Natural behavior occurs in multiple sensory and motor modalities and is dependent on sensory feedback that constantly adjusts behavior. To investigate the underlying neuronal correlates of natural behavior, it is useful to have access to state-of-the-art recording equipment (e.g. 2-photon imaging, patch recordings, etc.) that frequently requires headfixation. However, common head-fixed behavioral approaches reduce behavioral complexity and very difficult to implement. We developed a novel system 'Floating Reality'; a physical platform floating on an air table, that has all the properties of the "real" world, including multiple sensory modalities tightly coupled to motor actions.

The first development of the system adapt the form of a maze so called "Air-Track". While navigating a plus-maze, head-fixed mice perform a spatial orientation and multi-modal discrimination task. Furthermore, we show using quantitative tracking of whisker kinematics during maze navigation that mice utilize a stereotypically similar motor strategies during head-fixation and free movement. Besides, mice transfer learning and knowledge of environment rules between the two contexts.

Recently, we adapt 'Floating Reality' system to replicate nose-poking paradigm, a widely used paradigm to investigate cognitive behavior in rodents. In a nose-poking floating platform, head-fixed mice were trained to perform a two-choice random dots kinematics (RDK) visual discrimination task. As mice performance reach criteria, a post-decision wagering component was implemented in which mice either wait a self-timed delay for reward or reinitiate a new trial. Mice learn to wait after visual discrimination exhibiting long waiting time post-decision to collect reward. Using two-photon techniques, we investigate the role of the visual cortex during behavior.