

INTRODUCING A NOVEL TRAINING AND ASSESSMENT PROTOCOL FOR PATTERN MATCHING IN MYOCONTROL: CASE-STUDY OF A TRANS-RADIAL AMPUTEE

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BACKGROUND AND AIM

Multi-DoF prostheses and advanced myocontrol challenge both engineers and rehabilitation professionals to teach the patient to optimally control the prosthesis, and to assess their addition to functional recovery. This work proposes and evaluates a standardized clinical procedure of



Figure 1: the laboratory environment.

a training and assessment protocol characterized by reciprocal adaptation of subject and prosthesis in a case-study.

MATERIALS AND METHODS

One 35yrs old male trans-radial left-hand amputee (amputation in 2005), routinely using a *Variplus* hand (Otto Bock GmbH) with standard two-electrode control since 2012. For the experiment, he was fitted with a customized socket (Pohlig GmbH) with eight 13E200 *MyoBock* sensors (Otto Bock GmbH) and an *i-LIMB Revolution* prosthetic hand (Touch Bionics, Ltd.).

The protocol was organised in *sessions*, each session spanning several visits, characterised by patterns (*actions*) to be recognised by the myocontrol system and by *tasks* to be performed.

- session 1: rest, power grasp
- session 2: rest, power grasp, precision grip
- session 2': rest, power grasp, pointing index
- session 3: rest, power grasp, pointing index, thumbs up

The required tasks varied from performing simple grips to daily living tasks, using associated actions in a room-sized laboratory (see **Figure 1**). Non-linear incremental regression enforced interactive simultaneous / proportional control, so that *on-demand updating* could be applied.

Measures of performance were time required to complete each task, and the number of required updates.

Along six months, we measured four sessions of increasing difficulty, determined by using body postures, distances to be walked, graded-force tasks, etc. The subject's satisfaction was assessed multiple times per session, and the tasks were adjusted accordingly.

RESULTS

Fisher's index, measuring data cluster separation, applied to the subject's signals per each action, is visible in **Figure 2**, where each data point represents a visit. The colour indicates the session. Sessions 1 and 2' showed a stable performance after several visits (circles), while sessions 2 and 3 (square) did not reach a reliable. Fisher's

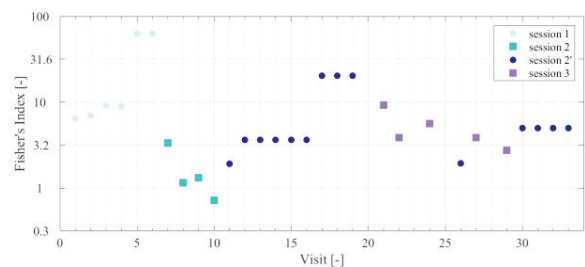


Figure 2: Fisher's index of the subject's signals over time.

index increased during sessions 1 (visit 1-6) and 2' (visit 11-19, 26, 30-33). The subject's satisfaction increased over sessions.

DISCUSSION

Measurements obtained during the experiments can *and should* also be exploited as a guidance for the experimenter: for instance, in session 2 we introduced a new action which proved to be unfeasible for the subject; the no-increase in Fisher's index induced us to switch to another action, which produced a definite improvement in session 2'. The findings indicate the feasibility of the protocol.

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