschool age temperament factor scores (Extraversion, Negative Affectivity) were entered prior to the infancy predictors (PAS, NE, RCO) in order to provide a more conservative test of the contribution of these earlier manifestations of temperament characteristics (i.e., controlling for concurrent manifestations of temperament attributes). Finally, a hierarchical regression procedure was performed with a combined sample (US and Russian children) in order to examine the potential moderator effect of culture by computing product terms that reflect interactions between the temperament characteristics examined as predictors in this study and the cultural status "dummy-code", based on the recommendations of Aiken and West (1991).

A hierarchical regression analysis conducted for the US sample indicated a significant contribution of the child's gender to the toddler/preschool age EC, with girls receiving higher ratings than boys (Table 3).

In addition, toddler NE, infancy PAS and RCO explained significant amounts of variance in the indices of EC for US children, with NE being associated with lower levels of EC, and PAS and RCO leading to higher EC scores.

For the Russian sample, only infant RCO contributed to predicting toddler/preschool EC, with higher levels of infant RCO being associated with higher subsequent EC scores (Table 4).

A hierarchical regression equation procedure with a combined sample was performed next (Table 5), wherein the dichotomous variable of cultural status (i.e., US vs. Russian sample) was reflected by a "dummy-code" (0, 1). Interaction terms that represent moderation effects of culture on the relationships between temperament characteristics were evaluated, after considering the relevant main effects (Aiken & West, 1991).

PAS-by-culture interaction was associated with a significant effect, which was subsequently followed-up through a schematic representation approach

TABLE 3
Hierarchical regression equation indices: Predicting EC for the US sample

Variable	*R*	R^2	R^2 *change*	*F change*	β
Block 1	.211	.045	.045	2.515*	
Child's age					.129
Child's gender					.158*
Mothers' education					.093
Mothers' occupation					−.049
Block 2	.315	.099	.055	6.447**	
Negative affectivity (toddlerhood)					−.243**
Extraversion/surgency (toddlerhood)					.002
Block 3	.610	.372	.273	30.370**	
PAS (infancy)					.425**
NE (infancy)					.068
Regulation capacity/orienting (infancy)					.252**

Note: *$p < .05$; **$p < .01$.

TABLE 4
Hierarchical regression equation indices: Predicting EC for the Russian sample

Variable	*R*	R^2	R^2 *change*	*F change*	β
Block 1	.224	.050	.050	.884	
Child's age					−.012
Child's gender					−.149
Mothers' education					.059
Mothers' occupation					−.181
Block 2	.224	.050	.000	.007	
Negative affectivity (toddlerhood)					.010
Extraversion/surgency (toddlerhood)					−.014
Block 3	.431	.186	.135	3.439*	
PAS (infancy)					−.157
NE (infancy)					−.167
Regulation capacity/orienting (infancy)					.362*

Note: *$p < .05$; **$p < .01$.

(Aiken & West, 1991; Cohen & Cohen, 1983), recommended for interaction effects that involve at least one continuous variable.

Figure 1 reflects a constant level of EC for Russian children, that did not vary as a function of infancy PAS. For the US children, on the other hand, higher levels of infancy PAS were associated with subsequently higher levels of EC.

Despite the non-significant contributions of child age to EC for the US and Russian children, analyses addressing the potential contribution of age

TABLE 5
Hierarchical regression equation indices: Predicting EC across the two cultures (Russia and USA)

Variable	*R*	R^2	R^2 *change*	*F change*	β
Block 1	.176	.031	.031	10.906**	
Culture (Russia vs. USA)					−.176**
Block 2	.263	.069	.038	6.951**	
Negative affectivity (toddlerhood)					−.197**
Extraversion/surgency (toddlerhood)					.014
Block 3	.467	.218	.149	21.324**	
PAS (infancy)					.255**
NE (infancy)					.025
Regulation/orienting capacity (infancy)					.226**
Block 4					
Negative affectivity × culture					.135
Extraversion/surgency × culture					.063
Block 5					
PAS × culture					−.321**
NE × culture					−.090
Regulation capacity/orienting × culture					−.097

Note: *$p < .05$; **$p < .01$.

were conducted with the combined sample, in order to ensure that this characteristic did not systematically affect the hypothesized relationships between infant RCO and later EC. Specifically, exploratory analyses were aimed at evaluating the possibility that the ability of RCO to predict EC varied as a function of the timing of the RCO evaluation. In essence, analyses were conducted to determine whether or not the timing of infant RCO assessment moderated the ability of RCO to predict later EC. Thus, a regression term reflecting an interaction between infant age and regulatory capacity (product of age and RCO) was evaluated in the context of the hierarchical regression analyses with the combined sample, after accounting for culture and the relevant main effects (e.g., age and RCO), but failed to make a significant contribution to explaining EC ($\beta = .06$; $p = .33$) variance.

DISCUSSION

The present study represents an attempt to examine the development of EC through a cross-cultural longitudinal evaluation. Specifically, infant and toddler temperament assessments were conducted with two samples of children, one from the USA and the other one from Russia. Recently developed parent-report instruments, shown to exhibit satisfactory

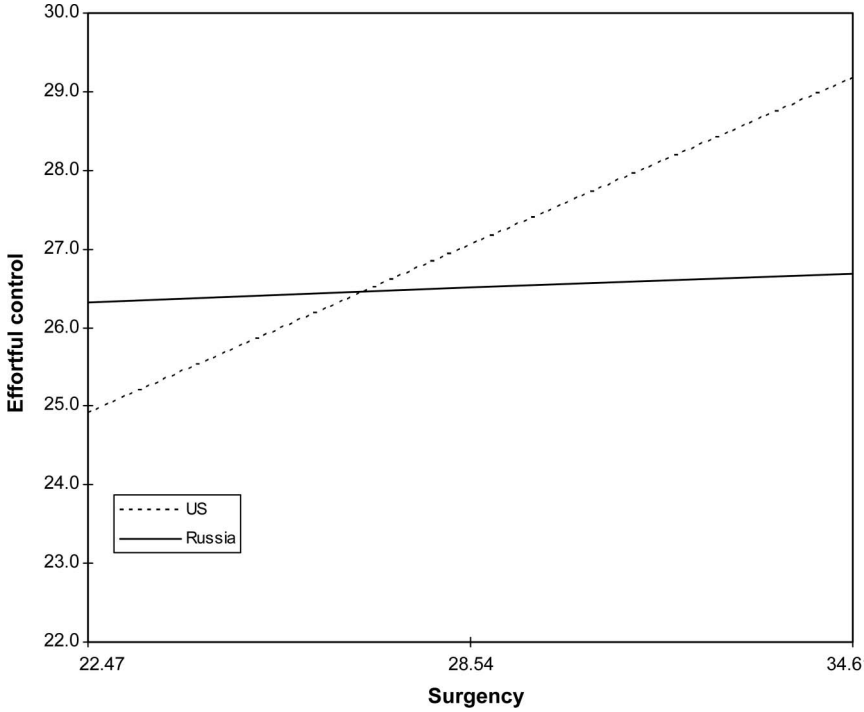

Figure 1. Effortful control (EC) as a function of infancy positive affectivity/surgency (PAS) for US and Russian samples.

psychometric properties, were utilized to provide indicators of temperament in this study. Specifically, over-arching factors of PAS, NE, and RCO in infancy were assessed via the IBQ-R, whereas Extraversion, Negative Affectivity, and EC (the dependent variable) in the toddler/preschool period were examined through the ECBQ. A number of important findings emerged in the course of the present investigation. First, infancy RCO was demonstrated as an important predictor of later EC, and the only independent variable predicting EC across the two cultures. Second, evidence of cross-cultural differences in the development of temperament emerged in the context of this study. That is, prediction of EC differed for children in Russia and the USA, with infancy RCO demonstrated as the only significant predictor of EC for Russian children. On the other hand, toddler NA, infancy PAS and RCO were shown to account for significant amounts of variance in EC for US children. Further analyses of a combined sample, including children from both cultures, indicated that children with higher levels of PAS were subsequently reported to exhibit higher levels of EC by the US, but not Russian, parents.

Toddler Negative Affectivity, infancy PAS and RCO explained significant amounts of variance in the indices of EC, with Negative Affectivity and PAS contributing to the prediction of EC for the US sample only. It should be noted that infant NE and toddler Extraversion/Surgency did not explain significant amounts of EC variance, suggesting that the effects of these attributes are unique to the respective developmental periods (i.e., toddler period for NE and infancy for PAS). As in previous studies (Eiden, Edwards, & Leonard, 2004; Rothbart et al., 2003), higher levels of NE were associated with lower levels of EC for the US children. The negative relationship between EC and negative affectivity has been observed across a wide age range with a variety of measures, including parent-report and laboratory observation-based instruments (Derryberry & Rothbart, 1988; Kochanska et al., 2000). This relationship has been interpreted as an indication of the ability to utilize EC as a means of modulating or reducing negative affectivity, and an important link between cognitive and emotional functioning that can be observed early in childhood (Rothbart et al., 2003). Similarly to the results obtained for the Russian sample in this study, this relationship between negative affectivity and EC was not observed for children in a Chinese sample assessed by Ahadi et al. (1993). In addition, higher levels of PAS were associated with higher EC scores in the context of analyses performed for the US sample. These results pertaining to positive emotionality appear to be in agreement with the findings of Rothbart et al. (2001), who extracted a regulatory/attentional factor that included indicators of positive affect with US and Japanese samples.

The significant contribution of infant RCO to toddler EC can be interpreted as an indication of stability of attention-based self-regulation skills that first begin to emerge in infancy, and by the second year of life encompass the multiple aspect of voluntary attention attributed to EC. Although the RCO infancy factor is functionally similar to the toddler EC, reflecting individual differences in the regulatory domain of temperament, considerable differences between the two constructs exist as a function of developmental differences between the first and the second years of life. Specifically, the infancy RCO factor contains the Soothability scale, not included in the ECBQ EC factor, which in turn incorporates Inhibitory Control and Attention Shifting, not a part of the IBQ-R regulation factor. Thus, the relationship between infancy RCO and toddler EC may be more accurately construed as a demonstration of early precursors of EC, observed in the first year of life across the two cultures included in this study.

Cross-cultural differences initially emerged in the comparisons of simple correlation coefficients between the USA and Russia and culture-specific hierarchical multiple regression analyses. These cross-cultural differences were further examined via a hierarchical regression procedure with a combined sample, including children from the USA and Russia. Interaction

effects involving culture (USA vs. Russia) and temperament attributes (infant PAS, NE, and RCO; toddler Negative Affectivity, Extraversion) were evaluated in a manner consistent with the recommendations of Aiken and West (1991), and provided a test of potential moderation effects of culture. A single significant interaction effect involving culture and infant PAS emerged, indicating that higher levels of PAS were predictive of higher toddler EC for US, but not Russian, children. To our knowledge the present study represents the only cross-cultural study of EC for US and Russian children, thus the results of this investigation should be considered with caution until replicated. Nonetheless, the cross-cultural differences that emerged in this investigation can be interpreted within the context of existing theory and research relevant to temperament development and the study of cultural attributes.

Thus, culture can be conceptualized as moderating the impact of infant temperament (PAS in particular) on later EC, with EC being independent of infant PAS in Russia, but varying as a function of PAS in the USA. The latter finding is consistent with our hypotheses, based on the theoretical distinction between more collectivistic and individualistic cultures, as well as concepts of ''developmental niche'' and ''culturally preferred phenotypes'' (Kohnstamm, 1989; Super & Harkness, 1986; Triandis, 1988). That is, the child's developmental niche, and the parents' perceptions of the culturally preferred phenotypes for child temperament were expected to vary as a function of the individualistic versus collectivistic orientation of a given culture, leading to cross-cultural differences in the development of temperament and the relationships between different domains of temperament over time. Results of this study suggest that in the USA, the generally individualistic orientation has led to parental demands and expectations that in turn have shaped the development of child temperament in a manner that facilitated a longitudinal link between infant PAS and toddler EC. Results of this study suggest that US parents' promotion of children's EC development may be contingent on the emotional state of the infant, specifically the child's expression of positive emotionality. This conclusion is consistent with the emphasis placed by parents on eliciting positive emotions and facilitating early self-regulation in more individualistic societies (Greenfield et al., 2003; Keller, 2002; Keller et al., 2004).

Our findings are also consistent with the results of the Rothbart et al. (2001) study addressing cross-cultural differences in the structure of childhood temperament. Specifically, it was demonstrated that positive emotionality loaded onto the EC factor for the US and Japanese, but not the Chinese, sample. Rothbart et al. (2001) concluded that a cultural emphasis on presenting with positive affect (e.g., smiling when being introduced, while greeting, etc.) may be responsible for the observed association between positive affectivity and EC in the cultures with a more predominant Western

orientation. Although the present study varies from the Rothbart et al. (2001) investigation in so far as it focuses on cross-cultural differences in predictive relationships rather than the structure of temperament, the explanation of the Rothbart et al. (2001) findings is nonetheless relevant. Russian culture has been exposed to Eastern influences for historical and geographic reasons, and can thus be described as less Western in its orientation than the USA and the significant relationships observed in this study could be conceptualized as longitudinal cross-domain associations, similar in essence to those observed by Rothbart et al. (2001), but demonstrated over time. Thus, the degree of Western orientation, and the associated value/emphasis of expressing positive emotions, may be responsible for the observed effect.

Alternative explanations of the cross-cultural differences in predictions of temperament observed in this study could be proposed as well. For example, it is possible that PAS expressed in the context of parent–child interactions in a more Western-oriented culture leads to a particular pattern of parent–child interactions, which in turn promotes the development of EC. Perhaps this parental response (i.e., a response that facilitates interactions, in turn supporting the development of EC) to infant positive affect occurs to a greater extent in cultures that especially value and emphasize this set of temperament characteristics (e.g., displays of positive affect such as smiling and laughter). Several aspects of parent–child interactions could serve as potential candidates for such culture-related mechanisms. For example, maternal sensitivity and responsivity have been linked with later increases in child attention (Bornstein & Tamis-LeMonda, 1997), and could be increased by child positive emotional reactions, especially in countries placing a particular emphasis on expressing positive affect. Whereas the latter hypothesis has not been empirically evaluated to the best of our knowledge, higher levels of irritability in infancy have been linked with less sensitive parenting (van den Boom, 1994, 1995), which could be expected to compromise subsequent development of EC. Differences in parent–child interaction dynamics associated with individualism/collectivism may also account for the observed differences. It is possible for example that parents in the USA, a more individualistic culture, engage in interaction mechanisms such as eye contact, object play, and/or contingent responding more frequently/effectively with infants demonstrating higher levels of positive affectivity, and these interaction mechanisms in turn lead to increases in self-regulation during infancy (Greenfield et al., 2003; Keller, 2002; Keller et al., 2004).

Another potential explanation includes the possibility that the cross-cultural differences observed in this study are a function of the parent-report-based methodology utilized in this investigation. In other words, it could be argued that the child behaviors themselves may not be differentially

related in the two cultures, but that "artifacts" of parent-report have lead to the observed differences in relationships between PAS and EC. Cautions regarding parental report have been raised due to concerns with potential error or bias (Kagan, 1994; Rothbart & Bates, 1998; Rothbart & Goldsmith, 1985), which may be inadvertently introduced due to the influence of social desirability, the caregivers' limited knowledge of the infant's behavior and its meaning, unfamiliarity with the behavior of other infants with whom the child is compared, and/or limited accuracy in caregivers' memories of events involving the infant. Such concerns can be at least partially addressed by careful construction and presentation of items, asking about only recently occurring events, and inquiring about concrete infant behaviors rather than asking the parents to make abstract or comparative judgments (Rothbart & Goldsmith, 1985). The IBQ-R was designed in an attempted to address these concerns (Gartstein & Rothbart, 2003; Rothbart, 1981). Specifically, caregivers were asked to report, on a 7-point scale, the relative frequency of occurrence of specified infant reactions in concrete situations during the previous week, or for some items, two weeks. This format is likely to minimize problems associated with recall, and to limit biases associated with more global questions that would require respondents to aggregate information across contexts or situations prior to answering. Also, the IBQ-R does not require caregivers to make comparative judgments that would be difficult if they lacked familiarity with other infants. Finally, the response format of the IBQ-R presents sets of items based on the context or situation eliciting the infant's reactions (e.g., bathing and dressing), which may serve to enhance specific recall and limit social desirability. It should also be noted that parent-report instruments take advantage of caregivers' extensive opportunities to observe young children across a broad array of contexts. In addition, recent evidence has demonstrated caregiver report of child temperament as superior in terms of predictive validity, relative to other sources of information, including structured observations (Pauli-Pott et al., 2003; Hart et al., 1999). Furthermore, error/bias-related concerns could also be raised with regard to laboratory-based observational measures. For example, children in one culture may have greater exposure to unfamiliar settings and adults, leading them to be less inhibited in the laboratory, relative to a sample from a society that limits infants' activities to the residence and/or immediate family.

Analysis conducted for the US sample indicated a significant contribution of the child's gender to the toddler/preschool age EC, with girls receiving higher ratings than boys. Eiden et al. (2004) found girls to be higher in EC at 2 years of age. Ahadi et al. (1993) also found that females tended to receive higher ratings for dimensions of EC, including Inhibitory Control, Low Intensity Pleasure, and Perceptual Sensitivity in the US

sample, but the converse relations with gender were observed for the Chinese sample.

Results of this study provide further evidence for the importance of cross-cultural developmental research, having demonstrated potentially important differences in the development of EC for US and Russian children. This research has clinical implications in so far as parental perceptions of child temperament are important determinants of "goodness-of-fit" between offspring characteristics and parental demands and/or expectations. The "goodness-of-fit" model has been one of the most prominent theories addressing the interplay between environment and biological predispositions. Specifically, Thomas and Chess (Thomas, Chess, & Birch, 1968) proposed that in order to understand how certain children demonstrate satisfactory gains in their social-emotional development (e.g., develop regulatory capacities that enable them to modulate reactivity) and positive adjustment, whereas others go on to demonstrate extremes of temperament (e.g., high levels of fearfulness/behavioral inhibition) and/or behavioral problems, the "goodness-of-fit" between child temperament and parenting needs to be considered. The basic thesis of this approach is that a good match leads to moderate levels of temperament characteristics (e.g., fearfulness) and/or positive adjustment for children, whereas a poor fit between child reactive and regulatory characteristics and parental approaches (e.g., demands, expectations, parent–child interaction patterns) leads to more "difficult" temperament and/or behavior problems. Cross-cultural longitudinal research is necessary to address the generalizability of developmental mechanisms (e.g., "goodness-of-fit" models), and to design intervention strategies, sensitive to potential differences. Results of this study indicate cross-cultural differences in the developmental mechanism contributing to early manifestations of EC. Future research should determine if specific parent–child interaction factors are related to the cross-cultural differences observed in this study. Identifying these potential differences in optimal and non-optimal matches between child temperament attributes and parent–child interaction dynamics are key in developing intervention strategies based on the "goodness-of-fit" model; that is in designing programs that provide parents with feedback regarding child temperament attributes, increasing parental sensitivity/responsivity, in order to ultimately improve the fit.

Despite this potential importance, limitations of the present research should be noted. First, our exclusive reliance on parent report represents the single most significant limitation of this study. Thus, future research should include observation-based measures along with parent-report instruments. Second, parent–child interaction factors were not examined in this study, but are central to some potential explanations of the results obtained in the context of this investigation. Thus, factors such as parental sensitivity, focus

on object play and/or contingent interactions, should be examined in future cross-cultural longitudinal research. In addition, the present sample was heterogeneous with regard to the age of infants during the initial assessment, potentially changing the nature of the relationship between infant RCO and toddler EC. That is, the contribution of RCO to explaining later EC may have varied as a function of infant age at the time of the RCO assessment. Analyses were conducted to address the contribution of infant age, ensuring that it did not systematically affect the relationship in question. Nonetheless, future research should recruit more homogenous infant samples to ensure that the relationship between infant RCO and later EC is not influenced by age-related factors. Finally, the present study could be described as somewhat limited in its cross-cultural and developmental scope, and consideration of additional cultural groups and developmental periods should be undertaken by future investigations.

Manuscript received 23 January 2006
Revised manuscript accepted 2 January 2007
First published online 9 August 2007

REFERENCES

Ahadi, S. A., Rothbart, M. K., & Ye, R. (1993). Children's temperament in the USA and China: Similarities and differences. *European Journal of Personality*, *7*, 359–377.

Aiken, L. S., & West, S. G. (1991). *Multiple regression: Testing and interpreting interactions*. Newbury Park, CA: Sage Publications.

Arcus, D., Gardner, S., & Anderson, C. (1992). *Infant reactivity, maternal style, and the development of inhibited and uninhibited behavior profiles*. In *Temperament and environment*. Symposium conducted at the Biennial Meeting of the International Society for Infant Studies, Miami, FL.

Bakeman, R., & Adamson, L. B. (1984). Co-ordinating attention to people and objects in mother–infant and peer–infant interaction. *Child Development*, *55*, 1278–1289.

Bornstein, M. H., & Seuss, P. E. (2000). Physiological self-regulation and information processing in infancy: Cardiac vagal tone and habituation. *Child Development*, *71*, 273–287.

Bornstein, M. H., & Tamis-LeMonda, C. S. (1997). Maternal responsiveness and infant mental abilities: Specific predictive relations. *Infant Behavior & Development*, *20*, 283–296.

Carranza, J. A., Perez-Lopez, J., Gonzalez, C., & Martinez-Fuentes, M. T. (2000). A longitudinal study of temperament in infancy: Stability and convergence of measures. *European Journal of Personality*, *14*, 21–37.

Caspi, A. (1998). Personality development across the life course. In W. Damon & N. Eisenberg (Eds.), *Handbook of child psychology: Social, emotional, and personality development* (5th ed., pp. 311–388). Hoboken, NJ: Wiley.

Caudill, W., & Frost, L. (1972). A comparison of maternal care and infant behavior in Japanese-American, American, and Japanese families. In U. Bronfenbrenner (Ed.), *Influences on human development*. Hinsdale, IL: Dryden Press.

Cohen, J., & Cohen, P. (1983). *Applied multiple regression/correlation analysis for the behavioral sciences* (2nd ed.). Hillsdale, NJ: Lawrence Erlbaum Associates, Inc.

Cohen, L. B. (1972). Attention-getting and attention-holding processes of infant visual preferences. *Child Development*, *43*, 869–879.

Derryberry, D., & Rothbart, M. K. (1988). Arousal, affect, and attention as components of temperament. *Journal of Personality and Social Psychology*, *55*, 958–966.

Digman, J. M., & Shmelyov, A. G. (1996). The structure of temperament and personality in Russian children. *Journal of Personality and Social Psychology*, *71*, 341–351.

Eiden, R. D., Edwards, E. P., & Leonard, K. E. (2004). Predictors of effortful control among children of alcoholic and nonalcoholic fathers. *Journal of Studies on Alcohol*, *65*, 309–319.

Eisenberg, N., Guthrie, I. K., Fabes, R. A., Shepard, S., Losoya, S., Murphy, B. C., et al. (2000). Prediction of elementary school children's externalizing problem behaviors from attention and behavioral regulation and negative emotionality. *Child Development*, *71*, 1367–1382.

Eysenck, H. J., & Eysenck, M. W. (1985). *Personality and individual differences: A natural science approach*. New York: Plenum Press.

Eysenck, H. J., & Eysenck, S. B. G. (1983). Recent advances: The cross-cultural study of personality. In D. Spielberger & J. N. Butcher (Eds.), *Advances in personality assessment* (Vol. 2). Hillsdale, NJ: Lawrence Erlbaum Associates, Inc.

Gartstein, M. A., Knyazev, G. G., & Slobodskaya, H. R. (2005). Cross-cultural differences in the structure of infant temperament: United States of America (USA) and Russia. *Infant Behavior and Development*, *28*, 54–61.

Gartstein, M. A., & Rothbart, M. K. (2003). Studying infant temperament via a revision of the Infant Behavior Questionnaire. *Journal of Infant Behavior and Development*, *26*, 64–86.

Gartstein, M. A., Slobodskaya, H. R., & Kinsht, I. A. (2003). Cross-cultural differences in the first year of life: United States of America (USA) and Russia. *International Journal of Behavioral Development*, *27*, 316–328.

Goldsmith, H. H. (1996). Studying temperament via construction of the Toddler Behavior Questionnaire. *Child Development*, *67*, 218–235.

Gonzales, C., Hidalgo, M., & Carranza, J. A. (1999). Spanish adaptation of the Toddler Behavior Assessment Questionnaire for the measurement of temperament in infancy. *Metodologia de Las Ciencas del Comportamiento*, *1*, 207–218.

Greenfield, P. M., Keller, H., Fuligni, A., & Maynard, A. (2003). Cultural pathways through universal development. *Annual Review of Psychology*, *54*, 461–491.

Harkness, S., & Super, C. (1995). Culture and parenting. In M. H. Bornstein (Ed.), *Handbook of parenting. Vol. 2: Biology and ecology of parenting* (pp. 211–234). Mahwah, NJ: Lawrence Erlbaum Associates, Inc.

Hart, S., Field, T., & Roitfarb, M. (1999). Depressed mothers' assessments of their neonates' behaviors. *Infant Mental Health Journal*, *20*, 200–210.

Hewlett, B. S., & Lamb, M. E. (2002). Integrating evolution, culture and developmental psychology: Explaining caregiver–infant proximity and responsiveness in Central Africa and the United States of America. In H. Keller, Y. H. Poortinga, & A. Schelmerich (Eds.), *Between culture and biology: Perspectives on ontogenetic development* (pp. 241–269). New York: Cambridge University Press.

Ho, D. Y. F. (1986). Chinese patterns of socialization: A critical review. In M. H. Bond (Ed.), *The psychology of Chinese people* (pp. 1–37). New York: Oxford University Press.

Ho, D. Y. F., & Kang, T. K. (1984). Intergenerational comparisons of child-rearing attitudes and practices in Hong Kong. *Developmental Psychology*, *20*, 1004–1016.

Hofstede, G. (2001). *Culture's consequences* (2nd ed.). Thousand Oaks, CA: Sage.

Hsu, C., Soong, W., Stigler, J. W., Hong, C., & Liang, C. (1981). The temperamental characteristics of Chinese babies. *Child Development*, *52*, 1337–1340.

Hughes, C., Dunn, J., & White, A. (1998). Trick or treat? Uneven understanding of mind and emotion and executive dysfunction in "hard-to-manage" preschoolers. *Journal of Child Psychology & Psychiatry*, *39*, 981–994.

Hughes, C., White, A., Sharpen, J., & Dunn, J. (2000). Antisocial, angry, and unsympathetic: "Hard-to-manage" preschoolers' peer problems and possible cognitive influences. *Journal of Child Psychology & Psychiatry & Allied Disciplines*, *41*, 169–179.

Kagan, J. (1994). *Galen's prophecy: Temperament in human nature*. New York: Basic Books.

Keller, H., Yovsi, R., Borke, J., Kartner, J. H., Jensen, H., & Papaligoura, Z. (2004). Developmental consequences of early parenting experiences: Self-recognition and self-regulation in three cultural communities. *Child Development*, *75*, 1745–1760.

Kemmelmeier, M., Jambor, E. E., & Letner, J. (2006). Individualism and good works: Cultural variation in giving and volunteering across the United States. *Journal of Cross-Cultural Psychology*, *37*, 327–344.

Kerr, S. (1996). Slovak families. In M. McGoldrick, J. Giordano, & J. K. Pearce (Eds.), *Ethnicity and family therapy*. (pp. 673–679). New York: Guilford Press.

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

Kohnstamm, G. A. (1989). Temperament in childhood: Cross-cultural and sex differences. In G. A. Kohnstamm, J. E. Bates, & M. K. Rothbart (Eds.), *Temperament in childhood* (pp. 483–508). New York: Wiley.

Kolpakov, V. G., Chuguy, V. F., Makarov, V. V., Rovda Y. I., Chepkasov, I. L., & Kazakova, L. M. (1987). Measurement of temperament in children by means of parental questionnaires. *Proceedings of the Siberian Branch of the USSR Academy of Sciences. Biological Sciences Series, 6/1*, 128–132. (In Russian).

Kolpakov, V. G., Makarov, V. V., Khryachkova, N. A., Chuguy, V. F., & Chepkasov, I. L. (1984). Measurement of temperament traits in children of the first two years of life by means of parental questionnaires. *Proceedings of the Siberian Branch of the USSR Academy of Sciences. Biological Sciences Series, 13/2*, 115–122. (In Russian).

Kusanagi, E., Chen, S., & Hoshi, N. (2000). Psychometric properties of the Toddler Behavior Assessment Questionnaire applied to Japanese children. *Psychologia*, *43*, 262–274.

Lewis, M., Goldberg, S., & Campbell, H. (1969). A developmental study of information processing within the first three years of life: Response decrement to a redundant signal. *Monographs of the Society for Research in Child Development*, *34*(9, Serial No. 133).

Marganoff, P. P., & Folwarski, J. (1996). Slavic families: An overview. In M. McGoldrick, J. Giordano, & J. K. Pearce, (Eds.), *Ethnicity and family therapy* (pp. 673–679). New York: Guilford Press.

Markus, H. R., & Kitayama, S. (1994). The cultural shaping of emotion: A conceptual framework. In S. Kitayama & H. R. Markus (Eds.), *Emotion and culture: Empirical studies of mutual influence* (pp. 339–351). Washington, DC: American Psychological Association.

McClintock, C. G., & Lieberman, W. B. G. (1988). The role of interdependence structure, individual value orientation and another's strategy in social decision making: A transformational analysis. *Journal of Personality and Social Psychology*, *55*, 369–409.

Oyserman, D., Coon, H. M., & Kemmelmeier, M. (2002). Rethinking individualism and collectivism: Evaluation of theoretical assumptions and meta-analyses. *Psychological Bulletin*, *128*, 3–72.

Park, S., Belsky, J., Putnam, S., & Crnic, K. (1997). Infant emotionality, parenting, and 3-year inhibition: Exploring stability and lawful discontinuity in a male sample. *Developmental Psychology*, *33*, 218–227.

Pauli-Pott, U., Mertesacker, B., Bade, U., Haverkock, A., & Beckmann, D. (2003). Parental perceptions of infant temperamental development. *Infant Behavior and Development*, *26*, 27–48.

Peyrot, M. (1996). Causal analysis: Theory and application. *Journal of pediatric Psychology*, *21*, 3–24.

Posner, M. I., & Rothbart, M. K. (1991). Attention mechanisms and conscious experience. In M. Rugg & A. D. Milner (Eds.), *The neuropsychology of consciousness* (pp. 91–112). London: Academic Press.

Putnam, S. P., Ellis, L. K., & Rothbart, M. K. (2001). The structure of temperament from infancy through adolescence. In A. Eliasz & A. Angleitner (Eds.), *Advances/proceedings in research on temperament* (pp. 165–182). Lengerich, Germany: Pabst Science Publishers.

Putnam, S. P., Gartstein, M. A., & Rothbart, M. K. (2006). Measurement of fine-grained aspects of toddler temperament: The Early Childhood Behavior Questionnaire. *Infant Behavior and Development*, *29*, 386–401.

Rothbart, M. K. (1981). Measurement of temperament in infancy. *Child Development*, *52*, 569–578.

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

Rothbart, M. K., Ahadi, S. A, Hershey, K. L., & Fisher, P. (2001). Investigations of temperament at 3–7 years: The Children's Behavior Questionnaire. *Child Development*, *72*, 1394–1408.

Rothbart, M. K., & Bates, J. E. (1998). Temperament. In W. Damon (Series Ed.) & N. Eisenberg (Vol. Ed.), *Handbook of child psychology. Vol. 3: Social, emotional, and personality development*. (5th ed., pp. 105–176). New York: Wiley.

Rothbart, M. K., & Derryberry, D. (1981). Development of individual differences in temperament. In M. E. Lamb & A. L. Brown (Eds.), *Advances in developmental psychology* (Vol. 1, pp. 37–86). Hillsdale, NJ: Lawrence Erlbaum Associates, Inc.

Rothbart, M. K., Ellis, L. K., Rueda, M. R., & Posner, M. I. (2003). Developing mechanisms of temperamental effortful control. *Journal of Personality*, *71*, 1113–1143.

Rothbart, M. K., & Goldsmith, H. H. (1985). Three approaches to the study of infant temperament. *Developmental Review*, *5*, 237–260.

Ruff, H. A., & Rothbart, M. K. (1996). *Attention in early development*. New York: Oxford University Press.

Ruff, H. A., Saltarelli, L. M., Capozzoli, M., & Dubiner, K. (1992). The differentiation of activity in infants' exploration of objects. *Developmental Psychology*, *11*, 705–710.

Silk, J. S., Steinberg, L., & Morris, A. S. (2003). Adolescents' emotion regulation in daily life: Links to depressive symptoms and problem behavior. *Child Development*, *74*, 1869–1880.

Slobodskaya, H. R. (1995). Early temperament: Parents' ratings of toddler's behaviour and family characteristics. *Voprosy Psychologii (Psychology Issues, Russia)*, *6*, 104–112.

Smith, N. A., & Putnam, S. P. (2004). *Parental warmth and control as predictors of children's shyness*. Poster presented at the International Conference on Infant Studies, May 2004, Chicago, IL, USA.

Stevens, G., & Featherman, D. L. (1981). A revised socioeconomic index of occupational status. *Social Science Research*, *10*, 365–395.

Super, C., & Harkness, S. (1986). The developmental niche: A conceptualization at the interface of child and culture. *International Journal of Behavioral Development*, *9*, 545–569.

Thomas, A., Chess, S., & Birch, H. G. (1968). Temperament and behavior disorders in children. New York: New York University Press.

Thompson, R. A. (1998). Early sociopersonality development. In W. Damon (Series Ed.) & N. Eisenberg (Vol. Ed.), *Handbook of child psychology. Vol. 3: Social, emotional, and personality development* (5th ed., pp. 25–104). New York: Wiley.

Triandis, H. C. (1988). Collectivism and individualism: A reconceptualization of a basic concept in cross-cultural social psychology. In B. K. Verma & C. Bagley (Eds.), *Personality, attitudes and cognitions* (pp. 60–95). London: Macmillan.

Triandis, H. C. (1995). *Individualism and collectivism*. Boulder, CO: Westview.

van den Boom, D. C. (1994). The influence of temperament and mothering on attachment and exploration: An experimental manipulation of sensitive responsiveness among lower-class mothers with irritable infants. *Child Development*, *65*, 1457–1477.

van den Boom, D. C. (1995). Do first-year intervention effects endure? Follow-up during toddlerhood of a sample of Dutch irritable infants. *Child Development*, *66*, 1798–1816.

Waite, L. J., Godscheider, F. K., & Witsberger, C. (1986). Nonfamily living and the erosion of family orientations among young adults. *American Sociological Review*, *51*, 541–554.