

# Serious Games as a training method for fine motor movements in microgravity

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## Idea

Developing of a muscle controlled serious game for a faster adaptation of fine motor movements in microgravity

## Background

- The human body has accustomed to earth gravity [1]
- In space the astronauts have to adapt their movements to microgravity
- In emergency situations these time for adaptation isn't provided

→ As most of the work in space is done by hands, the practice of **fine motor movements** is very important

→ The more precise you can control your muscles, the more accurate your movements can get

→ Positive effects in muscle control with muscle controlled serious games → decrease of time [2,3,4], increase of performance [4,5], increase of muscle control [3,5]

→ Changes in EEG are expected during the motor learning process → Alpha and theta frequencies are seen during motor learning process [7,8,9]

## Method

- Muscle controlled serious Game to practice the targeted control of muscle activity for the upper limbs
- Measuring System: EMG, EEG
- Measured Muscles: m. extensor digitorum (Fig. 2), m. flexor digitorum (Fig. 1)

- Control of the practice results:

→ Comparison between fine motor movements with and without exoskeleton

→ Looking for changes/ adaptations in EEG and EMG

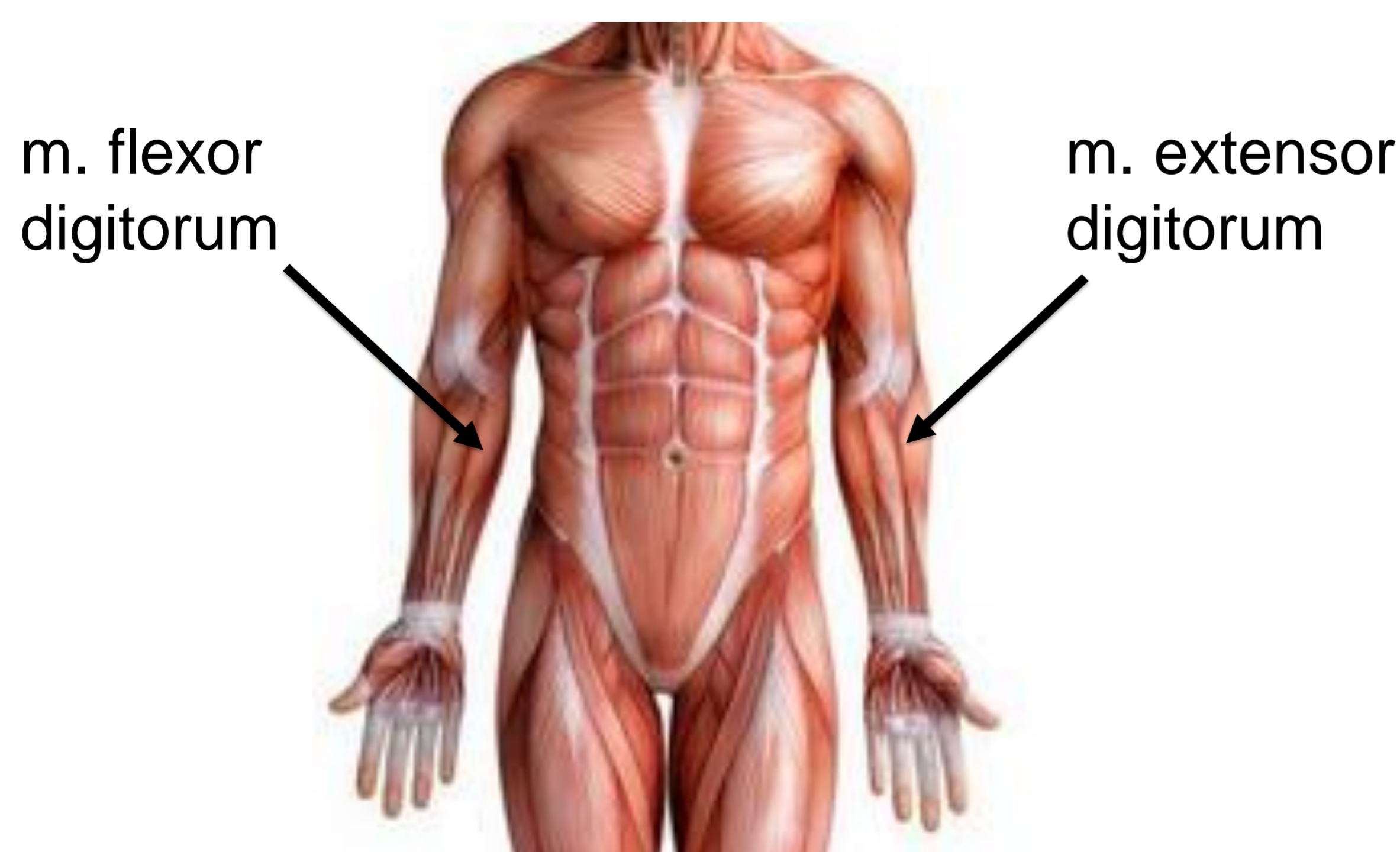


Figure 1: Location of the measured muscles

## The Exoskeleton

- Upper limb exoskeleton for simulating microgravity (Fig. 2)
- Actually designed for rehabilitation of stroke patients
- Can compensate its own arm weight and the weight of the human arm



Figure 2: Recuperera Reha Exoskeleton

## First Prototype

- The bar moves with muscle contraction
- The calibration of the numbers is the 20 (1), 50 (5) and 80 (10) percent of the maximum force
- The goal is to reach the specified number and hold the contraction for 3sec

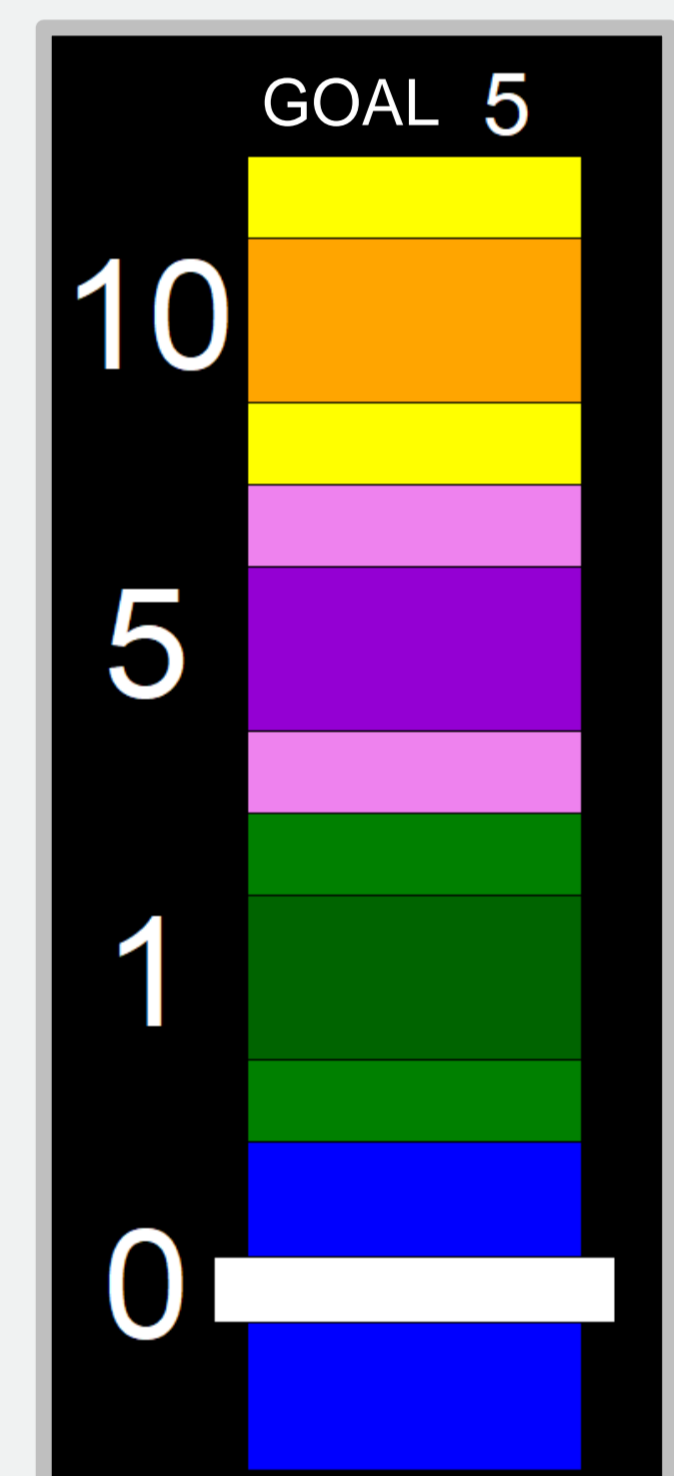


Figure 3. first prototype of the serious game

## Expected Results

It is possible to practice the control of the muscle activity to adapt to different environments faster

It is expected that...

- ...the **EMG variability** during the practice with the game **decreases**
- ...the **EEG frequencies change** by the time of **motor learning** (in this case motor learning is defined as a decrease of EMG variability, decrease of time and better control of the game)
- ...the **time** to reach the goal **decreases**
- ...the **control** of the game gets **better**

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