DANDRITE
Danish Research Institute of Translational Neuroscience
Nordic EMBL Partnership for Molecular Medicine

DANDRITE Topical Seminar

by visitor Irene Caprara

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Aud. 6, 3rd floor, building 1170, room 347
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Attention and motor planning in the frontal cortex of primates

The allocation of attention during saccade preparation has been studied in the last thirty years. Through the Premotor Theory of Attention (PTA), Rizzolatti and colleagues (1987) hypothesized the presence of a mechanism that can control both attention and motor planning (intention).
Despite the several relevant psychophysical results in literature, which attest the uncontested connection between these two cognitive functions from a behavioral point of view, another aspect of the problem is still unclear: is there selective tuning for attention and motor planning in each neuron, or, as the PTA proposes, are these two cognitive functions indissolubly linked?
On the basis of a previous work by Lebedev and colleagues (2004), which highlighted the possibility of a dissociation between two historically connected cognitive functions, working-memory and attention, we decided to adopt similar neurophysiological and analytical approaches on the study of a possible dissociation between attention and intention.
The present work, then, wants to test whether neurons in the frontal cortex of primates are tuned on both of these functions, as predicted by PTA or, instead, if a selective tuning is allowed.
To test this, a behavioral paradigm in which monkeys had to attend a location while planning a saccade to another, was designed, the Cocoa task. Through 20 conditions, represented by the combinations of two colored cues, an annulus and a circle, indicating respectively the location to which plan the saccade and the location to pay attention at, we were able to conduct a neurophysiological study (single neuron recordings) in the frontal cortex to assess whether a differential selectivity of cells for attention and intention existed.
Despite PTA predictions, we found that covert and overt attention can be independent from a neural point of view; according to our results, as a matter of fact, monkeys were able to covertly direct attention to one location while planning a saccade to another location maintaining central fixation. Therefore, from a neural point of view, we found cells with strong selectivity only for one of the two functions, attention or intention, and some cells tuned for both; the total amount of spatially-tuned neurons, then, was classified into three categories: Motor cells, Attention cells, and Hybrid cells. The presence of this third category could act as a bridge between different interpretations: although the multitasking activity seems to justify the predictions of PTA, we showed in our study that a partial neural dissociation between attention and motor planning exists, as highlighted by the presence of selectively tuned cells.

Host: Group Leader Duda Kvitsiani, DANDRITE