Psychometric properties of the Chinese version of the children’s empathy quotient and systemizing quotient: 4–12 years

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Abstract
We aimed to validate the Children’s Empathy Quotient (EQ-C) and Systemizing Quotient (SQ-C) in Mainland China, which can reflect the profiles of empathizing and systemizing, and describing specific characteristics of autism spectrum disorder (ASD) and gender-typical behaviors in general population. A total of 800 typically developing (TD) children, aged 4–12 years was recruited initially with whose parents/guardians complete the measurements, and 782 TD children who met inclusion criteria were finally included. A 23-item three-factor EQ-C and a 22-item four-factor SQ-C was developed with good internal consistency (Omega total values of 0.87 and 0.86) and test–retest reliability (Pearson correlation coefficients of 0.82 and 0.69). In TD children, girls scored significantly higher on EQ-C (31.4 / 7.8 vs. 28.2 / 7.7) but there were no gender differences in SQ-C scores. TD children showed different cognitive styles (empathizing-dominant for girls with 42.6% identified as Type E; systemizing-dominant for boys with 40.7% identified as Type S). A further sample of 222 children with ASD indicated that they scored lower on EQ/SQ-C compared to TD children (13.2 / 5.1 vs. 29.7 / 7.9, 12.4 / 5.8 vs. 23.5 / 8.3) and were generally systemizing-dominant (Type S: 50.8% for boys and 64.0% for girls). Autistic children scored higher on the SQ-C in those without intellectual disability and with higher paternal education level and family income (14.2 / 6.1 vs. 10.9 / 5.0, 13.3 / 6.2 vs. 11.5 / 5.1, 13.7 / 5.6 vs. 11.9 / 5.8), while there were no differences in the EQ-C. This study indicated good reliability and validity of the Chinese version of EQ/SQ-C, which can be used in Chinese children with and without ASD.

Lay Summary
We developed the Chinese version of the Children’s Empathy Quotient (EQ-C) and Systemizing Quotient (SQ-C) in 782 typically developing (TD) children aged 4–12 years in Mainland China, yielding a 23-item, 3-factor EQ-C and a 22-item, 4-factor SQ-C with good psychometric properties. In TD children, we found gender difference only in scores of EQ-C. Further analyses of 222 autistic children indicated that differences were found in scores of SQ-C when considering their gender, intelligence and socio-economic status.
INTRODUCTION

There is a drive to understand different features or dimensions that might contribute to the experiences of autistic individuals beyond the core deficits in autism spectrum disorder (ASD), namely in social communication and the presence of repetitive behaviors and/or restricted interests (Baron-Cohen, 2002, 2009). The profiles of empathizing and systemizing can be used to reflect specific characteristics of ASD related to these two deficits, and describe gender-typical behaviors in general population (Goldenfeld et al., 2005; Greenberg et al., 2018; Lawson et al., 2004). "Empathizing" is the drive to identify another person’s emotions and thoughts, and to respond to these with an appropriate emotion; while "Systemizing" is the drive to analyze the variables in a system, to derive the underlying rules that govern the behavior of a system (Baron-Cohen, 2002). These two components allow individuals to predict the behaviors of a person or system thereby achieving socialization and adaptation (Baron-Cohen et al., 2003; Golan & Baron-Cohen, 2006). Accordingly, two parent-reported questionnaires have been developed for children to measure the extent to which children possess empathizing and systemizing; the children’s empathy quotient (EQ-C) and systemizing quotient (SQ-C) (Auyeung et al., 2009).

Previous studies suggested good cross-cultural stability of the EQ-C and SQ-C among different countries, but with some differences (Auyeung et al., 2009; Chaidir et al., 2020; Escobar et al., 2016; Huang, 2015; Nasr Esfahani et al., 2018; Park et al., 2012; Sonié et al., 2011; Wakabayashi, 2013) (Tables S1 and S2 in Appendix A). Specifically, these previous studies focused on gender difference when characterizing the profiles of EQ-C and SQ-C. For example, studies of general population in UK (Auyeung et al., 2009) and Japan (Wakabayashi, 2013) found significant gender difference on both empathizing and systemizing. However, research from Korea (Park et al., 2012) revealed a gender difference only in systemizing while other studies of Taiwan, China and Indonesia (Chaidir et al., 2020) indicated a gender difference only in empathizing. Meanwhile, there were small or no gender differences in children with ASD when examining scoring patterns on the EQ/SQ-C (Auyeung et al., 2009; Nasr Esfahani et al., 2018; Park et al., 2012) in previous cross-culture studies. In addition, the cognitive “brain types” constructed by empathizing and systemizing were also reported showing that TD girls were mostly identified as empathizing-dominant type, while TD boys were mostly identified as systemizing-dominant type (Auyeung et al., 2009; Wakabayashi, 2013). The vast majority of children with ASD were found to exhibit “hyper-masculinization” type (Auyeung et al., 2009).

In China, to our knowledge, no psychometric properties of a Chinese variant of these questionnaires are available yet. Specifically, since about 30%-70% of autistic children were identified as having an intellectual disability (ID) in previous prevalence studies (Maenner et al., 2020; Matson & Shoemaker, 2009; Mefford et al., 2012), and earlier work has seldom investigated empathizing and systemizing in this subpopulation. Meanwhile, socioeconomic status (SES), defined as the social and material resources an individual possesses (Kraus et al., 2010), has been identified as a potential influence on the development of empathy and systemizing (Takeuchi et al., 2019). Therefore, this study aims to address these two challenges through the development of a Chinese version of the EQ/SQ-C.

Here we aim to validate the Chinese version of the EQ/SQ-C in children aged 4–12 years from both clinical and general population. Through this sample, we aim to: (1) examine the psychometric properties of a new Chinese translation of the EQ/SQ-C for use in mainland China; (2) investigate gender differences and cognitive brain types based on the EQ/SQ-C in Chinese children with and without ASD; and (3) understand the differences of EQ/SQ-C scores in autistic children by considering their intelligence and socio-economic status.

METHODS

Participants

The current study included a group of typically developing children ($n = 800$, 436 boys, 364 girls) aged 4–12 years from two samples: 1) 300 children from mainstream kindergartens in the Luohu District, Shenzhen City and 2) 500 children from a mainstream primary school in the Huangpu District, Guangzhou City. Questionnaires were distributed to parents of children from these two samples.

We also recruited children with a diagnosis of ASD for further analyses from two samples. In ASD sample 1, 144 autistic children (128 boys, 16 girls) were recruited between 2017 and 2020 from the Research Center of Children and Adolescent Psychological and Behavioral Development in the Department of Public Health, Sun Yat-sen University. In ASD sample 2, 78 autistic children (69 boys, 9 girls) were recruited from three therapeutic centers in Guangzhou City located in Southern China, which offered therapeutic services for children with ASD and other developmental disorders. All the participants had a historical diagnosis of ASD confirmed by the Childhood Autism Rating Scale (CARS) and an expert clinician in the hospitals. Diagnoses were further
confirmed by two expert child psychiatrists (Jin Jing and XiuHong Li) using Diagnostic and Statistical Manual of Mental Disorders, Fifth Revision (DSM-5) criteria.

All the participants were recruited during 2017–2020. The inclusion criteria for TD children and children with ASD were as follows: (1) chronological age between 4 years 0 months and 12 years 12 months; (2) voluntarily participation of the children’s parents; (3) absence of head trauma, cerebral palsy, or other movement disorders that would interfere with study assessments; and (4) absence of known genetic or chromosomal abnormalities or severe visual or hearing impairment. The exclusion criteria were as follow: (1) missing data of the questionnaire was more than five items; (2) there were parent-reported neuropsychiatric conditions, such as ASD (only in TD children), attention deficit/ hyperactivity disorder, dyslexia, tic disorder, mood disorder and other disorders those would interfere with social ability. The demographic characteristics of TD children and children with ASD were shown in Table S3 in Appendix A.

Instruments

A Chinese translation of the children’s Empathy Quotient (EQ-C) and Systemizing Quotient (SQ-C) was used. The measure includes items rated on a 3-point scale: 2 = definitely agree, 1 = slightly agree, 0 = disagree/ strongly disagree (Auyeung et al., 2009). Items 2, 4, 7, 9, 13, 17, 20, 23, 33, 36, 40, 53, and 55 for the EQ-C and item 3, 11, 15, 16, 22, 27, 32, 47, 51, and 54 for the SQ-C are reverse scored, where “slightly disagree” scores one point, “definitely disagree” scores two points, and “slightly agree” or “definitely agree” scores zero points. The maximum attainable score for the EQ-C is 54, and for the SQ-C is 56.

Five cognitive “brain types” can be defined by comparing an individual’s performance on the EQ-C and SQ-C using standardized scores which were calculated according to the formulae suggested by Auyeung et al. (2009). The five types include Extreme Type E (Empathizer), Type E, Type B (Balanced), Type S (Systemizer), and Extreme Type S, and the detail information was described in the supplemental file (Appendix B).

The translation of the EQ-C and SQ-C followed the forward and backward procedure (Hall et al., 2018). First, two of the authors (Lizi Lin and Meixia Dai) translated the items from English into Chinese independently, discussed and resolved any differences that arose during the translation. Then, an English-Chinese bilingual developmental and behavioral specialist (Jin Jing) checked whether the translated items corresponded with the original English items. Finally, the Chinese version of EQ-C and SQ-C was modified via discussion with the original author (Bonnie Auyeung), and the final version was agreed.

Cognitive measures for children with ASD

All children with ASD underwent face-to-face cognitive measures, and we assessed developmental quotient (DQ) using the Chinese version of Gesell Development Scale (GDS) (Zhang et al., 1994) ≤6 years) and intelligence quotient (IQ) using the Chinese version of Wechsler Intelligence Scale for children, Fourth revision (WISC-IV) (>6 years) (Zhang, 2009), which has been validated in mainland China with relatively good reliability and validity (Zhang, 2009; Zhang et al., 1994). These measures were performed by trained psychometrists, graduate students, or research assistants, who were trained by certified professionals of two authors (Xin Wang and Meixia Dai). All of them have practiced within the research group and they were allowed to perform measurements only when they passed the qualifying examination. The GDS provides DQ calculated by five domains: adaptive behavior, gross motor, fine motor, language behavior and personal-social behavior (Zhang et al., 1994). WISC-IV provides a full-scale intelligence quotient (FSIQ) based on the sum of scores from the 10 core subtests, as well as four index scores: Verbal Comprehension Index, Perceptual Reasoning Index, Working Memory Index, and Processing Speed Index (Zhang, 2009). DQ scores ≤75 or FSIQ <70 was classified as intellectual disability (ID) group.

Demographic information

We obtained children’s age, gender, maternal and paternal age, maternal and paternal education level, and per capita monthly household income via questionnaires. We defined low education levels as parents who completed their highest education in primary, secondary and high school. We defined low and high per capita monthly household income based on the statistics from the Guangzhou Statistical Yearbook 2021 (i.e., mean of ¥7123 per month for upper middle-income households) (Guangzhou Statistic Bureau Survey Office of the National Bureau of Statistics in Guangzhou, 2021).

Statistical analyses

We calculated the means and standard deviations for continuous variables and percentages for categorical
variables. We compared the basic information between TD children and children with ASD using chi-square tests and t-tests. We evaluated the gender difference by reporting effect size of Cohen’s d (Cohen, 1988).

We carried out multivariate analyses on the EQ/SQ-C to confirm their factorial consistency. Given the ordinal nature of the three-ordered item categories (i.e., definitely agree, slightly agree and disagree/strongly disagree), we perform the confirmatory factor analysis (CFA) with diagonally weighted least squares (DWLS) method (Rhemtulla et al., 2012) to examine the original one-factor structure of EQ/SQ-C. A variety of fit indices (listed in Appendix B) to determine if the model fit is acceptable, and the original structure of EQ/SQ-C fitted adequately. We also tested the best fitting model by removing items with low item-total correlations (≤0.30) (Ferketich, 1991).

In addition, we hypothesized that the cross-cultural adaptations of the two instruments might change their internal structure, and we therefore followed a standard procedure by conducting both exploratory factor analysis (EFA) and CFA to understand their current structures. We randomly split the original sample into a calibration and validation sample with the EFA on one half and the CFA on the other. We confirmed that the polychoric correlation matrix of EQ/SQ-C was factorable (Lee et al., 2012), and then used Bartlett’s test of sphericity to ensure that the polychoric correlation matrix was not random and the overall Kaiser-Meyer-Olkin (KMO) statistic was above a minimum of 0.50. Common factor analysis was selected because the intent was to identify a latent factor structure. Very Simple Structure (VSS) (Cattell, 1966), parallel analysis (Horn, 1965) and the visual scree test (Velicer et al., 2000) were used to determine the appropriate number of factors to retain. Parallel analysis with polychoric correlations, using principal component analysis (PCA) method of extraction and the mean eigenvalue criterion (Garrido et al., 2013). After determining the number of factors to retain, ordinary least squares (OLS) estimation of parameters in EFA with polychoric correlations was used (Lee et al., 2012) and an oblique (Promax) rotation was employed to rotate the factors (Watkins, 2018). The CFA was performed based on the results of EFA with items assigned to a factor having a loading >|0.3| was estimated, using the DWLS method (Detail listed in Appendix B).

For testing the reliability of the instrument, we applied a set of analyses including internal consistency (Cronbach’s alpha coefficients, Omega Hierarchical coefficients and Omega Total coefficients [α, ωh, and ωt]) and test–retest reliability (Pearson correlation coefficient).

We examined the known-groups validity by comparing the gender difference in both TD children and children with ASD separately. In children with ASD, we also compared the difference of EQ-C score and SQ-C score in children with different intelligence levels and SES.

We conducted all statistical analyses in the statistical software R 4.0.3 (R Core Team, 2019) and its psych package (Version 2.0.12). We considered a two-sided p value <0.05 as statistically significant.

RESULTS

Four questionnaires were discarded due to missing data on more than five items, and another 14 questionnaires were discarded because parents reported that the TD children were diagnosed with neuropsychiatric conditions (three with ASD, four with attention deficit/hyperactivity disorder, three with dyslexia, two children with tic disorder, one with mood disorder and one with seizure). A total of 782 TD children (mean age:7.9 ± 2.3 years, 423 boys, 359 girls) and a total of 222 children with ASD (mean age 7.2 ± 1.8 years, 197 boys and 25 girls) were included in the final analyses.

Factorial validity

Three CFA models were tested. Model 1 tested the original one-factor solution as proposed by the original study. Model 2 tested a one-factor solution by excluding the items with item-total correlations less than or equal to 0.30. We removed several items in EQ-C (item 7, 17, 40, and 43) and SQ-C (item 12, 15, 21, 51, and 54) according to the item-total correlations (Tables S5 and S6 in Appendix A). Model 3 tested a three-factor 23-item solution for EQ-C and a four-factor 22-item solution for SQ-C based on the results of EFA. During the EFA procedure, we examined the factorability of the EQ-C and SQ-C after testing the significance of Bartlett’s test of sphericity (χ² = 2138.32 and 1972.25, all df = 253, all p < 0.001) and obtaining the overall Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy (0.84 and 0.82). We chose Model 3 based on the best fit indices which were shown in Table 1 (The standard factor loading of CFA for EQ-C and SQ-C was in Tables S7 and S8 in Appendix A).

In the EQ-C, according the result of VSS, parallel analysis and scree plot (Figure S1 in Appendix A), three factors were identified (the different number of factor solutions were listed in Table S9 in Appendix A). The factor loadings of the included items varied from 0.314 to 0.798, accounting for 39.0% of the total variance (Table S10 in Appendix A). The three factors were labeled as “cognitive empathy” with nine items (1, 2, 6, 13, 18, 26, 28, 30, and 42), “social skills” with eight items (4, 9, 20, 23, 33, 36, 53, 55) and “affective empathy” with six items (14, 31, 37, 45, 48, 52)

In the SQ-C, a four-factor model should be retained according to the VSS and parallel analysis (the scree plot was showed in Figure S2 and the different number of factor solutions were listed in Table S11 in Appendix A). We extracted four factors with 22 items (item 38 was removed because the factor loading <0.3) and factor loads varied from 0.306 to 0.830, accounting for 41.4% of the total variance (Table S12 in Appendix A).
Factors were labeled as “technical systems” with eight items (24, 34, 35, 41, 44, 46, 49, 50), “abstract systems” with six items (25, 27, 29, 32, 39, 47), “organizable systems” with five items (3, 5, 11, 16, 22) and “collectible systems” with three items (8, 10, 19).

**Internal consistency and test–retest reliability**

The internal consistency was acceptable in both the EQ-C and SQ-C (Omega total value: 0.87 and 0.86; Omega Hierarchical value: 0.67 and 0.53; Cronbach’s alpha value: 0.85 and 0.85).

A total of 64 parents returned the second report 2 weeks after initial contact. There was a moderate correlation between the EQ-C scores or SQ-C scores obtained on the first and second visits for the overall scores (0.82, 95% CI: 0.72–0.89; 0.69, 95%CI: 0.53–0.80).

**Known-groups validity of the EQ-C and SQ-C in Chinese children**

According to the 23-item EQ-C and 22-item SQ-C, we calculated the total score and subscale scores based on the 23-item EQ-C and 22-tam SQ-C (see Table 2). With regards to the EQ-C, TD girls scored higher than TD boys in the total scores (31.4 ± 7.8 vs. 28.2 ± 7.7) and the three subscale scores (cognitive empathy: 12.2 ± 3.5 vs. 11.3 ± 3.5; social skill: 11.0 ± 3.3 vs. 9.6 ± 3.6; affective empathy: 8.2 ± 2.7 vs. 7.2 ± 2.7). However, there were no gender differences in the SQ-C total scores and its subscale scores except collectible systems (4.1 ± 1.5 vs. 3.4 ± 1.6). In children with ASD, there were no gender differences in EQ-C total score and its subscale scores, except that the subscale score of social skill was higher in autistic boys than those in girls (7.7 ± 3.1 vs. 6.4 ± 2.6). We found significant gender differences in the SQ-C total scores (12.7 ± 5.9 vs. 10.5 ± 4.0) and subscale score of abstract, organizable, and collectible systems (5.1 ± 2.9 vs. 4.4 ± 2.8; 2.6 ± 1.9 vs. 1.6 ± 1.5; 1.9 ± 1.4 vs. 1.6 ± 1.5). We also compared EQ-C and SQ-C scores on different demographic status in TD children (Table S13 in Appendix A) and the distribution of EQ-C and SQ-C scores in different gender of TD children and children with ASD (Figure S3 in Appendix A).

As shown in Figure 1, most of the TD boys were identified as Type S (40.7%) and TD girls as Type E (42.6%). Most of the autistic children were identified as Type S, and there were no gender differences in autistic children.

As shown in Table 3, autistic children without ID scored higher in SQ-C total score compared with their

### Table 1: The comparisons of confirmatory factor analysis model in the Chinese version of EQ-C and SQ-C

| Instrument | Model structure | # Items | Internal consistency (Cronbach’s α) | Fit indices in confirmatory factor analysis |
|------------|-----------------|---------|-------------------------------------|------------------------------------------|
| EQ-C       | Model 1: Original one-factor | 27      | Total (0.84)                         | χ²/df | CFI   | TLI   | SRMR | RMSEA |
|            |                  |         | 2143.298/324 0.885 0.876 0.112 0.085 | |
|            | Model 2: One-factor (items with item-total correlations ≤0.30 removed) | 23      | Total (0.85)                         | 1310.973/230 0.925 0.918 0.099 0.078 |
|            |                  |         | 465.728/227 0.968 0.964 0.084 0.052 |
|            | Model 3: three-factor (items with item-total correlations ≤0.30 and factor loadings ≤0.3 removed based on EFA) | 23      | Total (0.85)                        | 1410.549/350 0.918 0.912 0.082 0.062 |
| SQ-C       | Model 1: Original one-factor | 28      | Total (0.83)                         | 994.520/230 0.937 0.931 0.065 0.081 |
|            | Model 2: One-factor (items with item-total correlations ≤0.30 removed) | 23      | Total (0.85)                         | 413.828/206 0.964 0.959 0.052 0.076 |
|            | Model 3: Three-factor (items with item-total correlations ≤0.30 and factor loadings ≤0.3 removed based on EFA) | 22      | Total (0.85)                        | |

Abbreviations: CFI, Comparative Fit Index; EQ-C, children’s version of empathizing quotient; RMSEA, the root mean square error of approximation; SQ-C, children’s version of systemizing quotient; SRMR, the standardized root mean square residual; TFI, Tucker-Lewis Index.
counterparts (14.2 ± 6.1 vs. 10.9 ± 5.0), while no group difference were found in EQ-C total score. Meanwhile, although children with or without ID exhibited Type S, children without ID exhibited Extreme S type (10.6%) more when compared with autistic children with ID (1.7%) and TD children (3.5% in boys and 1.4% in girls). In Table 4, autistic children with high paternal education level and high household income scored higher in SQ-C total score when compared with their counterparts (13.3 ± 6.2 vs. 11.5 ± 5.1, 13.7 ± 5.6 vs. 11.9 ± 5.8). However, there was no difference on the EQ-C on different socioeconomic status.

**DISCUSSION**

After an iterative process of translation and revision of the scale, the Chinese version of EQ/SQ-C showed good psychometric properties including internal consistency, test–retest reliability, factorial validity and known-groups validity, which can be used to provide profiles of empathizing and systemizing in both TD children and autistic children aged 4–12 years. Based on our cross-cultural adaptation, we developed a three-factor structure for EQ-C (cognitive empathy, social skills and affective empathy) and a four-factor structure of SQ-C (technical systems, abstract systems, organize systems, and collectible systems) for both TD children and autistic children.
systems, abstract systems, organizable systems and collectible systems).

This is the first study to translate and employ the EQ/SQ-C for use in Mainland China. Although the original structures of EQ/SQ-C did not fit this Chinese sample adequately, the revised version demonstrated that the reliability and validity were adequate to measure individual difference of empathy and systemizing in Chinese children. Although studies of Japan (Wakabayashi, 2013) and Korea (Park et al., 2012) retained the 27-item one-factor model for EQ-C and 28-item one-factor model for SQ-C as original structures (Auyeung et al., 2012), other studies conducted in Taiwan, China (Huang, 2015) and Indonesia (Chaidir et al., 2020) suggested a different structure by removing several inappropriate items. The Taiwan version provided a 20-item 3-factor model for EQ-C and 12-item 3-factor model for SQ-C, and the Indonesian version provided a 20-item one-factor model for EQ-C and 18-item one-factor model for SQ-C. We found similar structure when comparing the Taiwan version, indicating that different child rearing culture in China might result in some inappropriate items in the original version. For instance, item 17 “My child can be blunt giving their opinions, even when these may upset someone” and item 43 “My child is good at negotiating for what they want” indicated a more Western style of self-expression, and Chinese parents tended to teach children to express their feeling in a conservative, subtle and restrained way (Sharp, 2020). These items might be less meaningful when considering the Chinese culture. We also found different items between the traditional Chinese version developed in Taiwan, China (Huang, 2015), and the current simplified Chinese version due to the difference in vocabulary, syntax and semantics when translating from English to simplified Chinese or traditional Chinese (Zhou & Zhou, 2019). Therefore, it is necessary for Chinese population to select appropriate version according to their language preference.

The factor analysis indicated that EQ/SQ-C showed good internal consistency despite moderately low Omega Hierarchical Coefficients, which is the ratio of the variance of the general factor compared to the total test variance. This value should be higher if we aim to make final, high-stakes decisions rather than for screening decisions in a measurement (Green & Yang, 2015; Trizano-Hermosilla et al., 2021). Since EQ/SQ-C were validated to quantify autistic trait instead of diagnostic measurements, we believed that the values were acceptable.

The Chinese version of three-factor 23-item EQ-C and four-factor 22-item SQ-C mapped onto the

### TABLE 3 The comparison of EQ-C scores, SQ-C scores and “brain type” in autistic children with and without ID

|                       | ASD with ID (N = 118) | ASD without ID (N = 104) | p value |
|-----------------------|-----------------------|--------------------------|---------|
| EQ-C scores           | 12.8 (5.1)            | 13.6 (5.1)               | 0.25    |
| SQ-C scores           | 10.9 (5.0)            | 14.2 (6.1)               | <0.01** |
| Brain type            |                       |                          |         |
| Extreme E             | 0 (0.0)               | 0 (0.0)                  |         |
| Type E                | 15 (12.7)             | 13 (12.5)                |         |
| Type B                | 41 (34.7)             | 24 (23.1)                |         |
| Type S                | 60 (50.8)             | 56 (53.8)                |         |
| Extreme S             | 2 (1.7)               | 11 (10.6)                |         |

Note: The bold value meant that the results had statistical significance.
Abbreviations: ASD, autism spectrum disorder; ID, intellectual disability; SD, standard deviation; EQ-C, children’s version of empathizing quotient; SQ-C, children’s version of systemizing quotient.

*aWe combined the groups of Extreme E and Type E together when we performed the chi-square test due to the null cells in the group of Extreme E.

*p < 0.05; **p < 0.01.

### TABLE 4 The comparison of EQ-C and SQ-C scores on different socioeconomic status in children with ASD

| Socioeconomic characteristics | N   | EQ-C Mean (SD) | SQ-C Mean (SD) | p value |
|-------------------------------|-----|----------------|----------------|---------|
| **Maternal education level**  |     |                |                |         |
| Low                           | 130 | 12.8 (4.9)     | 11.9 (5.6)     |         |
| High                          | 92  | 13.6 (5.4)     | 13.2 (5.9)     | 0.26    |
| **Paternal education level**  |     |                |                |         |
| Low                           | 109 | 13.3 (4.9)     | 11.5 (5.1)     |         |
| High                          | 113 | 13.0 (5.3)     | 13.3 (6.2)     | 0.72    |
| **Per capita monthly household income** |     |                |                |         |
| Low                           | 153 | 13.0 (5.0)     | 11.9 (5.8)     |         |
| High                          | 69  | 13.6 (5.3)     | 13.7 (5.6)     | 0.45    |

Note: The bold value meant that the results had statistical significance.
Abbreviations: EQ-C, children’s version of empathizing quotient; SD, Standard deviation; SQ-C, children’s version of systemizing quotient.

*aAll the comparisons were adjusted for child’s age, child’s gender, with ID (IQ ≥ 70) or without ID (IQ ≥ 70), maternal age, paternal age.
*bMaternal and paternal education level: low level including primary, secondary, high school; high level including university and above. Per capita monthly household income: low refers to the income <¥8000; high refers to the income ≥¥8000.

*p < 0.05.
traditional approaches of empathizing (Lawrence et al., 2004) and systemizing (Baron-Cohen et al., 2003), and the final model accounted for a moderate amount of the total variance. The three-factor model of EQ-C was in line with the original EQ developed for adults (Lawrence et al., 2004). Specifically, the first factor of cognitive empathy covered several items that measured the attribution of others’ mental state (item 6, 30, and 42), which was in line with the broader definition of theory of mind [ToM, the ability to attribute mental states and predict behavior accordingly (Frith, 1999)]. One item in another factor of affective empathy had high loadings in the cognitive empathy factor (item 31), indicating that affective empathy might rely on a certain amount of cognitive empathy (Lawrence et al., 2004).

Regarding the SQ-C, we developed a four-factor model to describe the profile of systemizing with acceptable model fit. Systemizing allows us to predict the behavior of a system and to control it. According to Baron Cohen’s description, there are at least six kinds of systems: Technical, Abstract, Organizable, Collectible, Natural, and Social Motoric systems (Baron-Cohen et al., 2003). We only extracted four systems (Technical, Abstract, Organizable, and Collectible) in this version of SQ, but all kinds of systems shared the same underlying process which is monitored closely during systemizing (Baron-Cohen, 2002).

Consistent with other studies, we confirmed the gender difference of empathy in TD children. In both Western (the UK (Auyeung et al., 2009; Baron-Cohen, 2002) and the USA (Escovar et al., 2016)) and Eastern (Japan (Wakabayashi, 2013) and Indonesia (Chaidir et al., 2020)) countries, TD girls scored higher on EQ than TD boys, suggesting that the gender difference in empathy might be stable in general population across different countries (Hoffman, 1977). We found no gender difference in empathy scores in children with ASD, indicating the general empathy impairment of ASD, which were also in line with most of the previous studies (Auyeung et al., 2009; Lawrence et al., 2004; Park et al., 2012). However, we did not find similar gender differences in systemizing scores in TD children, which was inconsistent with the results of the UK (Auyeung et al., 2009), Japan (Wakabayashi, 2013) and Korea (Park et al., 2012), but similar to results of Taiwan, China (Huang, 2015). Meanwhile, we also found that children with ASD did not reveal a systemizing-dominant profile compared with TD children although we found gender differences in total score and the subscale of organizable system. One potential explanation was that the ability of systemizing might be influenced by educational environment in China (Groen et al., 2018) since the Chinese overall education strategy focuses on teaching in accordance with procedures and standards, and more emphasis on repeated practice and effort to obtain certain results (Fang & Gopinathan, 2009), which might improve systemizing ability in children and reduce the gender gap.

When using empathizing or systemizing to describe the brain types, the distribution of the brain types in TD children were consistent with previous studies (Auyeung et al., 2009; Greenberg et al., 2018), indicating that TD girls on average were more likely to be Type E and TD boys on average were more likely to be Type S. Children with ASD were “masculinized” with S type and Extreme S type in both genders, but the proportion of Extreme S type in children with ASD was lower than the result of the UK (Auyeung et al., 2009). The difference might be attributable to the difference in intelligence level of the included autistic children. In our study, half of the autistic children were identified with ID indicating a more representative ID-ASD co-occurrence rate since about 3/4 of the individuals in the UK sample were Asperger Syndrome and high-functioning ASD (Auyeung et al., 2009). When we further considering the intelligence level, we found that autistic children without ID scored higher in SQ-C with higher proportion of Extreme S type compared with autistic children with ID, while there were no differences in EQ-C and related brain types (E and extreme E). Larson et al. indicated that the bias for empathizing over systemizing was modulated by intelligence and autistic adults presented a stronger drive to empathize than to systemize with decreasing in intelligence (Larson et al., 2015). Therefore, more studies are needed to consider the intelligence in autistic children to understand the differences in the profiles of empathizing and systemizing.

In addition, we found that children with ASD were more systemizing-dominant in those with high paternal education level and high family income, which was in line consistent with the previous findings in the general population (Baron-Cohen et al., 2005). Fathers with higher education level might promote their involvement in the education of children with ASD, contributing to a better development of children with ASD (Sharabi & Marom-Golan, 2018). In addition, children with ASD could obtain better ASD-related services (e.g., intervention, parenting consultation) and more support for the exploration of interests in higher-income families (Rosenbrock et al., 2021), strengthening the development of their systemizing ability. SES is an important factor that affects an individual’s neural and cognitive development. Higher family SES is associated with increased intelligence, academic performance, and sense of well-being and other cognitive and social behaviors in young individuals (Takeuchi et al., 2019). However, we did not observe the role of family SES in EQ-C of children with ASD, and more studies are needed to understand the associations between socioeconomic factors and the development of ASD in China.

STRENGTHS AND LIMITATIONS

To our knowledge, this is the first study using a large sample of clinical and general population to validate the
Chinese version of the EQ/SQ-C using a comprehensive process of validation in Mainland China. However, the present study has some limitations. First, the ratio of boys to girls in the ASD sample was not balanced with a small sample of girls, which might have biased the results when discussing their gender gap. Future studies should be conducted by considering oversample of girls with ASD. Second, empathizing and systemizing profiles involves the internal state of children, and the evaluation of EQ/SQ-C were derived from parent reports, which might not fully address the real situation of children and be affected by the parents’ personal perspective and expectations. More studies are needed to measure children’s empathizing and systemizing by laboratory experiment and compare the differences with parent-reports. Third, the neuropsychiatric conditions of TD children were obtained via parent-reported questionnaires rather than confirmed diagnosis, but this might be the most cost-effective method in studies with large sample size. Fourth, although the EQ/SQ-C covered the 4–12 years age span, similar measurements should be developed and validated for younger toddlers and older adolescents in Mainland China. Fifth, this validation study was conducted in more developed areas with high-SES households in China, which might not be representative for the general situation in China. We should and will replicate these findings in a nationwide sample and to develop Chinese specific norms in the future.

CONCLUSIONS

This study indicated good reliability and validity of the Chinese 23-item EQ-C and 22-item SQ-C, which can therefore be used to reliably assess Chinese children’s empathizing and systemizing cognitive style according to their parents’ report, especially in Southern China.

AUTHOR CONTRIBUTIONS

Xin Wang, Mei-Xia Dai, Li-Zi Lin, Si-Yu Liu, and Jia-Jie Chen contributed to the data collection. Xin Wang and Mei-Xia Dai designed the current study. Xin Wang and Mei-Xia Dai performed the statistical analysis and drafted the manuscript. Aja Murray and Bonnie Auyeung guided the statistical analysis. Li-Zi Lin and Jin Jing supervised the analysis and revised the manuscript. All authors read and revised the manuscript, and approved the final manuscript.

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CONFLICT OF INTEREST

The authors declare that they have no competing interests.

DATA AVAILABILITY STATEMENT

The generated datasets available by request to the corresponding author.

ETHICS STATEMENT

All the parents of the participants provided written consent. The study received approval from the Ethical Review Committee for Biomedical Research, Sun Yat-sen University (2015-No.29, 2020-No.133).

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REFERENCES

Auyeung, B., Allison, C., Wheelwright, S., & Baron-Cohen, S. (2012). Brief report: Development of the adolescent empathy and systemizing quotients. *Journal of Autism and Developmental Disorders*, 42(10), 2225–2235. https://doi.org/10.1007/s10803-012-1454-7

Auyeung, B., Wheelwright, S., Allison, C., Atkinson, M., Samarawickrema, N., & Baron-Cohen, S. (2009). The children’s empathy quotient and systemizing quotient: Sex differences in typical development and in autism spectrum conditions. *Journal of Autism and Developmental Disorders*, 39(11), 1509–1521. https://doi.org/10.1007/s10803-009-0772-x

Baron-Cohen, S. (2002). The extreme male brain theory of autism. *Trends in Cognitive Sciences*, 6(6), 248–254. https://doi.org/10.1016/s1364-6613(02)01904-6

Baron-Cohen, S. (2009). Autism: The empathizing-systemizing (E-S) theory. *Annals of the New York Academy of Sciences*, 1156, 68–80. https://doi.org/10.1111/j.1749-6632.2009.04467.x

Baron-Cohen, S., Knickmeyer, R. C., & Belmonte, M. K. (2005). Sex differences in the brain: Implications for explaining autism. *Science*, 310(5749), 819–823. https://doi.org/10.1126/science.1115455

Baron-Cohen, S., Richler, J., Bisarya, D., Gurunathan, N., & Wheelwright, S. (2003). The systemizing quotient: An investigation of adults with Asperger syndrome or high-functioning autism, and normal sex differences. *Philosophical Transactions of the Royal Society of London. Series B, Biological Sciences*, 358(1430), 361–374. https://doi.org/10.1098/rstb.2002.1206

Cattell, R. B. (1966). The scree plot test for the number of factors. *Multivariate Behavioral Research*, 1, 140–161. https://doi.org/10.1207/s15327906mbr0102_10

Chaidir, K. R., Nathania, E., Mahdiyyah, K., Phallavi, Y. R., & Wiguna, T. (2020). Gender differences in brain type according to the empathy/systemising quotient for children (EQ/SQ-C) questionnaire in Indonesia. *Journal of Child and Adolescent Mental Health*, 32(2–3), 111–117. https://doi.org/10.2989/17280583.2020.1848850

Cohen, J. (1988). *Statistical power analysis for the behavioral sciences* (2nd ed.). Lawrence Erlbaum Associates.
Escovar, E., Rosenberg-Lee, M., Uddin, L. Q., & Menon, V. (2016). The empathizing-systemizing theory, social abilities, and mathematical achievement in children. *Scientific Reports, 6*, 23011. https://doi.org/10.1038/srep23011

Fang, Y., & Gopinathan, S. (2009). Teachers and teaching in eastern and Western schools: A critical review of cross-cultural comparative studies. In L. J. Saha & A. G. Dworkin (Eds.), *International handbook of research on teachers and teaching* (pp. 557–572). Springer Science + Business Media, LLC.

Ferretti, S. (1991). Focus on psychometrics. Aspects of item analysis. *Research in Nursing & Health, 14*(2), 165–168. https://doi.org/10.1002/nur.4770140211

Firth, U. T. A. (1990). Theory of mind and self-consciousness: What is it like to be autistic? *Mind & Language, 14*(1), 1–22. https://doi.org/10.1111/1468-0017.00100

Garrido, L. E., Abad, F. J., & Ponsoda, V. (2013). A new look at Horn’s parallel analysis with ordinal variables. *Psychological Methods, 18*(4), 454–474. https://doi.org/10.1037/a0030005

Golan, O., & Baron-Cohen, S. (2006). Systemizing empathy: Teaching adults with Asperger syndrome or high-functioning autism to recognize complex emotions using interactive multimedia. *Development and Psychopathology, 18*(2), 591–617. https://doi.org/10.1017/S0954579406000305

Goldenfeld, N., Baron-Cohen, S., & Wheelwright, S. (2005). Empathizing and systemizing in males, females, and autism. *Clinical Neuropsychiatry, 2*(6), 338–345. https://doi.org/10.1037/t64815-000

Green, S. B., & Yang, Y. (2015). Evaluation of dimensionality in the assessment of internal consistency reliability: Coefficient alpha and omega coefficients. *Educational Measurement: Issues and Practice, 34*(4), 14–20. https://doi.org/10.1111/emip.12100

Greenberg, D. M., Warrier, V., Allison, C., & Baron-Cohen, S. (2018). Testing the empathizing-systemizing theory of sex differences and the extreme male brain theory of autism in half a million people. *Proceedings of the National Academy of Sciences of the United States of America, 115*(48), 12152–12157. https://doi.org/10.1073/pnas.1811032115

Groen, Y., Fuermaier, A. B. M., Tucha, L. I., Koerts, J., & Tucha, O. (2018). How predictive are sex and empathizing-systemizing cognitive style for entry into the academic areas of social or physical sciences? *Cognitive Processing, 19*(1), 95–106. https://doi.org/10.1007/s10091-017-0848-z

Guangzhou Statistic Bureau Survey Office of the National Bureau of Statistics in Guangzhou. (2021). *Guangzhou statistical yearbook 2021*. China Statistics Press.

Hall, D. A., Zaragoza Domingo, S., Hamdache, L. Z., Manchaiah, V., Thammaiah, S., Evans, C., Wong, L., & International Collegium of Rehabilitative Audiology and Tinnitus Research NETwork. (2018). A good practice guide for translating and adapting hearing-related questionnaires for different languages and cultures. *International Journal of Audiology, 57*(3), 161–175. https://doi.org/10.1080/14992027.2017.1393565

Hoffman, M. L. (1977). Sex differences in empathy and related behaviors. *Psychological Bulletin, 84*(4), 712–722. https://doi.org/10.1037/0033-2909.84.4.712

Horn, J. L. (1965). A rationale and test for the number of factors in factor analysis. *Psychometrika, 30*, 179–185. https://doi.org/10.1007/bf02289447

Zhang, H. C. (2009). Revision of the Chinese version of Wechsler Intelligence Scale for children, Fourth version. *Psychological Science, 32*(5), 1177–1179. https://doi.org/10.1016/j.psci.2009.02.003

Huang, H. Y. (2015). Psychometric Properties of the Children’s Empathy Quotient and Systemizing Quotient (Unpublished master’s thesis). Taiwan, China: National Taiwan University. https://hdl.handle.net/111296/9ehbhu

Kraus, M. W., Cote, S., & Keltner, D. (2010). Social class, contextualism, and empathic accuracy. *Psychological Science, 21*(11), 1716–1723. https://doi.org/10.1177/0956797610387613

Larson, F. V., Lai, M. C., Wagner, A. P., Baron-Cohen, S., & Holland, A. J. (2015). Testing the ‘Extreme Female Brain’ theory of psychosis in adults with autism spectrum disorder with or without co-morbid psychosis. *PLoS One, 10*(6), e0128102. https://doi.org/10.1371/journal.pone.0128102

Lawrence, E. J., Shaw, P., Baker, D., Baron-Cohen, S., & David, A. S. (2004). Measuring empathy: Reliability and validity of the empathy quotient. *Psychological Medicine, 34*(5), 911–919. https://doi.org/10.1017/s003329170001624

Lawson, J., Baron-Cohen, S., & Wheelwright, S. (2004). Empathising and systemising in adults with and without Asperger syndrome. *Journal of Autism and Developmental Disorders, 34*(3), 301–310. http://doi.org/10.1023/B:JADD.0000029552.42724.1b

Lee, C. T., Zhang, G. J., & Edwards, M. C. (2012). Ordinary least squares estimation of parameters in exploratory factor analysis with ordinal data. *Multivariate Behavioral Research, 47*(2), 314–339. https://doi.org/10.1080/00273171.2012.658340

Maenner, M. J., Shaw, K. A., Baio, J., Washington, A., Patrick, M., DiRienzo, M., Christensen, D. L., Wiggins, L. D., Pettygrove, S., Andrews, J. G., Lopez, M., Hudson, A., Baroud, T., Schwenk, Y., White, T., Rosenberg, C. R., Lee, L. C., Harrington, R. A., Huston, M., & Dietz, P. M. (2020). Prevalence of autism spectrum disorder among children aged 8 years - autism and developmental disabilities monitoring Network, 11 sites, United States, 2016. *MMWR Surveillance Summaries, 69*(4), 1–12. https://doi.org/10.15585/mmwr.s6904a1

Matson, J. L., & Shoemaker, M. (2009). Intellectual disability and its relationship to autism spectrum disorders. *Research in Developmental Disabilities, 30*(6), 1107–1114. https://doi.org/10.1016/j.ridd.2009.06.003

Melloff, H. C., Batshaw, M. L., & Hoffman, E. P. (2012). Genomics, intellectual disability, and autism. *The New England Journal of Medicine, 366*(8), 733–743. https://doi.org/10.1056/NEJMra111494

Nasr Esfahani, F., Hakim Shooshtari, M., Shirmohammadm Sosfadi, R., Saeed, F., Jalai, F., Farsham, A., & Bidaki, R. (2018). Internalizing and externalizing problems, empathy quotient, and systemizing quotient in 4 to 11 years-old siblings of children with autistic spectrum disorder compared to control group. *Iranian Journal of Psychiatry, 13*(3), 191–199.

Park, S., Cho, S.-C., Cho, I. H., Kim, B.-N., Kim, J.-W., Shin, M.-S., Chung, U.-S., Park, T.-W., Son, J.-W., & Yoo, H. J. (2012). Sex differences in children with autism spectrum disorders compared with their unaffected siblings and typically developing children. *Research in Autism Spectrum Disorders, 6*(2), 861–870. https://doi.org/10.1016/j.rasd.2011.11.006

R Core Team. (2019). R statistical software. Vienna, Austria: R Core Team. https://www.r-project.org/

Rhemtulla, M., Brousseau-Liard, P., & Savalei, V. (2012). When can categorical variables be treated as continuous? A comparison of robust continuous and categorical SEM estimation methods under suboptimal conditions. *Psychological Methods, 17*(3), 354–373. https://doi.org/10.1037/a0029215

Rosenbrock, G. J., Mire, S. S., Kim, H. J., & Aguirre-Munoz, Z. (2021). Exploring sociodemographic predictors of parents’ perceptions about their children’s autism and their families’ adjustment. *Research in Developmental Disabilities, 108*, 103811. https://doi.org/10.1016/j.ridd.2020.103811

Sharabi, A., & Marom-Golan, D. (2018). Social support, education levels, and parents’ involvement: A comparison between mothers and fathers of young children with autism Spectrum disorder. *Topics in Early Childhood Special Education, 38*(1), 54–64. https://doi.org/10.1177/0721121148762511

Sharp, A. (2020). The adaptations of immigrant Chinese American Mothers’ parenting with their reticent young children. *Family Perspectives, 2*(1), Article 4.

Somé, S., Kassai, B., Pirat, E., Masson, S., Bain, P., Robinson, J., Reboul, A., Wicker, B., Chevallier, C., Beaud-Chervet, V., Deleage, M. H., Charvet, D., Barthélémy, C., Rochet, T.,...
Tatou, M., Arnaud, V., & Manificat, S. (2011). French version of screening questionnaire for high-functioning autism or Asperger syndrome in adolescent: Autism spectrum quotient, empathy quotient and systemizing quotient. Protocol and questionnaire translation. *La Presse Medicale, 40*(4 Pt 1), e181–e188. [https://doi.org/10.1016/j.lpm.2010.07.016](https://doi.org/10.1016/j.lpm.2010.07.016)

Takeuchi, H., Taki, Y., Nouchi, R., Yokoyama, R., Kotozaki, Y., Nakagawa, S., Sekiguchi, A., Iizuka, K., Yamamoto, Y., Hanawa, S., Araki, T., Miyachi, C. M., Sakaki, K., Nozawa, T., Ikeda, S., Yokota, S., Magistro, D., Sassa, Y., & Kawashima, R. (2019). The effects of family socioeconomic status on psychological and neural mechanisms as well as their sex differences. *Frontiers in Human Neuroscience, 12*, 543. [https://doi.org/10.3389/fnhum.2018.00543](https://doi.org/10.3389/fnhum.2018.00543)

Trizano-Hermosilla, I., Gálvez-Nieto, J. L., Alvarado, J. M., Saiz, J. L., & Salvo-Garrido, S. (2021). Reliability estimation in multidimensional scales: Comparing the bias of six estimators in measures with a Bifactor structure. *Frontiers in Psychology, 12*, 508287. [https://doi.org/10.3389/fpsyg.2021.508287](https://doi.org/10.3389/fpsyg.2021.508287)

Velicer, W. F., Eaton, C. A., & Fava, J. L. (2000). Construct explication through factor or component analysis: A review and evaluation of alternative procedures for determining the number of factors or components. In E. Helmes & R. D. Goffin (Eds.), *Problems and solutions in human assessment*. Springer.

Wakabayashi, A. (2013). Individual differences in empathizing and systemizing in Japanese children: Psychometric properties of the children’s versions of the empathy quotient (EQ) and systemizing quotient (SQ). *Japanese Psychological Research, 55*(1), 12–19. [https://doi.org/10.1111/j.1468-5884.2012.00537.x](https://doi.org/10.1111/j.1468-5884.2012.00537.x)

Watkins, M. W. (2018). Exploratory factor analysis: A guide to best practice. *Journal of Black Psychology, 44*(3), 219–246. [https://doi.org/10.1177/0095798418771807](https://doi.org/10.1177/0095798418771807)

Zhang, X. L., Li, J. P., Qin, M. J., & Zhang, C. Y. (1994). Beijing revised version of Gesell development diagnostic scale for 3.5–6 years. *Chinese Journal of Clinical Psychology, 2*(3), 148–150. [https://doi.org/10.16128/j.cnki.1005-3611.1994.03.005](https://doi.org/10.16128/j.cnki.1005-3611.1994.03.005)

Zhou, J., & Zhou, S. (2019). A study on differences between Taiwanese Mandarin and Mainland Mandarin in vocabulary. Paper presented at the 3rd International Conference on Culture, Education and Economic Development of Modern Society (ICCESE 2019).

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