

Feedback matters – or doesn't it? User training for pattern-recognition controlled prostheses

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Introduction

Pattern-recognition control has been suggested as a control method for myoelectric prostheses. As with direct controlled prostheses, pattern-recognition control requires user training to obtain robust control. User training is, however, not well studied and training procedures are not standardised. The aim of this study is two-fold; first we wanted to discern to what extent increasing levels of feedback affects learning. Secondly we wanted to compare “conventional” training with a serious game by focusing on increasing Interclass Distance (ID) between movement classes.

Methods

50 able-bodied volunteers participated in the experiment. Each participant was assigned to one of the four experimental groups (fig. 1). Each group received specific feedback during training (fig. 2). Outcome measures were motion test results, feature space changes and questionnaire answers.

No feedback (NF)
System training + motion test x 3 without any feedback

Medium feedback (MF)
System training + motion test x 3 with visual feedback

Extensive feedback (EF)
System training + motion test x 3 with coaching and visual feedback

Game feedback (GF)
20 minutes play + system training + motion test with visual feedback

~30 minutes of training every day
5 consecutive days

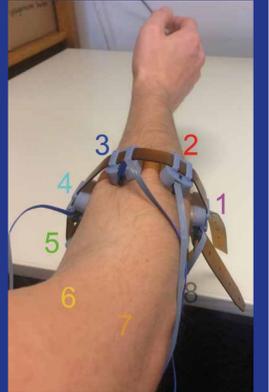


Figure 1

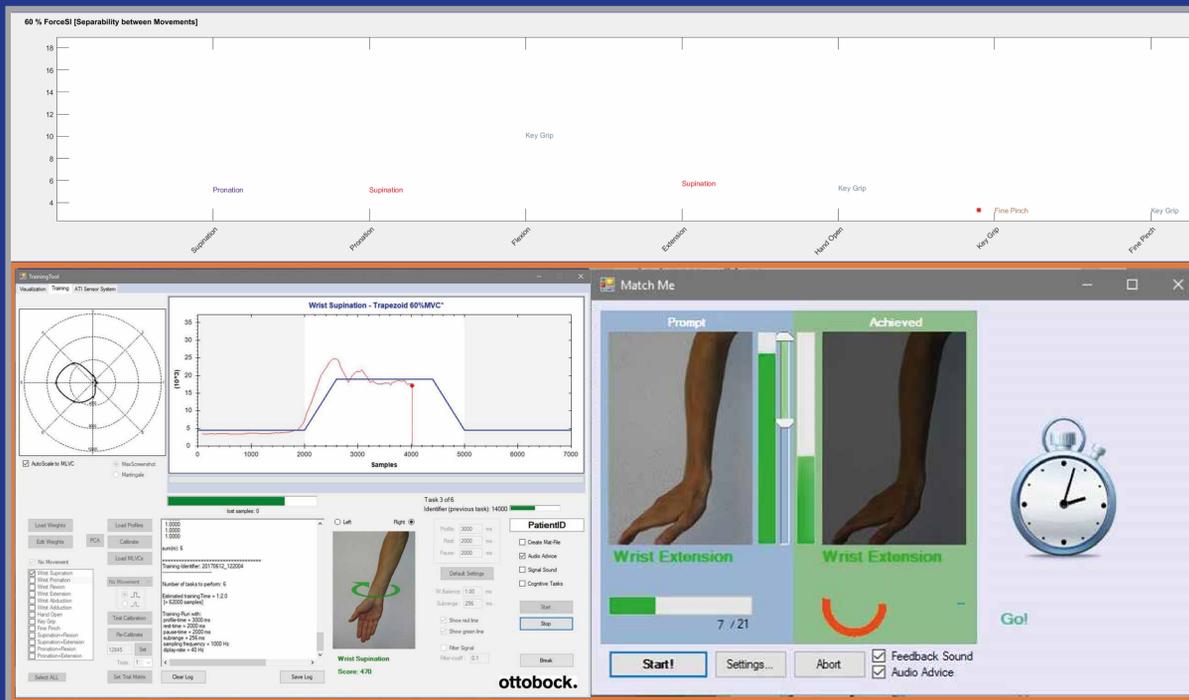


Figure 2

Results

All groups showed a significant improvement from pre-test to post-test in the motion test results (fig. 3-4) and ID. Group GF had a significantly worse result for number of completed movements at the post-test (fig 4). Group GF had a significantly higher ID at the post-test compared to the other groups while in the pre-test there were no significant differences between the groups (fig. 5).

Discussion

Surprisingly, the level of feedback in the motion test does not affect learning. This is an interesting finding since it means that pattern-recognition control can be trained without explicit feedback, which might have implications for rehabilitation. Focusing on increasing ID with a serious game was successful since group GF had significantly higher ID than the other groups. However the number of completed movements was significantly lower. It is still unclear what is learned when training pattern-recognition control, which is problematic since it makes developing specific training regimes difficult.

Figure 4

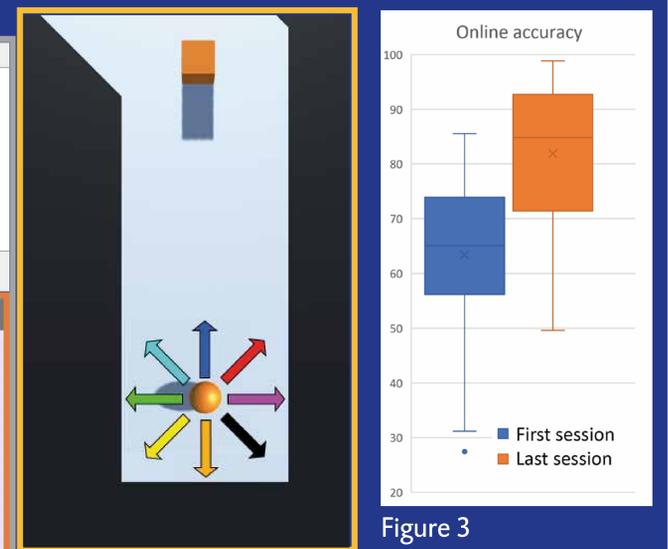


Figure 3

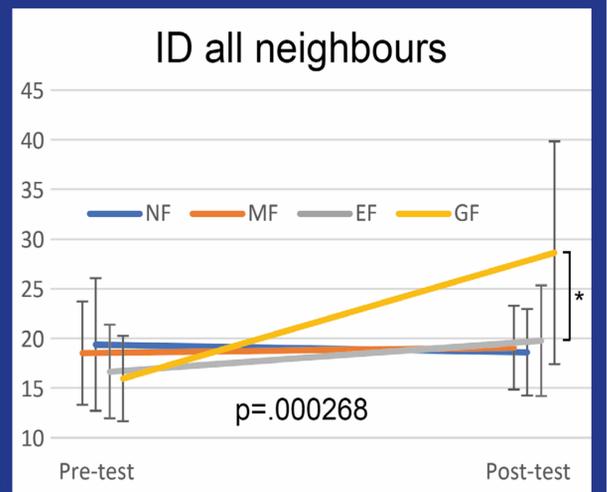
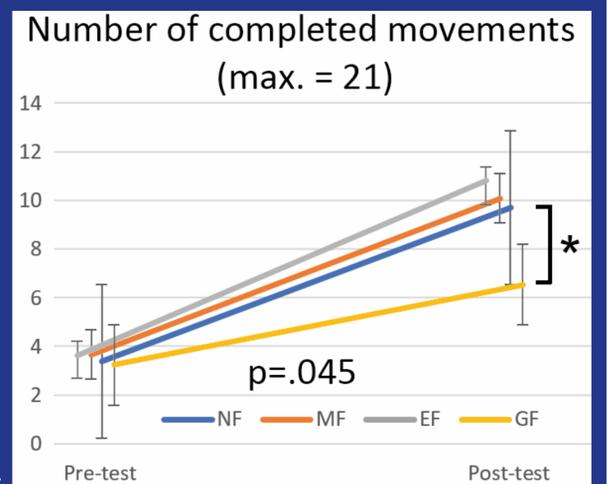


Figure 5

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