AUTOMATIC RESPONSE INHIBITION: BEHAVIOURAL, EMOTIONAL AND NEURAL MAPPINGS

David Mata-Marín[1,2], David Luque[2] & Ignacio Obeso[1]

[1] Centre for Integrative Neuroscience AC (CINAC-HM) Puerta del Sur, Madrid, Spain.
[2] Universidad Autónoma de Madrid (UAM), Madrid, Spain

Grant 230/18

Background: Sufficient repetition of similar contextual information leads to automatic behaviours. The ability to inhibit actions, thoughts or emotions may also run under automatic control. Yet, little is known on what behavioural and neural mechanisms turn inhibition automatic, whether emotional cues interfere the process and its underlying neurobiology.

Aims: We will test the presence of a brain network behind automatic inhibition. Also, how emotional influences on automatic inhibition mechanisms.

Method: On 3 experiments, a modified Go/NoGo learning task (automatic inhibition task) assessed learning of stimulus-stop associations throughout days of training. Formation and expression of automatic inhibition was assessed by comparing first vs last behavioural sessions. Subjects had to learn to emit or withhold a keypress upon the presentation of a primary object picture (6 neutral images: 3 go vs 3 no-go) with varying feedback probabilities. Reversal and slips of action tests were performed on the first and last sessions to assess automatic behaviour. In 3 experiments, behavioural, emotional cues and neuroimaging tools (fMRI and TMS) were used.

Results: After considerable training, significant better performance was seen across go and no-go learning trials and harder to suppress when asked to revert automatic actions. Emotional cues did not influence mean average on automatic inhibition but exploring single-trial changes showed negative images enlarged costs to revert inhibition automaticity. The neural circuitry responsible for the automatic inhibition engaged the SMA, putamen, caudate, substantia nigra and subthalamic nucleus. Finally, cortical excitability across different stages of learning (analysis of changes in MEPs) did not reveal significant time-related disparity between go and no-go trials compared to baseline trials.

Conclusions: We have defined automatic inhibition using a novel behavioural measure and how emotional cues may modulate the expression of automaticity. Importantly, a neural circuitry associated to automatic inhibition recruits fronto-striatal areas. This behaviour and associated brain responses may be of value to neuropsychiatric conditions were automatic control over pleasant cues becomes largely impaired.

Keywords: Cognitive control, Emotions, Automatic cognition, fMRI, TMS

E-mail contact: i.obesomartin@gmail.com; david.matamarin@gmail.com