

学位論文の要旨

Abstract of Thesis

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学位論文題目 Title of Thesis (学位論文題目が英語の場合は和訳を付記)

Study on Audiovisual Integration in Healthy Elderly and Parkinson Patients

健康高齢者とパーキンソン患者における視聴覚統合に関する研究

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Individuals are often surrounded by stimuli from various sensory modalities (e.g., auditory, visual, olfactory, somatosensory). The brain can screen available information from multiple senses and integrate them to better perceive the external environment, shaping and guiding our behaviors. Therefore, it is important to study integration across different sensory modalities. In the daily life, human beings receive approximately 80% information through vision and audition, however, the neural mechanism of audiovisual integration is not completely clear. Besides, how the brain processed the information when auditory and visual information arrive in our brain asynchronously is also unknown. The aim of the present study was to clarify how our brain processes the asynchrony audiovisual information, and whether the processing of audiovisual information change with age. Additionally, we also evaluated the audiovisual integration ability in Parkinson's disease.

Firstly, a visual/auditory discrimination experiment was conducted to examine the effect of stimuli onset asynchrony (SOA) on audiovisual integration, and the difference between younger and older adults. The results confirmed that the response for older adults was slowed and provided empirical

evidence that integration ability is much more sensitive to the temporal alignment of audiovisual stimuli in older adults.

To further clarify the effect of age on asynchrony audiovisual integration, the event-related potential (ERP) was performed using the similar paradigm. The results showed that in the simultaneous audiovisual condition, excepting the earliest integration (80 - 110 ms) that occurred in the occipital region for older adults was absent for younger adults, the early integration was similar for younger and older groups. Moreover, the later integration was delayed for older adults (280 - 300 ms) compared to younger adults (210 - 240 ms). In audition anterior to vision conditions, the earliest integration (80 - 110 ms) was absent in younger adults, but it occurred in older adults. Additionally, after increasing the temporal disparity from 50 ms to 100 ms, the later integration was delayed in both younger (from 230 - 290 ms to 280 - 300 ms) and older adults (from 210 - 240 ms to 280 - 300 ms). In audition posterior to vision conditions, the integration occurred in A100V for younger adults and in A50V for older adults. The current results suggested that the audiovisual temporal integration pattern was different between the audition-leading and audition-lagging vision conditions, and further revealed different temporal effect in younger and older adults on audiovisual integration.

In addition, the previous studies showed that audiovisual integration was abnormal in patients of Mild Cognitive Impairment, Alzheimer's disease and patients with headache. Parkinson's disease (PD) is traditionally recognized as a movement disorder and is a common neurodegenerative disease in the aged populations. Sleep disturbances that have a detrimental effect on health-related quality of life are a common disabling non-motor symptom of PD. Such sleep disturbances can occur at any point during the course of PD and even at the initiative stage. Sleep disturbances are estimated to occur in 60 - 98% of patients with PD. To evaluate whether the audiovisual information processing in

PD with or without sleep disturbance was normal with age-matched healthy adults, forced-choice experiment was conducted. The results showed that no significant audiovisual integration occurred in PD regardless of the presence of cognitive deficits or sleep disturbance; however, such integration did occur in age-matched normal controls. In addition, there were no significant correlations between audiovisual facilitation and H&Y stage or disease duration. The current study provides the first evidence that the audiovisual multisensory integration of peripheral stimuli is absent in PD patients regardless of the presence of sleep disturbances. The results of the study further suggest that abnormal audiovisual integration may be a potential early manifestation of PD.

According to the current situation, future studies will focus on development of audiovisual integration across the life span to uncover the neural mechanism of audiovisual integration and to provide important basis for the early clinical detection and rehabilitation of special brain disease. In addition, the attentional statuses altered greatly with aging or disease, whether the alteration of audiovisual integration with aging was due to the decline of attention is also important projection.