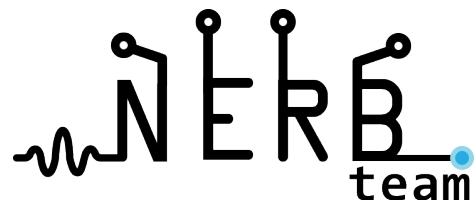


The BEhavioural AuTonomous Box (BEATBox): an automated, flexible, and low-cost system for high-throughput data acquisition

Eric Burguière, PhD



<https://nerb.team>

NeuroFrance 2023



The BeatBox: My journey toward
open-science...



2013

Objective: Establish as fast as possible my own scientific activity

Ressources: Few money, few people

1st step: Self critical assessment of my past experience

Psychiatric Diseases



Symptoms



*Quantitative Observable
Behaviors*



Animal Models

Psychiatric Diseases



Symptoms



*Quantitative Observable
Behaviors*



Animal Models

Obsessive Compulsive Disorders



Obsessions + Compulsions

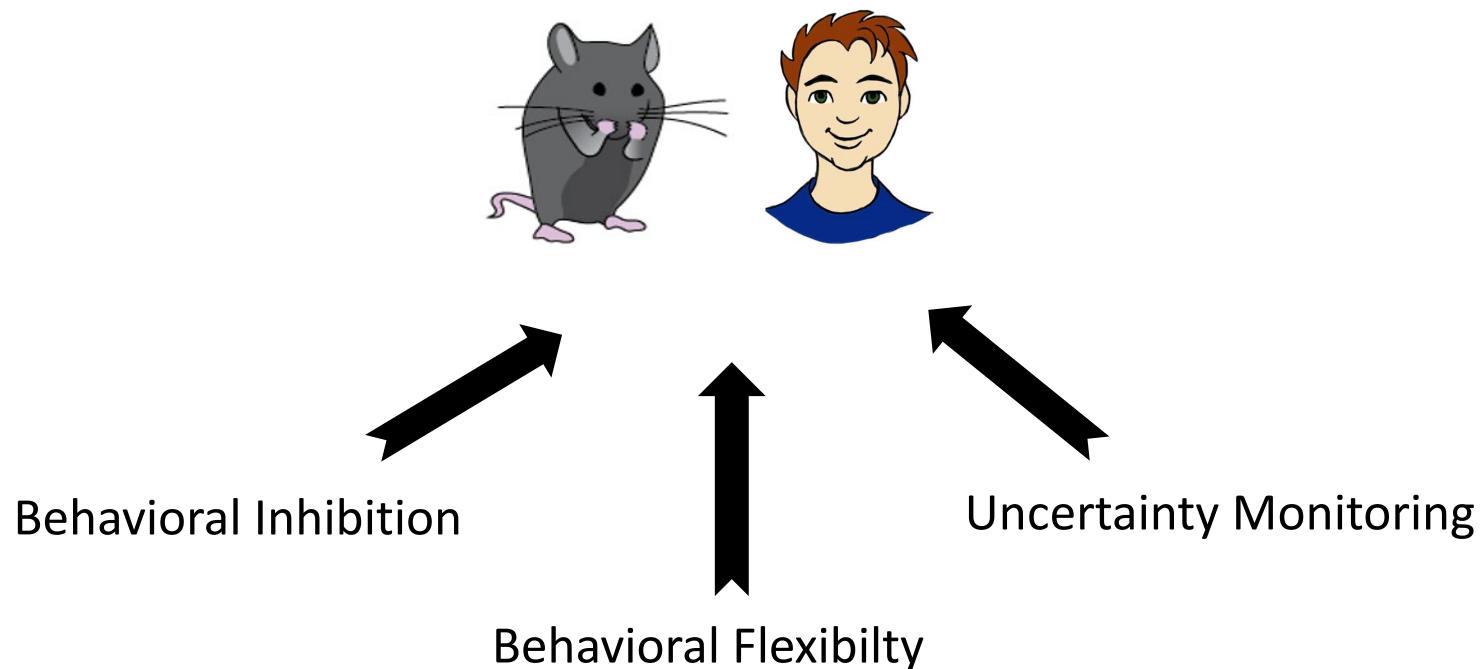


Compulsive Behaviors

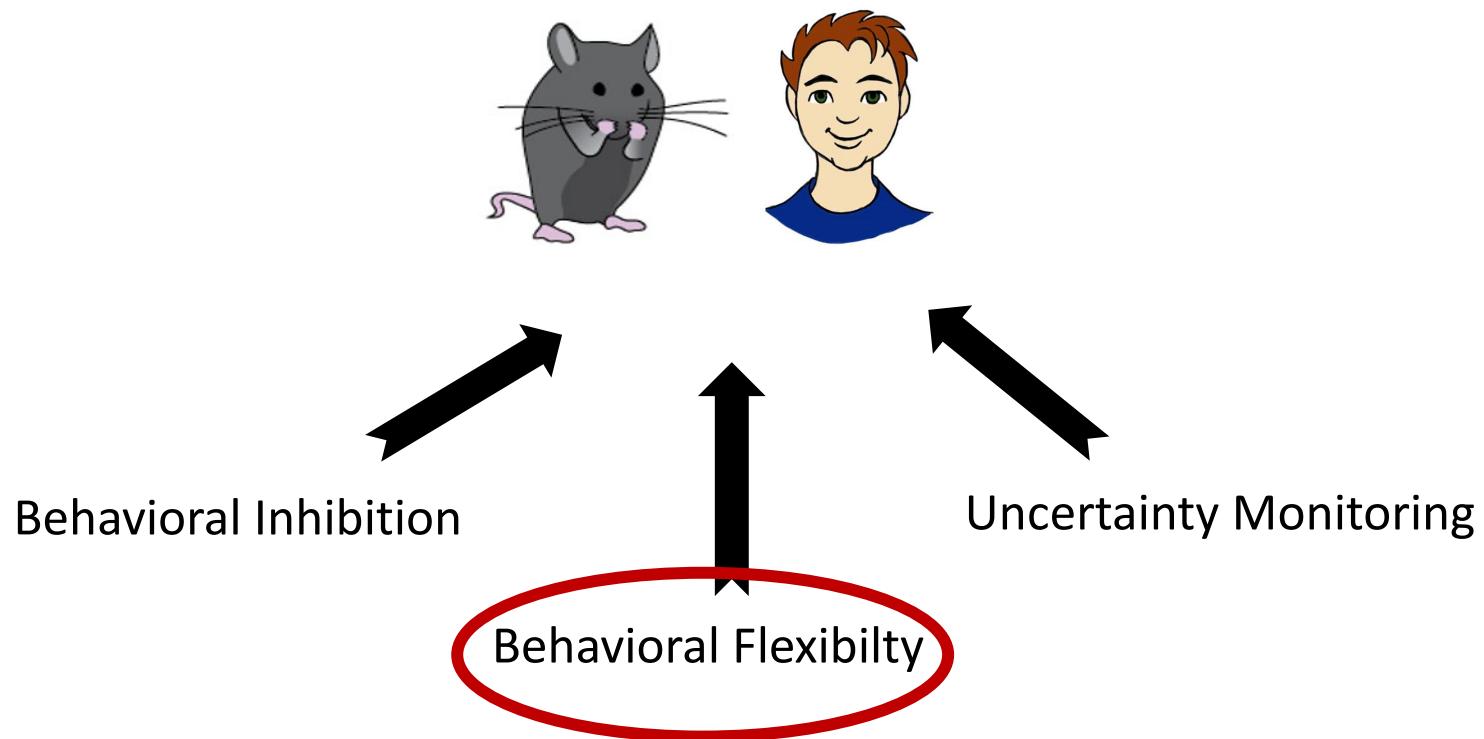


*Mouse model with
Compulsive Grooming*

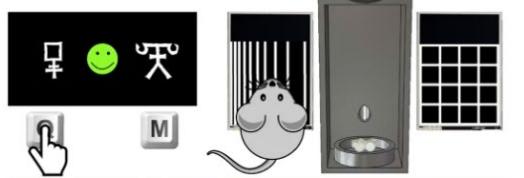
Searching for Functional Endophenotypes of Compulsive Behaviors



Searching for Functional Endophenotypes of Compulsive Behaviors

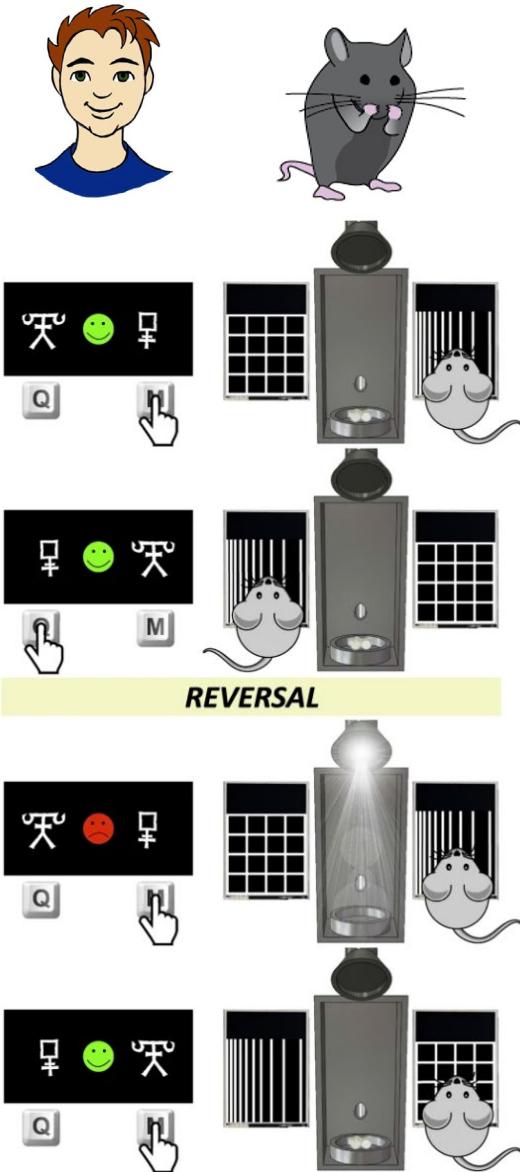






REVERSAL





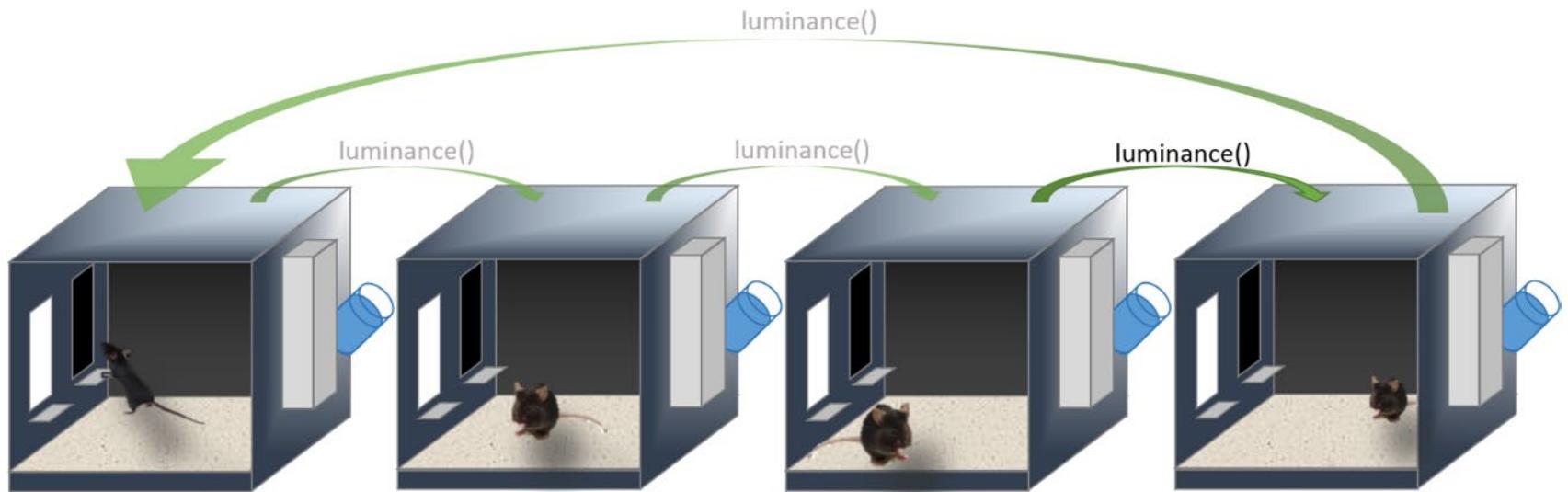
Classical approach in operant conditioning chamber

- Need extensive pretraining
- Food/Water deprivation
- Multiple interaction with experimenters
- Excessively time consuming
-

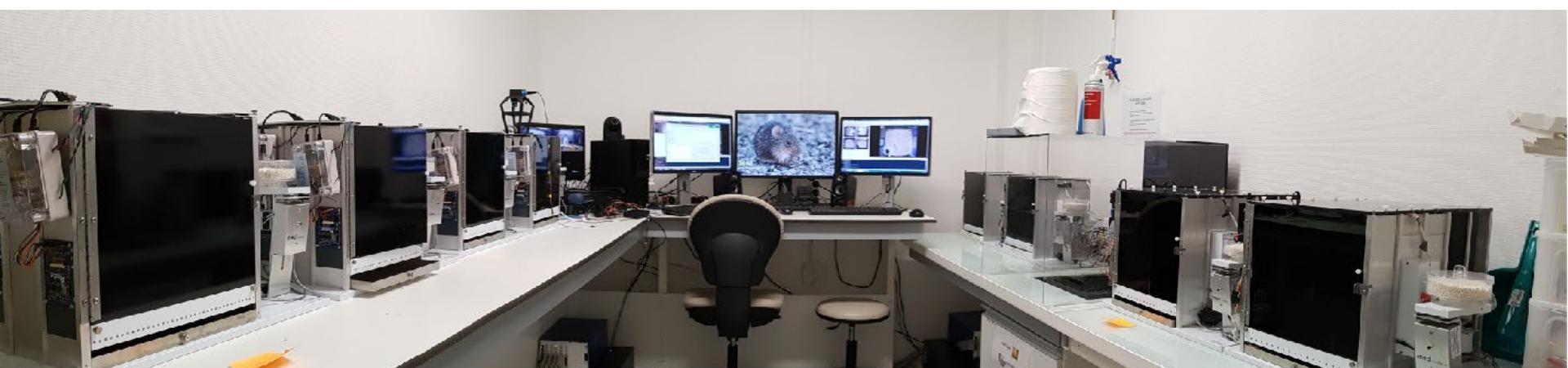
Self assessment:

- Reduce the time of the experimenter
- Extensive training to assess complex cognitive dimension
- Improve the quality of my data (less inter-animal variability)

Customize commercial system



- ❑ Ecological design (mice live in the cage, respect day/night cycle)
- ❑ High number of trials allow to train mice on complex task
- ❑ Modular and flexible (software, hardware)

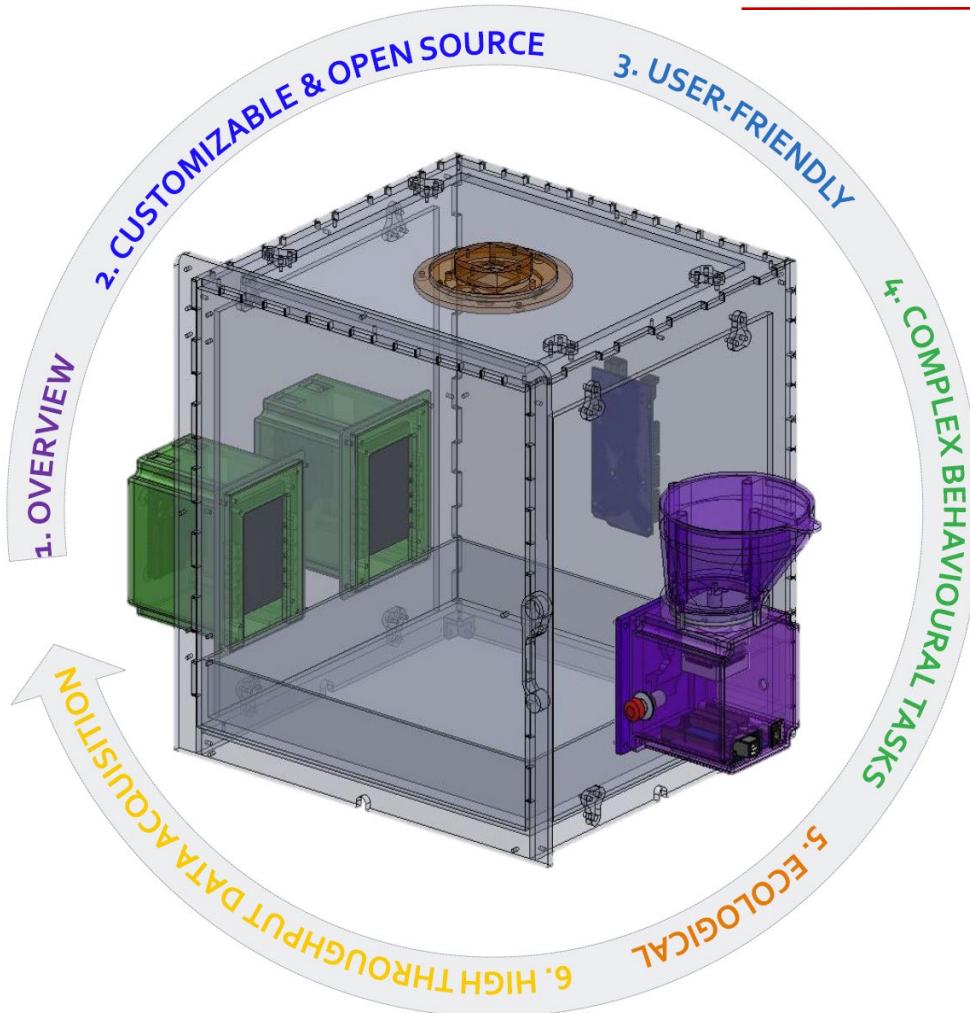


Limitations: Cost, Technical adaptations, data format,

Solutions: Design our own operant chamber

Decision: Going for an open-source solution

Consequences: Take into account several aspects fulfilling such a choice



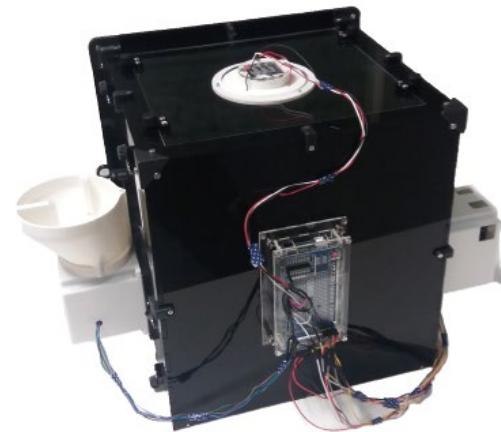
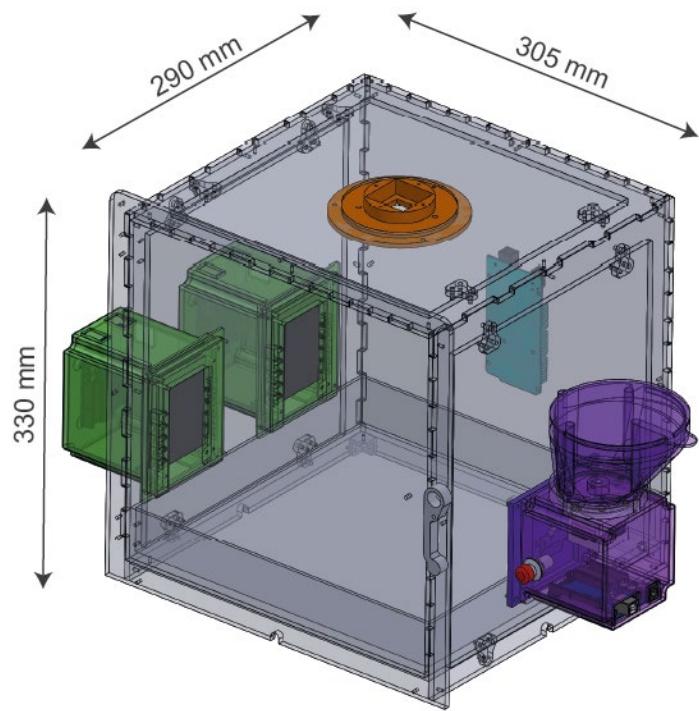
User friendly

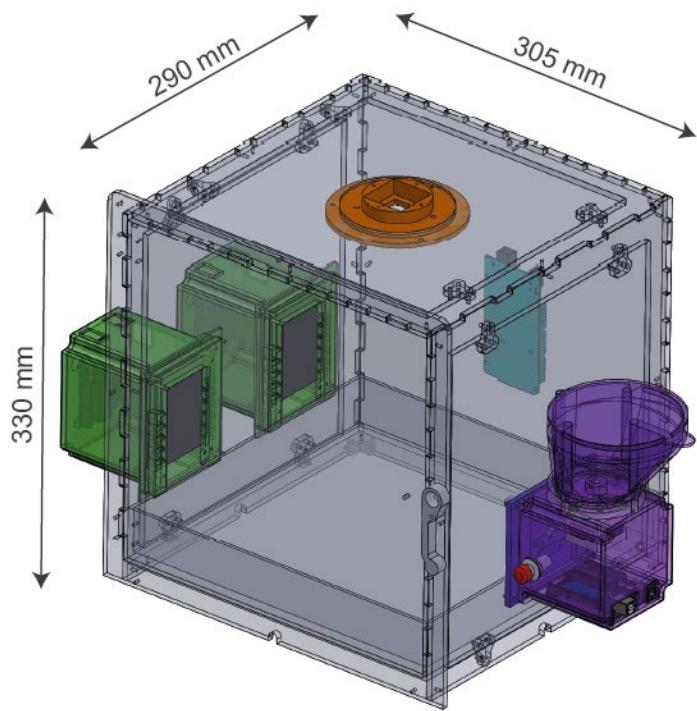
Easy to modify

Reduce the cost

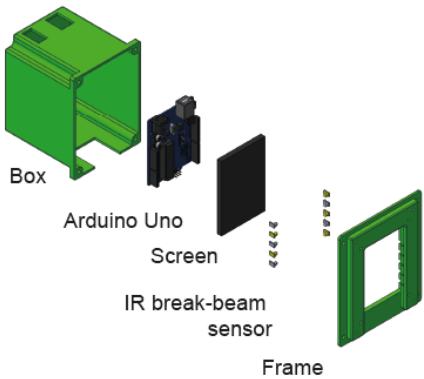
Data format and management

BEATBox





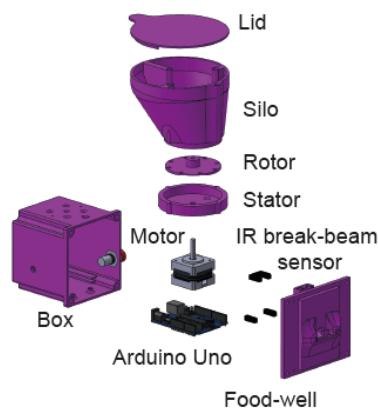
SCREEN MODULE



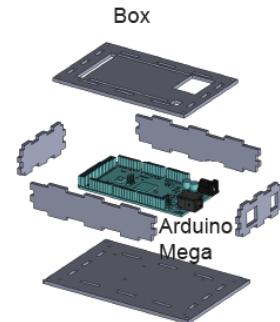
CEILING MODULE

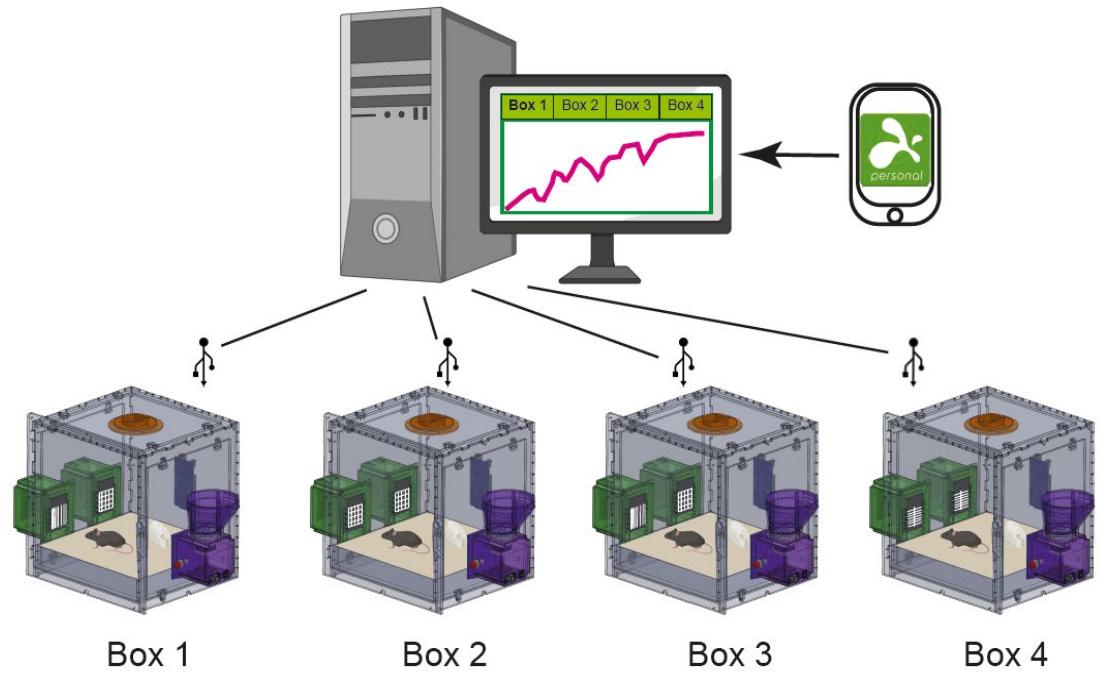


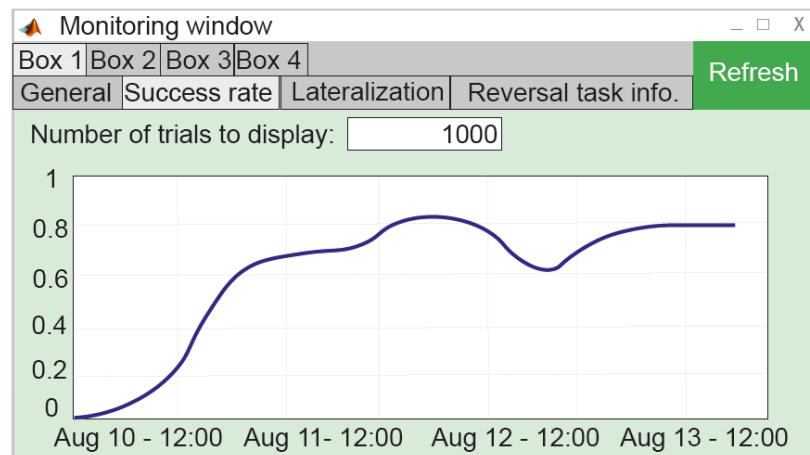
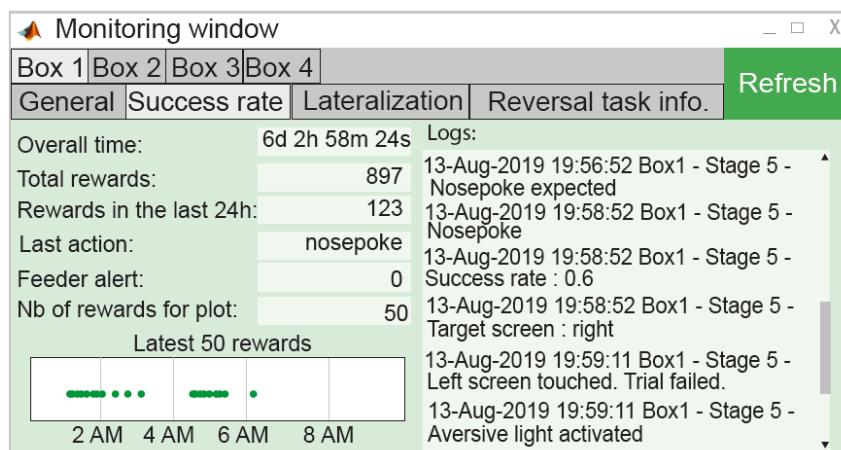
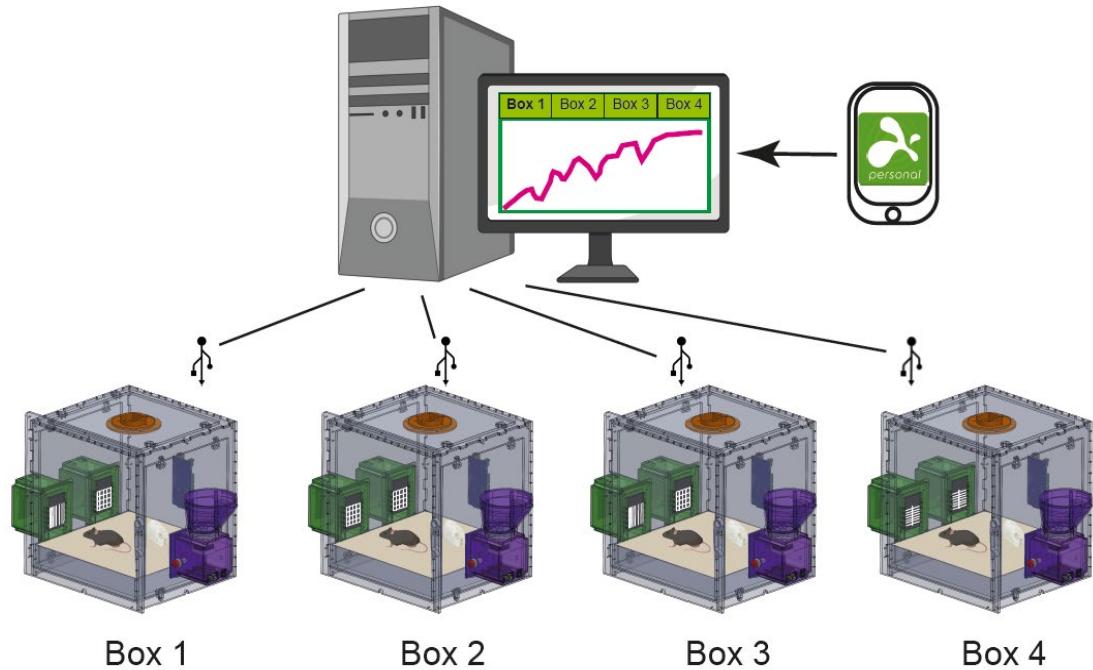
FEEDER MODULE



MASTER MODULE







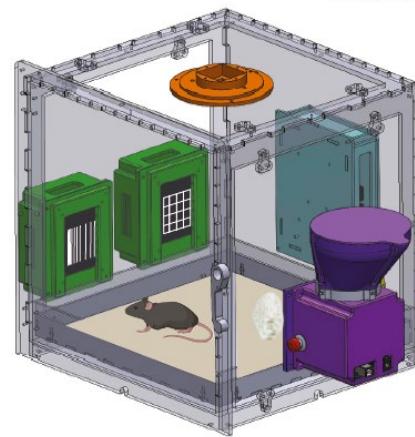




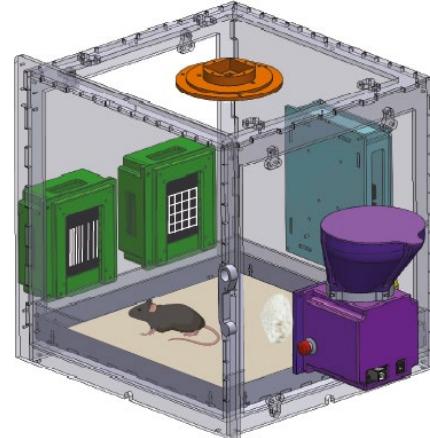
REVERSAL



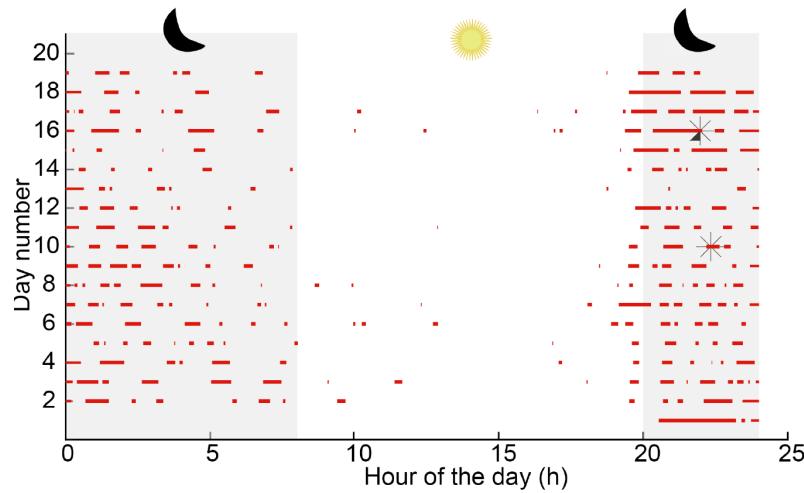
Discontinuous



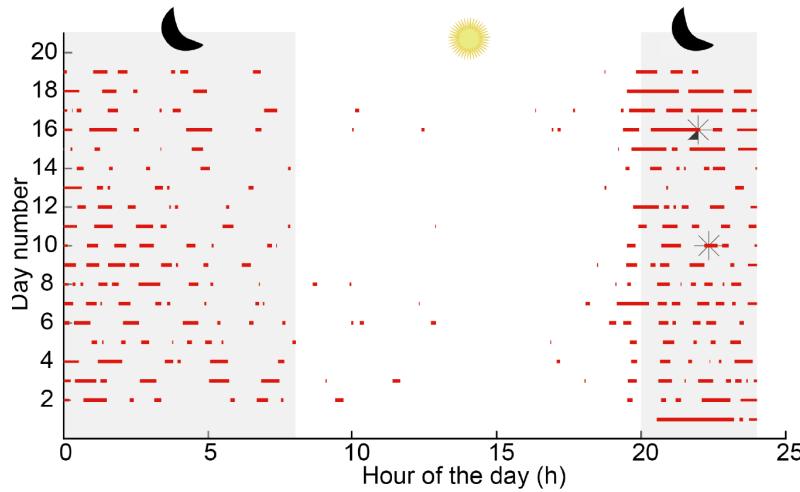
Continuous



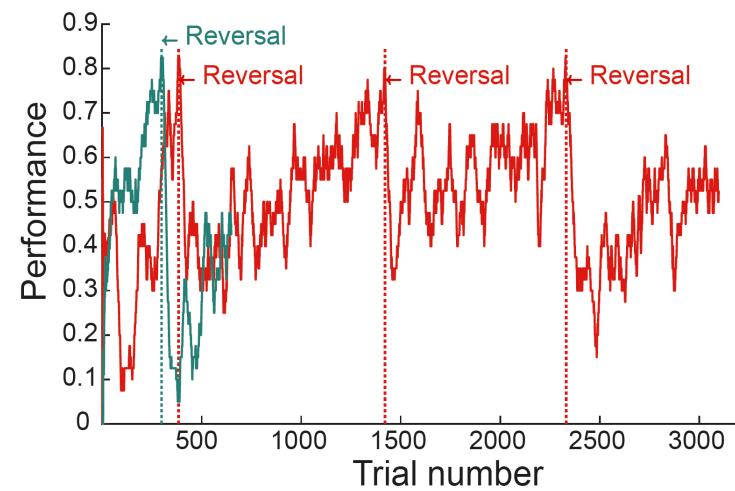
Activity in continuous version



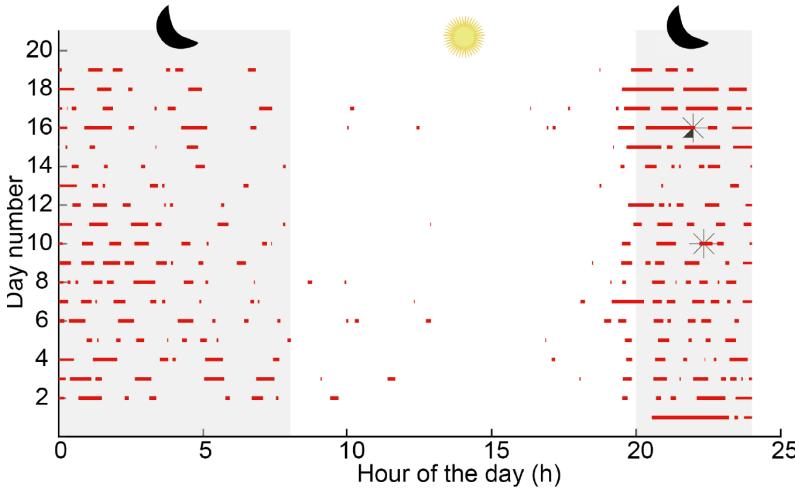
Activity in continuous version



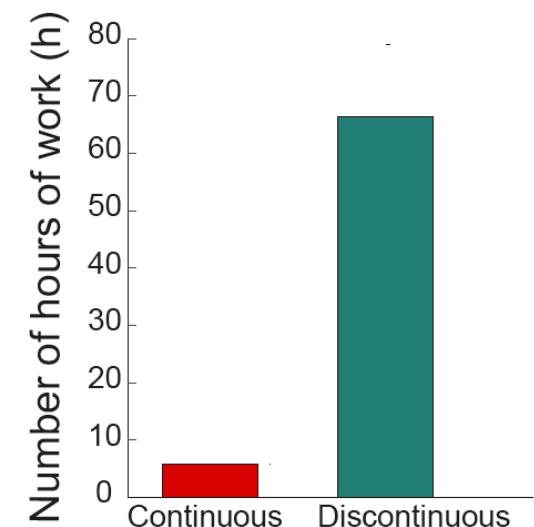
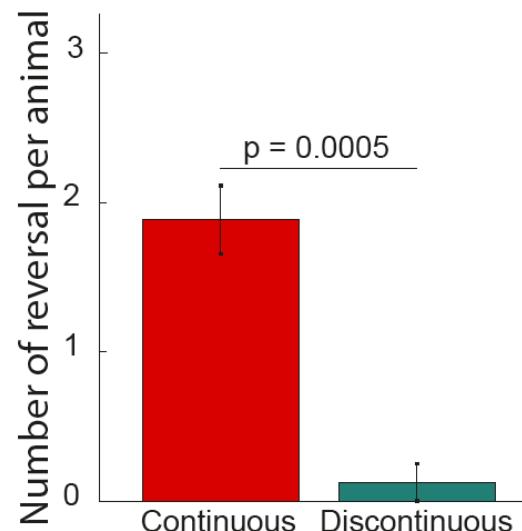
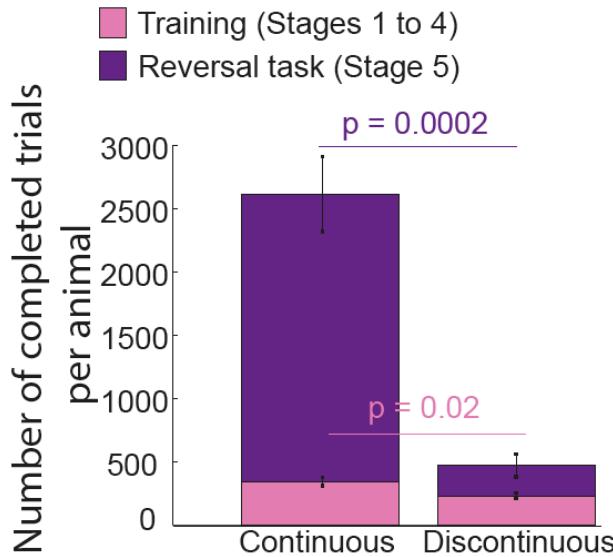
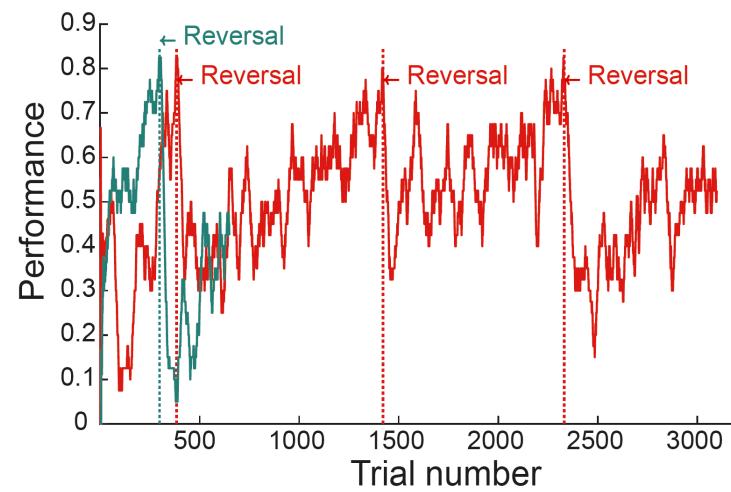
Performance in 20 days for two conditions



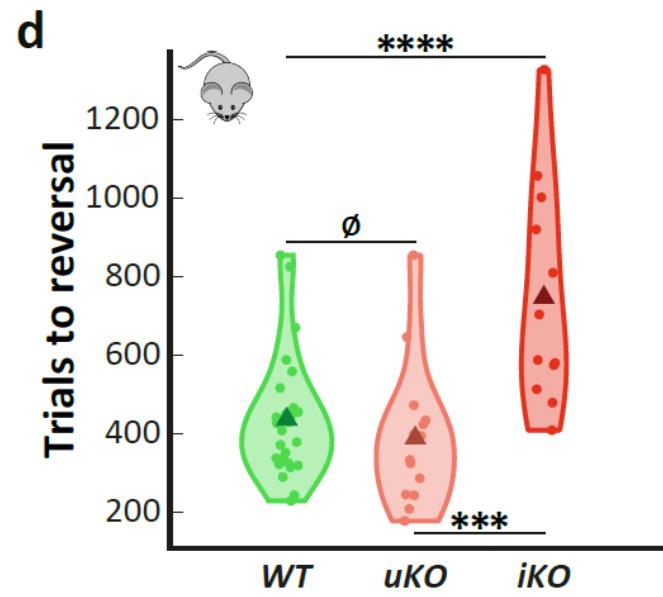
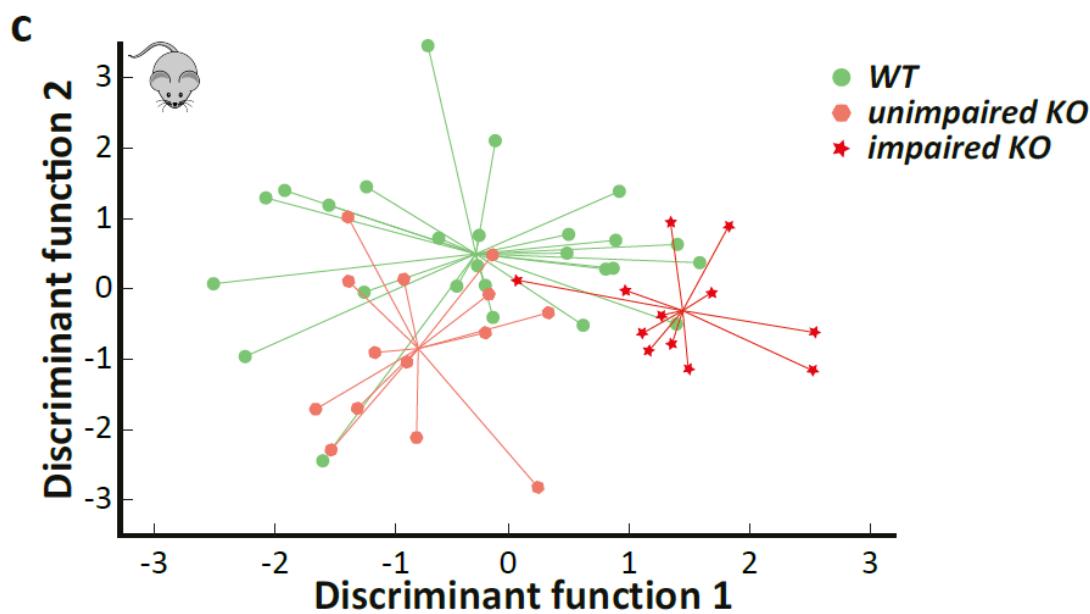
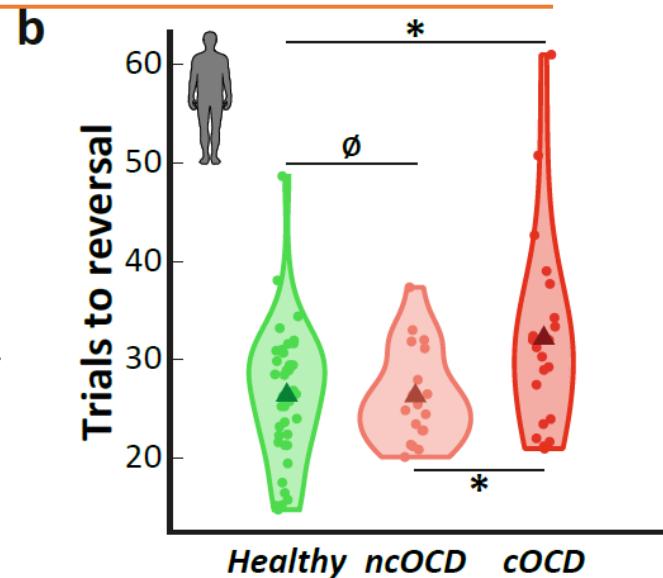
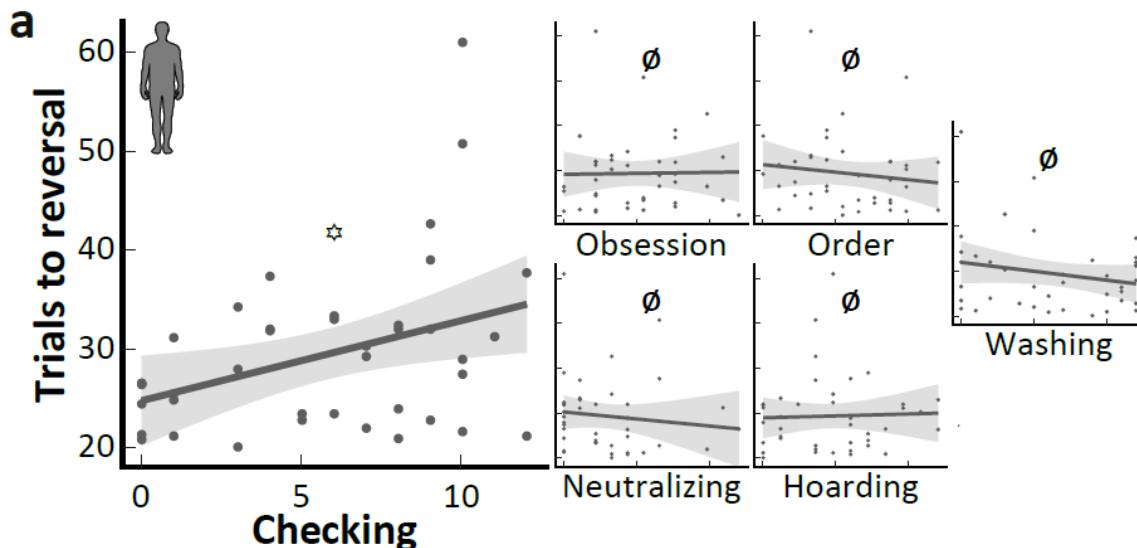
Activity in continuous version



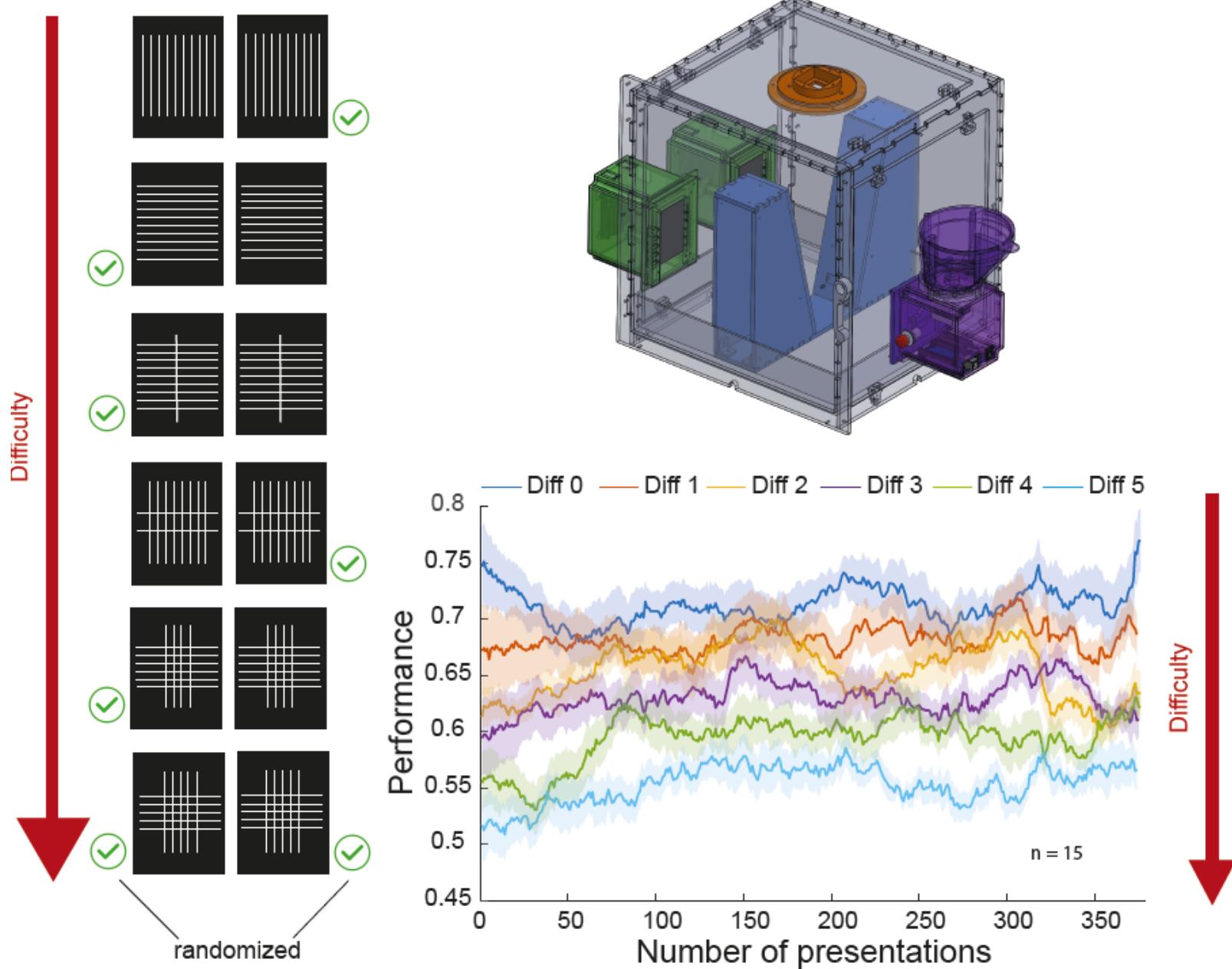
Performance in 20 days for two conditions



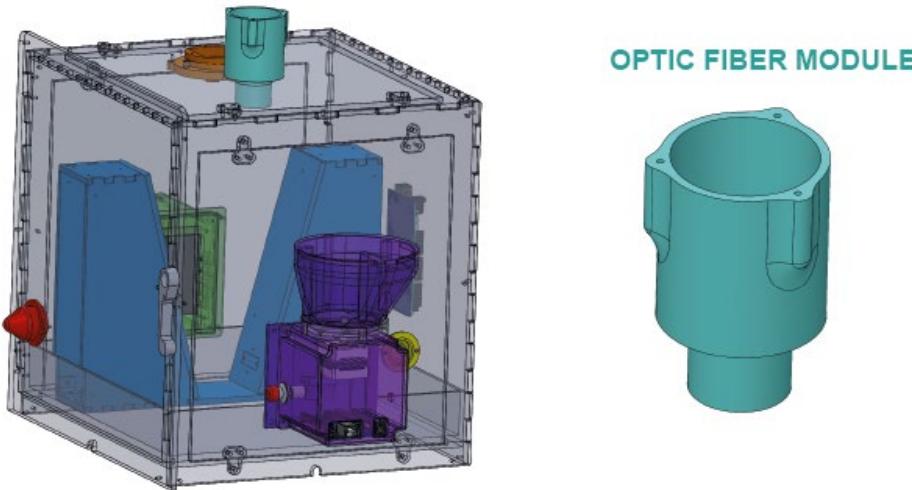
Behavioural flexibility in the Sapap3-KO mouse model



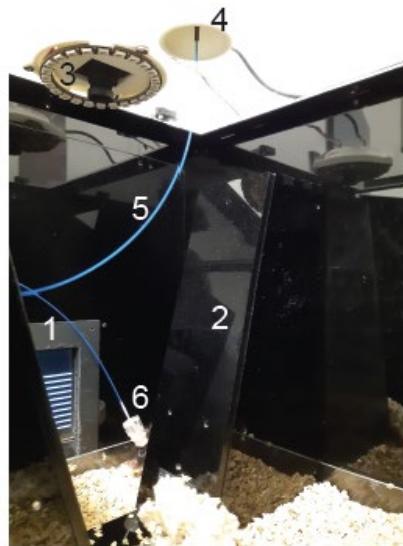
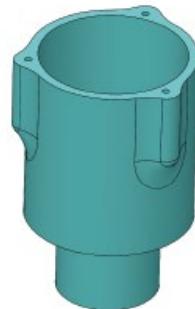
Uncertainty task



Adaptation for Neurophysiology/Optogenetic



OPTIC FIBER MODULE



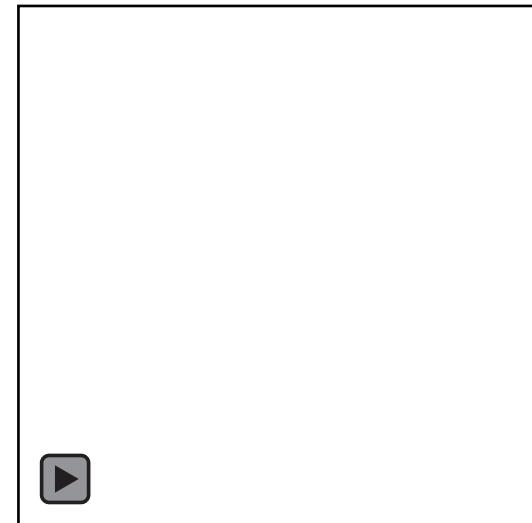
- | | |
|-----------|-----------------------|
| 1. Screen | 4. Optic fiber module |
| 2. Tunnel | 5. Optic fiber |
| 3. Camera | 6. Implanted mouse |

Improvements still needed

Adapt the software

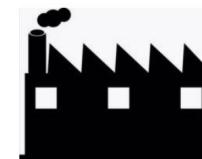


Adapt the hardware



Release and share the information (github, website, publication)

Solution of production to disseminate the system





Nabil Benzina



Lizbeth Mondragon



Marine Euvrard



Pierre Tissier



Oriana Lavielle



Christiane Schreiweis

