

Lingering effects of response inhibition: Evidence for both control settings and memory association mechanisms

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Question

How does response inhibition affect subsequent processing?

Background

Response inhibition

Withholding an automatic or already initiated response¹

Performance slowed following response inhibition¹

Two main hypotheses about the time course of response inhibition

1. Memory associations^{1,2}

- Association between “inhibit” and the stimulus that appeared during that trial
- When *that* stimulus reappears, the “inhibit response” goal is recalled

2. Adjustments in control settings³

- Response inhibition triggers switch to “inhibition mode”
- “Inhibition mode” carries over to subsequent trials

Current Questions

How does response inhibition influence subsequent visual search?

What is the time course of that effect?

Are the aftereffects of response inhibition driven by memory associations and/or adjustments in control settings?

Methods

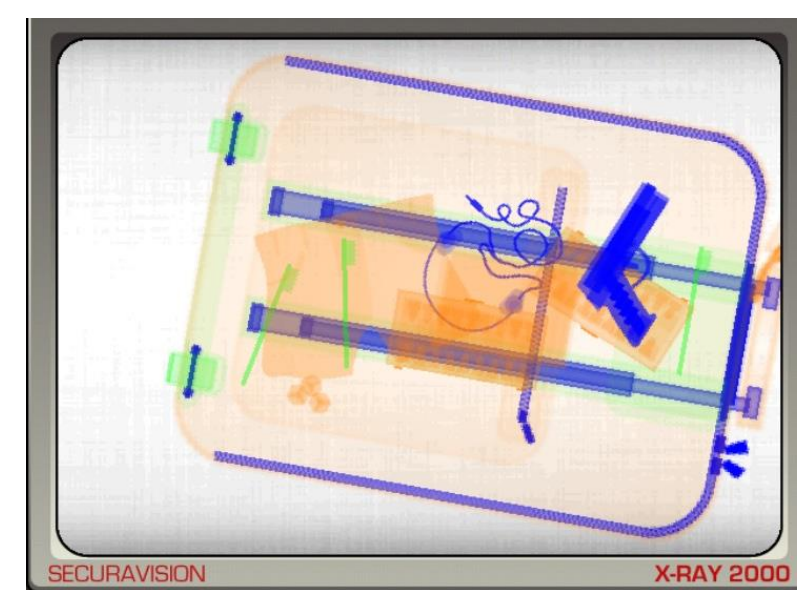
Airport Scanner

General Facts

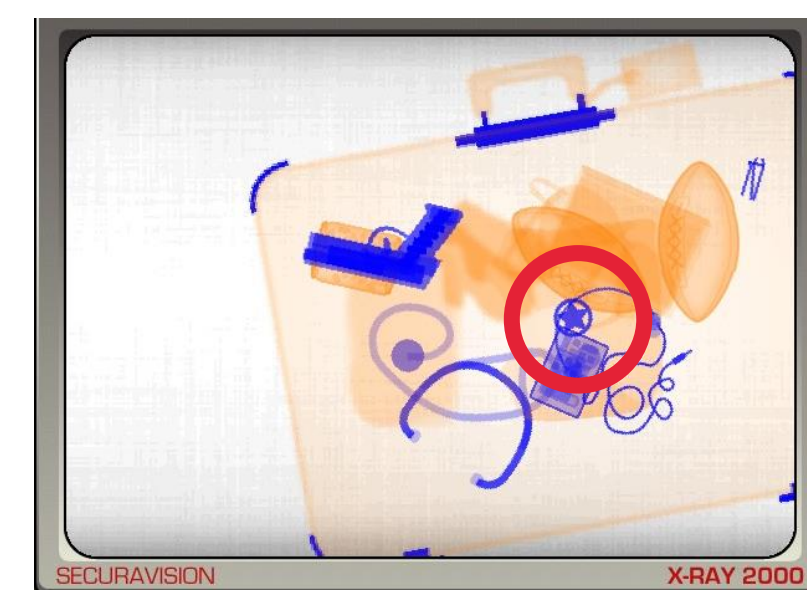
- Visual search mobile game app⁴
- Search for prohibited items
- Massive dataset – 39,750 individuals contributed data to this project

Key Trial Types

Search



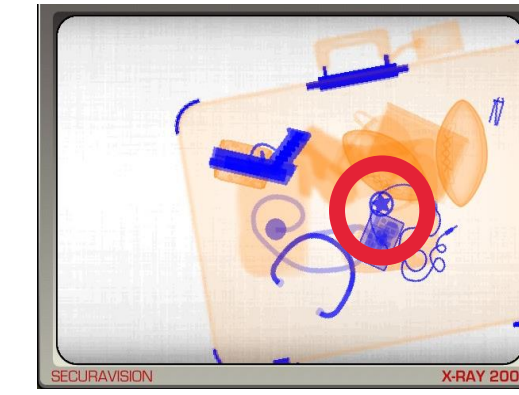
Response Inhibition



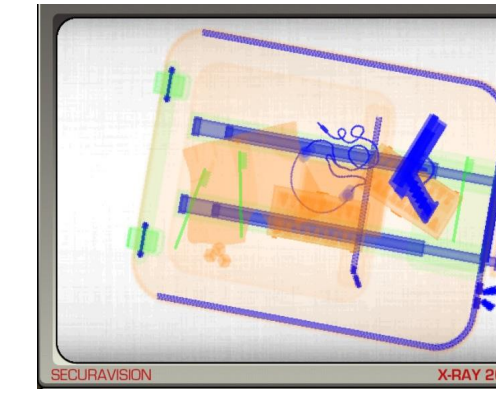
- Targets in ~50% of bags
- Use a finger tap to identify the item
- “Air Marshal” bags
- Indicated by a star badge
- Withhold the finger tap
- <3% of trials

Anchor

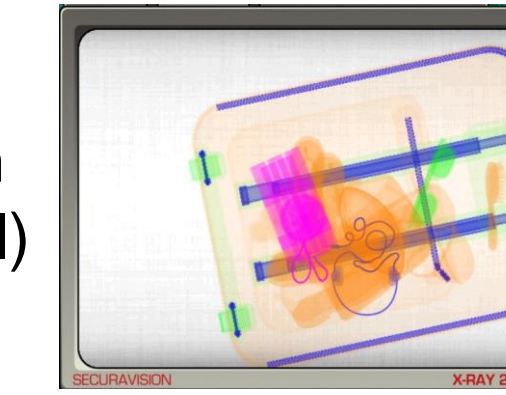
Air Marshal (Inhibition)



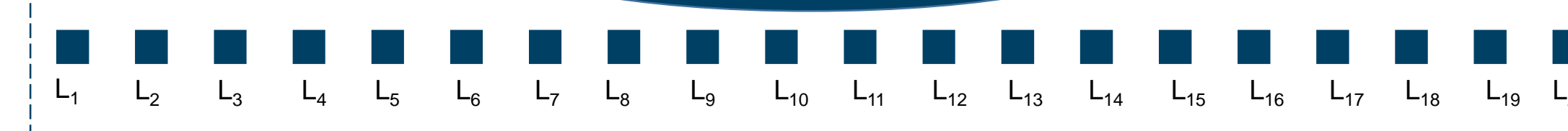
Pistol Search (Baseline for big bomb)



Big Bomb Search (Baseline for pistol)



Variable Lag



Trials of Interest

All lags individually examined
Response time and hit rate recorded

Pistol



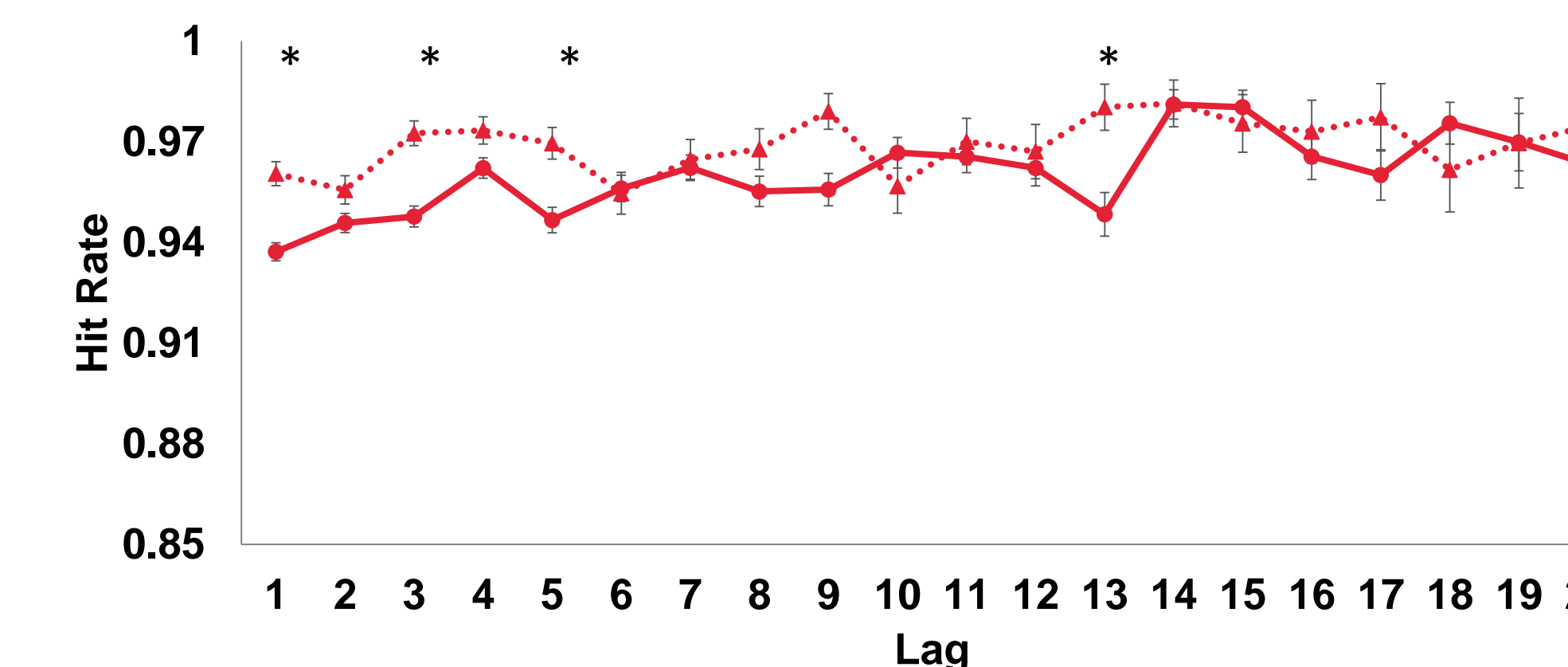
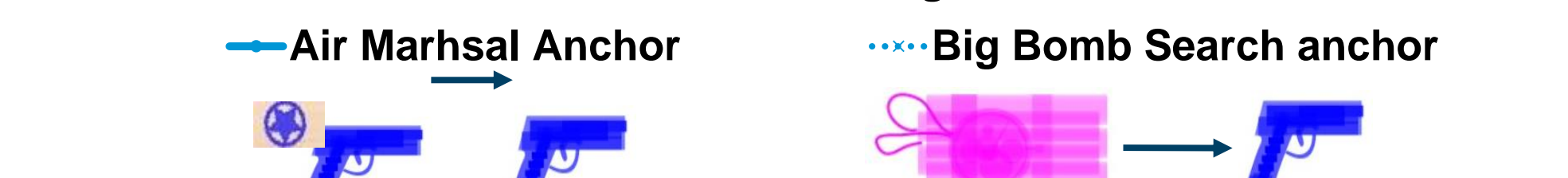
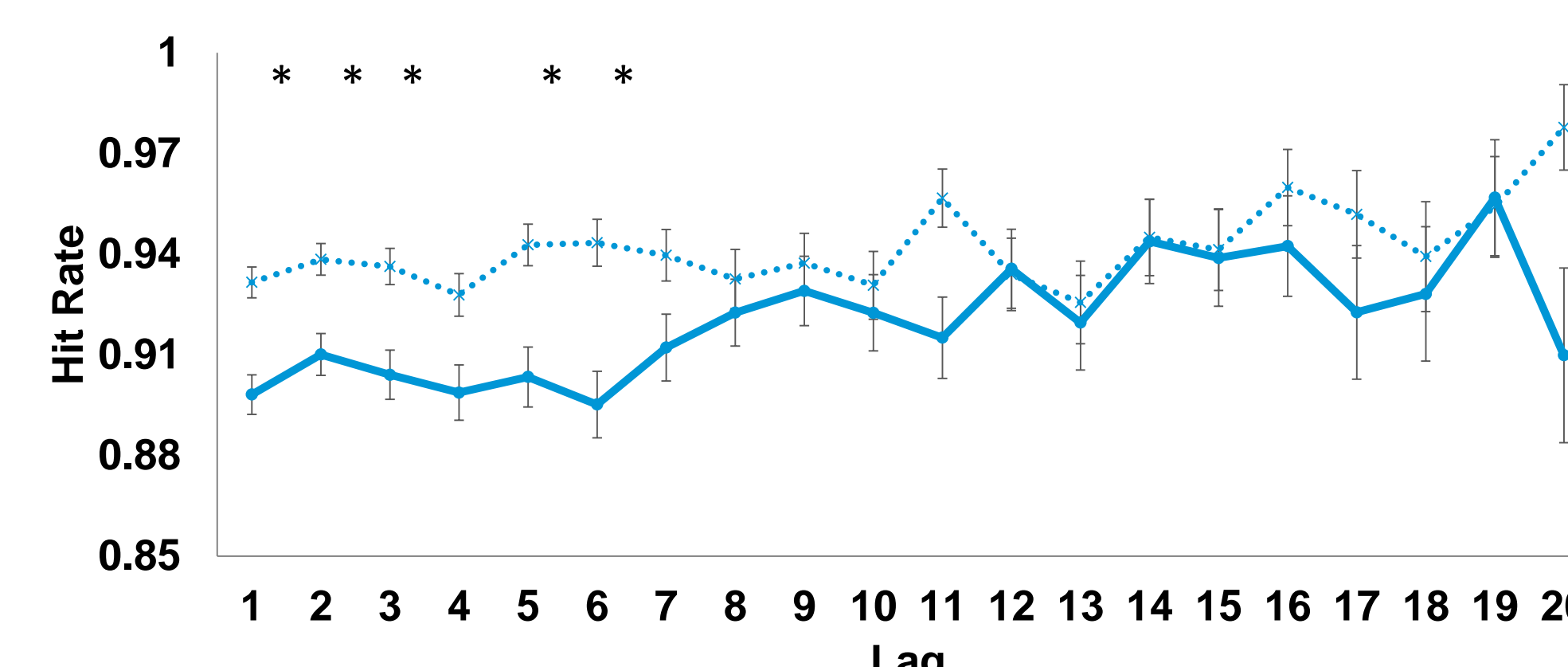
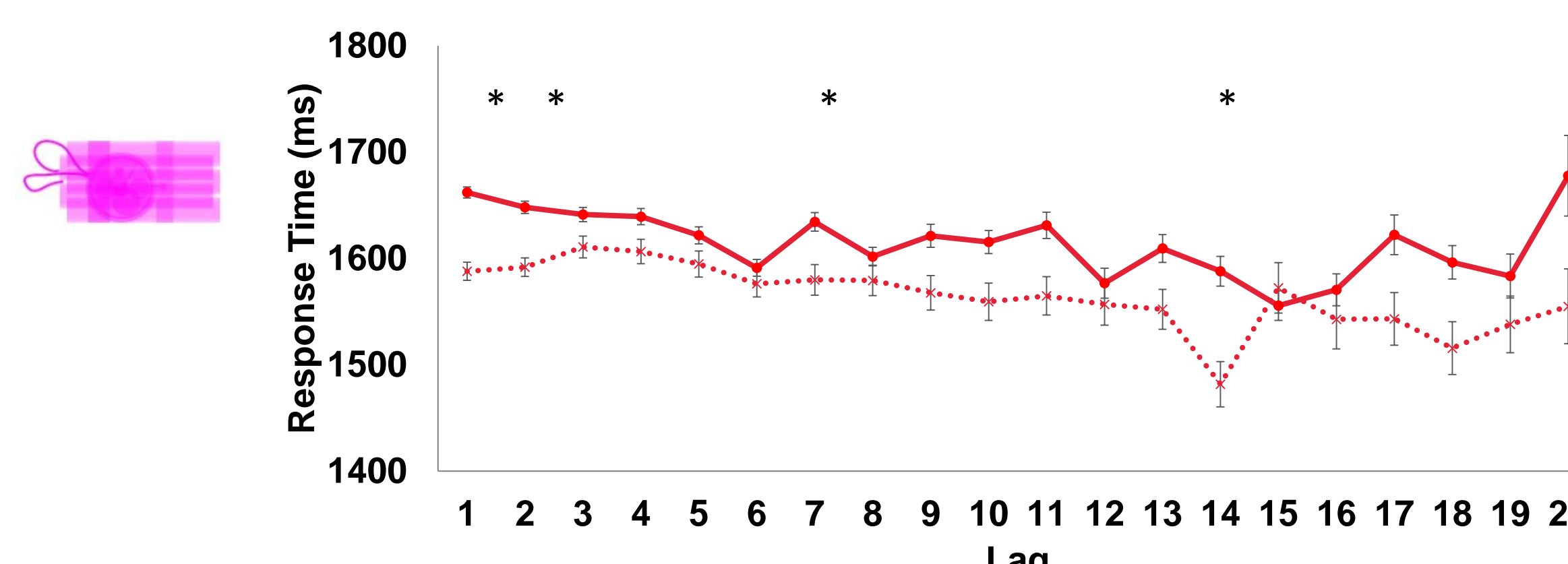
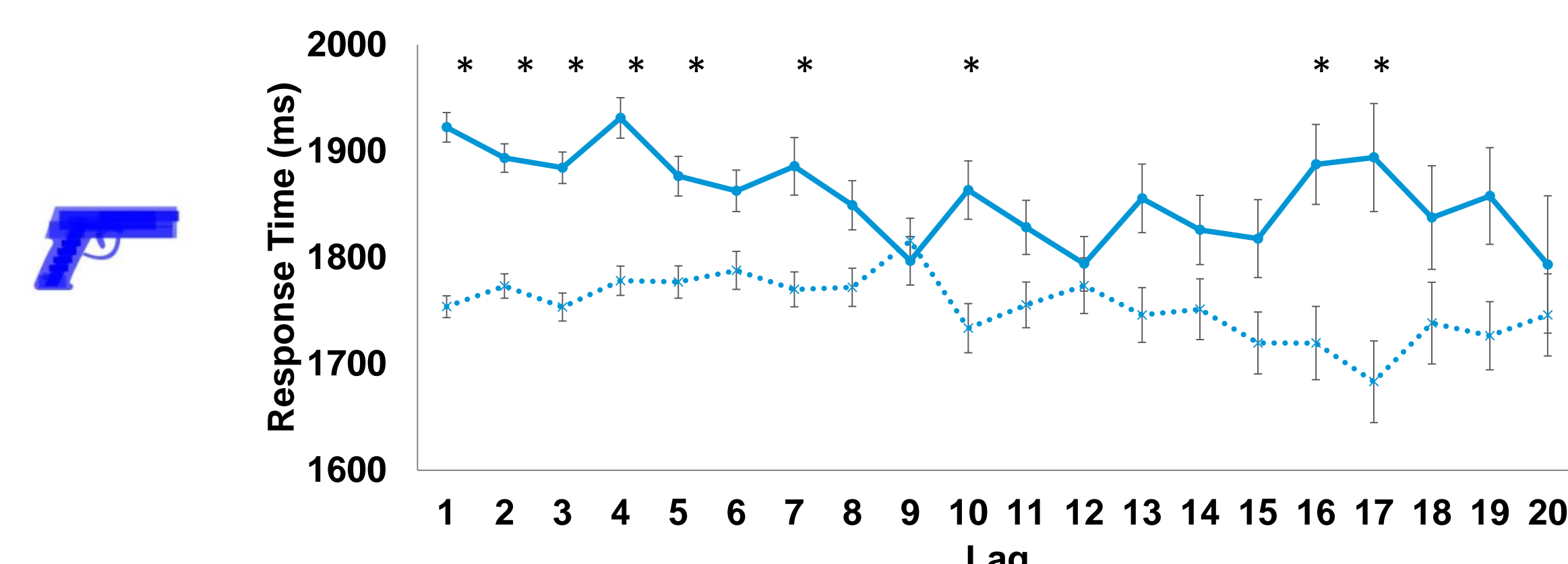
- Inhibited during Air Marshal trials
- 3.7% of overall trials, 92% accuracy
- Examined after pistol air marshal and big bomb search anchors

Big Bomb



- Never inhibited
- 3.6% of overall trials, 92% accuracy
- Examined after pistol air marshal and pistol search anchors

Results



Memory Associations

Response time reliably longer out to lag 7
Hit rate lower out to lag 7
Relatively large effect

Control Setting Adjustments

Response time reliably longer for lags 1 & 2
Hit rate lower for early lags
Relatively small effect

Discussion

Both memory associations and control setting adjustments influence visual search following response inhibition but on different timescales

- Memory associations have a prolonged, relatively large effect
- Control settings have a transient, relatively small effect

Next Steps

- Increase stability with full dataset (~10x more data)
- Examine additional influences on response inhibition interference:
 - Item-specific (e.g., shape, color, category)
 - Position-specific (e.g., rotation, location)
 - Context (e.g., previous experience with the items)
 - More? (tell us your favorite possible contributing factor!)

References | Funding

1. Rieger, M., & Gauggel, S. (1999). Inhibitory aftereffects in the stop signal paradigm. *British Journal of Psychology*, 90, 509-518. doi:10.1348/000712699151585

2. Verbruggen, F., & Logan, G. D. (2008). Long term aftereffects of response inhibition: Memory retrieval, task goals, and cognitive control. *Journal of Experimental Psychology: Human Perception and Performance*, 34(5), 1229-1235. doi: 10.1037/0096-1523.34.5.1229

3. Botvinick, M.M., Braver, T.S., Barch, D.M., Carter, C.S., & Cohen, J.D. (2001). Conflict monitoring and cognitive control. *Psychological Review*, 108, 624-652. doi:10.1037/0033295X.108.3.624

4. Kedin Co., www.airportscannergame.com