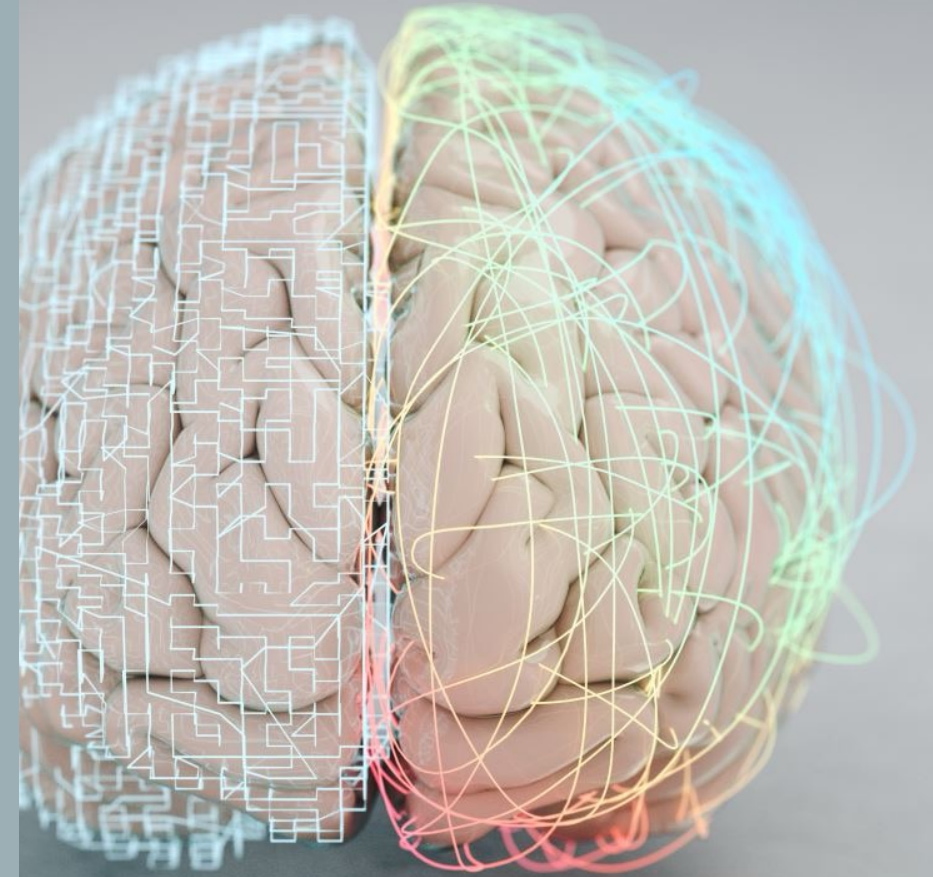


**FUNCTIONAL BRAIN
CONNECTIVITY:
A PRELIMINARY EEG STUDY OF
COGNITIVE-MOTOR INTERPLAY**

Elizabeth Loftus, SPT



BACKGROUND

MOTOR AND COGNITIVE IMPAIRMENTS INFLUENCE ON MOVEMENT¹⁻³



Post-Stroke Prevalence of Impairments

Motor Impairments: 50-70%

Cognitive Impairments: 50-70%

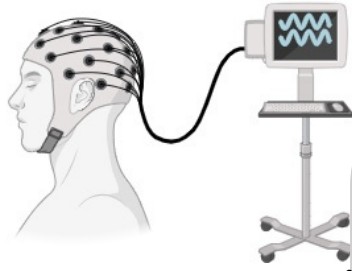
MEASURING MOTOR AND COGNITION

In Clinic

- Motor impairments
- Cognitive impairments

In Research

- Motor impairments
- Cognitive impairments



EEG

- electroencephalography
 - electrical activity in the brain
- electrical activity is measured in frequencies that look like small waves
 - Alpha Frequency (8-12Hz) - cognition
 - Beta Frequency (13-30Hz) - motor

Coherence

- measure of connectivity
- EEG + EMG - connectivity between brain and muscle

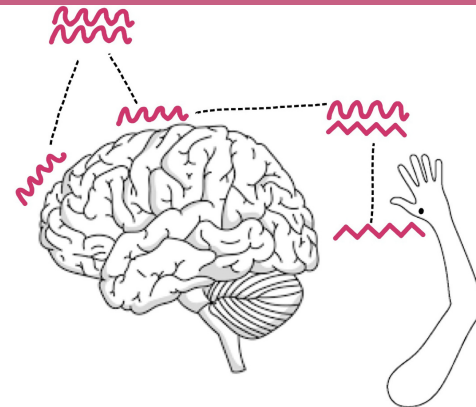


Understanding Connections Between Brain and Muscle

We examined people who were young and did not have a stroke.

When they had more connection between brain areas for thinking and moving, they had less connection between brain and muscles.

This provides us with a comparison for what happens after a person has a stroke, when cognition may be affected.



Electrodes

- small microphones that show electrical activity on computers
- not painful



EMG

- electromyography
 - electrical activity in muscles

Cognition

- thinking, learning, memory, and attention
- these skills are important for movement

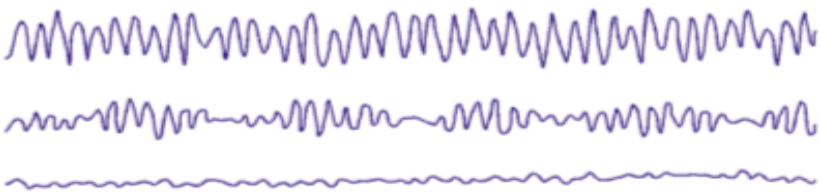


WHAT IS EEG?

- Measures electrical activity in the brain
- Measuring motor and cognition
- Electrodes

β 

Beta, 13-30 Hz

α 

Alpha, 8-12 Hz

θ 

δ 

Malmivuo & Plonsey, 1995



METHODS

PARTICIPANTS

15 young, unimpaired adults (28.6 ± 6 years, 9 females)

Right-Handed

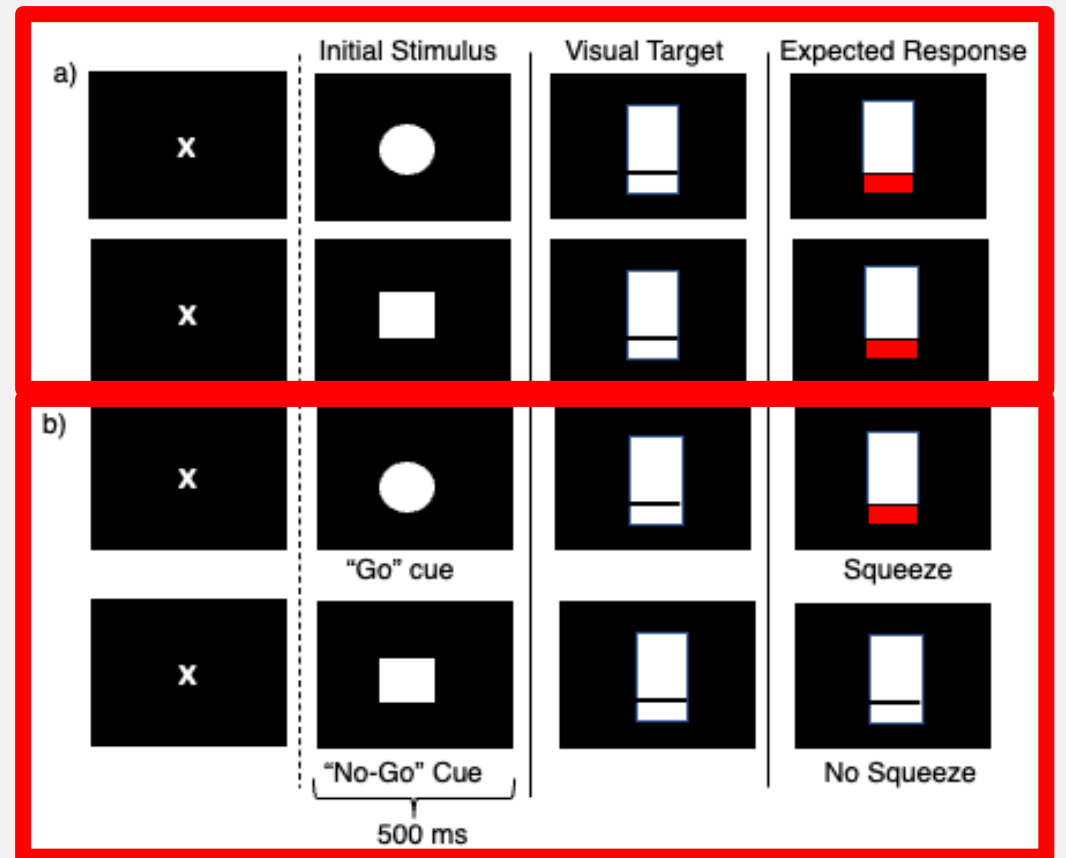
Recruited from UNC Chapel Hill



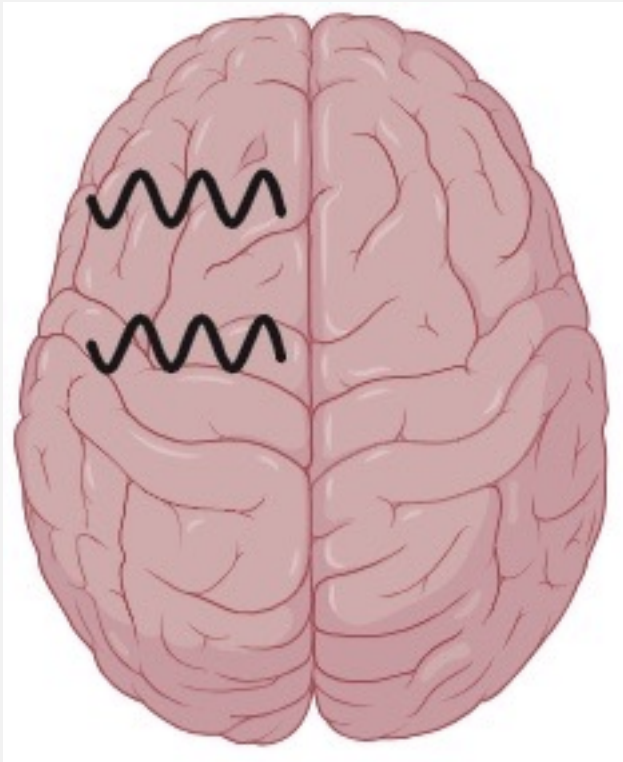
SINGLE RESEARCH VISIT

1. Resting-State EEG
2. Task-Based EEG
3. Cognitive Assessments

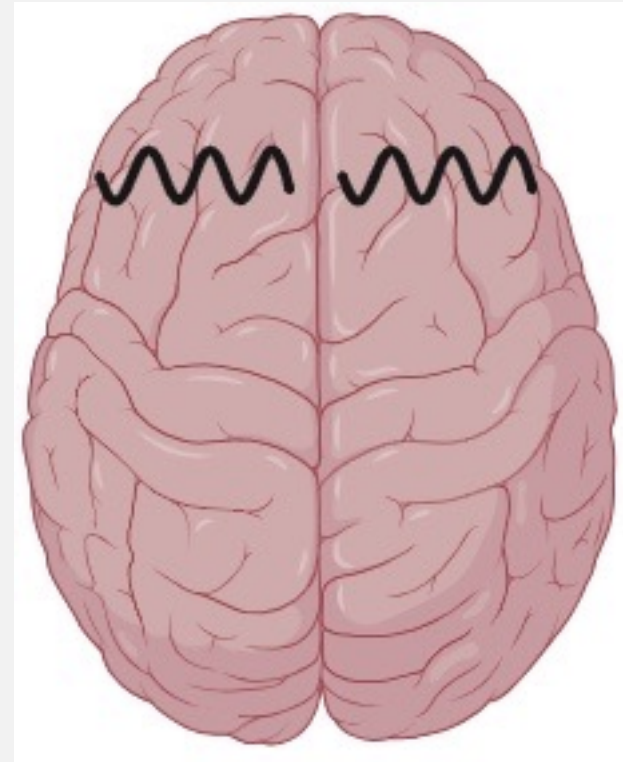
Blue Orange Green Red Purple
Red Purple Blue Orange Green
Green Red Purple Blue Orange
Red Blue Green Orange Purple



CORTICO-CORTICAL COHERENCE⁴



Left Prefrontal Area (IPf) and
Left Primary Motor Area (IMI)



Left Prefrontal Area (IPf) and
Right Prefrontal Area (rPf)

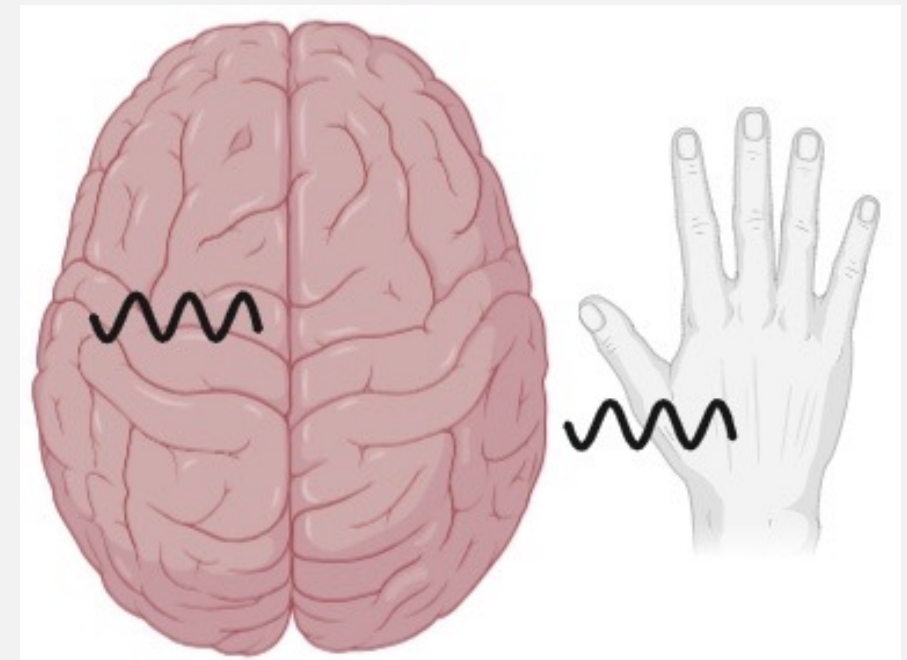
CORTICOMUSCULAR COHERENCE (CMC)⁵

- Brain Areas

- IMI
- IPf

- Muscles

- First Dorsal Interosseus (FDI)
- Flexor Digitorum
- Extensor Digitorum
- Biceps Brachii



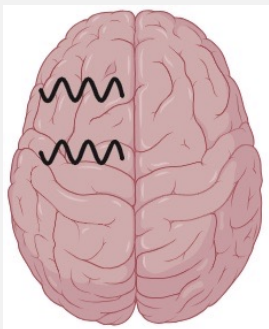
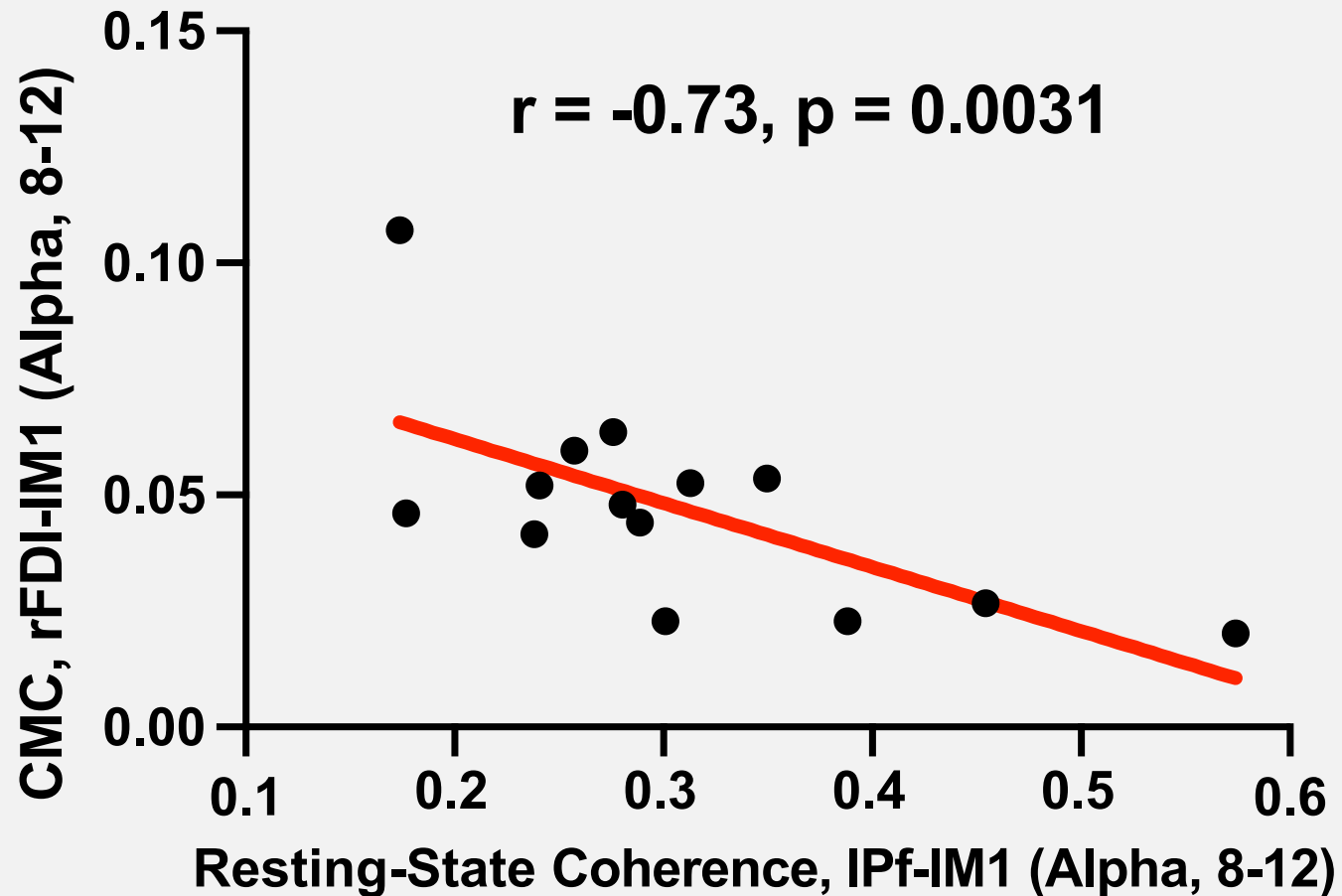
IMI and rFDI

STATISTICAL ANALYSES

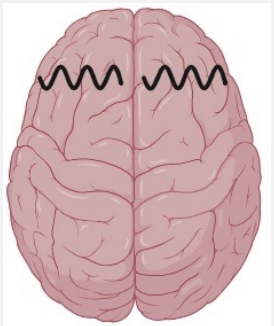
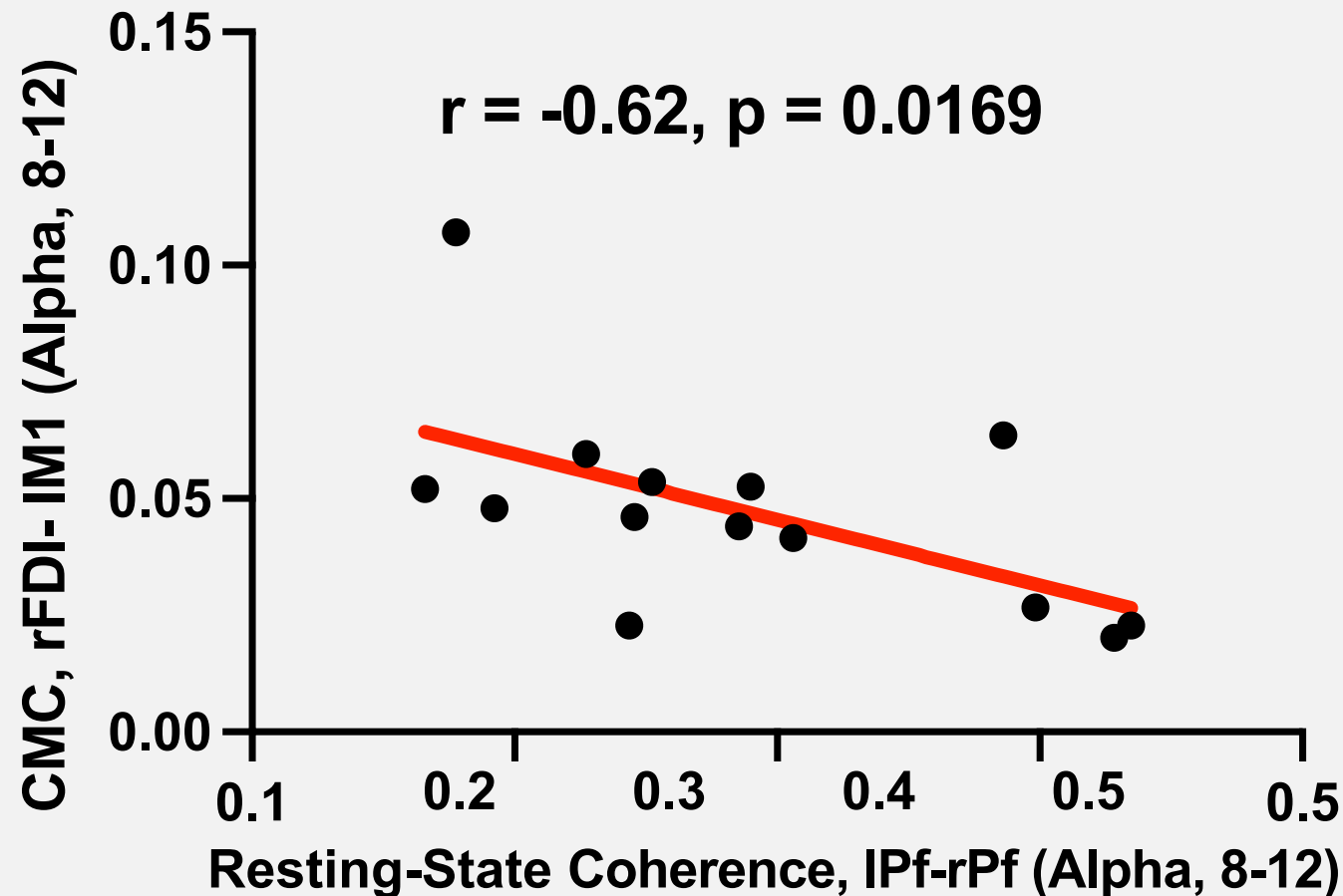
- Research Questions
 - Correlation between resting-state coherence and task-based CMC in alpha and beta frequency bands
 - Correlation between resting-state coherence and behavioral measures of cognition
- Pearson correlation

RESULTS

INCREASE IN RESTING-STATE CONNECTIVITY IS ASSOCIATED WITH DECREASED BRAIN-MUSCLE CONNECTIVITY DURING TASK.



INCREASE IN RESTING-STATE CONNECTIVITY IS ASSOCIATED WITH DECREASED BRAIN-MUSCLE CONNECTIVITY DURING TASK.



DISCUSSION

WHAT DO THE RESULTS MEAN?

- Brain states and engagement differences
- Contributions from non-dominant hemisphere
 - Alpha frequency

WHY IS THIS IMPORTANT?

- Clinical populations
- Importance of resting-state measures

NEXT STEPS IN RESEARCH

- Comparing results in other populations
- Expanding knowledge of neural circuits

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MY CAPSTONE EXPERIENCE

Research Elective

New Skills

Understanding of Research Process

Communication



THANK
YOU!!!

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The Cassidy Plasticity Lab

QUESTIONS?

EVALUATION

