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Establishing a New Paradigm to Detect Cognitive Bias in Rats

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Emotions have an impact on information processing and cognition. Anxious and depressive patients have a rather pessimistic expectation on future events with a tendency to interpret ambiguous information in a negative manner. Negative cognitive bias is a key feature of stress related disorders such as depression and central to psychotherapy. Humans can verbally self-report how they feel, but how to measure emotional valence in animals?

The underlying neurobiology of this bias, however, remains unclear, not at least because of a lack of translational tools. Understanding how affective states bias cognition could bridge the gap between the psychological phenomenon in humans and its underlying pathophysiological processes that can be fully explored only in animal models. The existence of a chronic stress-induced cognitive bias in animals could be demonstrated by Harding et al's go/no-go paradigm (2004), but not whether this bias was due to lowered positive or increased negative responding to emotionally ambiguous stimuli. We therefore addressed this problem in our study by developing a symmetrical go/go-task. Rats were trained to press a lever to receive a food reward contingent to one tone and to press another lever in response to a different tone in order to avoid contingent punishment. In the subsequent ambiguous-cue test, the lever press responses to tones with frequencies intermediate to the trained tones were taken as indicators for the rats' expectation of a positive or negative event.

The main challenge of this study was to find a stimulus which was aversive enough to induce active lever press avoidance and to define training parameters to approach a solid choice making task acquisition. Throughout five experiments we tested different variations of white noise and foot shocks as aversive stimuli. Animals showed improving noise lever press performances when presented an increasing pulsed noise with prior escape training, but we never obtained stable active avoidance. With foot- shock as negative stimulus, active lever press avoidance could be induced and a stable ambiguous-cue interpretation tool was established.

We developed a new go/go paradigm which needs validation in further studies to serve as a tool to evaluate the cognitive bias in animals and to study the influence of environmental, neurobiological and genetic risk factors on negative response bias. The behavioural task described is suitable to study the underlying neuronal basis of decision-making under ambiguity. Being analogue to human studies, this translational tool might promote innovative therapeutic treatment for depression.