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Understanding the constraints of finger motor control

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Title: UNDERSTANDING THE CONSTRAINTS OF FINGER MOTOR CONTROL

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Introduction

We routinely use our hands in numerous daily tasks, such as typing and manipulating objects. After having learned a specific task, most of us act without realizing the complexity of the required motor control. Fine hand motor skills require coordinated movements of fingers relative to each other, but individual fingers can only to a limited extent move or exert force independently. When asked to move one finger, involuntary movements of neighboring fingers are commonly observed. The same is true for the voluntary exertion of force by one finger. This limited finger independency has been termed enslaving (Zatsiorsky et al. , 1998). To understand finger force and movement enslaving, all structures that are involved (from the motor cortex to the muscles) need to be considered. Several features of the central and peripheral nervous system have been described constraining the independent control of fingers, such as the spatial overlap of motor cortex areas for movements of different fingers, as well as anatomical characteristics of the musculoskeletal system, such as connective tissue linkages between muscle bellies and tendons (See review by Van Duinen and Gandevia, 2011). Despite many years of research in this area, the relative importance of neural and musculoskeletal factors for the finger enslaving phenomenon is still under debate.

In the summer of 2016, we organized a symposium at the XXI Congress of the International Society of Electromyography and Kinesiology (ISEK, see <https://isek.org/past-conferences/>) entitled “Muscle mechanics and neural control determining fine hand-motor tasks”. This symposium brought together scientific contributions from the disciplines of biomechanics, neuroscience, and orthopedics, covering different determinants of hand motor control, including both basic science and clinical studies. This special issue is based on the talks and discussions of the symposium as well as on additional contributions to the topic of hand motor control.

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