

Physiological Responses and *Kansei* Evaluation on Awareness

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Abstract. For tasks in which the steps to achieve a goal are not specified, a user adopts the trial and error method to achieve the goal. If the system is able to induce “awareness” to user, the goal can be achieved in an effective manner. We aim to elucidate the mechanism of “awareness” in order to develop a system that incorporates induction of “awareness”.

In this study, we examined the changes in the physiological indices of autonomic nervous activity before and after the occurrence of “awareness”. We selected three types of tasks, namely, a jigsaw puzzle, a slide puzzle, and target shooting for which “awareness” was represented by the following items: “can see the end in sight”, “I think I may do it”, and “grasp the techniques”. *Kansei* evaluation was performed for each task.

Keywords: Physiological response, *Kansei*, Affectiveness, Awareness.

1 Introduction

Some sort of “awareness” occurs in the process of achieving the tasks. For example, when performing a task in situations where there are no manual handling procedures and steps. The user repeats trial and error on the task which is not clear steps for the

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goal. Then, the user explore the steps that can reach the goal, the user will reach the goal. If the system is able to induce “awareness” to user, the goal can be achieved in an effective manner. We aim to elucidate the mechanism of “awareness” in order to develop a system that incorporates induction of “awareness”.

There are several studies using physiological indices to measure the awareness. Paynter et al.[1] investigated possible non-conscious learning mechanisms by giving subjects three runs of task while recording ERPs. ERP showed clear evidence of information about the correctness of a move well before subjects were making progress on the task behaviorally, let alone being able to consciously determine if a move was correct or not. Furthermore, McIntosh et al.[2] obtained evidence for neural system interactions related to awareness and performance in a positron emission tomography(PET) regional cerebral blood flow study of sensory associative learning. Meanwhile, Schraw and Dennison[3] were constructed a 52-item inventory to measure adults’ metacognitive awareness. They developed a 53-item self-report instrument that includes multiple items within each of the eight component processes subsumed under knowledge and regulation of cognition.

These studies revealed that the awareness could be measured by PET and ERP. However, it is difficult to measure awareness using these physiological indices when users were used the system in their life. In this study, we examined the changes in the physiological indices of autonomic nervous activity before and after the occurrence of “awareness”.

2 Methods

2.1 Participants

Thirty participants (15 men, 15 women; 21~25 years old) participated in the study. Each participant performed the same task thrice. Physiological indices were measured during the experiment. *Kansei* evaluation of performance was conducted after the completion of each task.

2.2 Experimental Tasks

We selected three types of tasks, namely, a jigsaw puzzle, a slide puzzle, and target shooting for which “awareness” was represented by the following items: “can see the end in sight”, “I think I may do it”, and “grasp the techniques”. The three tasks were performed on a personal computer, and each task had three patterns.

The jigsaw puzzle (Fig.1) consisted of 50 pieces to make three pictures (a tree, shell, and beach). These pictures were shown for 10 seconds before the task; the participants were not shown the picture while they were solving the jigsaw puzzle. The point at which the participant’s operation became faster after he/she had seen daylight was considered the “change point”; this point indicated the occurrence of “awareness”.

The slide puzzle (Fig.2) had three levels (low, middle, and high) and was performed from the low level to the high level. The participants said the time point

when they thought they might do it as the occurrence of “awareness”. This time point was recorded.

The target shooting task (Fig.3) consisted of six arrows on a set. If participants ran out these arrows before reaching a reference point, the task come to an end. The task was performed thrice. The participants said the time point when they felt to grasp the techniques as the occurrence of “awareness”, and this time point was recorded.

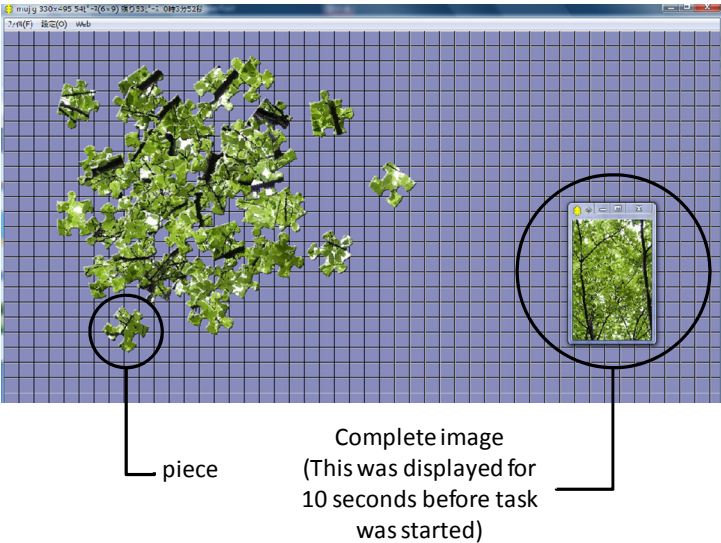


Fig. 1. Jigsaw puzzle sample

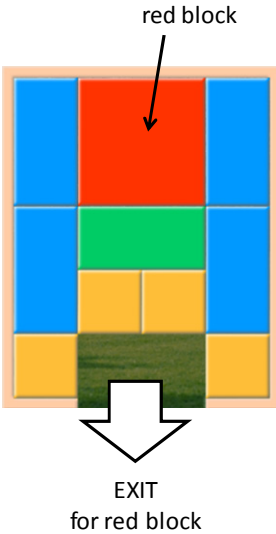


Fig. 2. Slide puzzle sample



Fig. 3. Target shooting task sample

2.3 Physiological Indices

The physiological indices consisted of the electrocardiogram (ECG), blood volume pulse (BVP), change of salivary amylase activity, and number of eye blinks. ECG, BVP and eye blinks were measured during the rest for a minute and the experiment. Salivary amylase was measured before and after the experiment. The values of physiological indices were considered as 100% at rest.

2.4 Evaluation Items

The 31 items related to “awareness” were selected for the *Kansei* evaluation. In addition, three items, namely, “can see the end in sight”, “I think I may do it”, and “grasp the techniques” were added as items representing “awareness”. Participants were evaluated for each item on a seven-point scale using the semantic differential method.

3 Results and Discussion

Data for the physiological indices measured 10 seconds before and after “awareness” (remark or change point), or before and after task were examined.

The R-R interval on the ECG and the amplitude of BVP tended to be lower after “awareness” than before “awareness”. The number of eye blinks and the change of salivary amylase activity before and after task were not significantly different.

The R-R interval is influenced by the sympathetic-parasympathetic activity. The R-R interval significantly reduced after the slide puzzle and target shooting tasks but not after the jigsaw puzzle task (Fig.4). It was difficult to appear psychological changes in the jigsaw puzzle task. This was because it acquired “awareness” not based on the participant’s remark but based on action data.

The amplitude of BVP is influenced by the sympathetic-parasympathetic activity. The amplitude of BVP significantly reduced after the slide puzzle task but not after the target shooting task and jigsaw puzzle (Fig.5).

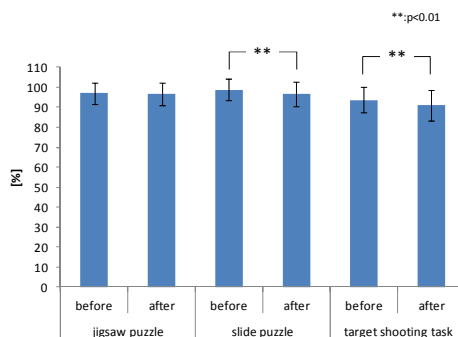


Fig. 4. The result of before and after awareness on R-R Interval

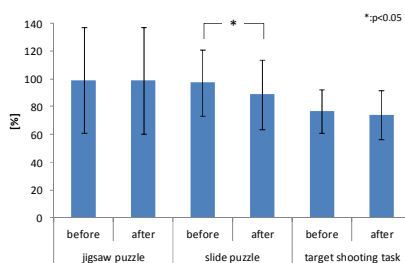


Fig. 5. The result of before and after awareness on BVP

Next, the *Kansei* evaluations of “can see the end in sight”, “I think I may do it”, and “grasp the techniques” were examined on each task. The score of “can see the end in sight” on jigsaw puzzle was 6.4, and the score of “I think I may do it” was 6.3, the score of “grasp the techniques” was 5.3. In the other words, the score in the items related to the sense of accomplishment at the time of clearing was high. The score of “I think I may do it” on slide puzzle was 6.3, the score of “can see the end in sight” was 5.6, and the score of “grasp the techniques” was 4.7. The items of other high score were “pleasant” and “delightful” and so on. The score of “I think I may do it” and “grasp the techniques” on target shooting task was 5.2, and the score of “can see the end in sight” was 5.1. In addition, the items for which the scores were higher than average in the target shooting task were related with a feeling of satisfaction, such as “delightful”, “satisfaction”, and “refreshing”.

As described in 2.2, we selected three types of tasks, namely, a jigsaw puzzle as “can see the end in sight”, a slide puzzle as “I think I may do it”, and target shooting task as “grasp the techniques”. This results were confirmed that the score of “I think I may do it” for slide puzzle was high and the scores of “can see the end in sight” and “I think I may do it” for jigsaw puzzle were high. Therefore, the induction of awareness was confirmed for selected tasks. It is necessary to examine for the other task in the future.

4 Conclusions

This study aimed to investigate the occurrence of “awareness” with a focus on the role of the autonomic nervous activity in the underlying physiological response. The results showed significant differences in the R-R interval and amplitude of BVP before and after the occurrence of “awareness”. This indicates that occurrence of “awareness” could possibly be detected by measuring the autonomic nervous activity. Furthermore, our results for *Kansei* evaluation suggest that the action of the mind tended to vary depending on the type of “awareness”.

References

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