

LUIS FELIPE JIMENEZ  
Kean University  
Union, New Jersey





KEAN  
UNIVERSITY  
www.kean.edu

# READER ENGAGEMENT

LUIS FELIPE JIMENEZ  
Kean University  
jimluis@kean.edu

Dr. JUAN GILBERT  
Clemson University  
juan@clemson.edu

MARVIN ANDUJAR  
Clemson University  
manduja@g.clemson.edu

Dr. SHANI DAILY  
Clemson University  
sdaily@clemson.edu



**Collaborators:** Jamal Thorn, Austin Toker and India Irish

# CONTENT

- WHAT IS ACTIVE READING
- WHY ACTIVE READING IS IMPORTANT
- PREVIOUS WORK
- BRAIN-COMPUTER INTERFACE (BCI)
- HYPOTHESIS
- CURRENT APPROACH
- VIDEO IMPLEMENTATION
- MEASUREMENT OF ENGAGEMENT
- CURRENT PROCESS
- SYSTEM ARCHITECTURE
- APPLICATION (IN PROGRESS)
- FUTURE WORK



# WHAT IS ACTIVE READING?

- Retain the information gained



- Improve reading skills

# WHY ACTIVE READING IS IMPORTANT?



- It gets the reader involved in the material
- Critical thinking skills



# PREVIOUS WORK

- Reading agent
- Interactive Rich Reading



# BRAIN-COMPUTER INTERFACE (BCI)

- Electroencephalography (EEG)
- Functional Magnetic Resonance Imaging (fMRI)
- Magnetic Resonance Image (MRI)
- Functional Near-Infrared (fNIRS)
- Among others.

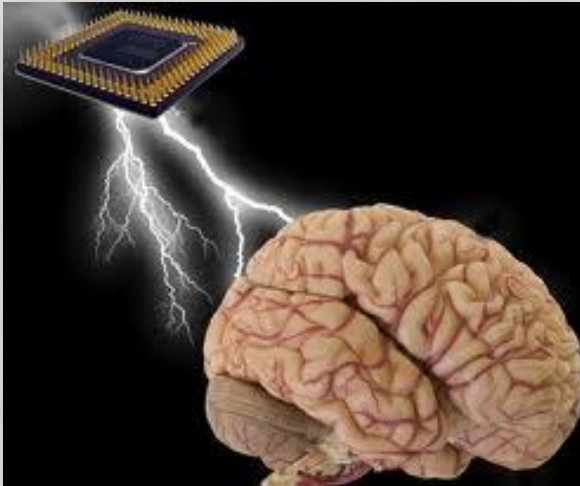
## WHAT IS EEG?

## WHY ARE WE USING EEG?

- PORTABILITY
- IT IS NOT BULKY COMPARE TO fMRI AND fNIRS
- POPULAR NON-INVASIVE METHOD
- LOWER COST vs fMRI/fNIRS



# RECORDING BRAIN WAVES



INVASIVE



PARTIAL



NON-INVASIVE



# ACTIVE AND PASSIVE BCI

## ACTIVE



- Use neural signals to interact with software/machines.

## PASSIVE



- Observatory, gather information while performing a task.

# EMOTIV EPOC HEADSET

## DETECTION SUITES

- Affective/ Emotional
- Cognitive/ Controlling objects
- Expressive/ Facial expressions

## CHARACTERISTICS OF THE DEVICE

- 16 electrodes and 2 references
- Wireless

## LIMITATIONS

- Signal depends of the Connectivity
- Type of hair



# WHY ARE WE USING THE EMOTIV EPOC HEADSET?

EEG measurements typically involves an array of head net.

## EMOTIV EPOC DEVICE

- Few minutes to set up
- It is wireless



# HYPOTHESIS

- While the readers are reading something that is not interesting for them, they do not obtain as much information as they can.
- Incrementing the level of engagement.

# CURRENT APPROACH

- The Emotiv EPOC device will be used to measure the participant's level of engagement physiologically.
- If the participant's engagement level is under the baseline 0.549 the video will pop out.



**Video**

# VIDEO IMPLEMENTATION

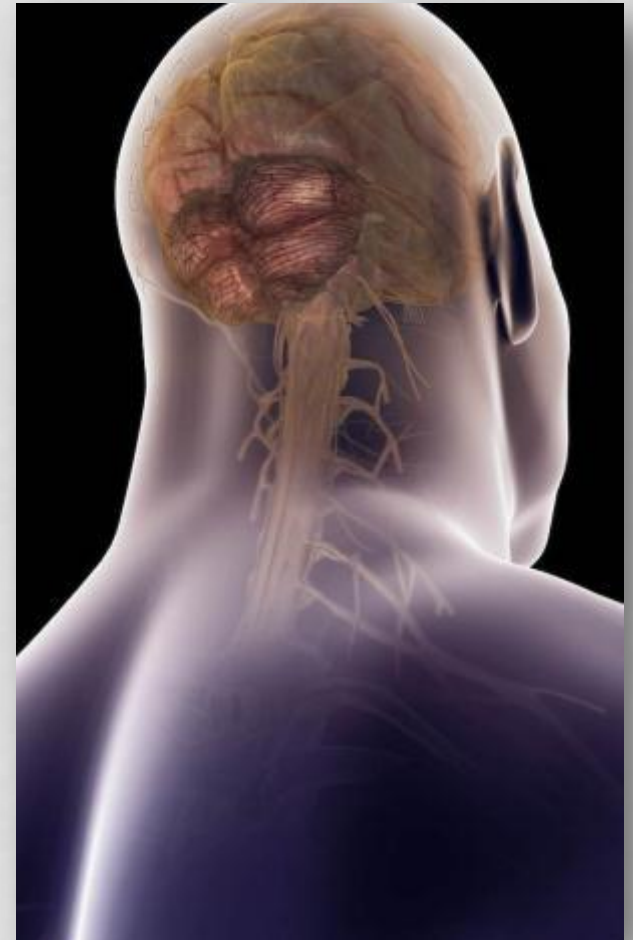
The videos will be chosen from YouTube according to the article topic. The “interesting” scale of the videos will be based on the video’s ratings.



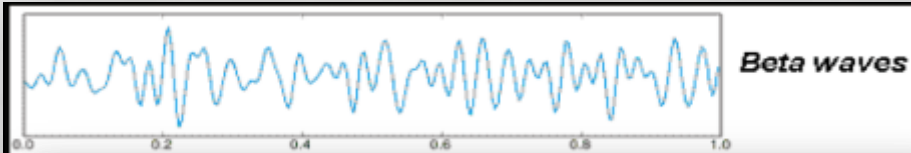
# MEASUREMENT OF ENGAGEMENT

- EMOTIV ENGAGEMENT (0 - 1)
- PARTICIPANTS ENGAGEMENT.
- ENGAGEMENT FORMULA

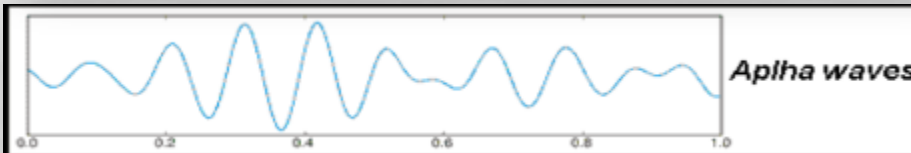
$$E = \frac{\beta}{(\alpha + \theta)}$$



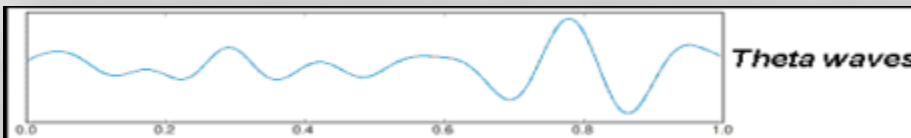
# BRAIN WAVES



Brainwave Type	Frequency Range (Hz)	Mental States & Conditions
Beta	13 - 30	Relaxed but focused, integrated, thinking, aware of self & surroundings, alertness, agitation



Brainwave Type	Frequency Range (Hz)	Mental States & Conditions
Alpha	7 - 13	Relaxed, tranquil, conscious

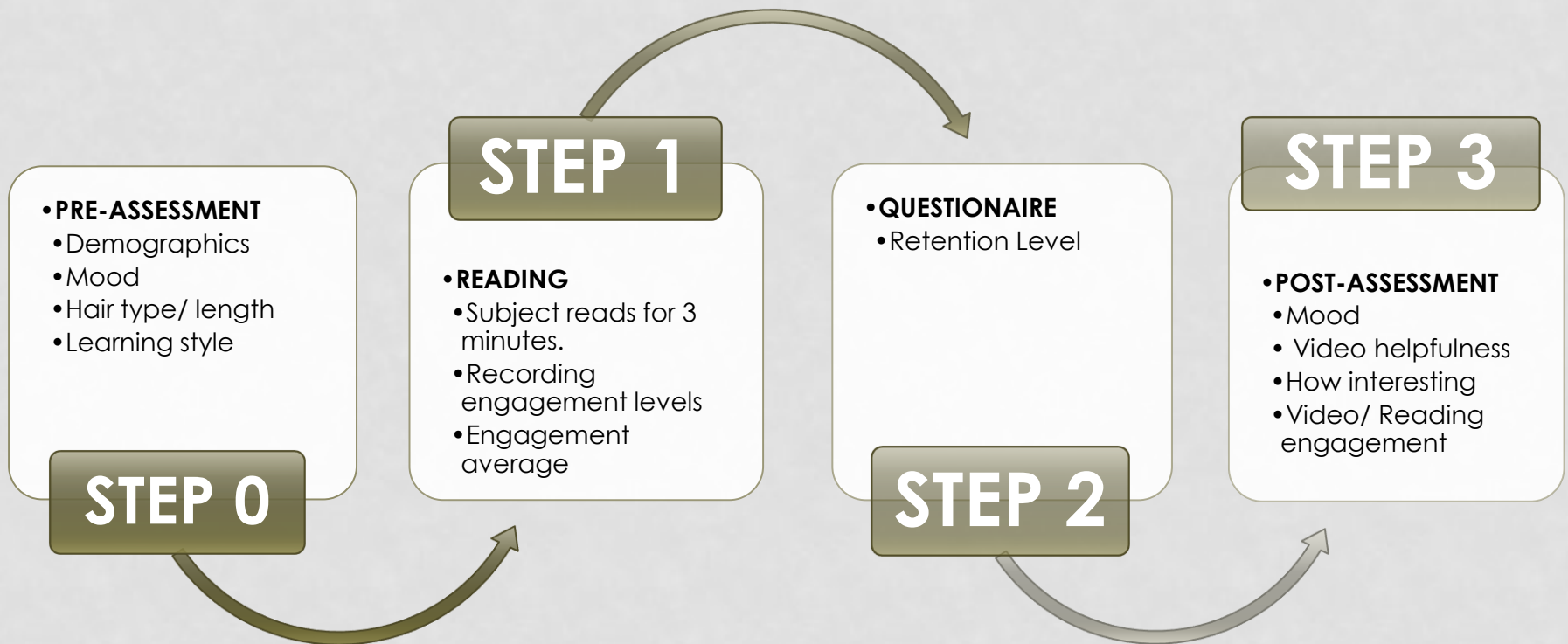


Brainwave Type	Frequency Range (Hz)	Mental States & Conditions
Theta	4 - 7	Intuitive, creative, recall, fantasy, imaginary, dream

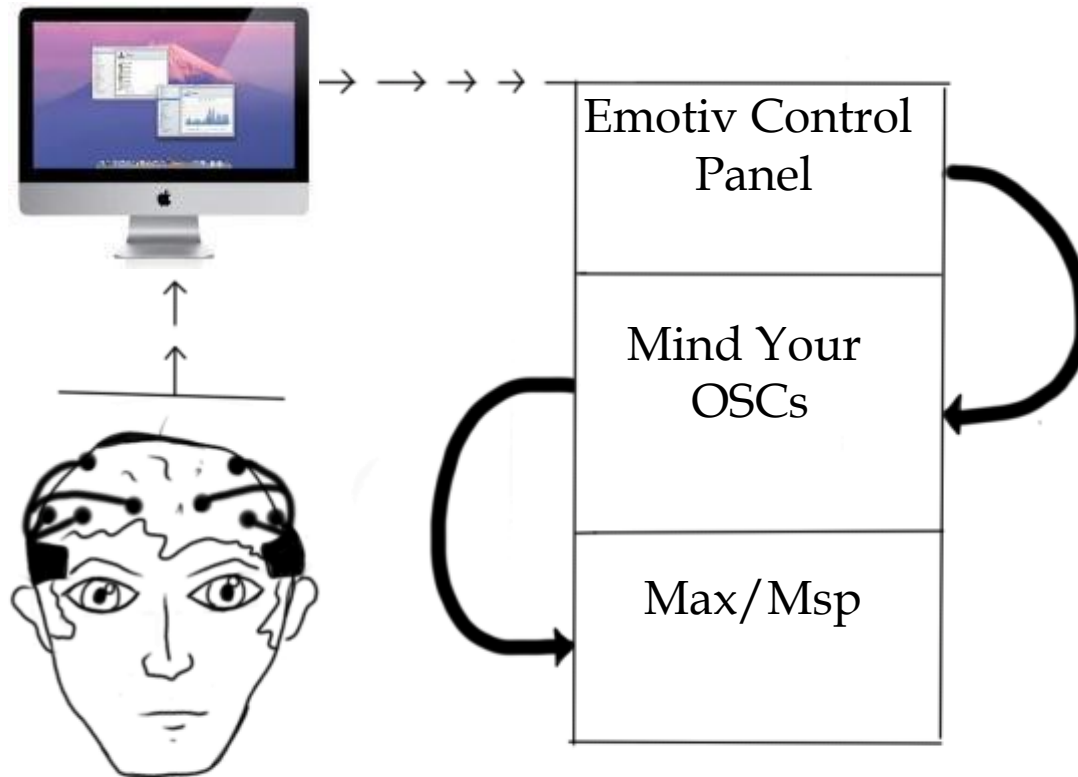




# CURRENT PROCESS



# SYSTEM ARCHITECTURE



# EMOTIV CONTROL PANEL

**ENGINE STATUS**

**System Status:** Emotiv Engine is ready  
**System Up Time:** 188.302  
**Wireless Signal:** Good  
**Battery Power:** High

**USER STATUS**

**Headset:** 0  
**User:** Participant

ADD USER REMOVE USER SAVE USER

epoc control panel

Headset Setup Expressiv Suite Affectiv Suite Cognitiv Suite Mouse Emulator

Status:OK...

**ADD USER**

Enter new username

Existing Users

- Felipe
- testing
- testing2

OK  
Cancel  
Remove User

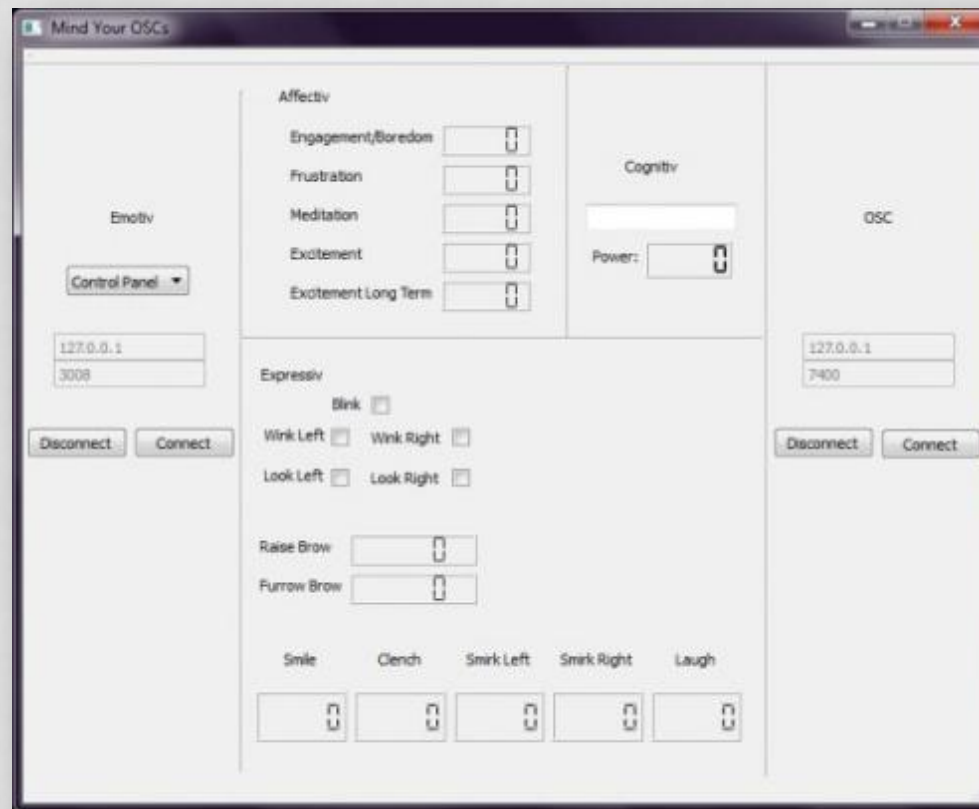
Ensure that each of the 16 electrode recesses are not already moist, wet them with saline solution liberally, use a medicine dropper to carefully

verify that the built-in battery is charged and is located near the power switch at the back of charging then set the power switch to the off Emotiv battery charger using the mini-USB cable set battery to charge for at least 15 minutes

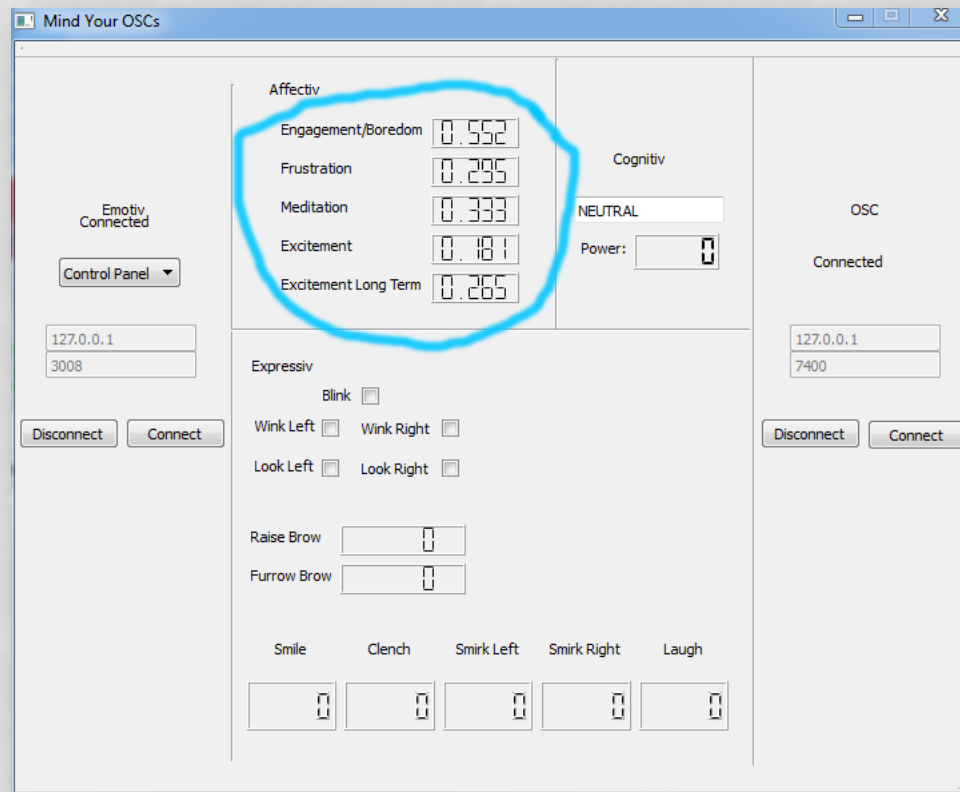
option is reported as Good by looking at the panel. If it is not, make sure that the Emotiv Dongle is inserted into a USB port on your computer and that the single LED on the top half of the dongle is on continuously or flickering very rapidly. If the LED is blinking slowly or is not illuminated, then remove the dongle from the computer, reinsert it, and try again. Remove any metallic or dense physical obstructions located near the dongle or the headset, and move away from any powerful sources of electromagnetic interference, such as microwave ovens or high-powered radio transmitters.

**Step 4** Put on the Emotiv headset by gently pulling apart the headband and lowering the sensor arms onto your head from the top down, near the rear of the skull. Next, slide the

# MIND YOUR OSCS



# MIND YOUR OSCS

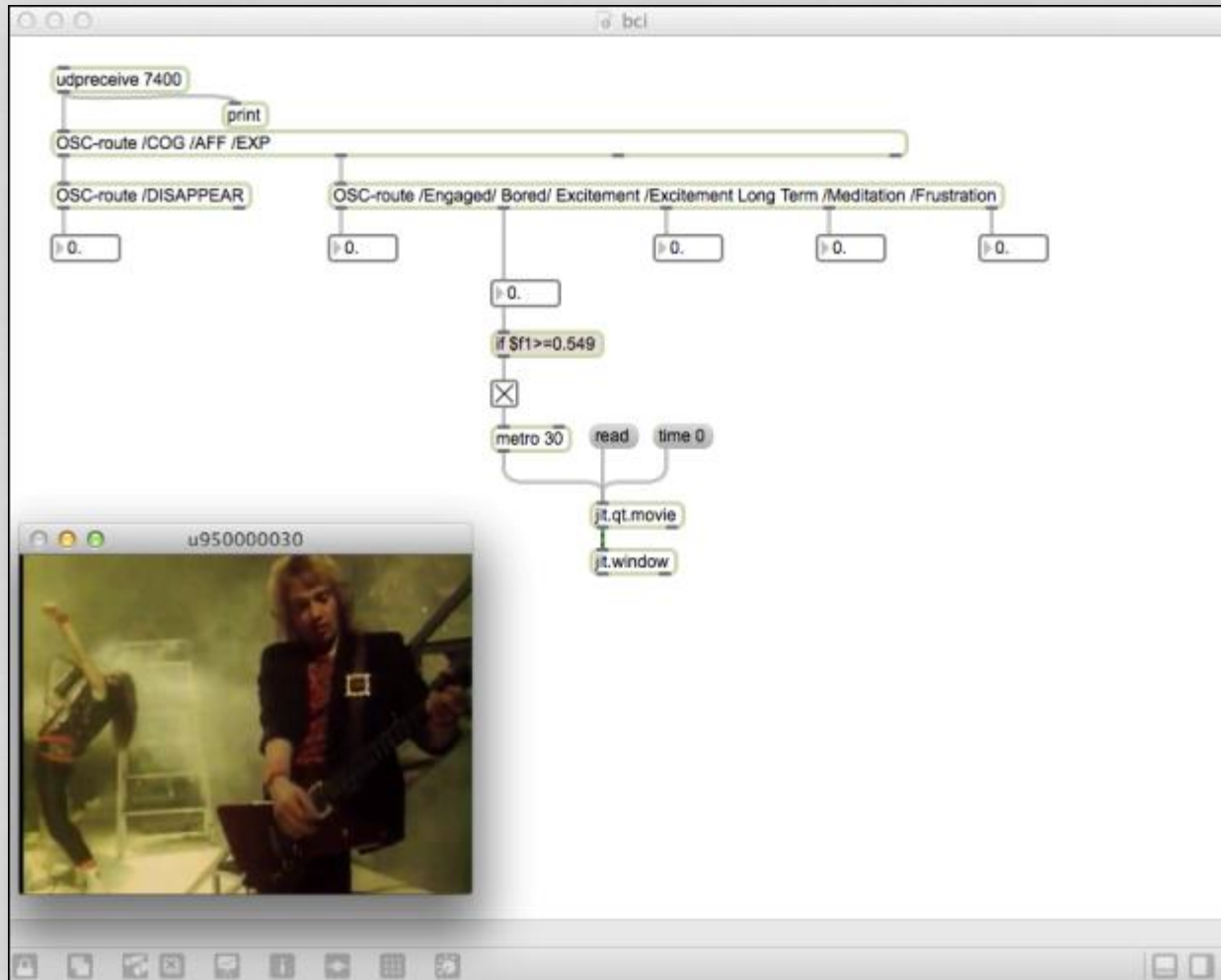


# MAX/MSP

- It is a visual programming platform for music and multimedia.
- Why Max/Msp?

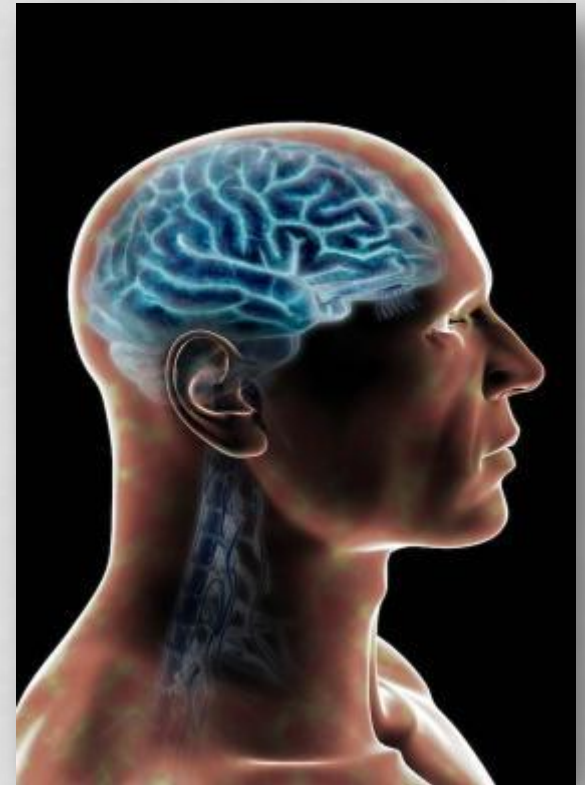


# APPLICATION (IN PROGRESS)



# FUTURE WORK

- FINISH THE SYSTEM ARCHITECTURE
- IMPLEMENTING THE ENGAGEMENT FORMULA
- DESIGN STUDIES
- CONDUCT STUDIES





# KNOWLEDGE GAINED IN REU

- Adobe Flex
- Emotiv Control Panel
- Max/Msp
- HTML5
- Brain Computer Interface



# QUESTIONS?

