What is EEG?

An electroencephalogram (EEG)

- A test used to find problems related to electrical activity of the brain.
- EEG tracks and records brain wave patterns.
  - Small metal discs with thin wires (electrodes) are placed on the scalp, and then send signals to a computer to record the signals.

EEG Measurement of brain functions

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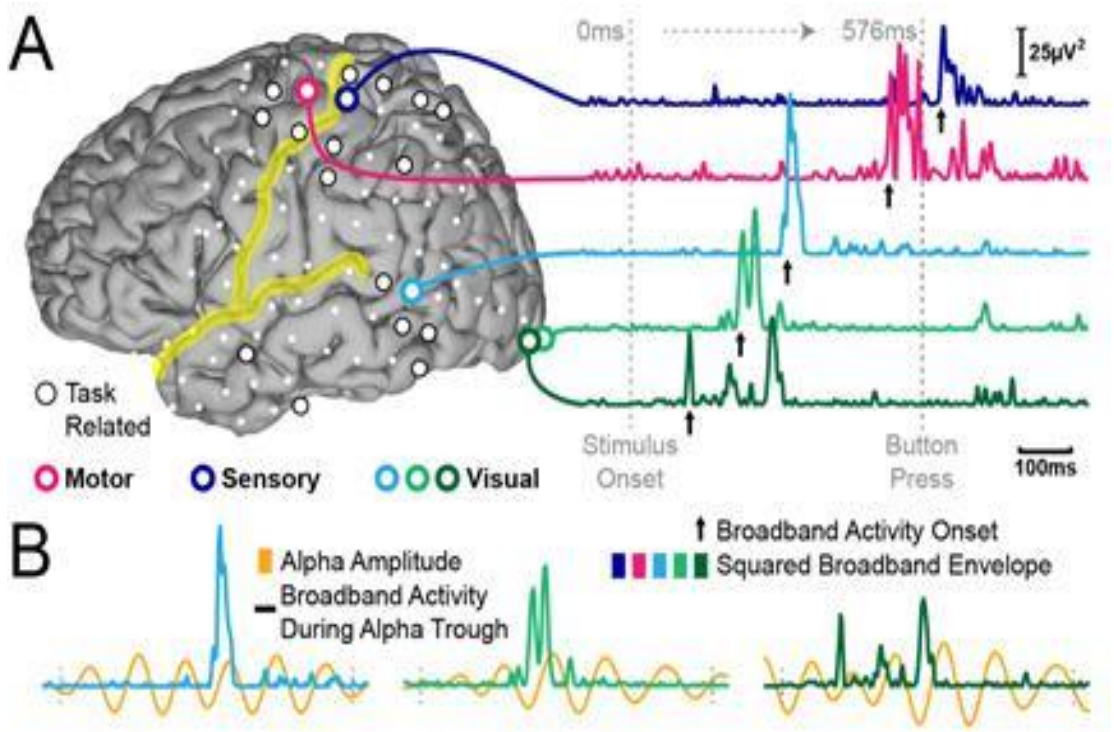
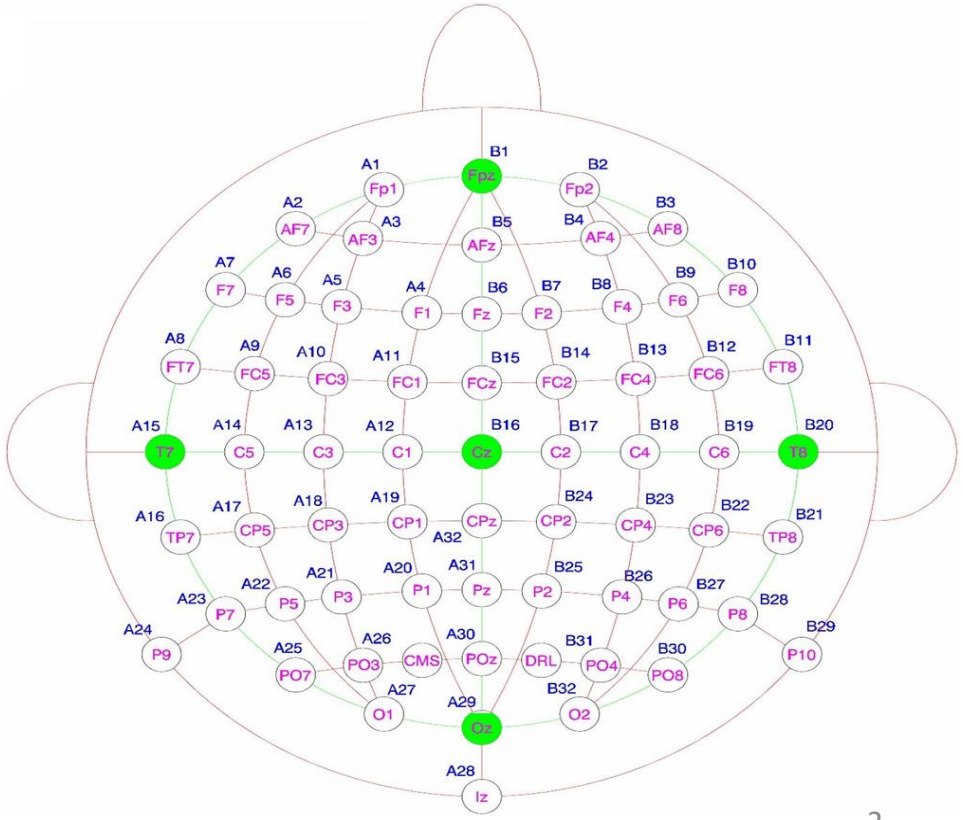


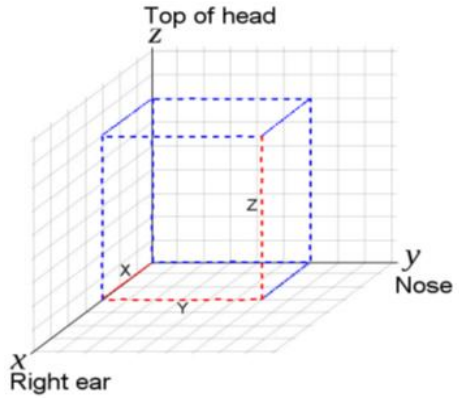
Electrodes(Sensors) Map



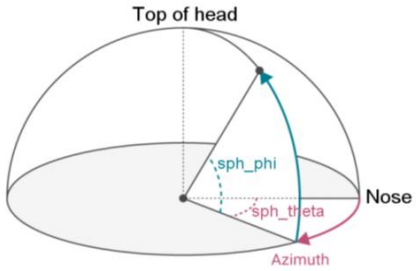
Spherical coordinates

- θ (inclination): range is from +180 degrees to -180 degrees. (at Cz, inclination = 0)
  - ➢Positive inclinations are right side of the head.
  - ➢Negative inclinations are left side of the head.
- ϕ (azimuth): range is from +90 degrees to -90 degrees.
  - ➢Positive is anti-clockwise, negative is clockwise.
  - ➢Positive inclinations: ϕ = angle from T8 (right ear) and for negative inclinations: ϕ = angle from T7 (left ear)

- Spherical coordinates



- Geographic coordinates (EEGLab)



Cartesian coordinates

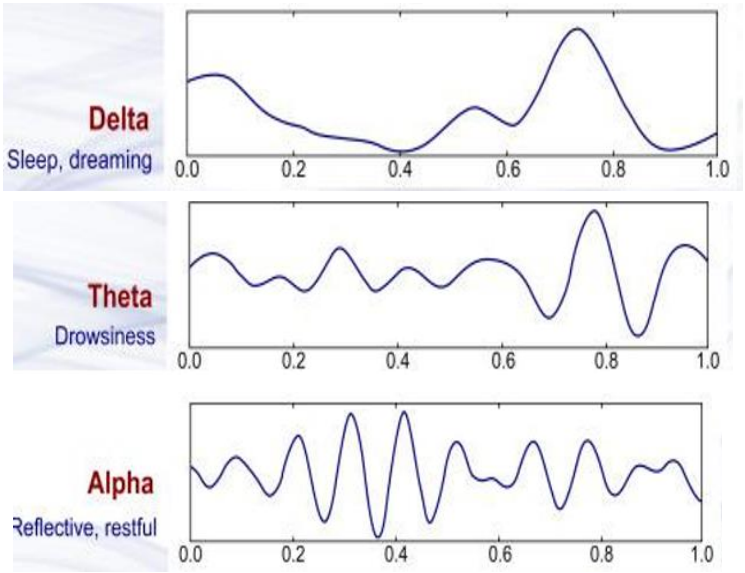
- Radius of the head is **r** (circumference divided by 2π)
  - ➢ Assuming the with r calculated from the entered head circumference.
- The center of the head is located at position (0,0,0).
- Enter the head circumference

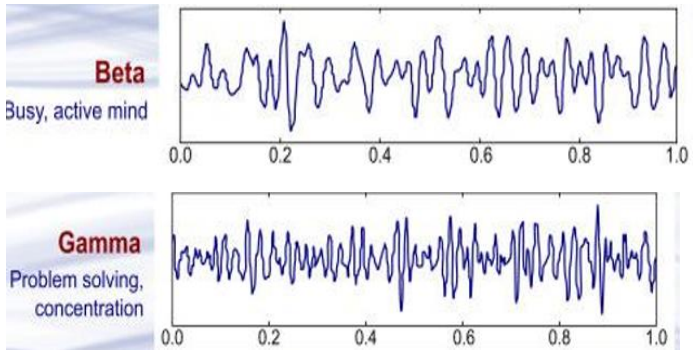
  Circumference = 55 cm
  - ➢ → r (in mm) = 87.53522298
- After entering the head circumference, all Cartesian coordinates are scaled accordingly.

- sph_phi (**elevation**):
  - ➢ range is from +90 degrees to -90 degrees (at the nose, elevation = 0)
    - positive elevations are upper half of the head
    - negative elevations are lower half of the head
- sph_theta (**azimuth**):
  - ➢ range is from +180 degrees to -180 degrees.
    - positive is anti-clockwise
    - negative is clockwise.(viewed from the top)

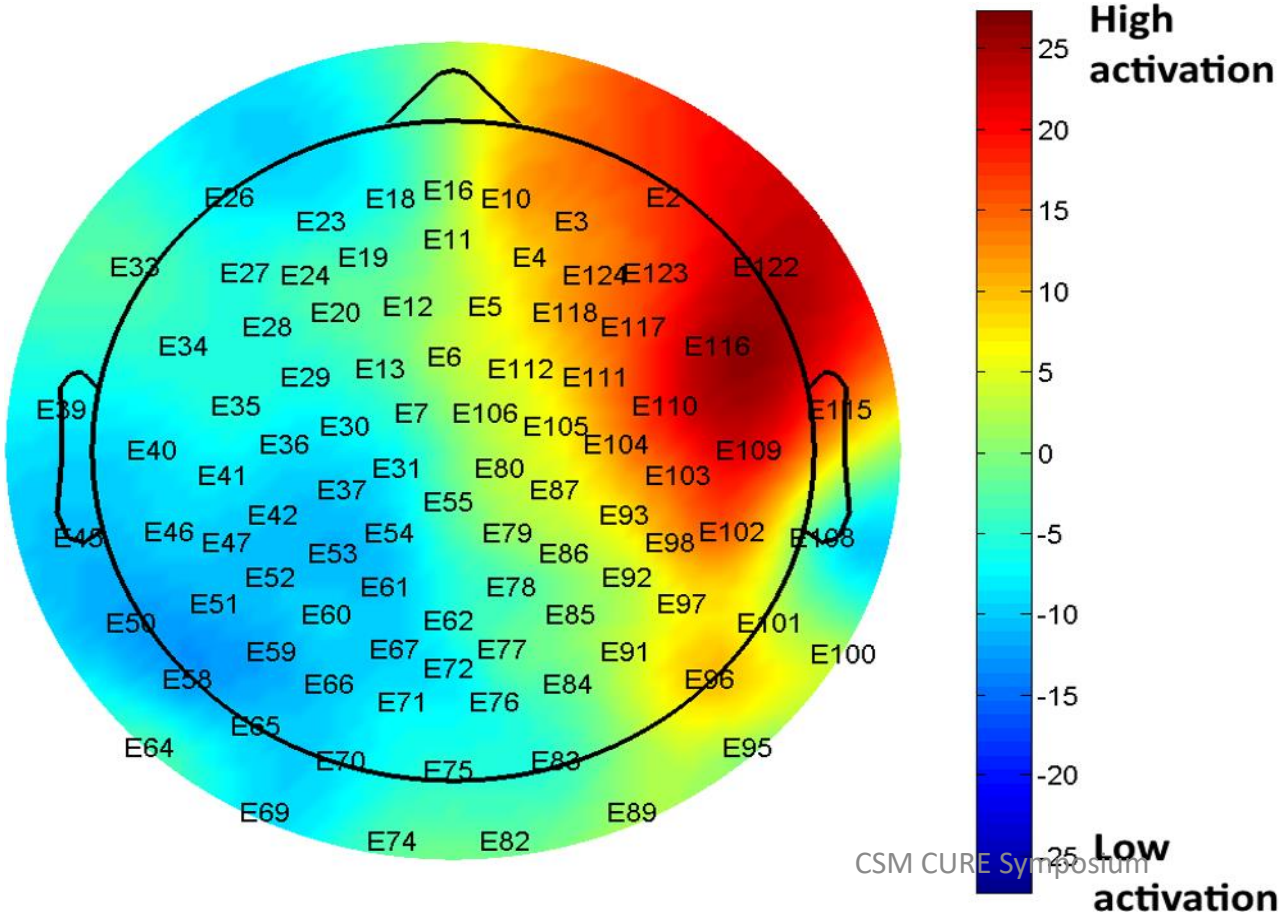
Brain Waves

- Brain waves are oscillating electrical voltages in the brain measuring just a few millionths of a volt.
  - Delta (< 4 Hz)
  - Theta (4-8 Hz)
  - Alpha (8-12 Hz)
  - Beta (12-24 Hz)
  - Gamma (24-40 Hz)





Visualization



RGB Colors representing the value of the EEG at a particular time (in micro volt)

VR application

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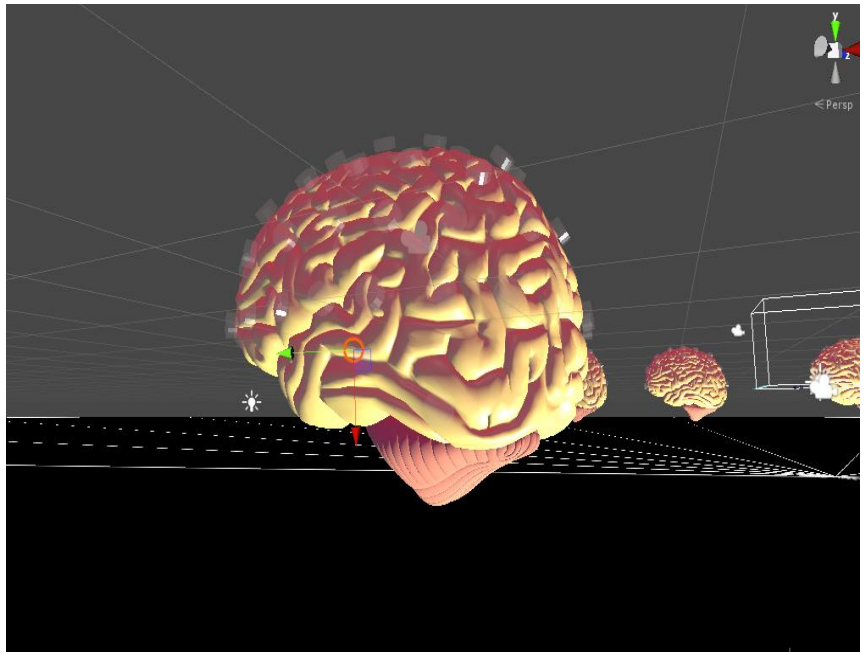
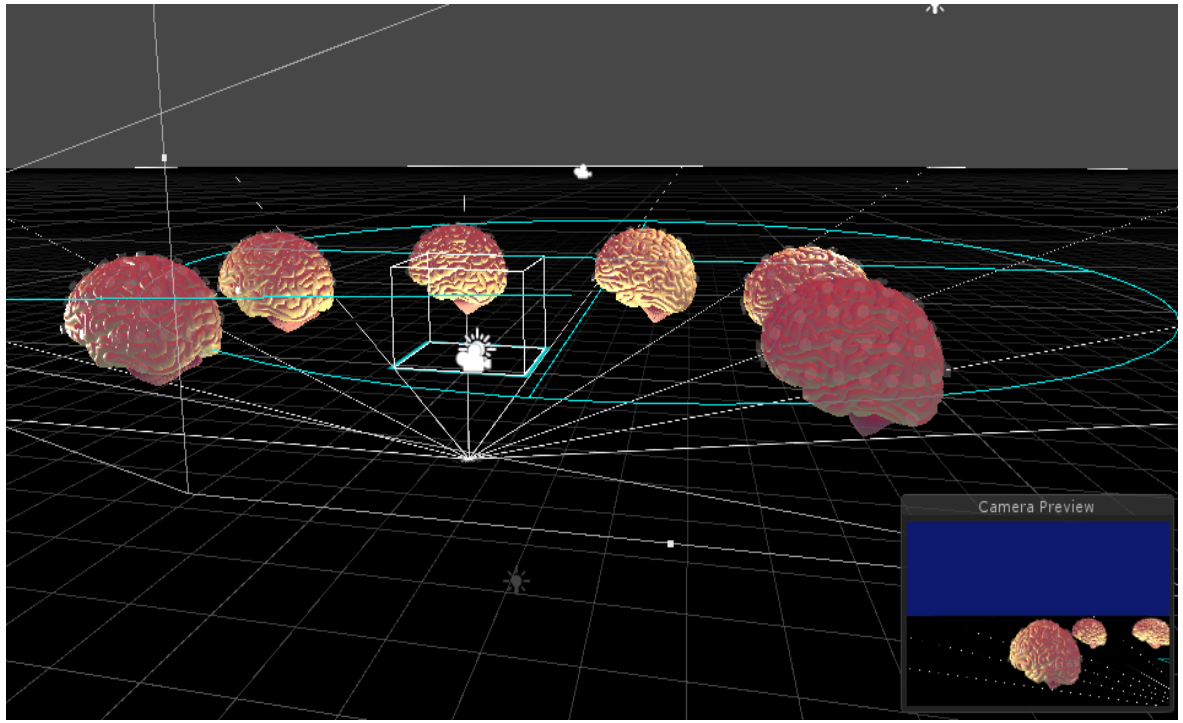


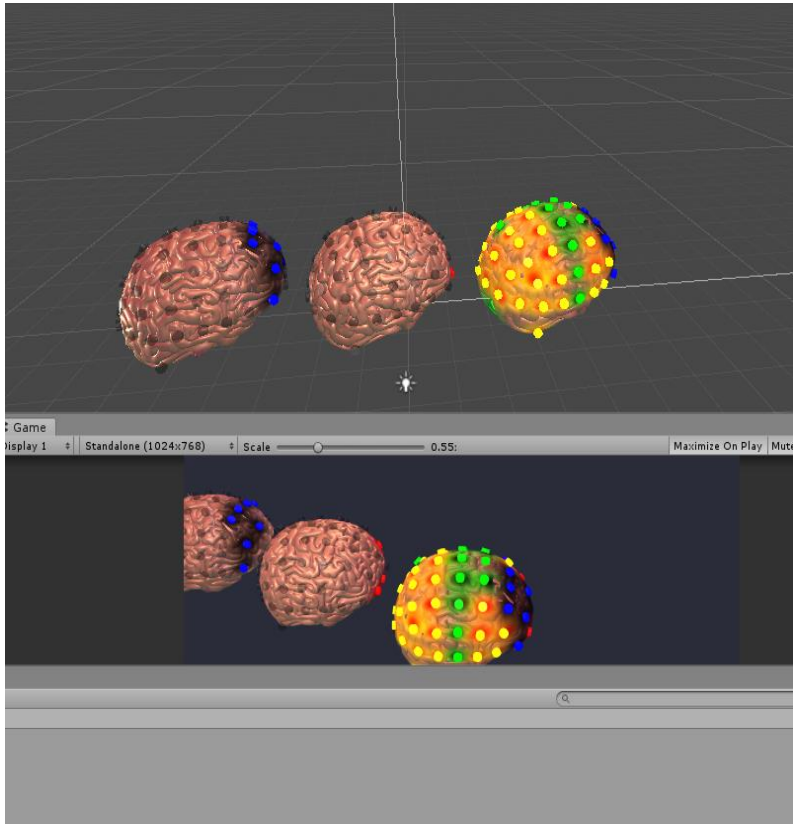
First brain model after placing the electrodes

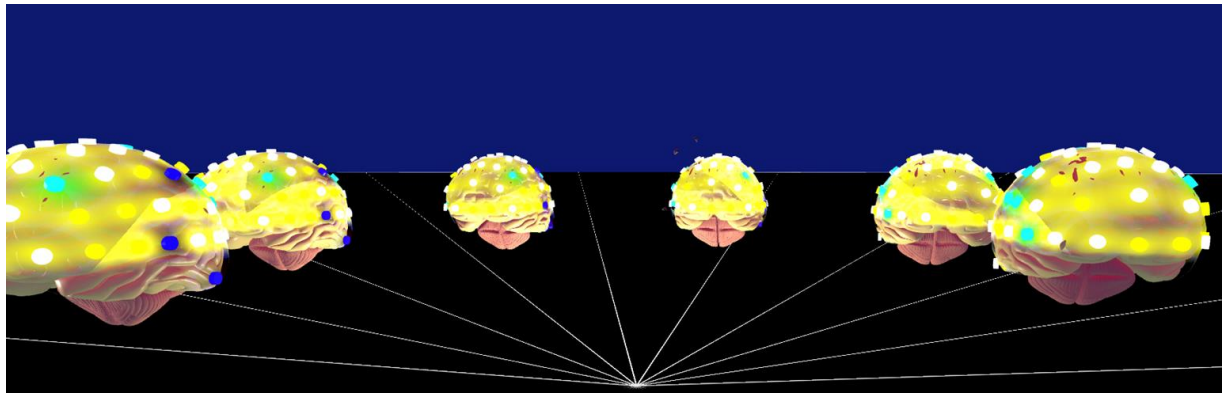


Adding 6 brain models to represent each EEG wave

VR application

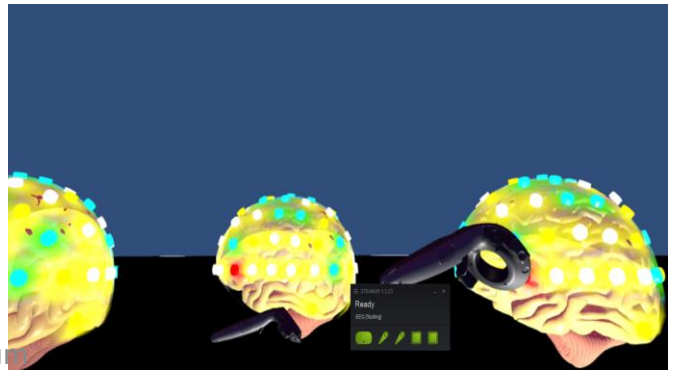
- Reading live data from outsource and convert them in the brain as RGB colors.





Unity 3D view

VR view



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