What do you notice?
Brain-computer Interface

https://www.youtube.com/watch?v=QRt8QCx3BCo
You would like to design a tool for patients that exploits features of the EEG signal to restore a function. What features could you train your tool to identify and eventually translate into a desired action or objective?
General Framework of Brain-Computer Interface Systems:

Case study: Selection of letters in a patient with severe motor deficit

Work-flow for the development of a BCI system:

- Patient is a 32-year-old with cerebral palsy and tetraparesis who lost the ability to speak.
- During basic training, subject is instructed to relax or imagine a movement with their right hand. What robust signal might you expect to see during this activity?

Step 1: Basic Training

From left sensorimotor cortex region (C3)

Neuper et al., *Clin. Neurophys.*, 2003
Case study: Selection of letters in a patient with severe motor deficit

Step 2: Continuous Power Feedback

Patient was allowed to freely imagine hand movement and shown the average beta power. Patient was instructed that imagining a movement would move a cursor downward, while relaxing would either move the cursor upward or the cursor would remain at the center of the screen.

Step 3: Cue-guided training

- Step 3: cue-guided training
- Patient was allowed to freely imagine hand movement and shown the average beta power.
- Patient was instructed that imagining a movement would move a cursor downward, while relaxing would either move the cursor upward or the cursor would remain at the center of the screen.

Neuper et al., Clin. Neurophys., 2003
Step 4: Letter Selection

Neuper et al., Clin. Neurophys., 2003
Case study: Two-dimensional cursor movement in paralyzed patients and normal controls

Vertical movement controlled by 24 Hz beta
Horizontal movement controlled by 12 Hz alpha

Decoding signals from sites C3 and C4

Wolpaw and McFarland, PNAS, 2004
Case study: Two-dimensional cursor movement in paralyzed patients and normal controls

Wolpaw and McFarland, PNAS, 2004
You would like to design a tool for patients that exploits features of the EEG signal to restore a function. What features could you train your tool to identify and eventually translate into a desired action or objective?