Behavioral task designing

Name: **Hosein Dadras**
mail: **Hoseindadras6@gmail.com**
Hoseindadras@ut.ac.ir

Contents

Part 1:Task 1 2

Summary 2
Abstract 2
Introduction 2
Comparison Effect 2
Opposing Learning Model (OL) 3
Participants 3
Behavioral Task 3

Part 2: Task 2 5

Summary 5
Significance 5
Abstract 5
Introduction 5
Methodology 5
Sessions and Tasks 6
Session 1: Self Trials 6
Session 2: Mixed Trials (Risk-Averse) 6
Session 3: Self Trials 7
Session 4: Mixed Trials (Risk-Seeking) 7
Session 5: Self Trials 7

Part 1: Task 1

Summary

Title: Implicit Counterfactual Effect in Partial Feedback Reinforcement Learning: Behavioral and Modeling Approach

Abstract

Context significantly influences learning behavior by adjusting the values of options based on their distribution. This study explores how displaying counterfactual outcomes alongside chosen options (complete feedback) enhances contextual effects in learning. It contrasts with situations where only partial feedback is available. Employing partial and complete feedback paradigms, the research reveals that models updating chosen and unchosen option values in opposing directions better account for behavioral data. The study extends understanding by showing that contextual effects extend beyond probabilistic to magnitude rewards.

Introduction

Context plays a crucial role in decision making and reinforcement learning, yet its impact on the latter remains understudied. Recent research indicates that cognitive biases emerge due to contextual influences during value learning. This study focuses on two learning paradigms: complete and partial feedback. In the complete feedback paradigm, participants compare factual and counterfactual outcomes, aiding value learning. However, the influence of context in the partial feedback paradigm is unclear. Reinforcement learning involves updating option values based on prediction errors encoded by dopamine in the brain. Inspired by dopamine's opposing effects on distinct neural populations, the study proposes the Opposing Learning (OL) model, wherein chosen outcomes influence both chosen and unchosen option values. This suggests that identical options may have different values in different contexts.

Comparison Effect

Participants' behavior was studied to understand the impact of regret and relief on decision-making. Regret and relief occur when individuals compare the outcomes of their choices. This comparison influences whether they switch to a different option or stick with the same one. The study found a significant comparison effect in the complete feedback version but not in the partial feedback version, suggesting that participants' decisions were influenced more strongly by regret and relief in the complete feedback scenario.

Opposing Learning Model (OL)

A novel reinforcement learning model, the Opposing Learning (OL) model, was introduced, inspired by the striatal mechanism and built upon the standard Q-learning model. Unlike previous models focusing on the role of the unchosen outcome in updating chosen values, the OL model explains contextual effects by updating unchosen values based on chosen outcomes. This model correlates competing option values, leading to contextual effects during value learning. It also accounts for the influence of continuous reward magnitude on contextual effects. The OL model outperforms standard Q-learning models and offers insights into decision-making mechanisms.

Participants

Two groups of participants, comprising 35 and 42 individuals, engaged in the Partial and Complete versions of the experiment, respectively. Exclusions were made based on learning performance and reward expectation differences. Participants were healthy volunteers who provided informed consent and received monetary rewards based on task performance.

Behavioral Task

Participants underwent instrumental learning tasks with two versions: Partial and Complete. These tasks consisted of learning, post-learning transfer, and value estimation phases. In the learning phase, participants chose between stimuli pairs, gradually learning the most advantageous options. Feedback differed between the two versions, with only factual outcomes provided in the Partial version and both factual and counterfactual outcomes in the Complete version. The learning phase was followed by a transfer phase where participants made choices without feedback and a value estimation phase. The task design aimed to ensure participants learned reward associations and tested their decision-making abilities.

Image 1

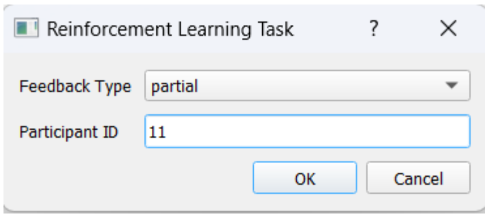


Image 2

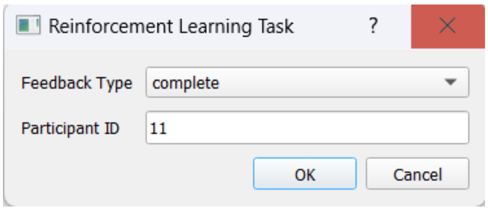


Image 3

Image 4

Image 5

Image 6

Image 7

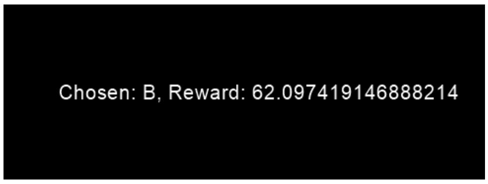


Image 8

Image 9

Image 10

Figure 1: Images from partial and complete feedback

Part 2: Task 2

Summary

Title: Behavioral Contagion During Learning About Another Agent's Risk-Preferences Acts on the Neural Representation of Decision-Risk

Significance

Understanding why individuals engage in risky behavior at certain times and avoid it at others is crucial for various fields such as psychology, neuroscience, and behavioral economics. This study explores one potential mechanism for this variability: behavioral contagion. Behavioral contagion refers to the phenomenon where observing another individual's risk-taking behavior influences one's own risk preferences. By using neuroimaging combined with computational modeling, this study aims to identify the neural basis of this effect.

Abstract

The research investigates how observing others' risk-seeking or risk-averse behavior can influence an individual's propensity for risky behavior. The study utilizes neuroimaging techniques to monitor brain activity and employs computational modeling to analyze the data. The findings suggest that the caudate nucleus, a brain region involved in processing risk, plays a significant role in this behavioral contagion effect. Furthermore, functional connectivity between the caudate nucleus and the dorsolateral prefrontal cortex, a region involved in learning about others' risk attitudes, is associated with an individual's susceptibility to behavioral contagion.

Introduction

Risk-taking behavior is a complex phenomenon influenced by various cognitive and emotional factors. This study investigates the neural mechanisms underlying the contagion effect, where observing another agent's risk preferences affects one's own risk-taking behavior. By combining neuroimaging with computational modeling, the research aims to provide a detailed understanding of how the brain processes and responds to observed risk-taking behavior,While performing the cognitive science task that is being designed, FMRI data is received from the person from the back, which has helped us to understand more.

Methodology

The study is divided into five sessions, each designed to assess different aspects of risk preference contagion. Participants undergo multiple trials in which they either make decisions about gambles themselves, observe another person making similar decisions, or predict the choices of the observed person. Neuroimaging data is collected throughout the sessions to identify the brain regions involved in processing these decisions and their changes due to observed behavior.

Sessions and Tasks

Session Overview

The following figure shows the structure and number of trials in each session of the task.

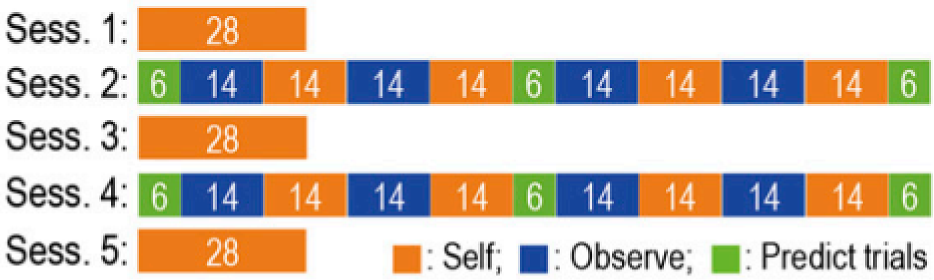


Figure 2: Session structure and number of trials.

Session 1: Self Trials

- **Description:** Participants make decisions on whether to accept or reject gambles. The gambles involve different probabilities and magnitudes, represented by pie charts and there are random with probability of 0.2 for 60 dollars to probability of 1 for 10 dollars.
  we have placed two 100 percent probabilities between these according to the article to ensure the correct speaking process of the participant
- **Number of Trials:** 28 Self Trials

Session 2: Mixed Trials (Risk-Averse)

- **Description:** Participants go through a series of blocks containing different trial types: Self Trials, Observe Trials (observing another person's choices), and Predict Trials (predicting the choices of another person). The observed individual exhibits risk-averse behavior.The second and third blocks in this session, like the first session, are obtained randomly, but we lie to the observer that they are real data. In the fourth and fifth blocks, these previous blocks are repeated.
- **Number of Trials:**
  - 6 Predict Trials
  - 14 Observe Trials
  - 14 Self Trials
  - 14 Observe Trials
  - 14 Self Trials
  - 6 Predict Trials
  - 14 Observe Trials
  - 14 Self Trials
  - 14 Observe Trials

- 14 Self Trials
- 6 Predict Trials

Session 3: Self Trials

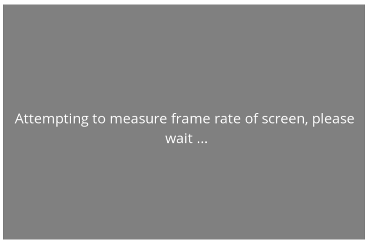
- **Description:** Similar to Session 1, participants make decisions about accepting or rejecting gambles.
- **Number of Trials:** 28 Self Trials

Session 4: Mixed Trials (Risk-Seeking)

- **Description:** Similar structure to Session 2, but the observed individual exhibits risk-seeking behavior.
- **Number of Trials:**
  - 6 Predict Trials
  - 14 Observe Trials
  - 14 Self Trials
  - 14 Observe Trials
  - 14 Self Trials
  - 6 Predict Trials
  - 14 Observe Trials
  - 14 Self Trials
  - 14 Observe Trials
  - 14 Self Trials
  - 6 Predict Trials

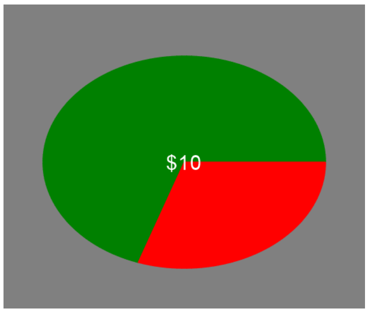
Session 5: Self Trials

- **Description:** Similar to Sessions 1 and 3, participants make decisions about accepting or rejecting gambles.
- **Number of Trials:** 28 Self Trials



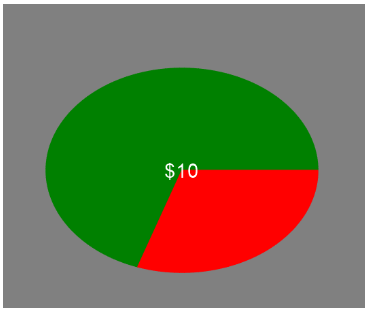
(a) Image 1

(b) Image 2

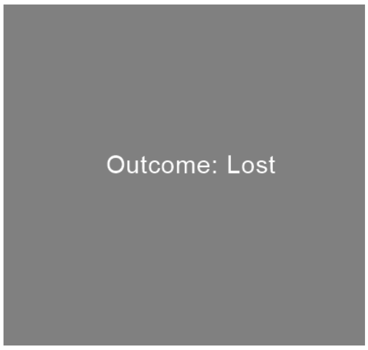


(c) Image 3

(d) Image 4



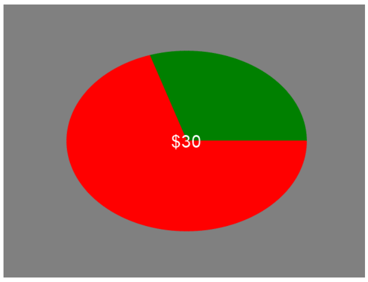
(e) Image 5



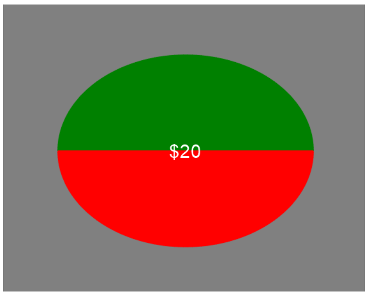
(f) Image 6

(g) Image 7

(h) Image 8

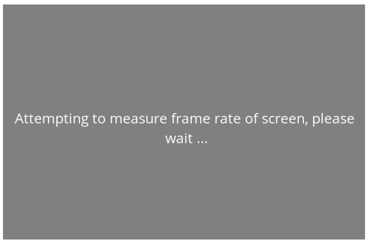


(i) Image 9



(j) Image 10

Figure 3: Images from Session 1-3-5



(a) Image 1

(b) Image 2

(c) Image 3

(d) Image 4

(e) Image 5

Figure 4: Images from Session 2-4

Session	**Type**	**Number of Trials**
1	Self Trials	28
2	Predict Trials	6
2	Observe Trials	14
2	Self Trials	14
2	Observe Trials	14
2	Self Trials	14
2	Predict Trials	6
2	Observe Trials	14
2	Self Trials	14
2	Observe Trials	14
2	Self Trials	14
2	Predict Trials	6
3	Self Trials	28
4	Predict Trials	6
4	Observe Trials	14
4	Self Trials	14
4	Observe Trials	14
4	Self Trials	14
4	Predict Trials	6
4	Observe Trials	14
4	Self Trials	14
4	Observe Trials	14
4	Self Trials	14
4	Predict Trials	6
5	Self Trials	28

Table 1: Sessions and Number of Trials