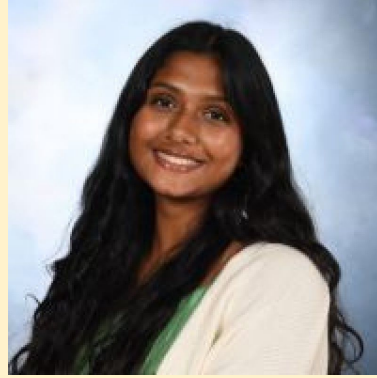


# Personalizing XR from Neural Responses to Multisensory Stimuli in Neurotypical and Neurodivergent Participants Using a Muse EEG Headband

Raghavi Aiyer, Purvi Vippulancha  
Winlab - Week 4

# TEAM



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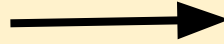
# HYPOTHESIS

The Muse Headband can inform a person's interest level to certain stimuli, which can inform VR learning.



## Gap

- Difficulty in accommodating neurodivergent individual into mainstream learning systems



## Objective

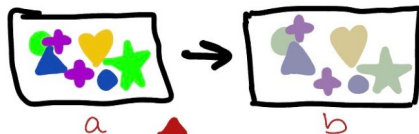
- Collects EEG, movement, and participants feedback
- Create personalized data for neurodivergent individuals
- Implement into virtual reality technologies

# Our Project

Stimuli #1  
spatial audio scene



Stimuli #2  
Light intensity / color tone

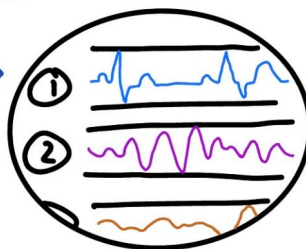
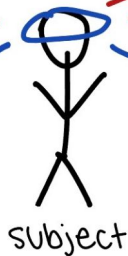


Stimuli #3  
environmental complexity



#4: control  
state

muse-2  
headband

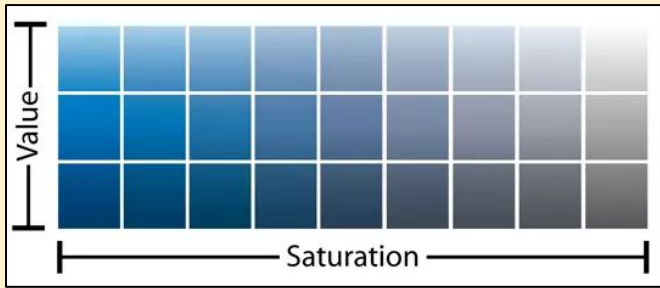


Muse-2 Headband

- Alpha: Relaxed
- Beta: Alert
- Theta: Dreaming
- Delta: Sleeping
- Gamma: Processing
- Accelerometer: Moving
- Gyroscope: Rotating

# Developing Stimuli Tests

Visual

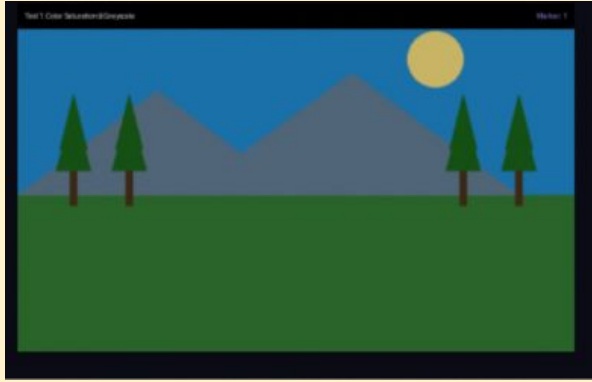


Auditory

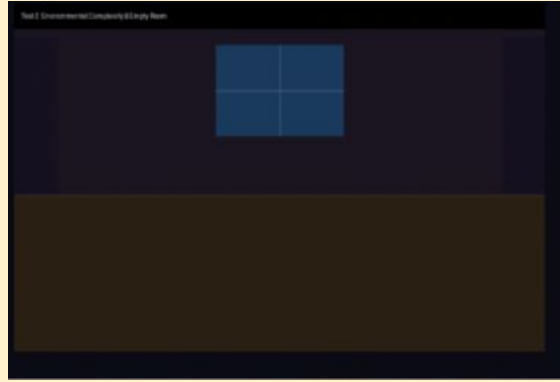
| Condition | Purpose                     |
|-----------|-----------------------------|
| Silence   | Baseline Control            |
| 174Hz     | Low Frequency               |
| 396Hz     | Lower-Middle                |
| 528Hz     | Middle                      |
| 741 Hz    | Upper-Middle                |
| 963 Hz    | High                        |
| 500 Hz    | Unlabeled Control Frequency |



# Developing Stimuli Tests



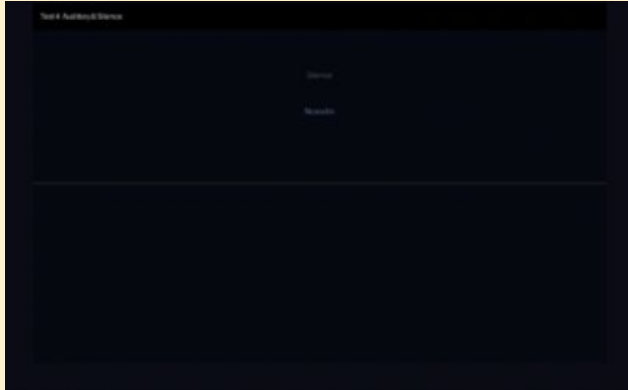
T1- Color Saturation



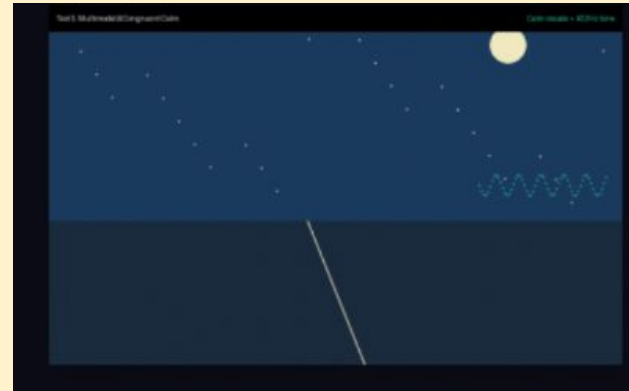
T2- Environmental Complexity



T3- Visual Motion



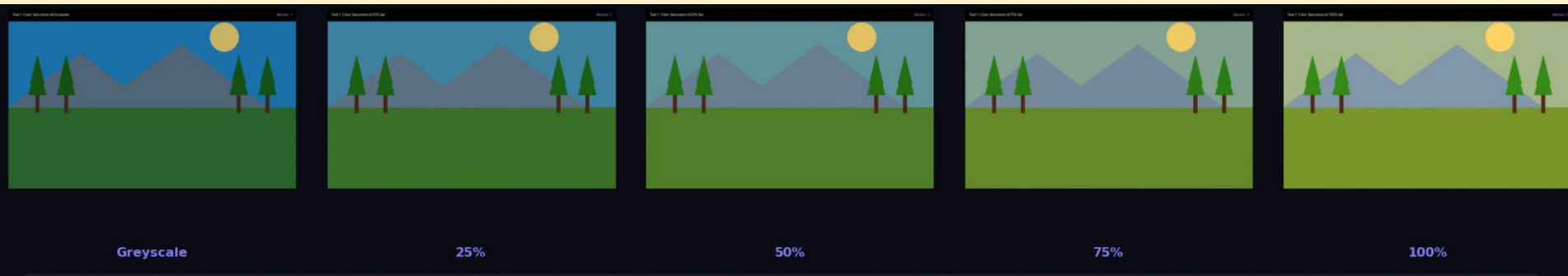
T4- Auditory Frequency



T5- Multimodal Congruence

# What the Participant Saw (Examples)

## Test 1: Color Saturation - stimulus at each condition



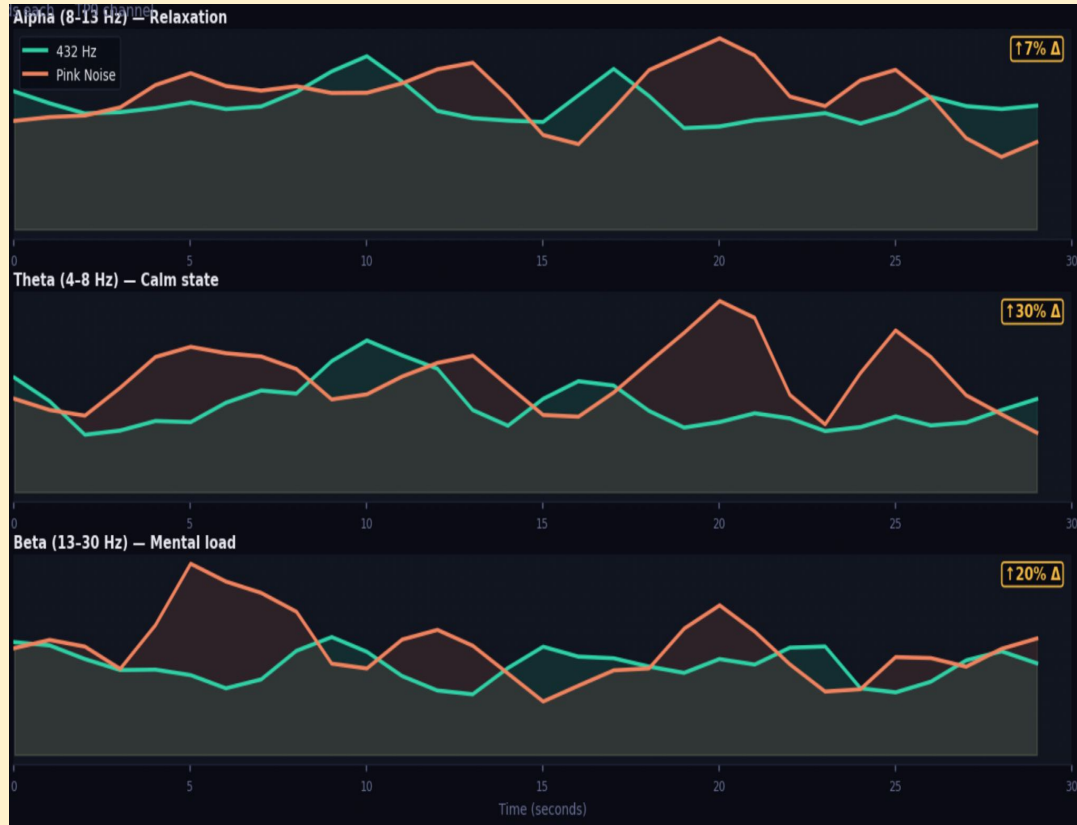
## Test 2: Environmental Complexity- stimulus at each condition





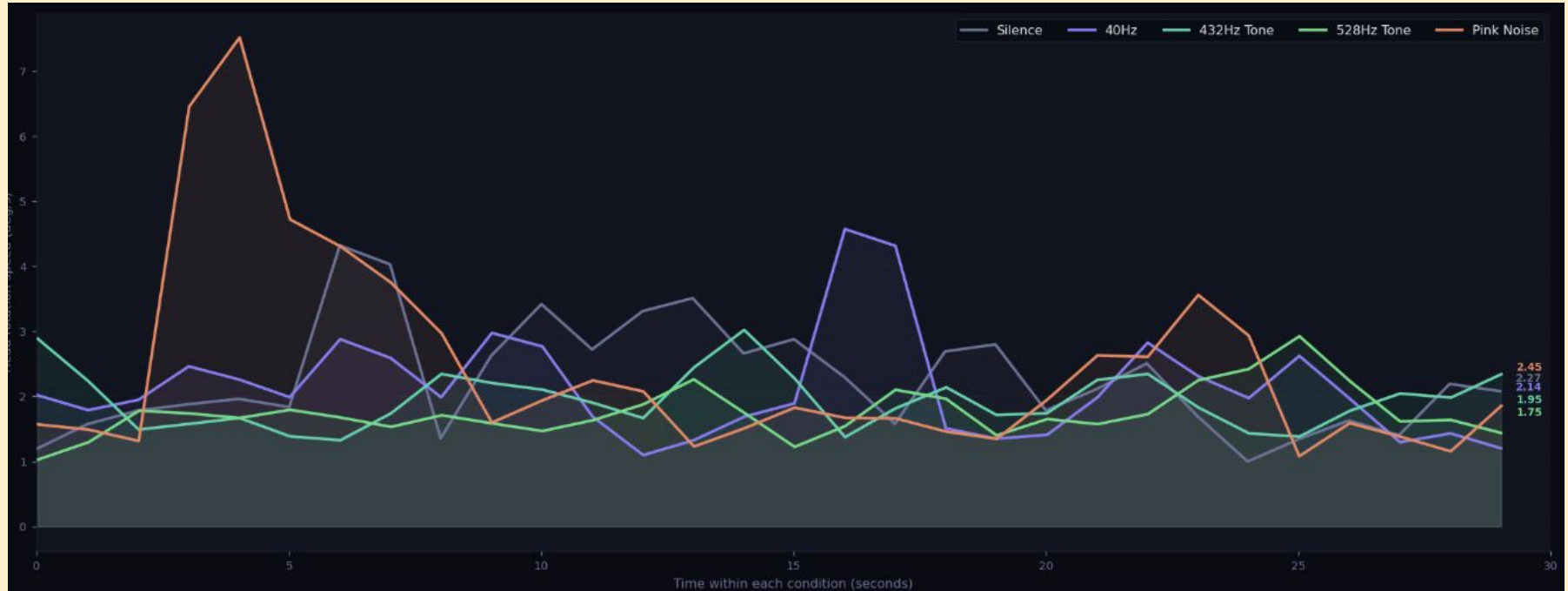
# EEG Brainwave Results

What the EEG recorded second-by-second during Test 4



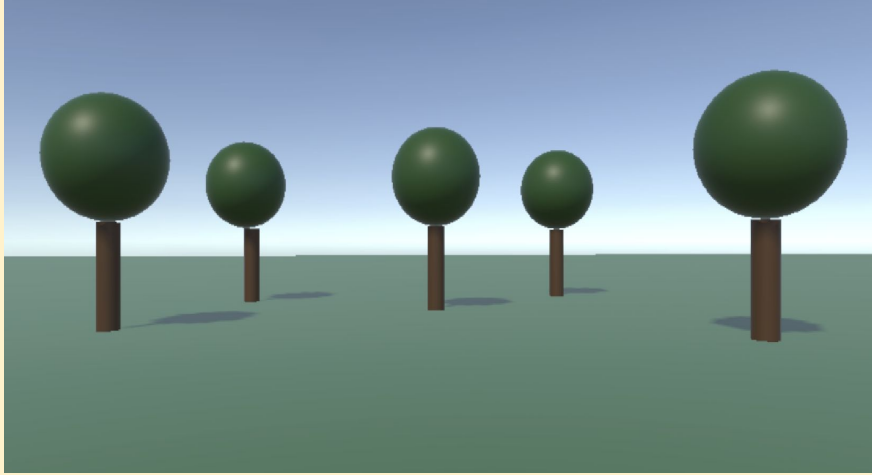
- Brain Data for One Participant (P001)
- 432Hz tone (calm) vs Pink Noise(Stimulating)

# Motion Data – Gyroscope

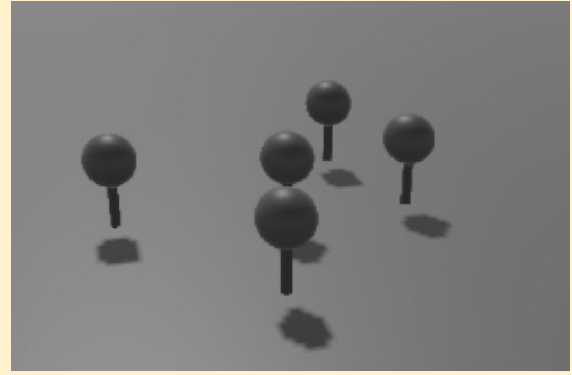


- Head movement data collected across all conditions – further testing needed to establish reliability.

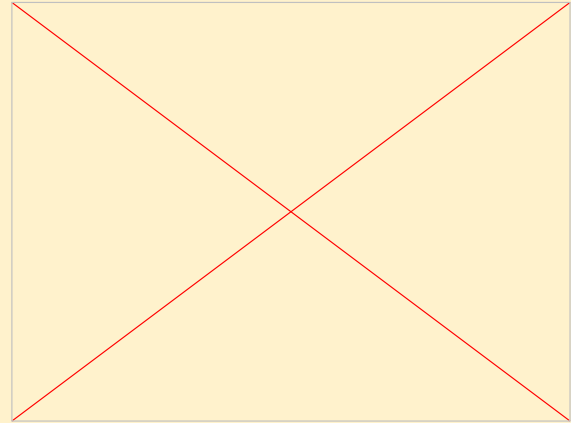
# Unity XR Baseline Environments



Baseline Setting



Saturation Index



Complex Environment

## Current Stage

- Stimuli Tests Developed
- Beginning Data Collection
- Unity Environments Built
- Inconclusive results due to minimal data

## Next Steps

- Collect more data to create comparisons
- IRB approval
- Configure Meta Quest with Unity
  - Using MLMs to implements personal data into Meta Quest