**The Serbian validation of three versions of the Rational-Experiential Inventory: REI-40,
REIm, and REIm-13**

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Abstract

The widely used Rational-Experiential Inventory-40 (REI-40, Pacini & Epstein, 1999) assesses rational and experiential thinking styles. Recently, the authors have distinguished three aspects of the experiential style: intuition, emotionality and imagination and developed the Rational-Experiential Multimodal Inventory (REIm, Norris & Epstein, 2011; a brief version: REIm-13, McGuiness et al., 2017).

We examined the internal consistency, structural/factorial, discriminant and known-groups validity of those three REI versions, in two Serbian student samples. Participants in Study 1 (N = 819, mean age M = 19.81, 31% males) completed REI-40 and HEXACO Personality Inventory (HEXACO-PI-R), while participants in Study 2 (N = 304, mean age M = 19.47, 29% males) completed REIm (including all REIm-13 items), HEXACO-PI-R and Disintegration inventory DELTA.

Internal consistency of REI-40 and REIm subscales was acceptable to good, and poor for REIm-13 subscales. The results of CFA analyses indicated acceptable fit for REI-40 and REIm-13, while structural validity of REIm was poor. REI-40 and REIm Rationality, REI-40 Experientiality and REIm Intuition demonstrated acceptable to good discriminant validity against personality traits, while REIm Experientiality, Emotionality and Imagination correlated highly with Openness and Emotionality. Obtained gender differences indicated acceptable known-groups validity.

Keywords: Rational-Experiential Inventory; REI-40; REIm; validity; HEXACO

Introduction

The majority of authors, especially in cognitive and social psychology, recognize the distinction between rational/reflective and experiential/intuitive information processing (Evans,

2008). A plethora of research seems to confirm that these dimensions are independent, rather than the opposite ends of a bipolar continuum (Wang et al., 2017). Although external factors could affect the preference of one over another thinking style, there are also stable individual differences in their habitual use (Pacini & Epstein, 1999; Phillips et al., 2016).

Theoretical foundations of rationality and experientiality

Similar to other dual processing models, the cognitive-experiential self-theory (CEST) posits the experiential system as preconscious, automatic, effortless, rapid, and associated with affect, and the rational system as conscious, analytical, effortful, slow, affect-free, and based on cognitive resources. The two systems are presumed to have access to distinct forms of knowledge, and each of them is linked to one of the competitive processing styles: rationality and experientiality.

Unlike other dual processing models, CEST is presented as a personality theory proposing the two thinking styles as specific variables not fully predicted by classical personality trait topologies (e.g. Big Five explained only 37% of the variance of rationality and 11% of experientiality; Epstein, 2003; Pacini & Epstein, 1999). While rationality in the CEST model corresponds to the classical understanding of cognitive abilities, the experiential system is understood in line with other evolutionary oriented models (Evans, 2008). The experiential system in the CEST is proposed to be evolutionary much older than the rational one, and it has an adaptive role as a learning system necessary for survival (Epstein, 2003; 2016).

Rational-Experiential Inventory: The three versions

There is an important distinction between measures of individual differences in cognitive abilities (what people are able to do) and dispositional thinking styles (what they prefer or are inclined to do), and these two classes of measures are not highly correlated (Evans, 2008). The

authors of CEST have considered measuring abilities (intelligence) related to both rational and experiential systems, assuming that the former can be measured by classical IQ tests, while they proposed an original instrument for measuring the intelligence of the experiential system (Constructive Thinking Inventory, CTI, Epstein, 1998, 2010). However, they mostly turned their attention to developing an instrument for measuring dispositional thinking styles.

Based on CEST assumptions, several self-report instruments for measuring individual differences in thinking styles have been developed. The most frequently used is the Rational-Experiential Inventory-40 (REI-40¹, Pacini & Epstein, 1999), while there is also a new version, the Rational-Experiential Multimodal Inventory (REIm, Norris & Epstein, 2011), and its short form, the Rational-Experiential Multimodal Inventory-13 (REIm-13, McGuiness et al., 2017).

In the initial version of REI (Epstein et al., 1996) the Rational scale was actually a modified Need for Cognition scale (Cacioppo and Petty, 1982), while the original contribution of the authors was the Faith in Intuition scale. A later version of REI (REI-40) was psychometrically improved by balancing positively and negatively worded items in both scales (rational and experiential), as well as the number of items in each scale and subscale (effectiveness/ability and frequency/engagement in the use of each thinking style; Pacini & Epstein, 1999). REI-40 has been widely used and translated into different languages, generally confirming the expected four-factor structure with orthogonal superordinate rationality and experientiality factors (e.g. Swedish, Björklund & Bäckström, 2008; Dutch and Spanish, Witteman et al., 2009; Slovakian, Ballová Mikušková et al., 2015).

And while past studies demonstrated good content validity of the Rationality scale in REI-40, convincing evidence was lacking for the Experientiality scale, which inspired the

¹ The Pacini & Epstein (1999) study has been cited by 1193 authors according to Google Scholar and 572 according to Scopus (30.10.2019)

authors to design a new version, the Rational Experiential Multimodal Inventory (REIm; Norris & Epstein, 2011). REIm kept selected items from the REI-40 rational dimension, while the experiential dimension was reconceptualized so as to be represented by three subdimensions: intuition, emotionality, and imagination. The authors, however, recommended REI-40 to be used in parallel with REIm, depending on research aims. Besides the English version, REIm has only been validated in the Italian language, confirming its proposed structure (Monacis et al., 2016).

Finally, a short version of REIm (REIm-13, McGuiness et al., 2017) was recently proposed in an attempt to provide a more convenient instrument for measuring thinking styles, given that REIm has 42 items. REIm-13 has not been widely used yet, but, considering its practical potential as a short scale, we found it worthwhile to validate as well.

To the best of our knowledge, except for the Slovakian (Ballová Mikušková et al., 2015) and the Russian (Kornilova & Razvaliaeva, 2017) validation of REI-40, there were no validations of any REI version beyond WEIRD populations (WEIRD: Western, educated, industrialized, rich, and democratic; Henrich et al., 2010). REI-40 was previously used in the Serbian language (e.g. Authors, 2019; 2021a²; Branković, 2019), but has not been validated so far, while REIm and REIm-13 had not yet been translated into Serbian. A Serbian validation would be a valuable contribution to the CEST literature, since Serbia is recognized as a non-WEIRD country, although not a typical one (i.e. as an East European country, it was poorly evaluated on industrialized and rich dimensions, but had favorable scores on educated and democratic dimensions; Klein et al., 2018).

Current study

² There is a partial overlap between the data presented in these two publications and the current study.

The current study aimed to examine the psychometric properties of REI-40, REIm and REIM-13, namely: 1) structural (factorial) validity, 2) internal consistency of scales and subscales, 3) discriminant validity against basic personality traits, and 4) known-groups validity regarding gender differences, all in two student participant samples.

We expected a four-factor solution with two correlated subdimensions of rationality and experientiality for REI-40, and a solution with one rational and three correlated experiential dimensions for REIm and REIM-13. In all cases, we expected rationality and experientiality factors to be orthogonal, although a low positive correlation would also be acceptable.

Based on previous research showing that REI scales have good internal consistency and subscales acceptable to good (Bjorklund & Backstrom, 2008; Witteman et al., 2009; Ballova Mikuskova et al., 2015; Pacini & Epstein, 1999), we expected to obtain similar results.

Past studies mostly confirmed that Big Five traits explain only a minor percentage of the variance of rationality and even less so for experientiality (Epstein, 2003; Pacini & Epstein, 1999; Witteman et al., 2009). We chose to employ the HEXACO model because it incorporates a larger amount of personality variance compared to the Big Five. This primarily refers to the inclusion of an additional, broad Honesty/Humility factor, but HEXACO may also have predictive advantages in the domain of Emotionality (HEXACO Emotionality and Agreeableness are rotational variants of Neuroticism and Agreeableness from the Big Five; Ashton & Lee, 2007; Lee & Ashton, 2018). A previous study examining the relation of REI-40 to HEXACO in Serbia showed that both rationality and experientiality mostly had low correlations with HEXACO dimensions supporting theoretical assumptions (Authors, 2019).

We also decided to include another personality dimension: *Disintegration*. Disintegration is a broad personality trait capturing psychosis proneness which has been demonstrated to be

temporally stable, normally distributed, cross-culturally validated and independent of existing personality traits in many of the most influential personality models (Knežević et al., 2017, Authors, , 2016a, Authors, 2016b). Disintegration subsumes irrational processes, such as magical thinking and a sense of enhanced awareness. It was, therefore, interesting to see whether CEST thinking styles, especially Experientiality, shared more variance with Disintegration than with other personality traits. Namely, besides its adaptive role, the experiential system is also a source of superstitions, prejudice, and biases in reasoning (Aarnio & Lindeman, 2005; Brankovic, 2019; King et al., 2007), similar to how Disintegration has been related to prejudice toward immigrants (Knežević & Keller, 2021) and engagement in pseudo-scientific practices related to COVID-19 pandemic (Authors, 2021b). The last study also found a moderate negative correlation of Disintegration with rationality and a small positive correlation with experientiality, however a very short REI version was used (10 items selected from REI-40; Authors, 2021b).

Finally, we sought to replicate the consistently found small to moderate gender differences in thinking styles. Men report higher levels of rationality and lower levels of experientiality (including intuition, emotionality and imagination) than women, with effect sizes averaging around .30 (Epstein et al., 1996; Norris & Epstein, 2011; Pacini & Epstein, 1999; Sladek et al., 2010).

We designed two studies: Study 1 examined REI-40 in relation to HEXACO and Study 2 examined REIm (and REIm-13) in relation to HEXACO and Disintegration. We opted to administer REI-40 and REIm on separate samples because there is substantial item overlap in the two instruments, and we wanted to make sure that participants viewed the items in their “natural context”, i.e. with other REI items they would typically be administered with.

Method

We report how we determined our sample size, all data exclusions (if any), all data inclusion/exclusion criteria, whether inclusion/exclusion criteria were established prior to data analysis, all measures in the study, and all analyses including all tested models. If we use inferential tests, we report exact p values, effect sizes, and 95% confidence or credible intervals.

Participants and procedure

There are no clear guidelines for determining the required sample size for confirmatory factor analysis, but some rules-of-thumb include $N > 200$ and participant:parameter ratio of 4:1 or 5:1 (Harrington, 2009). A sample size of $N = 273$ is sufficient to detect a small correlation of $r = .15$ with $p = .05$ and power = .80, while $N = 278$ enables for detection of small independent group differences of $d = .30$, with $p = .05$ and power = .80.

Participants in Study 1 were 819 students (mean age $M = 19.81$, $SD = 1.85$; 31% males) of University of Belgrade (Faculty of Philosophy $N = 270$ and Faculty of Technical Sciences $N = 549$ ³). Participants in Study 2 were 304 students (mean age $M = 19.47$, $SD = 1.79$; 29% males) of University of Belgrade (Faculty of Philosophy $N = 86$ and Faculty of Technical Sciences $N = 218$).

Data was collected in accordance with the Declaration of Helsinki. Participants were invited to take part in the study in exchange for course credit; alternative credit awarding activities were offered to those who did not wish to participate. All participants provided informed consent before taking part in the study and were debriefed as to the study goals afterwards. Participants in Study 1 completed REI-40 and HEXACO-PI-R, while participants in Study 2 completed REIm (including REIm-13 items), HEXACO-PI-R and DELTA. Participants

³ The Study 1 psychology sample has previously been used in Authors (2019) while both samples from Study 1 have been used in Authors (2021a)

completed the questionnaires either in the lab or from their home. There were no planned exclusions.

Instruments

Rational-Experiential Inventory-40 (REI-40, Pacini & Epstein, 1999) is a 40-item self-report instrument assessing rational (20 items) and experiential (20 items) thinking styles. The instrument also differentiates between Rational Ability (RA, 10 items), Rational Engagement (RE, 10 items), Experiential Ability (EA, 10 items) and Experiential Engagement (EE, 10 items). Responses are given on a 5-point Likert scale (1 = definitely not true of myself to 5 = definitely true of myself). The original study obtained high Cronbach's alpha reliabilities of $\alpha = .90$ for Rationality and $\alpha = .87$ for Experientiality, while reliabilities for subscales ranged from $\alpha = .79$ for EE to $\alpha = .84$ for RE. We used the modified Serbian translation of this scale (Branković, 2019). The modification refers to a slight change in the wording of 7 items, so that the translation would better correspond to the original item wording. In all cases the forward-backward translation procedure was used to ensure translation quality.

Rational Experiential Multimodal Inventory (REIm, Norris & Epstein, 2011) is a 42-item self-report instrument assessing the rational (12 items) and experiential thinking styles (30 items), as well as experientiality subdimensions: Intuition (10 items), Emotionality (10 items) and Imagination (10 items). Responses are given on a 5-point Likert scale (1 = definitely not true of myself to 5 = definitely true of myself). Cronbach's alpha scale reliabilities in the original study were high for both Rationality, $\alpha = .86$, and Experientiality $\alpha = .84$ and satisfactory for subscales: $\alpha = .74$ for Intuition and Emotionality and $\alpha = .78$ for Imagination. The items of REIm (which also include the REIm-13 items) were translated using the forward-backward translation procedure.

Rational Experiential Multimodal Inventory-13 (REIm-13, McGuiness et al., 2017) is a brief measure of rational (4 items) and experiential (9 items) thinking styles. It also assesses intuition (3 items), emotionality (3 items) and imagination (3 items). Responses are given on a 5-point Likert scale (1 = definitely not true of myself to 5 = definitely true of myself). The original study found reliability of scales to be somewhat lower than recommended values, ranging from $\alpha = .52$ for Emotionality to $\alpha = .73$ for Rationality, which was expected considering the number of items.

HEXACO Personality Inventory-Revised (HEXACO-PI-R, Ashton & Lee, 2007) is a 100-item inventory assessing six personality dimensions – Honesty/Humility (H), Emotionality (E), eXtraversion (X), Agreeableness (A), Conscientiousness (C) and Openness to Experience (O). Responses are given on a 5-point Likert scale (1 = strongly disagree, 5 = strongly agree). The original scale has good Cronbach's alpha reliability, ranging from .79 for Honesty-Humility to .92 for Openness to Experience. We employed the Serbian translation of the scale, which also demonstrated satisfactory reliability, ranging from $\alpha = .78$ for Emotionality to $\alpha = .84$ for Conscientiousness, as well as factorial structure similar to the original (Međedović et al., 2017).

DELTA, a short 20-item version (Knežević et al., 2017; Knežević & Keller, 2021) is a 20-item self-report inventory assessing the Disintegration trait. The reliability of the total score in our study was $\alpha = .87$.

Analytic strategy

Structural validity. We assessed structural validity via confirmatory factor analysis. For each of the instruments we compared the fit of several structural models which had previously been confirmed. We used the diagonally weighted least squares (DWLS) method of estimation

treating the items as ordered and excluded participants with missing data on single items via listwise deletion.

In case of REI-40 we tested the two-factor (rationality and experientiality) the four-factor (rational ability, rational engagement, experiential ability and experiential engagement) and the hierarchical model (ability and engagement factors forming the rationality and experientiality factors). For REIm and REIm-13, we tested the two-factor (rationality and experientiality factors), the four-factor (rationality, intuition, emotionality and imagination) and the hierarchical model (with intuition, emotionality and imagination forming the experientiality factor). For all three instruments we also tested the fit of a one-factor model for comparison purposes.

We evaluated model fit on the basis of χ^2/df ratio, Comparative Fit Index (CFI) and Root Mean Square Error of Approximation (RMSEA). Good models are characterised by $\chi^2/df \leq 2-3$, $CFI \geq .95$, $RMSEA \leq .06$. Values of $CFI \geq .90$ and $RMSEA \leq .08$ or $\leq .10$ can be considered as indicative of acceptable model fit (Brown, 2006; Harrington, 2009).

Internal consistency. We calculated Cronbach's alpha coefficients of reliability for all scales and subscales. Values of $\alpha \geq .70$ were defined as acceptable, $\alpha \geq .80$ good, and $\alpha \geq .90$ excellent (George and Mallery, 2003).

Discriminant validity. We assessed discriminant validity via correlations with HEXACO traits (and Disintegration) and regression analyses with REI scales as criterion variables, and basic personality traits as predictors. Based on the meta-analytically estimated intercorrelations between HEXACO traits, the majority of which were up to $r = .23$ (with the exception of $r = .42$ for Honesty-Humility and Agreeableness; Moshagen, Thielmann, Hilbig & Zettler, 2019), we set the value of .25 as the more strict and .40 as the more lenient benchmark for the existence of a substantial correlation between thinking styles and basic personality traits.

Correlations lower than .25/.40 would be considered as evidence of good/acceptable discriminant validity of REI instruments. Additionally, we expected that personality traits could explain no more than 40% of rationality and no more than 15% of experientiality variance (Pacini & Epstein, 1999; Witteman et al., 2009; Authors, 2019).

Known-groups validity. We assessed gender differences in REI scores through independent-group t-tests. Significant gender differences observed in this study would suggest good known-groups validity of the instruments.

Due to the number of comparisons (for 16 REI variables), we applied the Bonferroni p-correction for regression analyses and t-tests, by only considering significant models with $p \leq .05/16 \leq .003$.

The analyses were done in IBM SPSS (version 23) and R. Confirmatory factor analyses were done in the lavaan package (Rosseel, 2012).

Open Science

Data availability statement: The data that support the findings of this study are openly available on the OSF project page at https://osf.io/er2zu/?view_only=8c264321f8174a18bb1a5e9a5d1fc772, Data component (Authors, 2021c).

We confirm that there is sufficient information for an independent researcher to reproduce all of the reported methodology (OSF page, Instruments component). Studies were preregistered prior to Study 2 data collection (post Study 1 data collection) on OSF. The analytic strategy and cut-off values were determined prior to Study 2 data collection and uploaded on the OSF project page. All divergences from the preregistration are documented on OSF. All analytic scripts are also available on OSF (Analytic scripts component).

Results

Structural validity

To obtain parameter estimates for all of the hierarchical models, additional constraints had to be imposed on the models. In all three cases the loadings of the lower-level factors onto the higher order factor were constrained to be mutually equal.

Neither of the initially tested models demonstrated acceptable fit, however for all three instruments the four-factor model had the best fit (Table 1). Hierarchical models showed a similar, though slightly worse fit (for some indices the difference was at the third decimal place). Therefore, we inspected parameter estimates and modification indices for the four-factor model for both REI-40 and REIm(-13).

In the case of REI-40, adding two error covariances (for two pairs of Experiential Ability items) led to an acceptable fit of the model (although the Chi-square/df ratio was higher than the recommended value). Item loadings were mostly moderate to high and factor correlations were as theoretically expected (Tables S1.1 and S1.2 in Supplement 1).

As for REIm, even after adding up to five secondary loadings the model did not reach a satisfactory fit. We therefore inspected the fit of the one-factor solution for each of the four subscales (Table S1.3 in Supplement 1). Since these models showed satisfactory to good fit (with small modifications for Rationality and Emotionality), we decided to use the proposed subscales in subsequent analyses. It should be noted, though, that 1-2 items per subscale had loadings below .30 (Tables S1.4 to S1.7 in Supplement 1).

The fit of the four-factor model for REIm-13 was acceptable to begin with, however the estimated variance of one Intuition item, which had a standardized loading of 1.82, was negative. After fixing this loading to 1, model fit dropped slightly, but after adding one error covariance

(for one Rationality and one Imagination item) it was again acceptable. All standardized loadings were above .30 and the factor correlations were small to moderate (Tables S1.8 and S1.9 in Supplement 1).

Table 1.

Model fit of all tested confirmatory factor models

<i>Model</i>	$\chi^2(df)$	χ^2/df	<i>CFI</i>	<i>RMSEA</i>
REI-40				
One-factor	23954.97*** (740)	32.37	.64	.20
Two-factor	8350.65*** (739)	11.30	.88	.11
Four-factor	7714.37*** (734)	10.51	.89	.11
Hierarchical	7879.17*** (737)	10.69	.89	.11
Modified four-factor	5999.82*** (732)	8.20	.92	.10
REIm				
One-factor	7178.50*** (819)	8.76	.42	.16
Two-factor	4600.94*** (818)	5.62	.69	.12
Four-factor	3590.64*** (813)	4.42	.77	.11
Hierarchical	4025.40*** (817)	4.95	.73	.11
REIm-13				
One-factor	715.65*** (65)	11.01	.44	.18
Two-factor	493.66*** (64)	7.71	.63	.15
Four-factor ^a	173.51*** (59)	2.94	.90	.08
Hierarchical ^a	285.66*** (63)	4.53	.81	.11
Modified four-factor	160.75*** (59)	2.72	.91	.08

^a Negative variances estimated for some observed variables

Descriptive statistics

Next, we examined the descriptive statistics of all used instruments and their subscales in both samples (Tables 2 and 3).

Table 2.

Descriptive statistics of REI and personality variables used in Study 1

<i>Scale</i>	<i>k</i>	<i>N</i>	<i>M</i>	<i>SD</i>	<i>Min-Max</i>	<i>K-S p</i>	<i>α</i>
REI-40							
R	20	817	3.7	0.54	1.85-5	.223	.85 ^a
RA	10	817	3.74	0.55	2.1-5	.040	.73 ^b
RE	10	817	3.66	0.65	1-5	.190	.79 ^b
E	20	817	3.26	0.6	1.5-4.9	.292	.89 ^a
EA	10	817	3.34	0.67	1.4-5	.203	.83 ^b
EE	10	817	3.18	0.66	1.2-5	.038	.82 ^b
HEXACO							
H	16	731	3.4	0.64	1.38-4.88	.113	.81
E	16	731	3.31	0.64	1.38-4.94	.510	.83
X	16	731	3.41	0.7	1.31-5	.030	.88
A	16	731	2.94	0.6	1.19-4.69	.121	.82
C	16	731	3.62	0.6	2.06-5	.100	.83
O	16	731	3.55	0.71	1.56-5	.002	.85

Note. k - number of items; K-S p - Kolmogorov-Smirnov p value; α - Cronbach's alpha

reliability coefficient; ^a - N = 815 due to single-item missing responses of two participants; ^b - N = 816 due to single-item missing responses of one participant

Table 3.

Descriptive statistics of REI and personality variables used in Study 2

<i>Scale</i>	<i>k</i>	<i>N</i>	<i>M</i>	<i>SD</i>	<i>Min-Max</i>	<i>K-S p</i>	<i>alpha</i>
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REIm							
R	12	304	3.51	0.66	1.75-5	.800	.81
E	30	304	3.49	0.43	2.03-4.5	.532	.77
In	10	304	3.38	0.53	1.8-4.9	.278	.61
Em	10	304	3.41	0.6	1.4-4.8	.103	.65
Im	10	304	3.69	0.67	1.4-5	.018	.75
REIm-13							
R	4	304	3.58	0.82	1-5	.001	.62
E	9	304	3.68	0.53	1.78-5	.175	.55
In	3	304	3.48	0.78	1-5	.001	.52
Em	3	304	3.83	0.84	1-5	.001	.58
Im	3	304	3.74	0.87	1-5	.000	.59
HEXACO							
H	16	302	3.34	0.68	1-4.88	.465	.82
E	16	302	3.35	0.62	1.69-4.88	.797	.80
X	16	302	3.5	0.73	1.56-5	.039	.89
A	16	302	2.94	0.64	1.31-4.75	.670	.82
C	16	302	3.57	0.63	1.88-4.88	.071	.83
O	16	302	3.55	0.64	1.44-4.88	.073	.81
Disintegration	20	301	2.53	0.68	1-4.4	.598	.87

Note. k - number of items; K-S p, Kolmogorov-Smirnov p value; α - Cronbach's alpha reliability coefficient

The majority of REI-40 and REIm (sub)scales were normally distributed (except for RA, EE and Imagination). Conversely, with the exception of the total Experientiality score, all REIm-13 subscales deviated from normality. Regarding personality traits, eXtraversion was non-normally distributed in both samples, whereas Openness deviated from normality only on the

Study 1 sample. All variables which were not normally distributed were normalized using Blom's transformation for use in subsequent analyses.

Internal consistency

Internal consistencies of all variables used in both studies are shown in Tables 2 and 3. The reliability of REI-40 Rationality and Experientiality was good, as was the reliability of the EA and EE subscales, while the RA and RE reliability was acceptable. Reliability of REIm subscales was good for Rationality, acceptable for Experientiality and Imagination, and below acceptable values for Intuition and Emotionality. Neither of the short, REIm-13 form subscales reached the threshold for acceptable reliability. It should also be noted that all personality traits showed good reliability on both samples, comparable to that obtained in previous studies.

Discriminant validity

The full correlation matrices of measures used in Study 1 and Study 2 are provided in Supplement 2 (Tables S2.1. and S2.2. respectively). The correlations of REI-40 rationality and experientiality with their subordinate dimensions were all very high ($r \approx .90$), and the subdimensions also highly correlated with one another ($r \approx .65$). On the other hand, the correlations between the two thinking styles (including their subdimensions) were all below .10, confirming their independence. In line with theoretical expectations, correlations among HEXACO personality traits were mostly low ($r < .20$), with the highest correlation being $r = .27$, between Honesty/Humility and Agreeableness.

Finally, as for correlations between REI dimensions and personality traits - the Rational thinking style (including RA and RE) correlated positively to a moderately high degree with Openness (up to $r = .53$), and moderately low with Conscientiousness and eXtraversion ($r \approx .30$ and $r \approx .25$, respectively). Almost all of these correlations were at or above the more strict .25

benchmark for significant overlap, while correlations with Openness were above the more lenient .40 benchmark as well. There were also low negative correlations with Emotionality and positive with Honesty/Humility (up to $r = .14$). None of the Experientiality (and its subdimensions') correlations with personality traits were higher than .20, indicating a lack of significant overlap with personality. The highest correlations were obtained with Extraversion ($r \approx .20$) and Openness ($r \approx -.10$).

Corresponding REIm and REIm-13 dimensions were all highly correlated (in the .80 range, except for Intuition). The correlations between Experientiality subdimensions were moderate ($r \approx .30$) for REIm and low for REIm-13 ($r \approx .15$), and consequently the correlations with the superordinate Experientiality dimension were not as high as for REI-40 (in the .70 and .60 range, respectively). Looking at both REIm and REIm-13, Rationality was essentially orthogonal to Experientiality, however some low correlations could be observed for Experientiality subdimensions. Namely, Rationality was positively related to Imagination ($r \approx .20$) and negatively to Intuition and Emotionality ($r \approx .15$). Similar to Study 1, correlations between personality traits did not exceed .30, although there were several correlations in the .25-.30 range.

Rationality was positively related to Openness, Conscientiousness and eXtraversion and negatively to Emotionality and Disintegration. All of these correlations were close to or above the more strict .25 benchmark, but none exceeded the more lenient .40 benchmark. Experientiality correlated positively with Openness (.50 for REIm and .37 for REIm-13) and Emotionality (.33 for REIm and .31 for REIm-13). There was also a high correlation of Openness with Imagination (.68 for REIm and .51 for REIm-13), and REIMm-(13) emotionality

with its HEXACO counterpart ($r \approx .50$), while all other correlations between subdimensions and personality traits were below .20.

Table 4 summarizes the results of regression analyses predicting REI scores based on basic personality traits.

Table 4.

Regression analyses with REI dimensions as criteria and basic personality traits as predictors

<i>Criterion</i>	<i>Predictors</i>	<i>F(df)</i>	<i>p</i>	<i>R²</i>	<i>Significant predictors^a</i>
REI-40					
R	HEXACO	64.24(6,772)	<.001	.35	E- X+ C+ O+
RA	HEXACO	37.77(6,772)	<.001	.24	E- X+ C+ O+
RE	HEXACO	69.88(6,772)	<.001	.37	H+ E- X+ C+ O+
E	HEXACO	10.57(6,772)	<.001	.08	X+ C- O+
EA	HEXACO	8.17(6,772)	<.001	.06	X+ A- O+
EE	HEXACO	12.15(6,772)	<.001	.09	X+ C- O+
REIm					
R	HEXACO+D	23.07(7,292)	<.001	.36	E- A- C+ O+ D-
E	HEXACO+D	27.58(7,292)	<.001	.40	E+ O+ D+
In	HEXACO+D	6.88(7,292)	<.001	.14	E+ X+ C- O+ D+
Em	HEXACO+D	24.77(7,292)	<.001	.37	E+ A- O+ D+
Im	HEXACO+D	36.87(7,292)	<.001	.47	O+
REIm-13					
R	HEXACO+D	18.64(7,292)	<.001	.31	E- A- C+ O+ D-
E	HEXACO+D	14.95(7,292)	<.001	.26	E+ O+ D+
In	HEXACO+D	1.88(7,292)	.07	.04	
Em	HEXACO+D	23.17(7,292)	<.001	.36	E+ O+ D+

Im	HEXACO+D	15.81(7,292)	<.001	.27	O+
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^a significant at $p \leq .003$. Predictors significant at $.003 < p < .05$ are given in grey font.

With the exception of REIm-13 Intuition, all REI dimensions were significantly predicted by personality traits. Regarding Rationality, the percentage of explained variance was mostly in the 30% range, and the highest percentage of explained variance was 37% (in case of Rational Engagement), indicating a sufficient level of construct independence ($< 40\%$ benchmark). Similarly, the percentage of explained variance of REI-40 Experientiality and its subdimensions was below 10%, indicating low overlap of Experientiality with personality traits. Different results were obtained for REIm Experientiality and its subdimensions⁴. Namely, the percentage of explained variance was below the 15% benchmark only for REIm-13 Intuition, whereas for other dimensions it varied between 26% and 47%. However, only for REIm Imagination was the percentage of explained variance above 40%.

Known-groups validity

The results of t-tests comparing scores of male and female participants on all REI dimensions are shown in Table 5.

Table 5.

Gender differences in REI-40, REIm and REIm-13 dimensions

<i>Dimension</i>	<i>Males M(SD)</i>	<i>Females M(SD)</i>	<i>Cohen's d [95% CI]</i>	<i>t-test (df)</i>	<i>p</i>
REI-40					
R	3.74(0.54)	3.68(0.54)	.11 [-.04, .25]	1.39 (809)	.16
RA	0.14(0.97)	-0.07(1.0)	.21 [.06, .36]	2.78 (809)	.01

⁴ Apart from the difference in the way experientiality is operationalized in the two models, the regressions for REIm dimensions included an additional predictor - Disintegration. However, even when Disintegration was excluded from the model, the percentage of explained variance remained almost the same (the largest drop in explained variance was 3%, see Supplement 3).

RE	3.66(0.66)	3.66(0.65)	.00 [-.15, .15]	-0.00 (809)	.99
E	3.29(0.58)	3.25(0.61)	.06 [-.08, .22]	0.84 (809)	.40
EA	3.37(0.64)	3.33(0.68)	.07 [-.08, .22]	0.97 (809)	.33
EE	0.02(0.95)	-0.01(1.02)	.04 [-.11, .18]	0.46 (809)	.64
REIm					
R	3.62(0.60)	3.46(0.67)	.24 [-.01, .49]	1.88 (302)	.06
E	3.34(0.42)	3.55(0.42)	-.49 [-.74, -.24]	-3.88 (302)	<.001
In	3.26(0.48)	3.43(0.56)	-.32 [-.57, -.06]	-2.49 (302)	.01
Em	3.22(0.57)	3.49(0.60)	-.45 [-.70, -.20]	-3.56 (302)	<.001
Im	-0.21(0.94)	0.08(1.00)	-.29 [-.54, -.04]	-2.31 (302)	.02
REIm-13					
R	0.13(0.94)	-0.06(0.99)	.19 [-.06, .44]	1.53 (302)	.13
E	3.45(0.52)	3.77(0.51)	-.62 [-.88, -.37]	-4.91 (302)	<.001
In	-0.09(1.04)	0.03(0.94)	-.12 [-.37, -.13]	-0.95 (302)	.35
Em	-0.35(0.89)	0.12(0.94)	-.51 [-.76, -.26]	-4.03 (302)	<.001
Im	-0.37(0.87)	0.13(0.96)	-.54 [-.79, -.28]	-4.24 (302)	<.001

As expected, females had higher scores on REIm and REIm-13 Experientiality, Emotionality and REIm-13 Imagination. No differences were found for any of the other dimensions, although trends ($.003 < p < .05$) in the expected direction were also observed for REIm Intuition and Imagination (females scoring higher), as well as REI-40 Rational Ability (males scoring higher).

Discussion

In line with the CEST assumptions, the Rational-Experiential Inventory-40 included items that were expected to capture both the rational and the experiential thinking style (Pacini & Epstein, 1999). Nevertheless, research showed that, while the assessment of rationality was

adequate, measures of experientiality needed to be further developed. This resulted in the new version of REI: the Rational-Experiential Multimodal Inventory (REIm, Norris & Epstein, 2011), recently followed by a short version (REIm-13, McGuiness et al., 2017). Even though REI-40 has been widely used, its validity in non-WEIRD samples was rarely tested, while REIm and REIm-13 have not been widely used yet. In general, our results from two independent studies confirm the originality of the CEST constructs, leaving however the possibility of further improvements in measuring Experientiality.

Structural validity

In line with both theoretical expectations and the findings of Björklund & Bäckström (2008) and Ballová Mikušková et al. (2015) our data suggest a four-factor structure of REI-40. Both the results of CFA and the correlations between Rationality and Experientiality (including all their subdimensions) also strongly support the theoretical orthogonality of rationality and experientiality dimensions. These results provide additional support for a general claim that the two thinking styles are independent dimensions, rather than the opposite ends of a bipolar continuum (Wang et al., 2017).

Similarly, the results of the CFA support a four-factor solution for REIm-13, in line with McGuiness et al. (2017), while the full scale REIm does not show satisfactory structural validity. Moreover, contrary to theoretical expectations and past research (Monacis et al., 2016; Norris & Epstein, 2011), in our study imagination was low-to-moderately positively correlated to rationality for both REIm and REIm-13, indicating the complexity of the experientiality construct.

Internal consistency

Similar to past research (Bjorklund & Backstrom, 2008; Witteman et al., 2009; Ballova Mikuskova et al., 2015; Pacini & Epstein, 1999), we found the reliability of the REI-40 scales and subscales to be acceptable to good. The internal consistency of REIm was also mostly acceptable to good (except for Intuition and Emotionality), although somewhat lower than in the original research (Norris & Epstein, 2011). On the other hand, all REIm-13 subscales demonstrated poor internal consistency. It should be noted, however, that the authors of REIm-13 also reported relatively low reliability coefficients from a test-retest study (generally in the .60 to .70 range; McGuinness et al., 2017).

Discriminant validity

Overall, our findings support the discriminant validity of REI against broad personality traits, although the pattern of results was not the same for REI-40 and REIm(-13) models and for all dimensions.

Namely, the correlational analysis revealed poor-to-acceptable construct independence of REI-40 rationality (and its sub-dimensions) from HEXACO traits, while rationality as assessed in REIm and REIm-13 demonstrated acceptable-to-good discriminant validity against personality traits. The regression analysis indicated good discriminant validity of all rationality scales. Even though the percentage of explained variance was higher than what was previously obtained for the Big-five (Epstein, 2003; Pacini & Epstein, 1999; Witteman et al., 2009) or the HEXACO model (Authors, 2019), it was still under the 40% benchmark.

Operationalizations of experientiality in REI-40 and REIm(-13) differed noticeably in their relations to basic personality traits. Both correlations and the regression analysis clearly indicated that REI-40 experientiality, including its (sub)dimensions, is a construct separate from

broad personality traits, replicating previous findings (Authors, 2019; Epstein, 2003; Pacini & Epstein, 1999; Witteman et al., 2009).

On the other hand, REIm(-13) Experientiality demonstrated high positive associations with Openness and Emotionality. More specifically, Imagination and Openness were highly correlated, as were REIm(-13) Emotionality and HEXACO Emotionality. The percentage of explained variance was higher than theoretically expected, and for REIm Imagination even above 40% (the threshold we defined for Rationality). Only Intuition showed good discriminant validity against HEXACO traits and Disintegration. In other words, our results seem to indicate that the new operationalization of Experientiality actually made this construct more similar to some classical personality traits, with only Intuition seemingly keeping its originality.

It should be noted that, contrary to our expectations, Disintegration was only weakly positively correlated to Experientiality (sub)dimensions. Still, it was negatively correlated to Rationality, which is in line with the constructs' definitions, since Disintegration as a personality trait reflects a tendency to rely on processes that could be interpreted as irrational (Knežević, et al., 2017, Knežević et al., 2016). However, being irrational (and disintegrated), apparently does not necessarily mean being intuitive/experiential (i.e. the disengaged thinking style; Fletcher et al., 2012; Authors, 2019, 2021a).

Known-groups validity

Results for known-groups validity regarding gender differences were mostly as expected, although not all differences were statistically significant. Interestingly, only one trend was registered for REI-40, while all REIm dimensions indicated some gender differences, as well as three out of five REIm-13 dimensions. All differences/trends were in the expected direction, in line with more convincing results reported in past studies about men scoring higher on rationality

and lower on experientiality (including intuition, emotionality and imagination) than women (Epstein et al., 1996; Norris & Epstein, 2011; Pacini & Epstein, 1999; Sladek, Bond & Phillips, 2010).

Limitations

Since the study was conducted on student samples, the results cannot be generalized beyond this sociodemographic group. Moreover, although we labeled our samples as non-WEIRD, it should be noted again that Serbia is not a typical non-WEIRD country, having favorable scores on educated and democratic dimensions (Klein et al., 2018). Finally, for reasons elaborated above, REI-40 and REIm(-13) were validated on different samples. However, it should be noted that the two samples were demographically comparable, with a very similar age and gender structure.

Conclusion

Our validation of three REI versions in Serbian student samples revealed that REI-40 had superior psychometric properties compared to other versions - its internal consistency was the highest and REI-40 experientiality demonstrated the best discriminant validity against HEXACO. Discriminant validity of rationality was similar in all three REI versions. CFA generally indicated four-factor solutions for both REI-40 and REIm. The pattern of correlations supported the existence of orthogonal Rationality and Experientiality factors for REI-40, but not so much for REIm(-13). Thus, in future studies in the Serbian language, we recommend scoring for both main scales and subscales in case of REI-40 and subscales only in case of REIm(-13). Since REIm-13 did not show acceptable psychometric properties in the Serbian sample, we recommend the use of longer versions, preferably REI-40.

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