RehabMove 2018: TRAINING MOVEMENTS FOR DISTINCT ELECTROMYOGRAM PATTERNS USING SERIOUS GAMING

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PURPOSE: The purpose of this study was to investigate if a serious game, Myobox, could be used to train participants to generate distinct electromyography (EMG) patterns for use in EMG-controlled assistive devices such as upper-limb prostheses.

METHODS: Participants were fitted with 8 electrodes around their forearm and performed 5 training sessions lasting 30 minutes on 5 consecutive days, playing Myobox for 20 minutes. Myobox is controlled using a direct mapping from electrode orientation to avatar movement in a 2-dimensional space. Players explored different hand and wrist movements in order to learn which movements caused the avatar to move in the desired direction. A successful control of the game indicated that the player had found 8 movements resulting in distinct EMG patterns. After each game session, EMG data from each movement were used to train a machine learning system, used to classify the participant's movements. The participant was then tested by asking him/her to reproduce the movements without the game's feedback. Expected outcomes were an increase in the percentage of correct movements classified, an increase in EMG pattern separability measured as the average Mahalanobis distance between each pattern and all of its neighbours in the EMG feature space and a decrease in game score.

RESULTS: 13 Able-bodied participants (mean age 21.3ys, 6 females) participated. Mean percentage of correct movements increased from 56% to 73% ($p < .0001$). Mean pattern separability increased from 20.73 to 28.62 ($p = .004$). Mean game score decreased from 98680 to 19356 ($p = .002$).

CONCLUSIONS: A serious game can be used to train participants to find the movement set that provides the most distinct EMG patterns. The game seems to be a promising training tool for this purpose. However, it remains to be seen if such training improves performance of people using an EMG-controlled assistive device.