
DISSOCIATING BOTTOM-UP AND TOP-DOWN MECHANISMS IN THE CORTICO-LIMBIC SYSTEM DURING EMOTION PROCESSING

M. Comte¹, D. Schⁿ, J.T. Coull³, E. Reynaud¹, S. Khalfa¹, R. Belzeaux⁴, E.C. Ibrahim⁵, E. Guedj¹, O. Blin⁶, E. Fakra⁴

¹Institut de Neurosciences de la Timone, Aix-Marseille Université & CNRS UMR7289, Marseille, France ; ²INS, Aix-Marseille Université & INSERM UMR1106, Marseille, France ; ³Laboratoire des Neurosciences Cognitives, Aix-Marseille Université & CNRS UMR7291, Marseille, France ; ⁴Service Hospitalo-Universitaire de Psychiatrie, AP-HM Hôpital Ste. Marguerite, Marseille, France ; ⁵CRN2M, Aix-Marseille Université & CNRS UMR7286, Marseille, France ; ⁶CIC-UPCET et Pharmacologie Clinique, Hôpital de la Timone, Marseille, France

The cortico-limbic system, critically involved in emotional responses, has become increasingly central to models of psychopathology. Indeed, most psychiatric disorders are believed to be defined by some level of dysfunction in this circuit such as exacerbated limbic activity and/or inefficient prefrontal control. We here propose a novel functional magnetic resonance imaging (fMRI) paradigm, the VAAT (Variable Attention And congruency Task) which intends to dissociate bottom-up from top-down subnetworks within the cortico-limbic circuit.

Twenty-six healthy volunteers completed psychometric assessments and the VAAT Task. In this task, activity as well as connectivity between the amygdala, the anterior cingulate cortex (ACC) and the dorsolateral prefrontal cortex (DLPFC) was tested by varying three parameters: emotional valence, emotional congruency and attention load respectively. Functional relevance of this circuit was examined through multiple correlations analyses between BOLD / PPI (psychophysiological interactions) measures and trait anxiety, as assessed by The State-Trait-Anxiety Inventory (STAI).

The amygdala, and its connections to DLPFC and dorsal ACC, was engaged in bottom-up emotional processing. ACC, and its connections to DLPFC and amygdala, was preferentially recruited in top-down resolution of emotional conflict. DLPFC, and its connections to dorsal ACC, was engaged in top-down attentional control. In addition, trait anxiety was associated with increased ACC and DLPFC activity but decreased functional connectivity between these two regions.

This novel task provides a useful tool for exploring bottom-up and top-down processes underlying emotion. Furthermore, our findings suggest that trait anxiety is associated with less efficient connectivity in the higher-order cortical circuit involved in emotion regulation.