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Approach-avoidance conflicts

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Motivation and Aim: Area anterior hippocampus (aHC; homolog of rodent ventral hippocampus) is a common target in experiments on approach-avoidance conflicts. A recent report hypothesized that decreased activity in Area aHC reflects the suppression of aversive and emotional states, which would otherwise compete with goal-directed or motivational behavior [1]. Stimulation of Area aHC was shown to produce sustained increases in heart rate and blood pressure in normal rats, whereas bilateral inhibition of this area enhanced parasympathetic responses with no changes in sympathetic responses [2, 3]. Given the existing work, this study demonstrated that an abrupt instruction to open the eyes while the subject was resting quietly with eyes closed could probe brain reactivity to an aversive (or novel) stimulus.
Methods and Algorithms: A total of 49 young adults (26 females, mean age 22.94 ± 3.18) underwent 8-min resting-state fMRI (rs-fMRI) scans under 4-min eyes-closed (EC) followed by 4-min eyes-open (EO) conditions. During the experiment, each subject received exclusively auditory instructions to close or open the eyes. Image data were preprocessed by including motion correction, slice timing, linear detrending, and spatial transformation to the MNI-152 template. Standardized intraclass correlation (ICC) was applied to masking out voxels showing high degrees of synchronicity among subjects. The size of ICC was mainly contributed by temporal responses to the EC and EO instructions. The supra-threshold maps were co-registered to the JuBrain Cytoarchitectonic Atlas available at http://www.fz-juelich.de/inm/inm-7/tools for topographical definition of area-specific effects [4].
Results: Under the EC-then-EO paradigm, the auditory cortex presented a sharp increase in activity followed by a short-term decrease (the sharp increase could be partially caused by head motion). Area aHC presented an immediate increase followed by a short-term decrease in activity after the onset of the eyes-open instruction. The effect size of decreased activity was far larger in Area aHC than in the auditory cortex. We also observed an immediate increase followed by a short-term decrease in activity after EO onset in the caudal premotor cortex (6d1, 6d3, and 6mc-SMA), anterior parietal cortex (1, 2, 3a, 3b), and motor cortex (4a, and 4b), echoing the responses observed in Area aHC.
Conclusion: Decreased activity in Area aHC could release subjects from behavioral inhibition in favor of goal-directed behavior. Fear and stress have been shown to induce rapid and dramatic alterations in the respiratory effort, cardiac output, and blood pressure [5]. When reacting to novel (aversive) stimuli, the duration of an orienting response is normally shorter than that of a freezing response (specific to threatening stimuli), both of which occur prior to the fight-or-flight response and engage motor immobility as a parasympathetic brake on the otherwise active motor system [6, 7]. We hypothesize that the EO auditory instruction induced an immediate increase followed by a short-term and sharp decrease in activity in brain areas that react to auditory stimulation and participate

in the suppressed fight-or-flight response aiming to sustain on-going behavior (i.e., remaining motionless with eyes fixed on a central crosshair).

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