The Effect of Semantic Congruency on Object-in-Context Memory

Kyle Young[1], Valerie Sainterant[2] and Dr. Chris Martin[1,2]

[1]Department of Psychology, Florida State University, [2]Program in Neuroscience, Florida State University

Introduction

• Semantic memory enables the retention of conceptual knowledge concerning various aspects of our environment.

• Consequently, when confronted with items that deviate from or are incongruent with our established knowledge, we often spend considerable time and effort in attempting to process this contradictory information.

• This study aims to assess the role of eye tracking in enhancing our comprehension of decision-making processes when individuals are exposed to congruent or incongruent stimuli.

Hypotheses:

1. We hypothesize that participants will fixate more on the objects in the incongruent scene context during encoding, but that memory for objects-in-place will be better for semantically congruent stimuli.

2. We anticipate that gaze will reveal recognition indecision with increased fixations on semantically similar lures.

Background

- Semantic memory and our prior knowledge of aids us in quickly processing and remembering information about our environment.[1]
- Previous research has found that semantically congruent objects are more easily remembered as opposed to semantically incongruent objects, with a superior memory for targets in the presence of incongruent distractors.[2]
- Longer eye fixations and refixations reflect saliency and internal value when faced with competition. Eye movements reveal optimization in the decision-making process, reflecting the steps involved in sensory information accrual.[3]

Encoding and Memory Recall Tasks

Encoding Phase:

- 90 manipulated scenes (ex. Scene = Movie Theater, Beach, etc.)
- 10 trials in each different scene
- Participants categorize objects as congruent (30 scenes), mixed (30 scenes), or incongruent (30 scenes)
- Congruent condition: both objects fit the scene
- Mixed condition: only one object fits the scene, and the other one does not
- Incongruent condition: none of the objects fit the scene
- The scenes are randomized, and participants are not timed, as thorough observation is encouraged so that they are engaging with every detail of the images.

Picture1.png

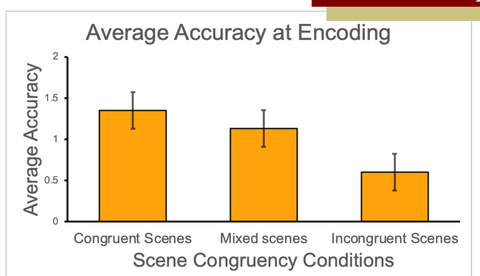
Memory Recall:

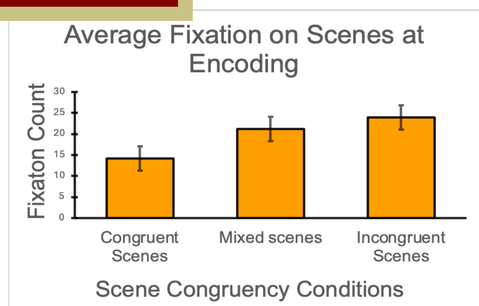
- Participants take a 5-minute break for a distractor task
- The same 90 scenes are shown, but with manipulated objects removed and replaced by a question mark.
- Participants must identify the missing object by selecting from four options: the target object, a lure object that is very similar to the target, the object that was in the other location in that scene, or an unrelated object to the scene.

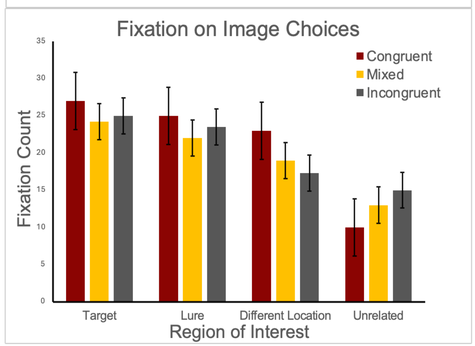
Encoding Scenes Conditions Examples

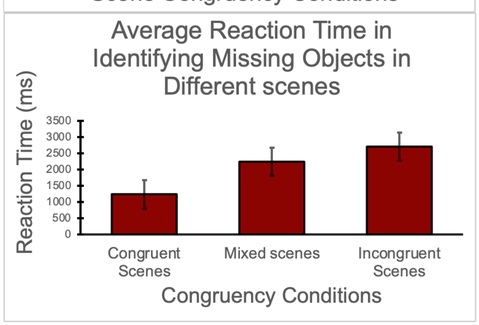
Test Scenes Conditions Examples

Anticipated Results









- We expect to see better memory recall from the congruent scenes as compared to the other scenes but expect to see higher fixations in the incongruent and mixed scenes compared to the congruent scenes.
- We anticipate to see higher fixations on target and lure images across all congruency conditions.
- We also anticipate to see an increased reaction time in identifying missing objects in the incongruent scene condition.

Discussion

- Eye tracking in this experiment can give us more insight on how individuals make decisions on challenges regarding congruencies and incongruencies in our environment
  - Eye tracking can also reveal how organizational structures work in relation to how sensory information are arranged regarding congruencies and incongruencies
- When we encounter incongruencies in our environment, it takes us longer to encode them due to lack of previous semantic knowledge
  - If data supports, this research will provide a deeper understanding of how we encode incongruent information presented.

Future Directions

1. As a future direction of this study, we hope to expand this project to test semantic memory of older adults, and if eye tracking can be used as an early detection tool to study cognitive decline
2. We hope to incorporate this stimuli into an fMRI research looking at the medial temporal lobe integrity, specifically activation in the antero-lateral (alERC) and posterior-medial entorhinal (pmERC) cortices.
   -previous research has shown alERC and pmERC are important for object related features and spatial memory representations[4]

References

[1]Bein, O et al. (2015). *Delineating the effect of Semantic Congruency on episodic memory: The role of integration and relatedness.*

[2]Laurent, X., Estévez, A. F., & Marí-Beffa, P. (2020). *Evidences for better recall of congruent items in episodic memory*

[3]Spering, M. (2022) *Eye Movements as a Window into Decision-Making*

[4]Schultz, H., Sommer T., & Peters J. (2015) *The Role of Human Entorhinal Cortex in a Representational Account of Memory*

Florida State University
cmartin@psy.fsu.edu