

両手協応運動における引き込み現象と パターン形成の解析

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Analysis of entrainment and pattern formation in bimanual coordination

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Abstract

Patterns of fundamental periodic movements observed in walking, flying, swimming and simple bimanual coordination are formed by dynamic entrainment among motor-neural oscillators that control each limb. However, entrainment in pattern formation of more complex rhythmic movements has not been clarified. In addition, although previous studies have examined a R-R situation in the retention stage, no data of the R-R and S-R situations in the acquisition stage prior to the retention stage have not been reported. Therefore, the purposes of this study were to identify the pattern of acquisition in the S-R situation and to clarify formation in movement patterns from a dynamical viewpoint by using a 5:3 polyrhythmic tapping as a complex bimanual coordination task. Ten subjects performed five trials under the S-R situation and five trials under the R-R situation on each of 14 consecutive days. On the 15th day, they performed two trials under a transfer condition. S-R intervals in the S-R situation and R-R intervals in the R-R situation and the transfer condition were measured, and types of response (anticipation, correct and omission or error), accuracy and stability of the intervals were analyzed. Results showed that a cognitive pattern was formed to perform the 5:3 polyrhythmic tapping in the S-R situation, where a dynamic pattern was formed by entrainment between the two hands in the R-R situation. Especially, the dynamic pattern was formed by the forced entrainment, in which the left hand tapping was entrained to the right hand tapping, or the mutual entrainment, in which the right hand tapping and the left hand tapping entrained each other. Furthermore, the long-term learning led to a pattern transition from 1:1 and 2:1 patterns, which are identified as low level patterns in Farey tree, to the higher level of 5:3 pattern. It was found that stable complex movement patterns were formed by both the cognitive factor in the S-R situation and the dynamic entrainment in the R-R situation.

Key words : bimanual coordination, polyrhythmic tapping, entrainment, S-R situation and R-R situation, pattern formation