



BRSM

RL MEMORY SPECIFICITY ANALYSIS

TEAM REWARD

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OBJECTIVES

OBJECTIVES

- Study the dynamic relationship between learning, decision-making, and memory across different life stages.
- Characterize how individuals of different age groups adapt the specificity of their representations during value-guided learning
- Explore how the specificity of these learned representations impacts subsequent memory by manipulating reward structures in two experiments.
- Address developmental questions about adaptive behavior and its significance for memory formation, providing valuable insights into the complex relationship between experience, cognition, and memory throughout life.



DATA DESCRIPTION

DATA



Comprises **behavioral data** collected from participants of different age groups through **two experiments** ($N = 224$)

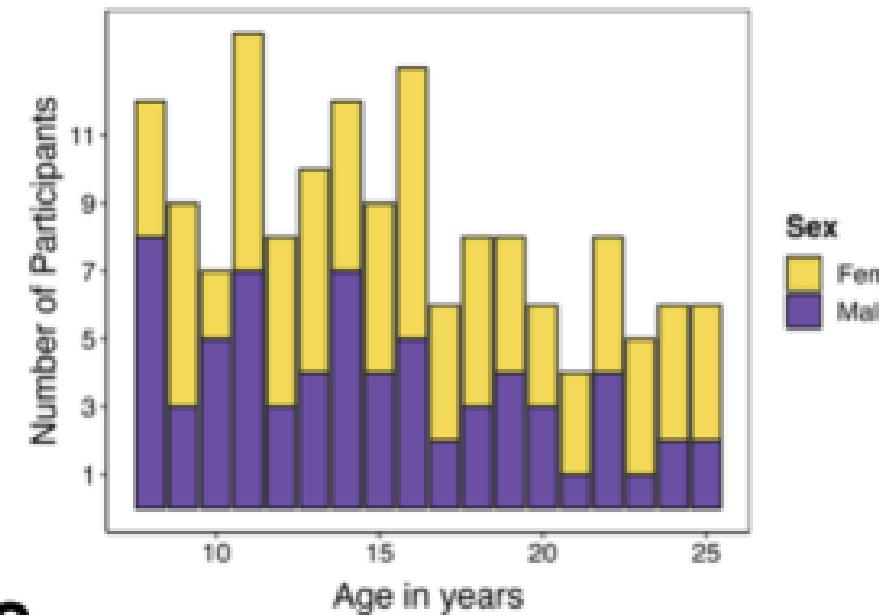


Provides insights into how reward shapes **learning strategies and memory formation** across developmental stages

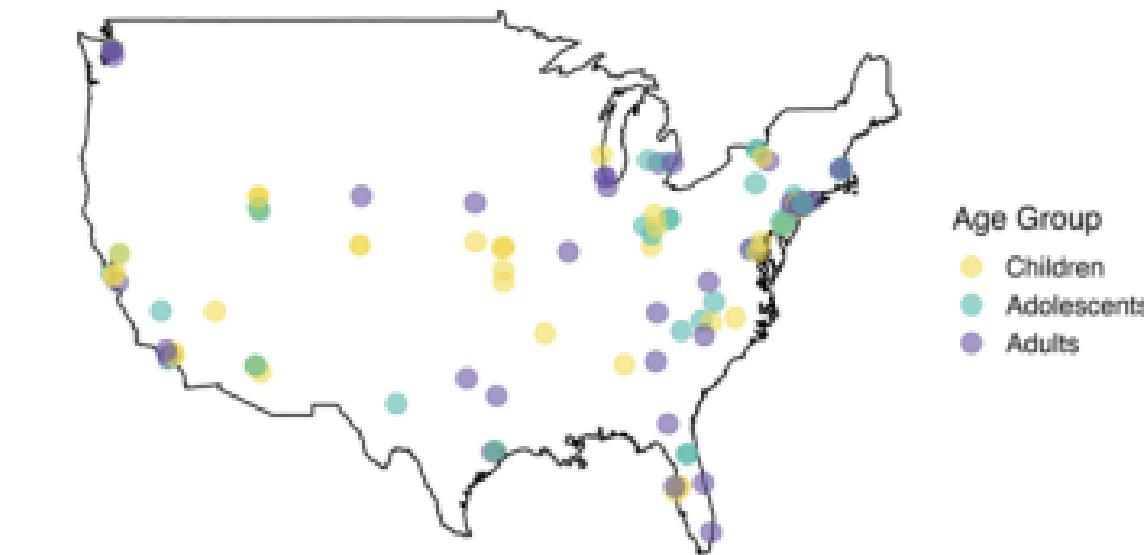


PARTICIPANT DEMOGRAPHICS

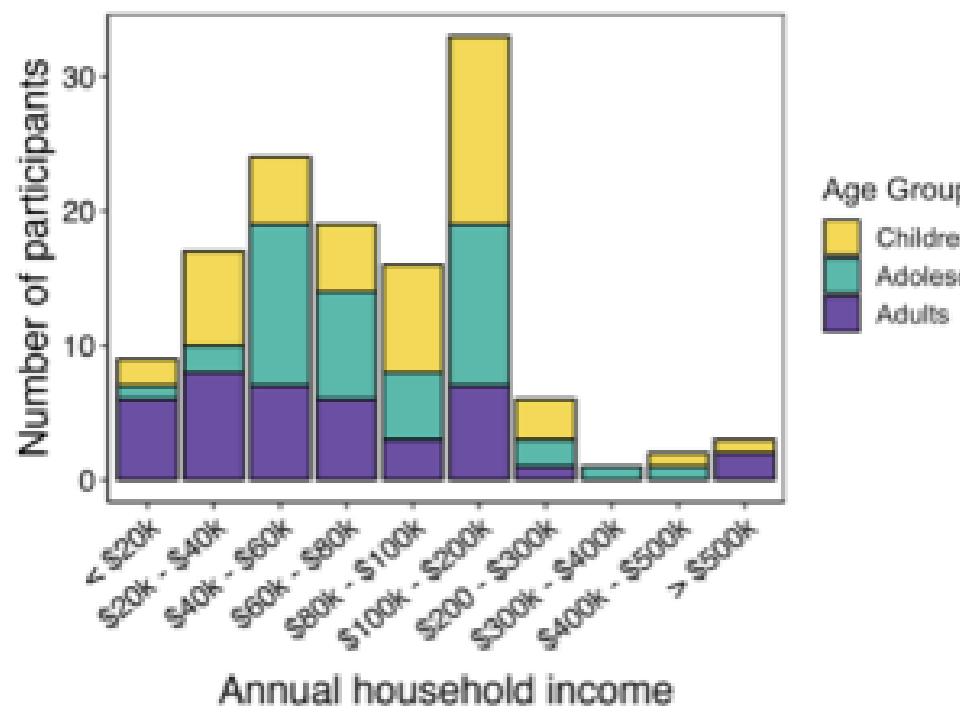
A.



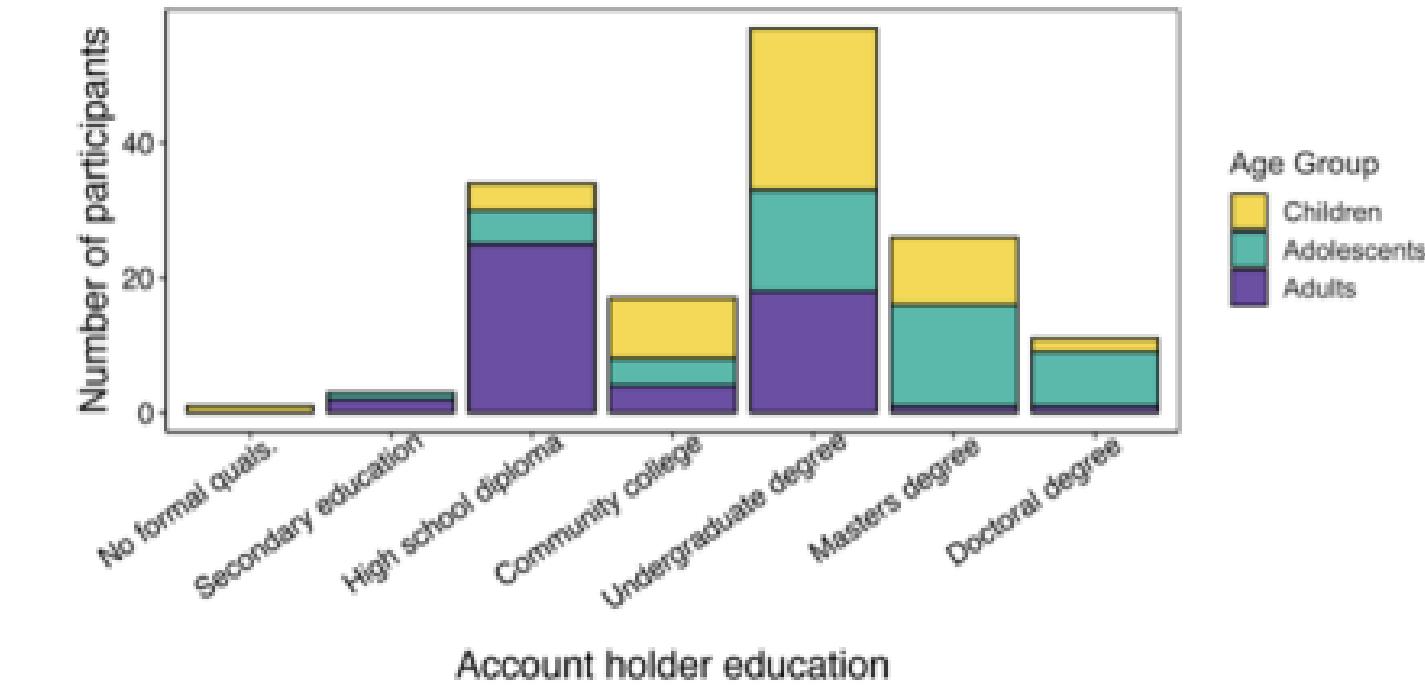
B.



C.



D.



EXPERIMENTAL DESIGN



EXPERIMENT 1

Participants: People of different ages, including children, adolescents, and adults.

9 unique stimuli, each with 3 exemplars from broader categories. Each picture had a corresponding reward, either tied to that specific picture or to a broader category it belonged to.

RL TASK DESIGN

Participants encountered different pictures and had to make choices based on the association between pictures and rewards.

LEARNING TASK

1 week after completing the RL task, subjects completed a test of recognition memory to decide whether stimuli were old or new on a four-point confidence scale.

MEMORY TEST

Objective - To understand how individuals adjust the specificity of their mental representations during value-based learning and the subsequent impact of this adaptability on memory.

EXPERIMENT 2

Participants: Included children (ages 8–12) and adults (ages 18–25). Excluded adolescents, focusing on age groups with expected significant performance differences.

Rewards made binary to introduce unpredictability and simulated a noisy environment for decision-making. Additional stimulus category with 5 novel stimuli and two novel exemplars per sampled category.

**TASK
MODIFICATIONS**

Participants encountered pictures with rewards tied to specific details or broader categories and had to choose from 3 options.

LEARNING TASK

Participants were tested on their memory performance for stimuli encountered in different learning conditions.

MEMORY TEST

Objective – To validate and extend Experiment 1 findings by introducing task modifications. Explore potential age-related differences in adaptive processes during learning, decision-making, and memory.

TABLES



18+

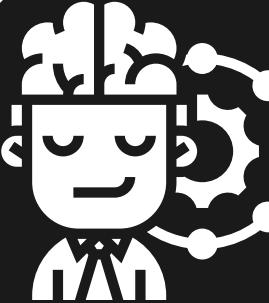
- subject IDs and ages

SUBJECT AGES



- Each row is a trial in RL task
- Has reaction times, points and decisions

LEARNING DATA



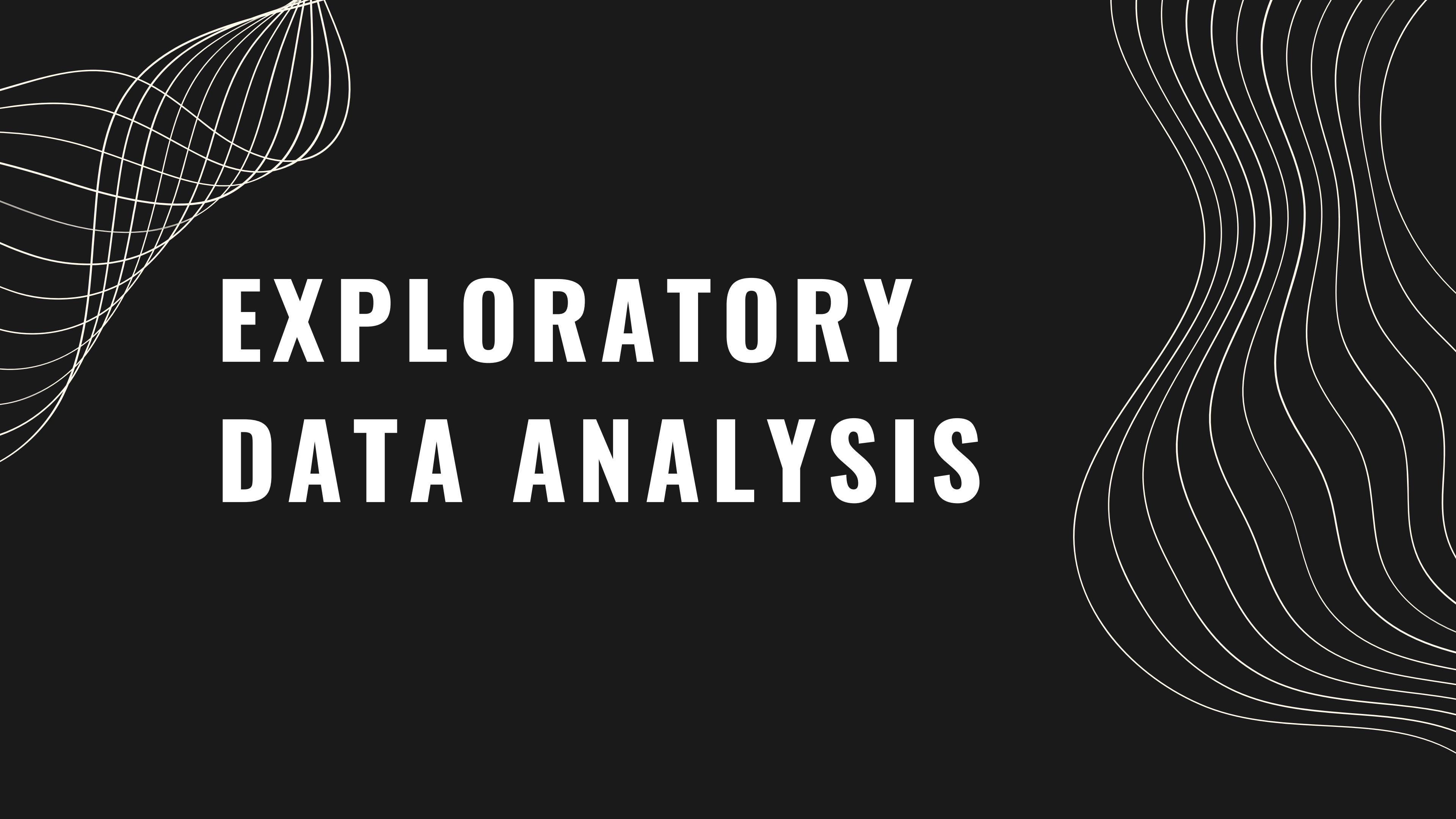
- Each row is a trial in RL task
- Has stimulus categories and block conditions

RL DATA



- Each row is a trial in Memory task
- Has accuracy, response time and confidence ratings

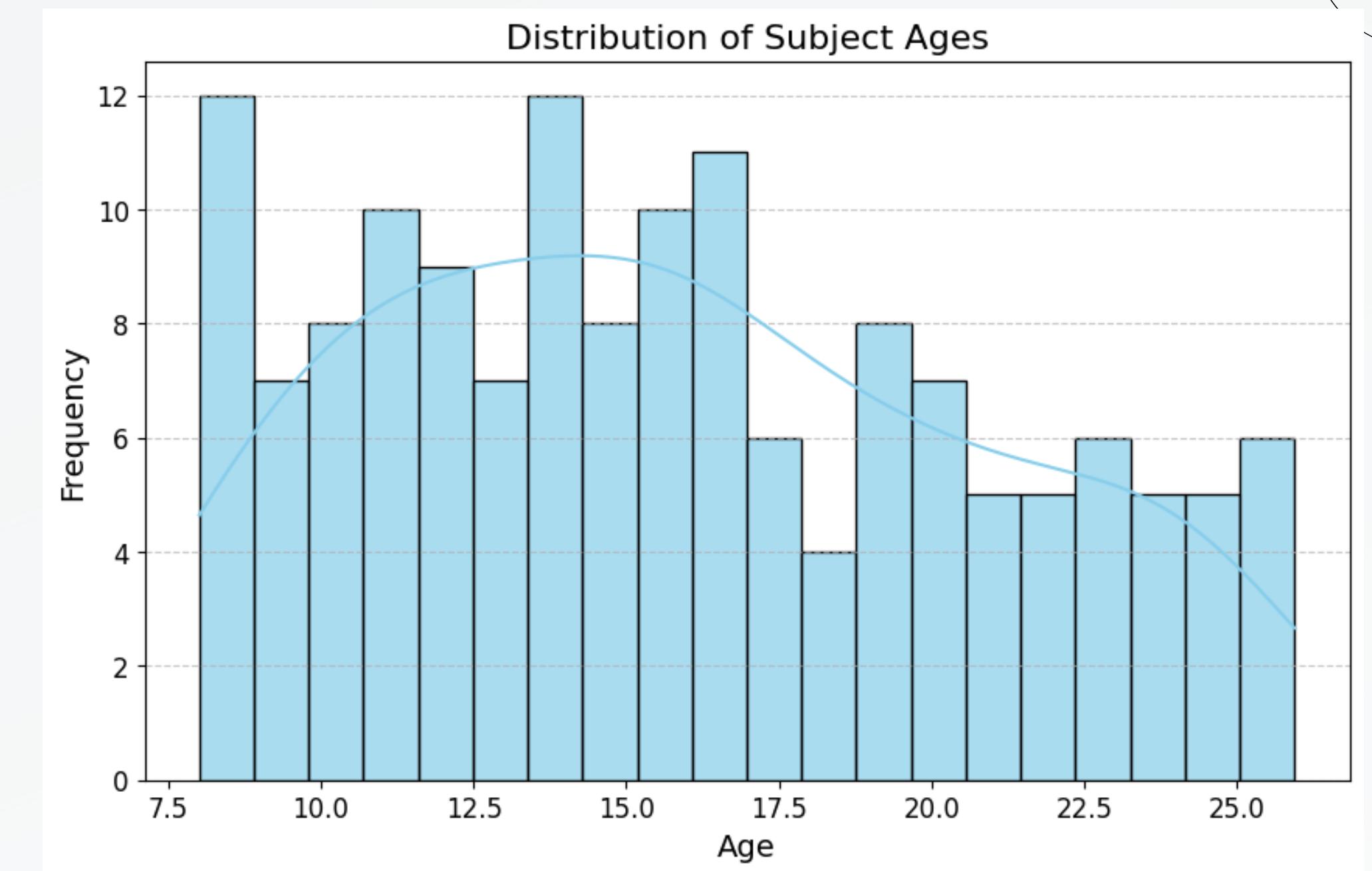
MEMORY DATA



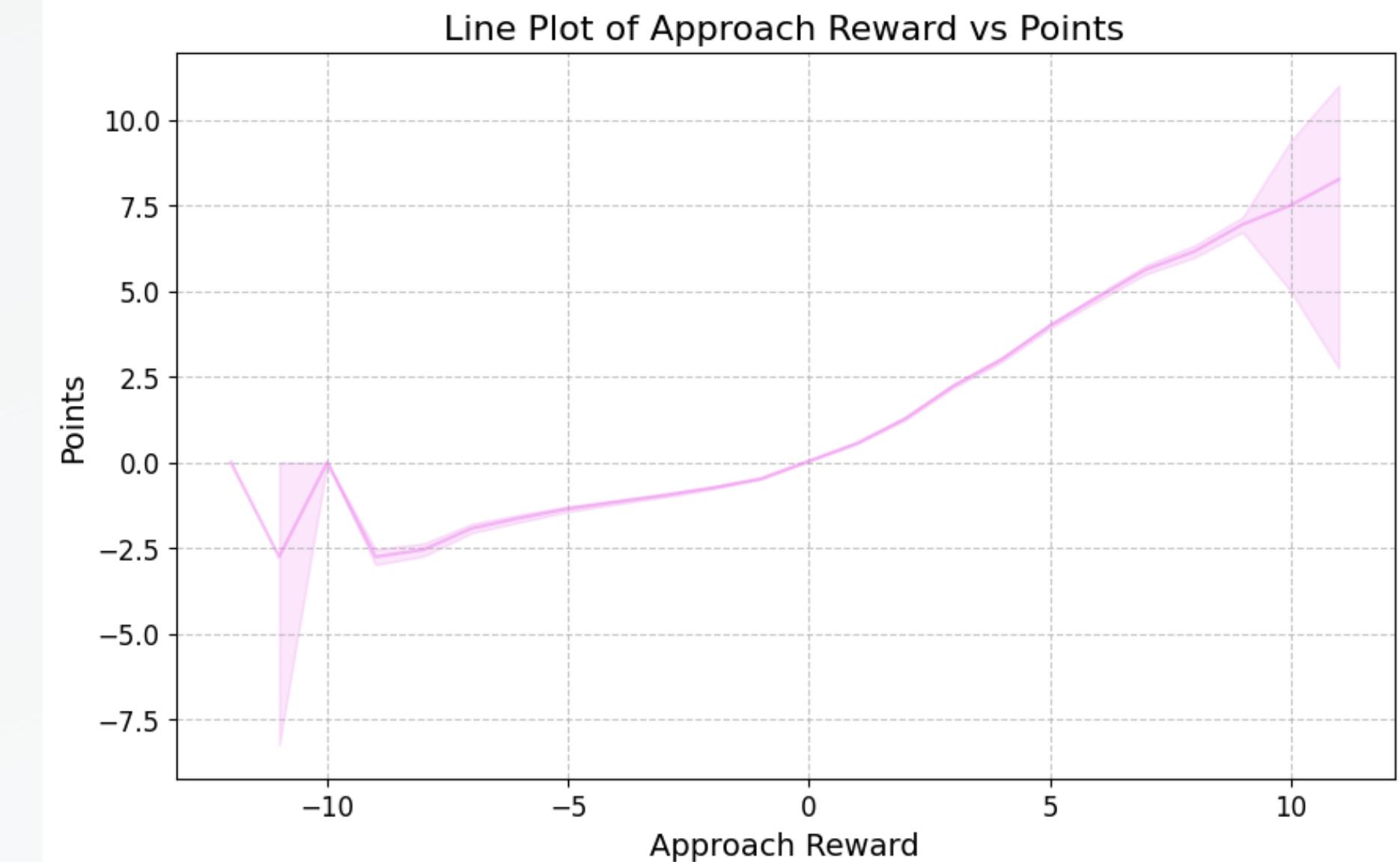
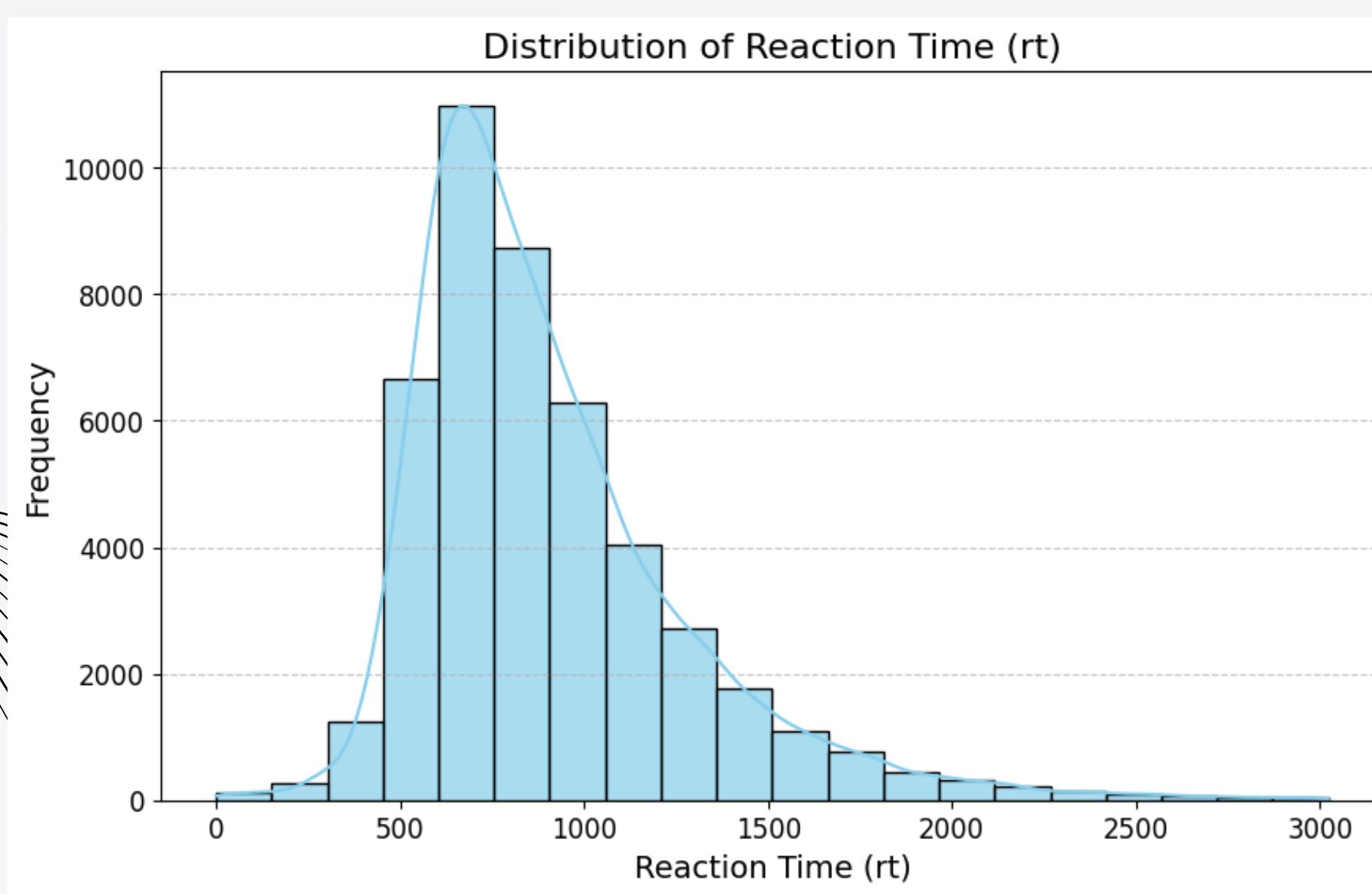
EXPLORATORY DATA ANALYSIS

EXPERIMENT 1 : SUBJECT AGE

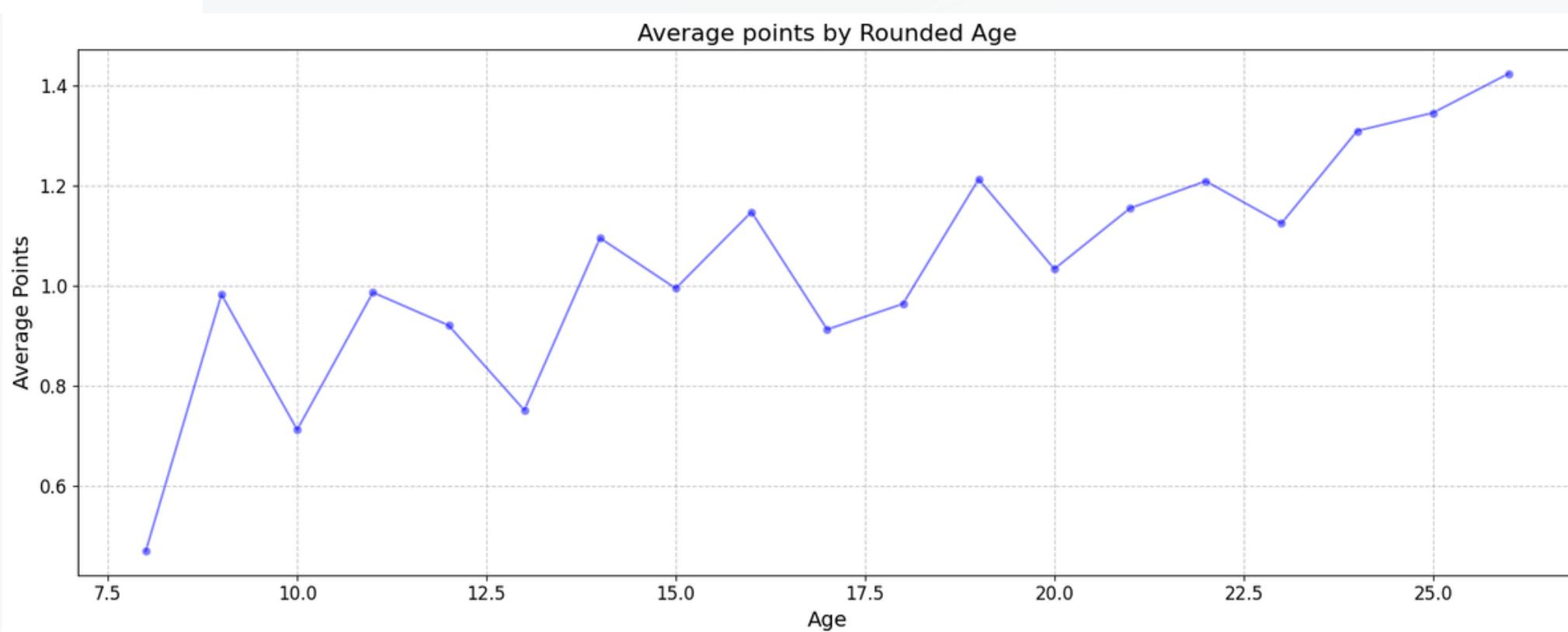
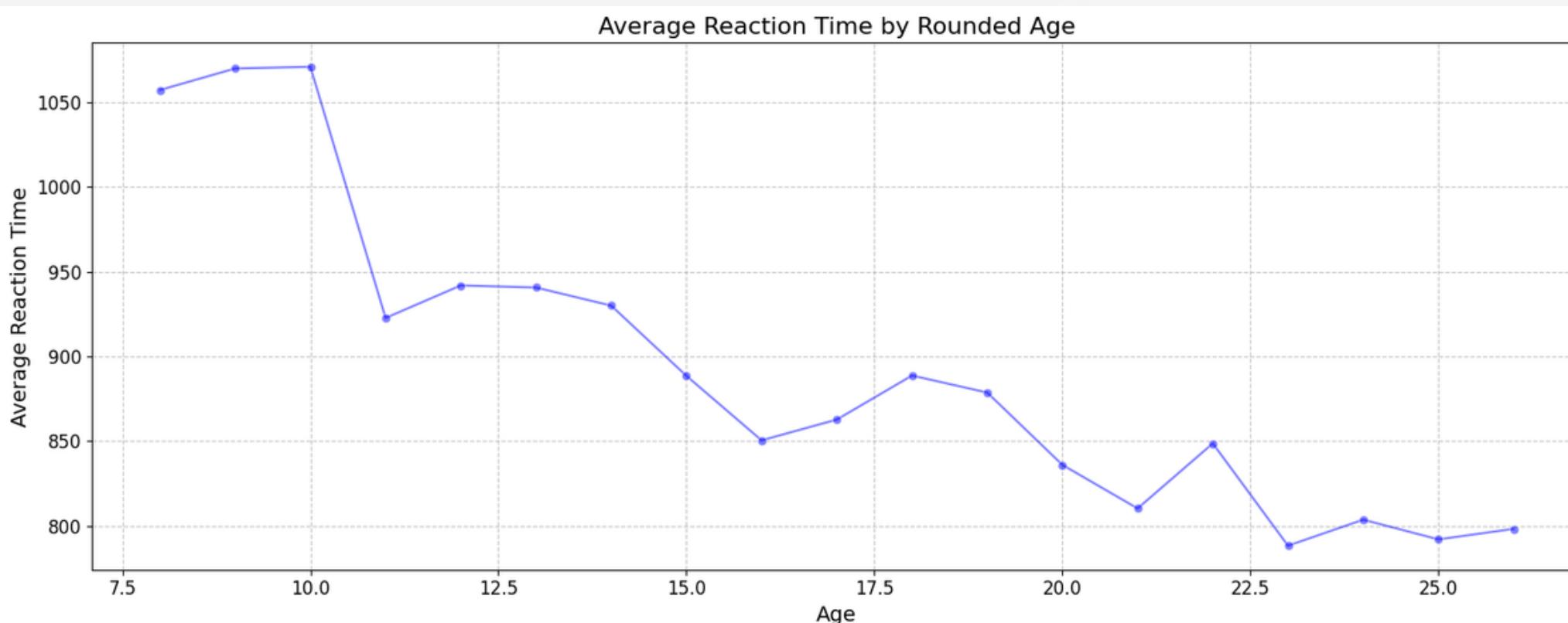
- There are 151 subjects.
- The age range is 8-25 years.
- The average age is 15.8 years .



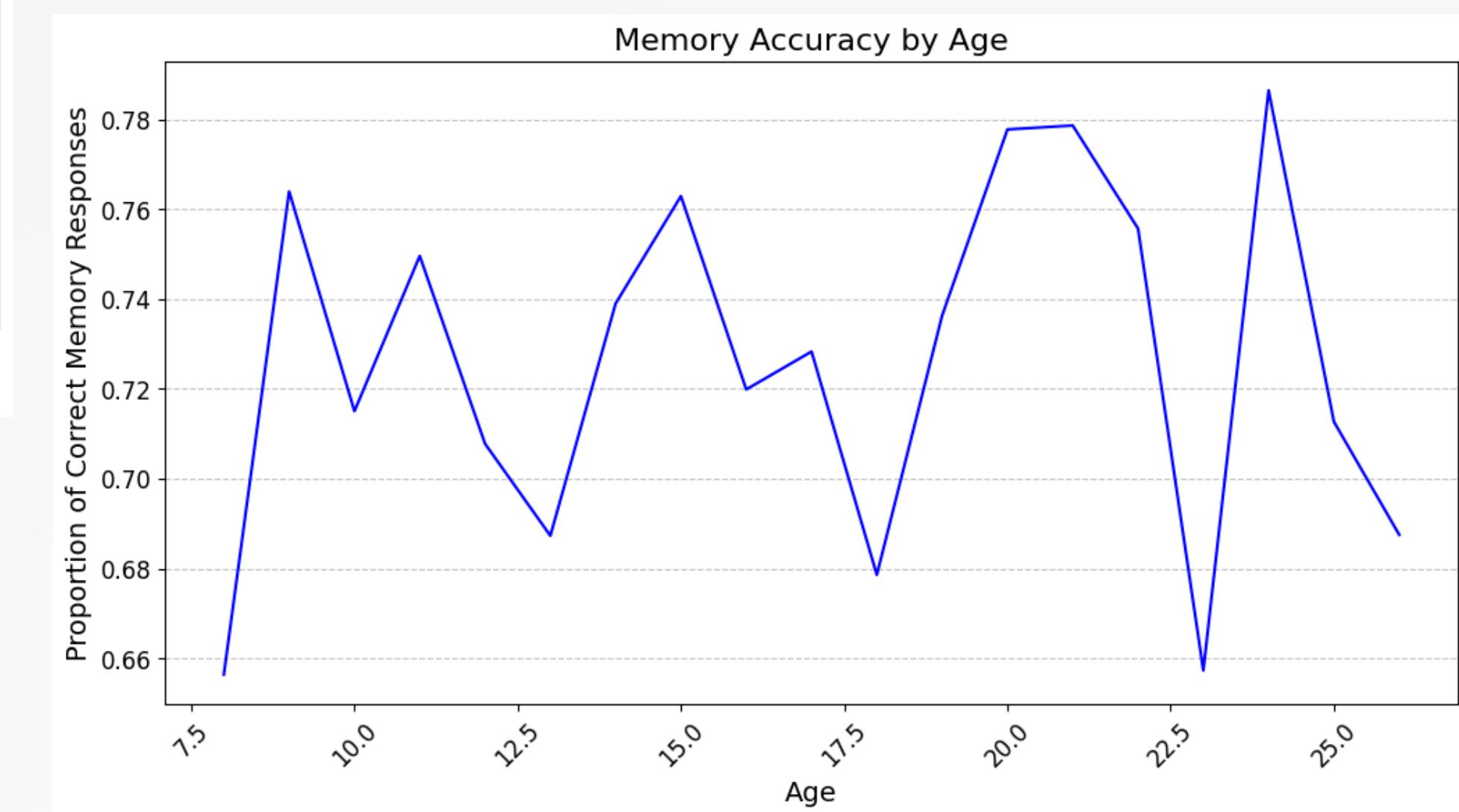
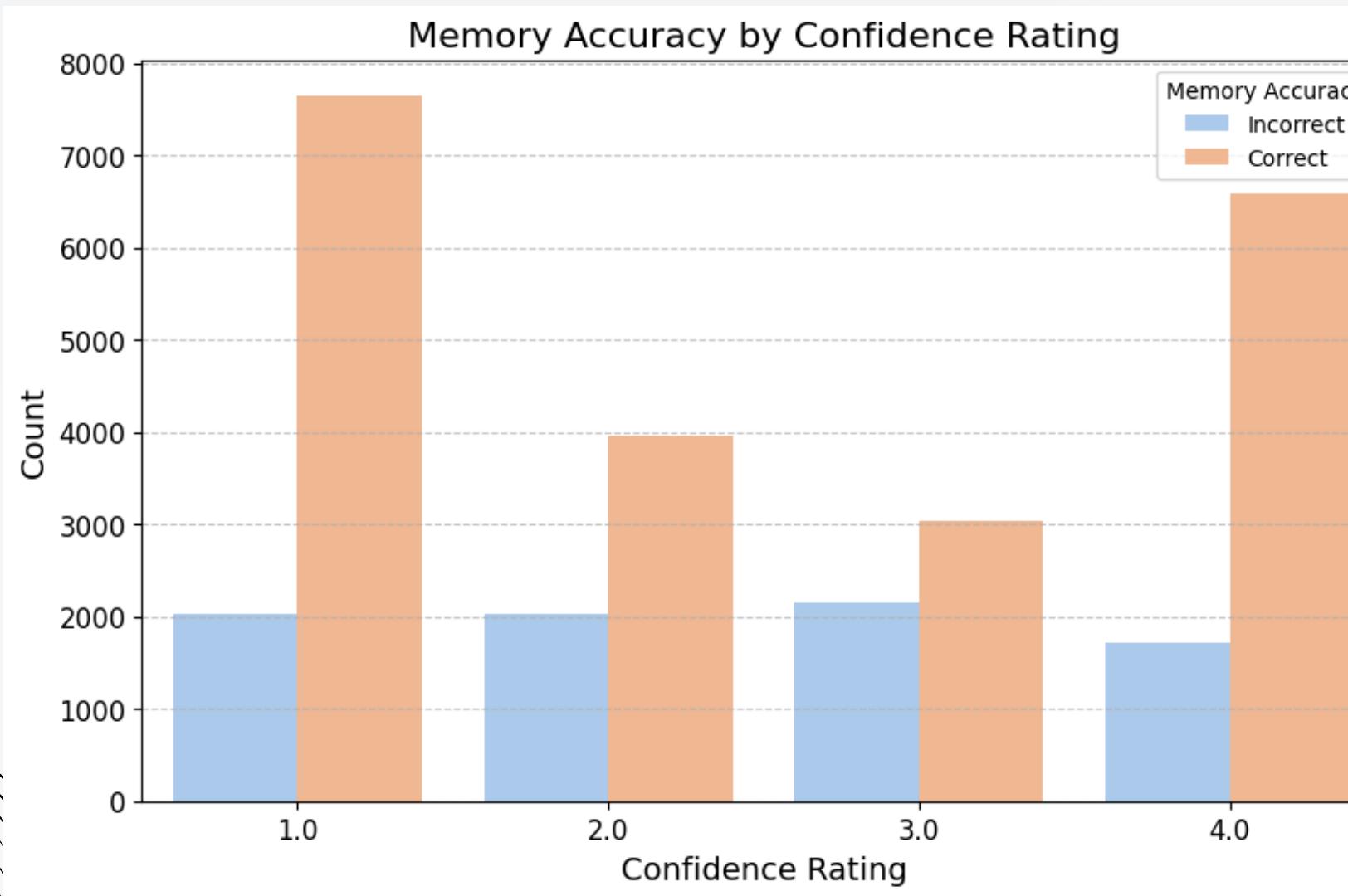
EXPERIMENT 1 : LEARNING DATA



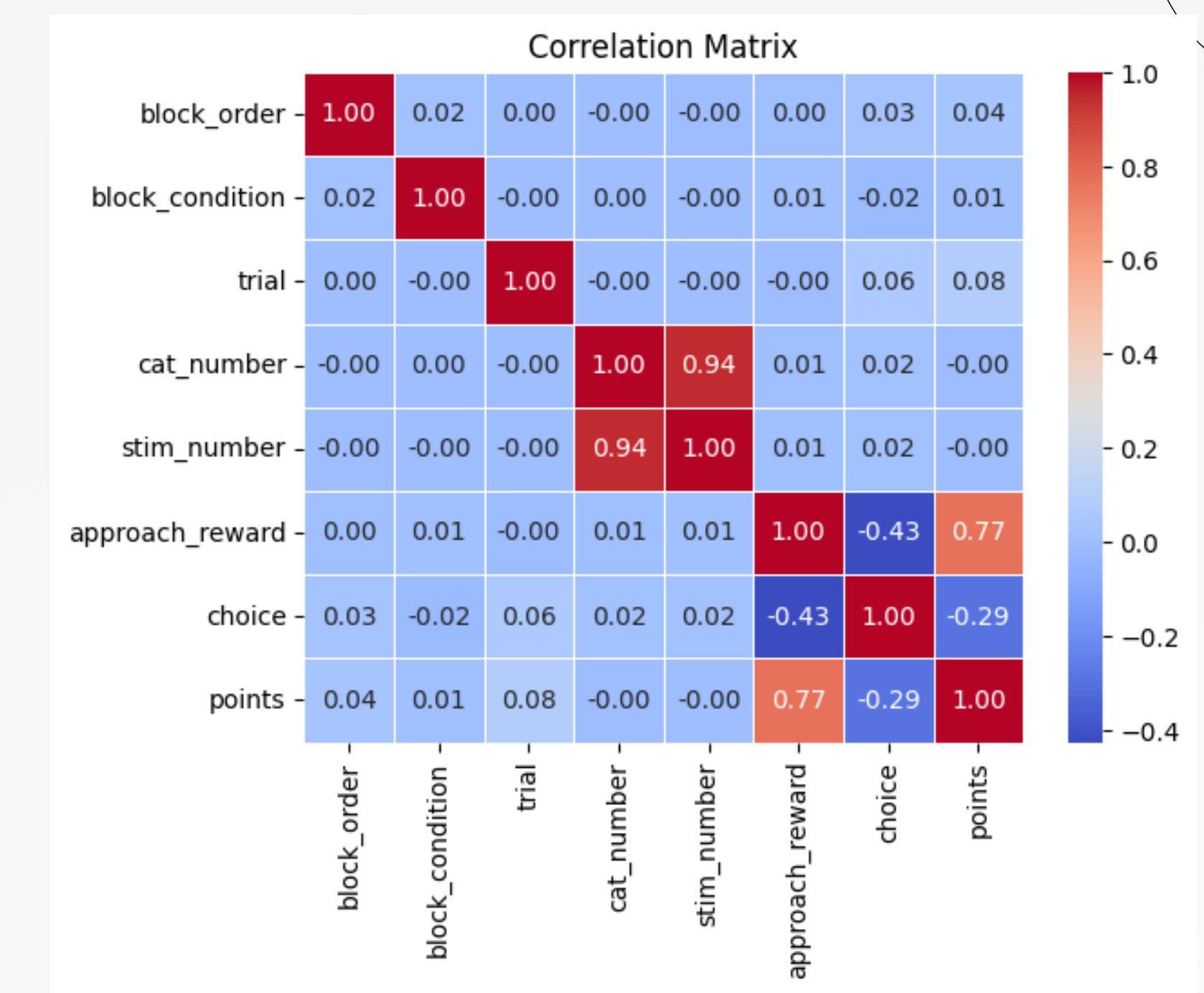
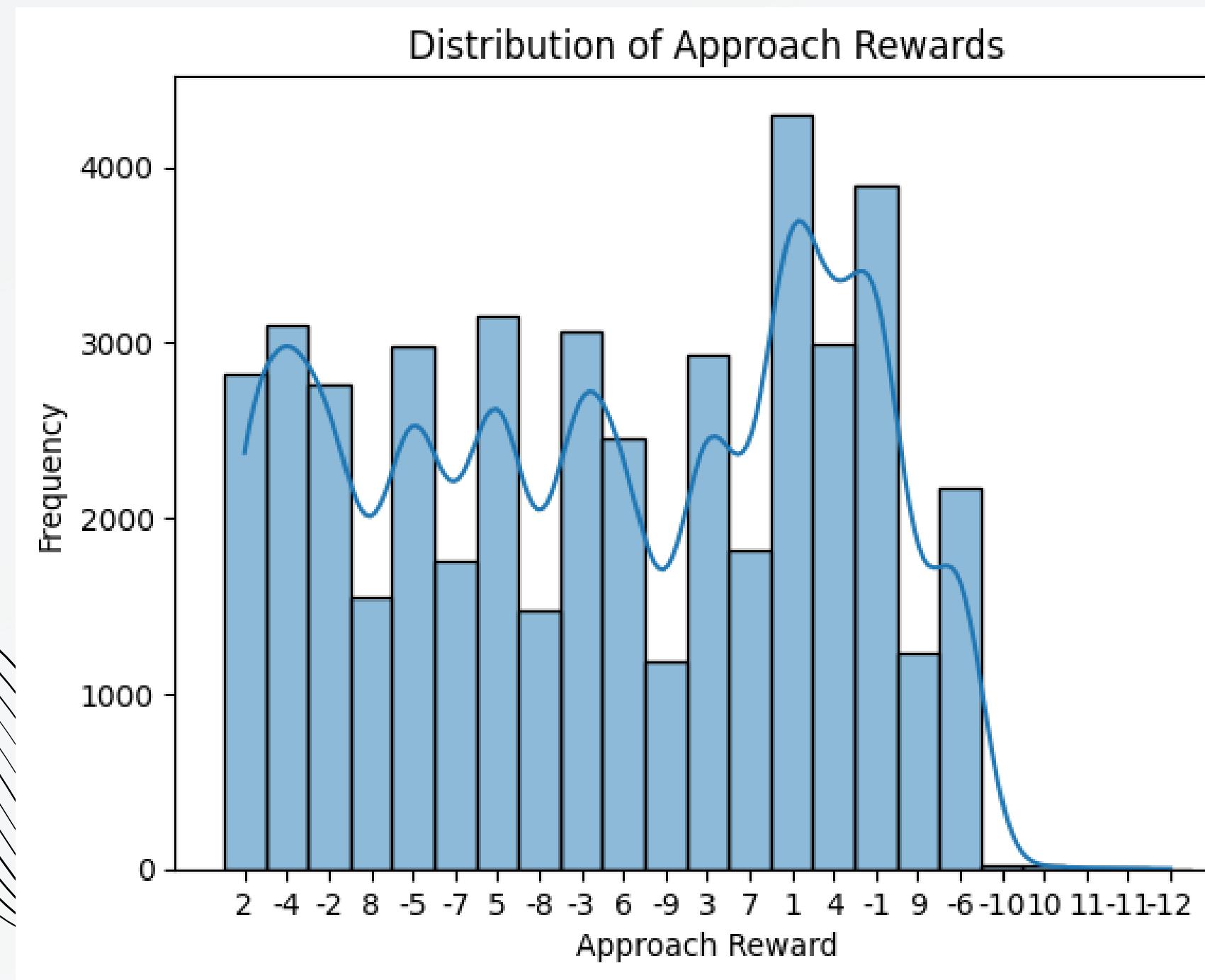
EXPERIMENT 1 : ANALYSIS ACROSS AGE

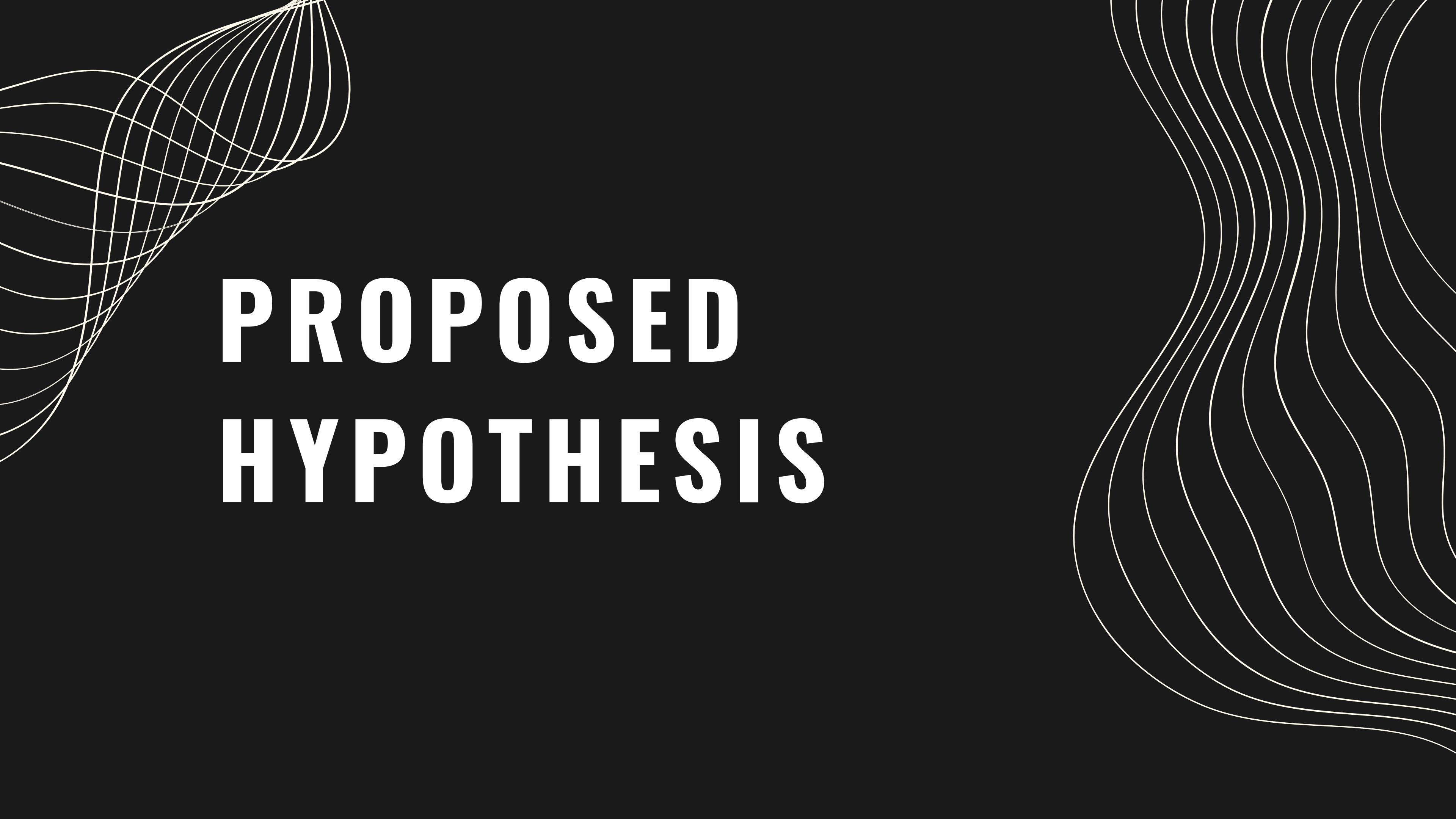


EXPERIMENT 1 : MEMORY DATA



EXPERIMENT 1 : RL DATA

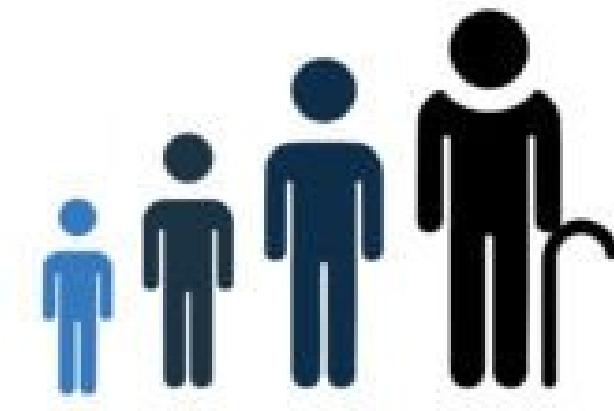




PROPOSED HYPOTHESIS

HYPOTHESES

1



Specificity in Learning Flexibility

- Participants of all ages will adapt the specificity of their information representation during value-guided learning.
- This adaptation towards more specific representations will increase with age.

Influence of Specificity on Memory

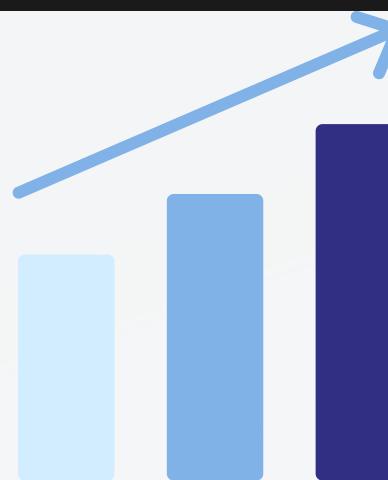
- The specificity of stimuli used during value-based choice will influence the specificity of information representation in memory.
- Specific memory for information encountered in contexts where detailed information was crucial for decision-making.

2



HYPOTHESES

3



Individual and Developmental Differences

- Individual differences in the specificity of learning computations will be reflected in subsequent memory.
- People who prioritize detailed information during learning will show corresponding enhancements in memory specificity.

Strengthening Influence with Age

- The influence of learning on memory will strengthen across development.
- Adults will demonstrate a tighter coupling between the specificity of their learning computations and subsequent memory representations compared to children and adolescents.

4





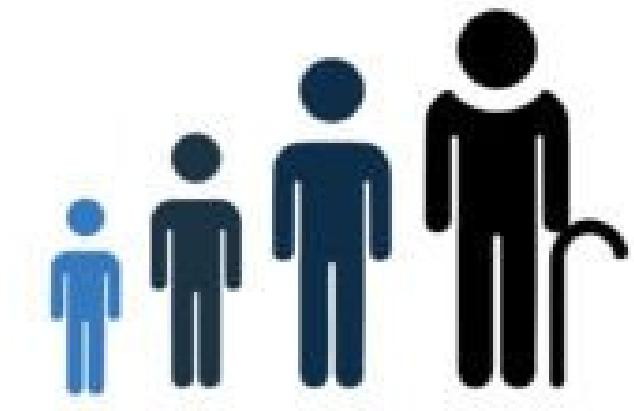
DATA ANALYSIS PLAN

HYPOTHESIS TESTING

sample test
t-test
size
hochberg correction
bonferroni correction
pearson correlation
benjamini-hochberg
cohen
whitney u test
moderation analysis

PROPOSED TESTS

1



Specificity in Learning Flexibility

- Conduct **descriptive statistics** to analyze the distribution of responses across age groups.
- **Two-sample Test:** To compare means of continuous variables between different age groups.
- **Effect Size (Cohen's d):** To quantify the magnitude of differences between age groups

Influence of Specificity on Memory

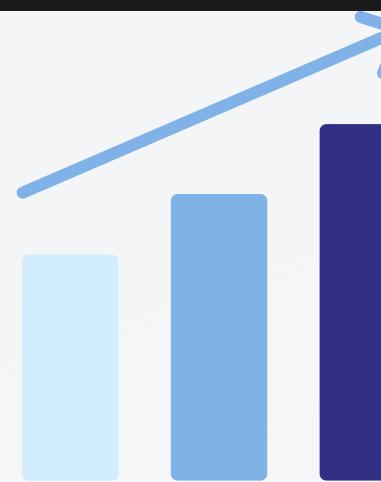
- Compute memory specificity scores based on the **proportion** of correctly recognized stimuli and confidence ratings.
- **Pearson correlation** coefficient to assess the relationship between memory specificity and specificity in decision-making.

2



PROPOSED TESTS

3



Individual and Developmental Differences

- Compare memory specificity scores across individuals with varying preferences using **Independent samples t-test**
- **Mann-Whitney U Test:** To compare memory specificity scores between individuals with different learning preferences.

Strengthening Influence with Age

- **Pearson Correlation:** To examine the relationship between age and the specificity of learning computations on memory specificity.
- **Bootstrapping or Permutation Test:** To test whether age moderates the relationship between learning specificity and memory specificity.

4



PROJECT TIMELINE



FEBRUARY

- Define Project Objectives
- Initial EDA
- Data Cleaning
- Start Hypothesis 1 Testing

MARCH

- Complete Hypothesis Testing for 1, 2 and 3
- Create visualizations to illustrate key results

APRIL

- Complete Hypothesis Testing for 4
- Incorporate feedback from Instructors
- Prepare final presentation and report

THANK YOU

TEAM REWARD

Shreeya Singh

Srujana Vanka

Hariharan Kalimutuu

