Neural processes underlying motor control and learning of bimanual movement

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【Outline of survey】

As symbolized by skillful movement during playing musical instruments and sports activity, human has an ability to perform a variety of movements by combining the movements of body parts such as arms and legs. A conventional research question is what neuronal mechanisms are involved in the spatial and/or temporal coordination of elemental movements. However, it seems necessary to reconsider the premise of the research question, because we have recently shown that compound movement is not constructed from the elemental movements. Specifically, distinct neuronal processes are likely to be involved in the control of the same left (right) arm movement across unimanual and bimanual movements. This new concept opens several novel research questions about the functional role, brain representation, process of selection, and acquisition of such multi-neuronal processes. This study aims to clarify the principle of how the CNS controls bimanual (or compound) movement by clarifying these questions using various methods such as motor learning experiment, brain functional imaging, and mathematical modeling.

【Expected results】

My hypothesis is that well-coordinated bimanual movement is achieved by mechanisms that flexibly switch neuronal processes for a limb control according to the kinematics of another limb. I believe that the exploration of the hypothesis will lead to a novel understanding for the bimanual movement control. Furthermore, the knowledge of the present research will provide a new rehabilitation technique for stroke patients and an efficient training program to develop bimanual motor skills.

【References by the principal investigator】

・Nozaki D, Kurtzer I, Scott SH. Limited transfer of learning between unimanual and bimanual skills within the same limb. Nature Neuroscience 9:1364-1366, 2006
・Yokoi A, Hirashima M, Nozaki D. Contralateral limb-dependent motor learning in bimanual movement. The 38th Annual Meeting of the Society for Neuroscience Abstract, 2008 (in press)

【Term of project】 FY2008− 2012	【Budget allocation】 66,900,000 yen (direct cost)

【Homepage address】 http://www.p.u-tokyo.ac.jp/~nozaki