NEUROCINEMATICS: THE INTELLIGENT REVIEW SYSTEM

DONE BY,

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MOTIVATION

- Each producer invests crores of rupees in each film, with the great uncertainty of getting the invested money back (leave alone the profit).
- This may lead to the producers incurring huge losses, losing their fame, and the cast and crew losing their popularity.
- Therefore a method of taking pre-release live review for a film using specially coded headsets has been proposed which is first of its kind.

OBJECTIVE

- Taking a pre-release live review of the film.
- Using specially designed headsets which help in the cognitive assessment.
- Develop a reference scale for mapping the cognitive readings recorded.

BRAIN COMPUTING INTERFACE

- A **Brain-Computer Interface** (**BCI**), sometimes called a **Mind-Machine Interface** (**MMI**), **Direct Neural Interface** (**DNI**), or **Brain-Machine Interface** (**BMI**), is a direct communication pathway between the brain and an external device.

- BCIs are often directed at assisting, augmenting, or repairing human cognitive or sensory-motor functions.

BCI DEFINED

A BCI generally consists of three main components:

1. A Signal-acquisition module (Electrode, Filtering and Amplifier)

2. A Signal-processing module (ASIC, DSP)

3. A Control module (Microcontroller & Driver)

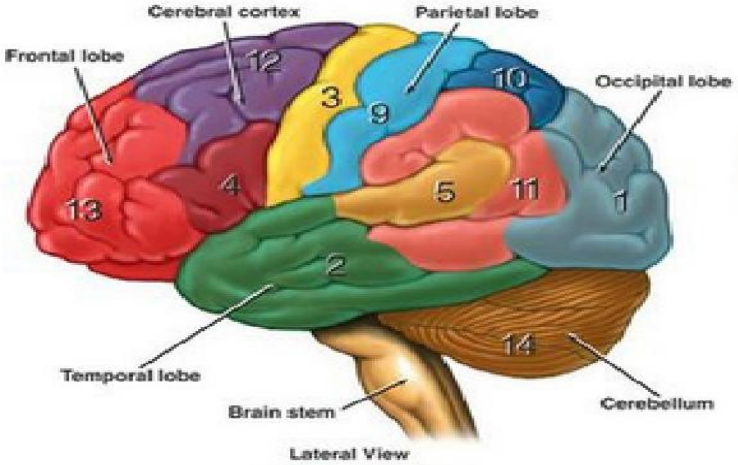
Anatomy and Functional Areas of the Brain

Functional Areas of the Cerebral Cortex

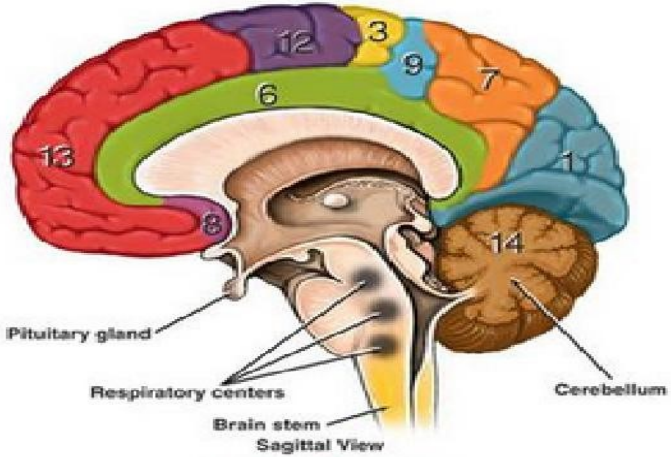
1. **Visual Area:**
   - Sight
   - Image recognition
   - Image perception
2. **Association Area**
   - Short-term memory
   - Equilibrium
   - Emotion
3. **Motor Function Area**
   - Initiation of voluntary muscles
4. **Broca's Area**
   - Muscles of speech
5. **Auditory Area**
   - Hearing
6. **Emotional Area**
   - Pain
   - Hunger
   - "Fight or flight" response
7. **Sensory Association Area**
8. **Olfactory Area**
   - Smelling
9. **Sensory Area**
   - Sensation from muscles and skin
10. **Somatosensory Association Area**
    - Evaluation of weight, texture, temperature, etc. for object recognition
11. **Wernicke's Area**
    - Written and spoken language comprehension
12. **Motor Function Area**
    - Eye movement and orientation
13. **Higher Mental Functions**
    - Concentration
    - Planning
    - Judgment
    - Emotional expression
    - Creativity
    - Inhibition

Functional Areas of the Cerebellum

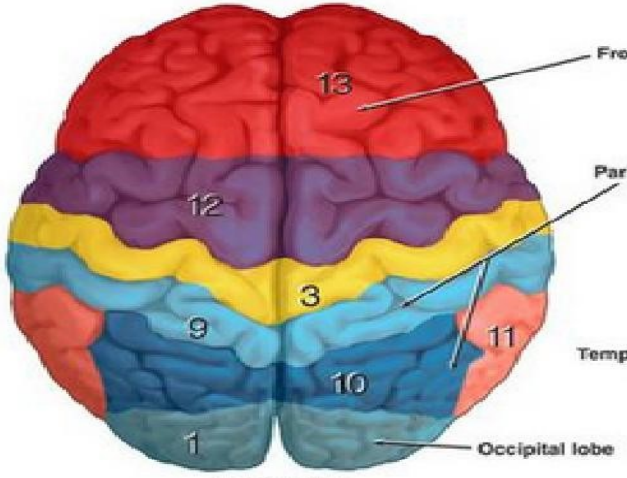
14. **Motor Functions**
    - Coordination of movement
    - Balance and equilibrium
    - Posture



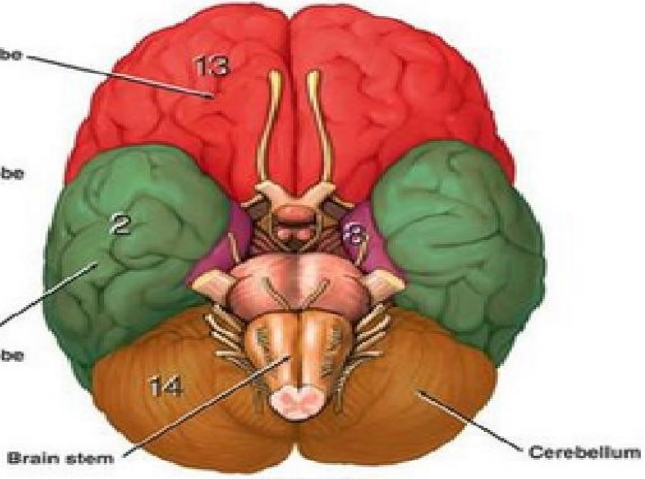
Lateral View



Sagittal View

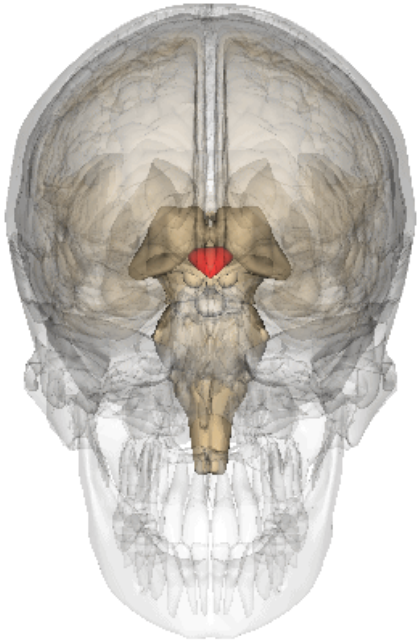


Superior View



Inferior View

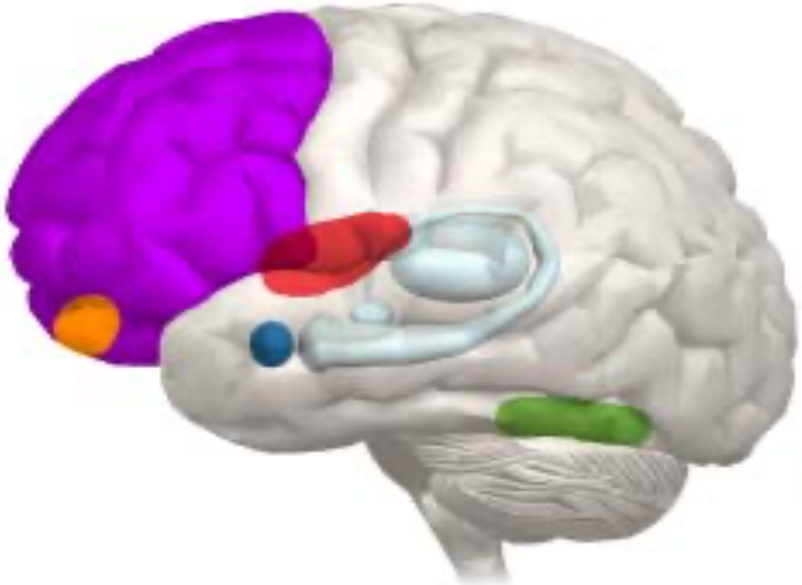
HYPOTHALAMUS REGION OF BRAIN



Movies on the brain

Scanning the brains of people as they watch a film may allow movie-makers to gauge the viewers' innate reaction to the footage

Frontal cortex
ATTENTION
Enables a viewer to understand consequences of actions



Insula
EMOTION
Involved in empathy and compassionate responses

Ventromedial prefrontal cortex
SELF-AWARENESS
Activity here likely means the film is "speaking" to the viewer

Amygdala
EMOTION AND MEMORY
Particularly active while experiencing threat or fear

Fusiform gyri
FACIAL RECOGNITION
Have a role in understanding facial expressions

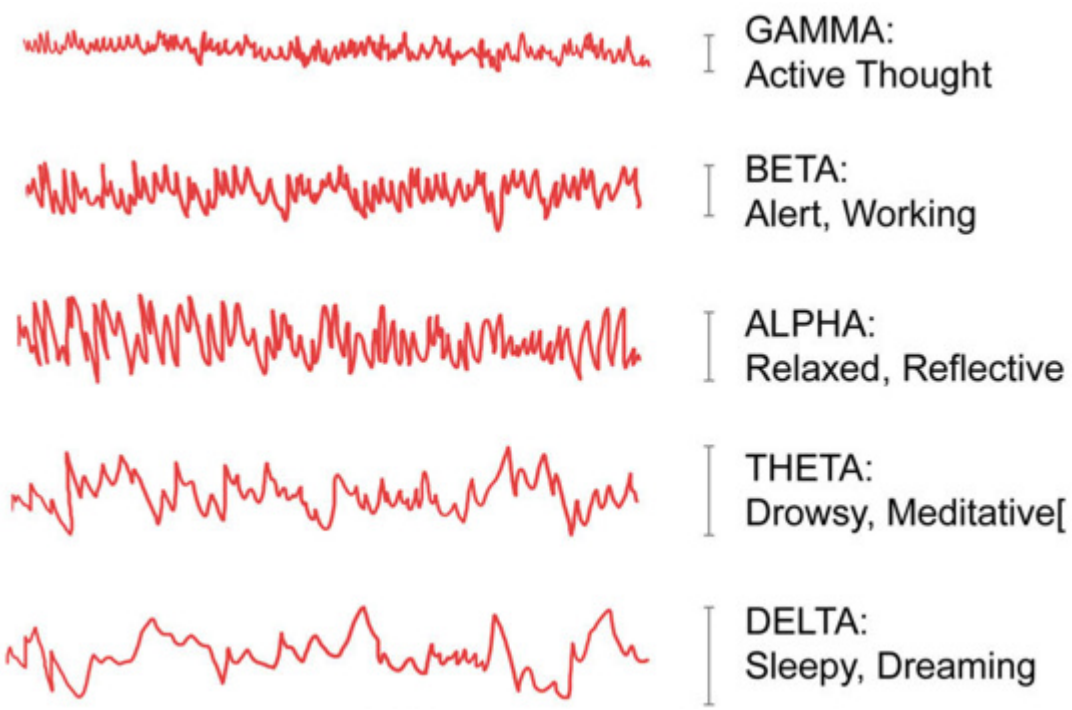
BIG CONCEPT

- The key to cognitive technological advancements, is **ELECTROENCEPHALOGRAPHY (EEG)**.
- This has enabled us to measure the brain activities effectively during viewing of cinemas.
- EEG refers to, "The recording of the brain's spontaneous electrical activity over a period of time."

HOW IT WORKS?

- Small electrodes and wires are attached to the user's head.
- The electrodes detect the brain waves and the EEG machine amplifies the signals and records them in a wave pattern on a computer screen.
- The obtained values are then mapped to a pre-defined scale to get the live review of a film.

BRAIN WAVES


GAMMA:
Active Thought
BETA:
Alert, Working
ALPHA:
Relaxed, Reflective
THETA:
Drowsy, Meditative[
DELTA:
Sleepy, Dreaming

COMPARISON OF EEG SIGNALS

TYPE	FREQUENCY(Hz)	STATE OF OCCURRENCE
Delta	0.5-4	a) Adults sleep wave signals b) In babies
Theta	4-8	a) Young Children b) Drowsiness or arousal in adults c) Idling
Alpha	8-13	a) Relaxed state b) Eye blinking
Beta	13-40	a) Alert or working b) Active, busy, anxious or thinking

SIGNAL RANGE

- **Signal range : 2μV (brain death) – several hundred μV.**
- **The frequency bands in EEG:**

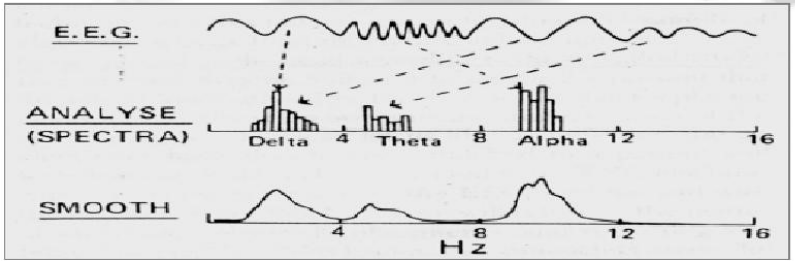
1- Delta (<4 Hz): deep sleep stages of normal adults.

2- Theta (4-8 Hz): normal infants and children as well as during drowsiness and sleep in adults.

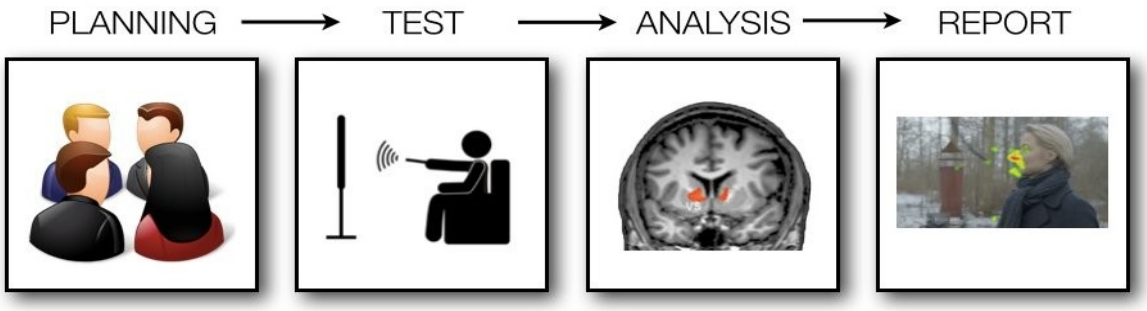
3- Alpha (8-14 Hz): mostly below 50 μV, normal adults during relaxed and mentally inactive awake ness.

4- Beta (14-30 Hz): mostly below 30 μV , It is enhanced by expectancy states and tension.

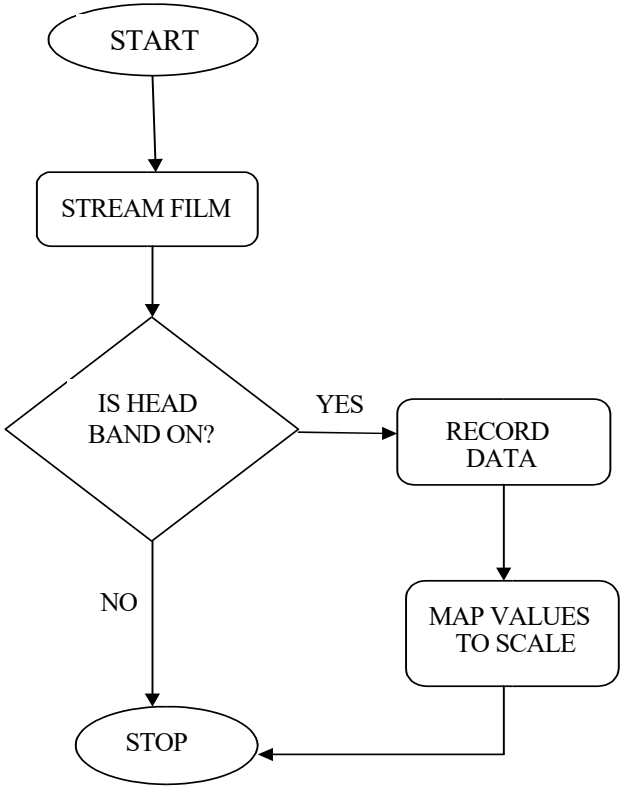
5- Gamma (>30 Hz): Usually, it is not of clinical and physiological interests and therefore often filtered out in EEG recordings



FLOW OF EVENTS

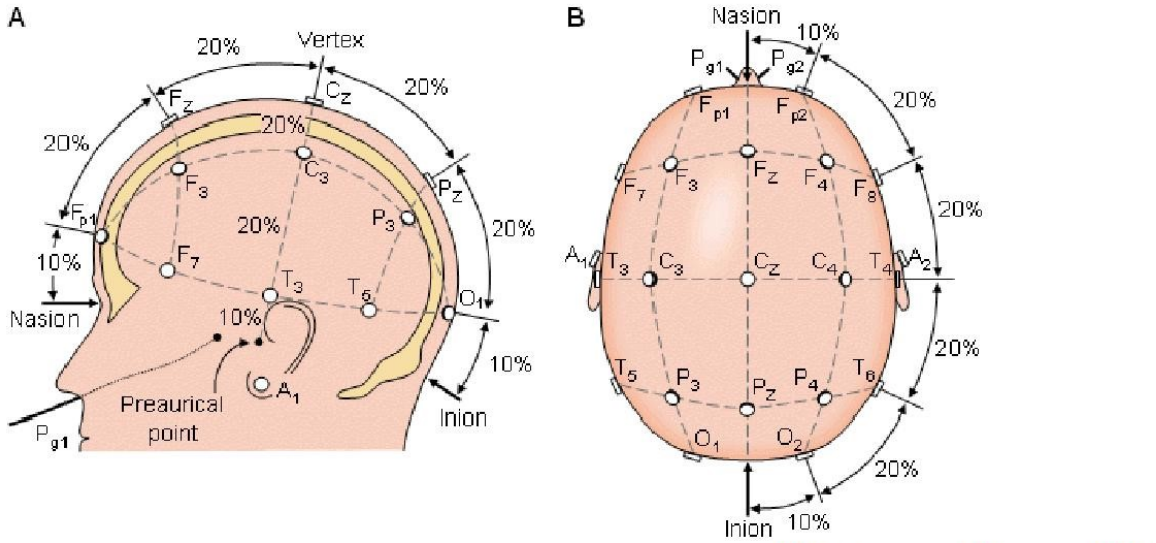


FLOW CHART


START
STREAM FILM
IS HEAD BAND ON?
YES
RECORD DATA
NO
MAP VALUES TO SCALE
STOP

ELECTRODE POSITION

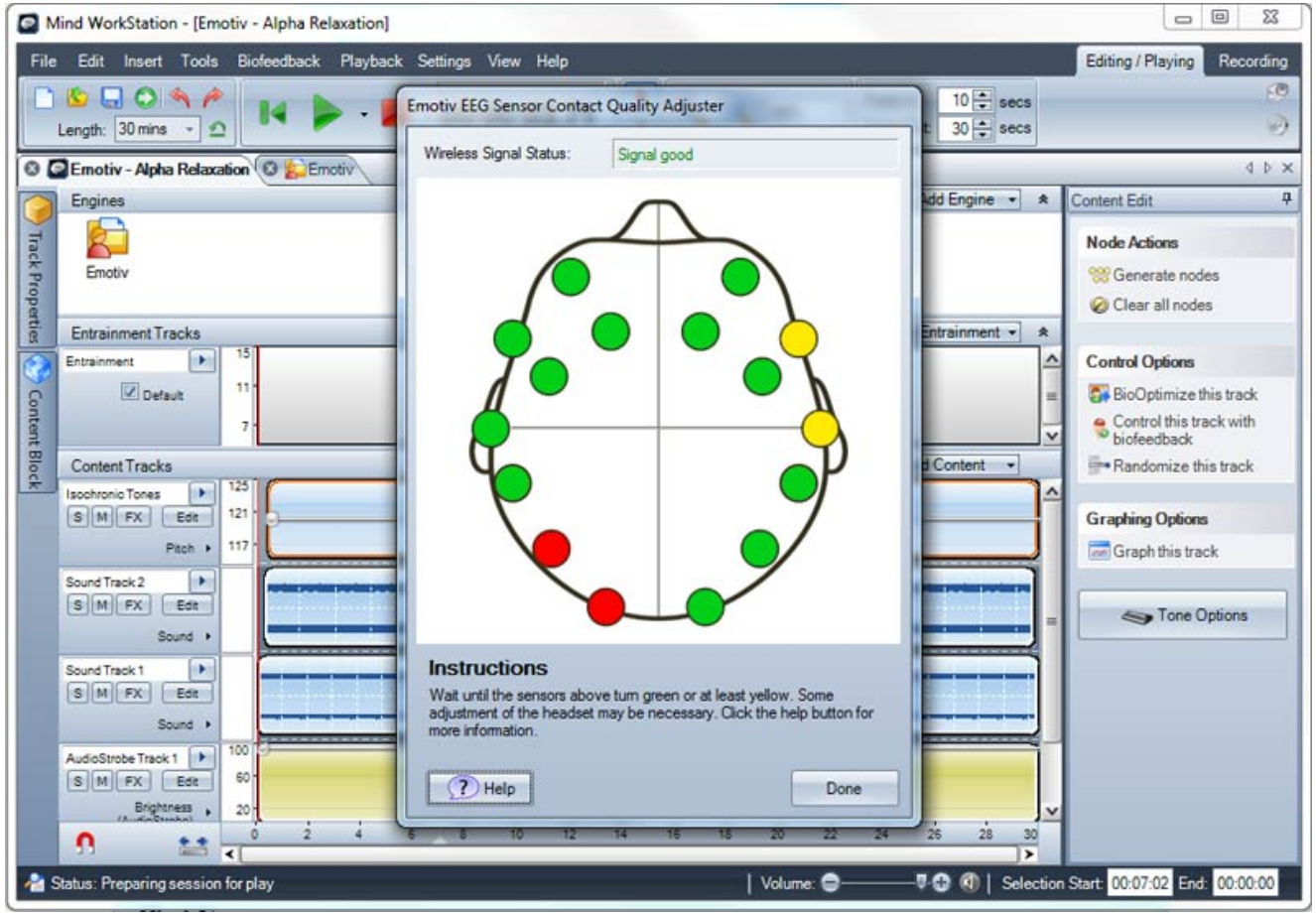
- Standardized location system (10-20 system)
- Saves a lot of hassle vs. custom labels



Malmivuo and Plonsey, 1995

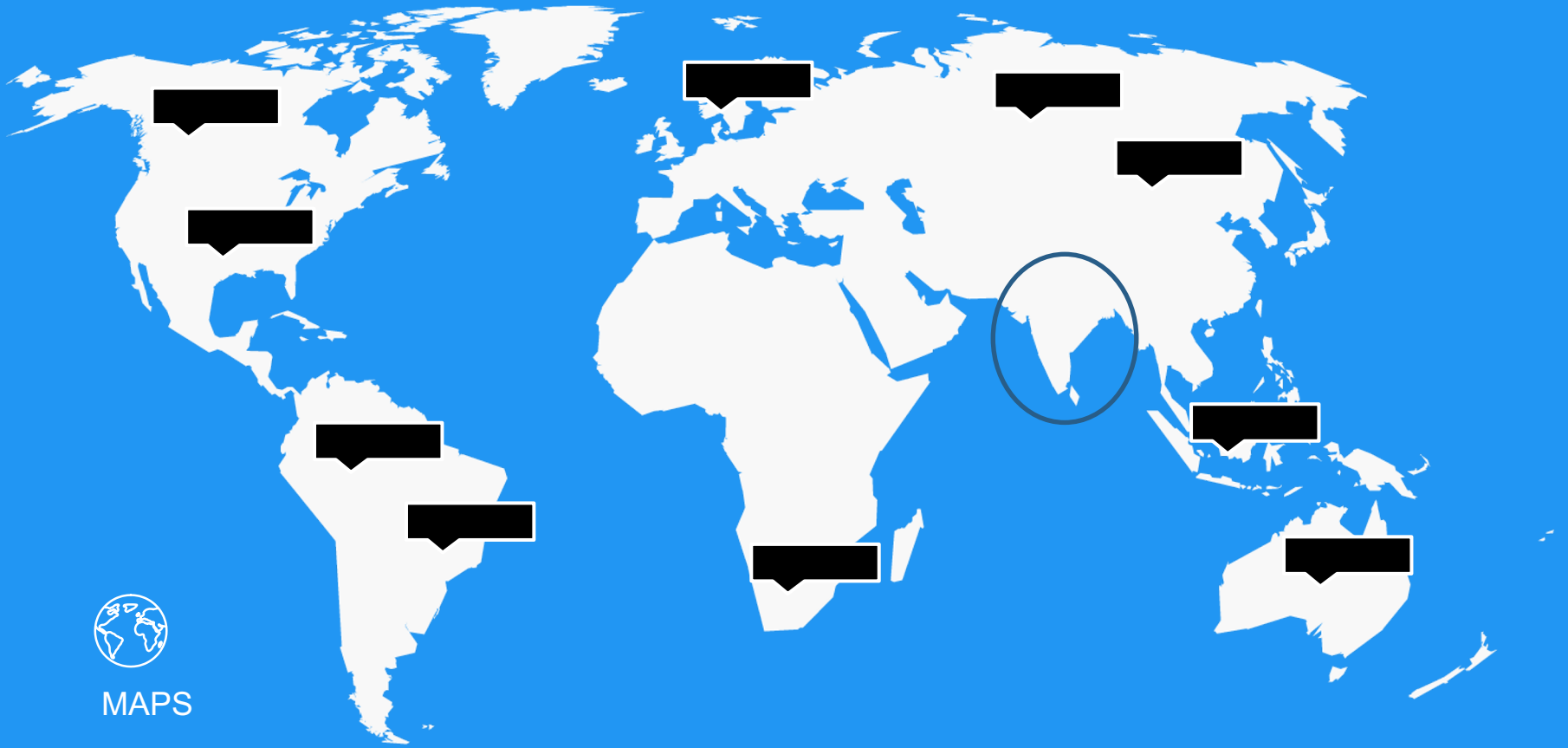
BRAIN SENSOR KIT

SOFTWARE USED



HURDLES AHEAD

- Processing depends on unknown parameters, most of the dynamics are still uncovered.
- Signal-to-noise ratio is very challenging, so sensitive measures are hard to obtain
- Relevant brain activity is small compared to interfering artifacts and compared to brain background activity
- Specific measures are even harder to obtain (with coarse-grained sensing)
- Large collections of neurons are involved in many different activities, not just one
- Underlying phenomena are also highly diverse and rich and derived measures are still poorly understood – not always clear what to look for


MAPS

BUDGET

MATERIALS	COST
BRAIN SENSOR KIT	25,000
MATLAB	NIL (University Edition)
TOTAL	**25,000**

THANK YOU!