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Familiarity-Based Object Recognition: A Continuous Recognition Task

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Familiarity-Based Object Recognition: A Continuous Recognition Task

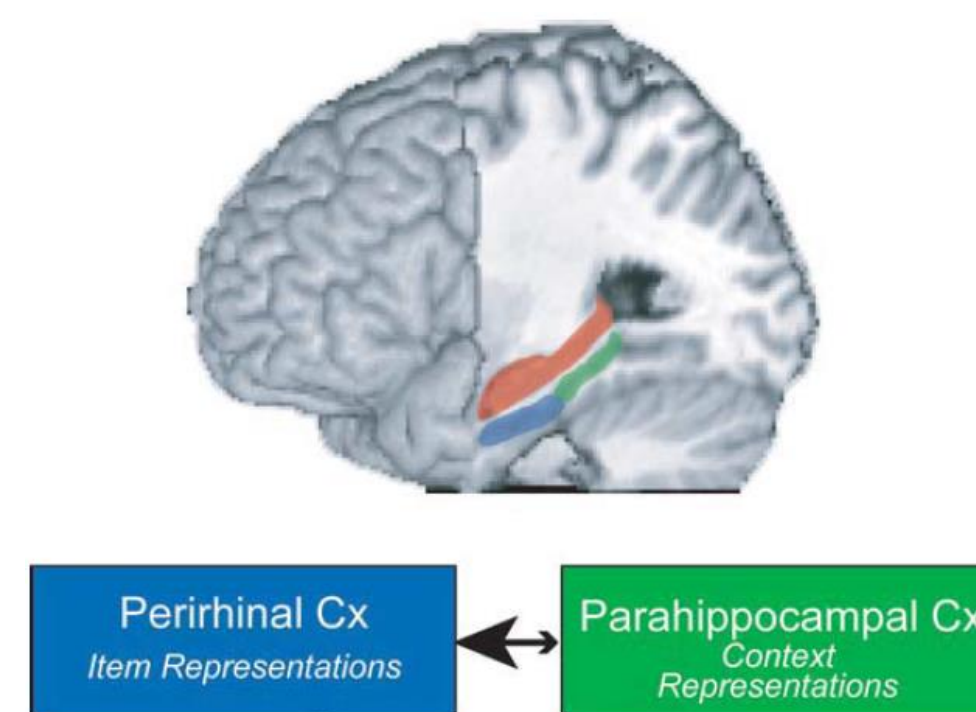
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Abstract

Previous evidence suggests that familiarity of items may be represented in perirhinal cortex (PrC) and parahippocampal cortex (PhC), with item categories being represented in one area more strongly than the other. The stimuli properties of these categories are thought to play a role in this differential association. The present study used a continuous recognition task to create a paradigm that will be used in a future imaging study to examine the representational structure of item-based familiarity signals in PrC and PhC, as a function of varying stimulus dimensions. Our findings suggest that the fourth version of the experiment is best for the imaging study.

Introduction

- Recognition memory is the ability to recognize stimuli that have been previously encountered and is divided into recollection and familiarity (Eichenbaum et al., 2007)
- Previous fMRI evidence suggests that item-based familiarity is associated with perirhinal cortex (PrC) while contextual recollection is associated with parahippocampal cortex (PhC) (Ranganath, 2010)
- However, recent evidence has shown that familiarity signals may occur in PrC or PhC based on the class of object (Martin et al., 2013)
- Previous evidence has found a difference in neural representations across animacy, and real-world size for inanimate items (Konkle & Caramazza, 2013)
- The different classes of objects are thought to mediate where the familiarity signal is localized during recognition (Martin et al., 2013)



Purpose

- To develop a recognition memory paradigm that will ultimately be used to characterize the representational structure of familiarity signals in PrC and PhC
- Iterative refinement of this paradigm to ensure:
 - Recognition is primarily familiarity-based
 - Overall memory performance significantly above chance
 - Performance is matched between categories

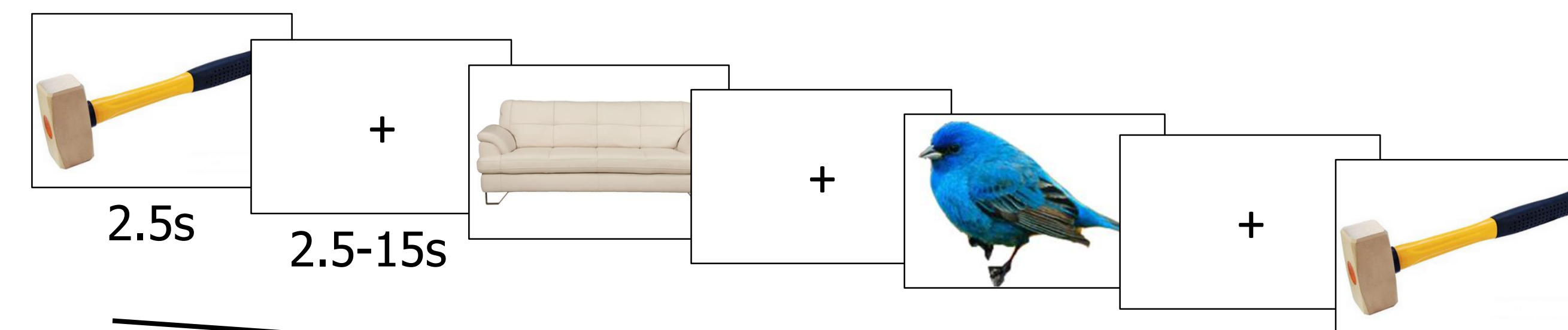
Method

Participants

- Thirty-nine subjects participated in the study (22 females, 17 males; age M = 19, SD = 1.59)

Design

Continuous Recognition Task

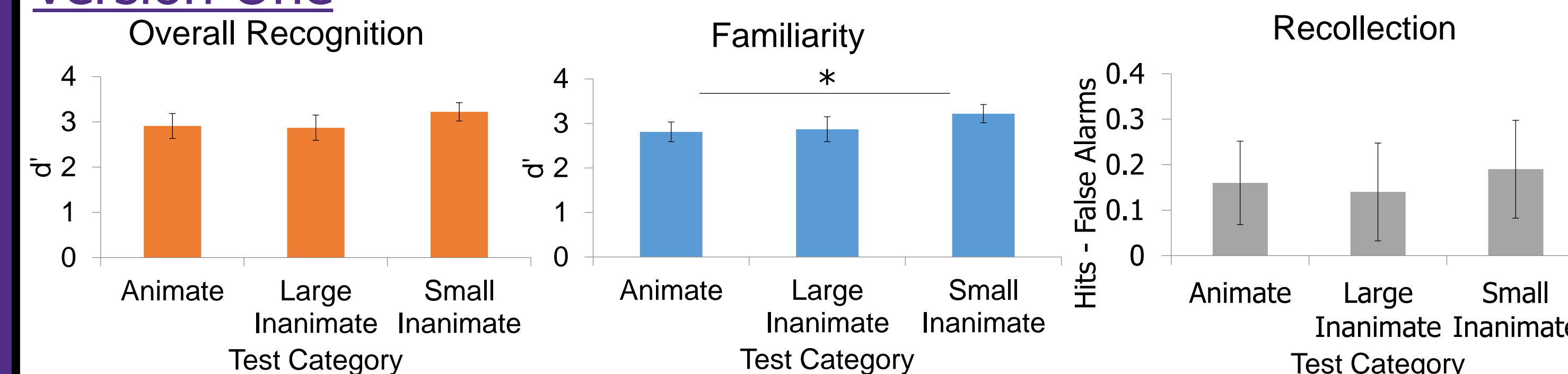


Recognition Response

- Sure novel
 - Unsure novel
 - Unsure familiar
 - Sure familiar
 - Recollection
- Stimuli consisted of animate, large and small inanimate items

Results

Version One

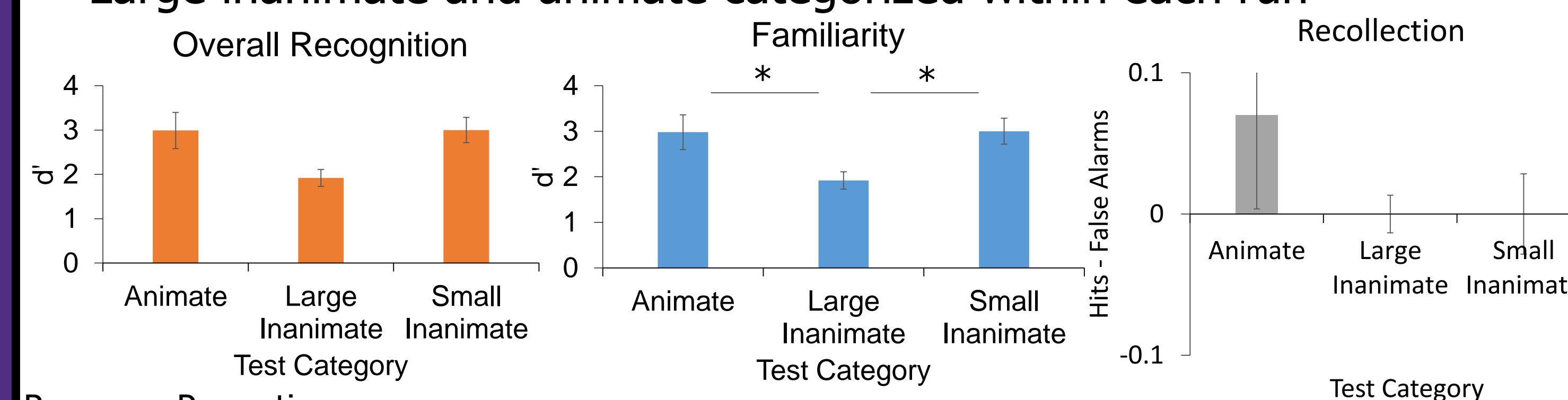


Response Proportions

Test Category	Novel					Studied				
	N1	N2	F1	F2	R	N1	N2	F1	F2	R
Animate:	0.86	0.08	0.02	0.02	0.02	0.09	0.08	0.14	0.52	0.18
Large Inanimate:	0.81	0.07	0.05	0.03	0.03	0.05	0.07	0.15	0.55	0.18
Small Inanimate:	0.93	0.04	0.01	0.01	0.01	0.08	0.06	0.17	0.48	0.20

Version Two

- Item presentation changed from 2.5s to 1.5s
- Large inanimate and animate categorized within each run



Response Proportions

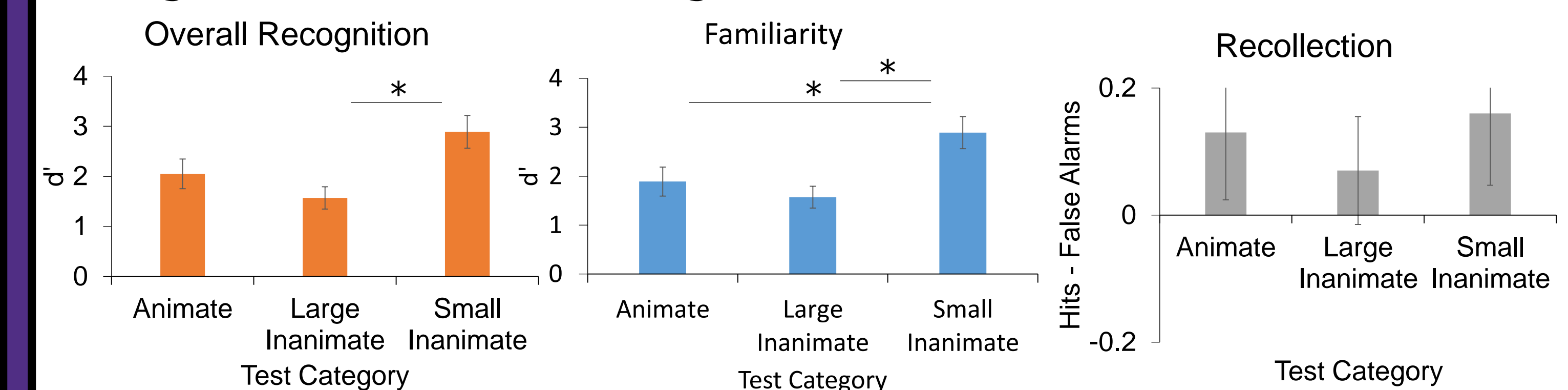
Test Category	Novel					Studied				
	N1	N2	F1	F2	R	N1	N2	F1	F2	R
Animate:	0.83	0.07	0.04	0.05	0.01	0.13	0.04	0.07	0.68	0.08
Large Inanimate:	0.74	0.09	0.07	0.10	0.01	0.14	0.06	0.10	0.69	0.01
Small Inanimate:	0.92	0.02	0.02	0.02	0.02	0.12	0.02	0.06	0.76	0.04

References

- Eichenbaum, H., Yonelinas, A.P., & Ranganath, C. (2007). The medial temporal lobe and recognition memory. *Annual Review of Neuroscience*, 30, 123-152.
- Konkle, T. & Caramazza, A. (2013). Tripartite organization of the ventral stream by animacy and object size. *Journal of Neuroscience*, 33(25), 10235-10242.
- Martin, C.B., McLean, D.A., O'Neil, E.B., & Köhler, S. (2013). Distinct familiarity-based response patterns for faces and buildings in perirhinal and parahippocampal cortex. *Journal of Neuroscience*, 33(26), 10915-10923.
- Ranganath, C. (2010). A unified framework for the functional organization of the medial temporal lobes and the phenomenology of episodic memory. *Hippocampus*, 20, 1263-1290.

Version Three

- Large inanimate stimuli changed for four runs

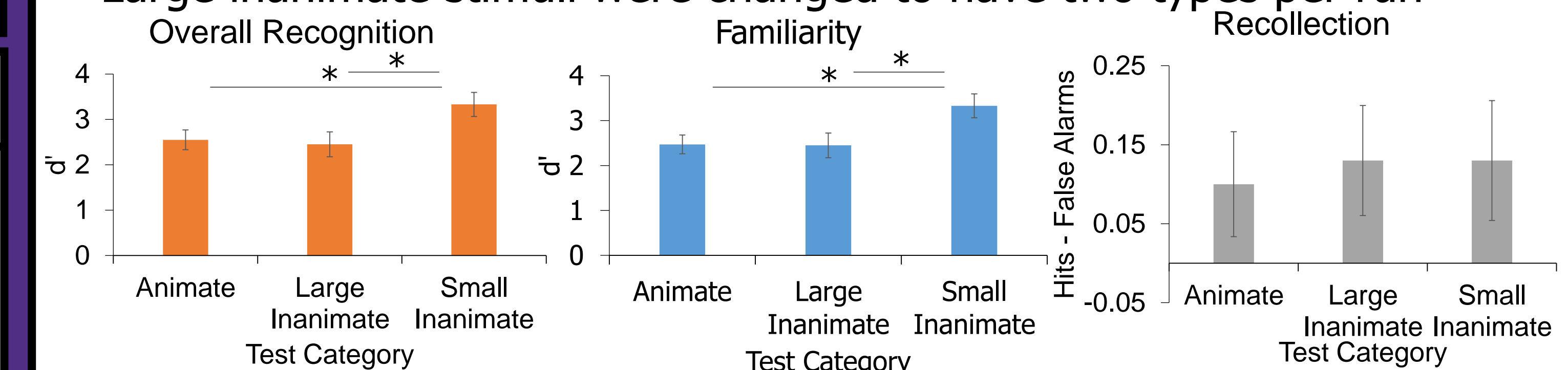


Response Proportions

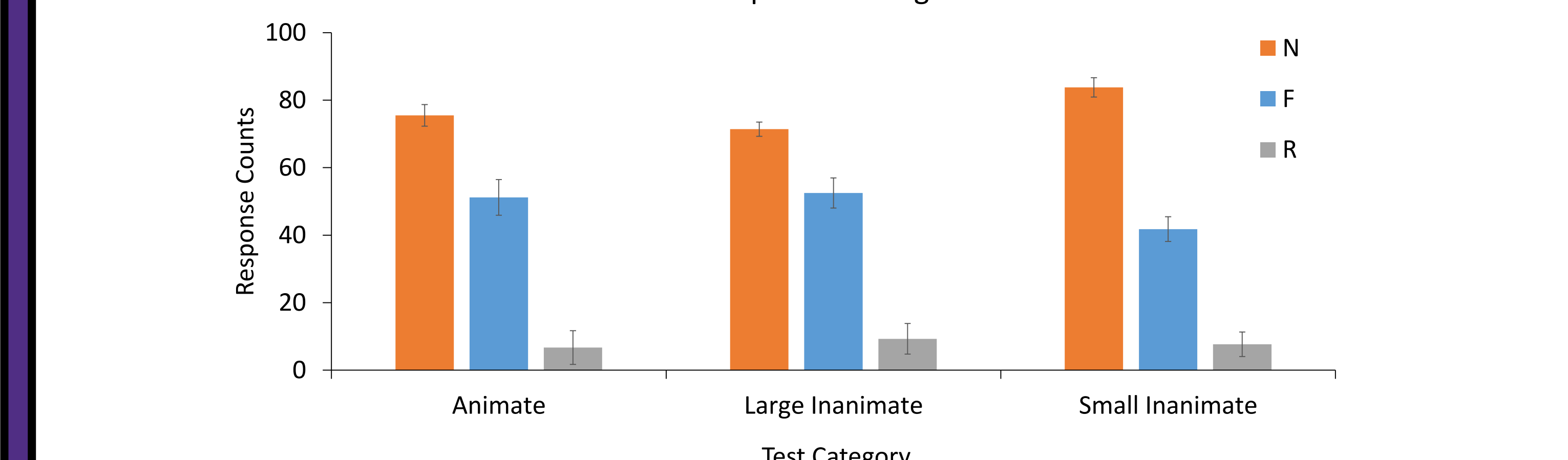
Test Category	Novel					Studied				
	N1	N2	F1	F2	R	N1	N2	F1	F2	R
Animate:	0.78	0.07	0.03	0.08	0.03	0.17	0.04	0.06	0.54	0.19
Large Inanimate:	0.61	0.06	0.05	0.21	0.06	0.13	0.05	0.10	0.56	0.17
Small Inanimate:	0.87	0.05	0.02	0.04	0.02	0.14	0.02	0.04	0.61	0.19

Version Four

- Large inanimate stimuli were changed to have two types per run



Overall Response Averages



Response Proportions

Test Category	Novel					Studied				
	N1	N2	F1	F2	R	N1	N2	F1	F2	R
Animate:	0.85	0.01	0.01	0.12	0.01	0.11	0.01	0.02	0.76	0.12
Large Inanimate:	0.81	0.01	0	0.17	0.01	0.11	0.01	0.02	0.72	0.15
Small Inanimate:	0.96	0	0	0.03	0	0.12	0	0	0.74	0.14

* indicates $p < .05$

Conclusions

- Version Four of the experiment is the ideal version to use as a paradigm for the future imaging study
- Recognition is primarily familiarity-based with Version Four, with an optimal number of recollection responses
- Overall recognition and familiarity are significantly above chance ($d' = 0$) for all versions
- Further refinement may be necessary to reduce performance on small inanimate stimuli