

Psychometric Properties of the Serbian Version of the Empathy Quotient (S-EQ)*

Aleksandar Dimitrijević¹, Nataša Hanak²,
Tatjana Vukosavljević-Gvozden¹, and Goran Opačić¹

¹ *Department of Psychology, Faculty of Philosophy, University of Belgrade, Serbia*

² *Faculty for Special Education and Rehabilitation, University of Belgrade, Serbia*

In the present study we examined psychometric properties of the Serbian translation of the Empathy Quotient scale (S-EQ).

The translated version of the EQ was applied on a sample of 694 high-school students. A sub-sample consisting of 375 high-school students also completed the Interpersonal Reactivity Index (IRI), another widely used empathy measure. The following statistical analyses were applied: internal consistency analysis, explanatory (EFA) and confirmatory (CFA) factor analyses, and factor congruence analysis. Correlation with IRI and gender differences were calculated to demonstrate validity of the instrument.

Results show that the Serbian 40-item version of EQ has lower reliability (Cronbach's alpha = .782) than the original. The originally proposed one factor structure of the instrument was not confirmed. The short version with 28 items showed better reliability (alpha = .807). The three-factor solution (cognitive empathy, emotional reactivity, and social skills) showed good cross-sample stability (Tucker congruence coefficient over .8) but the results of CFA confirmed the solution proposed in the reviewed literature only partially.

The mean scores are similar to those obtained in the other studies, and, as expected, women have significantly higher scores than men. Correlations with all subscales of IRI are statistically significant for the first two subscales of EQ, but not for the „social skills.”

We concluded that the Serbian version of the „Empathy Quotient” is a useful research tool which can contribute to cross-cultural studies of empathy, although its psychometric characteristics are not as good as those obtained in the original study. We also suggest that a 28-item should be used preferably to the original 40-item version.

Keywords: Empathy Quotient, Serbian version, psychometric properties, Interpersonal Reactivity Index

Corresponding author: adimitri@f.bg.ac.rs

The study was partly supported by project No. 179018: “Identification, measurement and development of cognitive and emotional competences important for a society oriented to European integrations,” funded by the Ministry of Education and Science of the Republic of Serbia.

S-EQ can be downloaded from http://www.autismresearchcentre.com/arc_tests.

Since mid-1950s, empathy has become increasingly important in psychotherapy and counselling. In the coming decades, it has inspired many social and developmental psychologists, as well as researchers coming from a wide array of scientific disciplines. English psychologist Simon Baron-Cohen and his teams from the Autism Research Centre in Cambridge, England, have devoted more than twenty years to collecting evidence that empathy is at the core of our social interactions and that diminished or absent empathy is an important cause of frequent and debilitating conditions such as autism, psychopathic personality, Borderline and Narcissistic Personality Disorders. Although empathy research has had its history in psychology, this frame of reference has led to many important results from several different fields,¹ and subsequently to conceptual analyses and clinical innovations.

Baron-Cohen defines empathy in the following way: „Empathy is our ability to identify what someone else is thinking and feeling, and to respond to their thoughts and feelings with an appropriate emotion” (2011, p. 11). We see that the definition includes two aspects: recognition and response. Believing that recognition alone is necessary but insufficient (and available even to psychopaths), Baron-Cohen explains: „Empathizing occurs when we feel an appropriate emotional reaction, an emotion *triggered* by the other person’s emotion, and it is done in order to understand another person, to predict their behaviour, and to connect or resonate with them emotionally” (2003, p. 2; emphasis in the original).

This definition of empathy seems to be an elegant way to overcome the old division between those psychologists who believed that empathy was mainly an affective state and those who claimed that it was a cognitive asset. The first group of authors saw empathy as a reaction in the empathizer that is similar to the original one in the perceived person, further differing among themselves regarding the hypothesised extent of that similarity. Among the instruments developed to measure emotional arousal to other people’s experience the most prominent was the „Questionnaire Measure of Emotional Empathy” (Mehrabian & Epstein, 1972), later revised by one of the authors and named the „Balanced Emotional Empathy Scale” (see Lawrence et al., 2004). The second group defined empathy as a capacity for non-self-centred perception and understanding of other people’s inner world, and its proponents constructed several instruments with hope that it may be possible to measure someone’s ability to take other people’s perspective. The once most widely used was the questionnaire aimed at measuring cognitive empathy (Hogan, 1969), but it later came under a lot of

1 Various studies have suggested that information about own or other person’s pain are processed in certain brain centres and that lesions to certain brain areas can lead to diminishing or absence of empathy (for a review see Baron-Cohen, 2011, pp. 19-28). Also, testosterone levels in amniotic fluid were shown to be predictive of the results on child version of the “Empathy Quotient” (Chapman, Baron-Cohen, Auyeung, Knickmeyer, Taylor & Hackett, 2006). Recently, a research has established a strong connection between the results on self-report measures of empathy and one of the genes related to sex steroids (Chakrabarti, Dudbridge, Kent, Wheelwright, Hill-Cawthorne, Allison, Banerjee-Basu & Baron-Cohen, 2009).

criticism, particularly that it is a measure of social skills rather than empathy (Davis, 1994).

Yet, it seems that both those views of empathy are seriously flawed. To begin with, if empathic process includes only 'sharing' someone's emotional states, this experience of sameness would not lead to empathic understanding, but to hyper-reactivity and illusion of identity between own and other selves; on the other hand, if we emphasize cognition too strongly, we may overlook that empathizer is emotionally moved besides his/her efforts to gain understanding (Vukosavljevic-Gvozden, 2002).² Furthermore, neuropsychological findings reveal „a remarkable behavioural and anatomic double dissociation between deficits in cognitive empathy and emotional empathy” that are „different in terms of synaptic hierarchy and phylogenetic age,” but both are sine qua non of a genuine empathic reaction (Shamay-Tsoory, Aharon-Peretz. & Perry, 2009, pp. 617, 625).

Baron-Cohen has opted for a unitary vision of empathy as affective-cognitive, but has introduced another dichotomy. Together with his colleagues (Baron-Cohen, Richler, Bisarya, Gurunathan & Wheelwright, 2003), he assumed that male brains are being characterized by the systemizing – the drive to analyze, understand and predict the law-governed inanimate universe, as well as „the ability to analyze changing patterns, to figure out how things work” (Baron-Cohen, 2011, p. 73); whereas female brains were primarily being driven by the empathizing – the drive to identify another person's emotions and thoughts, to recognize infant's preverbal signals, and to understand and predict the social world.

This dichotomy has important clinical implications. Namely, in most men and women systemizing and empathizing tendencies are a matter of degree and do not go to the extremes – but not in all. Baron-Cohen worked with persons with autism who were of average IQ or even got some sort of talent, but were basically unable to understand the rules of social interactions or to imagine their own or other persons' inner life. Believing that this was a consequence of strong systemizing and weak empathizing, Baron-Cohen described autism as „Extreme Male Brain” (2003). This hypothesis was corroborated by studies showing that persons with the Asperger syndrome were 'hyper-systemizers,' but had difficulties in recognizing other persons' feelings and thoughts from the photographs showing facial expressions, with their brain zones associated with empathy less active than in control subjects (Baron-Cohen, Wheelwright, Hill, Raste, & Plumb, 2001).³

2 This discussion is most frequent in psychoanalysis, where empathy is now considered one of the basic tenets of clinical technique, especially when empathy is seen as a sustained therapeutic process requiring effort (Aragno, 2008; Goldberg, 2011) – a notion more demanding than the one we are dealing with in this paper.

3 Baron-Cohen has recently tried to apply this conception to other clinically relevant conditions and psychological foundations of what used to be called evil, which is most evident in the title of his latest book – *Zero Degrees of Empathy. A New Theory of Human Cruelty* (2011).

Apart from neuropsychological and genetic studies, Baron-Cohen and his associates have tried to study empathy through a standard differential psychological procedure. They had at their disposal the then frequently used multidimensional scale aimed at measuring both the cognitive and the affective component of empathy – „Interpersonal Reactivity Index” (Davis, 1980, 1983a, b). However, they considered IRI inadequate arguing that its subscales – „perspective-taking,” „empathic concern,” „personal distress,” and „fantasy” – included more phenomena and not only empathy. Therefore, they constructed a new scale based on a unifactorial model of unity between cognitive and affective aspects of empathy (Baron-Cohen & Wheelwright, 2004). This scale, named the „Empathy Quotient” (EQ), is a short, easy to administer self-report measure of empathy. The EQ consists of 60 items: 40 of them measure empathy and 20 filler items serve to distract the participants from focusing on empathy. Responses are given on a four point scale ranging from „strongly disagree” to „strongly agree”. To avoid a response bias, the authors constructed about half of the items to produce a „disagree” and half to produce an „agree” response for the empathic response. Non-empathic responses are scored 0, while empathic responses receive 1 or 2 points, depending on the degree of empathic behaviour manifested. The total score on the scale is out of 80. It should also be noted that the EQ is particularly devoted to measuring the lack of empathy as a feature of psychopathology. Thus, a cut-off score of 30 is suggested and those scoring below it are considered „low-empathisers.”

The EQ was validated on a group of 197 healthy control volunteers. It showed excellent reliability (Cronbach’s $\alpha = .92$), and when retest was conducted 12 months later the correlation coefficient between the results was $r = .97$. The initial study confirmed both aforementioned hypotheses: persons with Asperger Syndrome scored significantly lower than controls and women scored significantly higher than men (Baron-Cohen & Wheelwright, 2004).

In the years to come, several modifications of the EQ were suggested. The major problem was the issue of the number of factors: different studies suggested that the EQ contains more than one factor (see below). A 22-item version, called „The Short Form,” was also published (Wakabayashi, Baron-Cohen, Wheelwright, Goldenfeld, Delaney, Fine, Smith, & Weil, 2006), but we are not aware of its further application. Finally, a children version of the EQ, which is in fact a parent-report scale, was introduced (Auyeung, Baron-Cohen, Wheelwright, Samarawickrema, Atkinson, & Satcher, 2009), and the scoring manual and interpretation guidelines were published in Baron-Cohen’s latest book, written for popular audience (2011, pp. 135–139).

Several studies have so far been devoted to the validation of the original and translated versions of the EQ. Two subsequent English studies (Lawrence, Shaw, Baker, Baron-Cohen, & David 2004; Muncer & Ling, 2006) have generally replicated many of the original results. The original EQ proved to be

highly reliable, and both basic hypotheses were confirmed as females scored significantly higher than males⁴ and persons with Asperger Syndrome scored significantly lower than controls. Even after only two studies, however, it became clear that the unifactorial solution was dissatisfactory. The study by Lawrence et al. (2004) showed that the EQ performs better as a 28-item scale with three distinct factors (cognitive empathy, emotional reactivity and social skills) instead of one.

Soon ensued validation studies in Japan (Wakabayashi, Baron-Cohen, Uchiyama, Yoshida, Kuroda, & Wheelwright, 2007), France (Berthoz, Wessa, Kedia, Wicker & Grezes, 2008), French-speaking part of Canada (Lepage, Lortie, Taschereau-Dumouchel & Theorer, 2009), Korea (Kim & Jae Lee, 2010), and Italy (Preti, Vellante, Baron-Cohen, Zucca, Rita Petretto, & Masala, 2011). The translated versions of the EQ showed that it is a measure that can usefully be applied in different cultures, although none of these versions had equally good psychometric characteristics as the original one. Thus, while reliability of the original EQ was .92, in translated versions its range was between .78 in Korea (Kim & Jae Lee, 2010) and .86 in Japan (Wakabayashi et al., 2007). Also, despite test-retest period was shortened to four weeks in the Korean and the Italian studies, the coefficients were .84 and .85 respectively. All those studies have, employing the Confirmatory Factor Analysis, established that the EQ contains three factors, just as was suggested by Lawrence et al. (2004).

RATIONALE

This study aimed at the examination of the basic psychometric proprieties of the Serbian translation of the EQ. We hoped that this would make an important addition to psychological measures available in Serbian as well as a contribution to cross-cultural studies of empathy and the EQ itself.

Specifically, we investigated the following: whether the mean EQ score is in the range of the previous European studies; whether the three-factorial structure of the measure is a better fit than unifactorial; whether shorter EQ (with 28 items) is better fit than the original 40-item measure; whether EQ can be validated (a) by means of correlations with the „Interpersonal Reactivity Index” and (b) by females demonstrating superiority in empathizing over males.

Method

Participants and procedure. The 694 participants were recruited from the population of secondary school students in Belgrade. The school principals have given their permission for student participation, after they have been informed about the purpose of the research and the data protection. The principles of anonymity and confidentiality were also explained to the students, and their participation was voluntary. The data were collected in group setting. The

4 It is also worth mentioning that early results of the application of the “Child EQ” show that girls score better than boys (Baron-Cohen, 2011).

participants' age range was from 15 to 19 years, with the mean age of 16.65 (SD = 1.003). All the items on the EQ scale were completed by 293 males (42.2%) and 401 females (57.8%). One part of them, consisting out of 375 students (38.4% males and 61.6% females, with the mean age of 16.72) completed both the EQ and the Interpersonal Reactivity Index.

Measures. We have already provided details about the EQ in the introductory section.

The EQ was translated into Serbian by a group of experienced clinical psychologists. The original version and the translation were then sent to a bilingual person who has formulated the final text of S-EQ, approved by the initial group of the translators.

The Interpersonal Reactivity Index (IRI) is a self-report scale designed to measure both cognitive and emotional components of empathy (Davis, 1983a). It consists of four subscales: perspective taking (IRI-PT), fantasy (IRI-FS), empathic concern (IRI-EC), and personal distress (IRI-PD). IRI-PT scale measures the tendency to take another's point-of-view, akin to the „theory of mind” (e.g., „When I am upset at someone, I usually try to ‘put myself in his shoes’ for a while.”). IRI-FS scale measures the tendency to identify with fictional characters (e.g., „I really get involved with the feelings of the characters in a novel.”). IRI-EC items relate to feelings of empathy toward others (e.g., „When I see someone being taken advantage of, I feel kind of protective towards them.”), and IRI-PD addresses the tendency to experience distress in stressful situations (e.g., „In emergency situations, I feel apprehensive and ill at ease.”). Participants are asked to express their own degree of agreement with 28 items on a 5-point Likert-type scale ranging from 1 („does not describe me well”) to 5 („describes me well”). Cronbach's alpha for the 28-items scale is .836, while reliabilities of the four 7-item subscales range from alpha=.656, for IRI-PT, to alpha=.788 for IRI-FS, which can be considered as acceptable for scientific purposes.

Results

Principal components analysis

Mean total scores on the EQ for men and women are presented in Table 1. Male overall scores were significantly lower than female scores ($t = -8.594$, $df = 692$, $p < .0001$), as was the case in all the studies using EQ as a measure of empathy. The means and standard deviations are similar to those obtained by Munzer & Ling (2006), significantly higher than those obtained by Kim & Lee (2010) on Korean sample, but significantly lower than those found by Lawrence et al. (2004) and Preti et al. (2011), with t-test values significant for all but one of those differences (see Table 2). Another study with the Serbian EQ found almost the same values of the mean EQ scores on the subsample of students of non-helping professions, with $M = 37.34$ and 42.34 for males and females, respectively (Dimitrijević, Hanak, & Milojević, 2011). Consistently, the percentages of those whose scores were below or equal to 30 were three times larger among men – 25.3% vs. 8.2%.

Table 1. Means and standard deviation scores on the EQ

	N	M	SD	Min	Max
Male	293	37.08	9.437	13	64
Female	401	43.13	8.965	17	67
Total	694	40.87	9.637	13	67

Table 2. Comparison of Means with the other samples

	M	SD	N	t	N1+N2	p
Our sample	40.87	9.64	694			
Preti et al. (2011)	43.7	9.5	256	-4.058	950	0.000
Kim & Lee (2010)	35.4	9.6	478	9.571	1172	0.000
Munzer & Ling (2006)	42.3	10.8	348	-2.088	1042	0.037
Wakabayashi et al. (2006)	33.4	10.72	1250	15.722	1944	0.000
Dimitrijević, Hanak & Milojević (2011)	44.06	10.09	864	-6.359	1558	0.000
Baron-Cohen & Wheelwright (2004)	42.1	10.6	90	-1.046	784	0.296
Lawrence et al. (2004)	45.6	11.6	172	-4.942	866	0.000

The Empathy Quotient is normally distributed (Kolmogorov-Smirnov $Z = .973$, 2-tailed sig. = .300), with internal consistency approaching the level of acceptable (Cronbach's alpha = .782). However, a number of items have low item-total correlation, such as items 12, 15, 29, 36, 38, 49, 50, and 54, with item-total correlation of less than .1. A principal components analysis (PCA) confirms that many items do not have loadings on the first component, presumed to measure empathy. The first component explains only 13.521% of variance, and five components with Eigenvalues over 1 explain up to 33.294% of variance.

Therefore, a shorter version of EQ with 28 items (EQ-28) was examined with PCA with a Varimax rotation. This solution was proposed by Lawrence et al. (2004) and partly confirmed by Munzer & Ling (2006) and Preti et al. (2011). Lawrence et al. reduced the original scale to 28 items that loaded onto three factors, labelled „cognitive empathy,” „emotional reactivity,” and „social skills”.

The first three components obtained in our study account for 32.624% of variance. The item loadings for these three factors in the rotated solution are shown in Table 3. Items were sorted from those with the highest loadings in the study of Lawrence et al. to those with the lowest loadings. It turned out that our three factor solution corresponded reasonably well with the proposed version. The first component bears the highest resemblance to Lawrence et al.'s „cognitive empathy” (CE). The second component resembles the „emotional reactivity” (ER) but three out of eleven items do not have appropriate loadings on this component. Item 27 loads on the „social skills” (SS) and items 22 and 29 have loadings lower than .30. The third component is less consistent with the proposed „social skills” factor. In our results, it consists only of six items, because the 35th loads on the „cognitive empathy,” and the 57th has a negative loading on the „social skills.” As shown in Table 4, there are a few items (4, 22, 27, 29 and 57) with low item-total correlation, representativity and/or stability.

Those problems are reflected in the internal consistency of the short version of the scale and of its subscales. The Cronbach's alpha for the EQ-28 is still only in the acceptable range, although slightly higher than for the 40-item version (.807). The „cognitive empathy” scale has very good reliability, with the Cronbach's alpha = .822. On the other hand, the „emotional reactivity” scale has Cronbach's alpha

.671, which is acceptable for research purposes, while the „social skills” scale has the alpha of only .320 which cannot be considered acceptable.

Table 3. *Rotated component matrix with factor loadings on three components of EQ-28 (Varimax rotation with Kaiser Normalization). Loadings in italics are from the original study of Lawrence et al. (2004, p. 915)*

	1	2	3
55 I can tell if someone is masking their true emotion.	.628	<i>.763</i>	
52 I can tune into how someone else feels rapidly and intuitively.	.643	<i>.726</i>	
25 I am good at predicting how someone will feel.	.635	<i>.723</i>	
54 I can easily work out what another person might want to talk about.	.606	<i>.696</i>	
44 I can sense if I am intruding, even if the other person doesn't tell me.	.408	<i>.688</i>	
58 I am good at predicting what someone will do.	.644	<i>.680</i>	
26 I am quick to spot when someone in a group is feeling awkward or uncomfortable.	.628	<i>.658</i>	
41 I can easily tell if someone else is interested or bored with what I am saying.	.595	<i>.633</i>	
19 I can pick up quickly if someone says one thing but means another.	.566	<i>.583</i>	
36 Other people tell me I am good at understanding how they are feeling and what they are thinking.	.496	<i>.559</i>	<i>.315</i>
1 I can easily tell if someone else wants to enter a conversation.	.498	<i>.505</i>	
32 Seeing people cry doesn't really upset me.		<i>.666</i>	<i>.675</i>
59 I tend to get emotionally involved with a friend's problems.		<i>.601</i>	<i>.658</i>
42 I get upset if I see people suffering on news programmes.		<i>.635</i>	<i>.593</i>
21 It is hard for me to see why some things upset people so much.		<i>.321</i>	<i>.528</i>
48 Other people often say that I am insensitive, though I don't always see why.		<i>.492</i>	<i>.508</i>
6 I really enjoy caring for other people.		<i>.596</i>	<i>.497</i>
27 If I say something that someone else is offended by, I think that that's their problem, not mine.			<i>.473</i> <i>.413</i>
50 I usually stay emotionally detached when watching a film.		<i>.454</i>	<i>.466</i>
43 Friends usually talk to me about their problems as they say I am very understanding.		<i>.511</i>	<i>.452</i>
22 I find it easy to put myself in somebody else's shoes.			<i>.385</i>
29 I can't always see why someone should have felt offended by a remark.			<i>.333</i>
8 I find it hard to know what to do in a social situation.			<i>.586</i> <i>.771</i>
35 I don't tend to find social situations confusing.	<i>.403</i>		<i>.768</i>
12 Friendships and relationships are just too difficult, so I tend not to bother with them.			<i>.522</i> <i>.619</i>
14 I often find it difficult to judge if something is rude or polite.			<i>.676</i> <i>.575</i>
4 I find it difficult to explain to others things that I understand easily, when they don't understand it first time.			<i>.331</i> <i>.538</i>
57 I don't consciously work out the rules of social situations.			<i>-.423</i> <i>.398</i>

Table 4. *Item Representativeness, Reliability and Validity*⁵

	Representa- tiveness	Reliability	Correlation with first principal component	Corrected ⁶ Item-Total Correlation	Factor ⁷ structure similarity (stability)
55 I can tell if someone is masking their true emotion.	.9583	.3111	.5687	.432	0.99013
52 I can tune into how someone else feels rapidly and intuitively.	.9593	.4173	.6728	.546	0.98762
25 I am good at predicting how someone will feel.	.9373	.3526	.5590	.421	0.98036
54 I can easily work out what another person might want to talk about.	.9366	.3321	.5368	.407	0.98412
44 I can sense if I am intruding, even if the other person doesn't tell me.	.9304	.2504	.5066	.405	0.92667
58 I am good at predicting what someone will do.	.9323	.3025	.4619	.311	0.96321
26 I am quick to spot when someone in a group is feeling awkward or uncomfortable.	.9397	.3330	.5662	.427	0.97636
41 I can easily tell if someone else is interested or bored with what I am saying.	.9384	.3237	.5665	.433	0.92186
19 I can pick up quickly if someone says one thing but means another.	.9316	.2548	.4844	.351	0.90773
36 Other people tell me I am good at understanding how they are feeling and what they are thinking.	.9543	.3972	.6602	.553	0.99394
1 I can easily tell if someone else wants to enter a conversation.	.9216	.2303	.4653	.353	0.77463
32 Seeing people cry doesn't really upset me.	.8760	.3229	.3546	.351	0.96230
59 I tend to get emotionally involved with a friend's problems.	.9343	.3060	.5198	.455	0.90436
42 I get upset if I see people suffering on news programmes.	.8878	.1926	.3150	.274	0.82954
21 It is hard for me to see why some things upset people so much.	.7546	.1237	.1727	.185	0.64885
48 Other people often say that I am insensitive, thought I don't always see why.	.8612	.2325	.2758	.260	0.99621
6 I really enjoy caring for other people.	.9099	.2332	.4152	.355	0.98001
27 If I say something that someone else is offended by, I think that that's their problem, not mine.	.7862	.1574	.1323	.154	0.97708
50 I usually stay emotionally detached when watching a film.	.9091	.1854	.3490	.327	0.92636
43 Friends usually talk to me about their problems as they say I am very understanding.	.9503	.3511	.5981	.509	0.95341
22 I find it easy to put myself in somebody else's shoes.	.9385	.1769	.4328	.340	0.90750
29 I can't always see why someone should have felt offended by a remark.	.4864	.0644	.0660	-.028	-0.44401
8 I find it hard to know what to do in a social situation.	.8230	.1449	.2572	.215	0.96683
35 I can easily work out what another person might want to talk about	.7750	.1488	.2400	.164	0.98464

5 Calculated by rtt10g SPSS macro (Knezević & Momirović, 1996).

6 Calculated by SPSS reliability procedure.

7 Calculated by Orthosim program (Baret, 2006).

	Representa- tiveness	Reliability	Correlation with first principal component	Corrected ⁸ Item-Total Correlation	Factor ⁹ structure similarity (stability)
12 Friendships and relationships are just too difficult, so I tend not to bother with them.	.8238	.1900	.2558	.245	0.98695
14 I often find it difficult to judge if something is rude or polite.	.8337	.2353	.3562	.335	0.95754
4 I find it difficult to explain to others things that I understand easily, when they don't understand it first time.	.6395	.0935	.0967	.119	0.95456
57 I don't consciously work out the rules of social situations.	.7464	.0791	.0801	-.102	0.98788

Gender differences were found on all three sub-scales of the EQ-28. The most pronounced were those on the „emotional reactivity” ($t=-9.360$ (682), $p<.001$), then on the „cognitive empathy” ($t=-3.861$ (682), $p<.001$), while differences between males and females on the „social skills” were barely statistically significant ($t=-2.024$ (682) $p=.043$).

Congruence analysis

In order to explore stability of the factor structure, the sample is divided in two subsamples using SPSS random number generator. Applying Horn’s parallel criteria for factor extraction three-factor solution was estimated as the best for both samples.

To calculate Tucker’s Congruence Coefficient we used Orthosim 2.01 software by Baret (2005). The Congruence Coefficient was first suggested by Burt (Burt, 1948) and later became popular as Tucker’s congruence coefficient (Tucker, 1951). It is widely accepted that coefficients above .8 indicate replicability of the factors (Fulgosi, 1981), but some argue that coefficients $\geq .85$ should be considered fair, and $\geq .95$ good (Lorenzo-Seva and Ten Berge, 2006). The more robust factors (i.e., more invariant across different sub-samples) are more fundamental, and they indicate a more important psychological mechanism, process or structure.

Table 5. *Congruence Coefficients: between the target and maximally congruent comparison matrix*

	FAC. 1	FAC. 2	FAC. 3
FAC. 1	0.9809	0.2773	0.2163
FAC. 2	0.2914	0.9363	0.3715
FAC. 3	0.2162	0.3533	0.8145

Stability of all extracted factors estimated by Tucker congruency coefficients are above the boundary proposed by Fulgosi (1981). The worst stability was demonstrated by the third factor („social skills”) that has congruence below lower bound proposed by Lorenzo-Seva and Ten Berge (2006).

8 Calculated by SPSS reliability procedure.
9 Calculated by Orthosim program (Baret, 2006).

Confirmatory factor analysis

Exploratory solution obtained by Lawrence et al. (2004) and examined by the PCA in the first part of this study was further tested by the means of the confirmatory factor analysis (CFA). In addition, we have included several solutions tested by other authors (Kim & Lee, 2010; Munzer & Ling, 2006). A CFA study at the item-level tested the following models:

- a) one-factor model;
- b) a model of three non-correlated factors based on explanatory factor analysis (EFA) of the results obtained by Lawrence et al. (2004);
- c) a model of three correlated factors;

Secondary loadings were not allowed (each item has only one non-zero loading). Error parameters were also considered as uncorrelated.

FIT INDICES

There are lots of indices of a model fit. For example, in the „Goodness of Fit Statistics” section of the LISREL program, the output contains 38 indices that should optimize a slightly different function.

In their meta-analytic study, Jackson, Gillaspay Jr., and Purc-Stephenson (2009) analyzed 194 CFA studies. Within the first five most often referred goodness of fit indices they found: χ^2 (and its degrees of freedom and p-value) used in 89.2% of studies, followed by Comparative fit index (CFI) – 78.4%, Root-mean-square error of approximation (RMSEA) – 64.9%, Tucker–Lewis index (TLI) – 46.4% and Goodness of fit index (GFI) employed in 34.0% of the studies. All other parameters were presented in less than 30% of analyzed papers.

What should be reported in SEM/CFA is not universally agreed upon; however, there is considerable consistency among authors who have addressed this question (e.g., Barrett, 2007; Bentler, 2007; McDonald & Ho, 2002). According to Iacobucci (2010), there is some agreement that researchers should report the following profile of indices: the χ^2 (and its degrees of freedom and p-value), Root-mean-square error of approximation (RMSEA), and the comparative fit index (CFI).

The most influential article on fit indices in CFA has been that by Hu and Bentler (1999), to the extent that Barrett (2007) has indicated that this work has become the „Bible” of the „Golden Rules” of fit and that it was cited over 12,500 times (as of May 09, 2012). Following their recommendations ideally, for a model that fits the data, the χ^2 would not be significant ($p < 0.05$), the RMSEA would be equal to or lower than 0.09, and the CFI would be equal to or higher than 0.95.

Statistic that minimizes the impact of sample size on the Model Chi-Square is Wheaton et al.'s (1977) relative/normed chi-square (χ^2/df). Although there is

no consensus regarding an acceptable ratio for this statistic, recommendations range from as high as 5.0 (Wheaton et al., 1977) to as low as 2.0 (Tabachnick & Fidell, 2007). According to Kline (2005), a model demonstrates reasonable fit if the χ^2 statistic adjusted by its degrees of freedom does not exceed 3.0.

Some authors (Beauducel and Wittmann, 2005; Marsh, Hau, & Wen, 2004) sought to replicate Hu and Bentler’s (1999) conditions. They came to the general conclusion that the cut-offs recommended by Hu and Bentler were to a certain degree conservative for some types of models.

In this paper we decided to follow the recommendations by Iacobucci (2010) and present the χ^2 (and its degrees of freedom and p-value), RMSEA, CFI. Besides, in order to preserve comparability with earlier papers on the psychometric properties of the EQ, we included GFI and χ^2/df as well as Goodness of fit index (AGFI).

The results of CFA are presented in Table 6.

Table 6. *Confirmatory factor analyses of the short EQ (N items = 28)*

Model	Goodness of fit indices							
	X ²	df	P	X ² /df	RMSEA	GFI	AGFI	CFI
One-factor model	1410.581	350	.000	4.03	0.066	0.831	0.804	0.672
Three-uncorrelated factors model	1187.609	350	.000	3.393	0.059	0.887	0.869	0.741
Three-correlated factors model	984.718	347	.000	2.838	0.051	0.900	0.883	0.803

X²=chi square test; df=degrees of freedom; GFI=goodness of fit index; CFI= Comparative Fit Index; AGFI=Adjusted goodness of fit index; RMSEA=root mean square error of approximation

The results of PCA and CFA do not support original proposition of unifactorial structure of the EQ, equally for the 40- and 28-item versions of the scale.

Indeed, the chi-square values were statistically significant for all solutions. Normed chi-squares (χ^2/df) for the „one factor” and the „three uncorrelated factor” models exceed the value of 3 recommended by Kline (2005). All models have χ^2/df greater than 2 recommended by Tabachnik and Fidel (2007). All fit indices based on Chi-square (AGFI, CFI) indicated poor fit except the GFI for the „Three-correlated factors” model. Nevertheless, the other fit indices based on the difference between the residuals of the sample covariance matrix and the hypothesized covariance model achieved their conventional adequacy standards. On the item level all the standardized factor loadings (except item 29) and correlations between proposed factors in the third model were statistically significantly different from zero, as well as all the correlations between the factors. There are several items with factor loadings lower than 0.30 (items 4, 21, 27, 29, 35 and 57).

In conclusion, if we follow the rules strictly, all of the previously identified factorial models have to be rejected given the poor fit to the data. Some other

solutions based on EFA probably would provide better fit on Serbian sample, but, other psychometrical proprieties, as well as the need to preserve compatibility with other translations and studies ensuing from them, made us decide to stay with the solution proposed by other authors (Lawrence et al., 2004).

Correlations with IRI

Correlations between the total original EQ, EQ–28, and sub-scale factor scores with IRI total and sub-scale scores are shown in the Table 7.

Table 7. Pearson's correlations between the EQ–28 and the Interpersonal Reactivity Index

	EQ total	EQ–28 total	EQ-CE	EQ-ER	EQ-SS	IRI-PT	IRI-F	IRI-EC	IRI-PD
EQ–28 total	.929(**)								
EQ Cog. empathy	.703(**)	.606(**)							
EQ Emot. reactivity	.796(**)	.772(**)	.351(**)						
EQ Social skills	.517(**)	.451(**)	.275(**)	.238(**)					
IRI Persp. taking	.458(**)	.471(**)	.259(**)	.429(**)	.106(*)				
IRI Fantasy	.186(**)	.193(**)	.031	.301(**)	-.061	.200(**)			
IRI Empat. concern	.394(**)	.424(**)	.199(**)	.497(**)	-.008	.298(**)	.324(**)		
IRI Personal distress	.300(**)	.298(**)	.071	.465(**)	-.049	.230(**)	.166(**)	.406(**)	
IRI total	.486(**)	.503(**)	.198(**)	.624(**)	-.012	.604(**)	.654(**)	.760(**)	.671(**)

** Correlation is significant at the 0.01 level (2-tailed)

* Correlation is significant at the 0.05 level (2-tailed).

The correlation between total scores on the EQ–28 and the original EQ is high and significant ($r=.929, p<.001$). Sub-scales of the EQ–28 have positive inter-correlations ranging from $r=.238$ ($p<.001$) between EQ-ER and EQ-SS to $r=.351$ ($p<.001$) between EQ-CE and EQ-ER. Short EQ total score has the highest positive correlation with the „emotional reactivity” ($r=.772, p<.001$). Correlations between the EQ–28 total score with the other two components are $r=.606$ ($p<.001$), and $r=.451$ ($p<.001$), for „cognitive empathy” and „social skills,” respectively.

The correlation between the EQ–28 total score and the IRI total score is moderate and significant ($r=.503, p<.001$). Correlations between the EQ–28 total score and the IRI subscales range from low to moderate: the lowest is with „fantasy” ($r=.193, p<.001$) and the highest with „perspective taking” ($r=.471, p<.001$). EQ subscale „emotional reactivity” has moderate positive correlations with all subscales of the IRI, ranging from .301 with „fantasy” to .497 with „empathic concern.” Contrary to the findings of other authors (Kim & Lee, 2010; Lawrence et al., 2004), we found a positive correlation between „emotional reactivity” and „personal distress” ($r=.465, p<.001$). „Cognitive empathy” scale was correlated with Perspective taking ($r=.259, p<.001$) and „empathic concern” ($r=.199, p<.01$). „Social skills” scale has the weakest convergent validity, since it was positively correlated only with „perspective taking” ($r=.106, p<.05$).

DISCUSSION

The aim of the study was to examine the reliability, factor structure, and concurrent validity of the Serbian translation of the EQ.

The Serbian versions of EQ, with 40 and 28 items, demonstrated acceptable internal consistency, measured by Cronbach's alpha. Still, alpha values of .782 for the original version and .805 for the 28-item version are among the lowest established in the studies with the EQ so far, together with values obtained in studies by Kim & Lee (2010) and Preti et al. (2011). In particular, the alphas for the sub-scales of the 28-item version are considerably lower than in the previous studies. This is especially the case with the Social skills scale, which has alpha = .320. The case may be that this subscale is simply not working properly when administered to the Serbian population. Otherwise, the result is not easy to understand, since one should not expect important empathy impairments among adolescents. Namely, developmental research suggests that empathy is primarily an affective phenomenon that is significantly transformed by cognitive development during adolescence, which enables the full range of empathic reactions (Hoffman, 2003). It is possible, however, that this capacity gets more stable in the adulthood through growing experience in different interpersonal situations. One confirmation for this comes from the study performed with the Serbian EQ on the university students where Cronbach's alpha was .824 (Dimitrijevic, Hanak, & Milojevic, 2011). Another possible explanation is that adolescents were less motivated to take part in the study than students, since they could leave the classroom as soon as they finished and some of them might have rushed wishing to use the opportunity.

The mean EQ score for the total sample of 40.87 was in the middle range of the scores obtained in other countries (Baron-Cohen & Wheelwright, 2004; Kim & Lee, 2010; Lawrence et al., 2004; Lepage et al., 2009; Munzer & Ling, 2006; Preti et al., 2011). It was also quite comparable with the one found in the subsample of the university students of non-helping professions in another study conducted with Serbian EQ (Dimitrijevic, Hanak, & Milojevic, 2011). Additionally, it may turn out that this finding adds to a pattern of cultural differences in the empathizing capacity. The mean scores obtained in the other European studies were higher than those in Canada and the Far East: they range from 42.1 in England and 41.8 in Italy, to 39.98 for students of humanities and 36.42 students of science in Canada, to 35.4 in Korea and 33.4 in Japan.¹⁰

Gender differences were expected and female superiority in empathy, measured with the EQ, was established. Females scored higher both on the mean EQ score of the original 40-item measure and the three subscales of the version with 28 items. In our study, the gender differences in the total EQ scores stem mainly from differences in „emotional reactivity,” ($t = -9.360 (692) r_{pb} = .335 p = .000$), followed by differences in cognitive empathy ($t = -3.956 (692) r_{pb} = .149$

10 In one study (Lawrence et al., 2004), the mean score was much higher – 46.2, but we believe that it was due to the fact that the sample consisted of health professionals at the London Institute of Psychiatry, who are likely well above average in empathizing capacity.

$p=.000$), while those that come from „social skills” are comparably neglectable ($t=-2.024$ (682) $r_{pb}=.077$ $p=.043$). Thus, we have confirmed results found by Lawrence et al. (2004) and Muncer & Ling (2006). We also confirmed that more men score below the cut-off score of 30.

The results of PCA and CFA do not support original proposition of unifactorial structure of EQ, equally for the 40- and 28-item versions of the scale. Generally speaking, it is very difficult to meet criteria for model fit, especially chi square and GFI using CFA on test items because discrepancy between original and reproduced covariances cumulatively increase with number of variables. A three-factor structure of the short version offers only partially satisfactory fit to the data, according to the results of the CFA. Nevertheless, we have confirmed deficiencies of the scale, which were revealed in the other papers as well. We will summarize those findings and propose a few possibilities for further use of the Serbian version of EQ.

There are a number of items which did not show adequate psychometric qualities in both our study and the reviewed studies. Munzer and Ling (2006) pointed out that some of the problems with the proposed short form of EQ with 28 items were caused by items which loaded onto more than one latent factor. Such items were: 43, 36, 1 and 22. Also item 57 had a poor item-total correlation as well as the correlation with the „social skills” factor. Authors also proposed omitting item 29, since it was measuring something very similar to item 21. Preti et al. (2011) also found a mismatch when they compared items which loaded on the three factors extracted in PCA and the items loaded on the factors in the study of Lawrence et al. (2004). Items 21, 22, 29, 36 failed to load onto emotional reactivity and item 1 failed to load onto social skills. Item 57 had negative loading onto social skills, as was the case in our study, too. Three of the above mentioned items had weak item-total correlations and low or inadequate loadings in our study as well: 22, 29 and 57.

Results of the PCA revealed, as in the study of Preti et al. (2011), a different degree of match of extracted factors with the subscales defined on the base of the factor loadings of the items in Lawrence et al (2004). The first factor is equivalent to the proposed „cognitive empathy” scale. Contrary to the results of Preti et al., but in line with the results of Muncer & Ling (2006), we found that the weakest scale was „social skills” (with Cronbach’s alpha = .320 and stability expressed with index of congruence $CC = .8145$), whereas „emotional reactivity” has acceptable reliability and stability. In the study of Preti et al. (2011), it was „emotional reactivity” that had weaker stability ($CC=.871$).

Concurrent validity of the 28-item version of the EQ was examined by the correlation analysis with the Interpersonal Reactivity Index. „Emotional reactivity” correlates moderately with all IRI subscales and the IRI total score ($r = .624$). Correlation of „cognitive empathy” with IRI is much lower, even with the cognitive dimension of empathy as measured by „perspective taking” scale of IRI. On the other hand, „social skills” scale correlates only with „perspective taking” scale of IRI, and the correlation is weak. Therefore, the place of „social skills” in the concept and operationalization of empathy may need re-

examination. On the one hand, it seems reasonable that social skills form a part of the concept of empathy. A person who understands someone else's emotional experience and way of thinking correctly can behave adequately, which increases the probability that others will value this behavior highly and perceive this person as good social interaction partner, as well as that this person will believe to have developed mature social skills. On the other hand, more thorough examination may reveal that it is more correct to consider empathy and social skills as interrelated but independent than to subsume social skills under empathy. Social competence can be defined as the efficacy in social interactions (Rose-Krasnor, 1997) and it is an independent and complex phenomenon founded upon a host of capacities, empathy being one of them, alongside emotional regulation, preferred style of coping with aversive emotions, etc. For instance, in a study with Serbian younger adolescents (Petrović, 2007) it was shown that groups of children, formed upon the level of social preference to the group of popular, rejected and children of average socio-metric status significantly differed in the following variables: recognizing emotions, liability/negativity and according to preferred style of coping with sadness. Some even think that empathy and social competence are not necessarily correlated, since too much empathy may lead to distress that inhibits socially competent behaviour (Eisenberg & Mussen, 1989).

It seems obvious that we are still far from consent about the relationship between empathy and social competence. The results of our study question subsuming social skills under empathy and suggest that in future research psychologists interested in empathy should focus on the complex mutual relationship of the two phenomena.

What are the implications of the results of the present study? Given the convergence of our results with the recent research on psychometric properties of different versions of EQ, it can be concluded that:

- a) In its Serbian translation, the EQ, with minor discrepancies, shows reliability and validity parameters previously obtained in studies across the globe: Cronbach's alpha approaches .8; the mean scores are similar to those of other European studies; women score higher than men; correlations with another established empathy measure – Interpersonal Reactivity Index – are moderate and significant.
- b) The EQ would benefit from excluding a number of items. In our research, as well as in the others which used CFA, better indices of model fit were consistently established for the shorter, 28-item version of the EQ when compared to the original 40-item scale.
- c) The EQ measures at least two different aspects of empathy – „cognitive empathy” and „emotional reactivity.” Those aspects have adequate concurrent validity when compared to the IRI.
- d) „Social skills” scale may be included into the model since three-factorial solution fits the data reasonably well. Nevertheless, this scale has the lowest replicability, reliability, and concurrent validity. From the theoretical point

of view, its inclusion may also be questioned. This fact may inspire research with an even shorter version of the EQ, consisting of only two subscales.

- e) „Cognitive empathy,” „emotional reactivity” and „social skills” have low to moderate intercorrelations. Although most of the authors utilized orthogonal rotation in PCA, and we did that too, there is no evidence that this practice is justified. The results of CFA demonstrate better fit for the model with three correlated factors.

It would be valuable to examine and validate S-EQ in the population based sample. Also, the examination of the validity of the S-EQ for use in clinical settings should be done both on non-clinical and clinical samples (such as subjects with Asperger syndrome and Borderline Personality Disorder). The S-EQ should preferably be used in pair with the „Systemizing Quotient,” which still has not been translated into Serbian, because only then it will become possible to adequately test Baron-Cohen’s model of the (lack of) empathy in various samples.

In conclusion, the present study (a) provides Serbian researchers with an acceptably reliable and valid measure of empathy whose psychometric characteristics were thoroughly analyzed and that would yield results comparable to those obtained in other cultures; (b) shows that the S-EQ total score (but not the sub-scores) can be used for clinical assessment; (c) partially confirms satisfactory psychometric properties, in particular of the 28-item version of the EQ, mostly its concurrent validity, and gives additional evidence for complex factorial structure of EQ; (d) calls for further research and possible development of an even shorter two-factor version of the EQ; and (e) indicates that besides gender differences in the EQ scores, systematic study of age and culture difference may make a valid agenda as well. For all these reasons, we believe that the „Serbian Empathy Quotient” will be of use in the research testing of the phenomenon of empathy and its different conceptualizations.

REFERENCES

- Aragno, A. (2008). The language of empathy: An analysis of its constitution, development, and role in psychoanalytic listening. *Journal of the American Psychoanalytic Association*, 56, 713–740.
- Auyeung, B., Baron-Cohen, S., Wheelwright, S., Samarawickrema, N., Atkinson, M., & Satcher, M. (2009). The Children’s Empathy Quotient (EQ-C) and Systemizing Quotient (SQ-C): A study of sex differences, typical development and autism spectrum conditions. *Journal of Autism and Developmental Disorders*, 39, 1509–21.
- Baret, P. (2005). *Factor Similarity Analysis – ORTHOSIM-2 – Factor and Multidimensional Scaling orthogonal vector Matrix comparison*, downloaded from <http://www.pbarrett.net/orthosim2.htm>
- Baron-Cohen, S. (2003). *The Essential Difference: Men, Women, and the Extreme Male Brain*. London: Penguin Books.
- Baron-Cohen, S. (2011). *Zero Degrees of Empathy. A New Theory of Human Cruelty*. London: Penguin Books.

- 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*, 358, 361–374.
- Baron-Cohen, S., & Wheelwright, S. (2004). The Empathy Quotient: an investigation of adults with Asperger Syndrome or high functioning autism and normal sex differences. *Journal of Autism and Developmental Disorders*, 34, 163–175.
- Barrett, P. (2007). Structural equation modeling: Adjudging model fit. *Personality and Individual Differences*, 42, 815–824.
- Beauducel, A., & Wittmann, W. W. (2005). Simulation study on fit indexes in CFA based on data with slightly distorted simple structure. *Structural Equation Modeling*, 12, 41–75.
- Bentler, P. M. (2007). On tests and indices for evaluating structural models. *Personality and Individual Differences*, 42, 825–829.
- Bentler, P. M., & Bonett, D. G. (1980). Significance tests and goodness of fit in the analysis of covariance structures. *Psychological Bulletin* 3, 588–606.
- Berthoz, S., Wessa, M., Kedia, G., Wicker, B., & Grèzes, J. (2008). Cross-cultural validation of the empathy quotient in a French-speaking sample. *Canadian Journal of Psychiatry*, 53, 469–477.
- Browne, M. W., & Cudeck, R. (1993). Alternative ways of assessing model fit. In: K. A. Bollen & J. S. Long (Eds.), *Testing structural equation models* (pp. 136–162). Newbury Park, CA: Sage.
- Burt, C. (1948). The factorial study of temperament traits. *British Journal of Psychology, Statistical Section*, 1, 178–203.
- Chakrabarti, B., Dudbridge, F., Kent, L., Wheelwright, S., Hill-Cawthorne, G., Allison, C., Banerjee-Basu, S., & Baron-Cohen, S. (2009). Genes related to sex steroids, neural growth, and social-emotional behavior are associated with autistic traits, empathy, and Asperger syndrome. *Autism Research*, 2, 157–177.
- Chapman, E., Baron-Cohen, S., Auyeung, B., Knickmeyer, R., Taylor, K., & Hackett, G. (2006). Foetal testosterone and empathy: Evidence from the „Empathy Quotient” (EQ) and the „Reading the Mind in the Eyes” test. *Social Neuroscience*, 1, 135–48.
- Davis, M. H. (1980). A multidimensional approach to individual differences in empathy. *JSAS Catalog of Selected Documents in Psychology*, 10, 85.
- Davis, M. H. (1983a). Measuring individual differences in empathy: Evidence for a multidimensional approach. *Journal of Personality and Social Psychology*, 44, 113–126.
- Davis, M. H. (1983b). The effects of dispositional empathy on emotional reactions and helping: A multidimensional approach. *Journal of Personality*, 51, 167–184.
- Davis, M. H. (1994). *Empathy: A Social Psychological Approach*. Colorado: Westview press.
- De Waal, F. (2009). *The Age of Empathy: Nature’s Lessons For a Kinder Society*. New York: Three Rivers Press.
- Dimitrijević, A., Hanak, N., & Milojević, S. (2011). Psihološke karakteristike budućih pomagača: empatičnost i vezanost studenata psihologije [Psychological characteristics of future helping professionals: Empathy and attachment of psychology students]. *Psihologija*, 41, 97–115.
- Eisenberg, N., & Lennon, R. (1983). *Sex differences in empathy and related capacities*. *Psychological Bulletin*, 94, 100–131.
- Eisenberg, N., & Mussen, P. H. (1989). *The roots of prosocial behavior in children*. Cambridge: Cambridge University Press.
- Fulgosi, A. (1981). *Faktorska analiza* [Factor Analysis]. Zagreb: Školska knjiga.
- Goldberg, A. (2011): The enduring presence of Heinz Kohut: Empathy and its vicissitudes. *Journal of the American Psychoanalytic Association*, 59, 289.

- Hogan, R. (1969). Development of an empathy scale. *Journal of Consulting and Clinical Psychology, 12*, 307–316.
- Hofman, M. L. (2003). *Empatija i moralni razvoj – značaj za brigu i pravdu* [Empathy and moral development: Implications for caring and justice]. Beograd: Dereta.
- Hu, L. T., & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling, 6*, 1–55.
- Iacobucci, D. (2010). Structural equations modeling: Fit Indices, sample size, and advanced topics. *Journal of Consumer Psychology, 20*, 90–98.
- Jackson, D. L., Gillaspay Jr, J. A., & Purc-Stephenson, R. (2009). Reporting practices in confirmatory factor analysis: An overview and some recommendations. *Psychological Methods, 14*, 6–23.
- Jöreskog, K. G., & Sörbom, D. (1989). A guide to the program and applications LISREL 7 (2nd ed.). Chicago: SPSS publications.
- Kim, J., & Lee, S. J. (2010). Reliability and validity of the Korean version of the Empathy Quotient Scale. *Psychiatry Investigation, 7*, 14–30.
- Kline, R. B. (2005). *Principles and practice of structural equation modeling*. (2nd ed.). New York: Guilford.
- Knežević, G., & Momirović, K. (1996). RTT9G i RTT10G: Programs for the analysis of metric characteristics of composite measuring instruments. In: P. Kostić, *Measuring in Psychology, 2* (pp. 35–56). Belgrade: Institute of Criminological and Sociological Research.
- Kohut, H. (1982). Introspection, empathy and the semicircle of mental health. *International Journal of Psychoanalysis, 11*, 395–408.
- 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*, 911–924.
- Lepage, J.-F., Lortie, M., Taschereau-Dumouchel, V., & Theoret, H. (2009). Validation of French-Canadian versions of the Empathy Quotient and Autism Spectrum Quotient. *Canadian Journal of Behavioral Science, 41*, 272–276.
- Lorenzo-Seva, U., & Ten Berge, J. M. F. (2006). Tucker's congruence coefficient as a meaningful index of factor similarity. *Methodology, 2*, 57–64.
- Marsh, H. W., & Hocevar, D. (1985). Application of confirmatory factor analysis to the study of self-concept: First and higher-order factor models and their invariance across groups. *Psychological Bulletin, 97*, 562–582.
- McDonald, R. P., & Ho, M.-H. R. (2002). Principles and practice in reporting structural equation analyses. *Psychological Methods, 7*, 64–82.
- Mehrabian, A., & Epstein, N. (1972). A measure of emotional empathy. *Journal of Personality, 40*, 525–543.
- Muncer, S. J., & Ling, J. (2006). Psychometric properties of the empathy quotient (EQ) scale. *Personality and Individual Differences, 40*, 1111–1119.
- Petrović, J. (2007). *Emocionalni temelji socijalne kompetencije* [Emotional foundations of social competence]. Beograd: Zadužbina Andrejević.
- Preti, A., Vellante, M., Baron-Cohen, S., Zucca, G., Petrello, D. R. & Masala, L. (2011). The Empathy Quotient: A cross-cultural comparison of the Italian Version. *Cognitive Neuropsychiatry, 16*, 50–70.
- Rose-Krasnor, L. (1997). The nature of social competence: A theoretical review. *Social Development, 6*, 111–135.
- Shamay-Tsoory, S. G., Aharon-Peretz, J., & Perry, D. (2009). Two systems for empathy: A double dissociation between emotional and cognitive empathy in inferior frontal gyrus versus ventromedial prefrontal lesions. *Brain, 132*, 617–627.

- Schulte-Ruther, M., Markowitz, H. J., Shah, N. J., Fink, G. R., & Piefke, M. (2008). Gender differences in brain networks supporting empathy. *NeuroImage*, *42*, 393–403.
- Steiger, J. H. (1990). Structural model evaluation and modification: An interval estimation approach. *Multivariate Behavioral Research*, *25*, 173–180.
- Tabachnick, B. G., & Fidell, L. S. (2007). *Using Multivariate Statistics* (5th ed.). New York: Allyn and Bacon.
- Tucker, L. R. (1951). A method for synthesis of factor analysis studies (Personnel Research Section Report No. 984). Washington, DC: Department of the Army.
- Tucker, L., & Lewis, C. (1973). A reliability coefficient for maximum likelihood factor analysis. *Psychometrika*, *38*, 1–10.
- Turkle, S. (2011). *Alone, Together: Why We Expect More from Technology and Less from Each Other*. New York: Basic Books.
- Vukosavljević-Gvozden, T. (2002). *Empatija i slika o sebi* [Empathy and self-representation]. Beograd: Institut za psihologiju.
- Wakabayashi A., Baron-Cohen S., Uchiyama T., Yoshida Y., Kuroda M., & Wheelwright S. (2007). Empathizing and systemizing in adults with and without autism spectrum conditions: cross-cultural stability. *Journal of Autism and Developmental Disorders*, *37*, 1823–1832.
- Wakabayashi, A., Baron-Cohen, S., Wheelwright, S., Goldenfeld, N., Delaney, J., Fine, D., Smith, R., & Weil, L. (2006). Development of short forms of the Empathy Quotient (EQ-Short) and the Systemizing Quotient (SQ-Short). *Personality and Individual Differences*, *41*, 929–940.
- Wheaton, B., Muthen, B., Alwin, D., F., & Summers, G. (1977). Assessing reliability and stability in panel models. *Sociological Methodology*, *8*, 84–136.