

An Experimental Study on the Relationship between Reaction Time and Personality Traits

—The Differences in Reaction Time by the Personality Trait Terms—

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We measured and examined RT to personality trait terms and the relationship between RT to personality trait terms, and personality traits related to extraversion and emotional stability in the Big 5 Personality Inventory. This study examined two hypotheses: 1) RT changes by personality trait term, and 2) Personality traits and RT to personality trait term are related in the personality self-rating session. For hypothesis 1, we compared RT in a simple response session and a personality self-rating session. Results revealed individual differences in RT to personality trait terms. For hypothesis 2, as an index of personality traits, this study used extraversion scores and emotional stability scores in the Big 5 Personality Inventory. The ANOVA results revealed a main effect between RT and emotional stability score. This result suggested a relationship between emotional stability and RT, and a relationship between the human nervous system reaction and personality in the internal cognitive process of stimulus-reaction.

Key words: reaction time, personality trait term, extraversion and emotional stability.

Introduction

When we describe or assess the personality traits of other individuals, we usually describe them using our own personality trait terms.

In the psychological lexical method, personality trait terms were extracted from the dictionary to create a taxonomy of personality traits. Allport catalogued 17,953 dictionary terms representing human personalities and grouped them into 4,504 representation terms to describe traits (Allport & Odbert, 1936).

Since then, many studies have discussed the structure of personality trait terms as an index of personality traits. However, few quantitative studies have examined human reaction to these terms. Personality trait terms may or may not represent one's per-

sonality, and they may arouse various reactions when used to evaluate others. It is not unusual for a commonly used term to evoke a heightened mood, agitation, change in facial color, or suddenly quickened speech or behavior. A quantitative measurement of human reaction to these personality trait terms could reveal an aspect of these terms other than their semantic meaning.

The easiest quantitative data to use in measuring human reactions is reaction time (RT). RT focuses on the relationship between stimulus and reaction and is used as objectively measurable and quantitative data. RT can be represented in quantitative terms and is not dependent upon subjective cognitive performance based coding techniques (McClelland, 1987). For this reason, it is considered to be objective (MacLeod, 1993). Recent research has considered mod-

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els of human cognition from the perspective of RT performance from a logical framework, based on selection RT and priming in measuring tacit social recognition (Robinson, 2004). Quantitative RT data represents the complex sum of the delay effect under various criteria, including the interval between application of a stimulus and observed reaction. RT is an approximate value that signifies the complex sum of biological responses and psychological effects (Chocholle, 1963). Since RT measured stimulus and reaction to personality trait terms, we would be able to measure reactions arising from personality trait terms. If RT related to some personality traits, RT to the personality trait terms would be quantitative RT data as index of personality traits.

In this study, we measured RT to personality trait terms and examined RT as the quantitative indicator to determine whether the personality trait terms match the participant's personality. For this purpose, we devised a simple response session and a personality self-rating session.

For Hypothesis 1, in order to compare RTs to personality trait terms, we conducted two sessions; one session, involved measuring simple RT to personality trait terms; the other was a personality self-rating session. For Hypothesis 2, since RT to personality trait terms were assumed to be related to personality traits, we examine the relationship between RT and extraversion and emotional stability scores in the Big 5 Personality Inventory. By examining RT to trait terms as a temporal variable based on this quantitative data, personality trait terms could be considered from a quantitative perspective.

Purpose

We measured and examined RT to personality trait terms and the relationship between RT to personality trait terms, and personality traits related to extraversion and emotional stability in the Big 5 Personality Inventory. We hypothesized that RT to personality trait terms would change

with the participant's personality traits.

Hypothesis 1. Reaction Time (RT) changes by personality trait term.

Hypothesis 2. The relationship between personality traits and RT to personality trait terms is reflected in personality self-rating.

Method

[Participants] Participants were 40 university undergraduate and graduate students (19 men, 21 women) aged 20–30 years (Mean = 21.83, $SD = 1.92$).

[Stimulus Terms] On the two axes of extraversion factors and emotional stability factors, we selected personality trait terms that would be easily recognized and be familiar to the university student demographic selected for participation (Table 1). Self-imagery targeted to university students was used heavily; selected personality trait terms were 3 characters long when written in Japanese, and had similar Japanese grammatical structure (ending with -na).

[Visual Stimuli] To enable easy visual perception from a personal computer (PC) screen (25 × 18.5 cm), 11 personality trait terms were set as computer image files, such that the Japanese text size was 4cm, or $\theta = 57.3 \times d/D$ (θ = angular subtense (degree), d = stimulus size (cm), D = viewing distance (cm)).

[Auditory Stimuli] Eight trait terms were recorded on a PC in a male voice (1,000 ms length).

[Equipment Used] The equipment included: 1) Laptop computer (Fujitsu FMV-5233NU/W); 2) E-prime (Psychology Software Tool); 3) Headphones; 4) Response key; 5) Face fixation device.

[Personality inventory] A total of 24 items (12 extraversion scale items and 12

Table 1 The stimuli terms of personality trait terms used in experiment

Practice	Sincere	Naivety	Easygoing	
Version	Clam	Inconsiderate	Quiet	Lively
Emotional stability	Irritable	Amenable	Docile	Selfish

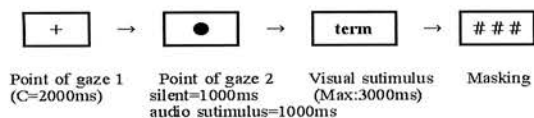


Figure 1 Experimentation block diagram of a simple response session

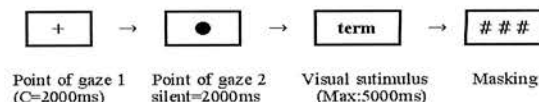


Figure 2 Experimentation block diagram of a personality self-rating session

emotional stability scale items) were selected from “—Scale construction of a “Big five” personality inventory.—” (Murakami & Murakami, 1997).

[Procedure] This experiment was set to be completed in 30 to 35 minutes.

- 1) Practice session: (two to three trials of a simple response session)
- 2) Simple response session (80 trials): (Fig. 1) After displaying a point of gaze (+) (1,000 ms) on the PC, we displayed a black dot (●) (2,000 ms). Upon seeing the black dot, participants pushed a key in response to the personality trait term that they heard via a headphone and displayed on the PC. If the audio and visual stimulus (four extraversion stimulus terms and four emotional stability stimulus terms) was fit, they pushed “○”. If was unfit, they pushed “×”. The trial was assigned randomly for each participant. After the subject had pushed the key, one trial was finished (Masking).
- 3) Rest break
- 4) Personality self-rating session (32 trials): (Fig. 2) After displaying a point of gaze (+) (1,000 ms) and a black dot (●) (2,000 ms), we randomly displayed personality trait terms on the PC. When participants saw a personality trait term that they believed applied to themselves, they pushed “○”. If they thought the trait did not apply to their own image and personality, they pushed “×”. One trial was then finished (Masking).
- 5) Personality inventory

[Analysis] In the simple response session, RT was analyzed in 40 trials that utilized auditory stimuli and visual stimuli. In the personality self-rating session, we analyzed RT of participants assessing eight per-

sonality trait terms. N was the number of trials \times participants. Because of the possibility of variance due to lost values or non-responses for repetitions in each criteria combination, an analysis of variance (ANOVA) was performed. We used the General Linear Model (GLM) by the Statistical Analysis System (SAS) statistics software package (Takeuchi et al, 1996). After classifying personality traits of each participant by the personality inventory, we examined RT of each trait term and personality traits.

Results

1. RT to personality trait terms in the simple response session and the personality self-rating session

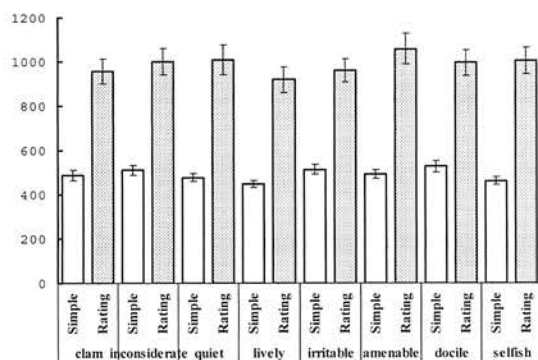
We examined RT to personality trait terms in the simple response session and the personality self-rating session. We showed RT, SD , and 95% critical limit mean of RT (ms) for eight stimulus terms for each session (Table 2, Fig. 3).

In the simple response session, the shortest RT was 448.34 ms for the term “lively.” while the longest RT was 526.07 ms for the term “docile.” A two-way ANOVA was performed for simple RT for participant \times stimulus terms. There was a main effect for participants ($F(39, 1495)=39.94, p<.01$). The difference for stimulus terms (extraversion or emotional stability) was significant ($F(1, 1495)=9.28, p<.05$). No significance was found for participant \times stimulus term ($F(39, 1495)=0.81, n.s.$).

In the personality self-rating session, the shortest RT was 918.23 ms for the term “lively” while the longest RT was 1,057.11 ms for the term “amenable.” A two-way ANOVA for personality self-rating session for participants \times stimulus terms showed a main effect for participant ($F(39, 1264)=$

Table 2 Means and SDs of RTs for each trait terms

Trait terms	Task	N	Means	SD
Clam	Simple	196	489.6	171.9
	Rating	158	955.6	359.4
Inconsiderate	Simple	198	510.7	155.5
	Rating	157	1,000.2	382.5
Quiet	Simple	198	477.5	134.5
	Rating	158	1,007.0	440.9
Lively	Simple	200	448.3	112.7
	Rating	160	918.1	380.2
Irritable	Simple	194	513.2	152.5
	Rating	158	960.9	336.7
Amenable	Simple	197	493.4	144.0
	Rating	158	1057.1	446.5
Docile	Simple	195	526.1	197.0
	Rating	159	995.1	373.7
Selfish	Simple	197	462.0	123.3
	Rating	157	1,004.3	394.4

**Figure 3** Means and 95% confidence limit of RT (ms) between a simple and personality self-rating session

20.04, $p < .01$) and a main effect for stimulus term ($F(7, 1264) = 3.22$, $p < .05$). Significance was also found for participant \times stimulus term ($F(273, 1264) = 1.33$, $p < .05$).

Concerning individual differences for the factor of RT in this experiment, RT to each term differed individually not only in the simple response session but also in the personality self-rating session. This result sug-

gested that RT to personality trait terms was unique for individuals. The SD tended to be large for RT to emotional stability stimulus terms in the personality self-rating session.

Additionally, the difference in participant \times stimulus term interaction was significant in the personality self-rating session, although no interaction was observed in the simple response session. This result suggested that participants discriminated between the two sessions: participants assessed and reacted to personality trait terms in the personality self-rating session.

2. RT to Each Stimulus Term for Extraversion Scores and Emotional Stability Scores

2.1 The change in RT for extraversion scores and emotional stability scores

Big 5 Personality Inventory extraversion scores and emotional stability scores were calculated for each participant. Defining a score higher than the extraversion score center value (Mean = 7.55, $SD = 4.07$, Median = 8) as extroverted and a score higher than the emotional stability score center value (Mean = 6.05, $SD = 3.23$, Median = 6) as emotionally stable, personality traits of each individual were set as the base criteria according to traits assessed by the inventory.

We determined RT, SD , and 95% critical limit mean of RT (ms) by personality traits in the personality self-rating session (Table 3). In the personality self-rating session, RT for extraversion scores and emotional stability scores were presented in Figs. 4 and 5. Two-way ANOVA revealed, no main effect for extraversion scores ($F(1, 1264) = 3.09$, $n.s.$) but a main effect was found for emo-

Table 3 Means and SDs of RTs by personality traits

Personality traits		N	Means	SD
Version	Extraversion	666	1,000.4	411.3
	Introversion	599	972.5	368.6
Stability	Nervous	786	1,022.7	419.3
	Tough	479	928.8	334.0

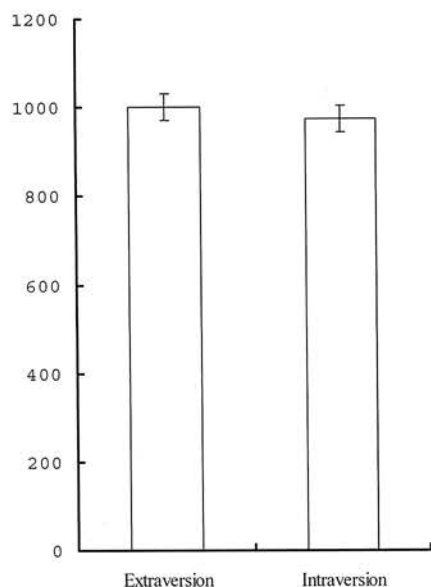


Figure 4 Means and 95% confidence limit of RT (ms) by version traits

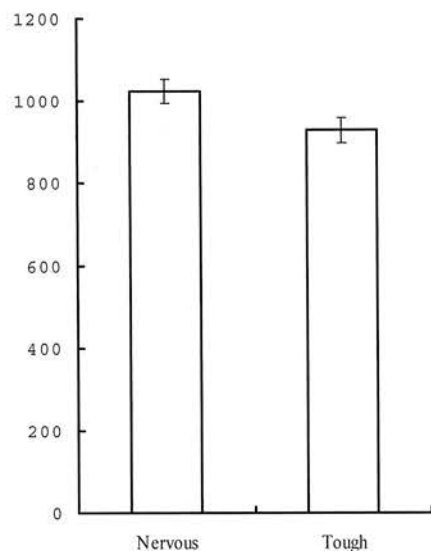


Figure 5 Means and 95% confidence limit of RT (ms) by stability traits.

tional stability scores ($F(1, 1264)=18.86, p < .01$). No interaction was found for extraversion score \times emotional stability score ($F(1, 1264)=1.58, n.s.$). As a result of ANOVA, RT to personality trait term changed by emotional stability scores. And the longest RT was 1,022.74 ms among participants with low emotional stability scores (nervous),

while the shortest RT was 928.76 ms among those with high emotional stability scores (tough). For participants with high extraversion scores (extraversion) and those with high emotional stability scores, RT was greater than 1,000 ms, with an SD of 400 ms. Meanwhile, for participants with low ex-

Table 4 Means and SDs of RT by participant's personality in personality in a self-rating session

Trait terms	Subject's personality	Number of response	Mean	SD
Clam	Extra nervous	48	984.0	473.6
	Extra tough	36	921.3	308.6
	Intra nervous	50	1,002.3	297.0
	Intra tough	24	852.7	267.2
Inconsiderate	Extra nervous	47	967.2	322.9
	Extra tough	35	990.9	380.5
	Intra nervous	51	1,082.6	470.1
	Intra tough	24	903.1	249.7
Quiet	Extra nervous	48	1,042.8	521.3
	Extra tough	36	900.7	308.6
	Intra nervous	50	1,097.0	491.0
	Intra tough	24	907.2	254.1
Lvely	Extra nervous	48	904.0	419.0
	Extra tough	36	827.8	247.1
	Intra nervous	52	1,003.4	461.3
	Intra tough	24	897.0	213.8
Irritable	Extra nervous	46	991.0	308.0
	Extra tough	36	979.2	342.4
	Intra nervous	52	929.3	330.2
	Intra tough	24	944.3	404.2
Amenable	Extra nervous	47	1,180.4	532.8
	Extra tough	36	1,054.1	469.1
	Intra nervous	51	1,055.7	383.7
	Intra tough	24	823.2	223.6
Docile	Extra nervous	47	1,106.7	451.5
	Extra tough	36	945.4	339.2
	Intra nervous	52	973.8	340.9
	Intra tough	24	897.3	280.6
Selfish	Extra nervous	48	1,080.2	400.7
	Extra tough	36	1,051.8	459.1
	Intra nervous	49	972.4	372.6
	Intra tough	24	846.3	269.2
Total of terms	Extra nervous	379	1,031.8	440.1
	Extra tough	287	958.8	366.5
	Intra nervous	407	1,014.3	399.4
	Intra tough	192	883.9	273.3

traversion scores (intraversion) and for those with high emotional stability scores, RT was less than 900 ms with an *SD* of 300 ms. These results suggested a tendency for consistent RT for each personality trait.

3.2 Change of RT to each stimulus term by extraversion and emotional stability score

Table 4 to 13 indicate the RT to each stimulus term in the personality self-rating session, according to personality traits. The change of RT to each stimulus term by personality trait had a large mean and *SD*, four the terms "quiet" "amenable" "docile" and "selfish." We examined the RT for each personality trait obtained by the personality inventory score.

[Clam] The RT to the "clam" tended to be shorter than the personality self-rating session mean of 955.56 ms. Individuals evaluated as emotionally stable had the shortest RT of 893.87 ms, and the *SD* was small

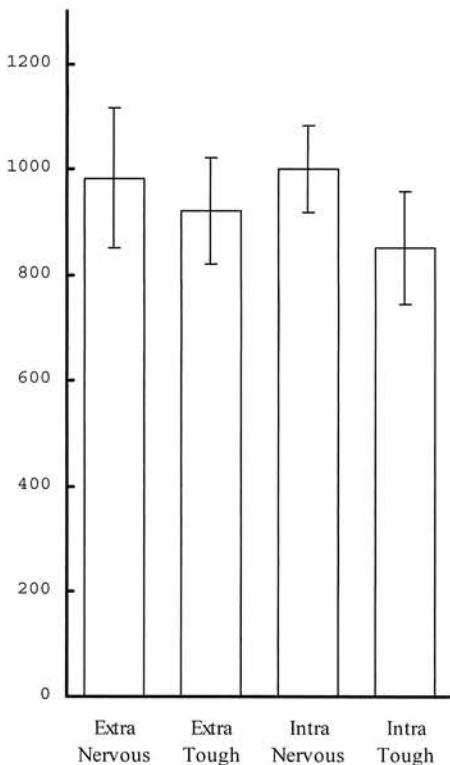


Figure 6 Means and 95% confidence limit of RT (ms) of the trait term "clam" by participant's personality pattern

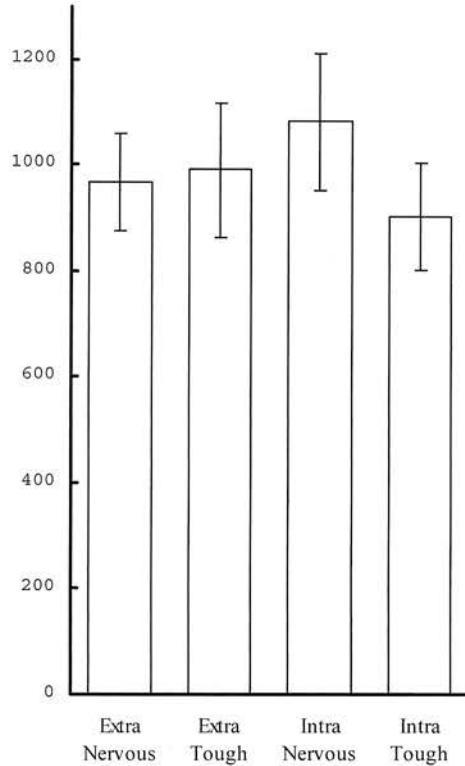


Figure 7 Means and 95% confidence limit of RT (ms) of the trait term "inconsiderate" by participant's personality pattern

(Fig. 6).

[Inconsiderate] For the term "inconsiderate" the RT of participants who were evaluated as emotionally stable was shorter than personality self-rating session mean of 1,000.15 ms (Fig. 7).

RT of participants who were evaluated as Intra-Nervous was the longest 1,082.6 ms, with an *SD* of 470 ms.

[Quiet] For the term "quiet" the RT of participants who were evaluated as emotionally stable was shorter than personality self-rating session mean of 855.50 ms. However, the RT was longer for low extraversion scores at 1,070.44 ms (Fig. 8). RT of participants who were evaluated as low emotional stability scores (nervous) was greater than 1,000 ms, with an *SD* of 400-500 ms.

[Lively] For the term "lively" the average value in the personality self-rating session was 918.1 ms, participants who were

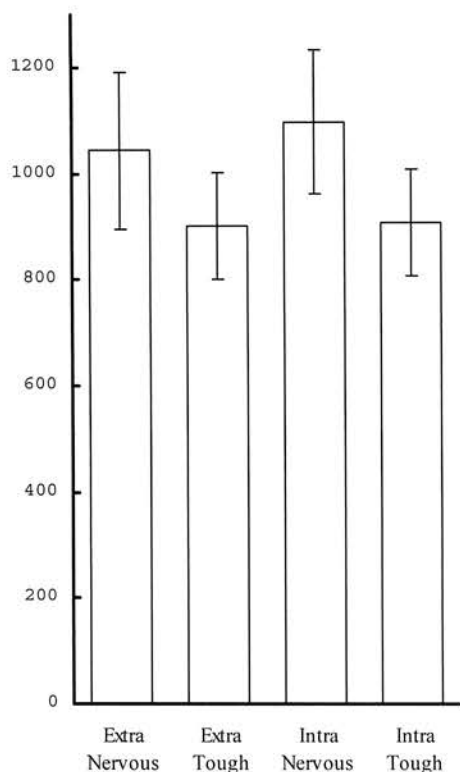


Figure 8 Means and 95% confidence limit of RT (ms) of the trait term "quiet" by participant's personality pattern

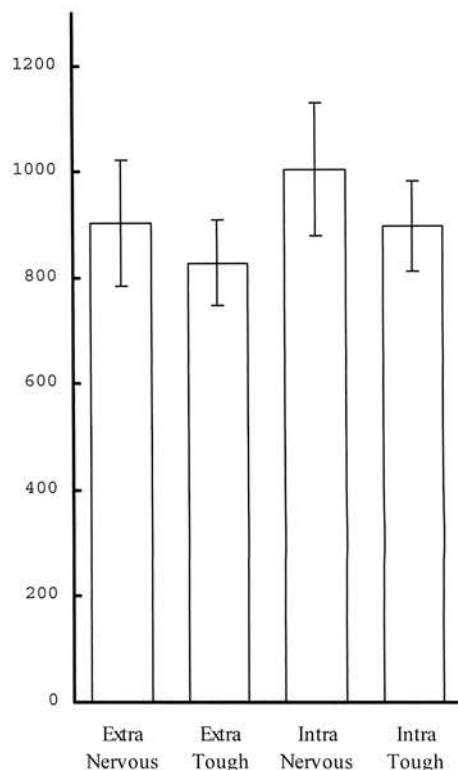


Figure 9 Means and 95% confidence limit of RT (ms) of the trait term "lively" by participant's personality pattern

evaluated as Intra-Nervous was the longest 1,003.4 ms and about 800 ms for those with high emotional stability scores (Tough) (Fig. 9).

[Irritable] No large difference was observed from the mean value of 960.92 ms for RT for the stimulus term "irritable" by personality trait (Fig. 10).

[Amenable] For the term "amenable" the RT was 1,057.11 ms, the longest of mean values in the personality self-rating session. RT was longest for participants who were evaluated as Extra-Nervous, exceeding 1,100 ms. However, the RT was 823.2 ms for Intra-tough participants with low extraversion scores and high emotional stability scores. These results indicated that RT for this stimulus term differed according to the personality trait (Fig. 11).

[Docile] For the term "docile" the mean was 995.1 ms for the personality self-rating session. RT was longer for participants with

high extraversion and high emotional stability scores, at 1036 ms. However, the RT was the shortest 897.3 ms for Intra-tough participants with low extraversion scores and high emotional stability scores. RT to this stimulus term therefore differed personality trait (Fig. 12).

[Selfish] For the term "selfish" the mean was 1,004.27 ms in the personality self-rating session. RT for Intra-tough participants with low extraversion scores and high emotional stability scores was short at 846.3 ms, while RT exceeded 1,000 ms for those with high extraversion scores (Fig. 13).

Discussion

This study examined two hypotheses: 1) RT changes by personality trait term, and 2) Personality traits and RT to personality trait term are related in the personality self-rating session.

For Hypothesis 1, we compared and exam-

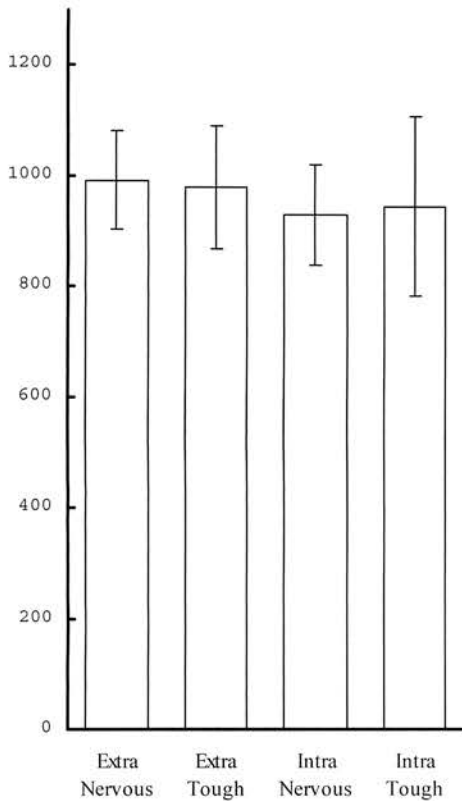


Figure 10 Means and 95% confidence limit of RT (ms) of the trait term "irritable" by participant's personality pattern

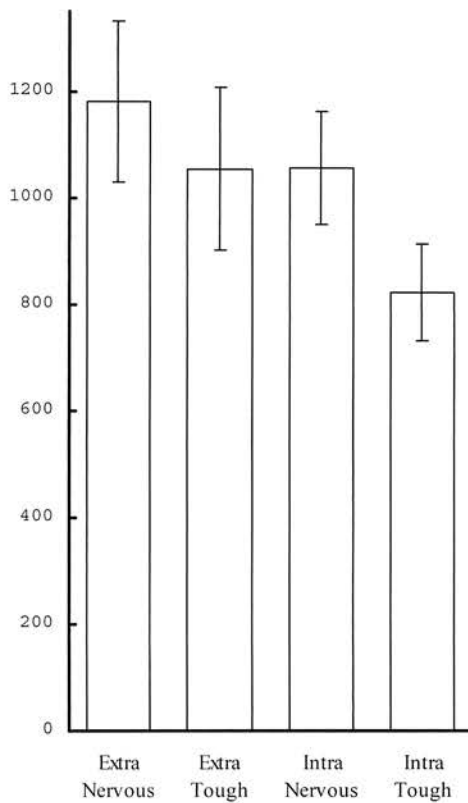


Figure 11 Means and 95% confidence limit of RT (ms) of the trait term "amenable" by participant's personality pattern

ined RT to personality trait terms in a simple response session and a personality self-rating session.

Results revealed individual differences in RT to personality trait terms. Individual differences are cited in cognitive psychology as one determining factor in simple RT (Oyama, 1986). Also, results revealed an interaction of participants \times stimulus term by ANOVA in the personality self-rating session, although no interaction was observed in the simple response session. This experiment revealed that the stimulus term had no effect on the participant's simple RT in the simple response session. The interaction for participants \times stimulus term suggested that RT to personality trait terms in the personality self-rating session involved the time it took to determine whether the term fit the subject's image or not. For Hypothesis 1, the result suggested individual differences in

RT to personality trait terms.

Hypothesis 2 examined the relationship between personality traits and RT to personality trait terms in the personality self-rating session. As an index of personality traits, this study used extraversion scores and emotional stability scores in the Big 5 Personality Inventory. The ANOVA results revealed a main effect between RT and emotional stability score. However, they indicated no main effect for extraversion score. The factors of RT to personality trait term were not definable in this experiment.

The participant's with high extraversion scores and those with low emotional stability scores had an unstable mean and *SD* for RT. In contrast, participant's with high emotional stability scores had a stable mean and *SD* for RT. This result suggested that the amount of time that individuals used to

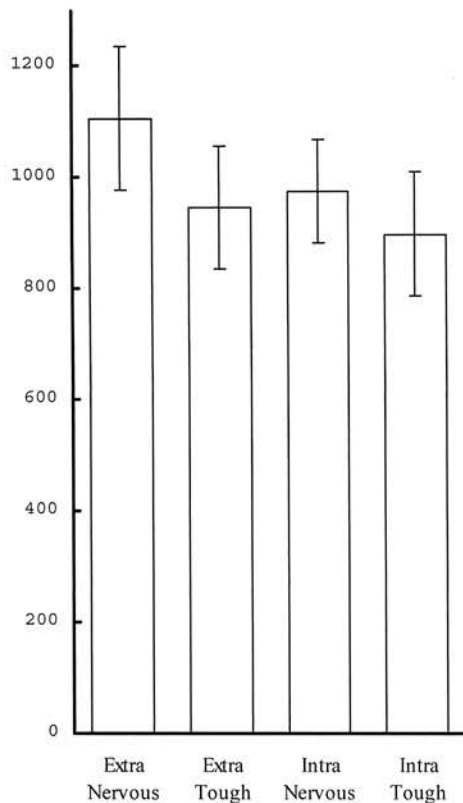


Figure 12 Means and 95% confidence limit of RT (ms) of the trait term "docile" by participant's personality pattern

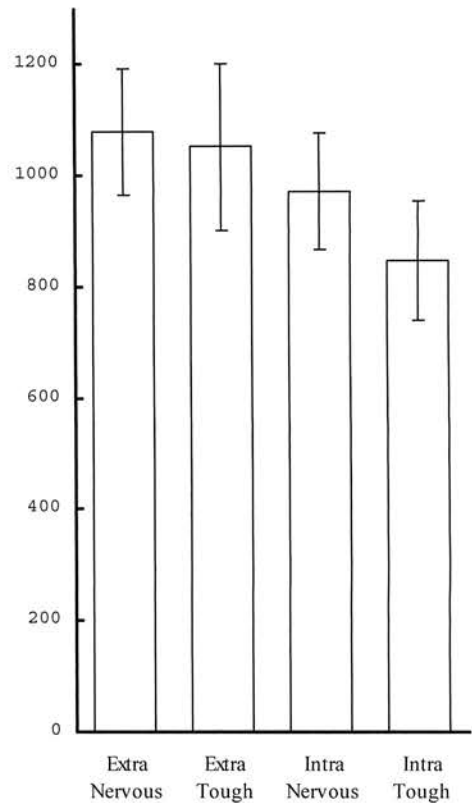


Figure 13 Means and 95% confidence limit of RT (ms) of the trait term "selfish" by participant's personality pattern

judge trait terms and assess themselves was relatively stable. We suggested that Individuals evaluated as extraversion and nervous have a tendency to change RT to judge and assess trait terms.

Reading changes in RT to stimulus terms by personality traits, the RT range was greatest for "quiet." among those with high emotional stability scores. Also, or the emotional stability stimulus terms, RT was greatest for "amenable," "docile," and "selfish." As a tendency for RT, the participants with high extroversion scores and those with high emotional stable scores had longer than average RT for each stimulus term in the personality self-rating session. However, the RT was shorter than average for participants with low extroversion scores and those with high emotional stability scores. This result suggested a relation-

ship between emotional stability and RT, and a relationship between the human nervous system reaction and personality in the internal cognitive process of stimulus-reaction. Although this study did not show any change in RT by extraversion, it did suggest RT differences by emotional stability.

This study examined the basic data regarding RT to personality trait terms. Results suggested the possibility of using a computer to obtain quantitative data using personality trait terms. However, it will be necessary to reveal the factors of RT to personality trait term without participants. Topics for future research include factors of RT to personality trait term and the relationship between personality traits and RT to personality trait terms in personality self-rating sessions.

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