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## The Relations of Temperament Reactivity and Effortful Control to Children's Adjustment Problems in China and the United States

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### Abstract

The relations of parents' and teachers' reports of temperament anger-irritability, positive emotionality, and effortful control (attention focusing and inhibitory control) to children's externalizing and internalizing problems were examined in Chinese ( $N = 382$ ) and U.S. ( $N = 322$ ) samples of school-age children. Results suggested that in both cultures, low effortful control and high anger-irritability were associated with high externalizing problems, although the relations were stronger in the Chinese sample than in the U.S. sample. Low positive emotionality was associated with high internalizing problems in both cultures. However, high positive emotionality was associated with noncomorbid externalizing problems (teachers' reports) in the Chinese sample but not in the U.S. sample. These findings suggest that there are considerable cross-cultural similarities in the temperament-adjustment associations, although some cross-cultural differences might exist. Implications of the findings for the detection and intervention of adjustment problems in Chinese children are discussed.

### Keywords

temperament; reactivity; effortful control; China; U.S.

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Temperament reflects constitutionally based individual differences in emotional and motor reactivity, attentional regulation, and inhibitory control—the latter two composing the construct of effortful control (Rothbart & Bates, 2006). Although temperament reactivity and effortful control reflect biologically based characteristics, they are also partly shaped by the environment (Rothbart & Bates, 2006). Although there has been a surge of research in the links of the proximal environments (e.g., parenting) to children's temperament

characteristics (e.g., Eisenberg, Zhou, et al., 2005; Kochanska & Knacck, 2003; Lengua, 2006), few researchers have examined the role of the larger sociocultural context in the manifestation of temperament and its implications for children's psychological adjustment. Specifically, little if any research has examined the cross-cultural similarities and differences in children's temperament reactivity and effortful control and their relations to children's adjustment problems. Using a cross-cultural sample of school-age children from mainland China and the United States, this study addressed these questions by studying the effect of culture on the relations of temperament reactivity (anger-irritability and positive emotionality) and effortful control (attention focusing and inhibitory control) to children's externalizing, internalizing, and comorbid problems. The study provided important insights into cross-cultural universality and cultural variation in temperament and its relations to children's adjustment.

## Culture, Temperament, and Adjustment

Because temperament reflects biologically rooted, early-appearing, and relatively stable individual differences in the reactivity and regulation of basic emotions such as joy, fear, and anger (Rothbart & Bates, 2006), which are found to exist universally across cultures (Ekman, 1972, 1994), one should expect to find at least some cross-cultural universalities in the basic structure of temperament. Indeed, Rothbart, Ahadi, Hershey, and Fisher (2001) found that a three-factor model of temperament that includes Extraversion/Surgency, Negative Affectivity, and Effortful Control can be reliably recovered in parental ratings of children's temperament across cultures (the United States, China, and Japan), although some cross-cultural differences were found in the loadings of individual temperament dimensions. Similarly, in adult samples, the five-factor model of personality has been replicated in most cultures (e.g., McCrae, Terracciano, & Members of the Personality Profiles of Cultures Project, 2005).

Despite the overall universality of temperament and personality across cultures, several theories have suggested that some crosscultural differences might exist in the manifestation of temperament or personality characteristics and their associations with individual adjustment. Kerr (2001) theorized that culture could influence the development of temperament in two ways. First, cultural values could influence how people perceive and respond to children with certain temperament characteristics, which in turn affects the stability of such characteristics and their implications for individual adjustment. Second, culturally laden institutions (e.g., family and school) or customs may favor temperament characteristics that are consistent with culturally admired behaviors and minimize those that are inconsistent with those values. Similarly, Matsumoto (2007) theorized that individuals adapt to the specific situational contexts within a culture to perform the culturally prescribed social roles, which may generate cultural differences in consistency and mean levels of the dispositional traits. Moreover, according to the goodness-of-fit perspective, optimal developmental outcomes occur when there is a good match between temperament and the child's socialization environment (Lerner, 1984). Because cultures vary in their models of socialization (e.g., Chao, 1994; Keller et al., 2004), similar temperament traits might be associated with different developmental outcomes in different cultural contexts.

An important aim for cross-cultural research on temperament is to identify similarities and differences on both norms or average levels of certain traits and the associations between traits and other constructs across cultures. Comparisons of means suggested that Chinese and Chinese American infants were less reactive or facially expressive than European American infants (e.g., Camras et al., 1998; Freedman, 1974; Kisilevsky et al., 1998). In a comparison of associations, Chen and colleagues (Chen, Dong, & Zhou, 1997; Chen, Rubin, & Li, 1995; Chen, Rubin, & Sun, 1992) found that although shyness was negatively associated with psychosocial adjustment in Western culture, it was positively associated with children's social competence in Chinese culture. This finding was consistent with the valuing of shy, reserved, and sensitive behaviors in the Chinese culture. Chen and colleagues' work demonstrated that culture may interact with temperament in affecting children's adjustment.

In this study, we aimed to examine the similarities and differences in the relations of parents' and teachers' reports of temperament anger-irritability, positive emotionality, and effortful control to children's adjustment problems between urban school-age children in mainland China and the United States. Because there are few existing cross-cultural studies of temperament (Oakland & Lu, 2006; Porter et al., 2005; Rothbart et al., 2001), especially those involving the dimensions of reactivity and effortful control, the specific hypotheses regarding cross-cultural similarities and differences were developed on the basis of the broader literature, including both within- and cross-cultural studies on temperament and related characteristics (e.g., emotion expressivity and affect valuation).

## **Hypothesized Cross-Cultural Similarities and Differences in Reactivity and Effortful Control**

### **Anger-Irritability**

*Anger-irritability* refers to the negative emotion associated with the interruption of ongoing tasks or blocked goals (Rothbart et al., 2001). Children with high anger-irritability tend to encounter peer rejection and victimization (Dougherty, 2006), which in turn can lead to externalizing behaviors (Schwartz, McFadyen-Ketchum, Dodge, Pettit, & Bates, 1998; Snyder et al., 2003). Indeed, anger-irritability consistently relates to greater externalizing problems in samples of predominantly European American children (e.g., Eisenberg et al., 2001; Eisenberg, Sadvosky, et al., 2005; Gilliom, Shaw, Beck, Schonberg, & Lukon, 2002; Lemery, Essex, & Smider, 2002; Lengua, 2003; Oldehinkel, Hartman, De Winter, Weenstra, & Ormel, 2004).

One difference between Chinese and Western cultures that has implications for temperamental anger-irritability is the cultural value placed on emotion expressivity. In Western, individualistic cultures, the open expression of emotions is usually encouraged because of the cultural emphasis on individuality and autonomy. In contrast, members of collective cultures such as mainland China are socialized to control emotion expression to maintain group harmony (Markus & Kitayama, 1991; Oyserman, Coon, & Kimmelmeir, 2002). As evidence, adults from the East Asian collective cultures are found to be less emotionally expressive than Westerners (e.g., Ekman, 1972; Levenson, Ekman, Heider, &

Friesen, 1992). Similarly, Chinese parents rated their children as less emotionally reactive than their U.S. counterparts (Porter et al., 2005). Moreover, Camras, Chen, Bakeman, Norris, and Cain (2006) found that mainland Chinese and Chinese American infant girls scored lower on observed disgust-related expressions and overall expressivity than European American girls and Chinese girls adopted by European American families. They also found that self-reported maternal strictness and aggravation mediated the cultural variability in infants' facial expressivity, supporting the role of the socialization environment in explaining the cultural differences in emotion expressivity.

Because of the cultural differences in emotion expressivity, Chinese children might score lower on anger-irritability than U.S. children. However, the relations between anger-irritability and children's adjustment outcomes are expected to be similar across the two cultures. In collective cultures, self-focused emotions, such as anger, motivate the individual to eliminate the obstacles and wrongs that threaten one's sense of independence; if unchecked, the public expression of anger may disrupt group harmony (Markus & Kitayama, 1991; Matsumoto, 2007). Moreover, Confucian values emphasize early training of affective control, which has an important influence on the Chinese model of socialization (D. Y. H. Wu, 1996). Thus, Chinese children with high anger-irritability may experience more conflict and rejection in social relationships (including parent-child, teacher-child, and peer relationships) than their peers, which in turn impairs their behavioral adjustment. This hypothesis is supported by within-culture findings on Chinese children: Anger-irritability was positively related to externalizing problems and negatively related to social competence (Eisenberg et al., 2007; Zhou, Eisenberg, Wang, & Reiser, 2004). In a cross-cultural sample, one can compare not only the direction but also the magnitude of relations between anger-irritability and adjustment. Because of the lower tolerance of open display of anger in the Chinese culture compared with the U.S. culture, we expected that the relation between anger and externalizing problems would be stronger in the Chinese sample than in the U.S. sample.

### Positive Emotionality

*Positive emotionality* refers to the intensity and duration of positive emotions such as smiling and laughter (Rothbart & Posner, 2006). In studies based on Western samples, a low level or the absence of positive affect is characteristic of depression (Clark, Watson, & Mineka, 1994), and a negative association has generally been found between positive emotionality and children's internalizing problems (e.g., Lengua, Sandler, West, Wolchik, & Curran, 1999; Lonigan, Phillips, & Hooe, 2003). Positive emotionality has also been associated with other adjustment outcomes, including higher social competence and prosocial behaviors (e.g., Denham, McKinley, Couchoud, & Holt, 1990; Eisenberg, Wentzel, & Harris, 1998; Shiner, Masten, & Tellegen, 2002) and lower externalizing problems (Eisenberg et al., 1996; Kim, Walden, Harris, Karrass, & Catron, 2007; Lengua et al., 1999; Lengua, West, & Sandler, 1998). However, consistent with the theory that positive emotionality is related to children's approach tendencies (Rothbart, 1988; Rothbart, Posner, & Hershey, 1995), some researchers found that children with unrestrained excitement or high-intensity pleasure are susceptible to externalizing problems (e.g., Oldehinkel et al., 2004).

Some cultural differences are expected in the relations of positive emotionality to adjustment problems. In Western culture, the experience and expression of positive affect (e.g., happiness and excitement) is viewed as an indication of social competence and psychological well-being because it signals that the individual has fulfilled his or her personal goals and managed the central cultural task of “standing out” (Mesquita & Albert, 2007). Positive emotions are also thought to broaden individuals’ thought–action repertoires and build up physical, social, intellectual, and psychological resources (Fredrickson, 2001). Accordingly, socialization practices aimed at promoting the child’s feeling of being special, important, and happy—such as the encouragement of “show-and-tell” use of smiley faces, stickers, and gift-box rewards for achievement; and so forth—are frequently used by Western parents and teachers (Mesquita & Albert, 2007). In contrast, in the Chinese culture, in addition to the general emphasis on control of emotion expressions (especially in public), the experience and expression of high-arousal positive affect (e.g., enthusiasm and excitement) is less valued or preferred than low-arousal positive affect (e.g., calm, serene, and relaxed) (Tsai, Knutson, & Fung, 2006; Tsai, Louie, Chen, & Uchida, 2007). Moreover, open expression of positive emotions including happiness and excitement might promote the feeling of pride—a less desirable emotion among Chinese (Russell & Yik, 1996). Therefore, although it is common for Chinese adults to praise and reward children for desired behaviors and attributes, they are usually cautious in these practices to avoid evoking intense positive emotions in children. Indeed, Chinese parents scored higher in encouragement of modesty (e.g., discouraging children from showing off their skills or proudly acknowledging compliments; P. Wu et al., 2002) than U.S. parents. Thus, in the Chinese culture, children high on positive emotionality may be perceived as impulsive, dysregulated, and at risk for developing externalizing problems.

### Effortful Control

*Effortful control* is defined as “the efficiency of executive attention, including the ability to inhibit a dominant response, to activate a subdominant response, to plan, and to detect errors” (Rothbart & Bates, 2006, p. 129). Effortful control includes attention focusing (i.e., the capacity to voluntarily focus attention) and inhibitory control (i.e., the capacity to suppress inappropriate responses). In studies based on Western samples, effortful control is negatively related to externalizing and internalizing problems (e.g., Eisenberg et al., 2001; Eisenberg, Sadovsky, et al., 2005; Kochanska & Knaack, 2003; Olson, Sameroff, Kerr, Lopez, Wellman, 2005).

Similar relations are expected between effortful control and adjustment problems in the Chinese culture. In addition to its role in individuals’ emotion regulation and goal-directed behaviors, effortful control is a vital skill in maintaining harmonious interpersonal relationships. Thus, Chinese children with lower effortful control are expected to have higher adjustment problems than their peers. This hypothesis was supported by within-culture studies on Chinese children (Eisenberg et al., 2007; Zhou et al., 2004). In a cross-cultural comparison study, one can further examine whether culture moderates the strength of the relation between effortful control and adjustment problems.

Keller et al. (2007) proposed that in contrast to the European American model of parenting, which focuses on the individual as a self-contained and separate agent, the Chinese model of parenting focuses on relatedness and family allocentrism. The relational model of parenting is hypothesized to promote children's self-regulation (Keller et al., 2004). Moreover, Chinese parents scored higher on authoritarian control than did Western parents (e.g., Dornbusch, Ritter, Leiderman, Roberts, & Fraleigh, 1987; P. Wu et al., 2002), likely because of the greater cultural emphasis on conformity to rules and emotional maturity (D. Y. H. Wu, 1996). In addition, compared with U.S. schools, Chinese schools tend to have large class sizes (with as many as 50–60 students led by only one teacher at a time). In Chinese classrooms, learning is primarily achieved through the teacher's lecturing and querying and seatwork exercises. Students are expected to pay undivided attention to the teacher, respond to queries, be attentive and respectful when classmates present, and complete seatwork in a timely and appropriate fashion (Phelps, 2005). The group-based and highly structured learning environment imposes greater demands on students' effortful control than does an individual-based and less structured learning environment. Thus, because of the greater social expectation for children's self-regulation, it is possible that the relation between effortful control and adjustment would be stronger in China than in the United States.

## The Present Study

In summary, our goal in this study was to conduct cross-cultural comparisons of the relations of temperament reactivity and effortful control to children's adjustment problems between children from China and the United States. On the basis of our literature review, we expected that high anger-irritability and low effortful control would relate to high externalizing problems (with or without comorbid internalizing problems) in both cultures, although the strengths of the relations might be somewhat stronger in the Chinese culture. Low positive emotionality was expected to relate to high internalizing problems in both cultures. In contrast, we expected that positive emotionality would relate positively to noncomorbid externalizing problems in the Chinese culture, but that the relation might be reversed in the U.S. culture. Because temperament and adjustment problems were both assessed through parents' and teachers' reports on rating scales, it is possible that the content overlap in measures might partly contribute to the temperament-adjustment association. However, previous work has found that removing the content overlap did not substantially change the magnitude of temperament-adjustment associations and did not substantially account for observed associations (Lemery et al., 2002; Lengua et al., 1998; Oldehinkel et al., 2004).

Following the suggestions of Vandenberg and Lance (2000), we examined measurement equivalence across cultures on both temperament and adjustment problem measures before testing the main hypotheses. Moreover, because some researchers have suggested that the temperament profiles associated with externalizing or internalizing problems differ among children with or without comorbid problems (e.g., Eisenberg et al., 2001; Eisenberg, Sadovsky, et al., 2005; Oldehinkel et al., 2004), we classified children into four adjustment problem groups (i.e., children with high externalizing problems only, high internalizing problems only, co-occurring externalizing and internalizing problems, or low or no adjustment problems) within each culture and examined the relations of temperament to



children's adjustment problem group membership. In addition, because some researchers have suggested that the relations between temperament and adjustment problems might be moderated by child sex (e.g., Colder & Stice, 1998; Lengua et al., 1999), we also tested the interaction between sex and temperament or culture in relation to adjustment problems.

## Method

### Participants

**Chinese Sample**—The Chinese participants were 382 fifth- and sixth-grade children (56% girls, 50% in fifth grade, mean age = 11.6 years,  $SD = 0.6$ , age range = 10.1–12.9) in Beijing who participated in a larger longitudinal study (Zhou et al., 2004, 2008). The children were first assessed in first or second grade (Wave 1, in 2000) and then again 4 years later (Wave 2, in 2004). Only the data from the Wave 2 assessments were included in this study. As a result of the “one-child-per-family” policy that was implemented in the late 1970s in China, 93% of the participants were the only child in the family. The percentages of children from two-parent, extended (including parents and grandparents or other adult family members), or single-parent families were 79.2%, 16.7%, and 4.1%, respectively. Monthly family income was reported on one of eight levels, ranging from 1 (*less than or equal to 500 Chinese yuan renminbi* [RMB; \$72.96]) to 8 (*more than 10,000 RMB* [\$1,459.22]). The mean level of family income was 4.29 (between 2,000 and 6,000 RMB [\$291.84 and \$875.53],  $SD = 1.41$ ). Of the mothers, 5% had less than a high school education, 34% had only a high school diploma, 57% had a college education, and 4% had graduate school education; the respective percentages for fathers were 5%, 38%, 54%, and 3%. On the basis of the demographic statistics of urban Beijing (National Bureau of Statistics of China, 2004), the sample included primarily low- to middle-income families.

Attrition analyses suggested that compared with the children ( $n = 43$ ) who were assessed only at Wave 1, the children in the final sample ( $n = 382$ ) who were assessed at both Wave 1 and Wave 2 came from families with higher maternal and paternal education and higher family income at Wave 1. However, the two groups did not differ on Wave 1 temperament variables.

**U.S. Sample**—The U.S. participants were 322 third-through sixth-grade children (53% girls, mean age = 9.6 years,  $SD = 1.0$ , age range = 7.8–12.0), combined from two community studies conducted in a northwestern metropolitan area (Seattle, WA) from 1997 to 2000 (see Lengua, 2003, 2006). The sample was ethnically diverse, with 28.6% African American, 2% Asian/Pacific Islander, 58.6% European American or White, 2% Hispanic, 1.2% Native American, and 7.6% multiple or other ethnicities. Caregivers included 93% biological mothers, 3% adoptive mothers, 1% foster or stepmothers, and 3% grandmothers who had primary residential custody of the child (because most female caregivers were mothers, they are referred to as mothers). Two-parent households made up 72% of the families, and 28% were single-parent households. Twentythree percent of the participants were the only child in the family, 39% had one sibling, 23% had two siblings, and 15% had three or more siblings. Annual family income was distributed roughly evenly across six categories of income: 12% less than \$20,000; 23%, \$21,000 to \$40,000; 18%, \$41,000 to

\$60,000; 14%, \$61,000 to \$80,000; 16%, \$81,000 to \$100,000; and 17%, more than \$100,000. Of the mothers, 2.8% had less than a high school education, 6.7% had a high school education, 58.8% had a college education, and 31.7% had a graduate education. The respective percentages for fathers were 7.1%, 13.0%, 46.8%, and 33.1%.

Although some demographic indices (e.g., income) cannot be directly compared across cultures, the two samples were similar in a number of aspects. First, both samples were recruited from public schools in urban metropolitan areas and consisted primarily of low- to middle-income families according to local standards. Second, in both samples, the modal level of parental education was college education. Third, both samples primarily included children from two-parent households. There are also some differences between the two samples. First, the U.S. sample had a wider age range than the Chinese sample. Second, the Chinese sample consisted of predominantly only children, whereas the majority of the U.S. children had one or more siblings. Third, the Chinese sample was homogeneous with regard to ethnicity (predominantly Han Chinese), whereas the U.S. sample was ethnically diverse.

## Procedures

**Chinese Study**—Participants were recruited from two public schools. There were three to four classrooms in each grade and 30 to 60 students in each classroom. Before the study began, a letter about the study and a written permission form were handed out to the parents of all the eligible students at the two elementary schools. At Wave 2, 99% of the contacted parents signed and returned the permission forms, indicating that they gave consent for their child's participation. Because the researchers requested that mothers complete the parent questionnaire (if possible), 82% of the parent questionnaires were completed by mothers, 12% by fathers, and 6% by other caregivers (e.g., grandparents). For each participating child, the head teacher ( $N = 14$ ) completed questionnaires (return rate = 98%). The parents and teachers were paid for their participation.

**U.S. Study**—Similar to the Chinese study, the U.S. participants were recruited through public school classrooms. Schools were selected for recruitment to represent a variety of sociodemographic and ethnic and racial characteristics of the urban area surrounding the university. One child in the target grades per family was asked to participate. If there was more than one child in the target grades, one child was randomly selected to participate. Mother data were collected using structured, scripted 2.5-hr interviews conducted in the families' homes. Mothers' informed consents were obtained before the start of the interviews. Participants were assured of the confidentiality of their responses. Families were compensated with \$40 for participating. Teacher-report data were collected using scripted interviews conducted in the classrooms, and the teachers were compensated \$10 for completing questionnaires for each child.

## Measures

In both studies, temperament and adjustment problems were assessed by means of rating scales completed by parents and teachers. Our goal was to select measures of temperament and adjustment problem constructs that were as comparable as possible across the two studies. Thus, for constructs for which a common set of items were used across the two



studies (i.e., temperament smiling–laughter and inhibitory control and externalizing and internalizing problems), we used matched scales (i.e., scales including the same set of items across the two studies) to calculate the composite scores. For constructs on which similar but not identical sets of items were used across the two studies (i.e., temperament attention focusing and anger–irritability), we used the original scales to calculate the composites. To adjust for the metric differences in temperament items between the two studies (i.e., a 7-point scale ranging from 1 [*extremely untrue*] to 7 [*extremely true*] was used in the Chinese study, whereas a 5-point scale ranging from 1 [*very false*] to 5 [*very true*] was used in the U.S. study), the temperament items in the Chinese study were recoded (Responses 2 and 3 were combined, Responses 5 and 6 were combined, and then all responses were recoded so that the final items were on a 5-point scale ranging from 1 to 5).<sup>1</sup>

### Temperament Reactivity and Regulation

**Anger–irritability:** Temperament anger-irritability was assessed by means of parent and teacher report on the Anger/Frustration subscale from the Chinese version of the Child Behavior Questionnaire (CBQ; Rothbart et al., 2001) in the Chinese sample and parent and teacher report on the Irritability subscale from the Early Adolescent Temperament Questionnaire (EATQ; Capaldi & Rothbart, 1992) in the U.S. sample. The two scales assess the amount of the child’s negative affect related to interruption of ongoing tasks or goal blocking and include a similar, but not identical, set of items (e.g., the CBQ items “Gets mad when provoked by other children” and “Easily gets irritated when s/he has trouble with some task” and the EATQ items “Is irritated by little things other kids do” and “Gets irritated when s/he has to stop doing something enjoyable”). Alpha reliabilities were .67 (11 items) and .89 (12 items) for parent and teacher report in the Chinese sample and .76 (8 items) and .91 (8 items) for parent and teacher report in the U.S. sample. Within each sample and for both reporters, the item scores were averaged.

**Smiling/laughter (positive emotionality):** In both studies, parents and teachers reported on the CBQ Smiling/Laughter subscale (Rothbart et al., 2001), which assesses the amount of positive affect in response to changes in stimulus intensity, rate, complexity, and incongruity. Seven items were matched across the two studies for both parents’ and teachers’ reports (e.g., “Laughs at lot at jokes and silly happenings,” “Sometimes smiles or giggles when playing by her/himself,” and “Smiles a lot at people s/he likes”). Thus, the matched items were used to obtain the smiling/laughter composites. Alpha reliabilities for the matched scale (7 items) were .53 and .71 for parent and teacher report, respectively, in the Chinese sample and .67 and .74 for parent and teacher report, respectively, in the U.S. sample.

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<sup>1</sup>We combined Responses 2 and 3 and Responses 5 and 6 because these are the less extreme response choices (in comparison to Responses 1 and 7). We understand that this method of metric transformation is somewhat arbitrary. To examine the effect of this transformation on our data analyses, we compared the zero-order correlations involving temperament variables in the Chinese sample with and without such transformation. As shown in Table 2, the changes in correlation coefficients as a result of the metric transformation were small (the absolute values of change ranged from .00 to .05). Because the focus of this article was on comparing the relations among temperaments and between temperament and adjustment problems and the method of combining the response points had little effect on the correlations among the study variables, we do not think that this transformation has altered the main analyses.

**Attention focusing:** In the Chinese sample, parents and teachers reported on the CBQ Attention Focusing subscale (Rothbart et al., 2001). In the U.S. sample, parents and teachers reported on the EATQ Attention Regulation subscale (Capaldi & Rothbart, 1992). Although the content and wording of the CBQ and EATQ items are somewhat different (e.g., CBQ items “When studying or reading a book, shows strong concentration” and “Will move from one task to another without completing any of them” [reversed] and EATQ items “Pays close attention when somebody tells him/her to do something” and “Often is in the middle of doing one thing, and then goes off to do something else without finishing it” [reversed]), they are both intended to assess the child’s tendency to maintain attentional focus on task-related channels (one item from the EATQ subscale in the U.S. study, “Finds it hard to shift gears when going from one activity to another,” was dropped because it assesses attention shifting). The alpha reliabilities were .70 (11 items) and .89 (12 items) for parent and teacher report, respectively, in the Chinese sample and .75 (7 items) and .88 (6 items) for parent and teacher report, respectively, in the U.S. sample. The item scores were averaged to form the attention focusing composite.

**Inhibitory control:** In both samples, inhibitory control was assessed with parent and teacher report on the CBQ Inhibitory Control subscale (Rothbart et al., 2001), which measures the child’s capacity to plan and suppress inappropriate approach responses under instruction or in novel or uncertain situations. Eleven parent-report items and 10 teacher-report items (e.g., “Can lower his/her voice when asked to do so” and “Has a hard time following instructions” [reversed]) were matched across the two studies. Thus, the matched items were used to obtain the inhibitory control composites. The alpha reliabilities were .61 and .85 for parent and teacher report, respectively, in the Chinese sample and .82 and .92 for parent and teacher report, respectively, in the U.S. sample.

### **Adjustment Problems**

**Externalizing problems:** In the Chinese sample, externalizing problems were assessed with the externalizing subscales of the Child Behavior Checklist (CBCL; parent report, Achenbach & Rescorla, 2001) and the Teacher Report Form (TRF; Achenbach & Rescorla, 2001). In the U.S. sample, the 1991 version of the CBCL (Achenbach, 1991a) and the TRF (Achenbach, 1991b) were used. The CBCL and TRF externalizing scales include two subscales: (a) Rule-Breaking/Delinquent Behaviors (e.g., “Lying or cheating” and “Disobedient at home or school”) and (b) Aggressive Behaviors (e.g., “Argues a lot” and “Hangs out with others who get in trouble”). Twenty-nine parent-report items and 17 teacher-report items were matched between the two studies, and the matched items were used to form the externalizing problems composites. The alpha reliabilities were .82 and .89 for parent and teacher report, respectively, in the Chinese sample and .86 and .92 for parent and teacher report, respectively, in the U.S. sample. Parents’ and teachers’ reports of externalizing problems were positively correlated in the Chinese and the U.S. samples,  $r(363, 224) = .37$  and  $.34$ ,  $ps < .001$ .

**Internalizing problems:** In the Chinese sample, internalizing problems were assessed with the internalizing subscales of the 2001 version of the CBCL parent report (Achenbach & Rescorla, 2001) and the TRF (Achenbach & Rescorla, 2001). In the U.S. study, the 1991

version of the CBCL (Achenbach, 1991a) and the TRF (Achenbach, 1991b) were used. The CBCL and TRF internalizing scales include three subscales: (a) Anxious/Depressed (e.g., “Cries a lot” and “Feels worthless or inferior”), (b) With-drawn/Depressed (e.g., “Too shy or timid” and “Would rather be alone than with others”), and (c) Somatic Complaints (e.g., “Feels dizzy or lightheaded” and “Aches or pains”). Twenty-six parent-report items and 11 teacher-report items were matched between the two studies, and thus the matched items were used to form the internalizing problems composites. The alpha reliabilities were .83 and .72 for parent and teacher report, respectively, in the Chinese sample and .83 and .85 for parent and teacher report, respectively, in the U.S. sample. In both samples, parents’ and teachers’ ratings of internalizing problems were uncorrelated.

## Results

### Effects of Nation and Demographic Variables on the Means of Temperament and Adjustment

**Nation and sex**—The means and standard deviations of temperament and adjustment variables by nations and across child sex are presented in Table 1. Missing data were less than 6% for the Chinese sample and less than 5% for the parent-report variables in the U.S. sample. About 28% of the teacher report data were missing in the U.S. sample because of the relatively low response rate from teachers. The zero-order correlations among the study variables within each sample are presented in Table 2. To examine the effects of nation, child sex, and their interaction on temperament and adjustment problems, we conducted a series of 2 (child sex)  $\times$  2 (nation) analyses of variance. For temperament, none of the Sex  $\times$  Nation interactions was significant. Significant main effects of child sex were found on parents’ and teachers’ reports of inhibitory control,  $F_s(1, 589) = 21.8$  and  $89.2$ , respectively,  $ps < .001$ . Both parents and teachers rated girls higher on inhibitory control than boys. Moreover, sex differences were found on teachers’ reports of attention focusing, irritability, and smiling–laughter,  $F_s(1, 587) = 54.4, 27.5,$  and  $89.2$ , respectively,  $ps < .001$ . Teachers rated girls as higher on attention focusing and smiling–laughter and lower on irritability than boys. Significant main effects of nation were found on parents’ and teachers’ reports of irritability,  $F_s(1, 590) = 44.1$  and  $9.1$ ,  $ps < .001$  and  $.004$ , respectively. Chinese parents rated their children lower on irritability than did U.S. parents, whereas Chinese teachers rated their students higher on irritability than did U.S. teachers. Main effects of nation were also found on parents’ and teachers’ ratings of smiling–laughter,  $F_s(1, 587) = 33.9$  and  $12.8$ , respectively,  $ps < .001$ . Both Chinese parents and teachers rated children lower on smiling–laughter than did U.S. parents and teachers. In addition, nation differences were found on teachers’ ratings of attention focusing and inhibitory control,  $F_s(1, 587) = 12.1$  and  $9.4$ ,  $ps < .001$  and  $.003$ , respectively. Chinese teachers rated children lower on attention focusing and inhibitory control than did U.S. teachers.

For adjustment problems, we found a significant Sex  $\times$  Nation interaction for parents’ reports of internalizing problems,  $F(1, 659) = 10.0$ ,  $p < .003$ . Probing the interaction indicated that Chinese parents rated boys higher on internalizing problems than girls,  $F(1, 356) = 12.1$ ,  $p < .002$ , whereas no sex differences were found on U.S. parents’ ratings of internalizing problems. Moreover, significant main effects of sex were found for parents’

and teachers' ratings of externalizing problems,  $F(1, 674) = 15.0$  and  $F(1, 597) = 33.3$ , respectively,  $ps < .001$ . In addition, significant main effects of nation were found for parents' and teachers' ratings of externalizing problems and teachers' ratings of internalizing problems,  $F_s(1, 597-674) = 102.3, 33.3, \text{ and } 144.8$ , respectively,  $ps < .001$ . Chinese parents and teachers rated children lower on externalizing problems than did their U.S. counterparts, and Chinese teachers rated children lower on internalizing problems than did U.S. teachers.<sup>2</sup>

**Age**—We conducted partial correlations by nation between age and temperament and adjustment problem variables. The only significant partial correlation was found between age and teachers' ratings of inhibitory control,  $r(537) = .14, p < .001$ .

**Socioeconomic status (SES)**—Within each sample, we created a family SES index by first averaging maternal and paternal education levels, and then averaging the standardized scores for parental education and family income. In the U.S. sample, SES was negatively correlated with parents' and teachers' reports of anger-irritability and externalizing problems and with teachers' reports of internalizing problems,  $r_s(225-307) = -.20 \text{ to } -.34$ ,  $ps < .004$ . SES was also positively correlated with parents' and teachers' reports of attention focusing and inhibitory control,  $r_s(225-306) = .16 \text{ to } .41$ ,  $ps < .001$ . In the Chinese sample, SES was positively correlated with parents' and teachers' reports of attention focusing and parents' reports of inhibitory control,  $r_s(364-371) = .13 \text{ to } .19$ ,  $ps < .05$ .

**Ethnicity and only-child status in the U.S. sample**—We conducted independent-sample  $t$  tests by ethnicity (European Americans vs. other ethnicities) within the U.S. sample. European American children scored lower on parents' and teachers' reports of anger-irritability and higher on parents' and teachers' reports of attention focusing and inhibitory control than did children from other ethnic groups ( $ps < .01$ ). Moreover, the European American children scored lower on parents' and teachers' reports of externalizing problems than did those from other ethnic groups ( $ps < .05$ ). In addition, we conducted independent-sample  $t$  tests by only-child status (children from only-child families vs. children with siblings) on temperament and adjustment problem variables within the U.S. sample. None of the  $t$  tests was significant.

### Testing Measurement Equivalence of Temperament and Equivalence of Relations Among Temperament Dimensions Across Nations

**Measurement equivalence**—To examine the measurement invariance of temperament dimensions between the U.S. and Chinese samples, we conducted a multiple-group confirmatory factor analysis using Mplus 4.02 (Muthén & Muthén, 1998-2006). In Mplus maximum likelihood estimation, missing data are allowed, but the missing values are not imputed. Rather, the method uses all information that is available to estimate the model (Muthén & Muthén, 1998-2006). A four-factor measurement model was tested simultaneously in the U.S. and the Chinese sample: the latent factors of Attention Focusing,

<sup>2</sup>We also conducted Levene's Tests to examine the equality of variances for temperament and adjustment problem measures between the two samples. Results suggest that with the exception of parents' and teachers' ratings of smiling-laughter (where the tests were nonsignificant), the variances for other temperament and adjustment problem measures were greater in the U.S. sample than in the Chinese sample ( $F_s = 15.8-131.1, ps < .001$ ).

Inhibitory Control, Irritability, and Smiling–Laughter were indicated by the corresponding parent- and teacher-reported observed variables. A constrained model was tested in which the loadings and intercepts of the observed variables were fixed to be invariant across the two samples. All the latent variables were allowed to correlate with each other, and the correlations were allowed to vary across samples. The error variances of observed variables from the same reporter were allowed to correlate with each other in both samples, but the sizes of the correlations were allowed to vary across samples. After releasing the invariance constraint on the intercept of parents' reports of irritability, the multiple-group model fit the data adequately,  $\chi^2(27, Ns = 313 \text{ and } 382 \text{ for the U.S. and Chinese samples, respectively}) = 68.44, p < .001$ , comparative fit index (CFI) = .97, Tucker-Lewis index (TLI) = .94, root-mean-square error of approximation (RMSEA) = .067. Releasing no other invariance constraint would significantly improve the model fit. According to Vandenberg and Lance (2000), the above results suggest that configural, metric, and partial scalar invariance across the two cultural groups were established for temperament measures. In the partially constrained model, all the loadings for the observed variables were significant and in a positive direction, suggesting that parents and teachers were in agreement in their ratings of temperament in both samples.<sup>3</sup>

**Equivalence of the relations among temperament dimensions—**We also compared the multiple-group confirmatory factor analysis model of temperament in which the correlations among the four latent factors were constrained to be invariant across samples with the model in which the correlations were allowed to vary across samples. Changes in the chi-square statistics between the two nested models were significant,  $\chi^2(5, Ns = 313 \text{ and } 382 \text{ for the U.S. and Chinese samples, respectively}) = 21.1, p < .001$ , suggesting that invariance of correlations was not supported. Modification indices suggested that releasing the invariance constraints on the correlation between Irritability and Smiling–Laughter and the correlation between Attention Focusing and Irritability would significantly improve the model fit,  $\chi^2(2, Ns = 313 \text{ and } 382 \text{ for the U.S. and Chinese samples, respectively}) = 17.7, p < .001$ . Irritability and Smiling–Laughter were positively correlated in the Chinese sample, but uncorrelated in the U.S. sample (Figure 1). Although Attention Focusing and Irritability were negatively correlated in both samples, the correlation was stronger in the Chinese sample than in the U.S. sample.

### Testing Measurement Equivalence of Adjustment Problems Across Nations and Classifying Adjustment Problem Groups

**Measurement equivalence—**A two-factor measurement model was fitted to the U.S. and Chinese samples simultaneously, in which the latent factors of Externalizing Problems and Internalizing Problems were indicated by the corresponding parent- and teacher-reported variables. A constrained model was tested in which the loadings and intercepts of

<sup>3</sup>We also tested a two-group, three-factor temperament model in which parents' and teachers' ratings of attention focusing and inhibitory control were loaded on one effortful control factor. The model fit indices of the three-factor model were similar to the fit indices of the four-factor model,  $\chi^2(34, Ns = 313 \text{ and } 382 \text{ for U.S. and China samples, respectively}) = 79.3, p < .001$ , CFI = .97, TLI = .95, RMSEA = .062. The three-factor model was a slightly better fit and more parsimonious than the four-factor model according to Akaike's information criterion (8,592.92 and 8,596.06 for the three-factor and four-factor models, respectively). However, because we were interested in examining the relations of different components of effortful control to reactivity and adjustment problems, attention focusing and inhibitory control were kept as separate variables in the analyses.

the observed variables were fixed to be invariant across the two samples. After releasing the invariance constraints on the intercepts of teachers' reports of externalizing and internalizing problems, the multiple-group model fit the data adequately,  $\chi^2(2, Ns = 312 \text{ and } 382 \text{ for the U.S. and Chinese samples, respectively}) = 5.92, p = .05, CFI = .99, TLI = .94, RMSEA = .075$ . Releasing no other invariance constraint would significantly improve the model fit. These results indicated that configural, metric, and partial scalar invariance was established for the adjustment problem measures across nations. However, in the partially constrained model, although parents' and teachers' reports of externalizing problems loaded significantly and positively on the designated latent factor, parents' and teachers' reports of internalizing problems did not load on the designated latent factors.

**Classifying adjustment problem groups**—Because parents' and teachers' reports of internalizing problems did not load on the same factor in both samples in the confirmatory factor analysis, separate adjustment problem group classifications were created using parents' and teachers' reports, respectively. Before the classification, parents' and teachers' ratings of adjustment problems were standardized within each sample. Within each sample, children who had a *Z* score equal to or greater than 1.0 standard deviation above the mean on either externalizing or internalizing problems, but not on the other, were assigned to the externalizing-problem-only (EXT) or internalizing-problem-only (INT) group, respectively. Children who had *Z* scores higher than 1.0 standard deviation above the mean on both externalizing and internalizing problems were considered to be in the comorbid group (COM). Children with *Z* scores lower than 0.5 standard deviation above the mean in both externalizing and internalizing problems were classified into the no-problem-behavior group (NONE). Because it is unclear whether the marginal cases (i.e., children with *Z* scores between 0.5 standard deviation and 1.0 standard deviation above the mean in both externalizing and internalizing problems) were more similar to the problem groups or the no-problem group, these cases were dropped from the classification. We chose the cutoff of 1 standard deviation above the mean (which approximates a *T* score of 60) because the most accurate cutpoints for discriminating between referred and nonreferred children using the Achenbach series measures are at about the 80th to the 84th percentiles of normative samples (Achenbach & Rescorla, 2001). The numbers of boys and girls in each group and within each sample are reported in Table 3.

### **Predicting Adjustment Problem Groups From Temperament, Culture, and Their Interactions**

To examine the relations of temperament to adjustment problem group and whether the relations were moderated by culture, a series of multinomial logistic regressions were conducted to predict the contrasts among the four adjustment problem groups from the covariates (child age and sex), each temperament dimension, culture (0 = China and 1 = United States), and the Temperament  $\times$  Culture interaction. On the basis of the results of the multiple-group confirmatory factor analyses, composite scores for the four temperament dimensions were created by averaging the corresponding scores across reporters. The regression analyses were conducted separately for the adjustment problem groups classified on the basis of teachers' (Table 4) and parents' (Table 5) reports. Listwise deletion was used to handle missing values. In preliminary analyses, to examine whether child sex moderated



the relations between temperament or culture and adjustment problem group, interaction terms involving sex (i.e., Sex  $\times$  Temperament, Sex  $\times$  Culture, and Sex  $\times$  Temperament  $\times$  Culture) were tested in the regressions. The evidence for moderation by sex was weak, as only 2 two-way interactions (out of the 96 tested) and 1 three-way interaction (out of the 48 tested) that involved sex were significant at .05. Thus, the interaction terms involving sex were removed from the main analyses. The regression analyses were conducted separately for the adjustment problem groups classified on the basis of teachers' (Table 4) and parents' (Table 5) reports.<sup>4</sup>

**Anger–irritability**—For teachers' reports of adjustment problem groups, anger predicted the contrasts of COM versus NONE and EXT versus INT and marginally predicted the contrast of COM versus INT. The COM group had higher anger than the NONE or INT groups, and the EXT group had higher anger than the INT group. In addition, an Anger  $\times$  Culture interaction was found for the contrast of EXT versus NONE. In both cultures, the EXT group had higher anger than the NONE group. However, the difference was greater in the Chinese sample ( $\beta = 3.41, p < .001$ , odds ratio [OR] = 30.22) than in the U.S. sample ( $\beta = 1.17, p < .02$ , OR = 3.23). In predicting parents' reports of adjustment problem groups, similar to the results with teachers' reports, anger predicted the contrasts of EXT versus NONE, COM versus NONE, EXT versus INT, and COM versus INT. The EXT and COM groups were higher on anger than the NONE and INT groups. There was no Anger  $\times$  Culture interaction.

**Smiling–laughter**—For teachers' reports of adjustment problem groups, smiling–laughter predicted the contrasts of INT versus NONE, EXT versus INT, and COM versus INT. The INT group had lower smiling–laughter than the NONE, EXT, and COM groups. In addition, there was a marginally significant Smiling–Laughter  $\times$  Culture interaction for the contrast of EXT versus NONE. The EXT group had higher smiling–laughter than the NONE group in the Chinese sample ( $\beta = 1.58, p < .007$ , OR = 4.83). In contrast, smiling–laughter did not predict the contrast between the EXT and NONE groups in the U.S. sample ( $\beta = 1.42, p = .81$ , OR = 1.16). For parents' reports of adjustment problem groups, neither the Smiling–Laughter  $\times$  Culture interaction or the main effects of smiling–laughter was significant.

**Attention focusing**—In predicting teachers' reports of adjustment problem groups, there was significant a main effect of attention focusing and an Attention Focusing  $\times$  Culture interaction for the contrasts of EXT versus NONE and EXT versus INT. The EXT group had lower attention focusing than did the NONE and INT groups in the Chinese sample ( $\beta s = -2.86$  and  $-3.34, ps < .001$ , ORs = .06 and .04), whereas these differences were nonsignificant in the U.S. sample. Moreover, attention focusing predicted the contrasts of COM versus NONE and COM versus INT. The COM group scored lower on attention focusing than did the NONE and INT groups. For parents' reports of adjustment problem groups, there were significant main effects of attention focusing for the contrasts of EXT

<sup>4</sup>Because of the heterogeneity in ethnicity in the U.S. sample, we also examined whether ethnicity moderated the temperament–adjustment group associations by conducting a series of multinomial regressions predicting the adjustment problem groups from ethnicity (coded as 0 = White, 1 = non-White), temperament, and Ethnicity  $\times$  Temperament interactions within the U.S. sample. None of the Ethnicity  $\times$  Temperament interactions was significant, suggesting that ethnicity did not moderate the temperament–adjustment associations.

versus NONE, COM versus NONE, EXT versus INT, and COM versus INT. The EXT and COM groups scored lower on attention focusing than did the NONE and INT groups. No significant Attention Focusing  $\times$  Culture interaction was found.

**Inhibitory control**—For teachers' reports of adjustment problem groups, inhibitory control predicted the contrasts of COM versus NONE, EXT versus INT, and COM versus INT. The COM group had lower inhibitory control than the NONE group. Moreover, the EXT and COM groups had lower inhibitory control than did the INT group. In addition, there was an Inhibitory Control  $\times$  Culture interaction for the contrast of EXT versus NONE. Although in both samples the EXT group had lower inhibitory control than the NONE group, the difference was greater in the Chinese sample ( $\beta = -4.24, p < .001, OR = .01$ ) than in the U.S. sample ( $\beta = -2.19, p < .001, OR = .11$ ).

Similarly, for parents' reports of adjustment problems, inhibitory control predicted the contrasts of COM versus NONE and COM versus INT. The COM group had lower inhibitory control than both the NONE group and the INT group. Moreover, inhibitory control predicted the contrast between the EXT and NONE groups. The EXT group had lower inhibitory control than the NONE group. No significant Inhibitory Control  $\times$  Culture interaction effects were found.

## Discussion

To our knowledge, among the few existing cross-cultural comparison studies on temperament-related characteristics between China and the United States (e.g., Camras et al., 1998, 2006; Oakland & Lu, 2006; Porter et al., 2005; Rothbart et al., 2001), this is the first examining the effect of culture on the relations of temperament reactivity and effortful control to children's adjustment problems. The study extended previous cross-cultural comparative studies on the means of temperament-related characteristics (e.g., Camras et al., 1998, 2006; Freedman, 1974) by conducting cross-cultural comparison of the interrelations among temperament dimension and the relations of temperament to adjustment. Moreover, the study extended the within-cultural research on the relations of temperament to Chinese children's adjustment (e.g., Eisenberg et al., 2007; Zhou et al., 2004; 2008) by testing the moderating effect of culture on the direction and magnitude of the temperament-temperament and temperament-adjustment associations. The most important finding is that considerable similarities were found between the Chinese and U.S. samples in the interrelations among temperament dimensions and the associations between temperament and children's externalizing, internalizing, and comorbid problems. A few cross-cultural differences were found, which may reflect cultural differences in the values toward certain temperament characteristics.

### Cross-Cultural Similarities

**Measurement equivalence**—For both cultures, satisfactory internal reliabilities were obtained for parents' and teachers' reports of temperament. The effect sizes for cross-reporter correlations were in the large range for effortful control (attention focusing and inhibitory control), the small to medium range for smiling-laughter, and the small range for anger-irritability. Moreover, ratings by parents and teachers loaded positively on the

designated latent factors of all temperament dimensions, and the loadings were invariant across the two cultures. These results demonstrated that in both cultures, parents and teachers are reliable reporters of children's temperament and that there is a general agreement between parents' and teachers' ratings.

In both cultures, parents' and teachers' ratings of externalizing problems were moderately and positive correlated, and they both loaded on one latent factor. In contrast, parents' and teachers' ratings of internalizing problems were uncorrelated and did not load on one factor. The loadings (regardless of significance) were invariant across cultures. Thus, in China and the United States, although parents and teachers are reliable and consistent reporters of children's externalizing problems, discrepancies exist in their observations of children's internalizing problems. This result is consistent with the findings from other U.S. studies (e.g., Achenbach, McConaughy, & Howell, 1987; Stanger & Lewis, 1993) and a large epidemiological study of native Chinese children (Deng, Liu, & Roosa, 2004). In both cultures, externalizing problems are more observable and more likely to attract adults' attention than are internalizing problems, which may partly explain the greater consistency of ratings across reporters and contexts (home vs. school). This finding has implications for detecting internalizing problems in Chinese children by demonstrating the importance of using multiple reporters and, perhaps, incorporating child self-report when possible.

**Temperament–temperament and temperament–adjustment associations—**As shown in multiple-group confirmatory factor analysis, in both cultures attention focusing and inhibitory control—two components of effortful control—were highly (.90) and positively correlated, and both were negatively correlated with anger–irritability. In regression analyses, the children with externalizing problems only or both externalizing and internalizing problems displayed lower effortful control (attention focusing and inhibitory control) and higher anger–irritability than those with internalizing problems only or no adjustment problems. The majority of the temperament–adjustment problem associations were not moderated by culture, suggesting cross-cultural similarities in the relations of effortful control and anger–irritability to children's adjustment. These findings confirm those from previous within-culture studies based on Western samples (e.g., Eisenberg et al., 2001, Eisenberg, Sadovsky, et al., 2005; Oldehinkel et al., 2004) and Chinese samples (Eisenberg et al., 2007; Zhou et al., 2004, 2008). The findings are also consistent with the roles of self-regulation and inhibition of anger in maintaining interpersonal harmony in collective cultures such as China (Markus & Kitayama, 1991; Matsumoto, 2007).

Cross-cultural similarities were also found in the relation of positive emotionality and internalizing problems. Children with internalizing problems (with or without externalizing problems) displayed lower positive emotionality than those with externalizing problems only or no adjustment problems. These associations were not moderated by culture. The findings extended the U.S. findings on the link between positive emotionality and internalizing problems (e.g., Lengua et al., 1999; Lonigan, Phillips, & Hooe, 2003) to the Chinese culture, suggesting that the lack of or low positive affect seems to be a universal risk factor for internalizing problems. Future research might investigate the link between positive emotionality and various subtypes of internalizing problems (e.g., depression or anxiety) and the mechanisms underlying these links.

## Cross-Cultural Differences

**Positive emotionality**—A few cross-cultural differences were found. First, culture moderated the relation between positive emotionality and the contrast between the EXT group and the NONE group. The EXT children (by teachers' reports) displayed higher positive emotionality than those with no adjustment problems in the Chinese sample, whereas the two groups did not differ on positive emotionality in the U.S. sample. This interaction effect, although rather small in size, suggests some cultural differences in the values toward the open display of positive emotions, particularly in the school context. The open display of positive emotions may be less favored in the Chinese culture than in the Western culture because of (a) the general cultural value toward inhibition of emotion expression and (b) the cultural emphasis on modesty, humbleness, and self-containment (Russell & Yik, 1996; P. Wu et al., 2002). Thus, the Chinese children displaying high positive emotionality might be perceived as unregulated and encounter greater conflict and rejection in interpersonal relationships, which in turn puts them at risk for externalizing problems. This hypothesis was also supported by the finding that the latent factors of positive emotionality and anger-irritability were positively correlated in the Chinese sample but uncorrelated in the U.S. sample. It is important to note, however, that the Culture  $\times$  Positive Emotionality interaction was only found in predicting teachers' but not parents' reports of adjustment problem groups. Moreover, smiling-laughter and externalizing problems were positively correlated in teachers' reports in the Chinese sample but negatively correlated in parents' reports in the Chinese sample. These results suggest that the cultural attitudes toward the display of positive emotions might have a greater influence on Chinese teachers' interpretation of children's emotions than Chinese parents' interpretation. Thus, because of the greater emphasis on children's conformity to collective behavioral standards in the structured school environment (Phelps, 2005) than in the less structured home environment, a Chinese child displaying high positive emotionality might be viewed as dysregulated by his or her teacher but well adjusted by his or her parents. Future research might test the hypothesis that Chinese children's expression of positive emotions is perceived differently by their teachers as compared with their parents and as compared with children in Western cultures. In addition, it is possible that children high on positive emotionality tend to display high-intensity positive affect (e.g., laughter and excitement), which is less preferred and encouraged than low-intensity positive affect (e.g., serenity and relaxation) in the Chinese culture (Tsai et al., 2006, 2007). However, because the positive emotionality measure used in this study does not differentiate high-intensity versus low-intensity positive emotions, we could not test this hypothesis in this study; however, it should be examined in the future.

The above finding has some implications for identification of and intervention in adjustment problems in Chinese school-age children. In contrast to the U.S. culture in which the experience and expression of positive affect is generally viewed as adaptive, excessive display of positive affect may be seen as disruptive in Chinese schools. Thus, psychosocial interventions that target adjustment problems by promoting positive affect (e.g., engaging in pleasurable events) might need to be adapted for the Chinese population to fit with the cultural emotion display rules.

**Anger–irritability and effortful control**—A few Culture  $\times$  Temperament interactions were found for anger–irritability, effortful control, and adjustment problems, although the patterns of interactions indicated relatively small cultural differences in the magnitude of temperament–adjustment relations. The negative correlation between the latent factors of effortful control and anger–irritability was larger in the Chinese sample ( $-.78$ ) than in the U.S. sample ( $-.53$ ). Because of the greater cultural emphasis on the regulation or inhibition of anger, the Chinese children who have frequent or intense displays of anger–irritability also tend to be underregulated, making it difficult to obtain an independent measure of anger (reactivity) and regulation through parents’ and teachers’ reports. Therefore, future research on Chinese children’s temperamental reactivity should also use measurement methods that are less influenced by cultural display rules (e.g., physiological measures) than adults’ reports, self-reports, or observations of expressed emotions.

Moreover, anger–irritability and effortful control predicted the contrasts between the EXT and NONE groups (by teachers’ reports) more strongly in the Chinese sample than in the U.S. sample. The results could not be explained by differences in variances of temperament or adjustment problems between the Chinese and U.S. samples (because the variances were larger in the U.S. sample than in the Chinese sample; see footnote 1). Therefore, likely because of less cultural tolerance of anger or underregulated behaviors, these temperament characteristics are more salient risk factors for adjustment problems in China than in the United States.

It is interesting to note that most of the Culture  $\times$  Temperament interactions were found for teachers’ reports (but not parents’ reports) of adjustment problems. This, again, suggests that the greater cultural valuing of self-regulation and inhibition of anger in Chinese society compared with Western society might be more influential in teachers’ perception of children’s behaviors than in parents’ perception. Chen et al. (2005) suggested that the rapid urbanization and modernization in Chinese society in recent years might have changed the values placed on specific social behaviors (e.g., shyness), which may explain the increasing similarity between Chinese and Western predictors of children’s social functioning. The present study indicates that the value shift might be more manifest among Chinese parents than Chinese teachers, likely because the traditional values on group harmony are still robust and influential in the Chinese school system.

### **Cultural, Sex, and SES Differences in Means**

Although not the main focus of this study, we also examined mean differences across culture in temperament and adjustment problems. With the exception of teachers’ reports of anger–irritability (in which the mean was higher in the Chinese sample than in the U.S. sample), the means were higher in the U.S. sample than in the Chinese sample for most measured variables. The lower means on parents’ ratings of children’s adjustment problems in the Chinese sample in comparison to the U.S. sample were consistent with the results of Liu et al.’s (1999) epidemiological study of Chinese children. Liu et al. suggested that a variety of factors might have contributed to the mean differences across cultures, including underreporting by Chinese parents because of cultural stigmatization toward or their general lack of awareness of behavioral problems in children. Interestingly, a similar pattern of

mean differences was also found with teachers' reports of behavioral problems in the present study.

The lower means for adults' ratings of children's effortful control in the Chinese sample than in the U.S. sample are contrary to the study by Sabbagh, Xu, Carlson, Moses, and Lee (2006), which found that Chinese preschoolers outperformed their U.S. counterparts on multiple behavioral measures of executive functioning—a construct that overlaps or correlates with effortful control (Hongwanishkul, Happaney, Lee, & Zelazo, 2005). The discrepancy in findings might be a result of differences in measurement approaches (adult report vs. behavioral tasks). Because all the constructs in the present study were assessed with rating scales, readers should be cautious in interpreting the mean differences as reflecting cultural differences in the norms of temperament or adjustment problems for at least two reasons. First, the mean differences in temperament variables might be because of metric differences (although they were adjusted before comparison). Second, cross-cultural differences in response styles and expectations for behavior might also have contributed to mean differences in rating scales (van Herk, Poortinga, & Verhallen, 2004).

A Sex  $\times$  Nation interaction was found in parents' reports of internalizing problems. Chinese parents rated boys higher than girls on internalizing problems, whereas no sex difference was found in U.S. parents' ratings of internalizing problems. The finding that Chinese boys scored higher on parent-reported internalizing problems than Chinese girls is puzzling and contradicts the well-established U.S. finding that girls are at a higher risk for internalizing problems (especially depression) than boys during adolescence (Hammen & Rudolph, 2003). Because this result was not found with the corresponding ratings by Chinese teachers, Chinese parents might have a lower threshold for detecting internalizing problems in boys than in girls.

In both cultures, SES was positively related to parents' and teachers' reports of children's effortful control, which is consistent with the findings from other U.S. studies (e.g., Eisenberg, Zhou, et al., 2005). Moreover, consistent with the findings from other U.S. samples (e.g., Loukas & Roalson, 2006), European American children scored higher on effortful control and lower on adjustment problems than non-European American children. These findings suggest that there is considerable within-culture heterogeneity in children's temperament and adjustment problems, which might not be adequately captured by cross-cultural comparisons.

## Limitations

This study has several limitations. First, some demographic differences existed between the two samples (age, ethnicity, only-child status, and SES), which might confound the results of crosscultural comparisons. However, child age was unrelated to study variables after controlling for culture. Within the U.S. sample, neither only-child status nor ethnicity moderated the temperament–adjustment association. Moreover, in previous within-culture studies, despite the SES differences in means, SES did not moderate the relations between temperament and child adjustment (Eisenberg, Zhou, et al., 2005; Zhou et al., 2004, 2008). Thus, the cross-cultural differences in the relations among study variables were unlikely to be solely explained by sample differences in demographic variables. Second, attention



focusing and anger–irritability were assessed with similar but not exactly the same set of items in the two samples. Thus, differences in measures might have contributed to the cross-cultural differences found in the relations involving these two constructs. It is important to note, however, that the relations involving these two constructs were largely similar across cultures. Third, both temperament and adjustment problems were assessed with questionnaires completed by parents and teachers, which might partly reflect the reporters' perception or subjective evaluation of children's temperament and behavioral tendencies rather than the child's actual behaviors. A multimethod measurement approach, including questionnaire ratings, behavioral observations, and physiological measures, should be used in future research on child temperament in different cultures. Fourth, because this was not a planned crosscultural comparative study, the cross-cultural comparisons were conducted post hoc, which might have inflated the Type I error rate. Fifth, the study did not measure the specific aspects of Chinese and U.S. cultures (e.g., individualism and collectivism and cultural values toward emotion expressivity) that might explain the cross-cultural similarities or differences in the temperament–adjustment associations. This is another important direction for future cross-cultural research on temperament.

In summary, this study examined cross-cultural similarities and differences in the relations among temperament reactivity, effortful control, and adjustment problems in Chinese and U.S. children. In both cultures, low effortful control and high anger–irritability were associated with externalizing problems, although the associations were stronger in the Chinese sample than in the U.S. sample. Low positive emotionality was associated with internalizing problems in both cultures. However, high positive emotionality was associated with noncomorbid externalizing problems in the Chinese culture but not in the U.S. culture. These results suggest that there are considerable cross-cultural similarities in the temperament–adjustment associations, although some subtle cross-cultural differences might exist.

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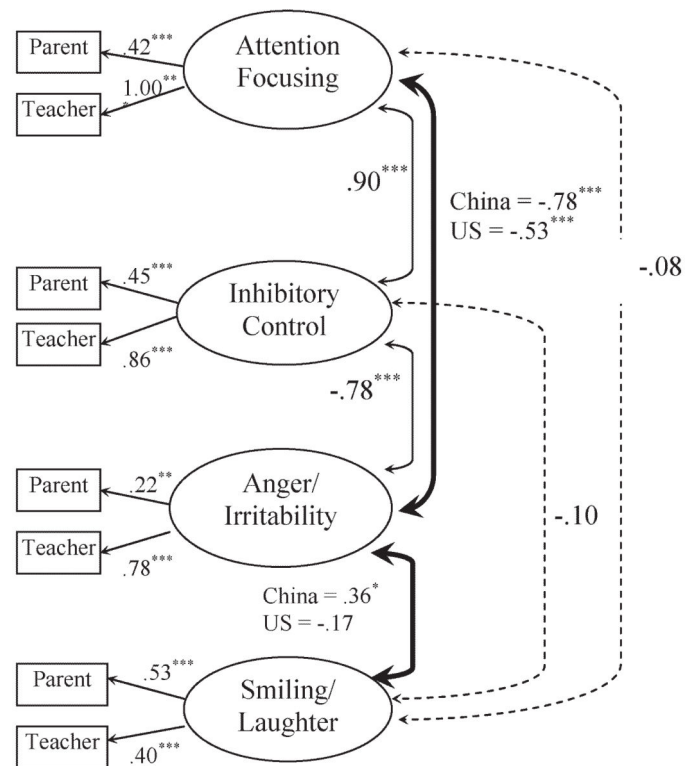
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**Figure 1.** Multiple-group confirmatory factor analysis for temperament measures. The numbers in the figure are standardized loadings or correlation coefficients. The dotted lines represent nonsignificant loadings or correlations, solid lines represent significant loadings or correlations, and bold lines represent correlations for which the cross-sample invariance hypothesis was not supported. Model fit:  $\chi^2(31, Ns = 382 \text{ and } 313 \text{ for Chinese and U.S. samples, respectively}) = 71.81, p < .001$ , comparative fit index = .97, Tucker–Lewis index = .94, root-mean-square error of approximation = .06. \*  $p < .05$ . \*\*  $p < .01$ . \*\*\*  $p < .001$ .



**Table 1**  
**Means and Standard Deviations of Study Variables for Each Sample and by Child Sex**

Variable	Chinese sample						U.S. sample					
	<i>M</i> ( <i>N</i> )	<i>SD</i>	Skewness	Kurtosis	<i>M</i> ( <i>SD</i> ) for boys	<i>M</i> ( <i>SD</i> ) for girls	<i>M</i> ( <i>N</i> )	<i>SD</i>	Skewness	Kurtosis	<i>M</i> ( <i>SD</i> ) for boys	<i>M</i> ( <i>SD</i> ) for girls
Attention focus (P)	3.32 (375)	0.54	-0.004	0.03	3.28 (0.52)	3.35 (0.55)	3.36 (306)	0.74	-0.18	-0.26	3.34 (0.70)	3.38 (0.77)
Attention focus (T)	3.35 (373)	0.73	-0.16	-0.59	3.05 (0.70)	3.58 (0.66)	3.56 (232)	0.93	-0.28	-0.97	3.33 (0.91)	3.75 (0.89)
Inhibitory control (P)	3.79 (375)	0.46	-0.18	-0.12	3.67 (0.45)	3.89 (0.45)	3.80 (306)	0.58	-0.55	-0.05	3.68 (0.57)	3.90 (0.57)
Inhibitory control (T)	3.74 (372)	0.65	-0.74	0.62	3.45 (0.69)	3.96 (0.53)	3.90 (235)	0.83	-0.65	-0.62	3.60 (0.84)	4.17 (0.73)
Anger-irritability (P)	3.01 (374)	0.53	-0.22	0.16	3.00 (0.51)	3.02 (0.54)	3.36 (307)	0.68	-0.06	-0.34	3.34 (0.69)	3.37 (0.68)
Anger-irritability (T)	2.85 (373)	0.67	-0.16	-0.41	2.99 (0.63)	2.74 (0.67)	2.66 (235)	0.90	0.24	-0.67	2.88 (0.92)	2.46 (0.87)
Smiling-laughter (P)	3.96 (372)	0.50	-0.59	0.75	3.93 (0.67)	3.99 (0.51)	4.24 (307)	0.49	-0.56	0.03	4.27 (0.50)	4.25 (0.49)
Smiling-laughter (T)	3.33 (372)	0.67	-0.13	-0.43	3.46 (0.67)	3.22 (0.65)	3.54 (235)	0.65	-0.62	0.68	3.57 (0.61)	3.51 (0.70)
Externalizing (P)	0.15 (373)	0.15	1.90	5.04	0.19 (0.18)	0.12 (0.13)	0.29 (305)	0.20	1.02	0.91	0.31 (0.19)	0.27 (0.21)
Externalizing (T)	0.09 (372)	0.01	3.32	13.00	0.14 (0.32)	0.05 (0.12)	0.20 (231)	0.31	2.19	4.82	0.28 (0.35)	0.13 (0.36)
Internalizing (P)	0.16 (358)	0.01	2.00	4.59	0.20 (0.22)	0.13 (0.14)	0.31 (305)	0.21	0.87	0.58	0.30 (0.20)	0.33 (0.21)
Internalizing (T)	0.10 (372)	0.01	2.46	7.04	0.10 (0.18)	0.10 (0.16)	0.35 (232)	0.33	1.10	1.18	0.33 (0.29)	0.37 (0.37)

Note. P = parent; T = teacher.

Table 2

Zero-Order Correlations Among Study Variables Within Each Sample

Variable	1	2	3	4	5	6	7	8	9	10	11	12
1. Attention focus (P)	—	.33*** (.36***)	.51*** (.53***)	.22** (.23***)	-.30*** (-.33***)	-.19*** (-.19***)	.06 (.09 <sup>†</sup> )	-.12* (-.13*)	-.45*** (-.46***)	-.20*** (-.21***)	-.29*** (-.30***)	.01 (.00)
2. Attention focus (T)	.46***	—	.36*** (.39***)	.74** (.79***)	-.14** (-.16**)	-.56*** (-.61***)	-.01 (-.01)	-.16** (-.18**)	-.44*** (-.45***)	-.46*** (-.46***)	-.30*** (-.31***)	-.10* (-.10 <sup>†</sup> )
3. Inhibitory control (P)	.59***	.43***	—	.31** (.33***)	-.34*** (-.36***)	-.23*** (-.25***)	.13* (.15**)	-.11* (-.12*)	-.48*** (-.49***)	-.29*** (-.30***)	-.30*** (-.31***)	-.00 (-.00)
4. Inhibitory control (T)	.33***	.75***	.43***	—	-.10 <sup>†</sup> (-.11*)	-.63*** (-.69***)	-.01 (-.01)	-.26*** (-.25***)	-.35*** (-.35***)	-.61*** (-.60***)	-.22*** (-.21***)	-.16** (-.15**)
5. Anger-irritability (P)	-.23***	-.14*	-.40***	-.15*	—	.09 <sup>†</sup> (.12*)	.09 (.07)	-.02 (-.01)	.32*** (.34**)	.13* (.15**)	.21*** (.23**)	.09 (.10 <sup>†</sup> )
6. Anger-irritability (T)	-.10	-.38***	-.28***	-.60***	.26***	—	.10 <sup>†</sup> (.08)	.24*** (.22***)	.24*** (.25**)	.43*** (.45**)	.14* (.14**)	.23*** (.24***)
7. Smiling-laughter (P)	.02	.03	.16**	.05	-.18**	-.16*	—	.18** (.17**)	-.01 (-.02)	-.01 (-.02)	-.17** (-.17**)	-.06 (-.07)
8. Smiling-laughter (T)	-.02	-.07	-.06	-.18**	-.07	.05	.27***	—	.14* (.15**)	.20*** (.19***)	.02 (.03)	-.19*** (-.20***)
9. Externalizing (P)	-.39***	-.18**	-.62***	-.31***	.52***	.25***	-.14*	.05	—	.34***	.66***	.03
10. Externalizing (T)	-.19**	-.42***	-.33***	-.72***	.21**	.58***	-.14*	.10	.37***	—	.20***	.27***
11. Internalizing (P)	-.22***	-.06	-.20***	.03	.42***	.00	-.20**	-.08	.43***	-.05	—	.08
12. Internalizing (T)	-.08	-.18**	-.05	-.09	.14*	.23***	-.16*	-.26***	.04	.20**	.09	—

Note. The correlations above the diagonal are for the Chinese sample, and the correlations below the diagonal are for the U.S. sample. For the Chinese sample, the correlations in parentheses are those with the raw variables and the correlations not in parentheses are those with the transformed temperament variables (on which the less extreme response points were combined to attain metric equivalence across samples). P = parent; T = teacher.

\*  $p < .05$ .  
 \*\*  $p < .01$ .  
 \*\*\*  $p < .001$ .  
<sup>†</sup>  $p < .10$ .

**Table 3**

**Frequencies for Adjustment Problem Groups**

Problem group	No behavior problem		Externalizing		Internalizing		Comorbid					
	Total	Boys	Total	Boys	Total	Boys	Total	Boys				
Grouping for the Chinese sample												
Teachers' reports	319	131	188	26	22	4	28	13	15	9	4	5
Parents' reports	324	130	194	17	10	7	13	7	6	28	23	5
Grouping for the U.S. sample												
Teachers' reports	273	128	144	14	11	3	23	5	5	17	12	5
Parents' reports	267	127	140	20	10	10	21	10	11	12	4	8

**Table 4**  
**Multinomial Logistic Regressions Predicting the Contrasts Among Behavior Problem Groups (Teachers' Reports) From Temperament, Culture, and Their Interaction**

Independent variable	EXT vs. NONE		INT vs. NONE		COM vs. NONE		EXT vs. INT		COM vs. INT		COM vs. EXT	
	B	OR	B	OR	B	OR	B	OR	B	OR	B	OR
Regressions with attention focusing as a predictor												
Attention	-2.77***	0.06	0.38	1.46	-1.66*	0.19	-3.14***	0.04	-2.04*	0.13	1.11	3.02
Attention × Culture	2.13**	8.42	-0.63	0.53	0.72	1.39	2.76**	15.79	0.96	2.61	-1.8	0.26
Regressions with inhibitory control as a predictor												
Inhibitory control	-4.15***	0.02	0.80	2.23	-2.92**	0.05	-4.96***	0.01	-3.72***	0.02	1.23	3.44
Inhibitory Control × Culture	1.97*	7.20	0.12	1.13	0.24	1.27	1.85	6.36	0.12	1.13	-1.73	0.18
Regressions with irritability as a predictor												
Irritability	3.39***	29.69	0.38	1.46	2.25*	9.49	3.01***	20.29	1.87 <sup>†</sup>	6.48	-1.14	0.32
Irritability × Culture	-2.24**	0.11	-0.69	.50	-0.83	0.44	-1.56	0.21	-0.14	0.87	1.42	4.13
Regressions with smiling as a predictor												
Smiling	1.56**	4.76	-0.93*	0.39	-0.69	0.50	2.49***	12.07	0.24	1.28	-2.25*	0.11
Smiling × Culture	-1.43 <sup>†</sup>	0.24	-0.46	0.63	-0.05	0.95	-0.96	0.38	0.41	1.51	1.38	3.96

Note. EXT = externalizing-problem-only group; INT = internalizing-problem-only group; COM = comorbid group; NONE = no-problem-behavior group; OR = odds ratio.

\*  $p < .05$ .

\*\*  $p < .01$ .

\*\*\*  $p < .001$ .

<sup>†</sup>  $p < .10$ .

**Table 5**  
**Multinomial Logistic Regressions Predicting the Contrasts Among Behavior Problem Groups (Parents' Reports) From Temperament, Nation, and Their Interaction**

Independent variable	EXT vs. NONE		INT vs. NONE		COM vs. NONE		EXT vs. INT		COM vs. INT		COM vs. EXT	
	B	OR	B	OR	B	OR	B	OR	B	OR	B	OR
Regressions with attention focusing as a predictor												
Attention	-2.19***	0.11	-0.53	0.59	-3.48***	0.03	-1.67*	0.19	-2.95***	0.05	-1.28	0.28
Attention × Culture	0.96	0.17	0.36	0.60	1.41 <sup>†</sup>	4.11	0.61	1.83	1.06	2.88	0.45	1.57
Regressions with inhibitory control as a predictor												
Inhibitory control	-2.57***	0.08	-0.37	0.69	-2.76***	0.06	-2.20	0.11	-2.39**	0.09	-0.19	0.83
Inhibitory Control × Culture	0.84	2.32	1.18	3.25	0.52	1.69	-0.34	0.71	-0.65	0.52	-0.32	0.73
Regressions with irritability as a predictor												
Irritability	2.31**	10.03	0.39	1.47	2.67***	14.50	1.92*	6.82	2.29**	9.86	0.37	1.45
Irritability × Culture	-0.94	0.39	0.17	1.19	-1.22	0.30	-1.12	0.33	-1.39	0.25	-0.28	0.76
Regressions with smiling as a predictor												
Smiling	0.51	1.66	-0.27	0.77	0.11	1.11	0.78	2.17	0.37	1.45	-0.40	0.57
Smiling × Culture	-0.70	0.50	-0.70	0.77	-0.87	0.42	.00	1.00	-0.17	0.84	-0.17	0.84

Note. EXT = externalizing-problem-only group; INT = internalizing-problem-only group; CON = ; COM = comorbid group; NONE = no-problem-behavior group; OR = odds ratio.

\*  $p < .05$ .

\*\*  $p < .01$ .

\*\*\*  $p < .001$ .

<sup>†</sup>  $p < .10$ .