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Assessing Rational and Intuitive Thinking Styles — Source link

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Assessing Rational and Intuitive Thinking Styles

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Abstract. Theories of dual cognition assume two distinguishable information processing styles: rational and intuitive. We discuss how the concepts of rationality and intuition are used in these theories, and the relations of these two thinking styles to personality characteristics. With the Rational-Experiential Inventory (REI; Pacini & Epstein, 1999), a questionnaire that assesses personal preferences for thinking either rationally or intuitively, we found clear evidence for the independence of the two thinking styles in a large Dutch sample (N = 774). We also found Conscientiousness to be a significant predictor of a preference for rational thinking and an inverse predictor of intuitive thinking. We also administered the REI and a Big Five inventory to a Spanish sample (N = 141), and present these results next to those of the Dutch sample. We further established the validity of the REI's distinction between rationality and intuition by administering another measure, the Preference for Intuition or Deliberation (PID; Betsch, 2004, 2008), to a subset of the Dutch sample (n = 405). We briefly describe two small studies in which a preference for rationality or intuition, measured by the REI, was found to be related to task behavior. In the general discussion we consider all results together, and compare them to Pacini and Epstein's results. We conclude that a dual-process distinction between rationality and intuition is valid cross-culturally and that a proclivity toward either is reliably measured by the REI, not only in the USA but in Europe as well.

Keywords: intuition, rationality, Big Five

Introduction

In their numerous publications on heuristics and biases in reasoning since 1974, Tversky and Kahneman, with most judgment and decision researchers in their footsteps, have portrayed analysis as the rational thing to do, at all times outperforming intuition. They have shown that people's performance systematically deviates from this rational norm, and that people use heuristics instead of following the correct rules of logic and probability theory. Recently they have come to call such heuristics "intuitions," and to recognize that they are valuable in their own right (Kahneman, 2003). Other researchers also increasingly find evidence that, depending mainly on the complexity of the task, intuitive thinking can be as powerful and accurate as analysis (Dijksterhuis, 2004; Klein, 2003; Witteman & Van den Bercken, 2007; for an overview of studies that directly compare intuitive and deliberate judgments see Plessner & Czenna, 2008). When tasks cannot be performed through analysis, for example, when they require pattern recognition or when they are complex and time pressure is high, intuition may be the more advantageous thinking style (see also De Vries, Holland & Witteman, in press; Wilson, 2002).

Dual-process theories aim to clarify the distinction between intuition and deliberation. They typify intuitive processing as preconscious, closely associated with affect, fast, and operating in an automatic, holistic manner; and rational thinking is characterized as slow, deliberative, rule-governed, primarily verbal and conscious (Epstein, 1990, 2008; see also Evans, 2008; Hammond, 1996**[not in refs]**; Hogarth, 2005; Kahneman, 2003; Kahneman & Frederick, 2002; Sloman, 1996; Stanovich & West, 2000). In his cognitive-experiential self-theory (CEST; e.g., Epstein, 1990, 1994, 2008; Epstein, Pacini, Denes-Raj & Heier, 1996), Epstein talks of rational processes and experiential processes, broadly contrasting conscious reasoning and automatic learning. People use both processes interactively, yet they have been found to differ in whether they habitually respond primarily rationally or intuitively to decision situations, or whether they prefer to follow their heart or their head (e.g., Langan-Fox & Shirley, 2003). What is interesting for our purpose is that Epstein and colleagues have developed a questionnaire, based on the CEST, to measure a person's habitual preference for either of the two styles: the Rational Experiential Inventory (REI; Pacini & Epstein, 1999). The REI has been validated in several studies by Epstein and colleagues, and also in a study in Israel (Shiloh, Salton, & Sharabi, 2002), in which support was found for individual differences in the two thinking styles, with rational but not experiential thinking positively correlated with normative-statistical responses in judgment tasks.

The preferred strategy is thought to generally prevail in reasoning tasks, although there obviously is interaction with the demands of and experience with the situation (e.g., Epstein, 1990; Hogarth, 2005; Pacini & Epstein, 1999). Since both rationality and intuition now seem to be valuable think-

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ing tools, it is of interest to look at them more closely, and to look at the relations between these preferred styles and personality characteristics. We think of people as predominantly rational or more intuitive, as in precise mathematicians and emotional artists. Looking at the correlates of both processing styles with personality characteristics, it is plausible to expect that the deliberate and verbal process, rationality, is the preferred style of the conscientious person. Pacini and Epstein (1999), indeed, found a significant correlation between rationality and Conscientiousness. Since we have, in advance, no reasons to expect different relations between preferences for thinking styles and personality characteristics with people in different cultures, we expected similar relations in our Dutch and Spanish samples to those reported by Pacini and Epstein (1999). That is: we expected rationality to be most strongly related to low Neuroticism, to Openness to Experience, and to Conscientiousness; less strongly, but still significantly, to Extraversion; and not at all to Agreeableness. Additionally, in our Dutch and Spanish samples, as in the American sample of Pacini and Epstein (1999), we expected the strongest association of experientiality with Extraversion. Pacini and Epstein also found significant though weaker associations of experientiality with three of the other Big Five measures: Openness to Experience, Agreeableness, and Conscientiousness. Only Neuroticism was not related to experientiality.

In this paper we describe a study of the validity of the two independent thinking styles: rationality and intuition, as measured by the REI and another thinking style measure, and of the relations between the preference for either of these two styles to personality characteristics, in The Netherlands and Spain. We first present a study with a large sample of Dutch participants ($N = 774$) who completed the REI and a Big Five questionnaire. Then we report a replication of this study in a smaller sample ($N = 141$) in Spain. The third study we present concerns a comparison of the REI to another thinking style measure, based on a large subset of the first sample ($n = 403$). We briefly report two small illustrative pilot studies, in which these thinking styles were found to be differentially associated with task behavior. We discuss similarities and differences in the three countries, we draw conclusions about the measurability of rationality and intuition with the REI, and we propose further research.

Study 1: Rationality, Intuition, and Personality Characteristics in a Dutch Sample

Method

Participants and Procedure

In this study, 774 bachelor students of the School of Educational Sciences of the Radboud University Nijmegen participated (80% of the bachelor students enrolled in 2006). Two questionnaires, the Rational Experiential Inventory (REI) and the Quick Big Five, were made available on the web. The majority of the participants (96%) were women, 97% were between 17 and 25 years old.

Measures

REI

The REI includes two reliable, independent constructs (Pacini & Epstein, 1999). The rational dimension, or REI-R, is measured with 20 items, for example: "I enjoy intellectual challenges." The experiential dimension, or REI-E, is measured by 20 items, for example "I believe in trusting my hunches." Respondents score each item on a 5-point scale, from 1 = *completely false* to 5 = *completely true*. Two people independently translated all the items into Dutch. Some 80% of the translations were exactly the same; for the remaining 20% both translations were sent to a third person, who decided upon the best wording. A check was then performed by translating the translated items back into English.

Big Five

We assessed the Big Five personality dimensions with the Quick Big Five (QBF; Vermulst & Gerris, 2006), a Dutch self-report questionnaire that has been developed over the last 10 years and validated with different, large samples of adults and adolescents. It contains 30 adjectives describing the five personality characteristics taken from Goldberg's list of markers (Goldberg, 1992), e.g., irritable, careful, and withdrawn: six for each of the five dimensions of Openness, Conscientiousness, Extraversion, Agreeableness, and Neuroticism (or its inverse: emotional stability). Subjects score these adjectives on a scale from one to seven, indicating to what extent the adjectives apply to them. The psychometric quality of the QBF is quite good. Values of Cronbach's α range from .79 to .88 (average interitem correlations: .39 to .55). As for goodness-of-fit-measures resulting from confirmatory factor analyses, the values of the Comparative Fit Index (CFI) ranged from .93 to .96, and the Root Mean Square of Approximation (RMSEA) had values ranging from .05 to .07 (Vermulst & Gerris, 2006).

Statistical Analyses

To confirm Pacini and Epstein's exploratory analyses, we performed a confirmatory factor analysis using the LISREL8 program and maximum likelihood estimation. The relations between the REI-measures and the Big Five scales were investigated by means of regression analyses. Since Pacini and Epstein (1999) report results both for regressing the REI on the Big Five and regressing the Big Five on the REI, we also report both types of regression analysis.

Table 1. First-order correlations between scale scores for thinking style and Big Five personality traits. Upper triangular part: Dutch sample ($N = 774$, listwise deletion); lower triangular part: Spanish sample ($N = 141$, listwise deletion)

	REI-R	REI-E	Extraversion	Agreeableness	Conscientiousness	Emotional stability	Openness
REI-R	1	.042	.123**	.251**	.316**	.146**	.329**
REI-E	.070	1	.131**	.178**	–.099**	.085*	.184**
Extraversion	.020	.054	1	.306**	–.027	.398**	.2001**
Agreeableness	–.023	.067	.210*	1	.197**	.227**	.312**
Conscientiousness	.148	–.005	.085	.266**	1	–.033	.047
Emotional stability	.010	–.087	.055	.147	–.029	1	.060
Openness	.215*	.225**	.153	.387**	.083	–.071	1

Note: REI-R = REI Rationality, REI-E = REI Experientiality; Emotional stability = inverse of neuroticism; Openness = Openness to Experience.
*$p < .05$, **$p < .01$

Results

Psychometric Characteristics of the REI

The fit measures obtained in a confirmatory factor analysis (two correlated factors) are indicative of a sufficiently satisfactory model (Hu & Bentler, 1999; Jaccard & Wan, 1996): RMSEA = .07 (90% CI = .064, .068), NFI = .77, SRMR = .054, GFI = .83. Of the 20 items defining rationality, 19 items had loadings higher than .40; all standard errors were below .05 and the highest crossloading was .18. Of the experientiality items, 19 had loadings ranging from .37 to .69 (all *SE*s below .05, and all crossloadings below .20). The factor correlation was .035. The model permits the conclusion that the Dutch version of the REI assesses the originally intended two independent factors: an intuition factor and a rationality factor.

The rationality scale of the REI had a reliability coefficient (Cronbach's α) of .86 and an average interitem correlation of .23; for the experientiality scale of the REI we obtained a value of .91 for Cronbach's α (average interitem correlation: .34). These values are quite satisfactory. Pacini and Epstein (1999) report .90 for the rationality scale, and .87 for the experientiality scale ($N = 398$; average interitem correlations: .31 and .25). The Pearson product-moment correlation between the scale values for the factors (obtained by averaging the relevant item scores) was .06 ($N = 774$; Pacini and Epstein report a correlation of –.04 ($N = 388$).

Thinking Styles and General Personality Dimensions (Big Five)

To evaluate the unique contribution of the Big Five general personality characteristics in predicting the thinking styles as measured by the REI, we performed a multiple regression analysis (separately for each REI-factor, since the factors are independent). The summary data (first order correlations) are presented in Table 1 (upper triangular part).

The correlations between the two REI scales were as expected (virtually zero). For the Big Five there were some significant correlations, but this is mainly the result of the large (Dutch) sample. The highest percentage of common variance is 16% (Emotional Stability and Extraversion), which does not seriously threaten independence. The results of the regression analyses are presented in Table 2.

Table 2. Big Five scales predicting REI scales (Rationality and Experientiality): standardized regression weights (β), *t*-values (*t*) and squared semipartial correlations (sp^2). First rows: Dutch sample ($N = 750$), second rows: Spanish sample ($N = 141$)

	Rationality			Experientiality		
	β	t	sp^2	β	t	sp^2
Extraversion	.00	.07	.00	.05	1.21	.00
	.00	–.04	.00	.03	.36	.00
Agreeableness	.08	2.10*	.01	.14	3.57**	.02
	–.19	–1.95	.03	–.01	–.07	.00
Conscientiousness	.29	8.78**	.08	–.13	–3.63**	.02
	.18	2.06*	.03	–.03	–.29	.00
Em. stability	.12	3.74**	.01	.02	.52	.00
	.06	.74	.00	–.07	–.85	.00
Openness	.28	8.24**	.07	.14	3.59**	.02
	.28	3.06**	.06	.22	2.39*	.04
Adj. R^2		.22			.07	
		.06			.02	

*$p < .05$, **$p < .01$

In case of the REI-R, the set of Big Five measures explained 22% of the variance (adjusted $R^2 = .22$; see Table 2, first column, first rows). The unique contribution was statistically significant for**[OK???]** four of the five personality dimensions: Agreeableness, Conscientiousness, Emotional Stability, and Openness. Note that only the contributions of Conscientiousness and Openness are substantial, the uniquely explained variance (measured by r^2_{part}) being 7% and 8%; the contributions of Agreeableness and Emotional Stability are negligible, their statistical significance being the result of the large sample. Of the REI-E scores only 7% of the variation could be accounted for by the Big Five (adjusted $R^2 = .07$; see Table 2, second column, first rows). Significant predictors were Agreeableness, Conscientiousness, and Openness.

Table 3. REI scales (R = Rationality and E = Experientiality) predicting Big Five: standardized regression weights (b), *t*-values (*t*) and squared semipartial correlations (sp^2). First rows: Dutch sample ($N = 750$), second rows: Spanish sample ($N = 141$)

	Ex			Ag			Co			ES			Op		
	β	t	sp^2	β	t	sp^2	β	t	sp^2	β	t	sp^2	β	t	sp^2
R	.12	3.26**	.01	.24	6.96**	.06	.32	9.29**	.10	.14	3.95**	.02	.32	9.44**	.10
	.02	.17	.00	–.03	–.32	.00	.15	1.76	.02	.02	.19	.00	.20	2.46*	.04
E	.13	3.49**	.02	.17	4.78**	.03	–.11	–3.36**	.01	.08	2.17*	.01	.17	5.01**	.03
	.06	.66	.00	.07	.81	.00	–.02	–.18	.00	–.09	–1.04	.01	.21	2.60*	.04
Adj. R^2		.03			.09			.11			.03			.14	
		.00			.00			.02			.00			.08	

*$p < .05$, **$p < .01$. *Note:* Ex = Extraversion, Ag = Agreeableness, Co = Conscientiousness, ES = Emotional stability, Op = Openness.

Pacini and Epstein (1999) report an (unadjusted?) R^2 value of .37 for REI-R, with statistically significant (negative) β-weights for all Big Five variables except Extraversion; for REI-E they have $R^2 = .11$, and significant βs for all Big Five predictors except Conscientiousness.

We also performed regression analyses to establish how much of the Big Five scores was predicted by the two REI scales (see Table 3, first rows).

The results of this analysis can be summarized as follows. The relation of both REI-Ry and REI-E to each of the Big Five factors turns out to be statistically significant (see *t* values in Table 3). In terms of effect size as measured by adjusted R^2, however, the relation is small for Extraversion (.03) and Emotional Stability (.03) and moderate for Agreeableness (.09), Conscientiousness (.11), and Openness (.14). For these three variables REI-R appears to be a stronger predictor than REI-E, since its unique contribution (measured by r^2_{part}) is much higher than that of REI-E, accounting for most of the total explained variance (as measured by R^2).

Study 2: Rationality, Intuition, and Personality Characteristics in a Spanish Sample

Method

Participants and Procedure

Third-year psychology students ($N = 141$) of the University of Malaga completed the REI and a Big Five inventory, partly fulfilling the requirement to obtain practice credits in a course on psychological assessment. The questionnaire data were obtained by paper and pencil during one regular classroom session. The age of the participants ranged from 20 to 45 years ($M = 21.4$, $SD = 2.6$); 17% of the respondents were male.

Measures

REI

Two different translators used the original English version and the Dutch version for a translation into Spanish; the final Spanish version was composed by the fourth author by aggregating these two translations. For example, Item 1 reads, in English, Dutch, and Spanish: "I try to avoid situations that require thinking in depth about something," "Ik probeer situaties te vermijden waarin je heel diep over iets moet nadenken" and "Intento evitar las situaciones que requieren pensar mucho sobre algo."

Big Five

For the Spanish sample we used a questionnaire that was recently developed and validated for the Spanish population (Ruiz, 2006). The response format is a nine-point scale for 25 bipolar adjectives (e.g., altruistic – egoistic, stressed – relaxed) each placed at one end of the scale. Scale-points are labeled from *very much* for the first adjective through *neither* of the adjectives to *very much* for the opposite adjective. The Big-Five factors had reliabilities (Cronbach's α) ranging from .65 for Agreeableness and between .74 and .85 for the other four factors (average interitem correlations between .27 and .53). Correlations with Goldberg's Big-Five markers vary from .78 to .91; with Shafer's Big-Five Factor Markers (Shafer, 1999) they are .61 for Agreeableness and vary from .92 to .97 for the other four factors.

Results

Psychometric Characteristics of the REI

The size of the Spanish sample did not permit confirmatory factor analyses. We inspected the results of an exploratory factor analysis of the REI with two factors (see Table 4). The pattern of loadings was in good agreement with that found for the Dutch sample. The first two eigenvalues were 7.3 and 6.1. The factors explained 33% of the variance. The Rationality factor had one loading of .15; the remaining

Table 4. Factor loadings found with exploratory factor analyses (principal component analysis, varimax rotation) of the REI items, Spanish sample (N = 141)

	1	2
REI1	.39	–.17
REI4	.72	.05
REI5	.60	.16
REI7	.65	.12
REI11	.67	–.11
REI12	.56	.03
REI15	.56	–.11
REI17	.39	–.03
REI18	.69	–.03
REI19	.50	–.03
REI21	.60	–.14
REI24	.41	.22
REI25	.65	.07
REI27	.60	–.07
REI30	.63	.14
REI32	.38	.22
REI34	.65	.18
REI37	.15	–.36
REI38	.69	–.03
REI40	.60	–.05
REI2	.11	.69
REI3	.03	.69
REI6	.10	.54
REI8	.03	.75
REI9	.08	.72
REI10	–.09	.76
REI13	–.05	.39
REI14	.21	.42
REI16	.26	.52
REI20	.10	.61
REI22	.10	.41
REI23	.03	.50
REI26	–.13	.38
REI28	–.10	.57
REI29	.36	.38
REI31	–.32	.41
REI33	.13	.40
REI35	–.10	.58
REI36	–.09	.66
REI39	.05	.01

loadings ranged from .38 to .69; only two crossloadings were higher than .20. REI-E had one loading of .01; the remaining loadings varied from .38 to .76.

The rationality scale of the REI had a reliability coefficient (Cronbach's α) of .88; for the experientiality scale of the REI we obtained a value of .86 (average interitem correlations: .27 and .23).

Correlations with Personality Characteristics

To evaluate the unique contribution of the Big Five general personality characteristics in predicting the thinking styles as measured by the REI in this sample, we again performed a univariate multiple regression analysis (see Table 1, lower triangular part, for the correlations). In the case of REI-R, the only statistically significant, standardized partial regression weights were for Conscientiousness and Openness to Experience. Much less of the variation of the REI-E scores was accounted for by the Big Five variables: The only significant predictor of experientiality was Openness (see Table 2, second rows).

In the Spanish sample the predictive power of the REI for the Big Five was, in general weak. Only Openness could be predicted, to some extent, by both REI-factors (see Table 3, second rows: R^2 = .08) with each factor being equally effective in terms of its unique contribution (.04).

Study 3: Comparing the REI with Another Measure in a Dutch Sample

Method

Participants and Procedure

In this study a subset of 405 of the bachelor students of Study 1 participated. After the REI, the Preference for Intuition or Deliberation (PID) was made available on the web.

Measures

REI

The REI is described in Study 1 above.

PID

The PID was developed in Germany (Betsch, 2004, 2008). It is a questionnaire to measure people's habitual preference for intuition versus deliberation, with two scales: the PID-I for intuition, and the PID-D for deliberation. It contains 18 statements, for example: "I like situations in which I have to rely on my intuition," or: "I think before I act," to be answered on a 5-point scale, from 1 = *I don't agree* to 5 = *I completely agree*. Deliberation, as Betsch understands it, is a decision mode that follows cognitions (reasons, beliefs), and intuition is a basic decision mode that follows feelings and affect. The English version and a Dutch translation were provided by the author (Betsch, 2008). The PID should measure the same dimensions as Pacini and Epstein's REI.

Results

Psychometric Characteristics of the PID

We performed a confirmatory factor analysis, with free factor loadings, the factors allowed to correlate, and the residuals all free. The resulting statistics show that the two-factor model fits quite well. The fit measures, with those reported by Betsch (2004) in brackets, are: RMSEA = .06 [.09], with, in our case, a 90% CI = .056, .073. As for additional fit measures: NFI = .897, the SRMR = .0413 and GFI = .92 [.88].

For the Intuition factor the loadings resulting from this analysis ranged from .43 to .84, with all standard errors below .05 and all crossloadings below .21. The loadings of the Deliberation factor varied from .46 to .82, with all standard errors below .05 and the highest cross-loading being .29. The factor correlation was .018, which was not statistically significant. Overall, our data offer clear-cut evidence for a two-factor solution.

The deliberation scale of the PID had a reliability coefficient (Cronbach's α) of .85 (N = 405); for the intuition scale we obtained a value of .87 (average interitem correlations: .39 and .43). These values are quite satisfactory, and compare well with the values reported in Betsch (2004): .78 for the deliberation scale, and .81 for the intuition scale (average interitem correlations: .28 and .32). The Pearson correlation between the scale values for the factors (obtained by averaging the relevant item scores) was .023 (N = 405, p = .64).

REI and PID: Convergent and Divergent Validity

An exploratory factor analysis over the combined questionnaires (REI + PID = 58 items) confirmed the structure reported above for the REI: two clearly separated factors were found, to be identified as rationality and experientiality (11.92% and 8.23% variance explained). The deliberation items of the PID turned out to be associated with the rationality factor of the REI; their loadings ranged from .44 to .64 and the average absolute value of the cross-loadings was .09. The intuition items of the PID were definitely associated with the experientiality factor of the REI, with loadings ranging from .43 to .79 (cross-loadings: .03 to .16).

Betsch (2004, 2008) reports correlations between PID-D and Conscientiousness, and between PID-I and Extraversion and Agreeableness. Above, we reported the relations shared by the Dutch, the Spanish and the Americans between the REI-R and Conscientiousness, and by the Dutch and the Americans between REI-E and Agreeableness. The overlap between these relations and those with the PID and the Big-Five dimensions suggests that highly similar styles are assessed. The correlation between REI-R and PID-D is statistically significant (see Table 5): .51 (corrected for attenuation: .60), although the relation is not very strong: the shared variance is $.60^2$ = .36. The correlation between REI-E and PID-I is higher: .83 (corrected for attenuation: .94). The overlap between the two measures of intuition may be said to be substantial: their shared variance is .88. We may conclude that the REI-E scale and the PID-I scale can be substituted for each other, but that the same is not true for the REI-R and the PID-D scales. These data concerning the relation between REI and PID cannot be compared directly to analogous data reported in Betsch (2004), since in the latter study a shorter, older version of the REI was used.

Table 5. Correlations between the REI scales and the PID scales (N = 405, listwise deletion)

	REI-R	REI-E	PID-I
REI-E	–.059	–	
PID-I	–.095	.835**	–
PID-D	.514**	–.119*	–.023

*p < .05, **p < .01. *Note:* REI-R = REI Rationality, REI-E = REI Experientiality, PID-I = PID Intuition, PID-D = PID Deliberation.

Comparisons of the items in the REI and the PID show some differences and many similarities. The differences are the number of items (40 in the REI, 18 in the PID) and the wording of the items: half of the REI items are negative, both for rationality and experientiality (e.g., I am not a very analytical thinker; I don't have a very good sense of intuition), while there are no negative items in the PID. This may be a limitation of the PID, since it, thus, fails to control for the tendency to respond yes (affirmative response bias). Also, negation of a negatively worded item (e.g., I am not a very analytical thinker) may have a subtly different meaning than affirmation of the same item worded positively (I am an analytical thinker). It would be an interesting project for a linguist to carefully inspect the semantic differences between seemingly similar items in the two questionnaires, and the effect of wording items negatively versus positively. To check whether the low correlation between the REI-R and the PID-D scales could be attributed to the inclusion of negative items only in the former, we obtained separate scores for the positive and negative items in the REI-R scale, and we then correlated the positive with the negative items and both with the PID-D scores. We found a correlation of –.59 between positive and negative items in the REI-R scale, and correlations of .54 between the positive items of REI-R and the PID-D scores and of –.38 between the negative items of REI-R and the PID-D scores. Since the correlation between the positive and negative items in the REI-R scale was higher than that between the positive items in the REI-R scale and the items in the PID-D scale, this cannot help explain the low correlation between the REI-R and the PID-D scales as being the result of negative items only in the former. Otherwise, both questionnaires have rational items concerning a liking of analysis and setting goals, and being a thoughtful person, and intuitive items concerning a preference to rely on feelings, and of emotional people and situations.

REI's Rationality and Intuition in Relation to Actual Task Behavior

We have not yet undertaken a rigorous study of the relations between the REI measures and actual behavior, but two pilot studies, which we present by way of illustration, are quite promising. The first is a study with teachers in special education ($N = 28$; 23 women and 5 men, M age = 35 yrs, $SD = 11$). They completed the REI, and they performed 10n tasks: they answered the well-known ball-and-bat question ("A bat and a ball together cost € 1.10. The bat costs € 1 more than the ball. How much is the ball?"; Frederick, 2002), four vignettes taken from Epstein et al. (1996) (e.g., missing a flight by 5 or by 30 minutes), the Wason selection task in the original abstract form and in a thematic version, and the jelly bean task (draw a red bean from a jar containing 10 or 100 beans, both with 10% red and 90% white beans; Kirkpatrick & Epstein, 1992; Denes-Raj & Epstein, 1994), and two diagnostic classification tasks (given 10 symptoms or behaviors, decide upon the DSM-classification). With all these tasks there is a heuristic, intuitive response or a reasoned, rational response. We found a significant correlation ($r = .40$, $p = .034$) of REI-R with rational performance on the tasks, that is: number of tasks solved rationally; and a significant negative correlation ($r = –.57$, $p = .002$) of REI-E with rational task performance. Further analyses showed that scores on the REI-R were most strongly correlated with rational performance on four tasks: the missing-a-flight vignette, the thematic version of the Wason task, the jelly bean task, and the first diagnostic classification task ($r = .55$, $p = .003$), and that performance on these tasks correlated strongly negatively with REI-E ($r = –.56$, $p = .002$).

In the second pilot experiment, we investigated the relation between the REI measures and the time needed for making a decision. Participants were a subset ($n = 102$) of the original sample from Study 1. They were given a vignette describing a decision problem (willingness to move to another city, when they could get a job there). We found that decision time was not correlated with REI-R but it was negatively correlated with REI-E ($r = –.30$, $p = .01$). This indicates that the more one prefers an intuitive decision style, the quicker a decision is made.

General Conclusion and Discussion

In both the Dutch and the American samples, the REI-R scores were, as we had expected, significantly predicted by Conscientiousness and Openness and, to a lesser extent, by Emotional Stability (or low neuroticism). In the American, but not the Dutch, sample Extraversion was also a less strong but still significant predictor, while in the Dutch, but not the American, sample Agreeableness was a predictor. The REI-E scores were, in the Dutch sample, best predicted by Agreeableness and Openness, and negatively by Conscientiousness; in the American sample Neuroticism was not predictive of the REI-E scores, but the other four Big-Five variables were.

In general, the results for the Spanish sample and the Dutch sample are in good agreement, especially when we look at the overall pattern of significances. Interestingly, again Openness is associated both with rationality and with experientiality, as it was in the Dutch sample reported above and in Pacini and Epstein (1999). In the Spanish sample, unlike in the Dutch and the American samples, agreeableness does not predict experientiality. In this sample only conscientiousness significantly predicts Rationality, as it did in the Dutch sample and in Pacini and Epstein (1999). There are fewer Big-Five dimensions that are predictive of thinking styles in the Spanish sample than in the American or Dutch samples. Differences may be explained by differences in size and/or composition of the samples, or by cultural differences in (self-reported) personality characteristics. This is an empirical question that is beyond the scope of the current study.

As is clear from this summary, in The Netherlands, Spain, and the US the REI assesses traits that are distinct from the Big Five dimensions, even though we used different instruments for measuring the personality traits. Pacini and Epstein (1999) used the 60-item NEO Five-Factor Inventory (Costa & McCrae, 1989), and we used the Quick Big Five (Vermulst & Gerris, 2006) for our Dutch sample and another version in our Spanish sample (Ruiz, 2006). Apart from these similar relations, the psychometric properties of the Big Five instruments used in our Dutch and Spanish samples were in perfect agreement with those reported by others.

It is worth noting that, in the Dutch sample, the Big Five scores are more strongly related to the conscious, deliberative, rational thinking style as measured by the REI-R than to an automatic, preconscious, intuitive style as measured by the REI-E. The REI, thus, provides illuminating information about what a Big Five test does and does not measure. It would be interesting to see whether it is a general phenomenon that personality inventories tend to measure people's more conscious, deliberative responses to a greater extent than their automatic, preconscious views.

The lack of a correlation between the REI scores for rationality and experientiality and between the PID scores for deliberation and intuition confirms the independence of the two factors. The REI's distinction between rationality and intuition appears to be supported by the PID, increasing the validity of the two processing-style preferences. Our analyses confirm that the REI reliably measures the two preferred thinking styles, rationality and intuition, in a Dutch and a Spanish adaptation. The interesting conclusion is that with the REI, we have a self-report questionnaire that measures thinking styles related to the Big Five personality characteristics yet adding significant aspects of personal preferences that are predictive of actual task be-

havior, and that it is valid not only in American samples but in Dutch and Spanish samples as well.

Limitations

Most of our participants were women; this may raise the suspicion that the results cannot be generalized to a population of both men and women. However, other studies have reported that gender differences were only small. Epstein et al. (1996) found that the mean levels of rational and experiential processing were similar for men and women, and Pacini and Epstein (1999) also concluded from gender comparisons that the correlations between the REI thinking styles and other variables were similar for men and women. As for the rational dimension in the REI, need for cognition was found to be gender-neutral (Cacioppo, Petty, Feinstein, & Jarvis, 1996), but obviously using a more balanced sample would have been preferable.

Further Research

We are satisfied that we may, in subsequent studies, use the REI in its Dutch and Spanish adaptations to assess the two thinking-style preferences identified in dual-process models. We will repeat the first pilot study reported above, which showed that these different styles are indeed predictive of actual task behavior, with a larger sample. We may also look more closely at the construct of intuition, which involves two different factors: high speed or automaticity, and affect. Burns and D'Zurilla (1999) developed a questionnaire with which they were able to differentially assess these two types of intuition, albeit in a study of coping reactions in stressful situations. In future studies we will also include equal numbers of women and men, and identify more precisely participants' social background. Most importantly, we will repeat and extend studies that catch the thinking styles "in the act."

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