- Neurons in the human brain are electrically active.
- This activity can be measured by means of electro-encephalogram (EEG).
- As the brain is performing various tasks, EEG signals change.
- These changes can be measured and mathematically analyzed in real time (as soon as they happen).
- If a computer can detect these changes, they can be used to communicate messages directly from the brain. This technology is called Brain-Computer Interface (BCI).

Fig. 1: The 4 lobes of the brain

The electrodes we use in the P300 spelling task are: C3 Cz C4 (frontal/parietal lobe border); P3 Pz P4 (parietal lobe); O1 O2 (occipital lobe).

Fig. 2: The 10-20 International Standard for EEG electrode placement

The mathematical challenge is to recognize whether P300 is present or not. If the computer determines that it is present, the highlighted letter (or a group of highlighted letters) will be selected.

Fig. 3: Snapshot of EEG signals when the intended letter is highlighted (P300 should be present)

Fig. 4: Snapshot of EEG signals when the intended letter is NOT highlighted (P300 should be absent)