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Low sensory information affects cortical activation and drives boredom-related behavior in humans and mice

Boredom is a ubiquitous human experience that has been defined as an aversive mental state, typically induced by monotonous environments. Under physiological conditions, boredom is thought to enhance exploration and creativity. However, chronically increased boredom is also linked to a variety of psychopathologies, such as ADHD and depression. Despite these psychosocial implications, the current understanding of the cognitive and neurobiological underpinnings of boredom remains qualitative. This void of knowledge is largely due to scarce assessment tools in order to translationally quantify boredom and link it to neural measurements. In our work, we overcome this problem by presenting a behavioral choice paradigm to quantify individual boredom under defined environmental conditions. With this task, we investigate boredom-related behavior in humans and mice, and combine this behavioral assay with neural recordings. In particular, we conduct large-scale calcium imaging to investigate the neural representation of boredom in the cortex. Across species, we find that the amount of sensory information, measured as empirical entropy, is a key driver of boredom. Furthermore, we observe that the information content of a given sensory stimulus is represented by the magnitude and pattern of the corresponding evoked neuronal response. Thus, we highlight boredom as an affective response to low information, that is moderated by the degree of cortical activation, and promotes explorative behavior.