Serious game training in machine learning controlled prosthetic hands: results on functional outcomes

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Conflict of Interest disclosure

The Author(s) declare(s) that there is no conflict of interest

Introduction

User training is required for ML controlled hand prostheses

Conventional training

- **Coaching (explicit feedback)**
- **Internal focus**
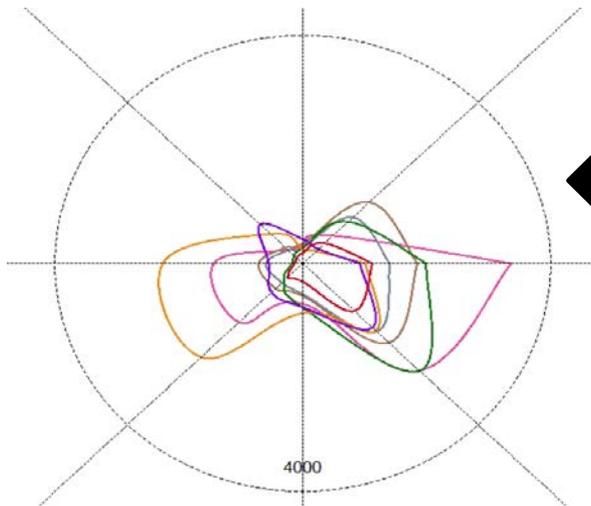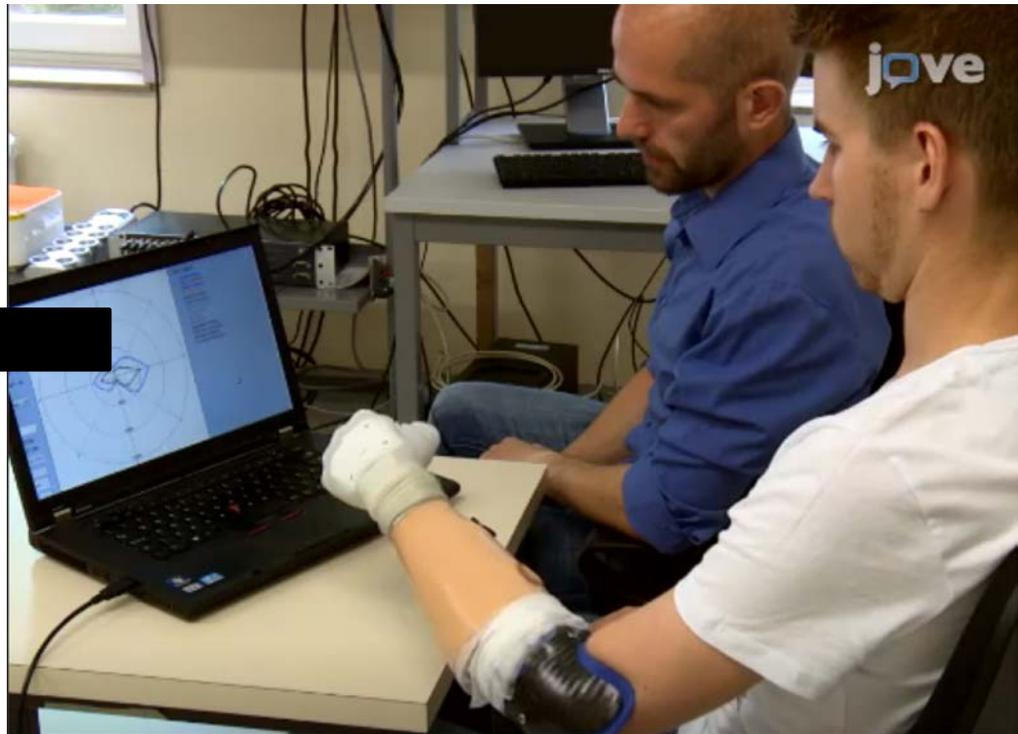- **Trial and error**

Image from Roche et al 2015. *J. Vis. Exp.*

Introduction

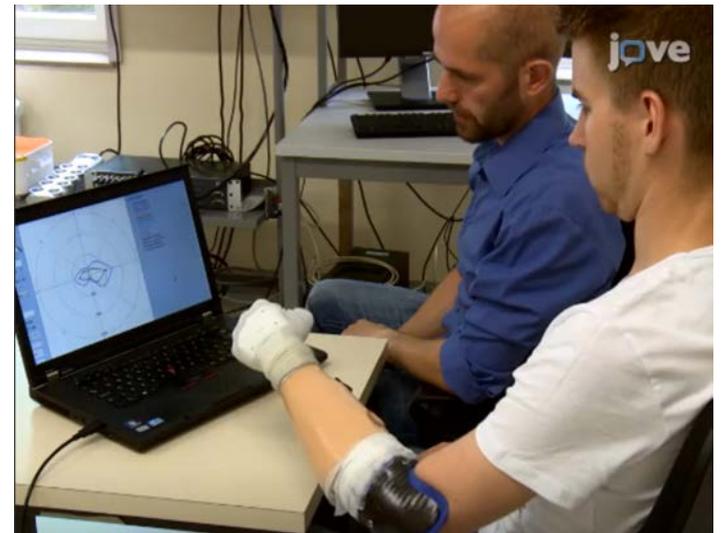**We suggest serious game based training to provide**

- **External focus**

- **No coaching (implicit feedback)**

- **Goal directed, with instant, relevant, feedback**

- **Training exposure**

Introduction
Research question

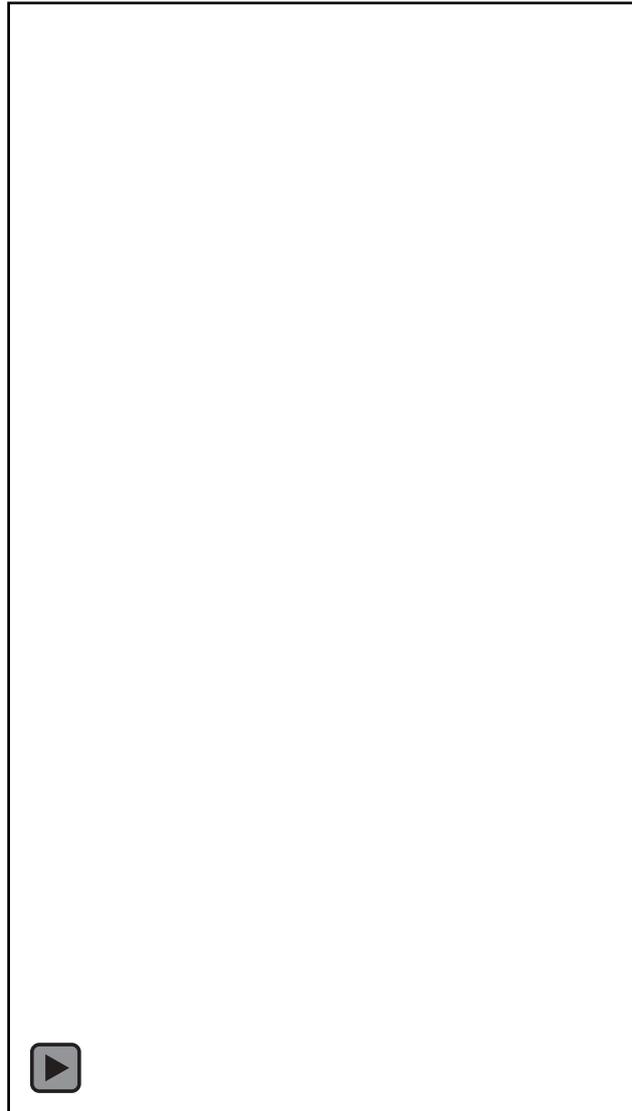**Can serious game training lead to the same functional/clinical outcome scores as conventional training?**

Methods
Conventional training

Methods
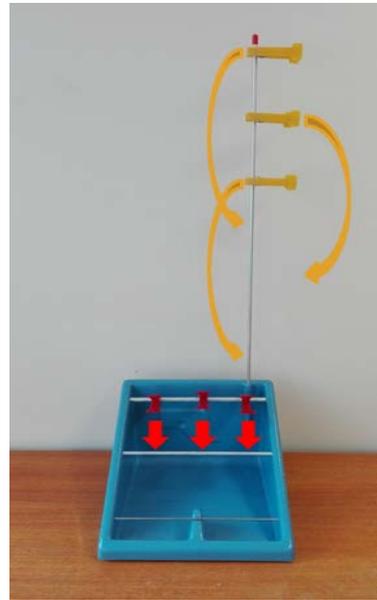## Game training

Methods
Inclusion criteria

- **Unilateral upper limb deficiency at the transradial level**

- **No experience with commercial ML systems**

- **Use a myoelectric prosthesis**

- **18+ years old**

Methods
Study design

Pre-test

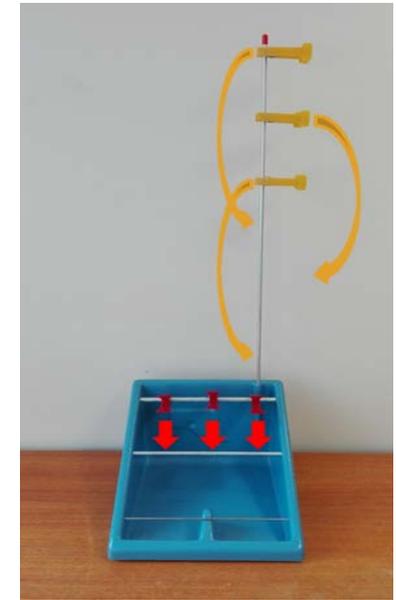7 x 1 hour
Training

Post-test

Fitting +
pre-
training

Conventional

Game

Methods
Hardware

- **Michelangelo Hand**
  - **3 DoF with 2 grips**
  - **Gradual increase of DoF**
- **8 Otto Bock Myoplus electrodes.**
- **Custom made socket**

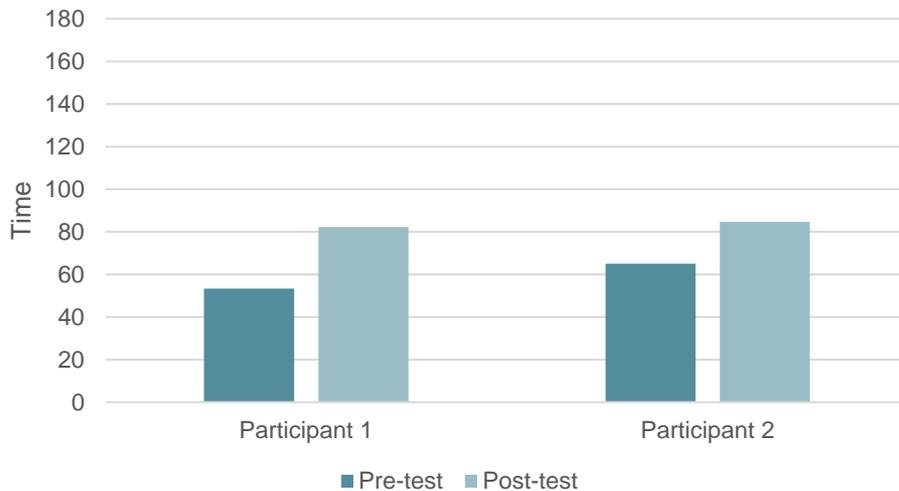# Results
Characteristics of participants

6 recruited, 4 completed

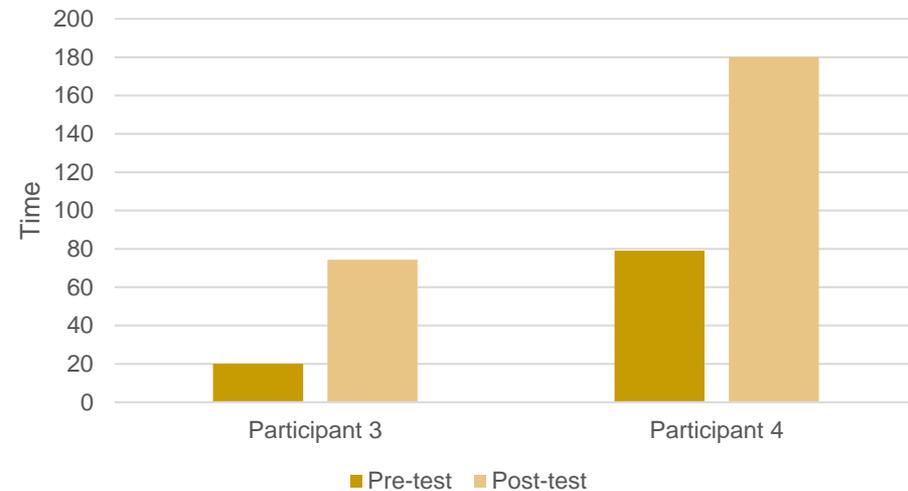| Gender	Age	Affected side	Stump length (cm)	Cause	Group
Female	39	Left	>10, wrist	Congenital	Conventional
Male	49	Left	<10	CRPS	Conventional
Male	59	Left	>10	Congenital	Game
Male	57	Left	>10	Trauma	Game

Results
Clothespin

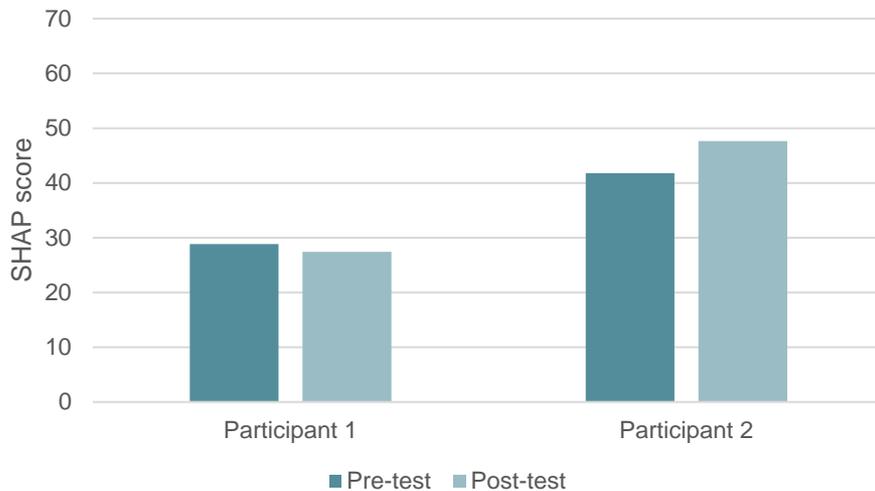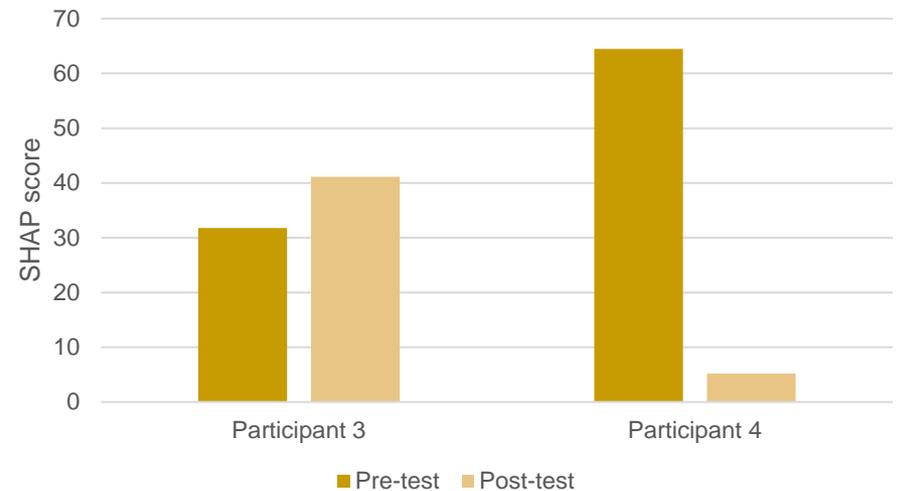Conventional training, Clothespin

Game training, Clothespin

Results
SHAP spherical

Conventional training, SHAP

Game training, SHAP

Discussion

- **Results are inconclusive**

- **Users spend more time completing tests, but used more DoF**

  - Presumably using fewer compensation movements

  - New functional measures?

Discussion

- **What have we learned?**

  - Some training is necessary before (pre-) testing

  - "Professional" sockets are necessary

  - Increase DoF gradually

  - A lot of training is required for 2 DoF

  - Robustness > DoF

Thank you very much
for your attention!

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