

# The relationship Between Cerebral Blood Flow and Behavior Activation During Personality Assessment.

**Kouhei Matsuda:** Tohoku Bunkyo Collage, JAPAN

**Emi Sato:** Tokyo Fiji University, JAPAN



**Kouhei Matsuda:** Tohoku-Bunkyo College, JAPAN  
E-mail: [jetta@t-bunkyo.ac.jp](mailto:jetta@t-bunkyo.ac.jp)

## Personality Assessment by the nIR-HEG

This experiment aimed to use individual nIR HEG(near infrared hemoencephalography) to develop a measure of cerebral blood flow and behavior activation during personality assessment. The specific individual variation was reflected, so a concentration ratio to a problem thought it could be used as an index of Personality.

## Purpose

The purpose of the experiment was not to develop an absolute measure of cerebral blood flow using HEG, but instead to examine if scores in intra-individual variations in evaluations can be made.

**Hypothesel.** The nIR-HEG in each personality measurement shows intra-individual variability.

**Hypothesel2.** The intra-individual variance of nIR-HEG is indicated by the ratio in the individual.

## Method

**Participants** There were 16 graduate students (9 males, 7 females), aged 19 to 22 years.

**Experiment period** May-December 2014

**Equipment** ProComp TM7500(Thought Technology Ltd, Canada) was measured electroencephalography(HEG), a laptop computer (Dell-Vostro 3360), E-prime 2.0 (psychology software tool), and headphones., Saliva amylase (NIPRO;27B1X00045000073)

**Experiment Stimulus** By referring to a manual of Big5 (Murakami and Murakami, 2008), we selected each four terms for five personality traits.

**Table1. The stimuli terms of personality self-rating**

Practice Stimuli	sincere	amenable	philosophical	
Extraversion	active	sociable	passive	restrained
Agreeableness	kindly	affable	headstrong	tightwad
Conscientiousness	capable	conscientious	sloppy	unreliable
Emotional Stability Stimuli	easygoing	sedate	irasciblenss	worrier
Openness to experience	intelligent	clever	conservative	naivety

## Procedure

1. Interview & Big5 inventory.

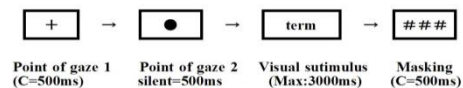
2. Practice trial (15trials)

3. Simple response condition (S1)

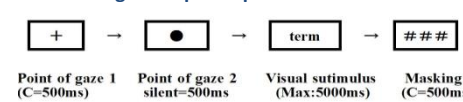
4. personality self-rating condition by term. (S2)

5. personality self-rating condition by sentence. (S3)

6. Inventory: BIS/BAS, Lie scale by MMPI. (SQ)



**Fig 1. Simple response session**



**Fig. 2. Personality self-rating session by term and sentence.**

## ANALYSIS:

HEG Ratio calculated as a value obtained by dividing the HEG of each session at the average of the HEG. Correlation coefficients were calculated with the personality tests.

**Acknowledgment :** This work was supported by JSPS KAKENHI Grant Number 24530846. Grant-in-Aid for Scientific Research (C) as "The Experimental study of the personality by the physiological and behavioral indexes." in Japan.

## Result

1. The HEG Ratio of S1 was significantly and negatively correlated to the BAS (Behavioral Activation System). HEG at the S1 decreased the higher the BAS scores( $r=-.561$ ,  $p<.05$ )

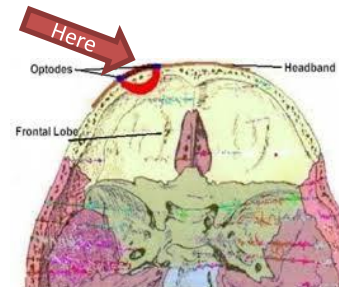
2. The HEG Ratio of S1 was significantly and negatively correlated to the FS(Fun Seeking). HEG at the S1 decreased the higher the FS scores( $r=-.728$ ,  $p<.01$ )

3. The HEG Ratio of S3 was moderately and positively correlated to the BAS (Behavioral Activation System). HEG at the S3 increased the higher the BAS scores( $r=.439$ ,  $p<.10$ )

4. The HEG Ratio of S1 was Insignificant and negatively correlated to the Lie Scale from MMPI.HEG was reduced by the higher score of the LIE( $r=-.359$ )

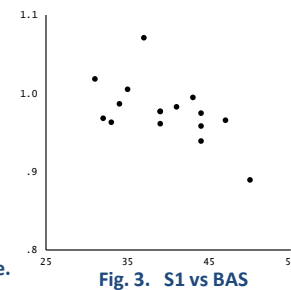
## Discussion

As a conclusion, when the BAS was high, the initial session did not increase the HEG, but the HEG did increase during the second half of the session. **It was suggested, when interest to a subjective problem was low, fictionality was admitted by an answer to the questionnaires.**

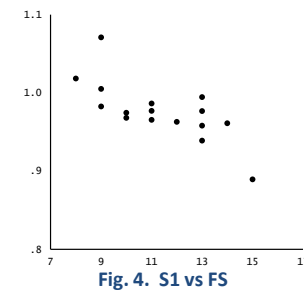


**Table 2. Correlations between questionnaires and hemoencephalography**

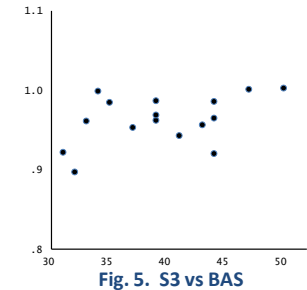
Questionnaires	S1	S2	S3	SQ
Lie Scale from MMPI	-.359	-.331	-.019	.375
BIS (Behavioral Inhibition System)	.380	.268	-.002	-.343
BAS (Behavioral Activation System)	<b>-.561</b>	-.247	<b>.439</b>	.242
D (Drive)	-.403	-.365	.210	.319
RR (Reward Responsiveness)	-.231	-.180	.375	.059
FS (Fun Seeking)	<b>-.728</b>	.011	.410	.204



**Fig. 3. S1 vs BAS**



**Fig. 4. S1 vs FS**



**Fig. 5. S3 vs BAS**

This result clarified that In high stimulation events, the HEG decreased, but in the latter half of the session though the personality assessment, the HEG increased. A possibility that a subjective arbitrary answer gets mixed was indicated by personality evaluation by the questionnaires.



### What's prefrontal cortex activity ?

The prefrontal cortex is related to a high-level emotion, motivation, a decision-making and the various functions such as the social behavior. When doing personality self-rating, What kind of alteration occurs for our body or brain? It's possible to measure cerebral bloodstream by electroencephalography(HEG).

### Purpose

When doing personality self-rating, we examined whether the personality self-rating on the PC uses an equivalent amount of cerebral activity compared to the questionnaire method by HEG.

**Hypotheses1.** There are individual differences in the cerebral bloodstream caused by personality self-rating.

**Hypotheses2.** Personality self-rating on the PC yields an amount of the cerebral activity equal to that of the questionnaire method.

### Method

**Participants** The participants were 21 graduate students (13 males, 8 females)

**Experiment period** May-December 2014

**Equipment** ProComp TM7500 (Thought Technology Ltd, Canada) was measured electroencephalography(HEG), a laptop computer (Dell-Vostro 3360), E-prime 2.0 (psychology software tool), and headphones., Saliva amylase (NIPRO; 27B1X00045000073)

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5. personality self-rating condition by sentence.
6. Inventory: BIS/BAS, Lie scale by MMPI.

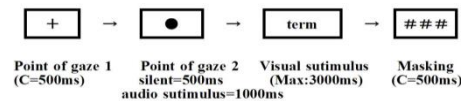


Figure1. Simple response session

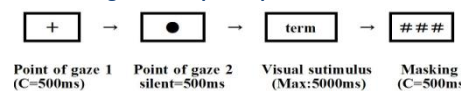


Figure2. Personality self-rating session by term and sentence.

### ANALYSIS:

We examined the cerebral activity mean of each condition measured by electroencephalography(HEG).

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### Result and Discussion

#### 1. Is there difference in forehead bloodstream by a person?

We examined the cerebral activity mean of each condition measured by electroencephalography(HEG). As a results ANOVA, a major effect on the amount of cerebral activity of each participant ( $F(3,60)=31.21, p<.01$ ), **the cerebral bloodstream had the individual differences, when performing personality self-rating.**

#### 2. Is there difference in cerebral bloodstream by evaluation method?

A significant differences were indicated in the amount of cerebral activity produced by the questionnaire and term the self-rating condition on PC ( $t(15)=5.28, p<.01$ ). A significant difference was indicated in the amount of cerebral activity produced by the questionnaire and sentence self-rating condition ( $t(15)=5.67, p<.01$ ). (**Hyp.2**) **the amount of cerebral activity was increasing in the questionnaire than PC evaluation.**

#### 3. The difference in HEG by personality self-rating on the PC conditions?

No significance was found for amount of the cerebral activity for term and sentence condition on PC.

**This suggests that it doesn't put a load on brain by personality self-rating on the PC.**

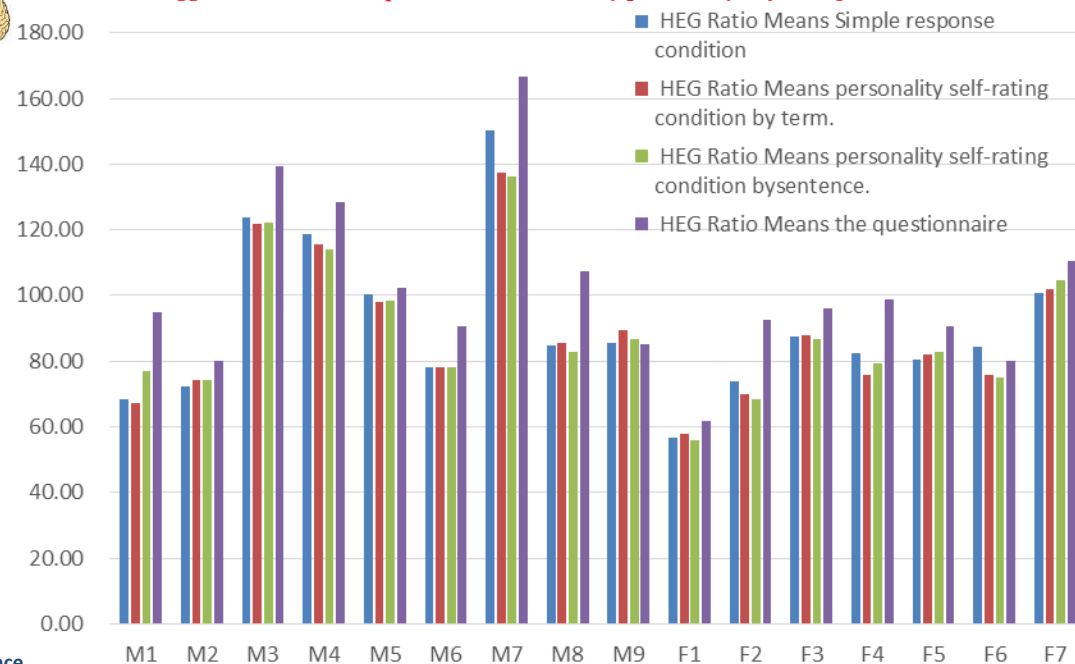


Figure3. The means of HEG Ratio by participants in each self-rating condition.

★This result clarified that the numerical value of the cerebral bloodstream produced by the questionnaire exceeded that of the personality self-rating on the PC.

★Thus, setting the experimental conditions, **it revealed that there were differences in the cerebral activity by a way of personality self-rating.**