

required to synchronize their respiration with 0.33Hz. The result was that, 0.1Hz component of R-R interval variation in free respiratory condition was larger than that in controlled respiratory condition. In free respiratory condition the component decreased with the task, but in controlled respiratory condition, that decrement could not be observed. In free respiratory condition low frequency respiration, such as a sigh or a yawn, was often observed at rest, but few of them during the task. This deep breathing caused remarkable increment of 0.1Hz component of R-R interval variation. It was concluded that, the decrement of 0.1Hz component of R-R interval variation due to the mental work load was mainly originating from the change of respiration patterns.

02 Study of R-R Interval Variation

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R-R Interval variation can be described by coefficient of variation (CV). These effects of mental task and exposure to white noise sound were examined. These effects were estimated for CV of R-R interval. The level of the noise was 90 dB(A) and was exposed intermittently. The irregular interval calculation of mental task was showed on CRT display. The five subjects were male students aged between 21-23 years. This experiment was observed under 4 conditions : rest, mental task, rest with exposure to the noise and mental task with exposure to the noise. Each condition was undertaken for 10 minutes. In this experiment, CV showed no significant change between rest and exposure to the noise condition. But in the mental task condition, CV lowered than the rest significantly ($P < 0.05$). These results suggest that stimulus of exposure to intermittent white noise sound can't change CV significantly. While the stimulus of irregular intervals calculation can lower CV significantly.

03 Measurements of Blood Flow in Skin Tissue

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Laser Doppler Flowmetry provides easy to use, non-invasive, real time measurements of local tissue blood flow.

Laser Doppler blood flow measurement works on the Doppler shift of laser light. Laser light is used to illuminate the skin tissue. Some of this light is reflected straight back by the static tissue, and some is reflected by one or more moving red blood cells. When the light is reflected off a moving object its frequency is shifted, the amount of shift is dependent on the speed of the moving object. The reflected light from the static tissue and the moving red blood cells is collected and mixed. The signal can then be processed to produce an indication of the flux of the red blood cells.

The system uses a solid state laser diode as the laser light source at about 780 nm. Two glass fibres are used, one to transmit the laser light to illuminate the tissue, and one fibre to collect the reflected light. This is then photodetected in the system. The signal from the photodetector is then amplified and processed by an analogue processor. The signal is then sampled and further processed by the digital processor. The digital processor also performs all the user interface and display functions.

07 Ability of Information Processing in Sensation Modality

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The purpose of the study is to elucidate the process in acquisition of perception by visual, auditory, and tactile senses for short presentation of sense stimuli.

The condition of the measurements are as follows. Stimula of visual, auditory, and tactile senses are given by luminous diode, speaker, and vibrator

with solenoid, respectively. The stimulus levels are taken as intermediate values between stimulus threshold and terminal threshold. Luminance and sound level are obtained to be 25 nt and 60 dB(A). The most suitable vibration sensation was decided by subject feeling. The number of stimulators for each perception is four. The number of stimula (N) kinds is three (i.e., 5, 6, and 7). The interval of stimula (I) is four kinds (i.e., 0, 0.1, 0.2 and 0.4 sec). The duration time of each stimulus is two kinds (i.e., 0.1 and 0.2 sec).

The data was analyzed by the statistics and the information theory. As for the modality in short interval of stimula presented, visual sense gives the highest correct rate, and tactile sense indicates the lowest correct rate. The result for longer interval (i.e., I=0.4 sec), however, shows that tactile sense is dominant for the other modality. Similar results are obtained by constraint coefficient (i.e., mutual information content divided by information content of stimula) in information theory. The order of presentation of stimula affects the response, so that the first half and the end shows higher correct rate, but previous stimulus just before the end indicates the lowest correct rate. Thus, the correct rate depends on the stimulus interval and the order of presentation. The feature of modality for short period memory are elucidated in the study.

08 Difference in Visual and Vibrotactile Information Processing

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An object which is perceived via either the visual or the tactile modality mostly can be identified as the same. However, there is a difference in visual and tactile information processing. Two psychophysical experiments performed to get basic knowledge to assess a communication system. Effect of inter-stimulus interval upon letter recognition presented either visually or vibrotactually was examined in the first experiment. Result showed

that there is a difference in visual and vibrotactile temporal integration of letter segments. In the second experiment, effect of orientation of letters to see if "mental rotation" effects exist in both modalities. Result showed that stimulus orientation affects visual recognition but not vibrotactile. Although further studies are warranted, from the results of these experiments it seems that any convenient presentation could be used for designing a communication system.

10 Effect of Visual Feedback on the Human Force Production from the Viewpoint of Single Motor Unit Activity

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It was known that a short period of muscle tetanus enhances multi-unit afferent discharge from the stimulated muscle for 10 seconds. This phenomenon was called the post-contraction sensory discharge. The purpose of the present study was to provide the evidence that measurements of reproduced criterion forces were examined before and after muscle relaxation from the viewpoint of single motor unit activity.

Experiments were conducted on five healthy adults. The right knee extension muscles (m. vastus medialis) were tested. Force was recorded by the strain gauge. Discharge potentials from single motor units were led and identified using coil-shaped inserted electrode techniques. Subjects were seated on the oscilloscope placed at eye level.

There was a natural tendency towards a positive bias (significant errors) in force after a period of relaxation. The post-contraction errors in force production after 25% MVC might be attributed to the central neural factors. The accuracy of reproducing the criterion force during visual and blind condition was observed as the central factors had been attributed to potentiated response.