

# **VISUALISING BRAINWAVES WITH EEG**

Trent Brooks - CC\_SYD July 2015



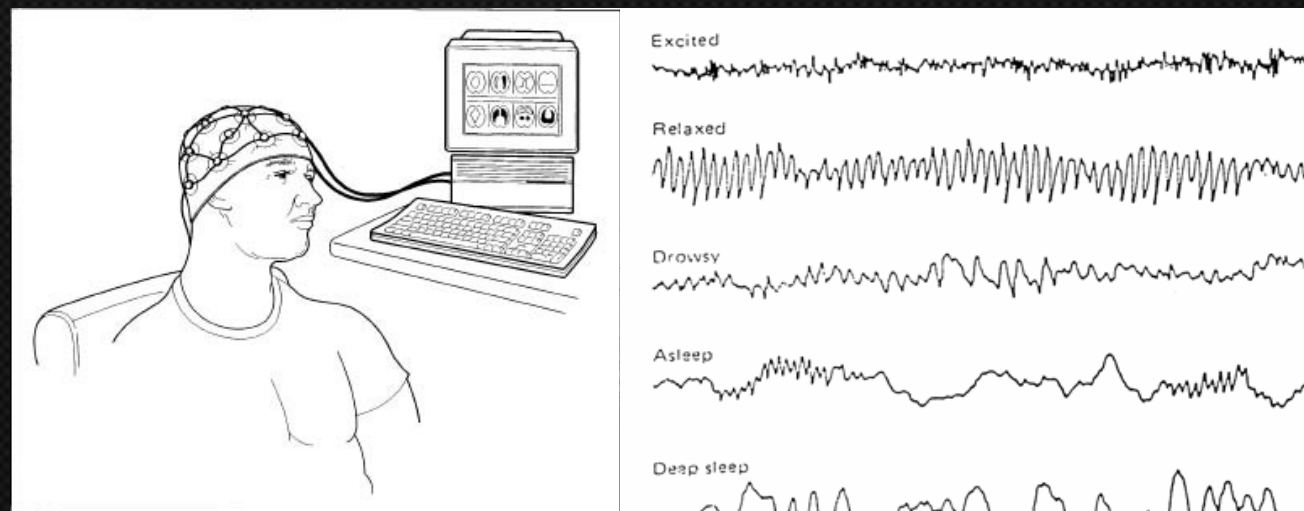
# OVERVIEW

1. About EEG & sensors
2. Brainwaves & Data
3. Consumer devices: Brainband & Muse
4. Brain Battle project
5. Code / examples



# WHAT IS EEG?

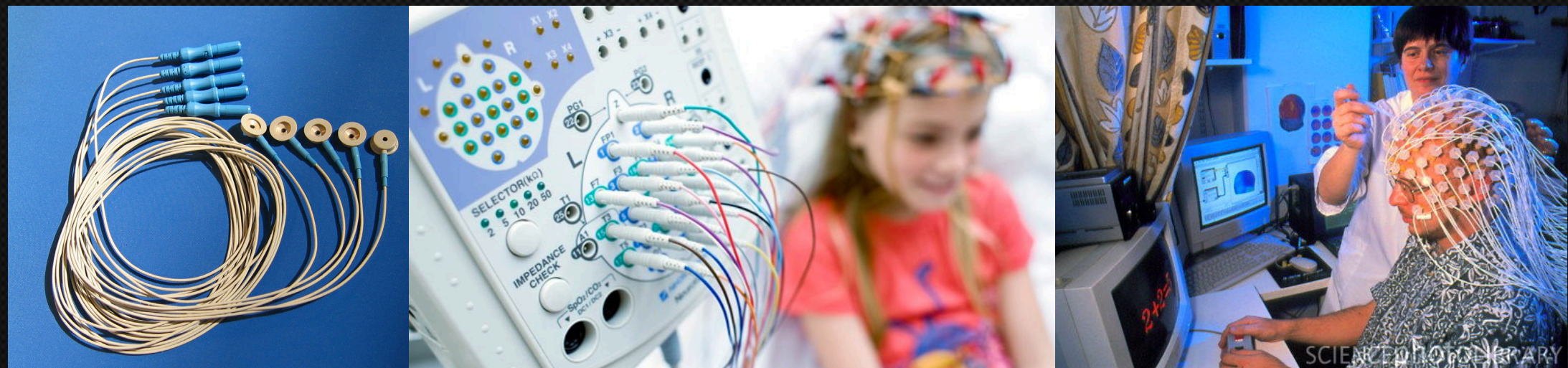
Electroencephalography (EEG) is a neurological test to measure and record electrical activity in the brain. EEG measures voltage fluctuations resulting from ionic current within the neurons of the brain.





# SENSORS

During an EEG, small electrodes and wires are attached to your head. The electrodes are disks that conduct electrical activity. They detect your 'brain waves' and an EEG machine amplifies the signals and records them in a wave pattern on graph paper or a computer screen.





# BRAINWAVES & DATA

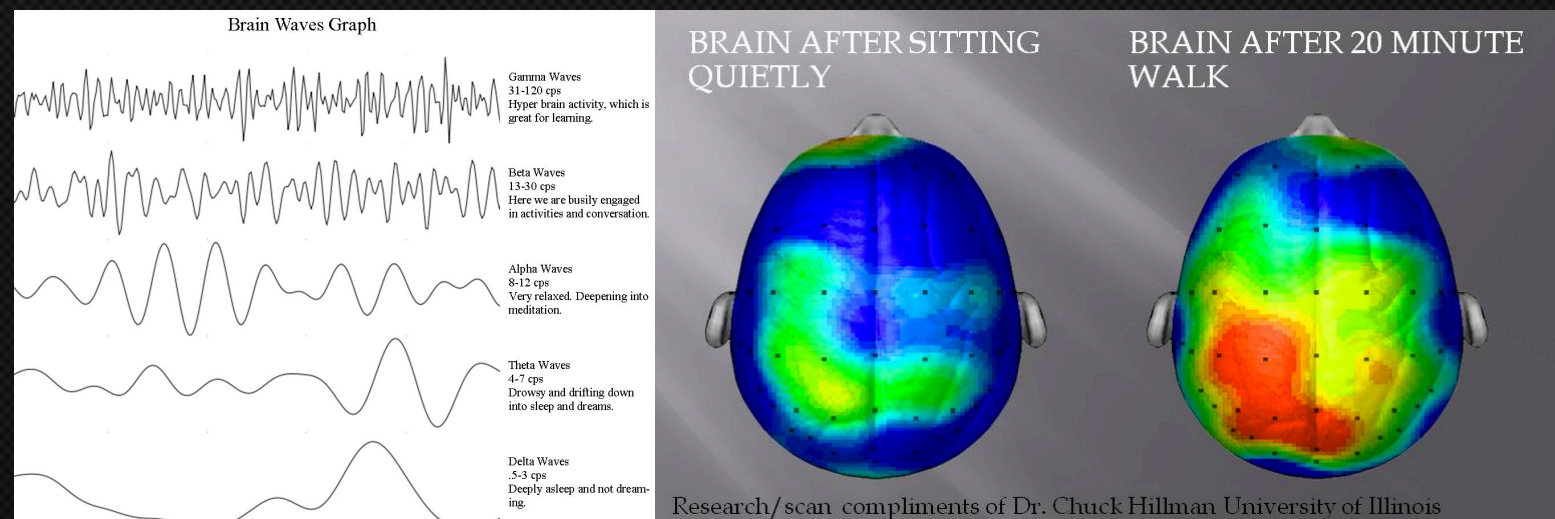
Delta (<4hz) - deep sleep, NREM

Theta (4-7hz) - sleep, dreaming, daydream / zoned out awake, REM

Alpha (8-15hz) - relaxed, meditative

Beta (16-31hz)- active thinking, focused, stressed, anxious

Gamma (32-50hz)- forming ideas, learning, processing language

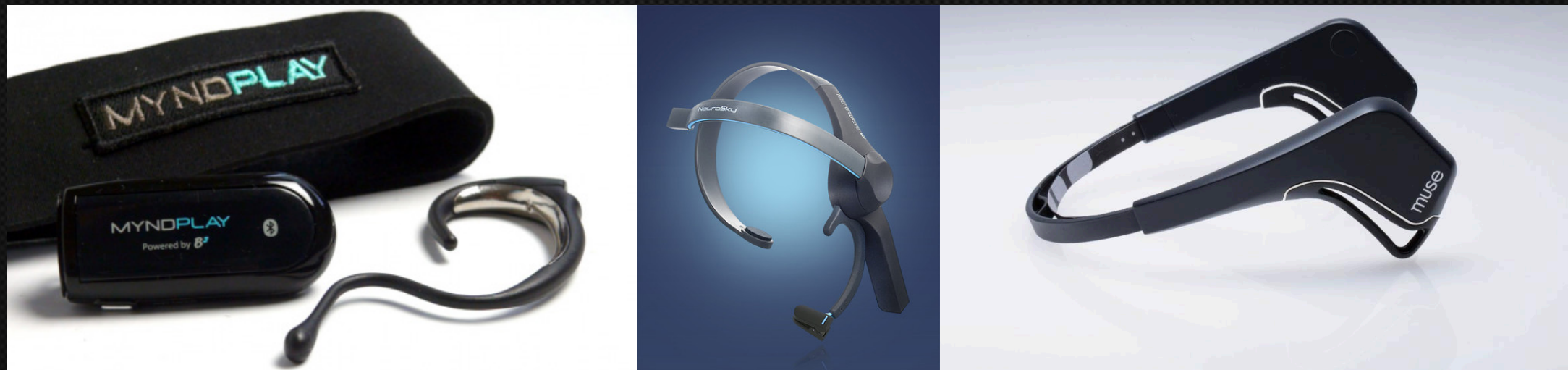




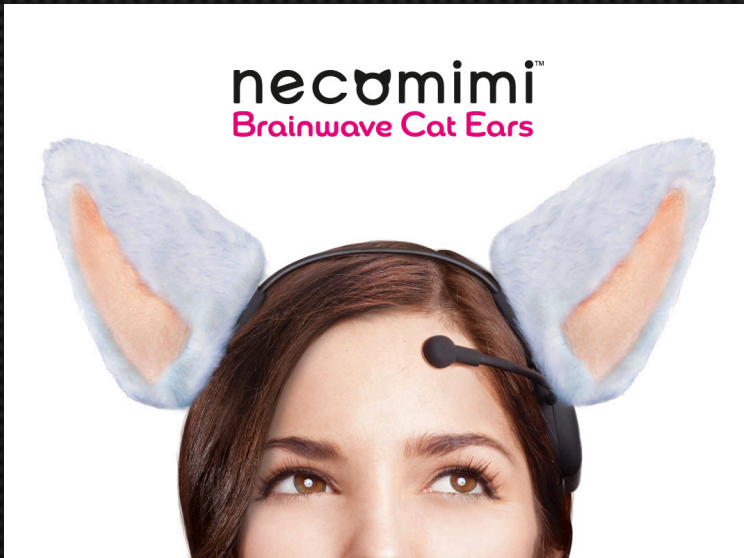
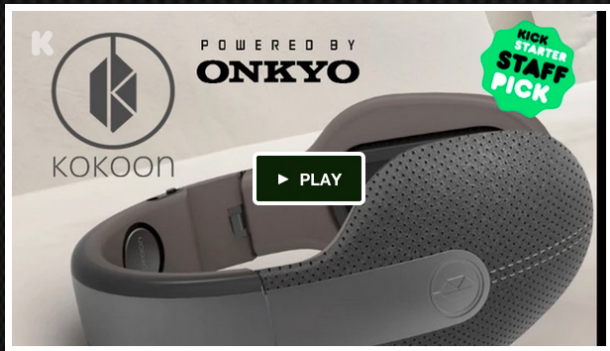
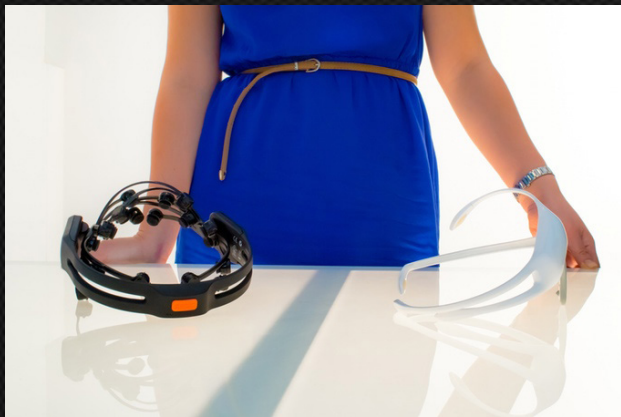
# CONSUMER DEVICES

BrainBand: <https://www.myndplay.com/>

Muse: <http://www.choosemuse.com/>

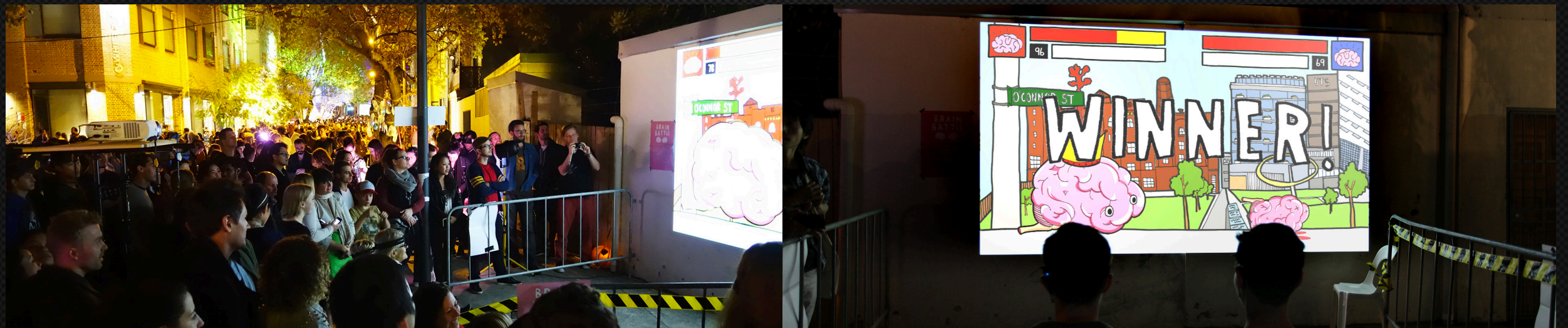








# BRAIN BATTLE & BEAMS 2013





# APIS/LIBRARIES + OF

- Different options for the neurosky api
  - ofxThinkgear addon
  - Brainwave OSC
- Why OSC over native integration. Recording/playback and faster to develop
  - MuseIO command line options
  - MuseEEG helper scripts



# CODE EXAMPLES

01\_brainband\_osc

02\_brainband\_addon

03\_muse\_osc

04\_muse\_moire

05\_brainband\_fft

<https://github.com/trentbrooks/EEGWorkshop>



# STILL INTERESTED?

Device comparison: [https://en.wikipedia.org/wiki/Comparison\\_of\\_consumer\\_brain%E2%80%93computer\\_interfaces](https://en.wikipedia.org/wiki/Comparison_of_consumer_brain%E2%80%93computer_interfaces)

BCI research paper: <http://daim.idi.ntnu.no/masteroppgaver/006/6288/masteroppgave.pdf>

Video lectures: [http://sccn.ucsd.edu/wiki/Introduction\\_To\\_Modern\\_Brain-Computer\\_Interface\\_Design](http://sccn.ucsd.edu/wiki/Introduction_To_Modern_Brain-Computer_Interface_Design)

Latest about BCI + games: <http://neurogadget.com/>



# THANKS

## REFERENCES:

<http://www.mayfieldclinic.com/PE-EEG.htm>

<http://electronics.howstuffworks.com/emotiv-epoc1.htm>

<https://en.wikipedia.org/wiki/Electroencephalography>

<https://www.myndplay.com/>

<http://www.choosemuse.com/>

Google images