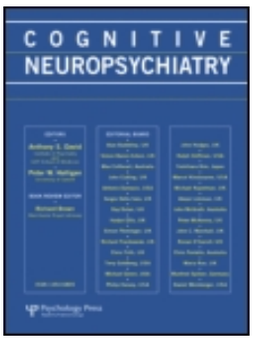

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The Empathy Quotient: A cross-cultural comparison of the Italian version

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Introduction. The Empathy Quotient (EQ) is a self-report questionnaire that was developed to measure the cognitive, affective, and behavioural aspects of empathy. We evaluated its cross-cultural validity in an Italian sample.
Methods. A sample of 18- to 30-year-old undergraduate students of both sexes ($N = 256$, males = 118) were invited to fill in the Italian version of the EQ, as well as other measures of emotional competence and psychological distress.
Results. The EQ had an excellent reliability (Cronbach's alpha = .79; test–retest at 1 month: Pearson's $r = .85$), and was normally distributed. Females scored higher than males, and more males ($n = 14$, 11.9%) than females ($n = 4$, 2.9%) scored lower than 30, the cutoff score that best differentiates autism spectrum conditions from controls. EQ was negatively related to the Toronto Alexithymia Scale (TAS) and positively related to the Marlowe-Crowne Social Desirability Scale (SDS). Principal component analysis retrieved the three-factor structure of the EQ. Lower emotional reactivity correlated with higher scores in measures of risk in both the schizophrenia-like (Peters et al. Delusions Inventory) and the bipolar (Hypomanic Personality Scale) spectra.
Conclusions. The Italian version of the EQ has good validity, with an acceptable replication of the original three-factor solution, yielding three subscales with high internal and test–retest reliability.

Keywords: Autism spectrum disorder; Delusion; Empathy; Hallucination; Reliability; Sex differences; Social cognition.

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Social cognition is a critical feature in human interaction (Adolphs, 2009; Gallese, Keysers, & Rizzolatti, 2004; Gallese, Rochat, Cossu, & Sinigaglia, 2009), and has a key role in psychopathology (Baron-Cohen, 2003, 2009; Decety & Moriguchi, 2007; Wheelwright et al., 2006). Empathy is a core component of social cognition, and involves operations aimed at detecting other's mental states and predicting their future behaviour (de Vignemont & Singer, 2006; Iacoboni, 2009). The concept of empathy has been variously defined (Brothers, 1989; Chlopan, McCain, Carbonell, & Hagen, 1985). We define empathy as (1) the identification of another's mental state, including their emotional state, and (2) an appropriate emotional response to their mental state (Baron-Cohen, 2003).

The experience of empathy does not entail experiencing the corresponding emotion, merely an appropriate one. Thus, if someone else is in pain, empathy does not only occur if the observer also feels pain (indeed, this may not be empathy at all) but if the observer feels a drive to alleviate the other's distress. Empathy appears related to brain areas involved in the distinction of self versus other (such as ventral medial prefrontal cortex), and in those recruited to determine another person's intentions (such as the temporal parietal junction) (Adolphs, 2009; Chakrabarti, Bullmore, & Baron-Cohen, 2006). Since empathy informs us about another's mental state, it is likely involved in the process of emotional regulation, a self-regulatory function tuning individual's action and reaction appropriate to the social context (Gross, 1999; Thompson, 1994).

There is some agreement that empathy involves at least four different components: (1) the intuitive apprehension of other's emotional state; (2) some kind of cognitive elaboration of this information; (3) an emotional response; and (4) a behavioural response, including a regulatory process involved in the modulation of the subjective feeling associated with emotion. One or more of these modules could be impaired in psychopathology (Decety & Moriguchi, 2007; Lawrence, Shaw, Baker, Baron-Cohen, & David, 2004).

Abnormalities in empathy have been reported in various psychiatric conditions, including antisocial personality disorder and psychopathy (Blair, 2005; Jolliffe & Farrington, 2004), borderline personality disorder (Harari, Shamay-Tsoory, Ravid, & Levkovitz, 2010), autism spectrum conditions (ASC; Baron-Cohen & Wheelwright, 2004; el Kaliouby, Picard, & Baron-Cohen, 2006; Oberman & Ramachandran, 2007), schizophrenia (Bigelow et al., 2006; Langdon, Coltheart, & Ward, 2006; Montag, Heinz, Kunz, & Gallinat, 2007), bipolar disorder (Bozikas, Tonia, Fokas, Karavatos, & Kosmidis, 2006; Brotman et al., 2008), and eating disorders (Guttman & Laporte, 2000, 2002).

Measuring empathy, therefore, can have applications for both basic neuroscience research and in the investigation of psychopathology. A frequently used measure of empathy is the Interpersonal Reactivity Index

(Bonino, Lo Coco, & Tani, 1998; Davis, 1983), tapping two different facets of empathy: the empathic concern (EC) scale assesses the tendency to experience feelings of sympathy and compassion for others' misfortune, and the personal distress (PD) scale taps the tendency to experience distress and discomfort in response to extreme distress in others. However, sympathy does not coincide with empathy, and personal distress, although important, does not necessarily imply empathic concerns (Lawrence et al., 2004). Also, an Italian version of Eysenck, Pearson, Easting, and Allsopp's impulsiveness, venturesomeness, and empathy questionnaire (1985) is available, and used in studies of clinical samples (Martinotti, Di Nicola, Tedeschi, Cundari, & Janiri, 2009), but in this scale empathy is measured as a unitary facet, which is unsuitable for differentiation of subcomponents of the construct.

The Empathy Quotient (EQ) is a self-report questionnaire that was developed to measure the cognitive and affective aspects of empathy. Unlike previous scales, it was designed to assess low empathy as a feature of psychopathology, so as to be used in clinical setting. It was also designed to detect subtle individual differences in empathy in the general population, such as sex differences. Currently, the original English EQ (Baron-Cohen & Wheelwright, 2004; Lawrence et al., 2004) has been validated in Japanese (Wakabayashi et al., 2007) and French (Berthoz, Wessa, Kedia, Wicker, & Julie Grèzes, 2008). Sex differences (females scoring higher than males) have been reported in every study to date. There is also a child version of the EQ, which is parent-report (Auyeung et al, 2009). In the study reported here, we tested the (adult) EQ's cross-cultural validity in an Italian sample. Previous factor analysis identified three subscales of EQ: cognitive empathy, emotional reactivity, and social skills (Lawrence et al., 2004). This structure was partially confirmed in an independent investigation (Berthoz et al., 2008; Muncer & Ling, 2006), with females scoring higher than males on cognitive empathy and emotional reactivity, but with no differences in social skills.

The EQ-Italian was the main instrument in this study, and we sought to validate it against a measure of alexithymia, since both on theoretical grounds and also on the basis of other studies (Lombardo et al., 2007) we should expect EQ to be inversely correlated with alexithymia. We also included a set of measures of mental health risk (e.g., proneness to delusions/hallucinations, or hypomania) since we expected that EQ would be *negatively* correlated with measures of mental health risk in the schizophrenia-like (Langdon et al., 2006; Montag et al., 2007), and bipolar-like spectra (Brotman et al., 2008). Indeed, although the existence of an empathy deficit in psychosis is generally accepted, there is very limited direct empirical evidence for this (Bora, Gökçen, & Veznedaroglu, 2008; Brotman et al., 2008; Shamay-Tsoory et al., 2007). Finally, we used a measure of social desirability, because we predicted that EQ would correlate *positively* with social desirability. In past studies, self-reported measures of empathy were

related to self-reported social desirability (Cialdini et al., 1987; Eisenberg et al., 1994), and empathy is likely to be the driver behind the motivation to be compliant with other's expectations and feelings.

METHODS

Sample

We used an undergraduate sample of 256 students studying engineering ($n = 53$), law ($n = 51$), foreign languages courses ($n = 24$), music ($n = 32$ musicians), painting and sculpture ($n = 32$), dance ($n = 32$), and drama ($n = 32$). This sample participation rate was 85%, from an original 300 subjects sample invited to take part in the study.

Measures

Each participant was told their data would remain confidential, and received a booklet containing the questionnaires listed in this section, which they were asked to complete. The institutional review board authorised this study. The protocol of the research project conforms to the guidelines of the 1995 Declaration of Helsinki (revised in Edinburgh in 2000).

The Empathy Quotient (EQ). We used the Italian version of the questionnaire, as reported in the Italian translation of *The Essential Difference* (Baron-Cohen, 2003, 2004), which was based on translation and back-translation, with a final check by the author. The EQ is a 60-item questionnaire, with 40 questions tapping empathy and 20 filler items. Responses are given on a 4-point Likert scale. Scores can range from 0 to 80. A cutoff score of fewer than 30 was the most useful to differentiate adults with ASC from controls. The original version of the EQ shows acceptable internal consistency, concurrent and convergent validity, and good test–retest reliability (Baron-Cohen & Wheelwright, 2004; Lawrence et al., 2004).

The 20-item Toronto Alexithymia Scale (TAS-20). The TAS-20 is a self-report scale that is comprised of 20 items, and it is the most frequently used self-assessment instrument to assess alexithymia, because of its good reliability and construct validity (Bagby, Taylor, & Parker, 1994; Taylor, Bagby, & Parker, 2003; Taylor et al., 1988). The TAS-20 has been translated and validated in numerous countries and languages, and is used worldwide, allowing comparison of results (Taylor et al., 2003). We used the validated Italian version of the questionnaire (Bressi et al., 1996). The factorial structure of the TAS-20, however, showed some variability, and the three

classic factors has not been always supported (Müller, Buhner, & Ellgring, 2003). For this reason, we used the total score only to assess alexithymia in our sample.

The Peters et al. Delusions Inventory (PDI). This questionnaire was designed to measure unusual beliefs and experiences pertaining to the dimension of delusional ideation in the general population (Peters, Joseph, Day, & Garety, 2004). The 21 original questions are derived from items in the Present State Examination (Wing, Cooper, & Sartorius, 1974) to assess delusional symptoms, modified to explore life-time experience (for example: "Do you ever feel that you are especially close to God?", "Do you ever feel as if someone is deliberately trying to harm you?"). The Italian version of the PDI discriminates patients diagnosed with psychosis from controls with a sensitivity = 0.74 and a specificity = 0.79 (AUC = 0.815) (Preti, Rocchi, et al., 2007), and classified patients into three classes traceable to the three major dimensions of psychosis, i.e., paranoia, grandiosity/hypomania, and the schizophrenia-like profile (Rocchi et al., 2008).

The Revised Launay-Slade Hallucination Scale (LSHS-R). This scale has 16 items investigating hallucinatory experiences in the domain of auditory, visual, olfactory, tactile cognition, and sleep-related perception, and including items that tap into the experience of feeling the presence of someone close who isn't there, so-called "sensed presence" (Larø, Marczewski, & van der Linden, 2004; Launay & Slade, 1981). The Italian version of the LSHS-R showed good convergent validity and reliability (Preti, Bonventre, Ledda, Petretto, & Masala, 2007).

The Hypomanic Personality Scale (HPS). This 48-item scale was designed to identify people with hypomanic personality, conceived as an overactive, highly sociable style of behaviour in which episodes of hypomanic euphoria are likely to recur (Eckblad & Chapman, 1986). This questionnaire has been used as a measure of affective/hypomanic traits, and discriminates between patients with bipolar disorder and controls and predicts the onset of bipolar disorder in adulthood, from scores in late adolescence (Kwapil et al., 2000).

Sample items are: "There are often occasions when I am so restless that I cannot even remain seated", "I often feel excited and happy for no apparent reason", "I have such a wide range of interests that I often wonder what I will do later", "I think I have a special ability to persuade and motivate other people", "I have often felt happy and irritable at the same time". For the purpose of this study, the original English version of the HPS was translated into Italian by the principal investigator, then checked for correctness by an English-speaking translator; back translation into English

was then checked by a second English-speaking translator. This version was finalised with the aid of one of the principal investigators of the HPS (T. R. Kwapil) to assure full compatibility of the translation as far as meaning and understanding of the items were concerned.

The Marlowe-Crowne Social Desirability Scale (SDS). This is a 33-item self-report questionnaire aimed at measuring socially desirable response (Crowne & Marlowe, 1960). Subjects rate the extent to which they agree (true) or disagree (false) with each item: the 15 items keyed false (denial subscale, D) are likely but socially undesirable and are thought to measure denial and self-deception (e.g., "I am sometimes irritated by people who ask me some favours"); the 18 items keyed true (positive attribution subscale, PA) are improbable but socially desirable and are thought to measure a tendency to positive attribution, or to attributing the self traits that are seen by society positively (e.g., "No matter who I'm talking to, I am always a good listener") (Ramanaiah, Schill, & Leung, 1977). The Italian version of the SDS showed good psychometric functioning when tested in nonclinical populations and, in past studies (Lane, Merikangas, Schwartz, Huang, & Prusoff, 1990), it showed a negative correlation with measures of psychopathology, particularly the denial subscale (Miotto, de Coppi, Frezza, Rossi, & Preti, 2002; Miotto & Preti, 2008).

A subgroup of 40 participants were recontacted after 4–6 weeks and invited to again fill in the EQ, together to the Interpersonal Reactivity Index (IRI), a 28-item questionnaire with four subscales aimed at measuring different facets of empathy: perspective taking (PT), empathic concern (EC), personal distress to others' negative experiences (PD), and fantasy (F), which measures a tendency to identify with fictional characters; the IRI proved good internal and convergent validity, and test–retest reliability (Davis, 1980, 1983). The Italian version of the questionnaire was used in the study (Bonino et al., 1998).

General sociodemographic information from self-report data was collected for the following variables: age, sex, and socioeconomic status. As a measure of socioeconomic status we used the highest level of parental education (Galobardes, Shaw, Lawlor, Lynch, & Smith, 2006), which was further classified into three categories: lower than high school diploma; high school diploma; college graduate or higher.

Statistical analysis

All data were coded and analysed using the Statistical Package for Social Sciences (SPSS) for Windows (Chicago, Illinois 60606, USA), version 13. All tests were two-tailed, with a conservative $\alpha = .05$. Scale reliability was

measured by Cronbach's coefficient alpha, a measure of internal consistency (Cronbach, 1951). To compare groups, alpha values of .70 are considered satisfactory (Bland & Altman, 1997). However, when dealing with subscales derived from a single questionnaire, values around .60 are considered acceptable (Nunnally, 1978). A subgroup of 40 participants was invited to complete the EQ on two occasions (4–6 weeks after Time 1), to assess test–retest reliability of the questionnaire.

A principal component analysis (PCA) was carried out on EQ, with Pearson correlations. We applied parallel analysis using marginally bootstrapped samples ($n = 500$) to extract factors with eigenvalues higher than 1, retaining only those statistically higher than the mean of random eigenvalues generated by bootstrapping. Ratio of root mean square of residuals (RMSR) to the expected mean value of RMSR was used to assess fit of the model: It is assumed that when the value of RMSR is much larger than the expected mean value of RMSR, the model cannot be considered as good. The Bentler's simplicity index (1977), and the reliability estimate of the extracted components (Mislevy & Bock, 1990) were also used to assess adequacy of the model. We used FACTOR to generate these analyses (Lorenzo-Seva & Ferrando, 2006).

To evaluate congruence between potentially homologous factors we used two indexes: the coefficient of congruence (CC) and the salient variable similarity index (S). The CC is the sum of the products of the paired loadings divided by the square root of the product of the two sums of squared loadings (Tucker, 1951); the CC ranges from -1.00 (perfect negative similarity) to 1.00 (perfect positive similarity), and zero stands for complete dissimilarity: There is not a definite taxonomy of CC values, but in past studies, thresholds for very high, high, and moderate agreements between factors were 0.90, 0.80–0.89, and 0.70–0.79, respectively (Sakamoto, Kijima, Tomoda, & Kambara, 1998). The S classifies factor loading according to matching on the basis of a prespecified cutoff of loading: It varies 0 to 1, with 1 indicating perfect congruence (Cattell & Baggaley, 1960); in this study, S was explored using 0.300 as a cutoff of minimal loading (equivalent to a 9% of variance contribution) (Velicer, Peacock, & Jackson, 1982). CC and S were calculated with the software Invariance (Watkins, 2005).

As for confirmatory factor analysis (CFA), there is some dissatisfaction about the current use of goodness-of-fit indexes. According to Marsh et al. (2009, p. 441) "Conventional CFA goodness of fit criteria are too restrictive when applied to most multifactor rating instruments". Therefore, it has become habitual in testing CFA models to rely on the rather liberal Hu and Bentler (1999) criteria. They recommended the use of the standardised root mean square residual (SRMSR) together one of several other indexes, such as the root mean square error of approximation (RMSEA; Browne &

Cudeck, 1993, Steiger & Lind, 1980), among others. On the other hand, more common indexes, such as the goodness of fit index (GFI) and adjusted goodness of fit index (AGFI), were considered insufficiently and inconsistently sensitive to model misspecification, and are strongly influenced by sample size (MacCallum & Austin, 2000). According to Hu and Bentler (1999), RMSEA of 0.06 or lower (with 90% CI below 0.08) and a SRMR of 0.09 or lower are acceptable. A test of close fit for RMSEA is also available, testing the null hypothesis that the population RMSEA is not greater than 0.05.

In CFA, the Chi-square value (χ^2) is the only available measure for evaluating overall model fit and "assesses the magnitude of discrepancy between the sample and fitted covariance matrices" (Hu & Bentler, 1999, p. 2). A nonsignificant chi-square suggests that the model does not deviate from the data. However, even if the chi-square statistic is significant, but its value is less than twice the *df* ($\chi^2/df < 2$), the model is thought to be a good representation of the data.

Sample size

We carried out a preliminary power calculation to determine the minimum sample necessary to test our hypothesis. Based on a Pearson product-moment correlation test, a sample of 82 participants would be needed to achieve 80% power to detect $r = .30$ (medium effect size) in the relationship between measures of EQ and those of psychopathology at a two-sided significance level of .05. As a nonparametric Spearman correlation index has been used, a sample of 104 participants would be needed, at the same levels of power and significance, since efficiency of the Spearman coefficient is about .91 of the corresponding Pearson coefficient (Lehmann, 1975). Calculation was performed using G*Power 3 (Faul, Erdfelder, Lang, & Buchner, 2007).

RESULTS

In our sample we had 118 males (46.1% of the sample) and 138 females (53.9%); so, we had the power to analyse sex differences and to test correlation between scales within each sex, on the basis of our a priori sample size analysis. Mean age was 24 ($SD = 4.5$), with a balance between the young (18 to 24 years old: $n = 135$, 52.7%) and older adult (25 to 38 years old: $n = 121$, 47.3%). Table 1 lists sociodemographic data of the sample. We found no sex differences in age, highest level of parental education or marital status.

Reliability of scales was good to very good for all scales: Cronbach's $\alpha > .70$, except for the two subscales of the SDS, positive attribution and

TABLE 1
General characteristics of the sample ($n = 256$)

Sociodemographic group	*N (%)*	*Emotional Quotient Mean (SD)*
Gender		
Male	118 (46.1%)	41.8 (9.4)
Female	138 (53.9%)	45.5 (9.3)
Age		
Mean (*SD*)	24.0 (4.5)	
18–24 (%)	135 (52.7%)	43.1 (9.3)
25–38 (%)	121 (47.3%)	44.6 (9.6)
Highest level of parental education		
Lower than high school diploma	78 (30.5%)	44.5 (9.4)
High school diploma	110 (43.0%)	43.7 (9.5)
College graduate or higher	68 (26.6%)	43.2 (9.7)
Marital status		
Unmarried	248 (96.9%)	—

denial (with Cronbach's $\alpha = .63$ and .64, respectively, which is acceptable for subscales). In particular, Cronbach's α was .79 for EQ and .70 for TAS. On the EQ, 27 items had item-total correlation above .25, 10 items had value near .25, and 3 items only had item-total correlation below .10.

Among those who completed the EQ in two occasions ($n = 40$), the test–retest reliability was satisfactory, Pearson's $r = .85$, $p < .0001$, Spearman's rho $= .76$, $p < .0001$.

In the sample, the EQ and TAS were normally distributed; all other scales were nonnormal, Kolgorov-Smirnov, with Lilliefors significance correction's $p < .0001$.

Table 2 lists general data on the measures used in this study, by sex. Females scored higher than males on the EQ, $t = 3.11$, $df = 254$, $p = .002$, Cohen's $d = 0.39$, 95% CI = 0.14–0.63; on the LSHS-R, $t = 3.37$, $df = 254$, $p = .001$, Cohen's $d = 0.43$, 95% CI = 0.18–0.68; and marginally on the positive attribution subscale of the SDS, $t = 2.03$, $df = 254$, $p = .043$, Cohen's $d = 0.23$, 95% CI = -0.01–0.48). Separate analysis with the nonparametric Mann-Whitney U-test confirmed all differences (except on the positive attribution subscale of the SDS), $p = .163$. No differences emerged for sociodemographic group on the EQ, except for sex (Table 1).

In the sample, 14 males (11.9%) and four females (2.9%) had an EQ ≤ 30, the cutoff score that best differentiates ASC from controls (Fisher exact test's $p = .006$). Conversely, four females (2.9%) and only one male (0.8%)

TABLE 2
Participants' scores on the self-report scales

	Males (n = 118)			*Females (n = 138)*			*Total sample (N = 256)*	
	Minimum	*Maximum*	*Mean (SD)*	*Minimum*	*Maximum*	*Mean (SD)*	*Mean (SD)*	*Median (Int. quart. range)*
EQ	12.0	66.0	41.8 (9.4)	20.0	65.0	45.4 (9.3)	43.7 (9.5)	43.0 (13.0)
TAS	20.0	73.0	47.4 (11.9)	21.0	79.0	48.2 (11.3)	47.90 (11.6)	47.0 (17.0)
SDS—positive attribution	1.0	16.0	9.4 (3.4)	5.0	17.0	10.1 (2.6)	9.8 (3.0)	10.0 (4.0)
SDS—denial	0.0	14.0	6.1 (3.1)	1.0	12.0	5.6 (2.6)	5.8 (2.8)	6.0 (4.0)
PDI	0.0	16.0	5.8 (3.7)	0.0	20.0	6.7 (3.9)	6.3 (3.8)	6.0 (5.0)
LSHS-R	0.0	57.0	15.2 (12.5)	0.0	56.0	20.9 (13.9)	18.3 (13.6)	15.0 (22.0)
HPS	0.0	45.0	17.8 (8.4)	1.0	36.0	18.6 (7.8)	18.3 (8.1)	19.0 (12.0)

scored 64 or higher on the EQ, a threshold for highly efficient empathy processing subjects (Fisher exact tests $p = .378$).

Students from dance schools had the highest scores on the EQ (48.5 ± 9.1) and those from fine arts (painters and sculptors) had the lowest (40.4 ± 11.2), and in both groups females outnumber males (29/3 and 18/14, respectively). When the comparison was confined to female participants only, these differences became even larger (dance students' EQ $= 48.7 \pm 9.2$ vs. fine arts students' EQ $= 39.2 \pm 10.4$). Students from engineering scored lower on the EQ (42.3 ± 8.6; m/f ratio = 41/12), but this was largely due to males (female students from engineering's EQ $= 45.9 \pm 9.3$). Students from fine arts were more likely to score ≤ 30 on the EQ: 9.4% ($n = 3$) compared to 3.1% ($n = 1$) in those from dance and drama schools, or 6.3% ($n = 2$) in musicians (but $p > .05$, due to small sample size). On measures of psychopathology, students from dance and those from fine arts did not differ (data available on request).

In female students ($n = 138$), the EQ was negatively related to the TAS, Pearson's $r = -.38$, $p < .0001$, and positively related to both the SDS positive attribution, $r = .34$, $p < .0001$, and denial, $r = .40$, $p < .0001$, subscales. In male students ($n = 118$), too, the EQ was negatively related to TAS, Pearson's $r = -.25$, $p < .01$, and positively related to SDS positive attribution, $r = .28$, $p < .01$, but not denial, $r = .12$, $p > .05$, subscale. Partial correlation of sex (m = 0; f = 1) to EQ, controlling for SDS denial subscale increased from $r = .192$ ($p = .002$) to $r = .221$ ($p = .0001$), indicating that sex differences in social desirability reduce actual sex differences in EQ scores.

In both female and male students, EQ was not related to measures of psychopathology, whereas TAS and SDS were: TAS was positively associated to higher scores on PDI, LSHS-R, and HPS, whereas both subscales of SDS (the denial subscale, in particular) were negatively related to scores on the measures of psychopathology, as reported in the past (data available on request). As expected, all measures of psychopathology were positively related to each other. Using Spearman's Rho nonparametric correlations did not change the results.

In the subgroup ($n = 40$) tested for construct validity with the IRI, EQ correlated with the EC, $r = .431$, $p = .005$, and the PT subscales, $r = .419$, $p = .007$, but not with the PD, $r = .076$, $p = .642$, or the F, $r = .193$, $p = .232$, subscales.

Factor analysis

PCA with Promax rotation was applied to the data. Promax rotation applies a Varimax rotation to the data, then forces the solution to a target allowing

the intercorrelation of the extracted factors, as awaited on the basis of past studies. Adequacy of the correlation matrix was fair, Kaiser-Meyer-Olkin test = 0.733; Bartlett's test of sphericity: $\chi^2 = 2321.7$, $df = 780$, $p = .00001$, suggesting the data were suitable for PCA. Five factors were extracted with eigenvalues higher than the mean of random eigenvalues generated by bootstrapping with value higher than 1.

However, the scree plot indicates a point of inflection towards levelling after the third factor: indeed, goodness of fit for a three-factor model based on residuals was reasonably acceptable (RMSR = 0.0665; expected value of RMSR = 0.0626; ratio = 1.06). Bentler's simplicity index also was good for the three factors solution (0.923), as they were the reliability estimates for the three factors: 0.783, 0.879, and 0.831 for Factor 1, Factor 2, and Factor 3, respectively (very good for subscales).

The items factor loading was comparable to the original solution in the study of Lawrence et al. (2004) (Table 3), with good overlap between Factor 1 in our study and Factor 3 (social skills) of the Lawrence et al. study, and between Factor 2 and Factor 1 (cognitive empathy) of the Lawrence et al. study; Factor 3 in our study was less consistent with the remaining Factor 2 (emotional reactivity) of the Lawrence et al. study. Congruence between putatively homologous factors, according to the two indexes used, is good to acceptable for all the three factors.

The retrieved three factors of our study were interrelated: Factor 1 to Factor 2 Pearson's $r = .148$, Factor 1 to Factor 3 $r = .160$, Factor 2 to Factor 3 $r = .172$, $p < .05$ in all correlations; as in the original Lawrence et al. (2004) study, the coefficients were not so high to preclude discriminant validity. Cognitive empathy factor scores were consistently higher among females than males, $t = 4.825$, $df = 254$, $p = .0001$; there were no differences by gender on the social skills, $t = 1.358$, $df = 254$, $p = .176$, or the emotional reactivity factor, $t = -0.408$, $df = 254$, $p = .684$.

Cognitive empathy and emotional reactivity were positively related to social desirability subscales (positive attribution and denial), and negatively to TAS score; emotional reactivity was negatively related to measures of psychopathology; cognitive empathy was negatively, and the social skills factor was positively related to hypomanic traits as measured by HPS (Table 4). Second order (total scores) factor analysis showed that EQ segregated into an emotional competence factor, separated from a factor more clearly related to psychopathology (Table 5).

Confirmatory factor analysis

The confirmatory analysis of the factorial structure, exactly as specified in the Lawrence et al. (2004) study, was acceptable: We found an SRMSR = 0.072,

TABLE 3
Final loadings from principal component analysis (three-factor forced solution)

	Factor 1 in our study	*Factor 3 in Lawrence et al. (2004)*		*Factor 2 in our study*	*Factor 1 in Lawrence et al. (2004)*		*Factor 3 in our study*	*Factor 2 in Lawrence et al. (2004)*
EQ8	0.667	0.771	EQ52	0.720	0.726	EQ48	0.599	0.508
EQ35	0.601	0.768	EQ25	0.666	0.723	EQ32	0.556	0.675
EQ14	0.501	0.575	EQ58	0.652	0.680	EQ27	0.528	0.473
EQ4	0.461	0.538	EQ55	0.614	0.763	EQ39	0.472	—
EQ12	0.460	0.619	EQ54	0.580	0.696	EQ6	0.450	0.497
EQ15	0.442	—	EQ36	0.547	0.559	EQ34	0.436	—
EQ57	−0.385	0.398	EQ19	0.532	0.583	EQ42	0.400	0.593
EQ1	—	0.315	EQ41	0.528	0.633	EQ46	0.389	—
			EQ44	0.489	0.688	EQ50	0.387	0.466
			EQ43	0.471	0.442	EQ59	0.375	0.658
			EQ1	0.467	0.505	EQ49	0.367	—
			EQ26	0.455	0.658	EQ43	0.349	0.452
			EQ60	0.411	—	EQ10	0.341	—
			EQ22	0.373	0.322	EQ36	—	0.315
						EQ21	—	0.528
						EQ22	—	0.385
						EQ29	—	0.333
Indexes of congruence	CC = 0.945			CC = 0.992			CC = 0.871	
	S = 0.833			S = 1.000			S = 0.800	

Loading <0.30 omitted. CC = coefficient of congruence; S = salient variable similarity index.

TABLE 4
Relations between the three PCA extracted factors of EQ and the other measures used in the study (Pearson's *r*)

Total sample	*Factor 1 (social skills)*	*Factor 2 (cognitive empathy)*	*Factor 3 (emotional reactivity)*
TAS	−0.133	−0.199*	−0.507**
SDS—positive attribution	0.218**	0.234**	0.253**
SDS—denial	0.072	0.167*	0.354**
PDI	0.107	−0.058	−0.314**
LSHS-R	0.156	−0.008	−0.328**
HPS	0.237**	−0.210*	−0.161*

$N = 256$. *$p < .01$, **$p < .0001$.

and an RMSEA = 0.056 (90% CI = 0.049–0.063, $p = .077$ for test of close fit). However, fitting was not very good, $\chi^2 = 618.69$, $df = 343$, $p = .0001$, but $\chi^2/df = 1.80$, and GFI = 0.846 was slightly lower than the conventional threshold for acceptance (0.85). Factors were interrelated:

TABLE 5
Second order factor analysis on all measures used in the study

	Communalities		*Component matrix*		*Rotated component matrix*	
	Initial	*Extraction*	*1*	*2*	*1*	*2*
EQ	1	0.635	−0.334	0.723		0.772
TAS	1	0.425	0.567	−0.322		−0.607
SDS—positive attribution	1	0.498	−0.559	0.431		0.686
SDS—denial	1	0.570	−0.707	0.265	−0.383	0.650
PDI	1	0.640	0.723	0.341	0.777	
LSHS-R	1	0.732	0.728	0.450	0.849	
HPS	1	0.609	0.656	0.423	0.776	
Eigenvalues			2.72	1.38	2.19	1.91
% of variance explained			38.9%	19.7%	31.3%	27.3%
	Cumulative variance explained = 53.13%					
Extraction: PCA	Kaiser-Meyer-Olkin measure of sampling adequacy = 0.738					
Rotation: Varimax	Bartlett's test of sphericity: $\chi^2 = 399.58$, $df = 21$, $p = .0001$					

$N = 256$. Loading < 0.25 not reported.

Factor 1 to Factor 2 yielded $r = .24$; Factor 1 to Factor 3 yielded $r = .23$; Factor 2 to Factor 3 yielded $r = .24$.

DISCUSSION

This study adds to previous investigations reporting a female superiority on questionnaires of empathy. Values on the EQ were slightly higher than in a recent study from France (Berthoz et al., 2008), and consistently higher than in a study from Japan (Wakabayashi et al., 2007), but comparable to the original study (Lawrence et al., 2004) and to the Muncer and Ling (2006) North England study. Some cultural specificity can account for these differences, in all likelihood on the side of social desirability.

In our sample, total EQ was statistically related to a measure of social desirability as in a recent French study (Berthoz et al., 2008). In earlier studies, the Marlowe-Crowne SDS was negatively related to measures of psychopathology in both the affective and eating disorders spectrum (Lane et al., 1990; Miotto et al., 2002), and in both affective and eating disorders, empathy deficits have been reported. We expected that EQ scores would be positively related to social desirability scores, because being able to be compliant with the expectations of others requires intact empathising ability. Indeed, a link between social desirability and measures of empathy has been reported earlier (Cialdini et al., 1987; Eisenberg et al., 1994). It must be emphasised that a link between social desirability and empathy so far has not demonstrated with instruments that do not rely on self-reports.

On the other hand, it may be that people prone to social desirability might emphasise their empathic skills in self-report measures, so as to make other people perceive them as caring and sympathetic irrespectively of their actual skills. However, in our study social desirability actually reduces the impact of sex differences on EQ, when controlling for the denial subscale in partial correlation. So, apparently social desirability is not the main reason explaining higher scores of females on EQ, compared to male students.

Construct validity of EQ was corroborated by the correlation, with relatively high effect size according to conventional criteria (Kraemer & Kupfer, 2006), with the subscales EC and PT of the IRI, as in the original study (Lawrence et al., 2004) and the French study (Berthoz et al., 2008). The PD subscale was not related to EQ in any study, while the F subscale was related to EQ in the French study but not in the original one, again possibly for cultural reasons.

The EQ maps onto a general factor measuring emotional competence, but it is not specifically related to psychopathology in a nonclinical sample. This is understandable, since a deficit in emotional competence is involved in

psychoses expressing proneness to delusions, hallucinations, or hypomania. Emotional stability and the ability to empathise, on the other hand, are features of mental health. In this study, scores on the TAS, measuring alexithymia, were positively related to measures of psychopathology, whereas TAS was negatively related to EQ, confirming past reports (Guttman & Laporte, 2002; Lombardo, Barnes, Wheelwright, & Baron-Cohen, 2007; Moriguchi et al., 2007).

A three-factor structure offers a reasonably satisfactory fit to the data, according to the results of CFA. Factors were interrelated, although the correlations were not so high to prevent discriminant validity. When confined to the factors extracted by PCA, a more definite relation emerged between the emotional reactivity factor and psychopathology, with lower emotional reactivity correlating to higher scores in measures of risk in both the psychotic (PDI, LSHS-R) and the bipolar spectrum (HPS), consistent with past studies (Bigelow et al., 2006; Bozikas et al., 2006; Brotman et al., 2008; Langdon et al., 2006; Montag et al., 2007). On the other hand, higher social skills were related to higher scores on a measure of hypomania-propensity, in all likelihood because people with hypomanic temperament have an inflate perception of their own social abilities.

Evidence for Factor 1 (social skills) and Factor 2 (cognitive empathy), which are equivalent to Factors 3 and 1 in Lawrence et al. (2004), was good. However, the matching of Factor 3 (emotional reactivity) to the equivalent in the Lawrence et al.'s study was poor. Items 21 ("It is hard for me to see why some things upset people so much"), 22 ("I find it easy to put myself in somebody else's shoes"), and 29 ("I can't always see why someone should have felt offended by a remark") are not included in our model. All these items have a social desirability flavour, and indeed they correlate with the SDS denial subscale ($p < .01$ or lower; data not shown). Since EQ scores correlated to the SDS denial subscale scores in females but not in males, this might have unbalanced the factorial analysis. Moreover, we did not have people with diagnosed psychiatric conditions in our sample, and this might have produced a different solution than that found by Lawrence et al. In their study with undergraduate students, Muncer and Ling (2006) were not able to repeat the results of the Lawrence et al. factor structure using confirmatory factor analysis. People with ASC and healthy people might reply in a different way to items tapping into the emotional reactivity factor. Further studies will be necessary to determine whether EQ subscales scores can be used appropriately to measure the different facets of empathy.

Lower EQ scores among fine arts students were unexpected. However, a subgroup of individuals on the autistic spectrum excels in the visual arts (Hou et al., 2000). Therefore, a subgroup of students high on autistic traits could have influenced total empathy scores in the fine arts group, leading to lower average scores on the EQ. We found a trend for students from fine arts

to score more often than those from the other groups in the EQ score range that best differentiates ASC from controls; however, a larger sample than ours would be necessary to confirm this hypothesis, and appropriate measure to identify the prevalence of ASC in art students should be used.

In contrast, higher empathy scores amongst dance students have previously been reported (Kalliopuska, 1989), and may point towards a motor, embodied foundation of empathy (Gallese, Eagle, & Migone, 2007).

In our sample, females were superior to males in cognitive empathy, confirming results from the original study (Baron-Cohen & Wheelwright, 2004; Lawrence et al., 2004), and a recent Swedish study (von Horn, Bäckman, Davidsson, & Hansen, 2010), but differently from the French study (Berthoz et al., 2008). Nevertheless, females have higher scores on empathy measures than males: Some studies, limited by small sample size, reported neural correlates of sex differences in empathy measures to be observable at both neuroanatomy (Cheng et al., 2009) and neurophysiology (Yang, Decety, Lee, Chen, & Cheng, 2009) of human mirror-neuron system. This provides a tentative neurological basis for sex differences in measures of empathy, needing more extended investigation. As predicted, three times as many male as female students scored ≤ 30 on the EQ, as in the French study (Berthoz et al., 2008), in line with the accepted male to female ratio at risk for ASC. Conversely, more females than males were stronger empathisers. Sex differences favouring women in empathy measures have often been reported on self-reported scales, but have rarely been confirmed in laboratory tests (crying in response to other crying) or when empathy is measured with physiological methods (heart rate/pulse rate, skin conductance) or independent third parties observations (Eisenberg & Lennon, 1983). Behavioural tests of sex differences in empathy remain to be more fully explored in the future.

In conclusion, this study of the Italian version of the EQ confirmed the high reliability of the questionnaire, with an acceptable replication of the original three-factor solution, yielding three subscales with high internal and test–retest reliability.

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