

Elucidation of affective (kansei) response determination mechanism through development of precise and stable methods for affective response measurement

Supervisor (Principal Investigator)

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1. Objective

Affective “kansei” responses can be defined, in a restrictive sense, as the results and outputs of evaluations of an object’s value and expressions of the relationships between humans and the object. They are psychological and behavioral responses concerning human perception, recognition and judgment and are obtained by brain processes that are higher and more complex than the simple perceptual responses that have hitherto been measured in physiological and psychophysical experiments that use threshold measurements and so on. Thus, the measurement and investigation of affective responses have a reasonably-high possibility of bringing deep insights to human brains process information when they are in a conscious state.

Several well-known methods have been used to measure these “kansei” responses, including the paired comparison method, the magnitude estimation method, the semantic differential method, and the questionnaire method. For more precise and stable measurement, however, further improvements are required to these methods, particularly in terms of measurement precision, accurate reproducibility of data, precise comparison between observers, and minimization of psychological biases. Furthermore, a new method, that is either a drastic evolution of one of the current methods or a completely new method, is needed to construct brain-function models which can explain information processing and cognition and can predict human judgment quantitatively and mathematically.

In this laboratory, I have already successfully produced a hierarchization of the relationship between color (vision) and semantic words using “the method of bi-directional verification of semantic word space,” [See ref. 1] and further improvement and development of this method is needed. Therefore, the three purposes of this project are (a) to improve the hierarchical method, (b) to create a new method for precise and stable measurements of affective responses, and (c) to develop a model of an affective “kansei” response determination mechanism that is based on these two new methods.

2. Project Outline

(1) Background:

Some types of brain activity are connected with the early stages of information processing, in which information from the environment is analyzed and integrated. Higher stages of information processing in the brain include activities for recognition, judgment, decision-making, and preparation for behavior with memory control. Even in simple stimulation and response scenarios, such brain activities are very complex and have interactions between them. It has been difficult for traditional physiological approaches to investigate the relations between activities in different areas of the brain, even in non-human primates. On the other hand, psychophysical methods that use human observers are a good way to investigate more complex relationships for conforming affective (kansei) responses, but these complex relationships are available only in terms of input-output relationships, i.e. as a black box. Considering these situations, psychophysical, psychological and cognitive methods still have some advantages in the investigation of affective responses.

(2) Steps of the project:

This project has three research steps, as follows.

(a) Improvement of the method of bi-directional verification of semantic word space:

Evaluation scales of quality for objects, especially commercial products, can be defined in many different ways. The basic concept currently used in such evaluation of quality is referred to as KANSEI (affectivity). Evaluation in KANSEI ordinarily depends on a complex interaction between localized evaluation scores of many aspects of evaluation belonging to a set of evaluations for one kind of object. In a psychological manner, the semantic differential (SD) method is used to find the set of semantics and principal components in the set. However, keyword evaluation in the set of semantics is often distorted by the semantics of words. Additionally, although there are many evaluation scores in the set,

the basis for evaluation cannot be directly expressed verbally. The PI has already proposed a new method which can verify such distortions [See ref. 1].

(b) Development of a new method for precise and stable measurements to affective responses:

This step is important to make the research deeper and wider. Proposals from candidates at the time of application are welcome for this step. The proposed new method will be investigated and developed for better measurement of affective responses.

(c) Elucidation of affective (kansei) response determination mechanism:

In the main focus of this research, it is envisaged that, based on results of those measurements, brain function models which are suitable for use as cognition models that predict human perception, recognition and judgment for affective response, can be constructed quantitatively and mathematically. Even if the new brain function models are more practical and phenomenological than traditional models, they can still be useful as prediction tools. While giving due consideration to the error rates found in the models, they will be used as the basis for the development of practical applications.

3. Expected Performance

In this project, the successful candidate would be expected to:

- (a) Write good proposals for a project including experiments, especially for a Ph.D. (SSP) project.
(This ability will be initially evaluated by the research proposal in the SSP application documents)
- (b) Contribute to the supervisor's projects to learn protocols and procedures for high quality research.
- (c) Work independently in experimental preparation, work and data analysis.
- (d) Assist senior members (most likely Masters students) in the lab in all aspects of research activities.
- (e) Share some of the routine work required to run and manage the laboratory.

4. Required Skills and Knowledge

The successful candidate for this project will have the following knowledge and skills:

- (a) Some background in vision, brain and/or psychological research is strongly preferred.
- (b) Ability to communicate effectively in English, including writing research papers in English.
- (c) Ability to adapt quickly to new research areas.
- (d) Ability to collect, analyze and report to English research publications.
- (e) High motivation to conduct foundation research on human factors.
- (f) Programming skill (MATLAB), and strong ability in mathematics are preferred.

SSP status is restricted to a three-year period; all SSP students have to write at least two excellent research papers for established English language journals within three years. Thus, the accepted candidate will join the supervisor's project immediately and he/she soon will establish the precise research plan following the stream of the project as the core of his/her Ph.D. thesis. Additionally, the candidate's proposals for new, creative, and interesting research sub-projects, which are not concerned directly to this project, are welcome.

References (Underlined authors are SSP graduates of this laboratory)

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- 3) Miao Song, Keizo Shinomori and Qian Qian, "Perception and Expression Habits of Smiling and Angry Expressions Modulated by Facial Physical Attractiveness in Asian Female Persons", Japanese Psychological Research, vol. 61, No. 1, pp.12-24, 2019.
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- 5) Keizo Shinomori and John S. Werner: "Aging of human short-wave cone pathways," Proceedings of the National Academy of Science of the United States of America (PNAS), 109 (33), pp.13422-13427, 2012.

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