

# Pupil size variation and autonomic activity during subliminal mere exposure

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**Abstract**— To explore the unconscious preference formation mechanism, we have investigated activity of the autonomic nervous system during subliminal mere exposure by measuring pupil diameter, HRV and respiratory. Smaller size and constriction of pupil was found for participants with mere exposure effect and for stimuli with high preference, respectively.

**Clinical Relevance**—Although it might not be directly of interest to practicing clinicians, this will help to and diagnose the human perceptual and cognitive function in future.

## I. INTRODUCTION

Preference is formed unconsciously in daily life, and we tend to prefer objects that they have observed repeatedly. This phenomenon is called the mere exposure effect, and this effect is observed even when visual stimuli are presented subliminally [1]. This mere exposure effect has reported to relate to pupil diameter dilation [2], suggesting that pupil diameter variation is involved in impression formation as a factor of preference. Pupil diameter fluctuation is under the control of the autonomic nervous system. Therefore, investigating the activity of the autonomic nervous system may help clarify the mechanism of impression formation. In this study, to explore the mechanism of unconscious preference formation, we have investigated activity of the autonomic nervous system by measuring pupil diameter, HRV and respiratory.

## II. METHODS

Five subjects aged 20-30 years with corrected visual acuity of 0.7 or better (glasses or contacts allowed) were participated. The stimulus image was displayed for 0.0083 sec followed by the mask image for 0.5 seconds. Two types of images were used: line drawings and Bengali letters. 10 images were presented at subliminally 8 times each, for a total of 80 times. After the session, the participants were asked to choose one of the presented two images: one is subliminally presented, and the other was unrepresented. Pupil diameter, ECG, and respiration were recorded during the session. Each participant was asked to perform the task twice, changing the type of images presented. From the measured pupil diameter, ECG, and respiration, we calculated the temporal variation of

pupil diameter and the LF/HF value, which is an evaluation index of autonomic activity. The preference rate was calculated as the percentage of preference for the presented image in the preference task.

## III. RESULTS AND DISCUSSION

Mere exposure effects were found in three participants for line drawings, the preference rate for the old images was 54.3%, but not found in Bengali letters. For line drawings, the pupil diameter during stimulus presented (from 0 to 0.01 sec) in participants with mere exposure effect group was smaller ( $0.961 \pm 0.048$ ) than others ( $0.973 \pm 0.034$ ) with others. Figure 1 shows one example of pupil diameter changes during subliminally image presenting. Amplitude of constriction after the stimuli was larger for stimuli with high preference than those for low preference. We also found that there is a relationship between preference and the autonomic nervous system by comparing the respiratory sinus arrhythmia components, although more specific analysis of autonomic nervous system activity will be required.

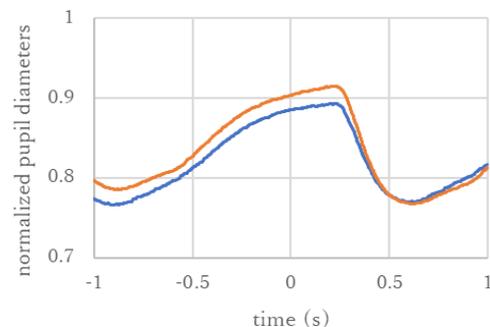


Figure 1. Pupil diameter changes (averages obtained from one subject) during subliminal stimulus presentation. Orange line denotes the average for stimuli with high preference, and blue denotes those with lower preference.

## REFERENCES

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