

# Development of a Neuroscientific Basis for Visualization and Manipulation of the Mind



Project manager

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R&D institutions

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## Progress until FY2022

### Summary of the project

This project aims to elucidate the mind through understanding the mechanisms and movements of functional brain networks. To create the basis for elucidating the mechanisms of the human mind in the future, we conduct research using mice, which enable direct observation and manipulation of the brain.

Specifically, we develop a virtual reality (VR) system that can visualize the dynamics of functional brain networks by providing various sensory stimuli to mice in action. Furthermore, by combining two sets of systems and placing mice in a metaverse space in VR, we quantify the "mental" state of mice communicating with other mice in a social environment as changes in their brain function networks. In addition, by artificially altering the brain functional network using optogenetics, a technology to control neural activity with light, we clarify how the brain functional network responds to changes in the "mind" and changes its behavior. In other words, we create a fundamental technology to elucidate the mechanisms of the human mind through research on mice that can directly manipulate the brain.

### Milestone by the end of project (year 2024)

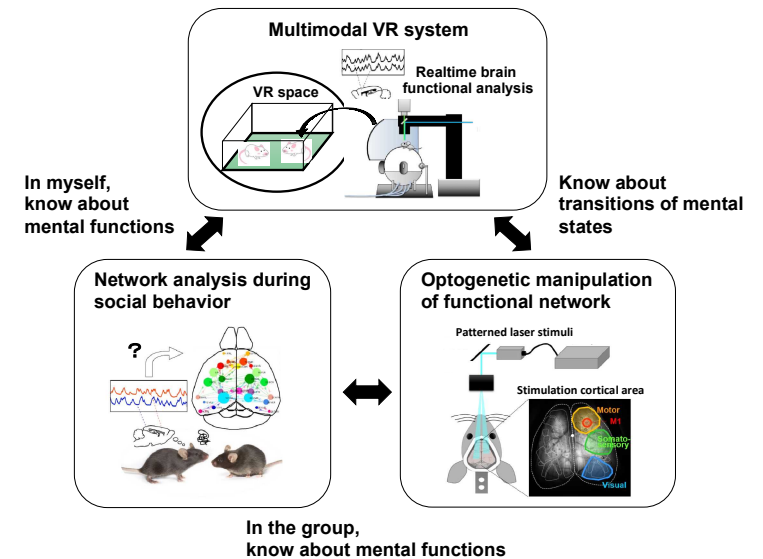
1. Establishment of a VR system to visualize the dynamics of functional brain networks

Mice are given behavioral tasks of social stimuli on a VR system, and the phenotype of the social behavior of mice is evaluated in real-time. In addition, factors related to "positive promotion clusters" such as familiarity and curiosity, and "negative inhibition clusters" such as alienation and wariness in social communication, are identified from the functional brain network based on analysis of cortical activity.

2. Optical manipulation of functional brain networks by optogenetics  
We construct a system to manipulate the functional brain network of mice by

light stimulation from the outside of the cranium. By stimulating the functional area network of the cerebral cortex at multiple points, we control the dynamic patterns of the functional network and analyze the changes in mouse behavior observed during such stimulation.

### R&D theme structure of the project



R&D Theme1:

Establishment of a VR system to visualize brain function network dynamics

TAKUMI Toru: Kobe University

R&D Theme2:

Optical manipulation of functional brain networks by optogenetics

MATOBA Osamu: Kobe University

TAKUMI Toru: Kobe University