

1-8 Applicabilities of Transient Visual Evoked Potentials

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Although steady-state visual evoked potentials (SSVEPs) have been recently utilized to brain-computer interfaces (BCIs), there still remain two problems in the SSVEP-based BCIs. One is that they might be annoying because users have to gaze at high-speed blinking visual stimuli, and the other is that they may not be used as universal interfaces because SSVEPs are not detectable by some users. Therefore, it will be necessary to develop alternative VEP-based BCIs. Transient VEPs have not been used for BCIs because they generally need long detection time due to their necessity of about 100 responses for signal averaging. We therefore employed short-distance bipolar derivation to shorten detection time, and could reduce the number to 15 responses. Furthermore, transient VEPs were detected even when users did not gaze at visual stimuli, and they showed different waveform when visual stimuli was displayed in the right-side or the left-side of users' visual field. These results indicate possibilities and future hope that non-offensive BCIs could be developed by using transient VEPs.

1-9 A Study of Weber-Fechner's Law on Human's Sensory Characteristics of Exerted Force by Hand

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To design operational equipments by hand that feel easy-to-use and suitable, it is necessary to study human's sensory characteristics of force exerted by hand. However, the researches about voluntary exerted force (active sense) are not enough. Therefore, we have studied the human's sensory characteristic of voluntary exerted force on actual operating position.

In this research, we focused on a verification of the Weber-Fechner's law: the correlation between the subjective sensory quantities and the measured values is nonlinear, and the physical quantity exponentially increases with regard to the sensory quantity.

In this experiment, only the auditory feedback was used (there is no visual feedback). In the condition that required an exerted force 2 and 3 times larger than the standard force value, the measured value was larger than the desired value in some cases and smaller in others.

These results suggest the possibility that the Weber-Fechner's law is not applicable for the active sense.

1-10 Development of Time-domain EEG, Neuro-CardioVascular Analyzing System

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To examine the effects of auditory stimuli on electroencephalographic (EEG) changes and skin blood flow, EEG, skin blood flow and heart rate (HR) reactions to 80 dB white noise exposure were recorded from 6 volunteers with a mean age of 21. The beat-by-beat changes of mean EEG frequency and the mean EEG amplitude were analyzed by using Cosine Spectrum Analysis Method. The mean EEG frequency and the mean EEG amplitude increased, skin blood flow on the other hand, showed biphasic changes after the auditory stimuli. In most cases, HR and skin blood flow were slightly increased for the first 4–5 heart beat after white noise exposure, skin blood flow was markedly decreased for the first 4–5 heart beat. We suspect that changes of skin blood flow were determined by 1) changes of cardiac output, 2) passive vasodilation and 3) active vasoconstriction.

1-11 Visual Evoked Potentials Elicited by Chromatic Flash Stimulation

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The aim of this study was to investigate the color related information in cortical activity by VEPs (visual evoked potentials) recorded from the scalp. Seven subjects (range 20–35 years) were recruited to this study. To confirm reproducibility, all the subjects were asked to participate twice on different days. The stimuli were generated by red, green and blue LEDs which had a continuance lighting time for 500 ms, a randomly interval at 1.5–2.5 s and were presented a simple color once. The experiment lasted 1.5 hours; subjects exposed to stimuli in three-minute and then had a three-minute rest. We performed the repetition 15 times for making sure having enough times for signal averaging calculation. As the results, we found that at the amplitude responses, red stimulus shows a significant difference of cortical activity in frontal area. And at latency responses, early component N72 shows a delay towards frontal area from visual area; later component P200 shows a delay from frontal area to visual area. The reproducibility was affirmed by intraclass correlation coefficient. VEPs as a proposed method can be used to locate in time and quantify the differences in cortical activity during color perception.