

# BSc Project Introduction

## Analyzing Monkey Brain Signals In Experimental Test Of learning and Memory

Mohamad Hosein Faramarzi  
Sharif University of Technology

Supervisor: Dr.Ghazizadeh-Dr.Vahdat  
Apr 15-2024



# Exploring Learning and Memory in Monkey by Brain Signals

- Introduction to fundamental concepts
- Overview of the current study's detailed subject
- Task design and methodology understanding
- Data analysis and research focus

# Introduction to Fundamental Concepts

- Learning and memory, decision making and their mechanisms



# Introduction to Fundamental Concepts

- Value Memory : history of being associated with reward





# Introduction to Fundamental Concepts

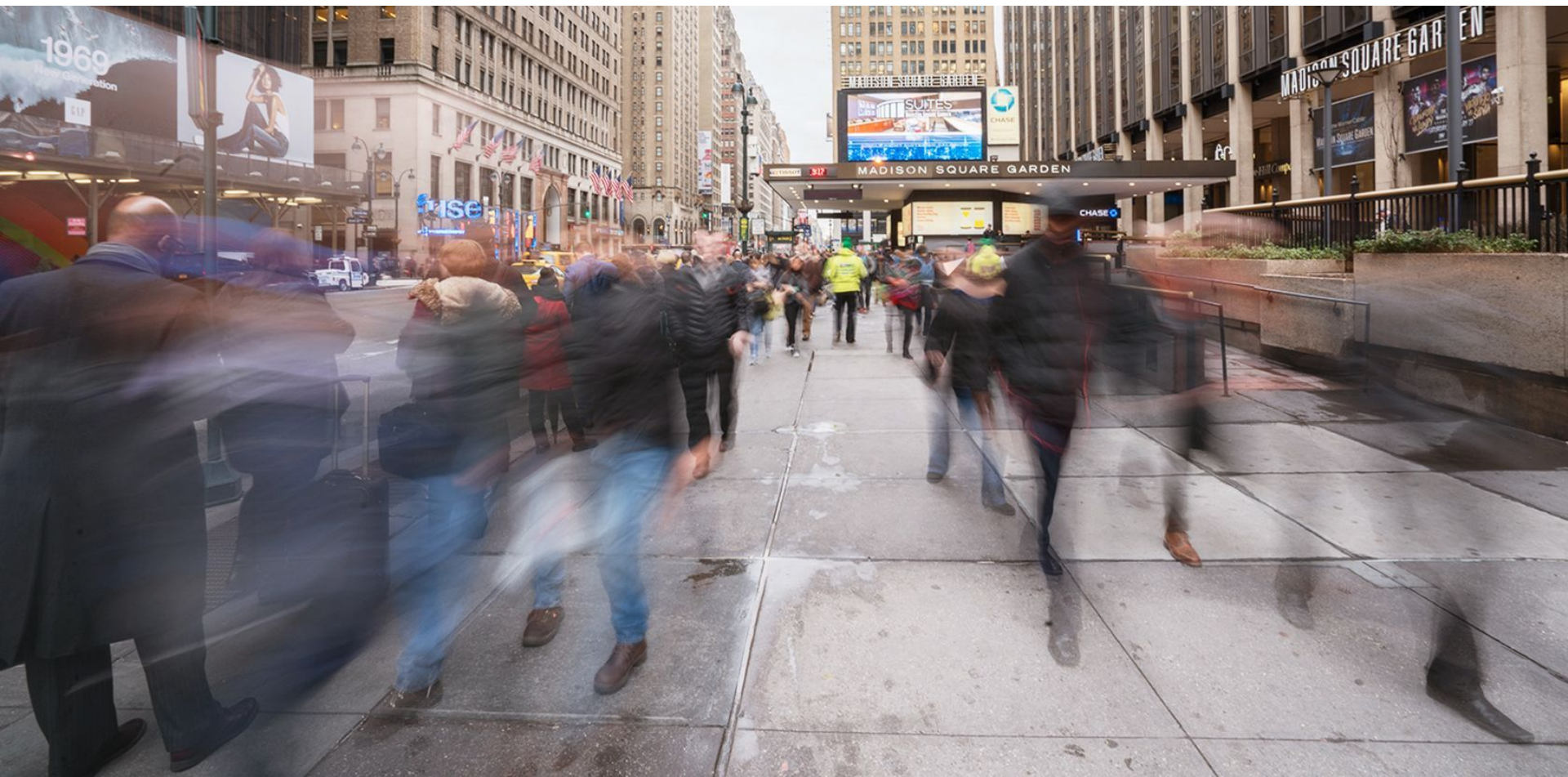
- Visual search and search efficiency





## Overview of the Current Study's Detailed Subject

- Object distinction from their surroundings based on **low-level features**
- Efficiency in finding **valuable objects** if they have been repeatedly paired with reward





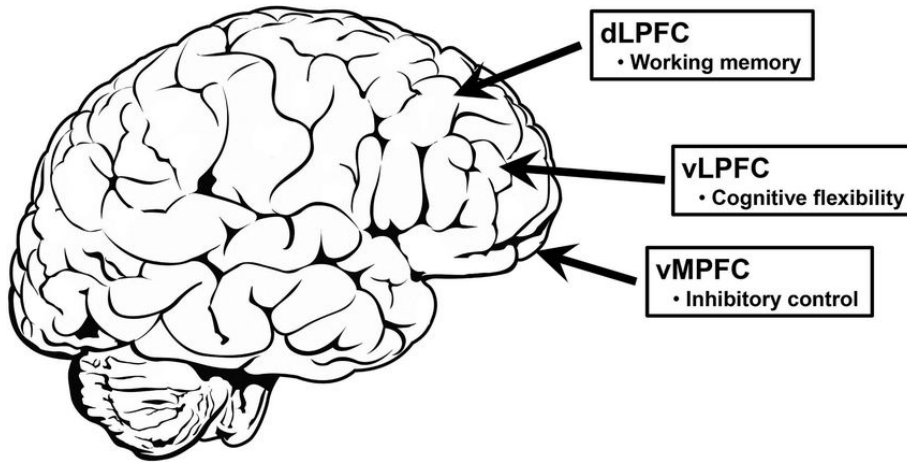
# Method of Research

- Single cell recordings during tasks
- 2 Macaque Monkeys (7 and 8 years old)
- Neural recording along with eye-tracking
- Reward system with juice

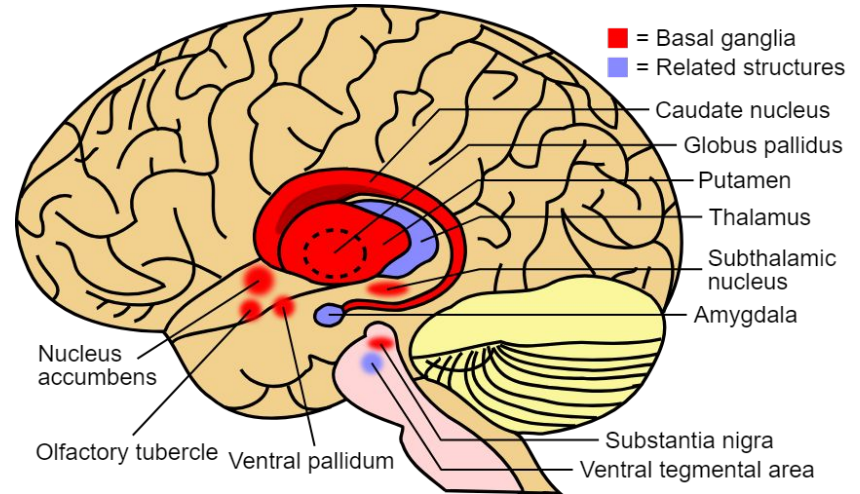




# Regions of Interest (ROI)



1) vLPFC (526 Neurons)

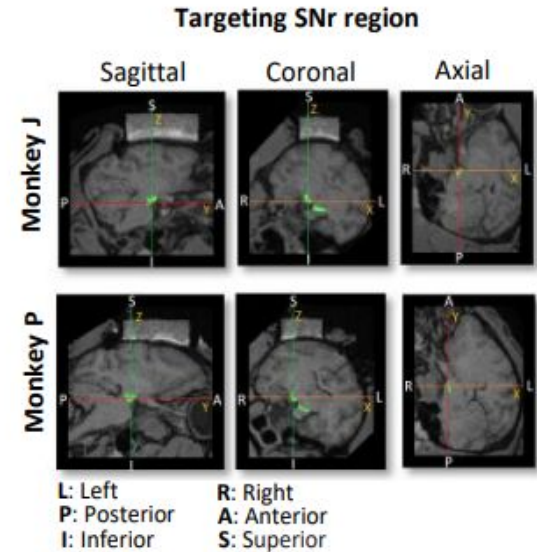


2) SNr (50 Neurons)



# Target Regions

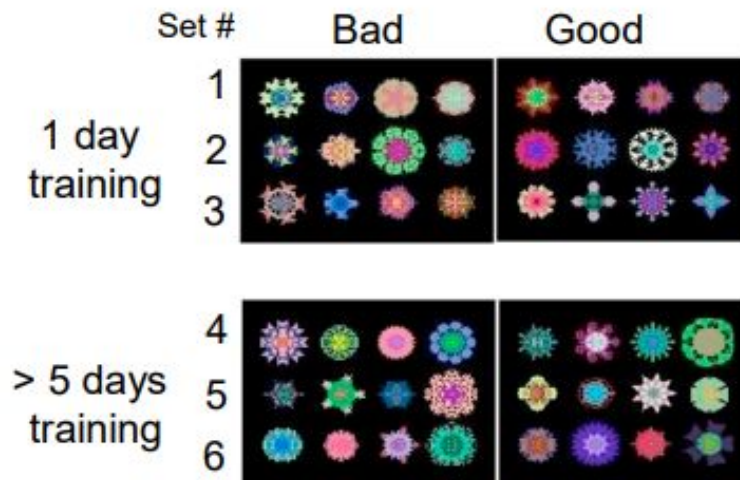
- A rectangular chamber
- Finding recording chamber's location with fMRI





# Stimuli

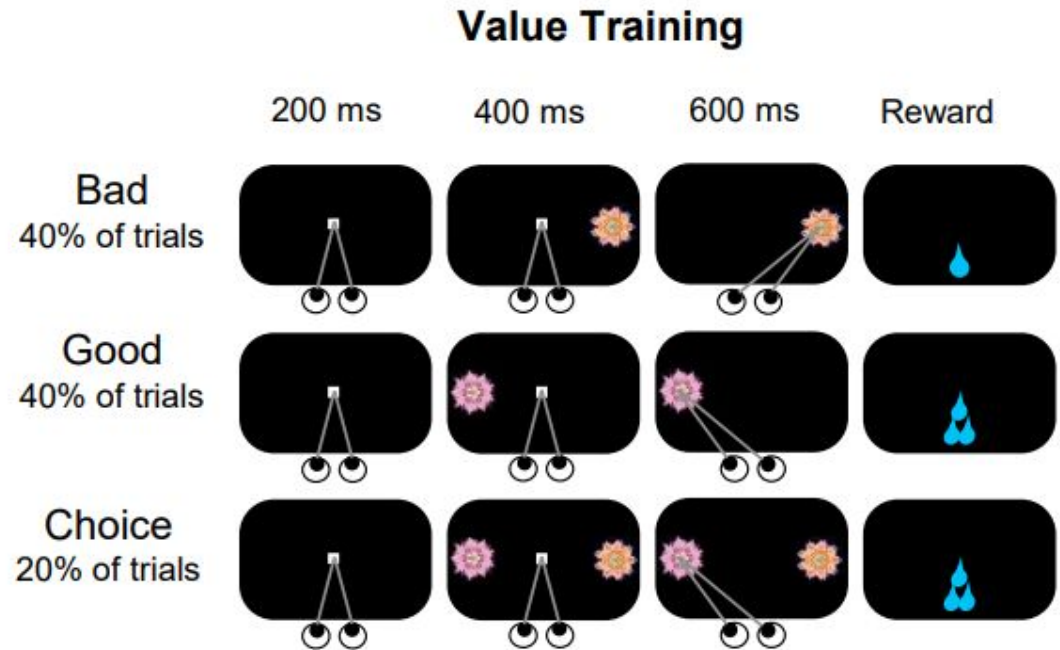
- Good / Bad Objects
- 1 Day / >5 days Trained Objects





# Experimental Paradigm

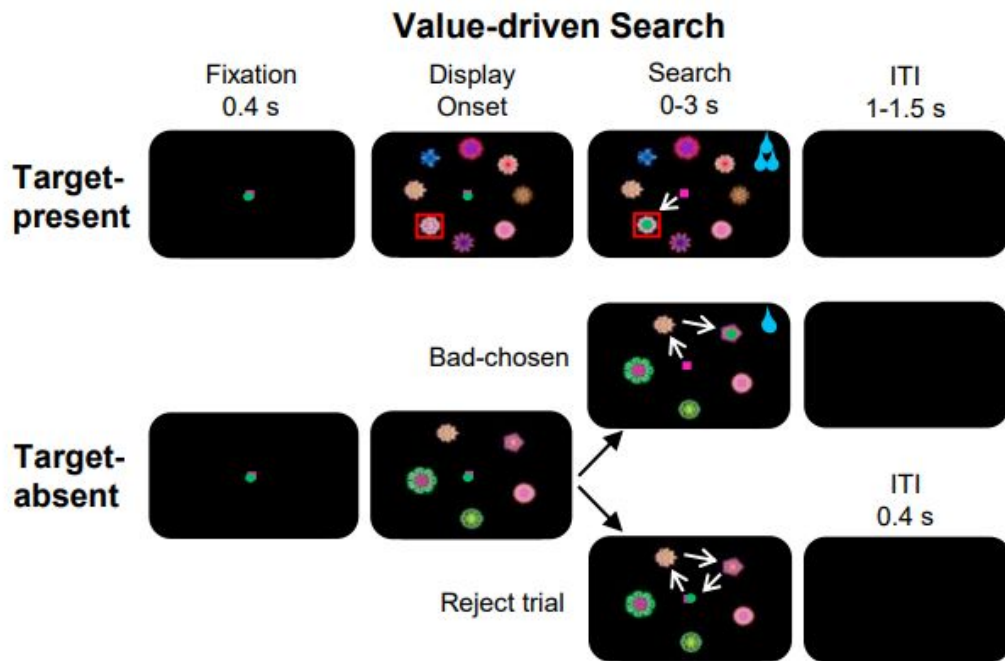
## 1) Value Training Session





# Experimental Paradigm

## 2) Value-Driven Search Sessions





# Current State of Project

Prefrontal cortex encodes value pop-out in visual search - 2023

(Mojtaba Abbaszadeh, Armin Panjehpour, Seyyed Mohammad Amin Alemohammad, Ali Ghavampour, Ali Ghazizadeh)

Value-based search efficiency is encoded in substantia nigra reticulata firing rate, spiking irregularity and local field potential – 2023

(Abdolvahed Narmashiri, Mojtaba Abbaszadeh, Mohammad Hossein Nadian, Ali Ghazizadeh)



# References

1-Hikosaka, O; Takikawa, Y; Kawagoe, R (2000). "Role of the basal ganglia in the control of purposive saccadic eye movements". Physiological Reviews

2-Prefrontal cortex encodes value pop-out in visual search - 2023 (Mojtaba Abbaszadeh, Armin Panjehpour, Seyyed Mohammad Amin Alemohammad, Ali Ghavampour, Ali Ghazizadeh)

3-Value-based search efficiency is encoded in substantia nigra reticulata firing rate, spiking irregularity and local field potential – 2023 (Abdolvahed Narmashiri, Mojtaba Abbaszadeh, Mohammad Hossein Nadian, Ali Ghazizadeh)

4-Common coding of expected value and value uncertainty memories in the prefrontal cortex and basal ganglia output (2021) - Ali Ghazizadeh and Okihide Hikosaka

5-Salience memories formed by value, novelty and aversiveness jointly shape object responses in the prefrontal cortex and basal ganglia (2021) Ali Ghazizadeh and Okihide Hikosaka





# Gantt Chart

2023

August

September

October

November

December

2024

January

February

March

April

May

June

July

August

## ▼ To do

- ☑ Start Analyzing Data for new i  Feb 27 – May 26 64 days
- ☑ Finding some results and chei  Mar 13 – Jun 22 73 days
- ☑ Applying some methods like F  Apr 3 – Jul 31 86 days







Add task...

## ▼ Doing

- ☑ Finding Ideas of PCA analysis  Feb 1 – Mar 9 27 days
- ☑ Start working with the data se  Feb 11 – Mar 4 16 days
- ☑ Replicating some previous res  Feb 21 – Mar 15 18 days

Add task...

## ▼ Done

- ☑ Getting Introduced with funda  Aug 6, 2023 – Aug 30, 2023 18 days
- ☑ Reading Introduction Papers  Aug 30, 2023 – Sep 23, 2023 18 days
- ☑ Studying previous results  Sep 23, 2023 – Nov 19, 2023 40 days
- ☑ Studying about experiment  Oct 3, 2023 – Dec 3, 2023 44 days
- ☑ Introduction with Data set anc  Nov 7, 2023 – Jan 7, 2024 44 days
- ☑ Introduction with PCA method  Dec 22, 2023 – Feb 16, 2024 41 days

Add task...

+ Add section



**Thanks for your  
attention**