Development of Rational and Intuitive Information-Processing Style Inventory

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Abstract

An inventory to measure information-processing style indicative of individual differences in rational and intuitive thinking (Pacini & Epstein, 1999) was developed. In Study 1, confirmatory factor analysis was performed on the data from 290 participants to confirm the 2-factor structure of the information processing style inventory (IPSI): rationality and intuition. Moreover, the internal consistency, test-retest reliability, and the discriminant/convergent validity of the IPSI were demonstrated. In Study 2, the relationship between IPSI scores and probability-reasoning was examined using data from 237 participants to assess the construct validity of the scale. The results indicated that respondents with an intuitive information processing style used representativeness heuristics, while those with a rational style used statistical principles.

Researchers in the feilds of social, and cognitive psychology, have proposed dual-process models of social information processing (Chaiken & Trope, 1999). Recently, Epstein and his colleagues have proposed the Cognitive-Experiential Self-Theory (CEST: Epstein, 1994; Epstein, Pacini, Denes-Raj, & Heier, 1996; Pacini & Epstein, 1999). According to this theory, people adapt to their environments by using two different information-processing systems: the experimential system and the rational system. The rational system is a deliberate, analytical system that operates through the understanding of logical rules of inference and has a relatively brief evolutionary history. The experiential system is a concrete, intuitive system that operates according to heuristic principles and has a very long evolutionary history.

Epstein et al. (1996) and Pacini and Epstein (1999) developed the Rational-Experiential Inventory (REI) that measures individual differences in rational and experiential thinking. The reliability and validity of REI has been demonstrated. For example, the investigation of the relation between REI and responding to vignettes has suggested that people with high experientiality scores responded more heuristically and individuals with high rationality scores responded less heuristically. Even though it is known that there are individual differences in thinking, an inventory that measures dual-mode processing styles has not been available in Japan.

The aim of this study was to develop an information-processing style inventory (IPSI) in Japanese, and to examine the reliability and the validity of the scale. In Study 1, we examined the factorial validity, internal consistency, test-retest reliability, and discriminant/convergent validity of the new scale. In Study 2, we examined the construct validity of the scale using two probability-reasoning tasks.

Study 1

The Japanese items of the IPSI were developed based on Pacini and Epstein (1999). and their factor validity was examined. It was postulated that the IPSI consists of two independent factors: intuitive and rational processing (Epstein, 1994; Epstein et al., 1996; Pacini & Epstein, 1999). Others have, however, proposed that the two processing styles consit of a continuum that could be explained by one factor（e.g., Petty & Wegener, 1999). Therefore, in confirmatory factor analysis, we compared the one-factor model with the two-factor model to clarify this issue. Next, the reliability of the scale was examined using the Cronbach's coefficient alpha and test-retest reliability. Correlations between IPSI and (a) Ambiguity Tolerance, (b) theory orientation, and (c) self-esteem, (d) social desirability, were also investigated to establish the discriminant/convergent validity of the scale.

Method

Participants and Procedure

Undergraduate students (n =276, 189 men and 87 women) at two universities in Tokyo participated in the study and 47 of them participated again after approximately eight weeks in the test-retest reliability study. The instruments listed above were administered to the participants during a portion of the time allocated for a lecture.

Measures

IPSI Items. The authors translated the items developed by Pacini and Epstein (1999) and two graduate students who were fluent in English checked the translation for accuracy. The IPSI consists of two subscales: the 20-item Rationality and the 20-item Intuition, scales. Each subscale was divided into 10 ability and 10 engagement

categories.

Scales used in the validation study. (a) Ambiguity Tolerance: the Japanese version of the Ambiguity Tolerance Scale (ATS-IV) was developed by Imagawa (1981). Intuitions help in prediction and rule generation in ambiguous situations. Therefore, it was predicted that ATS scores would be positively correlated with scores on intuitive thinking style. (b) Theory Orientation: To measure this, a subscale of the Value-Intention scale (Spranger, 1966) translated by Sakai and Hisano (1997) was used. Theory Orientation indicates the tendency for analytical or logical thinking. It was predicted that scores on this scale would be positively correlated with the rational processing style. (c) Self-Esteem: Yamamoto, Matsui, and Yamanari (1982) developed the Japanese version of the Self-Esteem Scale. Epstein (1999) has postulated that the desire for self-esteem motivates rational and intuitive thinking styles. Therefore, it was predicted that this thinking style would be positively correlated with self-esteem. (d) Social desirability: Short version of the social desirability scale (Kitamura & Suzuki, 1986) was used. A low correlation between social desirability and rationality and intuition would suggest that the IPSI scores were not distorted by socially desirable responses.

Results and Discussion

Item selection

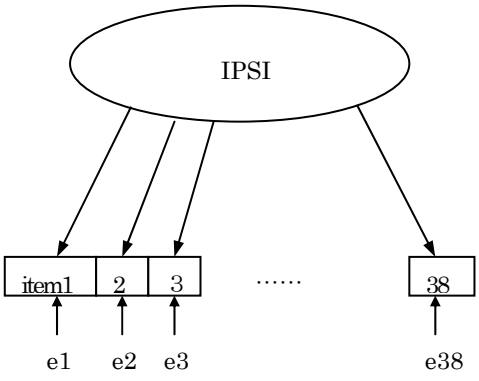
To conduct the item analysis、correlations were calculated between each rationality item and the total score for rationality. Similarly, correlations among intuition items were also calculated. One rationality item (“I enjoy thinking in abstract terms”), and one intuition item (“I suspect my hunches are inaccurate as often as they are accurate”) did not show an adequately high correlation. After removing these items, the analysis described below was conducted using the scores of the remaining 38 items.

Factorial validity

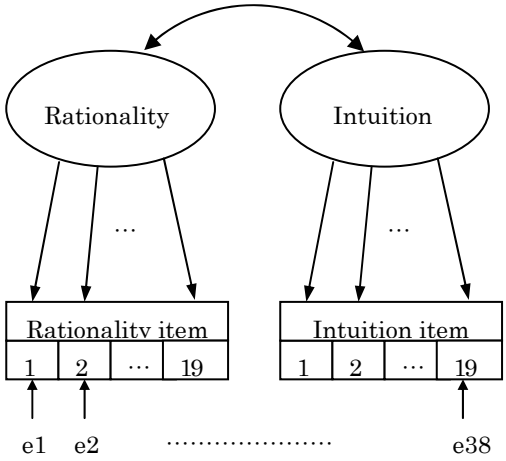
A confirmation factor analysis was performed using the scores of the 38 items in the IPSI. In this analysis, two models were assumed based on theories on dual-mode processing (Figure 1). Model A assumed a continuum, with rationality and intuition at the two extremes. Model B assumed two factors: rationality and intuition. The two models were compared for Goodness of Fit Index (GFI), Adjusted Goodness of Fit Index (AGFI), Comparative Fit Index (CFI), Root Mean Square Error of Approximation (RMSEA), and Akaike’s Information Criterion (AIC; Jaccard & Wan, 1996; Toyoda, 1992).

Results suggested that Model B fitted the data better than Model A (Table 1). However, Model B also did not obtain a satisfactory fit index. Therefore, we modified Model B. Pacini and Epstein (1999) has suggested that rationality and intuition could be separated into ability and engagement categories, respectively. Therefore, we assumed a Model C that included two additional factors: ability and engagement, in addition to the factors in Model B (Figure 1

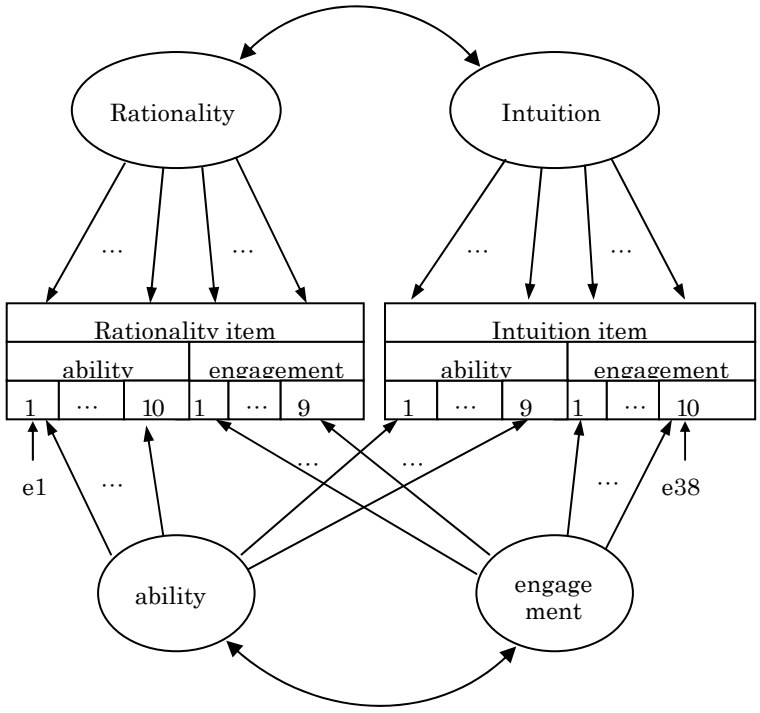
below). As shown in Table 1, fit index of Model C was adequately high. According to these findings Model C was adopted to explain the factor structure of the IPSI.



Model A



Model B



model C

Figure 1. Causal models of IPSI

Reliability

Table 2 shows the means, SDs, Cronbach's coefficient alpha, and test-retest reliabilities of the IPSI. The results suggest that IPSI has satisfactory internal consistency and stability.

Discriminant/convergent validity

Correlations of rationality with (a) Ambiguity Tolerance, (b) theory orientation, (c) self-esteem, and (d) social desirability were examined after controlling for demographic variables. As shown in Table 3, correlations were congruent with the theoretically predicted direction, thereby confirming the discriminant/convergent validity of the IPSI.

Table 1 Goodness of fit index of the causal models

	GFI	AGFI	RMSEA	CFI	AIC
Model A	.534	.425	.104	.407	1206.427
Model B	.723	.658	.077	.679	350.050
Model C	.804	.743	.061	.811	-28.897

Table 2 Means, SDs, alpha coefficients, and test-retest correlations of IPSI

	Means	SD	α	Test-retest
Rationality	65.43	10.67	.85	.79
ability	31.70	6.57	.82	.74
engagement	33.73	5.60	.75	.66
Intuition	57.69	11.19	.85	.76
ability	25.30	5.47	.69	.64
engagement	32.38	7.03	.82	.76

Table 3 discriminant/convergent validity of IPSI

	Ambiguity Tolerance	theory orientation	self-esteem	social desirability
Rationality	.03	.64**	.31**	.00
ability	-.01	.52**	.38**	-.02
engagement	.08	.60**	.15*	.02
Intuition	.25**	.01	.20**	.04
ability	.14*	.04	.33**	.06
engagement	.28**	-.02	.06	.02

**p<.01; *p<.05

Study 2

In Study 2, two probability-reasoning tasks were conducted to examine the construct validity of the IPSI. The tasks consist of the Linda problem (Tversky & Kahneman, 1982) and the event problem (Esptein, Denes-Raj & Pacini, 1995). The Linda Problem was as follows: "Linda is a bright 31-year-old single woman who majored in philosophy and was, as a student, an activist concerned with discrimination and social issues." Respondents were given the following three statements about Linda: (a) Linda had been active in the feminist movement, (b) had been a bank teller, (c) had been a bank teller and had been active in the feminist movement. Participants were requested to rank-order the statements: 1 *(most likely)* to 3 *(least likely)*. The Event Problem was as follows. Participants were instructed to "Assume that, A is a likely event, and B is an unlikely event." Participants were asked to rank-order the three statements, (a) A will occur, (b) B will occur, (c) A and B both will occur on a scale such that 1 *(most likely)* to 3 *(least likely)*.

According to the conjunction rule in the probability theory, rule (c) is least probable in both cases because the likelihood that two independent events will happen simultaneously cannot be higher than the likelihood that either one of the two events will happens. Thus, it could be assumed that individuals high in rationality would rank (c) as number 3, because they think about the problem rationally, by trying to conserve the conjunction rule. Although it is a violation of the conjunction rule to consider (c) as being more probable than (a) or (b), high conjunction error (CE) rates have been observed in the Linda problem. Tversky and Kahneman (1982) have proposed that the high CE may have been the result of representativeness heuristic, or judging on the basis of the similarity between Linda's behavior and her personality. Similarly, in the event problem, it is possible that CE was cause by including likely event in the statements, as a sort of likelihood heuristic. Thus, it could be assumed that individuals who have a high intuition score, rank-order (c) as 1 or 2 because they use heuristics to think about the task, in

violation of the conjunction rule.

Method

Participants and Procedure

Undergraduates (n = 237; 121 men and 116 women) attending a university in Tokyo completed the questionnaire. As in Study 1, portion of the time allocated for a lecture was used to administer the questionnaire.

Measures

Two probability-reasoning tasks, the Linda problem and the event problem, as well as the IPSI were administered to all participants.

Results and Discussion

Probability-reasoning tasks. In each problem, CE was defined as when (C) was ranked 1 or 2. Respondents were divided into two group, high/low rationality, based on the median rationality score, and to high/low intuition based on the median intuition score. A log-linear model analysis was conducted on each cell frequencies, with 2 (rationality: high/low)×2 (intuition: high/low)×2(CE: any/none) as the independent variables. In the Linda problem, there was a significant intuition×CE interaction ($\chi^2(1)=4.49$, $n=230$, $p<.05$). As shown in the left of Table 4, this interaction suggests that the low intuition group had lower frequencies of CE than the high intuition group. In the event problem, a significant rationality ×CE interaction was indicated ($\chi 2(1)=8.00$, $n=232$, $p<.01$). As shown in the right of Table 4, this interaction suggests that high rationality group had a lower frequency of CE than the low rationality group. These findings support the prediction that frequencies of CE are related to intuition and rationality.

Table 5　Frequencies of CE in probality-reasoning task

	Linda probrem		Event probrem	
	CE	No CE	CE	No CE
Intuition				
Low group	82	36	100	19
High group	61	51	92	21
Rarionality				
Low group	68	49	90	29
High group	75	38	102	11

Conclusion

This study examined the reliability and validity of the IPSI. In Study 1, four different analyses indicated the factorial validity, discriminant/convergent validity, internal consistency, and stability of the IPSI. In study 2, the construct validity of the scale was examined using two probability-reasoning tasks. The results suggested that low intuition and high rationality are associated with of CE rates. These findings suggest that the IPSI has acceptable reliability and validity.

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