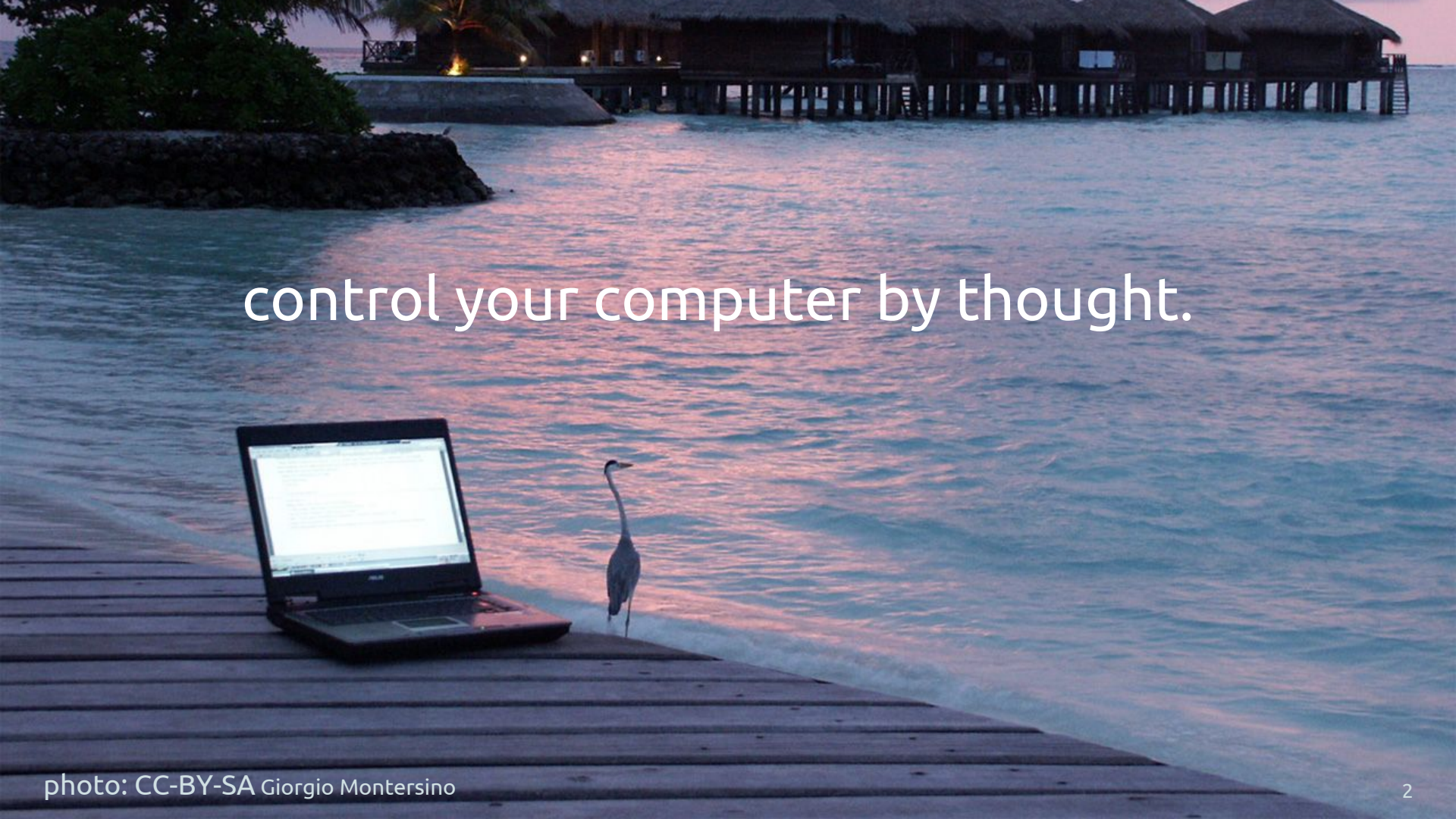
# Neurofox Brain-Duino

open-source, high-quality
brain-computer interface

fractalfox // Willi Döring // 2016

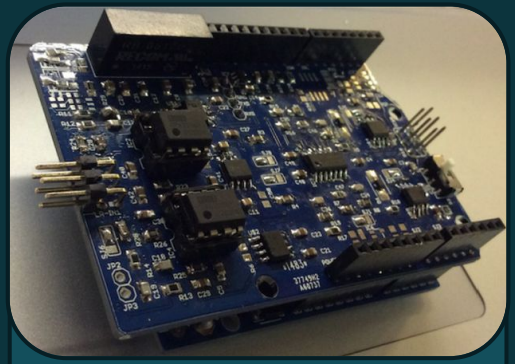


play video games by the power of your mind.

# enhance your well-being evidence-based.

now this!

- reliable, hackable, affordable
- high sampling rate, low noise



brain-duino v.0.2
as Arduino UNO Shield

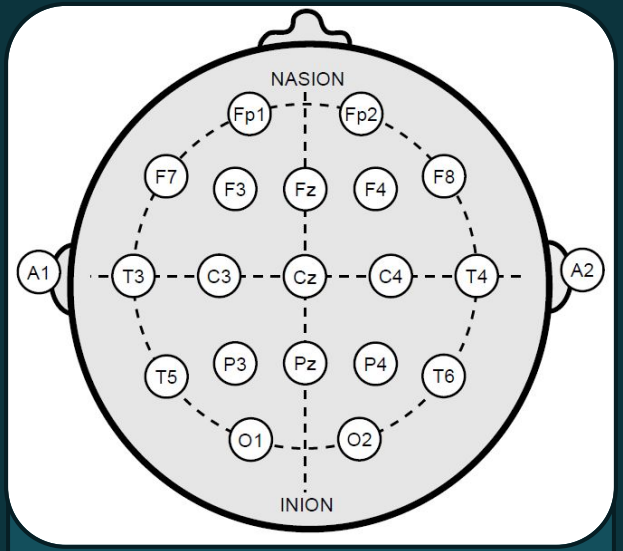
brain-duino v.0.3 (24 bit)
box (Arduino Pro Mini)

brain-duino v.0.3
headset (Arduino Pro Mini)

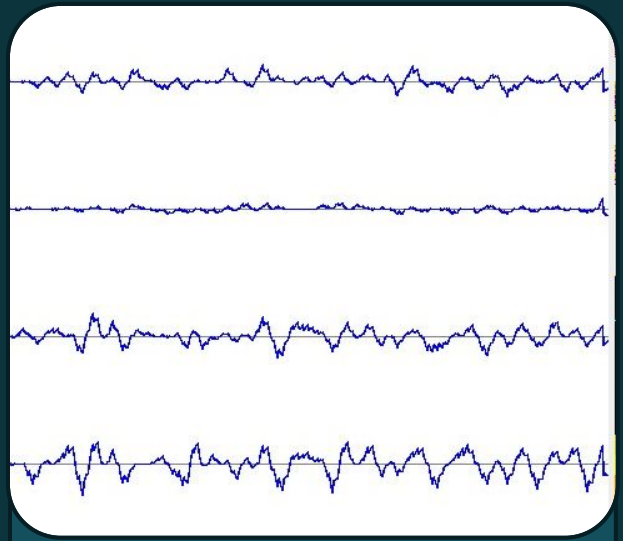
based on the IBVA (30 years of development) by Masahiro Kahata

# EEG + BCI Basics

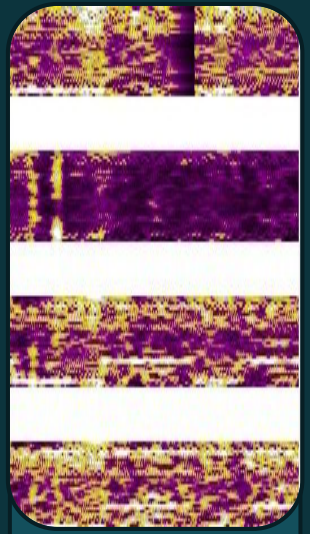
just a very brief overview!




typical placement of electrodes
10-20 system



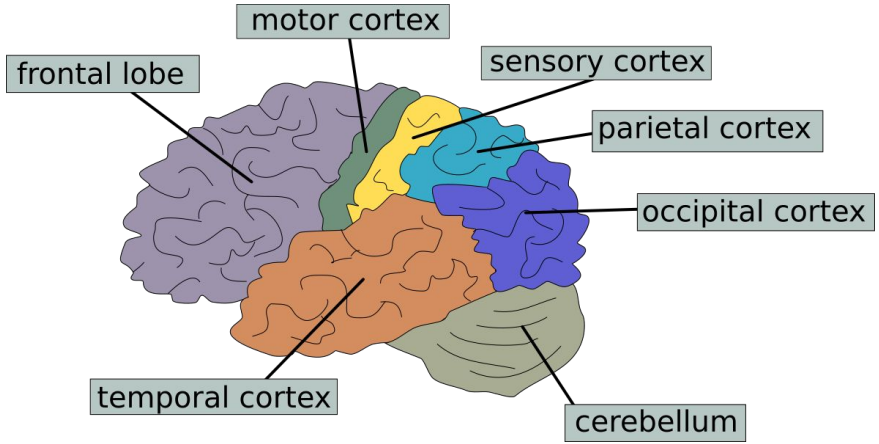
raw data stream



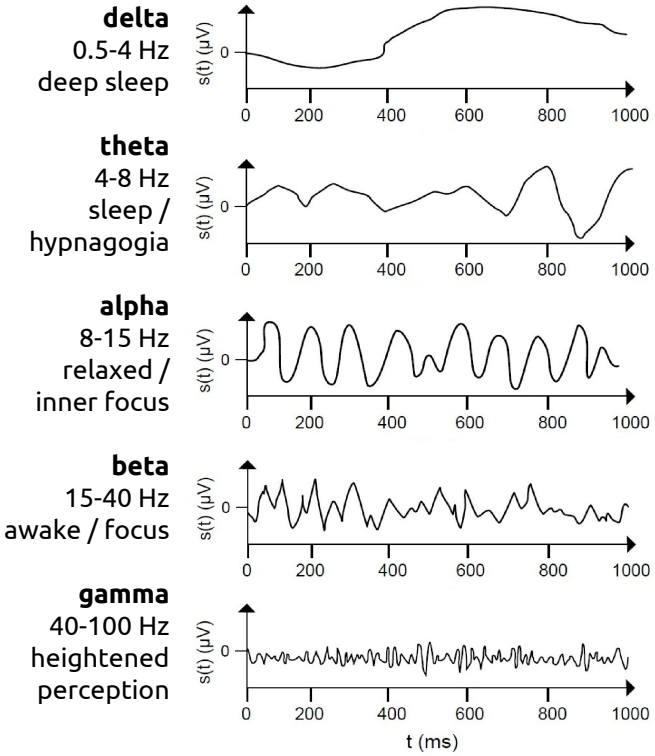
frequencies

EEG: brain waves by space and frequency

- unmix signal (spatial, freq)
- decode brain processing




functional brain areas (simplified)

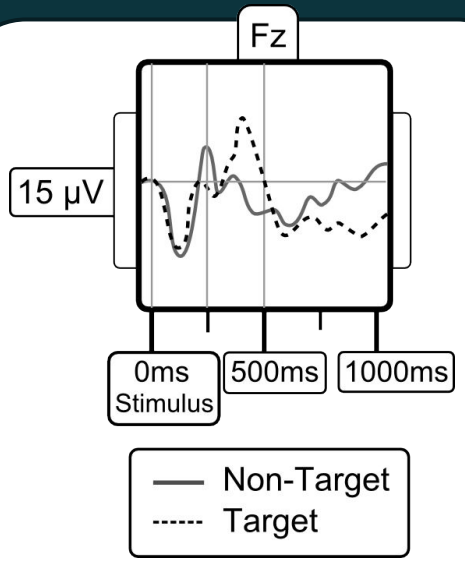



frequency bands

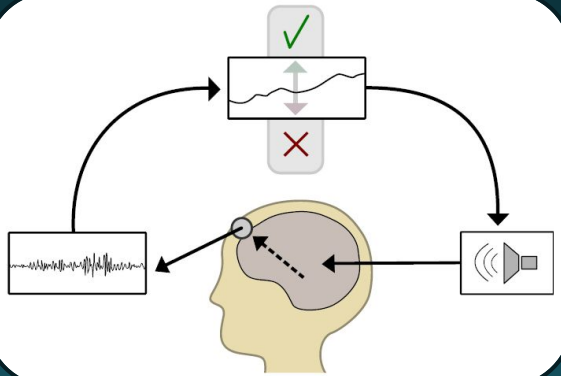
EEG: brain waves by space and frequency

SMR / motor imagery
imagining movement
(Pfurtscheller et. al, 2006)

SSVEP
response to flickering stimulus
(Jeffreys et. al, 1972)

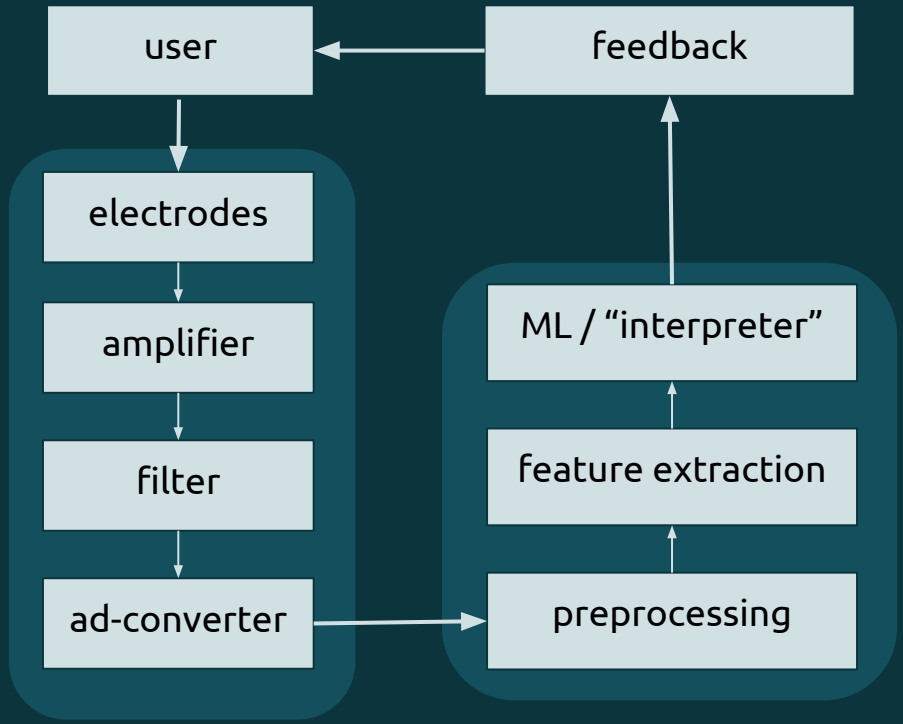



P300 / P3a / P3b
attention-driven reaction to stimulus
(Polich et. al, 2007)



neurofeedback training
(Elbert et. al, 1980)

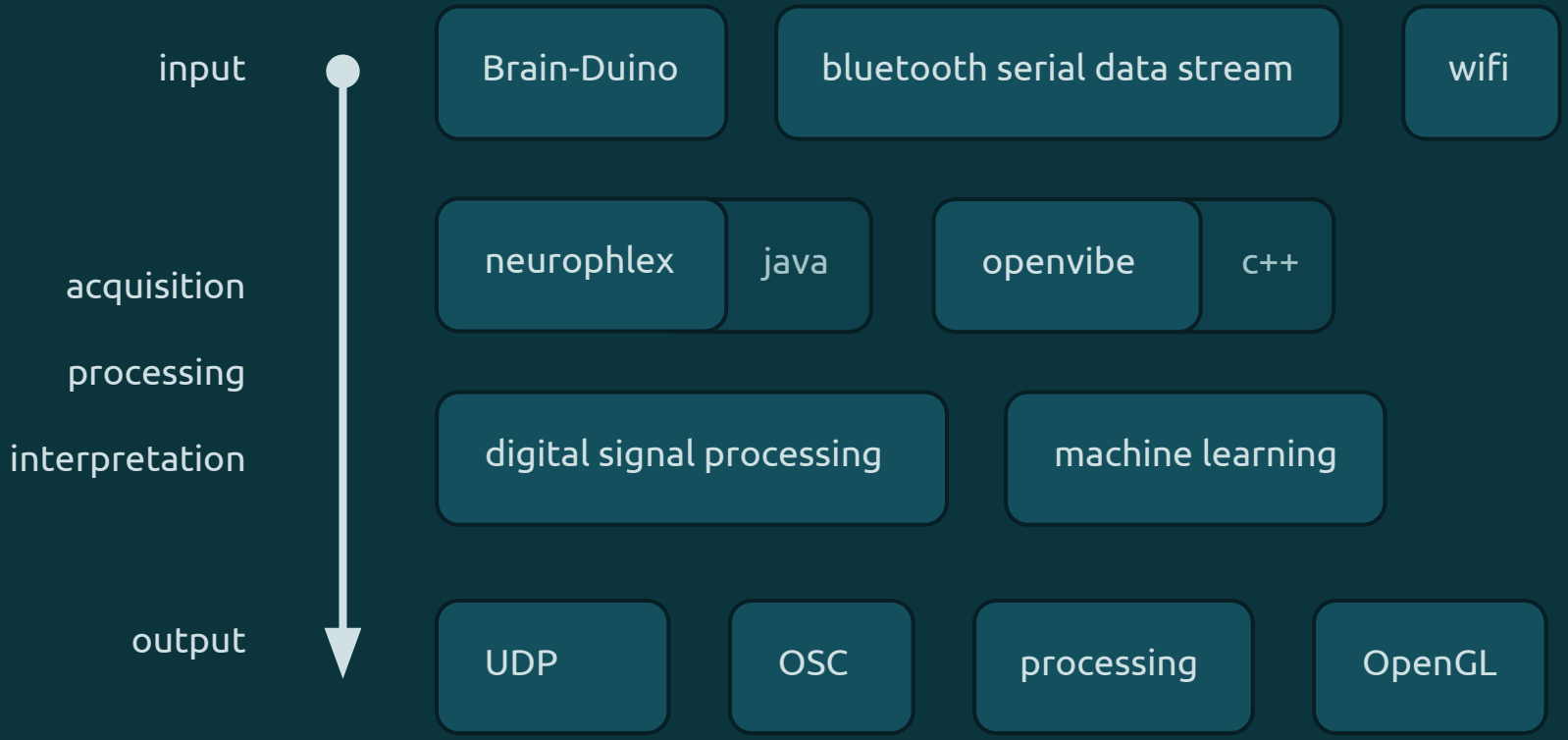
HOW? → BCI methods

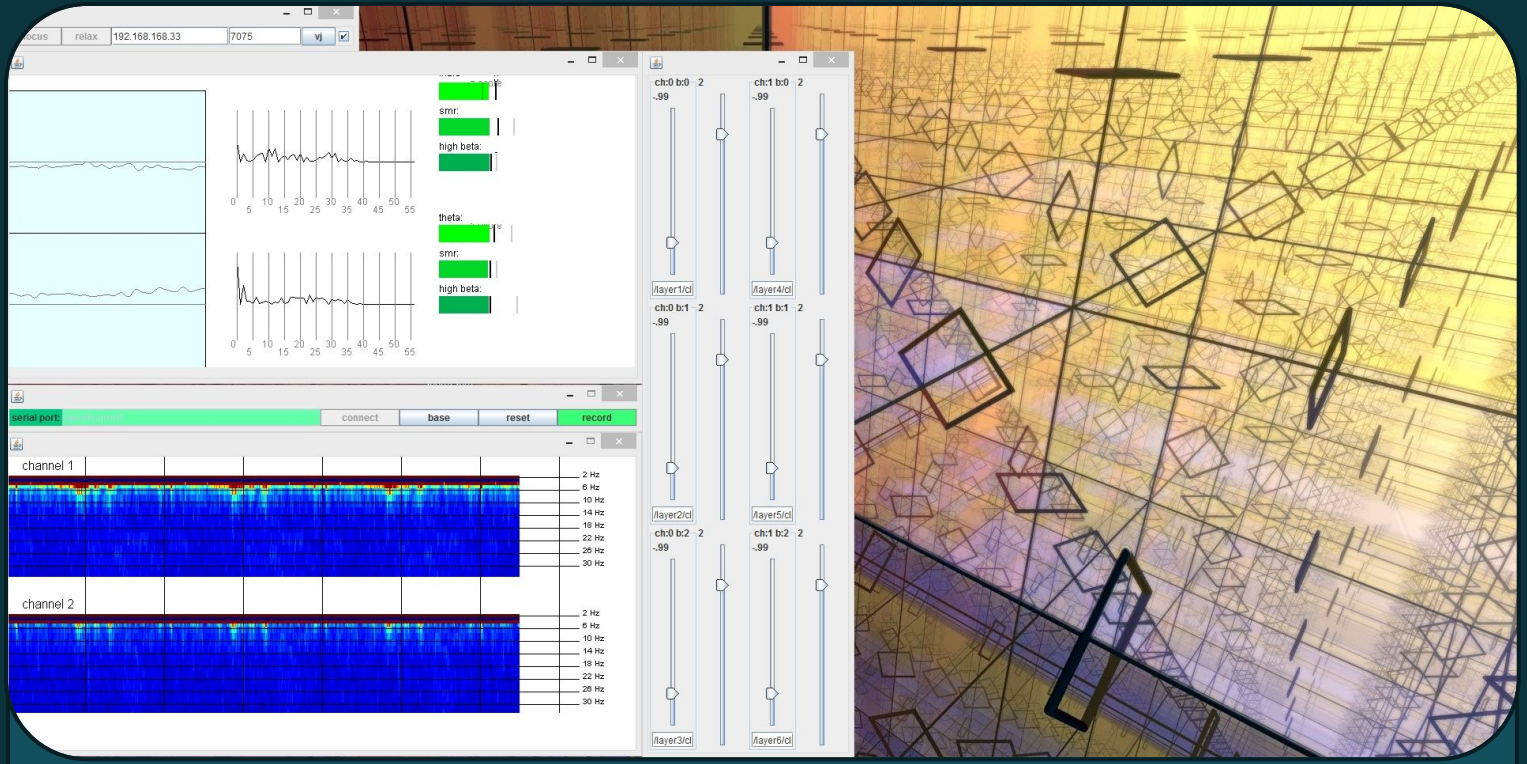



BCI feedback loop

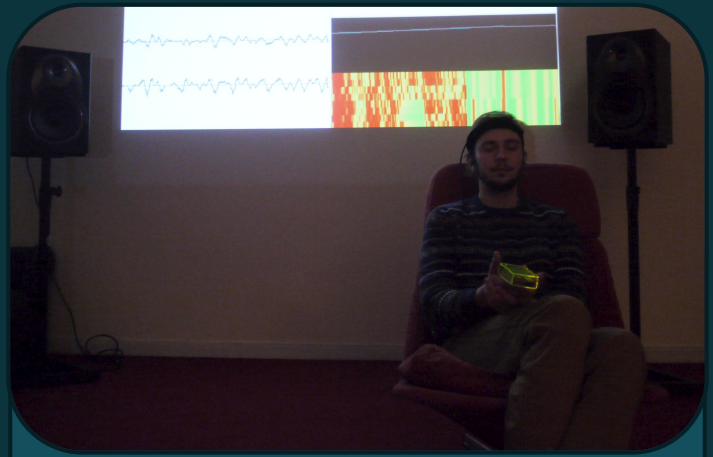
# Status Quo

## hardware, software & interfaces


input
acquisition
processing
interpretation
output
Brain-Duino
bluetooth serial data stream
wifi
neurophlex
java
openvibe
c++
digital signal processing
machine learning
UDP
OSC
processing
OpenGL




neurophlex https://github.com/brain-duino/neurophlex (soon-ish! ;)



audio feedback
installation @ berlin

audio-visual feedback
installation @ berlin

visual feedback
brainvj @ new york

# Call for Participation

let’s do awesome things together!

slack
( invitation on brainduino.com )

github
( github.com/brain-duino )

meetup
( meetup.com/Neurohacking-Berlin/ )

software development

hardware development

community

research

neurogames

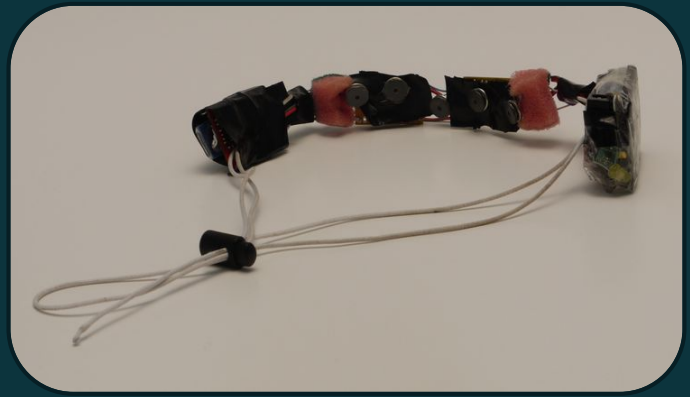
interfaces

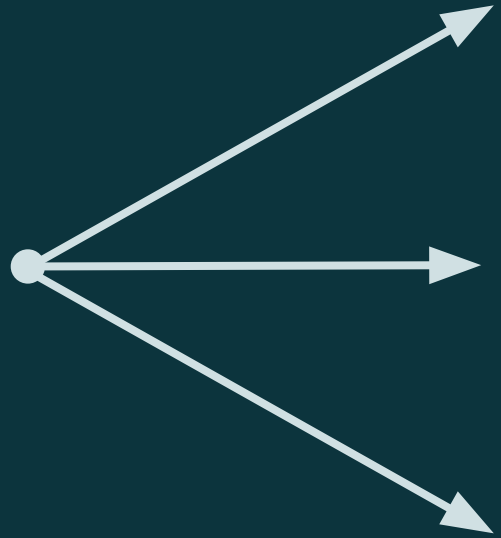
circuit design

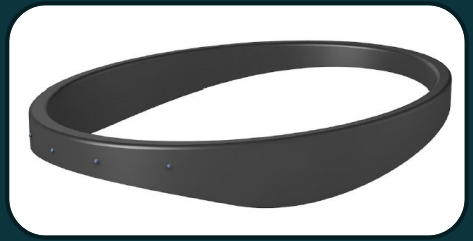
3d print / lasercut / ...

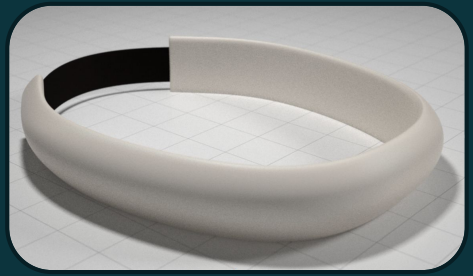
tutorials / methods

**CALL FOR PARTICIPATION**









?

# support our kickstarter!

- miniaturize pcb components
- lower price
- no fiddling
- assembled / make soldering optional
- easy accessibility

Willi Döring

software dev

Robert Langer

organizing

Masahiro Kahata

hardware dev

Silver Kuusik

hardware dev

- **Polich, John**. "Updating P300: an integrative theory of P3a and P3b." *Clinical neurophysiology* 118.10 (2007): 2128-2148.
- **Pfurtscheller, G.**, et al. "Mu rhythm (de) synchronization and EEG single-trial classification of different motor imagery tasks." *Neuroimage* 31.1 (2006): 153-159.
- **Elbert, Thomas**, et al. "Biofeedback of slow cortical potentials. I." *Electroencephalography and Clinical Neurophysiology* 48.3 (1980): 293-301.
- **Jeffreys, D. A.,** and **J. G. Axford**. "Source locations of pattern-specific components of human visual evoked potentials. I. Component of striate cortical origin." *Experimental Brain Research* 16.1 (1972): 1-21.
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