Feature extraction of human face image for preference database

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Abstract: In this study, aimed for a preference judgment for the face image of the person by the single trial ERP. Cognitive task imposed on subjects with human faces. At the time of the image presentation of the key push it down, and impose a problem the time response time (RT).200ms to 400ms after image presentation time of peak positive potentials appear focused ± 100ms. Calculated from the maximum amplitude ± 100ms latency and area of potential. P300 is analyzed to extract frequency components, 1.28 seconds for ERP 2-3Hz amplitude spectra obtained.1 Analyzed EEG frequency components appear to recognize the human face image and asked the potential spectrum. Spectral correlation potential in the area and potential. Correlated with latency and RT. Single-trial ERP waveforms were extracted correctly.

Keywords: ERP, P300, preference, face image, feature extraction.

I. INTRODUCTION

When a human being runs a social life, ability to read the will of another person, and to take the appropriate behavior is very important as towards other people communicative competence. Emotional intelligence EQ is famous in recent year[1]. "KANSEI" is socialized in the same way of frequent occurrence for "Human being serious consideration" and "KANSEI society". Communication is transmission of "KANSEI". If "KANSEI infomation" has gotten across to machine , It should have gone of smooth communication between person and person. Preference is one of the factors of human action. KANSEI information communication technology is expected of used to human preference. It will be the application as quite new communications tool. Event Related Potential (ERP) is caused cerebral evoked potential reaction of the mental work of the subjects [2]. Preference is involved with attention and a cognitive level. There have been various investigations of preference to the event [3]. ERP was evaluated sensitivity information about the preference. However, face images were not evaluated. That was aimed at estimating the correlation of the face image as preference because quantity of characteristic of the face image was extracted.

II. EXPEROMENTAL

Experimental equipment setup and electrode arrangement for scalp EEG are shown in figure1. Experiments were executed in a measurement booth divided with partition walls of 1.8m in height. An infrared thermograph system (TVS-200EX, AVIONICS) was installed 0.7m in front of subject. Facial skin thermograms were created with 1s sampling periods. Image resolution of thermograms was 320×240 pixels, and room temperature was set at 26 ± 1.0 degrees Celsius. a seated position in a resting. An electrode headpiece (Pasteless Electrode Helmet, Brain Function Laboratory) and set of headphones were placed on the subject. EEG was recorded at a sampling frequency of 200 Hz using a biological plifier/sampler (5102 EEG HEAD BOX, NF Electronic Instruments) and digital signal processor unit (5101 PROCESSOR BOX, NF Electronic Instruments). Electrodes used for scalp for scalp EEG were Pz, based on the international 10-20 method, and a reference electrode was A1. Electrodes used for ECG were put on the superior margin of the sternum and cardiac apex based on a modified Lead NASA in order to reduce artifacts of EEG from ECG. A common ground electrode for both EEG and ECG was put on Cz. EEG was recorded at a sampling frequency of 200 Hz using a biological amplifier/sampler (5102 EEG Head Box, NF Electronic Instruments) and digital signal processor unit (5101 Processor Box, NF Electronic Instruments).The protocol for the experiment is shown in figure2. Subject was 22 year-old healthy men. Subject was well informed about the experiments and the objective of this study before participation experiments. The day of experiment could be before or after the day scheduled. The measurement was not begun until the subject had been in the room for at least 15 minutes to habituate to the room temperature. In this study, subjects performed discrimination task of the face images. The subject carried out a discrimination

task to distinguish images shown every 0.5 second in the measurement. The images consist of the faces of the man and woman. The target image is told to a subject before the measurement. The target image was displayed on the display of the PC. Subjects was instructed to push the key as quicklyas possible. Response time (RT) was defined as the time of pushing down the key on presenting stimulation. The presentation frequency of a target image and the non-target image follows (Non-target) : (Target) = 1:1. In addition, subjects carried out POMS (short form) and STAI-JYZ and VAS (pleasant - unpleasant) before and after the measurement pleasant. Afteran experiment, preference of each image was measured by VAS. The measurement was not begun until the subject had been in the room for at least 15 minutes to habituate to the room temperature. The experiment was conducted during the day except with in 2 hours after eating, a was limited to be conducted once daily for each subject. And an oral explanation about experiment contents, purpose and investigation object were given by a document, and the subjects confirmed an agreement for the experiment cooperation by a signature. The ERP is the reaction that is caused when a percept. A component of ERP called P300 is related to the cognition of stimulus.P300 can represent reaction corresponding to the discrimination of the stimulus quantitatively. The ERP is expressed definitely so that discrimination of the stimulation is performed easily. ingredient called P300 wave related to the recognition develops, and ERP are shown in figure 3. An areal voltage and latency of the ERP were focused to evaluated quantity of the preference for the face image. In this study, P300 was defined as 300ms the positive peak potential in range of 300±100ms. It was reported that P300 and preference have positive correlation. Positive areal potential in range of±100ms of the latency of the peak was calculated. Areal voltage and latency of the peak are assumed from the time when showed the positive peak of±100ms.Preference for the stimulation of the subjects have been assessed with areal voltage and latency of the peak. Calculated from the maximum amplitude ± 100ms latency and area of potential. Areal Voltage and Amplitude spectrum are shown are shown in figure4. P300 is analyzed to extract frequency components, 1.28 seconds for ERP 1-7Hz amplitude spectra obtained. ERP is reaction of induced by mental work to impose on task of subject.
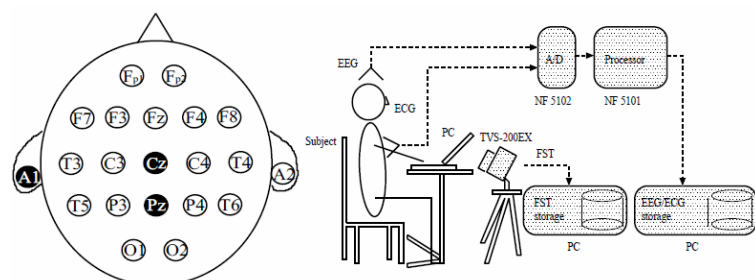

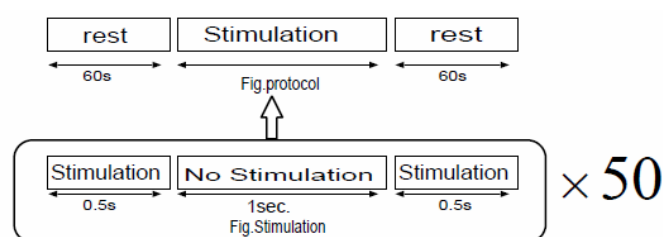Fig.1. Measurement system and EEG electrode arrangement
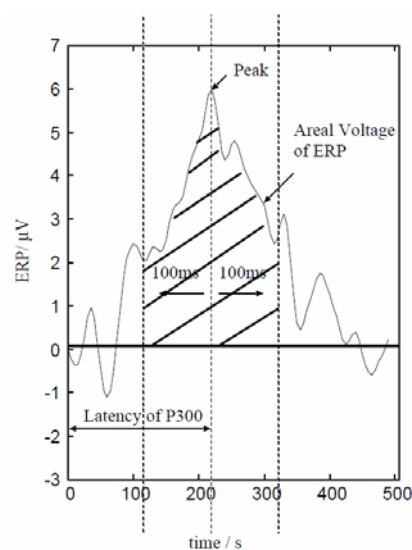

Fig.2. Experiment protocol
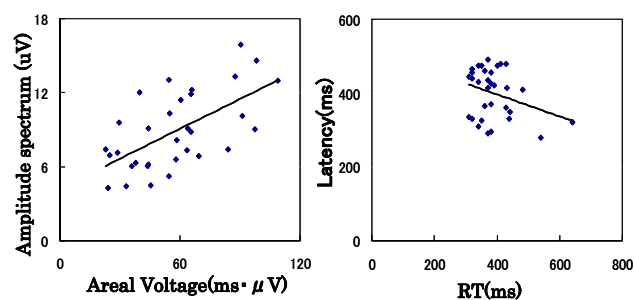

Fig.3. Latency and Areal Voltage of P300

Fig.4. Areal Voltage and Amplitude spectrum

An ingredient called P300 wave related to the recognition develops, and ERP for the discrimination problem by the sight stimulation can arrest reaction corresponding to the discrimination of the stimulation quantitatively. ERP is developing that a difference of the stimulation is big. In this study, preference of subject was measured based on the areal voltage and latency of ERP. Furthermore, P300 was extracted by frequency analysis. Characteristic of an ERP pattern provided from target stimulation, expression of the positive electric potential is accepted as of 300ms by the stimulation presentation and is called P300 wave generally. Analysis of the ERP,   evaluation are usually made by extracting the amplitude of P300, an area, quantity of characteristic such as the top latency. The ingredient related to discrimination should be included during the response button exercise start time to push it down from the time of the sensory receptor excitement by the presentation stimulation. In addition, the evoked potential should develop for positive electric potential because P300 wave affects it in one way or another for cognitive process. It is quantity of characteristic of the ERP to reflect these two businesses and refers to this parameter. Method of evaluating on brain waves is reading of P300 of top latency of positive electric potential 250ms-500ms interval. About ERP and the connection of the preference, the amplitude value and an amplitude spectrum and correlation of the preference of P300 were reported [4]. Imitated this in this study, attention to ± 50ms of the top latency of the positive electric potential of the single trial ERP wave pattern, an amplitude spectrum is demanded of 1-7Hz from the time when the positive greatest amplitude for the amplitude value and the ERP of 1.28 second time of P300 in the section of ± 50ms was showed. The amplitude value and an amplitude spectrum were assumed on evaluation value. Preference for stimulation of the subject was evaluated. The amplitude value, amplitude spectrum, RT and latency relations is shown in figure 3. Than a precedent study, the preference has relation to an electric potential area of the amplitude value of P300 for latency. Than a precedent study, the preference has relation to an electric potential area of the amplitude value of P300 for latency. Even this study imitates, the preference as latency and an electric potential area of P300 were estimated. An expression as a lineament was extracted. The extraction method of the expression compares eyebrows width and the width of

the mouth with a standard value for a standard price at the interval of the eyes of right and left. The correlation of the psychology index was estimated as the numerical value extracted

III. RESULTS AND DISCUSSION

An electric potential area when the face image of the man a target assumed and an amplitude spectrum and RT and correlation of the latency are shown in figure 5.Equilateral correlation (r=0.406,n=50, *p <0.05) was accepted between an electric potential area and amplitude spectra in the case of a man a target.It is supposed that an electric potential area and extraction of amplitude spectrum P300 wave based for top latency were made from P300 wave between 250-500ms. As a result, an electric potential area and an amplitude spectrum for an index were used when correlation of the preference was judged. Because the electric potential area was based for top latency, latency was used for an evaluation index of the preference equally.Latency and preference on correlation when the face image was made of the man a target are shown in figure 6.Negative correlation (r=-0.271, n=50, *p <0.05) was accepted between a target liking it in the case of a man with latency. When a subject discriminated the image of the woman from it, as for meaningful correlation having come out to the face image of the man than a woman, it is thought that taste did not show a remarkable difference because an object is the opposite sex.A target used it for an index of the image extraction as a result of above more because the taste in case of the man was based on ERP. Eyebrows width and the width of the mouth and the ratio of the interval of both eyes are shown in figure 7.Eyebrows width and the ratio and the taste of the interval of eyes did not have the correlation. The width of the mouth and the ratio and the taste of the interval of eyes did not have the correlation.The graph was divided which was into top and bottom 15 items of the polarity of the preference valuated are shown in figure 8.Correlation (r=0.418, n=15, *p) equilateral between the width of the mouth of the image which taste was reflected on weakly and the ratio with the interval of eyes and taste > 0.05) was accepted.If the width of the mouth was wide, for the face image of the man, it followed that it was favorable for the image.As for the width of the mouth being wide, the subject takes the expression of the person as "a smile". Therefore it
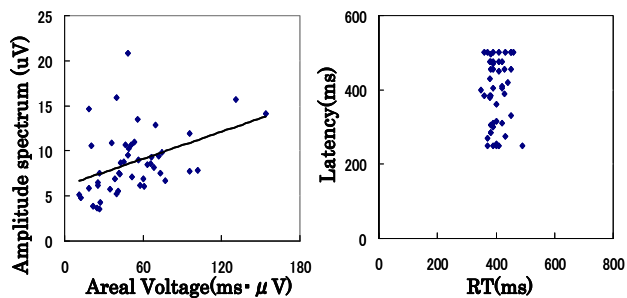
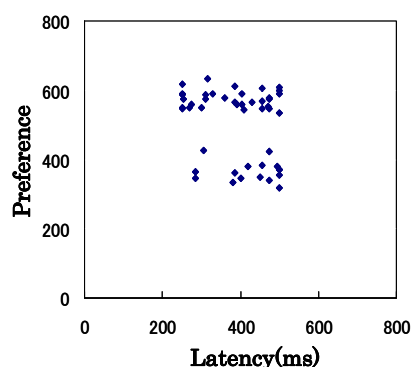Fig.5. Areal Voltage and Amplitude spectrum

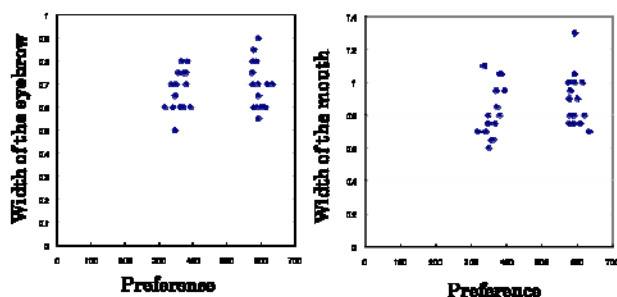
Fig.6. Latency and Preference

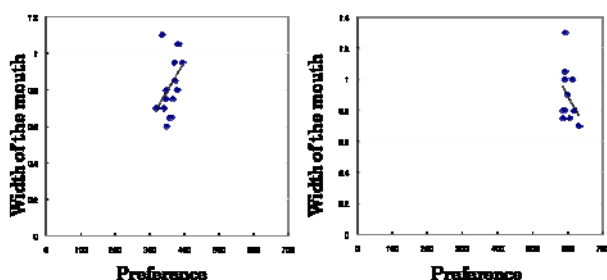Fig.7. Preference and Width of the eye brow
and mouth

Fig.8. Preference and Width of the eye brow
and mouth

followed that a subject had a favorable impression from an image.

VI. CONCLUSION

In this study, the preference for the face ofthe subject was evaluated. Brain waves and the correlation of the psychology index were accepted when u sed ERP. An expression was extracted for quantity of characteristic of the image. width of the mouth was used for quantity of characteristic of the expre ssion. As a result, correlation was accepted by area and the taste of the width of the mouth.

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