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Neurobiological, attentional and memory changes in posttraumatic stress disorder

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This dissertation aimed at investigating the role of fear learning and encoding mechanisms in the development and maintenance of anxiety and trauma-related disorders in two studies.
In study 1, we combined functional resting state connectivity with skin conductance data of cued and contextual fear conditioning in 119 healthy individuals.
In study 2, we applied simultaneous high-density electroencephalography (EEG) with eye-tracking during free picture viewing (including traumatic cues in neutral contexts) and memory tests of the same materials in 20 patients with post-traumatic stress disorder (PTSD) and 20 trauma controls who did not develop PTSD (NPTSD). In study 1, we hypothesized that increased functional connectivity of the default mode network (DMN) (1) with the amygdala and frontal control regions would be associated with a decrease in the magnitude of cue aversive learning, and (2) that another DMN connectivity pattern including the hippocampal formation, would negatively correlate with the strength of contextual conditioning indices.
The main result of this study is that two different DMN patterns were identified in which stronger connectivity linked to lower differential SCRs during fear and anxiety was learning. One was related to cue conditioning and involved the amygdala and the medial prefrontal cortex, and one was associated with context conditioning and included the hippocampal formation and sensorimotor areas.
In the second study, we expected an early perceptual bias on trauma-related cues at the expense of the context in PTSD compared to NPTSD as visible in the modulation of polarity/amplitudes of the visual C1 and in eye tracking early fixation measures. Referring to the memory performance we expected the PTSD group to better retrieve pictures requiring a more elemental/unitary strategy (aka where the association between cues and contexts was kept constant) and consequently in being especially worse than NPTSD in retrieving cue-context modified associations. We finally expected encoding strategies to account for the memory performance.
In the simultaneous EEG-eye-tracking task we found that the PTSD but not the NPTSD group oriented more towards traumatic but not neutral cues at the expense of the context. These outcomes were present at the first stages of information processing as indicated by the changes in polarity of the C1 component of the EEG and predicted the following associative memory performance.
Different resting-state connectivity patterns within the DMN could emerge in association with individual predispositions of learning fear and anxiety.
Because of the recognized clinical implications of these learning mechanisms in trauma and anxiety disorders, our findings highlight the relevance of brain connectivity differences as possible biomarkers already at rest and in healthy individuals, for example in healthy populations with high exposure to traumatic events (such as medical personal, rescue workers, police officer, soldiers) in order to reduce vulnerability and/or promote resilience to develop PTSD.
An hippocampal processing impairment is probably responsible for the memory deficits in PTSD but possibly promoted from the strongly biased encoding strategy of the cues versus contexts, which also it is helpful in explaining intrusions and hyperarousal symptoms in a more complex perspective.
Moreover, increasing awareness encoding used strategies could help existing therapies (e.g. cognitive behavioral and exposure therapy) in modifying faster the appraisal and memory of the trauma through trained restructuring of events and contextual representations