

**A SWING BETWEEN THE INNER AND THE OUTER WORLDS:
EXPLORING THE FUNCTION OF THE FRONTAL ASLANT TRACT WITH
TRANSCRANIAL MAGNETIC STIMULATION**

Luigi Cattaneo

University of Trento, Italy

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Background: Human behavior in a changing world oscillates between two mutually incompatible timing strategies: predicting the upcoming changes or reacting to it. In the brain, the medial frontal lobes represent internally-timed (predictive) actions, while the lateral frontal lobes represent externally triggered (reactive) actions. The medial and lateral systems are connected by a white matter bundle, the Frontal Aslant Tract (FAT).

Aims: Is the FAT connectivity necessary to mediate the relation between internally generated actions and externally-cued behavior? We explore the FAT's role in the domains of action control, speech production and action execution. We expect that portions of the medial and lateral systems that are directly connected by the FAT support similar functions.

Method: The whole project is based on individual tractography-guided transcranial magnetic stimulation (TMS), to probe the individual dorsal origins, in the superior frontal gyrus (SFG), and ventral origins of the FAT, in the inferior frontal gyrus (IFG). We have performed 3 experiments. A) The FAT in action control. We used a task in which participants choose between two mutually incompatible predictive or reactive strategies and applied online TMS to 3 pairs of FAT-connected spots in the IFG and SFG. B) The FAT in speech articulation. We stimulated the individual dorsal origins of the FAT in SFG, with online TMS during the spontaneous production of syllables or of finger tapping (as a control task). C) The FAT in the execution of movements. We stimulated the IFG and SFG during the execution of reaching and grasping motor acts, while recording the movement kinematics.

Preliminary results: Experiment A) showed that stimulation of two FAT-connected portions in the superior frontal gyrus biases the individuals' propensity to choose reactive over predictive strategies. Experiment B) showed that a specific caudal portion of the SFG origin of the FAT interferes with both speech and finger tapping. Experiment C) is not yet conclusive. Taken together, we show that the FAT mediates competition between predictive and reactive behavior. A caudal-rostral gradient of abstraction of representations is present and the processes are domain-general, effector-independent. As a collateral finding, observation of individual FAT anatomy lead us to the re-definition of the dorsal origin of the FAT compared to the one in literature, i.e. in the convexity of the SFG rather than in its medial wall.

Keywords: Predictive, Reactive, Frontal aslant, Action, Motor control

E-mail contact: luigi.cattaneo@unitn.it