Let's Move: Case Studies in Learning Basic Power Mobility Skills Using BCI

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***Introduction*:** Exploration of powered mobility devices (PMDs) can enhance inclusion, autonomy, and overall quality of life for children with severe physical disabilities [1]. However, traditional PMD access methods, such as joysticks or switches, require some degree of motor control to operate [2]. Brain-computer interface (BCI) systems offer a potential PMD access solution for children with severely limited motor control [3]. BCi-Move is an ongoing, multi-center, longitudinal case study exploring how commercial-grade BCI systems can be integrated into a personalized therapeutic framework to help such children achieve personal mobility goals.

Figure 1: Participant playing a Harry Potter Quidditch game with his caregiver during a BCI-Move training session, working on driving forward and stopping.

Materials, Methods, and Results: 30 children with severe physical disabilities will be recruited across 4 sites to participate in the BCi-Move study. Participants first identify personalized power mobility goals and then participate in a 12-week training program to develop both power mobility and BCI skills. Two children have completed the entire training program. The 14-channel, saline-based, wireless Emotiv Flex and the Emotiv Epoc X headsets were used for the BCI hardware, and a motor imagery BCI paradigm was used with 12 calibration runs at the start of each session. The Flex cap was modified to maximize the fit and contact quality for participants as required. Participants then engaged in motivating and skill-building activities, working towards their personalized power mobility goals (Fig. 1). Goal Attainment Scaling (GAS) was used to measure progress towards goal achievement, and the Assessment of Learning Powered (ALP) mobility instrument was used to score power mobility skill development. Participants reported workload experiences using a modified NASA-TLX and family/caregivers ranked participant and clinician engagement. ALP scores indicated some improvement in power mobility skills. Participants highly rated their satisfaction and perceived performance on their personalized mobility goals, but reported some frustration due to technical issues and troubleshooting during the sessions. Participants consistently rated high levels of engagement over the training sessions.

***Discussion*:** Early results suggest that personalized goals and training for power mobility can facilitate the development of PMD skills for children with physical disabilities using BCIs. Engagement and perceived performance measures indicate that power mobility can be an engaging and motivating task for BCI skill development. However, participant frustrations highlight that BCI-enabled power mobility can be further optimized for use by children with severe physical disabilities.

***Significance**:* Participant-centered, longitudinal multi-site trials exploring movement and learning BCI power mobility and potential impactful for children with severe disabilities.

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References

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