

# The Brain during Movement Execution and Movement Observation in Children

Niloufaralsadat Hashemi, Deryk Beal, Si Tou, Kristen Wong, Feny Pandya, Anna Tendera, Tom Chau

## Introduction



### Objective

To understand and characterize the oscillatory brain state during movement observation and compare this brain state to that observed during movement execution



### Research Questions

1. Can observation of hand movement elicit ERD in the hand representation region of motor cortex in the paediatric population?



### Motivation

Mirror neurons discharge during the hand movement as well as observation of hand movement

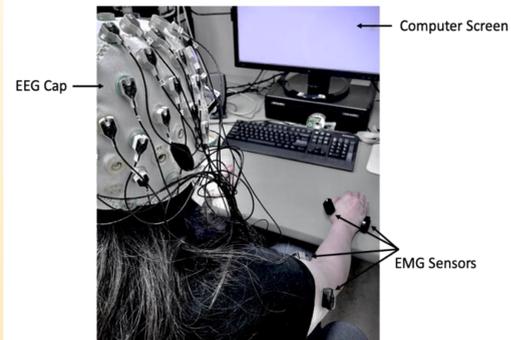
Mirror neurons play an essential role in motor learning where they decompose the observed actions into simple motor acts that activate the corresponding motor representations (Buccino et al., 2006).

Studies indicate that the mirror neuron system is fully functional in children and therefore, this research assumes that its activation through motor observation may be a valuable avenue in bringing new rehabilitation techniques to children.

## Methods



### Data Collection Set Up



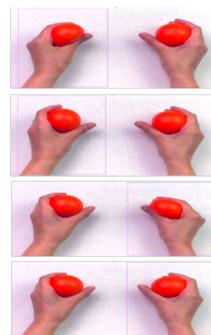
- 64 channels EEG
- Wireless Trigno EMG Sensors on both hands: FDI, ADM, EDC, and Biceps muscles



### Protocol



1. Motor Execution Trials (ME): Squeeze the ball in the respective hand on cue



2. Motor Observation Trials (MO): Observe video playbacks of hand squeeze motions while at complete rest

3. Imitation Trials (ME+MO): Observe video playbacks of hand squeeze motions while imitating the observed movement



### Participants

- 15 Typically developing Youth (9-19 years old), right handed
- 15 youth (9-19 years old) with upper limb paralysis (eREB0177)

Note: Data collection is ongoing



### Data Analysis

Time-Frequency Analysis to extract instances of ERD & ERS

- ERD: Event Related Desynchronization (Colour coded in blue strips)
- ERS: Event Related Synchronization (Colour coded in red strips)

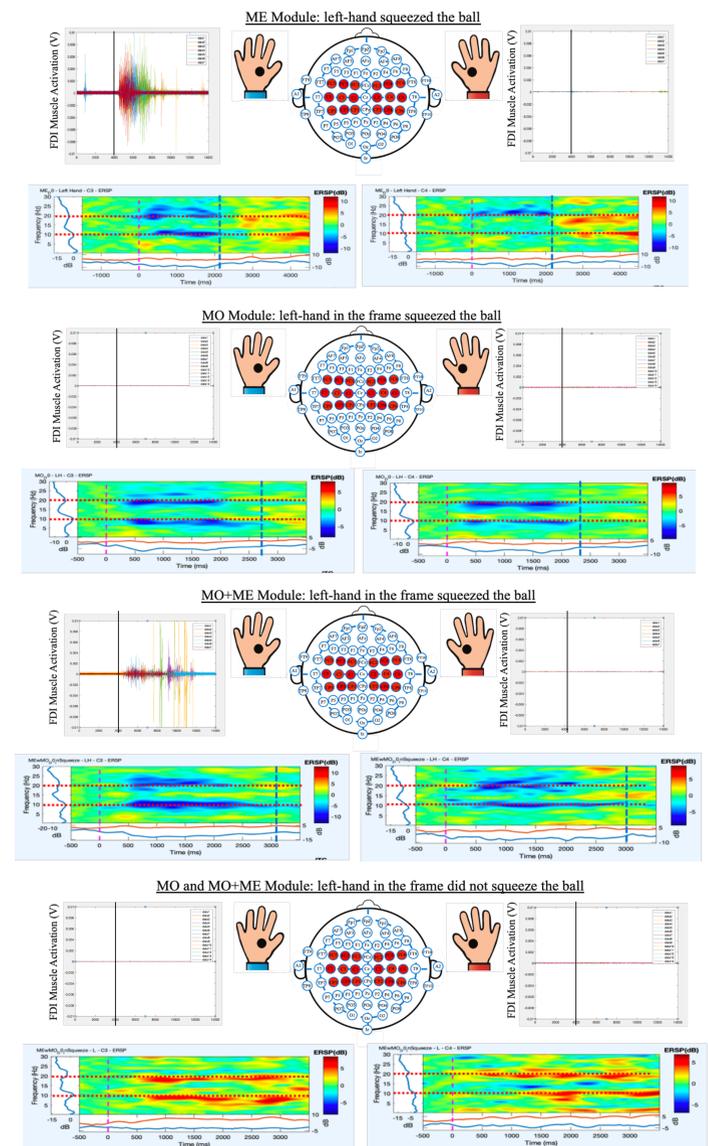
## References

Borroni, P. et al., (2008). doi:10.1080/17470910701515269  
Buccino, G. et al., (2006). doi:10.1097/00146965-200603000-00007

## Results



### Qualitative Results



## Discussion & Conclusion

- MO elicits ERD similar to ME
  - ME + MO trials, elicits much stronger ERD than ME trials
  - MO and ME + MO no squeeze trials, elicit ERS
- Note: Statistical power of the demonstrated results is pending ongoing data collection

## Significance

Movement observation can be used to facilitate motor skill acquisition in children via activation of muscle-specific motor representations