論文 / 著書情報
Article / Book Information

題目(和文)	随意運動が異種感覚統合に与える影響－聴覚刺激と触覚刺激の時間順序判断
Title(English)	Voluntary Movement Affects Simultaneous Perception of Auditory–tactile Stimuli in TOJ Task
著者(和文)	カク巧
Author(English)	Qiao Hao
出典(和文)	学位:博士（理学）, 学位授与機関:東京工業大学, 報告番号:甲第10368号, 授与年月日:2016年12月31日, 学位の種別:課程博士, 審査員:三宅 美博,新田 克己,中村 清彦,宮下 英三,瀧ノ上 正浩
Citation(English)	Degree:, Conferring organization: Tokyo Institute of Technology, Report number:甲第10368号, Conferred date:2016/12/31, Degree Type:Course doctor, Examiner:,,,,
学位種別(和文)	博士論文
Category(English)	Doctoral Thesis
種別(和文)	論文要旨
Type(English)	Summary

（博士課程）
Doctoral Program

論 文 要 旨

THESIS SUMMARY

専攻： Department of	知能システム　専攻	申請学位（専攻分野）： Academic Degree Requested	博士　（　理学　） Doctor of
学生氏名： Student's Name	カク　巧	指導教員（主）： Academic Advisor(main)	三宅　美博
		指導教員（副）： Academic Advisor(sub)	

要旨（英文 800 語程度）
Thesis Summary（approx.800 English Words ）

The simultaneous perception of multimodal sensory information has a crucial role for effective reactions to external environment. Up until now, many studies of simultaneous perception of multimodal sensory information have focused on no movement, in which participants simply receive information from external environment. Whereas, such temporal perceptions of multimodal sensory information often accompany voluntary movements. There is a little studies to investigate whether voluntary movements affect simultaneous perception of multimodal sensory information or not. However, these previous studies reported contradictory effects of voluntary movements on simultaneous perception of visual or auditory and tactile stimuli, when tactile stimulus was presented to the moving body part. Furthermore, the same location of voluntary movements and tactile stimuli raised another question that whether voluntary movements affect the simultaneous perception or not, when tactile stimulus was a non-moving body part. Until now, little is known about spatial limits on the effect of voluntary movements on simultaneous perception, especially when tactile stimulus was presented to a non-moving body part. This study aimed to investigate the effect of voluntary movement on the simultaneous perception of auditory and tactile stimuli in experiment 1 and the spatial effects on the abovementioned effect in experiment 2 by temporal order judgment (TOJ) task. In a TOJ task, the point of subjective simultaneity (PSS) and the just noticeable difference (JND) are measured. The PSS is a time point in which the two stimuli is perceived at the same time. The JND is the smallest interval participants can clearly judge the order of two stimuli, as a measure of participant's 'temporal resolution'. In particular, in voluntary movement condition, participants were asked to voluntarily move their right index fingers and judge the temporal order of auditory and tactile stimuli. In experiment 1, the tactile stimulus was presented to the moving right index finger, whereas in experiment 2, the tactile stimulus was presented to the non-moving left index finger. We designed passive movement condition to exclude the effect of proprioceptive information of the movements, in which participants' right index fingers were moved by device, while no movement condition was used as the control condition. Thus, there were three conditions including voluntary movement, passive movement, and no movement in these two experiments. In the experiment 1, the results showed that the PSS during voluntary movement shifted from the tactile stimulus being first during passive movement or no movement to the auditory stimulus being first, whereas there was no difference of PSSs between passive movement and no movement conditions. Although there was no statistic difference in the JNDs among the three conditions, these differences were marginal differences. These results of experiment 1 indicate that voluntary movement affected the PSS in auditory–tactile simultaneous perception, and it seemed to impair the temporal resolution, even there was no significant difference between voluntary movement and passive movement conditions, between voluntary movement and no movement conditions. In experiment 2, the results showed that there were significant differences of PSSs between voluntary movement and passive movement conditions, between voluntary movement and no movement conditions, whereas there was no difference between passive movement and no movement conditions. On the other hand, voluntary movement and passive movement, compared with no movement, significantly increased the JNDs. And, voluntary movement, compared with passive movement, increased the JND. These results of experiment 2 indicate that voluntary movement also affected simultaneous perception of auditory and tactile stimuli, even when the tactile stimulus was presented to a non-moving body part, not just to a moving body part as has been shown in experiment 1. Thus, from the results of this study, we suggest that voluntary movement affected the simultaneous perception of auditory and tactile stimuli, and that the same shift effects of voluntary movement, compared with passive movement and no movement, on the PSSs occurred, when tactile stimulus was presented to both the moving body part and non-moving body part. The inconsistent effects of passive movement on the temporal resolution, in which passive movement, compared with no movement, did not affect the JND in experiment 1, while increased the JND in experiment 2, might be attribute to the divided attention by movements of non-moving left index fingers in method procedures of experiment 2. After discussed the same shift effects of voluntary movements on PSSs and JNDs, and the different effects of passive movement on the JNDs, we suggested that attention is not enough to affect the PSSs, as prior entry effect reporting by in previous studies, the unique mechanism in voluntary movement (motor information, such as efference copy) might also affect the PSSs. In conclusion, this study indicates that voluntary movement affected simultaneous perception of auditory and tactile stimuli, when tactile stimulus was presented to both of the moving body part and non-moving body part.

備考 ： 論文要旨は、和文 2000 字と英文 300 語を 1 部ずつ提出するか、もしくは英文 800 語を 1 部提出してください。
Note : Thesis Summary should be submitted in either a copy of 2000 Japanese Characters and 300 Words (English) or 1copy of 800 Words (English).
注意：論文要旨は、東工大リサーチリポジトリ(T2R2)にてインターネット公表されますので、公表可能な範囲の内容で作成してください。
Attention: Thesis Summary will be published on Tokyo Tech Research Repository Website (T2R2).