Brain Computer Interaction

EEG Signal Pre-processing - Epoching
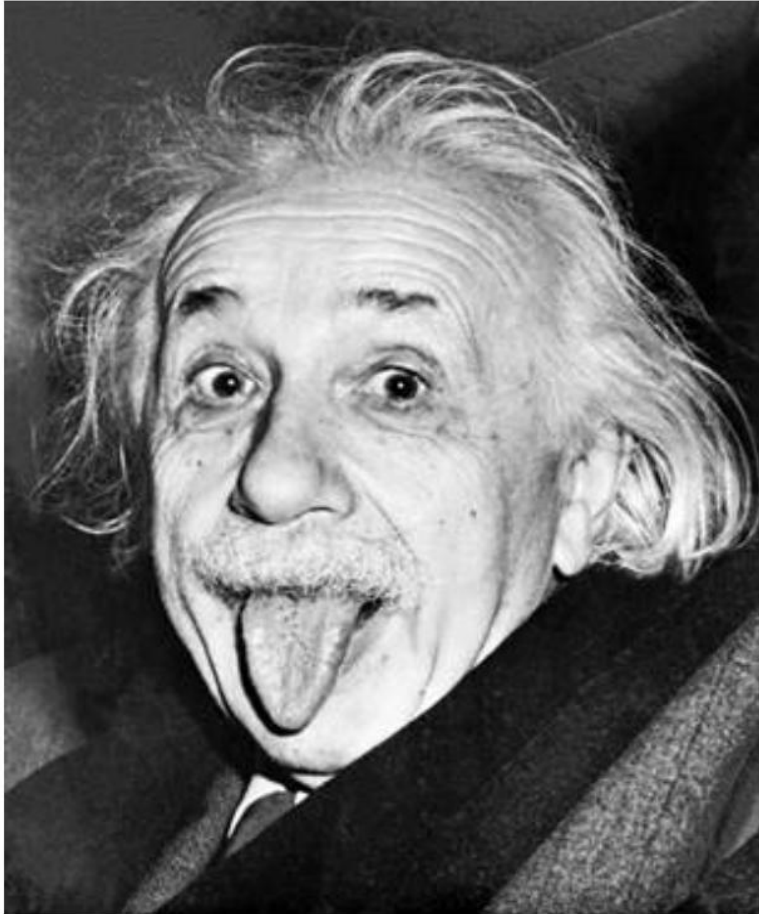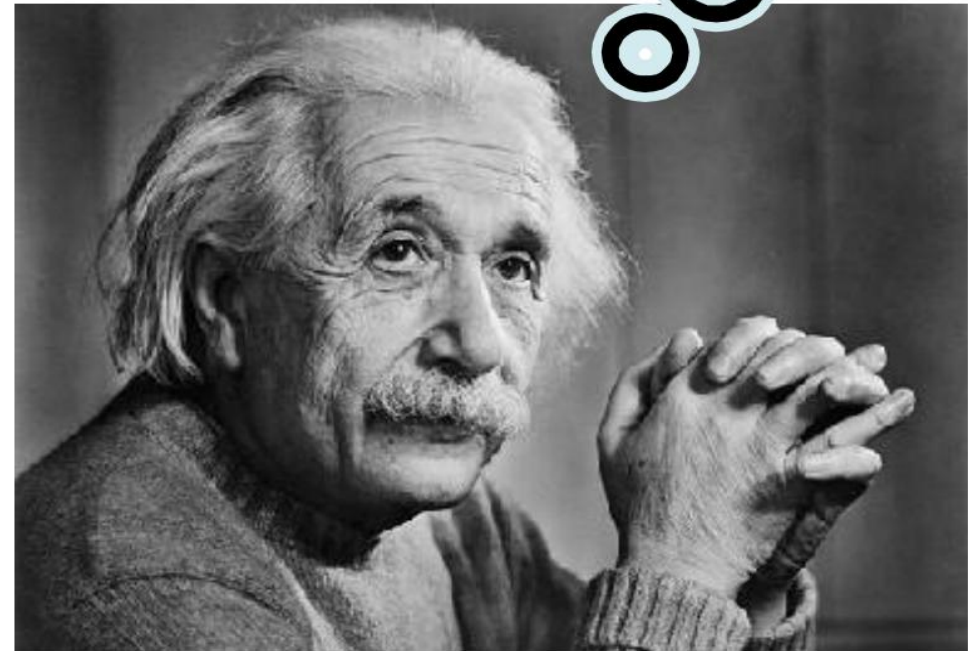
Course Instructors

Dr. Sreeja S R

Assistant Professor
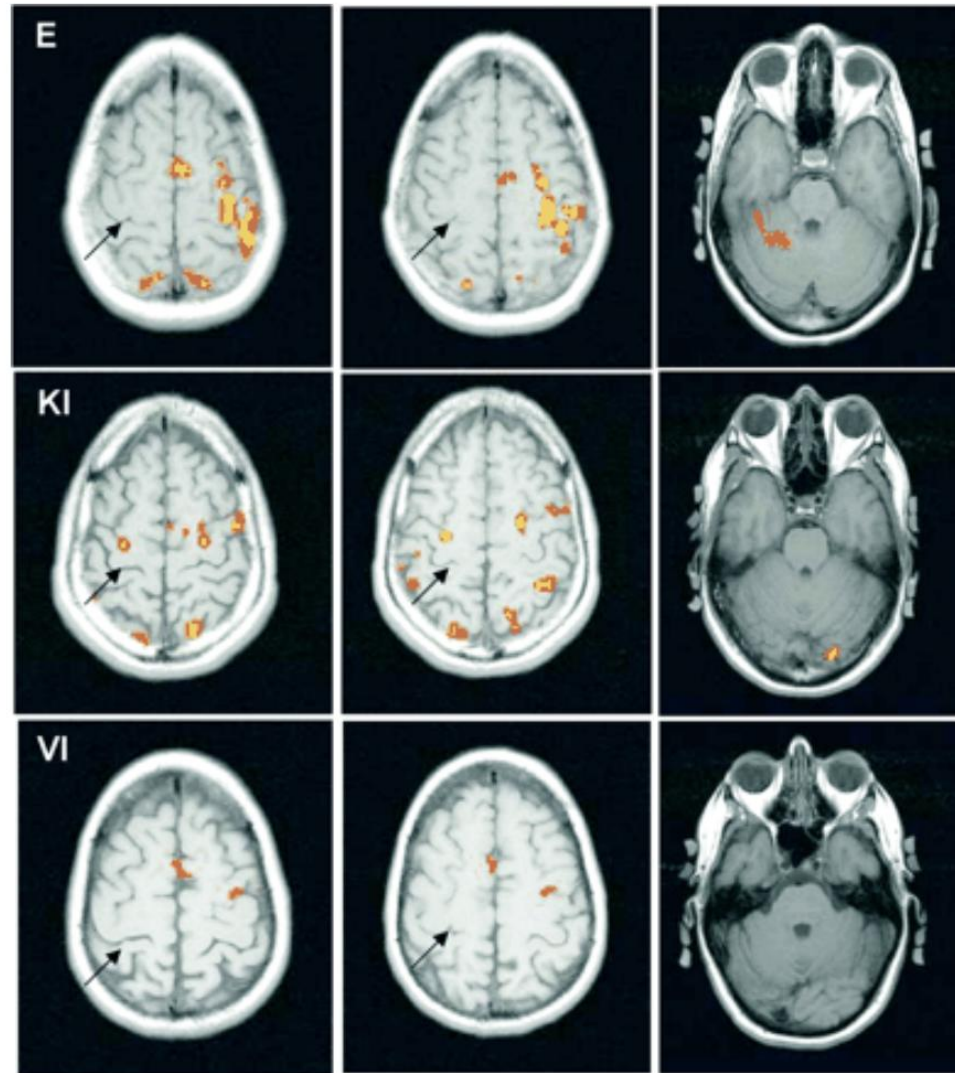**Indian Institute of Information Technology
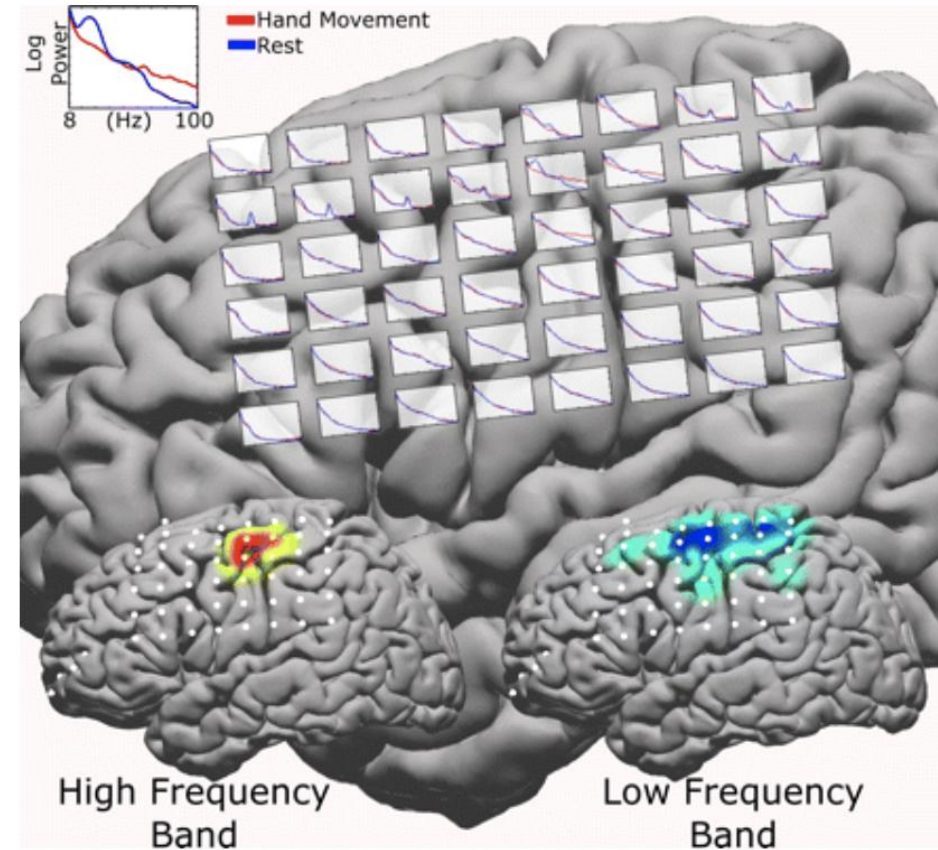IIIT Sri City**

Motor Imagery

VS

Brain activity during motor action vs imagery
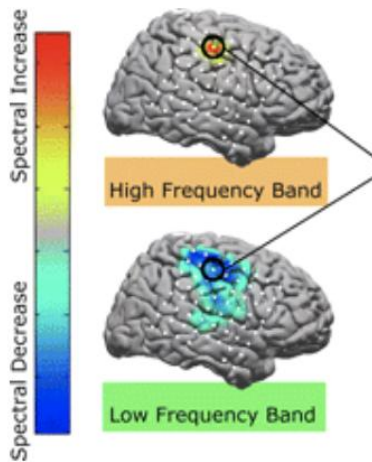

Solodkin et al, 2004

Motor rhythms in cortex

Aplha waves
8-13 Hz

Beta waves
14-25 Hz

Gama waves
25-150 Hz

Hand Movement
Rest

Log Power
8 (Hz) 100

Spectral Increase
High Frequency Band
Spectral Decrease
Low Frequency Band

LFB
HFB
Hand Movement
Rest

Log Power
Frequency (Hz)
0   50   100   150

High Frequency Band
Low Frequency Band
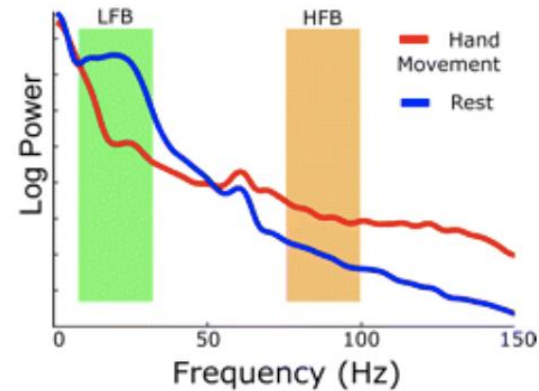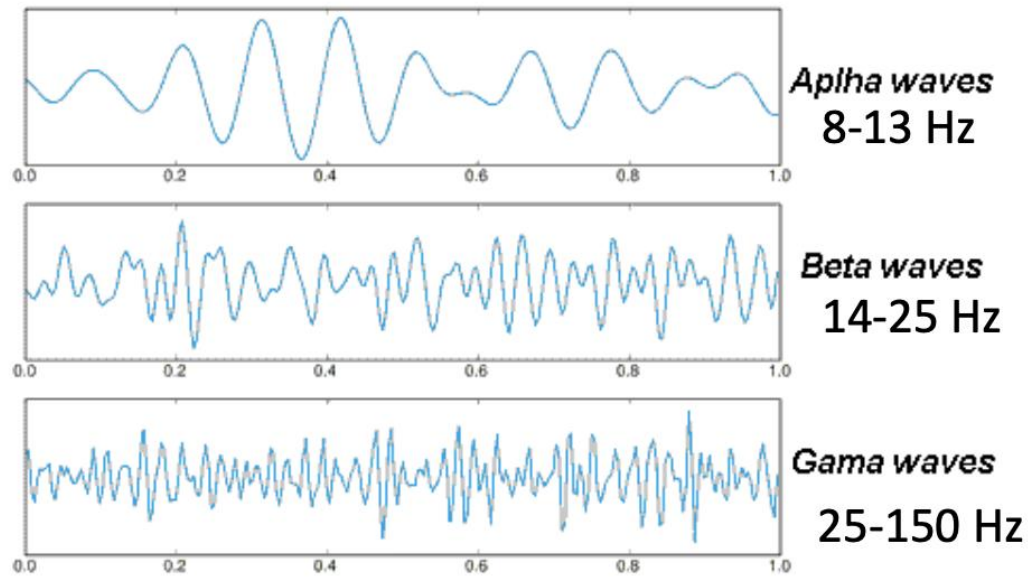
Miller et al, 2007

Goal of the work

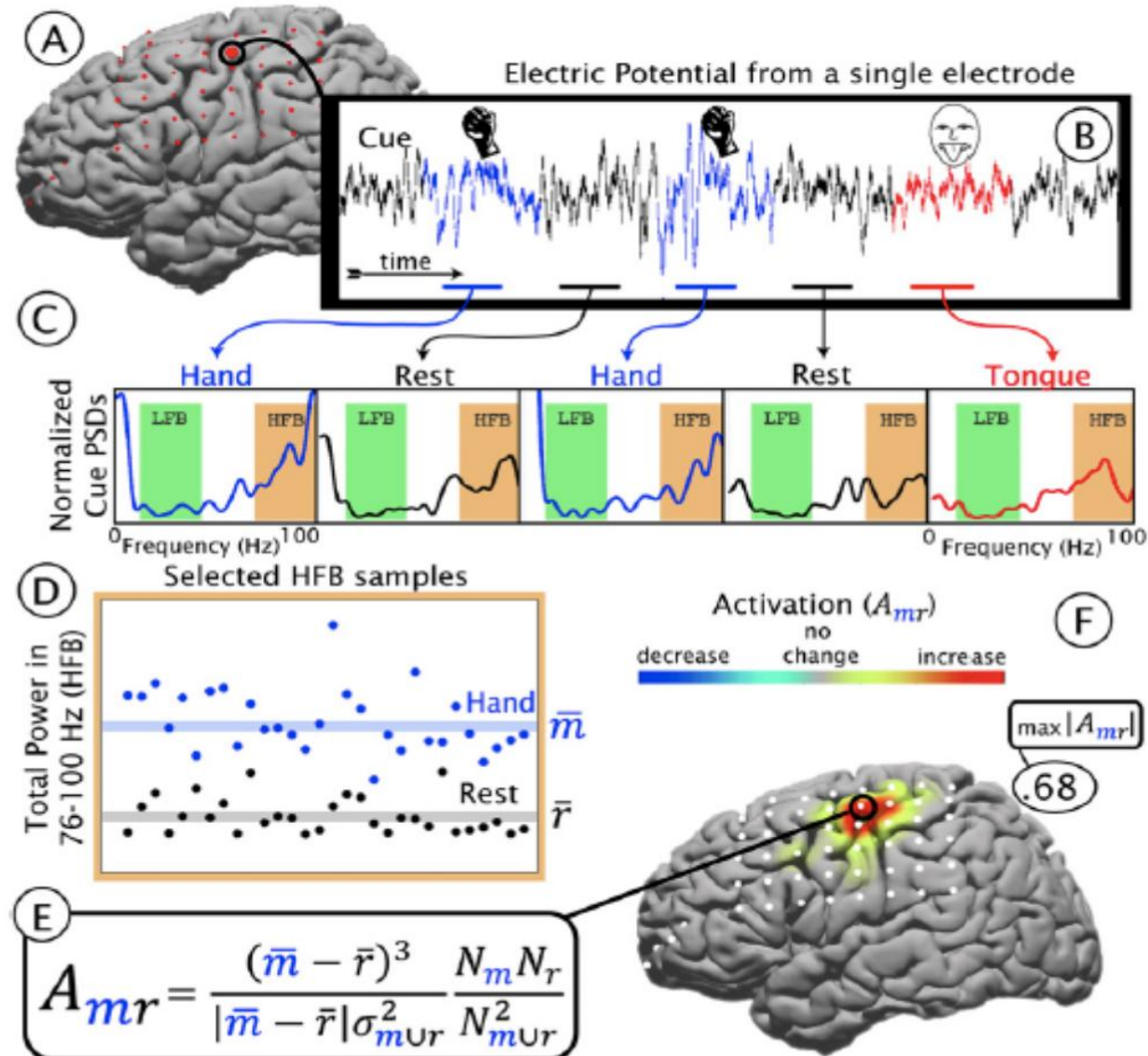To check whether real movements can be compared with imagery movements.
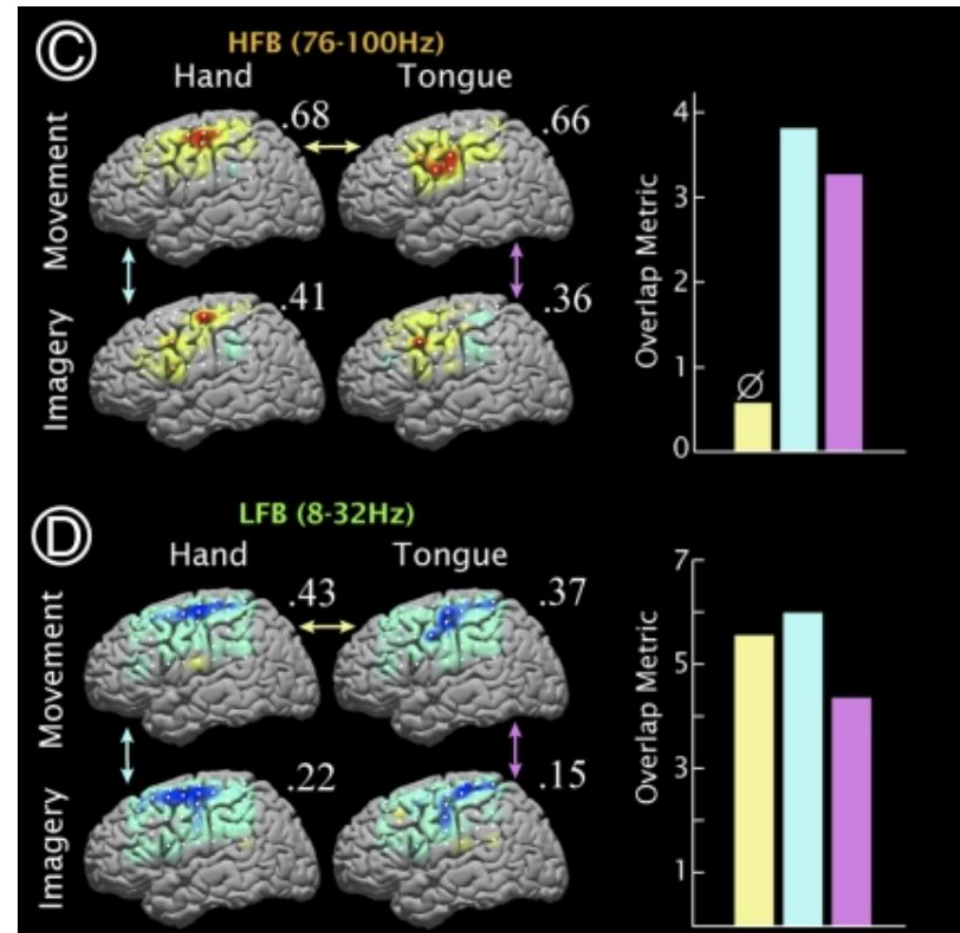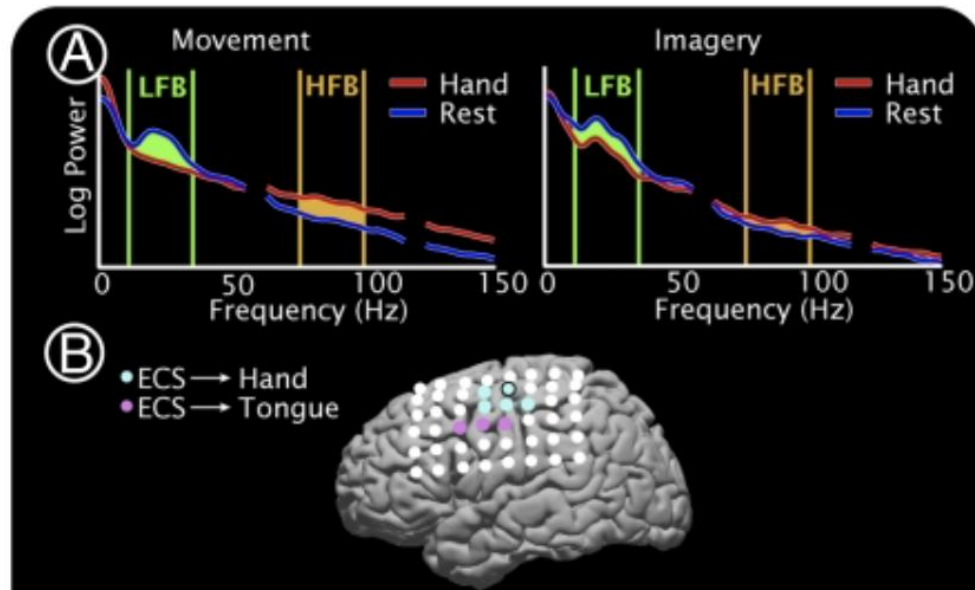
Methods Used:

- 8 patients implanted with 4x8 or 8x8 grid

1) Active movements –clench – release of hand, stick out tongue, shoulder shrug, say the word "move"
2) Image movements – same as before

Quantification of brain activity

Cortical activity during real and imagined movements
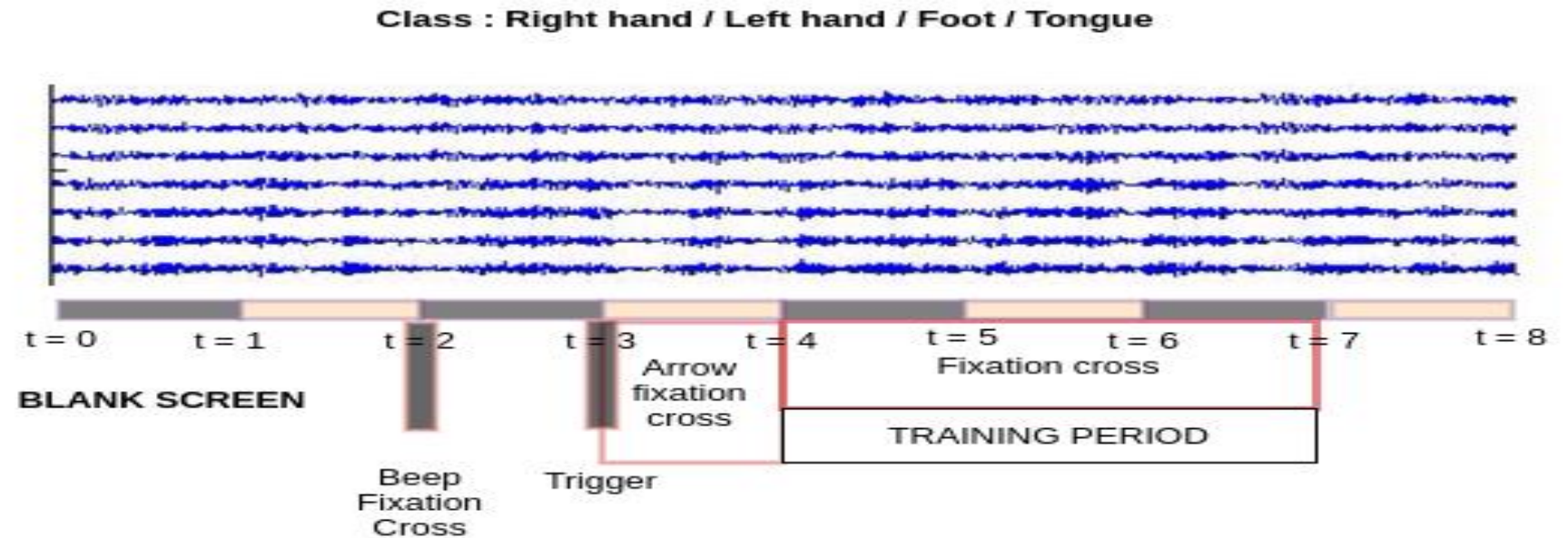
Data Epoching

Selecting data epochs

There is no real good reason to <mark>select subsets of data epochs</mark>. When comparing conditions – performed by creating contrast at the STUDY level (the group analysis interface which may also be used for single-subject analysis) – one may ignore specific data epochs.

- <mark>Non-overlapping segments</mark>

- <mark>Overlapping segments</mark>

  - <mark>Fully overlapping</mark> segments

  - <mark>Partially overlapping</mark> segments
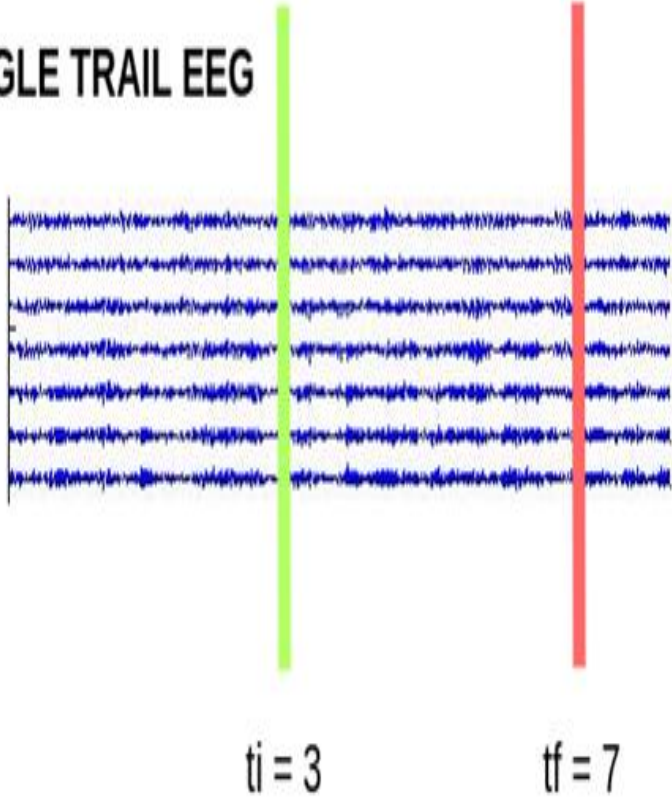
DATASET 1 SINGLE TRIAL
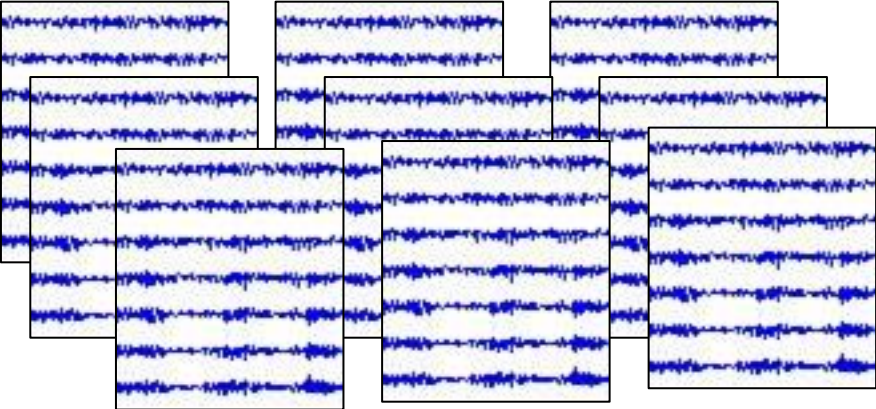
Class : Right hand / Foot

t = 0   t = 1   t = 2   t = 3   t = 4   t = 5   t = 6   t = 7

REST PERIOD   TRAINING PERIOD   REST PERIOD

Visual Cue Begins   Visual Cue Ends

DATASET 2 SINGLE TRIAL

Class : Right hand / Left hand / Foot / Tongue

t = 0   t = 1   t = 2   t = 3   t = 4   t = 5   t = 6   t = 7   t = 8

Arrow fixation cross

Fixation cross

BLANK SCREEN

TRAINING PERIOD

Beep Fixation Cross   Trigger

Data Epoching

SINGLE TRAIL EEG
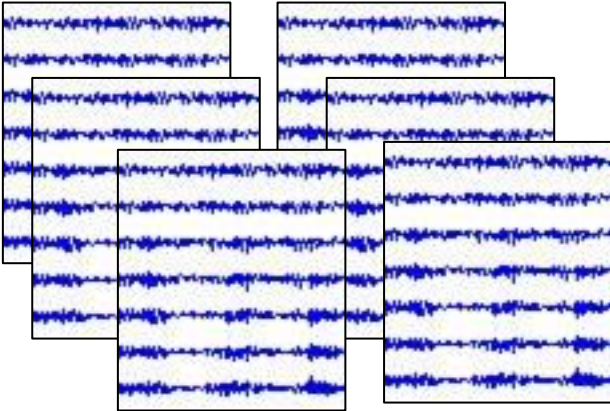
ti = 3   tf = 7

ONE SECOND EPOCHS

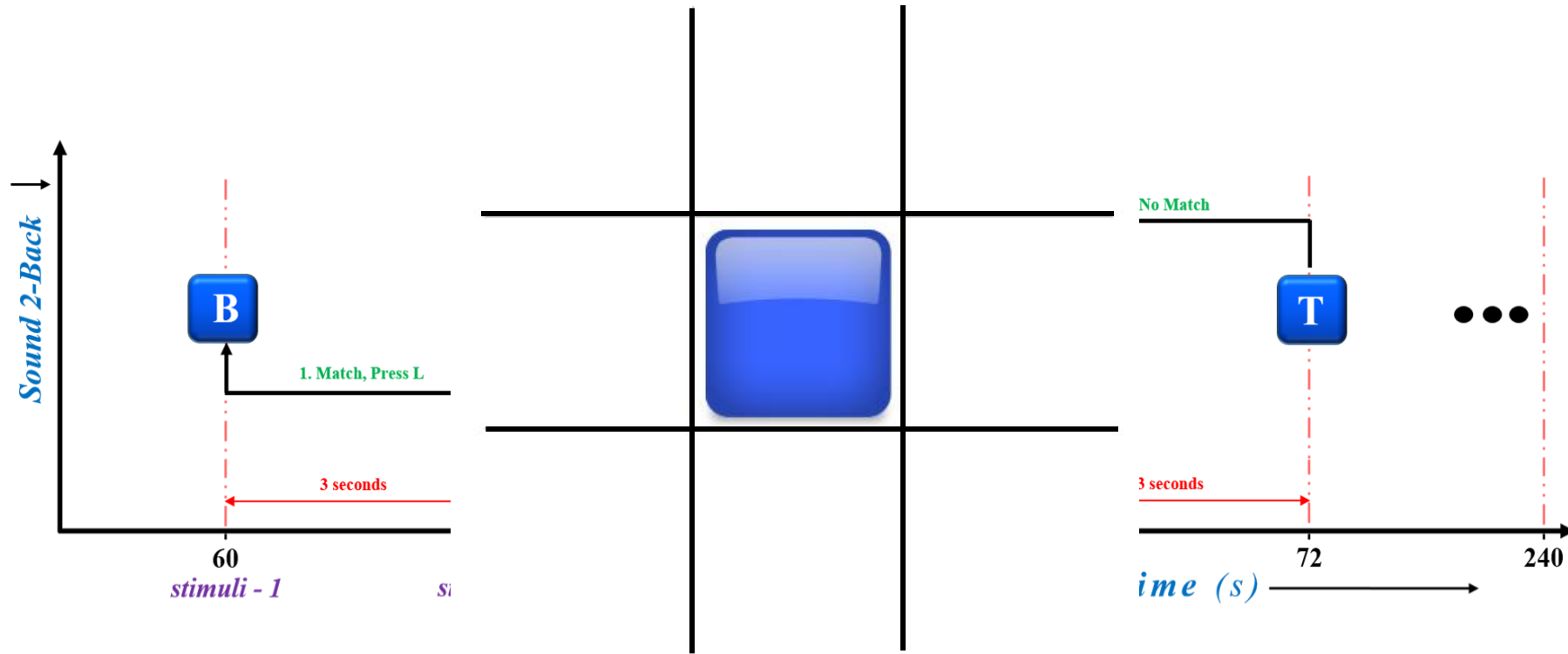epoch1   epoch2   epoch3

TRAINING SET(80%)

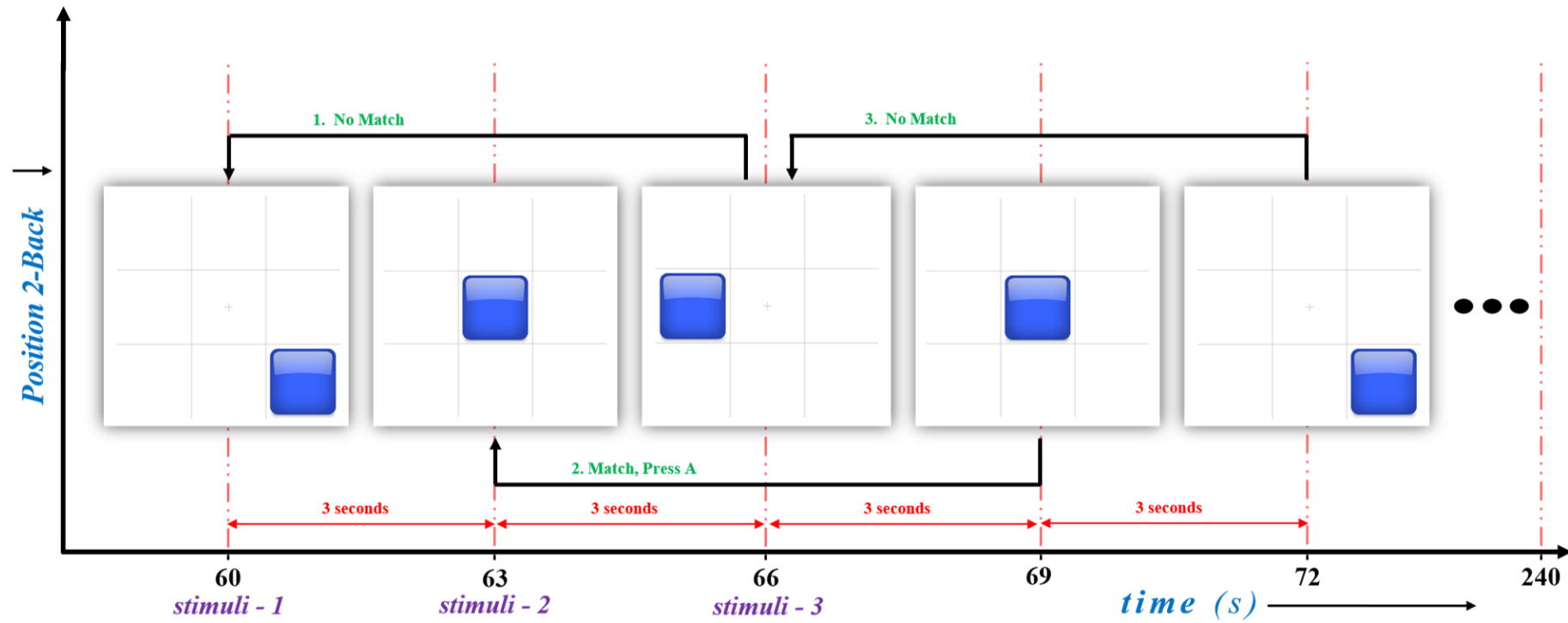**TEST SET(20%)**

Cognitive Workload

- Cognitive Workload (**CWL**) is a demand placed upon ==humans== for ==mental recourses== while performing a task.

- Mental resources include working memory, ability to process, etc.

- **Working memory (WM)** is a cognitive system with a limited capacity to hold a small amount of information and process it.
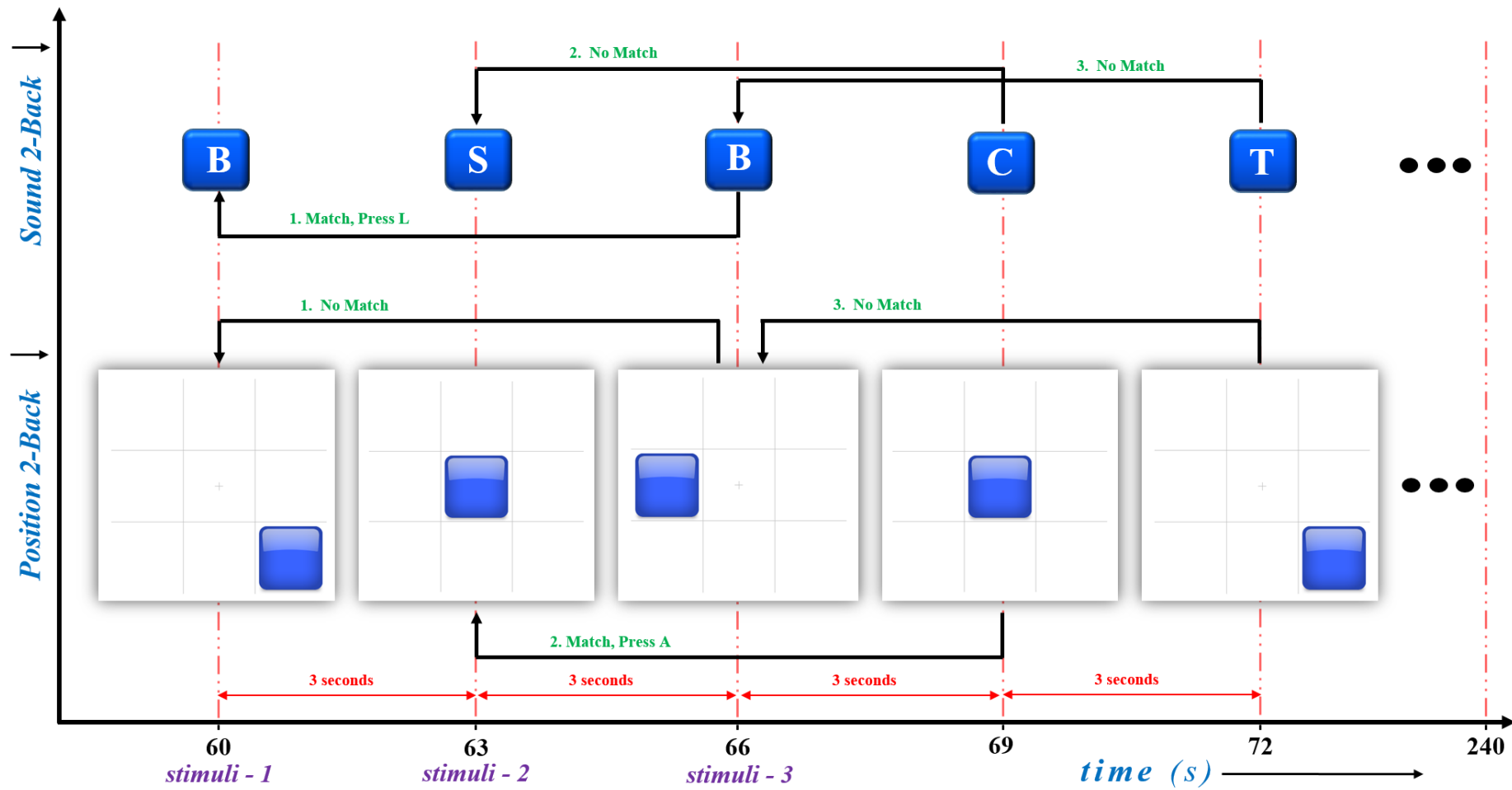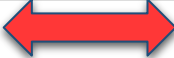
n-Back Task
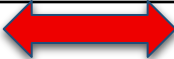

Sound *2*-Back

n-Back Task

Position 2-Back

n-Back Task

Sound & Position *2*-Back

Data Epoching

Task	Cognitive Workload Class	Colour Code depicting Load Variation
Idle	C1	
1-Back	C2	
2-Back	C3	
Dual 1-Back	C4	
Dual 2-Back	C5	

Thank you!!