

Title	感覚遮断環境におけるヒトの心拍変動・脳波ダイナミクスと意識の状態に 関する研究
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Dynamics of human heart rate variability and electroencepharogram and their relation to states of consciousness under sensory deprivation

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The recent studies on sensory deprivation (SD) and its psychophysiology have been focused on its clinical effects such as relaxation, stress reduction, and treatment for hypertension or addictions. But it is still not clear what kind of physiological states under SD underlie such distinct effects.

In this study, the uniqueness of the physiological states and states of consciousness under SD was investigated through differentiation of physiological states under SD from natural sleep and wakefulness in terms of physiological characteristics (dynamics of electroencephalogram (EEG) and heart rate variability (HRV)) and subjective experiences.

The flotation tank method was used to realize SD environment. Subjects were left for one hour in the flotation tank. For each subject, polygraphic recordings (EEG, electrooculogram (EOG), electromyogram (EMG), and electrocardiogram (ECG)) were performed during SD, natural nocturnal sleep and resting state. In addition subjective reports on their experiences under SD were collected. The data analyses were performed as follows: 1) The relationship between the polygraphic observation and the corresponding subjective experience was investigated, and features of the relationship were compared with those of natural nocturnal sleep and wakefulness. 2) Time-frequency analysis of EEG and HRV data was performed. 3) The difference between dynamics of EEG and HRV during SD, and each stage of natural nocturnal sleep and wakefulness were quantified by Kullback-Leibler divergence.

As a result, the state of consciousness under SD were divided into three categories in terms of the relationship between the dynamics of the polygraphic signals and the experiences. Among them, there was the special category of state more or less resembled REM sleep with the experience of visual image, where the experienced visual image during SD might correspond to dreaming during REM sleep. After involved in this state, the subject reported deeper relaxation and refreshment than in any other states. Therefore, this special state of consciousness might underlie the psychological and clinical merits of SD. Nevertheless, strictly speaking this state is not the same as REM sleep, because the subject was aware where her/his state of consciousness is throughout the experience of visual image.

In conclusion, REM sleep-like state of consciousness with the awareness induced by SD is suggested to realize the relaxation, refreshment, and inspiration.