
A Virtual Reality System for Investigating Reward-Independent Exploration in Macaques

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Abstract

Intrinsic motivation, or curiosity, drives exploration of novel environment without external rewards. To experimentally reproduce such natural, reward-independent information-seeking behaviors in macaque monkeys, we developed a novel virtual reality (VR) paradigm. In this setup, the monkey, seated in a primate chair, can freely explore a VR space by orienting its head in the desired direction. Using real-time head movement tracking, the VR rendering system (Unreal Engine 5.1) generates dynamic, naturalistic stimuli displayed throughout a large-scale immersive setup with three 48-inch monitors covering a 180-degree field of view around the subject. Three male macaques (ages 3-5 years) were introduced to this VR environment. After optimizing parameters, such as exploration speed and environmental factors, they learned to voluntarily engage in VR exploration for an average of 45 minutes within each one-hour daily session. Preliminary data capturing exploration patterns in VR space demonstrate the potential of this VR system as a unique and advanced tool for studying the behavioral and neural mechanisms of underlying intrinsic motivation, especially curiosity, and for distinguishing these from reward-dependent exploratory behavior.

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