Electrophysiology of human associative learning exemplified by long-term visuo-gustatory conditioning

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19 November 2019 | 11:00 | DPG 1 Meeting Room, Psychology Building 1, via Venezia 8, Padova

The human brain is highly flexible and plastic. It is constantly changing as a result of the stimuli it encounters. Many of the changes the human brain undergoes are results of conditioning or associative learning. Developments and changes of food preferences is just one example of how conditional learning pervades human life.
Other examples arise when visual cues are used to recognize objects or commodities whose properties might be mostly determined by other senses, tactile e.g., or smell, taste and chemeshesis.

In this talk I will present the results of a recent experiment from my lab in which we studied the dynamics of neurophysiological plasticity related to acquisition of longterm associations between flavour and images.
The effects of appetitive and aversive visuo-gustatory conditioning were studied with high density EEG-recordings focusing on late components in the visual evoked potentials (VEPs), specifically the N2-P3 waves. Unfamiliar images were paired with either a pleasant or an unpleasant juice and VEPs evoked by the images recorded before the pairings were compared with VEPs recorded 1 day after.
Effects of conditioning show up both as changes in the delay of components of the VEP signal after conditioning and as changes in the neural activities in a number of brain areas. The changes in delay are 10-20 msec and would be completely undetectable by brain imaging methods which are based on the hemodynamic response, such as fMRI. On the other hand, the spatial resolution of EEGs is not as good as that of fMRI, but the source current distributions calculated by sw LORETA revealed that visual evoked currents rose as a result of conditioning in five cortical regions—from primary visual areas and into the inferior temporal gyrus (ITG).
Despite using symmetrical images, we found a right-side dominance of learning induced increases of amplitudes. Interestingly enough, percentage increases of N2-to-P3 amplitudes in each experimental subject correlated with the subject's evaluation of positive or negative hedonic valences of the two juices.
I will discuss these results and put forward arguments in favour of high density EEG for other problems.