The Feature of the Reaction Time for Performing Personality Self-rating[1]: Conditions by Personality Trait Terms and by Sentence

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This purpose of study was to make clear the feature of the condition of measurement and the personality traits by a quantitative change in reaction time. This experiment examined the RT for performing personality self-rating under the two conditions: personality self-rating by-term and by-sentence conditions. Our two hypotheses are: (1) when performing personality self-rating, RT has a tendency determined by the stimulus conditions and five personality traits, and (2) these RTs have a characteristic involving the individual. This experiment measured RT in three sessions on a computer, in order to measure RT of the term and sentence stimulus which obtained to five personality traits. The participants were 53 graduate students. As a results of ANOVA, This experiment clarified that it was changed by personality traits the RT when performing personality self-rating, not in the self-rating conditions. And, In order to examine intra-individual differences for the RT, we compared three intra-individual differences models. As a result, a significant difference was indicated for traits by SRT model the in both self-rating conditions. It was suggested that the time which reacts to some stimuli was individually different, not time to judge whether it was everything.

key words: reaction time, self-rating conditions, intra-individual differences

Introduction

Personality has been conceptualized from a variety of theoretical perspectives, and at various levels of abstraction or breadth (John, Hampson, & Goldberg, 1991). The basic unit of personality is the trait, so a difference in personality is a difference caused by a combination of traits. Since the personality traits present human responses, behaviors and performances, it's possible to quantitatively measure the behaviors which show personality traits. In experimental measurement of personality, it's necessary to be specifying a factor of recognition and a biological factor for the behavior which shows the personality traits. The reaction time (RT) is an approximate value that signifies the complex sum of biological responses and psychological effects (Chocholle, 1963). In cognitive psychology research, RT is often also influenced by the concentration ratio, the psychology of fatigue, and physiological factors involving measurement specification, the method for measurement, and differences between individuals and within an individual with respect to reaction time. Additionally, RT can be represented in quantitative terms and is not dependent upon subjective cognitive performance based coding techniques (McClelland, 1987). It's possible to describe RT from a quantitative change in some behavior. So, when we examine RT on performance of some task and to ascribe a factor to the individual, it's possible to consider a factor in the individual of personality in a study of personality.

This experiment measures the RT when judging one's own personality self-rating by some stimuli, along with the RT of five personality traits. So, we assumed a factor by the stimulus condition and by the individual as a prescriptive factor in RT when judging one's own personality self-rating. As a factor by the stimulus condition, we examine a change of RT by the method of the stimulus presentation.

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Personality measurement by a questionnaire is usually evaluation of sentences, and the Semantic−Differential method which coupled the personality trait term as the way to rate an image of a person and things. To compare these ways by a quantitative change as RT when judging one's own personality self-rating of this experiment, measurement of one's own personality self-rating sets two conditions: personality self-rating by-term condition and by-sentence condition. And so, in Hypothesis 1, RT has a tendency determined by the stimulus conditions and personality traits upon the RT in performing a personality self-rating. In Hypothesis 2, these RTs have a characteristic involving the individual. Reaction time is classified into the simple RT when reacting some stimulus to reacts and the chose RT when judge a stimulus. The RT when judging one's own personality self-rating will be selective reaction time. In an experiment in RT, SDs of RT is typically viewed as error, but such error is an individual difference (Baumeister, 1998). And there were individual RT differences in simple reaction trials by the version and emotional stability term (Sato & Matsuda, 2009). In order to examine intra-individual differences for the RT, this experiment examines three intra-individual difference models: decision reaction time (DRT), stimulus reaction time (SRT), and personality reaction time (PRT). DRT is the time required for one's own personality judgment, using the time obtained in a simple response session and in a personality self-rating session. This model sets the judgment time, based on Donders (1969), in order to determine whether a stimulus term or sentence matches the participant's personality, using the time to determine one's own personality. It was thought that each participant had an individual pace when evaluating his or her own personality from stimulus terms and sentences. SRT is the time required for a participant to change response to a stimulus. The questionnaire method shared several sentences with the behavioral pattern that exhibits some trait. This experiment was limited and used directly the stimulus term or sentences that generated some trait. We considered the influence of mental load by repeated stimulus and reaction. In a study about factors in the individual involving stimulation and a reaction, neuroticism has been associated with temporal variability (Eysenck and Eysenck, 1985). In consideration of individual variations in the reaction

to a stimulus, SRT examines the variation in each participant's response to a stimulus. PRT is the time for each participant's self-rating. In the questionnaire method of personality, there is an issue with sentences containing words the participant does not know, or sentences that are too long. To exclude such factors, the personality self-rating condition on the computer was set and made easy to measure by personality trait terms and sentences. We examine a given factor in the individual participant's judgment time stimulus term or sentences many times. For SRT and PRT, we considered the influence of mental load, which was repeated to judge the stimulus term and sentence. And when prescribing a factor in these individuals in the RT when judging one's own personality self-rating, it's possible to make clear the feature of RT each five personality trait as the systematical difference between the individuals of the hypothesis 1. Thus, this study reveals that it is possible to indicate quantitative data about an individual by considering intra-individual differences in the RT during personality self-rating.

Purpose

This experimental purpose examined the feature of the condition of measurement and the five personality traits by a quantitative change in reaction time. This experiment measured the RT for performing personality self-rating under the two conditions: personality self-rating by-term condition and by-sentence condition. Our two hypotheses were: (1) when performing personality self-rating, RT has a tendency determined by the stimulus conditions and five personality traits, and (2) these RTs have a characteristic involving the individual.

Method

Participants　The participants were 53 graduate students (26 males, 27 females), aged 18 to 30 years (Mean age＝19.62, SD＝1.11).

Experiment period　May−July 2013

Equipment　The equipment included a laptop computer (Dell-Vostro 3360), E-prime 2.0 (psychology software tool), and headphones.

Experiment stimulus　By referring to a manual of Big5 (Murakami & Murakami, 2008), we selected each four terms that would be familiar to university students (Table 1). These twenty personality trait terms were set as visual stimuli in computer image

Table 1　Stimulus terms of personality traits used in experiment

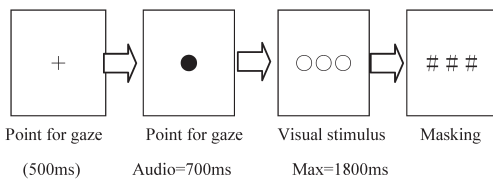| Practice Stimuli	Sincere	Amenable	Philosophical	
Agreeableness (A)	kindly	affable	headstrong	tightwad
Conscientiousness (C)	capable	conscientious	sloppy	unreliable
Extroversion (E)	active	sociable	passive	restrained
Neuroticism (N)	easygoing	sedate	irascibleness	worrier
Openness to experience(O)	intelligent	clever	conservative	naivete

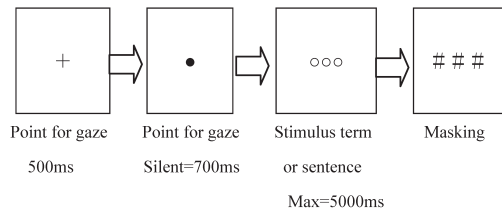**Figure 1**　Block diagram for the simple responses session (1 trail)

Figure 2　Block diagram for the Personality self-rating by-term conditions and by-sentence condition (1 trial)

files for display on a personal computer screen. Auditory Stimuli of twenty traits were then recorded on a PC in a male voice (700 ms length).

Personality inventory　Before the experiment, Participants rated 30 items on a questionnaire of Japan edition POMS (Yokoyama, 2012) using pen and paper in order to measure each participant's physical condition and feeling. After the experiment, a total of 70 items were used based on the scale construction of the Big Five Personality Inventory (Murakami & Murakami, 2008).

Procedure　This experiment was designed to be completed in 40 to 45 min. After explaining the experiment to the participant, a questionnaire from POMS was completed using pen and paper. In addition, we measured RT in three sessions on the computer: a simple response session, a personality self-rating by-term condition, and a personality self-rating by-sentence condition.

First, the simple response session measured the individual differences in RT to stimulation and reaction (Figure 1). After displaying a gaze point (＋) for 500 ms on the PC, we displayed a black dot (●) (700 ms). Upon seeing the black dot, participants heard via a headphone audio stimulus. And visual stimulus display on next screen (max＝1800 ms). If the audio and visual stimuli fit, they pressed "○". If the terms did not fit, they pressed "×." After participants had pressed a key, that trial was finished (masking). The visual and audio stimulus was used

twenty personality terms (Table 1), the trial was assigned randomly for each participant. In a practice session, participants practiced two or three times in a simple response session, and performed 200 trials in the simple response session (20 terms×10＝200 trials).

Next, we measured RT of the personality self-rating by-term condition (Figure 2). After displaying a gaze point (＋) for 500 ms and a black dot (●) for 700 ms, we randomly displayed personality trait term as visual stimulus on the next screen. A black dot screen was not the audio stimulus. When participants saw a personality trait term that they believed applied to the personality trait term, they pressed "○". If they did not think it applied to the personality trait term, they pressed "×". The trial was then finished (masking). Participants performed 100 trials (20 terms×5＝100 trials). Finally, we administered the personality self-rating by-sentences condition, using the stimulus terms (Table 1) in an "Are you-" format. After displaying a gaze point (＋) for 500 ms and black dot (●) for 700 ms by silence, we randomly displayed "Are you-"sentence using personality trait terms on the next screen (Figure 2). For example, when participants saw a sentence of "Are you kindly", they pressed "○"that they believed applied to the sentence. If they did not think it applied to the sentence, they pressed "×". Partici-

Table 2 Three models of examination RT to personality self-rating

DRT RT−mrt	Time of decision personality model
SRT (RT−mrt)/mrt	The increasing rate of stimuli to reaction time model
PRT (RT−mrt)/RT	The increasing rate of personality valuation time model

mrt: Means of RT in simple response session.
RT: RT on Personality self-rating condition by-term and by-sentence.

pants performed 60 trials (20 terms×3＝60 trials). After three sessions on the PC, participants performed scale construction of a Big five personality inventory by pen and paper, and the experiment was ended.

Analysis   In the simple response session, RT was analyzed in 200 trials that utilized auditory and visual stimuli. In the personality self-rating conditions, we analyzed participants' RT assessing 20 personality-trait terms. *N* was the number of trials × 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) from the Statistical Analysis System (SAS) statistics software package.

Model   As RT also needs to be examined in terms of intra-individual differences, we operationally defined three processing models: DRT, SRT, and PRT (Table 2). It was possible to examine the amount of intra-individual variability for personality traits. We calculated a numerical value for each model and performed a two-way ANOVA for five factors using each model.

Model 1. Time of decision personality model (DRT): DRT was based on the time to determine one's own personality by a stimulus term or sentence. It was thought that each participant had an individual pace when evaluating his or her own personality from stimulus terms. DRT was determined by subtracting the *means* of RT in the simple response sessions from the RT of each participant in the personality self-rating conditions.

Model 2. Increasing rate of stimuli to reaction time model (SRT): SRT was based on repeated stimulation and reaction during a condition. We considered the influence of a mental load by repeated stim-

uli and reactions. Based on each participant's response time to a stimulus in the simple response session, we examined the variation in each participant's response to a stimulus by personality trait.

Model 3. Increasing rate of personality valuation time model (PRT): PRT was based on the load on the individual from personality self-rating many times in response to a stimulus. Based on each participant's time of judgment in the personality self-rating conditions, we examined the variation in each participant's judgment by personality trait.

Results

To examine the RT during personality self-rating, we calculated the means and *SD* of RT to five personality traits in the personality self-rating conditions by-term and by-sentence. And, we performed a two-way analysis of the variance for five traits × a participants in each self-rating condition and examined the RT in each self-rating condition. In the by-term condition, there was a major effect for five traits ($F(4, 5018)＝10.04, p＜.01$) and a major effect for participants ($F(52, 5018)＝34.72, p＜.01$). A significant difference was indicated for five traits ×participants ($F(208, 5018)＝1.41, p＜.01$). The multiple comparison by tukey method indicated significant difference at 5％ level at A−E, A−O, C−A, C−N and E−N.

In the by-sentence condition, there was a major effect for the five traits ($F(4, 2905)＝8.76, p＜.01$) and a major effect for participants ($F(52, 2905)＝26.57, p＜.01$). A significant difference was indicated for five traits × participants ($F(208, 2905)＝1.24, p＜.05$). The multiple comparison by tukey method indicated significant difference at 5％ level at A−E, A−N, E−A and E−O. This result revealed that the RT during personality self-rating differed individually for every participant and each trait in both conditions. As for interaction, the participant's RT differed depending on each of the personality five traits. ANOVA of condition and five traits indicated condition ($F(1, 8443)＝0.94$, n.s.), five traits ($F(4, 8443)＝10.60, p＜.01$) and interaction condition by five traits ($F(4, 8443)＝2.92, p＜.05$). The simple effects sliced by traits indicated significant difference at 5％ level at Neuroticism. This result revealed that difference by the condition was not indicated except for traits Neuroticism.

1. RT of five personality traits by Yes/No key difference in each self-rating condition

We examined the means and *SD* of RT to the five traits by a Yes/No key in each self-rating condition (Figure 3). Figure 3 through 6 indicate RT, *SD*, and the 95％ critical limit mean of RT (n.s.) for five traits by Yes/No key. The solid line represented the means of RT in the by-term condition, and dotted lines were for the by-sentence condition in the figure. Vertical axis on a Figure 3 and Figure 4 was milli second (ms) in reaction time.

We performed a two-way analysis of the variance for five traits × Yes/No key in each self-rating condition. Results in the by-term condition indicated a major effect for five traits ($F(4, 5273)＝6.71$, $p＜.01$) and a major effect for the Yes/No key ($F(1, 5273)＝4.21$, $p＜.05$). A significant difference was indicated for five traits × Yes/No key ($F(4, 5273)＝2.69$, $p＜.05$). The simple effect of the 5％ level sliced by five traits was showed at A, E and O, and sliced by Yes/No key showed at Yes.

In the by-sentence condition, there was a major effect for five traits ($F(4, 3160)＝6.25$, $p＜.01$). No significance was found for the Yes/No key ($F(1, 3160)＝0.01$, n.s.). A significant difference was
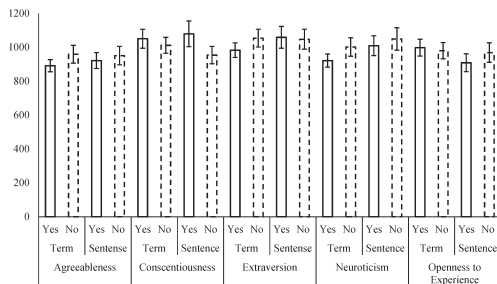

Figure 3 Yes/No key Means in reaction times of each condition by five personality traits

Figure 4 Yes/No key Means in DRT of each condition by five personality traits

indicated for five trait × Yes/No key ($F(4, 3160)＝3.01$, $p＜.05$). The simple effect of the 5％ level sliced by traits was showed at Conscientiousness, and sliced by Yes/No key showed both Yes and No. This result revealed that the RT during personality self-rating differed individually for the Yes/No key and each trait in both conditions. And, no significance was found for the Yes/No key in the by-sentence condition. In the response tendency of the Yes/No key, there were a lot of Yes keys for Conscientiousness, but there were few No keys for Neuroticism in the by-sentence condition. This results of ANOVA suggested that the RT was changed by the five personality traits more than the response tendency of Yes/No.

2. Three models of intra-individual differences in the RT of personality self-rating

We compared three models of the RT of personality self-rating and examined intra-individual differences by the self-rating conditions. A two-way ANOVA of five traits × participants indicated that the RT during personality self-rating was individually different in each self-rating condition. Thus, we assumed that there was a difference in the RT as a factor in the individual. We set up three models that factor in the individual in the RT during personality self-rating. We calculated the *means* and *SD* of RT and performed a two-way ANOVA for traits × Yes/No key using the three models in each self-rating condition.

2.1 Time to decide one's own personality by a stimulus term or sentence (DRT)

DRT focuses on the time to determine one's own personality in each self-rating condition. We performed a two-way analysis of variance for five traits ×Yes/No key in each condition. In the by-term condition, there was a major effect for five traits ($F(4, 5273)＝4.13$, $p＜.01$) and a major effect for the Yes/No key ($F(1, 5273)＝6.32$, $p＜.05$). No significance was found for five traits × Yes/No key ($F(4, 5273)＝1.86$, n.s.). The simple effect of the 5％ level sliced by five traits was showed at A, E and N, and sliced by Yes/No key showed at Yes.

In the by-sentence condition, there was a major effect for five traits ($F(4, 3160)＝3.43$, $p＜.01$). No significance was found for the Yes/No key ($F(1, 3160)＝0.24$, n.s.). A significant difference was indicated for five traits × Yes/No key ($F(4, 3160)＝3.74$, $p＜.05$). The simple effect of the 5％ level
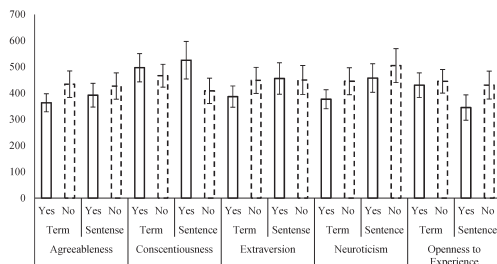
sliced by traits was showed at Conscientiousness and Openness, and sliced by Yes/No key showed at Yes. In both conditions, there was a major effect for five traits, so the time to determine one's own personality changed for traits. No significance was found for the Yes/No key in the by-sentence condition; there were no changes in the means RT of Yes/No when sentences were evaluated. There was a major effect for five traits × Yes/No key by-sentence condition, so it was the evaluation of sentences that changes the time to determine one's own personality by each trait and Yes/No reaction. The time to determine one's own personality was short, about 300 ms, for Agreeableness term with Yes, the Extroversion term with Yes, and Neuroticism terms with Yes in the by-term condition. In the by-sentence condition, it was short (345 ms) for the Openness term with Yes. This suggests that the participant reacted faster to a socially desirable term as judged by others. The result form *ANOVA* revealed that difference by the condition was not indicated.

2.2　Repeated stimulation and reaction (SRT)

SRT focuses on the factor by which a stimulation and a reaction are repeated in a session. *ANOVA* in the by-term condition revealed a major effect for five traits ($F(4, 5273) = 5.18, p < .01$) and a major effect for the Yes/No key ($F(1, 5273) = 5.52, p < .05$). A significant difference was indicated for five traits × Yes/No key ($F(4, 5273) = 2.56, p < .05$). The simple effect of the 5％ level sliced by traits was showed at Agreeableness, and sliced by Yes/No key showed at Yes. In the by-sentence condition, there was a major effect for five traits ($F(4, 3160) = 4.47, p < .01$). No significance was found for the Yes/No key ($F(1, 3160) = 1.14$, n.s.). A significant difference was indicated for five traits × Yes/No key ($F(4, 3160) = 3.96, p < .05$). The simple effect of the 5％ level sliced by traits was showed at Conscientiousness, and sliced by Yes/No key showed both Yes and No. As in the result of the DRT, the means RT of SRT changed by trait in both conditions. There was an interaction for five traits × Yes/No key in both conditions, so the means RT of SRT changed for each trait and Yes/No reaction. There was a feature in the *SD* using this model, with the *SD* around 1*SD* for the Agreeableness term with No, the Conscientiousness term with Yes, the Extroversion term with No, and the Openness term with No in the by-term condition, revealing that there was variability in the re-
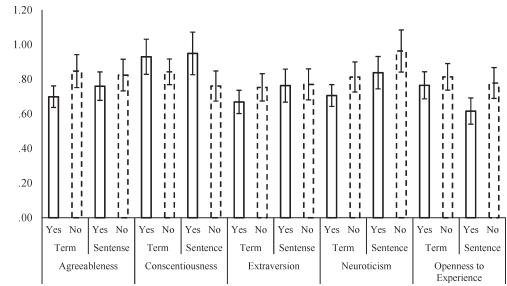

Figure 5　Yes/No key Means in SRT of each condition by five personality traits

action when a participant reacted to a stimulus term. In the by-sentence condition, there were a few Yes /No key features, but the means were high: for the Conscientiousness sentence with Yes it was 0.949 and for the Neuroticism sentence with No it was 0.963, and the *SD* exceeded 1, indicating that there was vary enormously in the time to press the Yes/No key and RT was delayed when one reacts to Conscientiousness many times. The result form ANOVA revealed that difference by the condition was not indicated.

2.3　Personality self-rating is judged repeatedly (PRT)

PRT focused on the mental load of the individual after self-rating personality many times in response to a stimulus. ANOVA in the by-term condition indicated a major effect for five traits ($F(4, 5273) = 6.98, p < .01$) and a major effect for the Yes/No key ($F(1, 5273) = 16.23, p < .01$). No significance was found for five traits × Yes/No key ($F(4, 5273) = 0.85$, n.s.). The simple effect of the 5％ level sliced by traits was showed at Agreeableness and Openness, and sliced by Yes/No key showed both Yes and No. In the by-sentence condition, there was a major effect for five traits ($F(4, 3160) = 2.39, p < .05$). No significance was found for the Yes/No key ($F(1, 3160) = 1.31$, n.s.). A significant difference was indicated for five traits × Yes/No key ($F(4, 3160) = 4.41, p < .01$). The simple effect of the 5％ level sliced by traits was showed at Agreeableness and Openness, and sliced by Yes/No key showed both Yes and No. As in the result of the DRT and SRT, the means RT of PRT changed for each trait in both conditions and no significance was found for the Yes/No key in the by-sentence condition. There was a major effect for five traits × Yes/No key in the by-sentence condition, so the evaluation of sentences caused the time
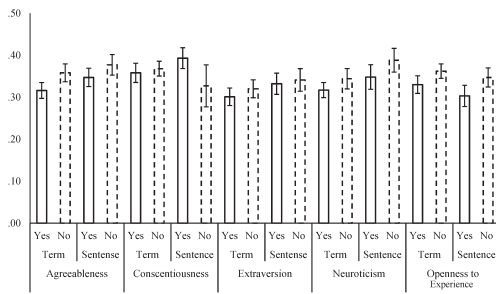
Figure 6　Yes/No key Means in PRT of each condition by five personality traits

to determine one's own personality to change for each trait and Yes/No reaction. the means RT of PRT was around 0.300 and the *SD* of around 0.200 was stable for the five traits, so there were no differences in the RT in judging many times. This revealed that personality judgement would continue, and that no factors influenced the variability of personality judgement. The *SD* of Conscientiousness with No in the by-sentence condition was 474 ms. There was thus variability in the RT when it was judged repeatedly many times. ANOVA of condition and five traits indicated condition ($F(1, 8443)＝5.46$, $p<.05$), traits ($F(4, 8443)＝5.69$, $p<.01$) and interaction condition by traits ($F(4, 8443)＝3.82$, $p<.01$). The simple effects sliced by traits indicated significant difference at 5％ level at Agreeableness and Neuroticism. This result revealed that difference by the condition was not indicated for traits Agreeableness and Neuroticism.

Discussion

This experiment examined the change of RT for five personality traits and for performing personality self-rating under the by-term and by-sentence conditions. In our Hypothesis1, when performing personality self-rating, RT has a tendency determined by the stimulus conditions and five personality traits. In the ANOVA for five traits × a participant in each self-rating condition, the RT when performing personality self-rating differed individually for every participant. To compere RT of the two conditions, there were the difference in the RT by some stimulus term related Conscientiousness term, but RT didn't change by the two conditions. As a conspicuous result, as there was a major effect for five traits RT and three models in the both conditions, the RT when performing personality self-rating changed for the five personality traits in both conditions. In addition, ANOVA for five traits × Yes/No key indicated a significant difference for five traits × Yes/No key in both conditions, suggesting that the Yes/No key with personality traits changed the RT of personality self-rating. This result indicated that differences in the RT were not caused by the self-rating conditions on the computer, and that the RT when performing personality self-rating changed by the five personality traits and by participant in both conditions.

In our Hypothesis 2, these RTs have a characteristic involving the individual. We examined the intra-individual differences in RT during personality self-rating and the factors within the individual, by a self-rating process using three models for each condition. After we performed ANOVA using each model and compared the intra-individual difference of RT by each model, the following thing became clear. From a common standpoint of low RT data and three models in both conditions, two points became clear. First, there was a major effect for five traits, so it became clear that the RT when performing personality self-rating changed by five traits. Second, the difference in RT by the self-rating condition was the Yes/No key. No significance was found for the Yes/No key in the by-sentence condition, so RT was changed by Yes/No in the by-term condition. A point of difference in the low RT data and the three models in both conditions was the difference in the interactions in the self-rating conditions. In the by-sentence condition, a significant difference was indicated for five traits × Yes/No key in the low RT data and the three models. However, in the by-term condition, no significance was found for the five traits × Yes/No key in DRT and PRT, suggesting that it does not change when judging personality in key with some traits in the by-term condition. In SRT, the characteristic RT was changed by the five traits and self-rating conditions. There were large variations in intra-individual differences in the means of RT in Agreeableness, Conscientiousness, and Neuroticism. In the by-term condition, the means of Yes/No key RT vary widely, suggesting that the by-term condition was a factor in the individual differences in RT when performing personality self-rating. In the by-sentence condition, there were a few features of the Yes /No key, but the means were high: 0.949 for the Conscientiousness sentence with Yes, 0.963 for Neuroticism sentence with No, and

the *SD* exceeded 1, suggesting that when one reacted to Conscientiousness many times, there were variations in the time to press the Yes/No key and RT was delayed. This suggested that when a participant reacts many times to the answer with Yes in Conscientious and the answer No with Neuroticism, briefly "I'm conscientious" and "It isn't neuroticism", the time which reacts to the stimulus vary greatly among individual. An earlier study about the RT of Neuroticism pointed out that there is a relationship with the variability of the recognizing performance (Eysenck & Eysenck, 1985). In RT study, neuroticism was associated with variability in stimulus-response behavior as measured by reaction time (Robinson & Tamir, 2005). Thus, there is a possibility affected by Neuroticism in SD of RT of this experiment. In a study about a factor of a variation of *SD*, Standard deviations of RT are typically viewed as error, but such error is an individual difference (Jenssen,1992). It was suggested the some personality trait has some feature of the RT and *SD* in this experiment. It would be necessary to specify a factor which personality traits is a factor of a change in next experiment. As a factor besides the personality traits, we considered as this reason that this experiment participated university students. In case of the university student who is the one from Neuroticism, there is a possibility which it appeared as variability in RT, and it may be some potential for bias for particular personality traits and Yes/No reactions. As a result of SRT model the in both self-rating conditions, it was suggested that the time which reacts to some stimuli was individually different, not time to judge whether it was everything. Through this experimental RT, we may be able to describe the different individuality of another side using the RT. Linking the intra-individual differences in RT to five personality traits and conditions may enable extracting more in depth personality information by examining the *means* and SD of RT when performing personality self-rating.

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