

FACTOR STRUCTURE INVARIANCE AND DISCRIMINANT VALIDITY OF THE SELF-CURIOSITY ATTITUDE-INTEREST SCALE

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This study evaluated the factor structure of the Self-Curiosity Attitude-Interest (SCAI) scale. We conducted analyses of the configural, metric, and scalar factor invariance of the SCAI using data from three groups of participants with varying levels of fluid intelligence. We also explored the relationship between fluid intelligence and self-curiosity. The results provided support for the previously identified two-component factor structure of the SCAI (Aschieri & Durosini, 2015). The factor structure was invariant across the different levels of participant intelligence. Furthermore, as expected, regression analyses did not yield a significant relationship between self-curiosity and fluid intelligence. Limitations of this study and areas for future research are discussed.

Key words: Curiosity; Self; Intelligence; Raven Standard Progressive Matrices; Personality assessment.

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Curiosity is a complex aspect of human behavior as evidenced by its shifting conceptualization over time. In the past, curiosity has been seen either as an unpleasant state, triggered by unusual stimulations, aimed at reducing cognitive and perceptual incoherence (Berlyne, 1954) or as a pleasant experience pursued to maintain the organism in an “optimal level of arousal,” namely one in which research of novelty and anxiety are balanced (Berlyne, 1967). Historically, curiosity has been characterized as epistemic (related to abstract knowledge), perceptual (connected to sensorial stimuli), specific (focused on a target), or diversive (aimed at maintaining the subject’s activity) (Berlyne, 1960, 1978). Curiosity is currently viewed as a potential outcome of

feelings of interest or of feelings of deprivation (Litman, 2005). Kashdan and Fincham (2004) recently found that curiosity comprises both dispositional (trait) and situational (state) components.

The desire and interest in discovering new aspects of one's own inner world has recently been identified as a specific aspect of curiosity. Self-curiosity is conceptualized as one's disposition about exploring the self and discovering new aspects of its psychological functioning. A new self-report measure, the Self-Curiosity Attitude-Interest (SCAI; Aschieri & Durosini, 2015; see Appendix) scale, was developed to assess this phenomenon. The SCAI comprised two factors: Attitude toward Self-Curiosity, which is a four-item factor (e.g., "The best part of traveling is what it teaches us about ourselves"), and the three-item Interest in Increasing Knowledge of Self factor (e.g., "I am not interested in understanding how my past experiences impact my current life"). The SCAI has acceptable internal reliability ($\alpha = .65$), good test-retest reliability ($r = .78$) and construct validity. The scale partially overlaps, yet is distinct from other related constructs such as reflection ($r = .55$), openness to experience ($r = .35$), and general curiosity ($r = .30$). From a clinical point of view, these constructs represent metacognitive traits that enable self-regulation activities, direct one's attention toward the inner world, and promote the exploration of mindful feelings and sensations. Self-curiosity can be thought of as a part of overarching processes, such as metacognition, but it also has a more focused scope and a more specific aim: increasing knowledge of one's own psychological functioning.

One aspect of curiosity that could be related to the factor structure and validity of the scale is intelligence. General intelligence is positively correlated with general curiosity and openness to experience (Powell & Nettelbeck, 2014; Silvia & Sanders, 2010). Although there is a relationship between intelligence and general curiosity, findings from the psychotherapy literature suggest that these two client factors could be operating very differently when it comes to treatment-relevant outcomes. On the one hand, processes with similar psychological underpinnings like self-curiosity are instrumental to the course and positive outcomes of psychotherapy. Psychological mindedness, the "patient's ability to recognize psychological problems, use psychological terminology, and acknowledge possible psychological causes" (Barrett, Chua, Crits-Christoph, Connolly Gibbons, & Thompson, 2008, p. 251), promotes retention in therapy while awareness and contact with emotion impacts the process and outcome of psychological treatment (Elliott, Geenberg, & Lietaer, 2004). Further, a client's openness to emotions and inner experiencing appears to benefit treatment outcomes (Bohart & Greaves Wade, 2013), particularly in experiential and psychodynamic treatment. On the other hand, client intelligence is typically unrelated to psychotherapy outcomes (see, for a review, Bohart & Greaves Wade, 2013). Despite early results to the contrary (Barron, 1953; Rosenberg, 1954), recent reviews of the psychotherapy outcome literature exclude intelligence from the list of client characteristics related to treatment success (Garfield, 1994; Lambert, 2013). Thus, fluid intelligence is an appropriate variable to use when assessing the discriminant validity of the SCAI.

Despite promising psychometric properties, the invariance of the factor structure and the discriminant validity of the SCAI have not yet been evaluated. In this study, we focus on fluid intelligence, which is defined as flexible thinking and novel problem solving. We evaluated the factor invariance of the SCAI across three groups of participants with varying levels of fluid intelligence and the discriminant validity of the SCAI with respect to intelligence. This study also addresses the relation between self-reported self-curiosity and intelligence. We expected to find no association of fluid intelligence with any aspect of self-curiosity.

METHOD

Participants and Procedure

We administered the SCAI and the short form of the Raven Standard Progressive Matrices (Bouma, Mulder, & Lindeboom, 1996) to 122 participants recruited through psychology blogs, commercial mailing lists, and social networks. The participants consented to the study and completed the two measures online. Participants were entered into a draw to win items such as USB flash drives, pens, and neck chains. Eighty-six women and 36 men (age: $M = 26.86$, $SD = 6.95$) with an average of 14.93 years of education ($SD = 2.98$) participated in the study.

Measures

Self-Curiosity Attitude-Interest (SCAI) scale. The SCAI is a seven-item self-report Likert-type scale (1 = *completely disagree*, 7 = *completely agree*) questionnaire that assesses individual differences in curiosity about self. The measure has a bidimensional factor structure: Attitude toward Self-Curiosity, referring to the cognitive propensity to explore one's own psychological functioning, and Interest in Increasing Knowledge of Self, referring to the emotional and motivational desire to understand one's inner world.

Standard Progressive Matrices (SPM). The SPM is a widely used measure of general mental ability or fluid intelligence (Raven, Raven, & Court, 2000), assessing particularly perceptual processes and analogical reasoning (van der Ven & Ellis, 2000). Various shorter versions of the original 60 items matrices were developed to address the length of the administration. This study used the 36 items version developed by Bouma et al. (1996) and normed by Van der Elst et al. (2013). IQ standardized scores were estimated with the software created by Van der Elst et al..

Data Analyses

Analyses were conducted in SPSS, Version 21.0 (2012) and AMOS, Version 21.0 (2012). Preliminary analyses indicated that the distribution of fluid intelligence (IQ) in this sample resembled a normal curve ($M = 98.88$, $SD = 12.77$; Skewness = .39; Kurtosis = .48). We used the SPM distribution to divide the sample into tertiles, which resulted in three groups with similar size. Group 1 included 41 participants with IQs between 72 and 92. Group 2 included 41 participants with IQs between 93 and 104. Group 3 included 40 participants with IQs between 105 and 144. Omnibus chi-square tests did not reveal any significant differences among the tertiles concerning gender, age, or employment status. Analysis of variance revealed that participants in Group 3 had a higher education attainment ($M = 16.12$, $SD = 2.45$) compared to those in Group 1 ($M = 14.71$, $SD = 2.87$) and Group 2 ($M = 13.97$, $SD = 3.20$), $F(2, 119) = 5.88$, $p < .01$ (Table 1).

An analysis of measurement invariance was conducted to determine whether the two-factor structure and single items of the SCAI differed across the three groups (Brown, 2006; Byrne, 2001). We conducted this analysis by testing increasingly restrictive models. Model 1 tested the equality of the factor structure across groups — a test of configural invariance. Model 2 tested the metric invariance by constraining the factor pattern coefficients to be equal across groups. Scalar invariance was tested in Model 3 by constraining the intercepts of individual items

to be equal across groups. Chi-square difference tests were used to test the difference in the fit of the baseline model compared to a model with the equality constraints added.

Bootstrapping with 1000 iterations was used to test the reliability of the results. Concerning discriminant validity, linear regressions were used to evaluate the relation between the total score and the two factors of the SCAI and intelligence.

TABLE 1
 Sociodemographic variables by group

Descriptive data	Group 1 (N = 41)		Group 2 (N = 41)		Group 3 (N = 40)		χ^2	df	p
	n	%	n	%	n	%			
<i>Gender</i>							2.99	2	.22
Women	32	78.0	25	61.0	29	72.5			
Men	9	22.0	16	39.0	11	27.5			
<i>Age range</i>							4.31	6	.63
18-25	26	63.4	22	53.7	19	47.5			
26-35	13	31.7	16	39.0	18	45.0			
36-45	2	4.9	2	4.9	1	2.5			
46-65	–	–	1	2.4	2	5			
<i>Employment status</i>							5.44	6	.49
Unemployed	25	61.0	22	53.7	22	55.0			
Blue collar	7	17.1	8	19.5	3	7.5			
White collar	6	14.6	8	19.5	8	20.0			
Self-employed	3	7.3	3	7.3	7	17.5			

Note. Chi-square tests were used to assess group differences in gender, age, and employment status.

RESULTS

The total scale of the SCAI showed a good internal consistency ($\alpha = .72$). Factor 1 and Factor 2 had alpha coefficients equal to .67 and .72, respectively. Table 2 and Table 3 report inter-item correlation matrix, descriptive data and item-total correlation coefficients for all the seven items of the SCAI in each of the three groups considered.

A confirmatory factor analysis was conducted prior to comparing the factor structure across the three groups with different IQs to assess the fit of the two-factor solution reported by Aschieri and Durosini (2015) on the full sample. Results indicated excellent model fit: $\chi^2(13) = 6.35$, $\chi^2/df = .49$; GFI = .98; RMSEA = .00, 90% CI [.00, .02]; CFI = 1.00; SRMR = .04. CFAs were also run within each tertile to assess the fit of the model in each group. Results show good model fit for Group 1: $\chi^2(13) = 12.97$, $\chi^2/df = 1.00$; GFI = .92; RMSEA = .000, 90% CI [.00, .16]; CFI = 1.000; SRMR = .09; Group 2: $\chi^2(13) = 9.97$, $\chi^2/df = .77$; GFI = .94; RMSEA = .000, 90% CI [.00, .12]; CFI = 1.000; SRMR = .06; Group 3: $\chi^2(13) = 9.25$, $\chi^2/df = .71$; GFI = .94; RMSEA = .00, 90% CI [.00, .11]; CFI = 1.00; SRMR = .09.



TABLE 2
Inter-item correlations coefficients by group

Item	1	2	3	4	5	6	7
1. I like to listen to music because it teaches me what I am like as a person	–						
2. The best part of traveling is what it teaches us about ourselves	.34/.43/.37	–					
3. My favorite movies are those that taught me new things about myself	.46/.29/.43	.39/.38/.27	–				
4. I select my best friends among those with whom I can grow as a person	.39/.37/.15	.38/.28/.03	.51/.26/.12	–			
5. I am not interested in understanding how my past experiences impact my current life	.10/.29/.36	.18/.38/–.00	.33/.32/.17	.37/.14/.12	–		
6. I get bored when I have to talk about my feelings	–.08/.22/.29	–.10/.25/.00	.17/.44/.13	.04/.27/.25	.48/.34/.37	–	
7. I am not interested in understanding what motivates my behaviors	.22/.22/.36	.17/.44/–.09	.26/.22/.08	.25/.31/.32	.68/.46/.60	.39/.50/.39	–

Note. Group 1 (N = 41), Group 2 (N = 41), Group 3 (N = 40).

TABLE 3
 Means, standard deviations, descriptive statistics, item-total correlations coefficients by group

Item	<i>M</i>	<i>SD</i>	Skewness	Kurtosis	Item-total correlations
1. I like to listen to music because it teaches me what I am like as a person	4.32/4.46/4.58	1.62/1.63/1.55	-.43/-.40/-.45	-.19/.50/.04	.37/.45/.59
2. The best part of traveling is what it teaches us about ourselves	5.27/5.00/5.18	1.47/1.48/1.26	-.49/-.34/-.35	-.56/-.62/-.41	.35/.55/.19
3. My favorite movies are those that taught me new things about myself	4.54/4.51/4.33	1.70/1.42/1.61	-.62/.06/-.17	-.36/-.57/-.22	.46/.48/.35
4. I select my best friends among those with whom I can grow as a person	5.71/5.54/5.95	1.49/1.21/.99	-1.34/-.90/-.74	1.64/.53/.43	.52/.41/.27
5. I am not interested in understanding how my past experiences impact my current life	5.51/5.88/6.03	1.57/1.25/1.07	-1.33/-1.54/-1.88	1.11/2.80/4.97	.61/.49/.45
6. I get bored when I have to talk about my feelings	4.34/4.71/4.68	1.92/1.66/1.57	-.38/-.09/-.30	-.98/-1.31/-.59	.13/.51/.38
7. I am not interested in understanding what motivates my behaviors	5.66/5.76/6.20	1.54/1.55/1.02	-1.41/-1.62/-1.96	1.64/2.19/6.05	.56/.55/.45

Note. Items 5, 6, and 7 were reversed. Group 1 (*N* = 41), Group 2 (*N* = 41), Group 3 (*N* = 40).

The multigroup confirmatory factor analysis of Model 1 provided excellent fit to the data: $\chi^2(39) = 32.18$, $\chi^2/df = .82$, $p = .77$; RMSEA = .00, 90% CI [.00, .04]; CFI = 1.00; $\Delta\chi^2 = 25.83$, $\Delta df = 26$, $p = .47$, indicating that the factor structure is invariant across groups. Model 2, with item factor loadings constrained, also provided excellent fit to the data: $\chi^2(49) = 47.64$, $\chi^2/df = .97$, $p = .53$; RMSEA = .00, 90% CI [.00, .06]; CFI = 1.00; $\Delta\chi^2 = 41.29$, $\Delta df = 36$, $p = .25$. Chi-square difference test results indicated that the parameter constraints introduced in Model 2 did not result in a significant decrement in model fit compared to the baseline model, indicating that the factor loadings were invariant across the three groups. For Model 3, the intercepts were constrained to be equal across groups. Model fit was again excellent: $\chi^2(63) = 58.86$, $\chi^2/df = .93$, $p = .62$; RMSEA = .00, 90% CI [.00, .05]; CFI = 1.00; $\Delta\chi^2 = 52.51$, $\Delta df = 50$, $p = .38$, and this additional constraint did not result in a significant decrement in fit from the baseline model. The bootstrap test indicated that only the coefficient of one item (“I select my best friends among those with whom I can grow as a person”) was not reliable in the configural invariance model in Group 3, bias corrected 95% CI [-.53, .68], $p = .59$.

The analysis of linear regression analyses of continuous intelligence scores regressed on curiosity about self shows that IQ scores were unrelated to the SCAI factor Attitude toward Self-Curiosity, $R^2 = .00$, $F(1, 120) = .15$, $\beta = .01$, $p = .70$. Intelligence was not significantly related to participants’ Interest in Increasing Knowledge of Self, but the results were marginally significant, $R^2 = .03$, $F(1, 120) = 3.24$, $\beta = .04$, $p = .07$. However, the variance accounted for by intelligence was negligible. Last, overall intelligence was not significantly related to self-curiosity in general, $R^2 = .01$, $F(1, 120) = 1.62$, $\beta = .06$, $p = .20$.

DISCUSSION

The results of this study offer confirmation of the SCAI’s two-factor solution previously reported by Aschieri and Durosini (2015). Evidence of factor invariance suggests that across levels of intelligence factor structures on the SCAI were statistically similar. Metric invariance indicates that the strength of the relation between the items on the two subscales, and their corresponding factor loadings, are equivalent across groups. Lastly, scalar invariance indicates that the observed scores are related to the latent scores across groups, which indicates that individuals who have the same score on the latent construct would have the same intercept on the observed variables; in this case, level of intelligence. The results of the regression analysis indicate no relation between intelligence and self-curiosity. Stated differently, the results suggest that being interested in talking about deep and meaningful topics or being motivated to understand the origins of one’s own behaviors are not necessarily indicative of intelligence level in our sample.

CONCLUSIONS

This study focused on two important questions not addressed in previous research: (1) is the SCAI factor structure identified by Aschieri and Durosini (2015) invariant across levels of intelligence? and (2) are intelligence and self-curiosity related? Our findings indicated invariance

across three groups of participants with different levels of IQ. The results also support the discriminant validity of the SCAI concerning intelligence. Intelligence and self-curiosity appear to be unrelated. These conclusions must be considered tentative for various reasons. Intelligence was assessed with a test of fluid reasoning, which is a performance-based task, while self-curiosity was measured via self-report. Therefore, the lack of relation between intelligence and self-curiosity might be accounted for by the heteromethod-heterotrait principle (Campbell & Fiske, 1959). Despite the application of bootstrapping, the relatively small sample size of the three groups, which affects the power to detect group differences and also limits the generalizability of the findings, the results were robust. Another consideration is that our data collection procedures did not allow us to examine and control for participants' motivation and attention during administration of the SPM. Further, the SPM is a measure of one aspect of intelligence: non-verbal reasoning ability. Future research would benefit from examining the relationship between self-curiosity and verbal or crystallized intelligence.

FUTURE DIRECTIONS

Despite the noted limitations, the results of this study, coupled with previous research on the SCAI, generate new questions for empirical inquiry. Prior research highlighted a modest correlation between self-curiosity and openness to experience (Aschieri & Durosini, 2015). Openness has consistently been shown to be related to intelligence (Moutafi, Furnham, & Crump, 2006). Hence, future studies need to address the possible indirect effect of intelligence on self-curiosity, mediated by openness, and even the potential moderating role of openness on the relationship between these two variables. It could be hypothesized that differing levels of openness interact with intelligence in relation to self-curiosity.

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APPENDIX

Self-Curiosity Attitude-Interest (SCAI; Aschieri & Durosini, 2015) Scale

1. Mi piace ascoltare la musica soprattutto perché mi insegna come sono fatto [I like to listen to music because it teaches me what I am like as a person]
 2. La parte migliore del viaggiare è ciò che può insegnarci su di noi [The best part of traveling is what it teaches us about ourselves]
 3. I film che ho preferito sono quelli che mi hanno fatto scoprire aspetti nuovi di me [My favorite movies are those that taught me new things about myself]
 4. I miei migliori amici sono quelli con cui posso crescere come persona [I select my best friends among those with whom I can grow as a person]
 5. Non mi interessa capire l'impatto che le mie esperienze passate hanno su quello che succede oggi nella mia vita [I am not interested in understanding how my past experiences impact my current life]
 6. Mi annoiano i discorsi in cui devo parlare dei miei sentimenti [I get bored when I have to talk about my feelings]
 7. Non mi interessa conoscere ciò che sta alla base dei miei comportamenti [I am not interested in understanding what motivates my behaviors]
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