

## Introduction

- Associative inference is the ability to indirectly link two elements across related experiences based on their shared commonalities.<sup>1</sup>
- This ability has been shown to be supported both by distinct, pattern separated memories, or integrated memories. The order in which information is studied can bias whether learned episodes become integrated or separated.<sup>1,2</sup>
- Prior research shows that associative inference develops in adolescence and is linked to hippocampal structure, but little is known about how it changes as individuals enter older adulthood, a period marked by cognitive decline.<sup>3,4</sup>
- This study explores whether blocked learning sequences can support memory and associative inference in older adults by reducing interference and promoting memory integration.

## Research Question

How do different learning sequences impact both direct memory and associative inference in older adults?

## Data

### Participants:

- 71 older adults, all right-handed (34 for blocked condition, 37 for interleaved)
- Recruited online via Prolific

### Task & Stimuli:

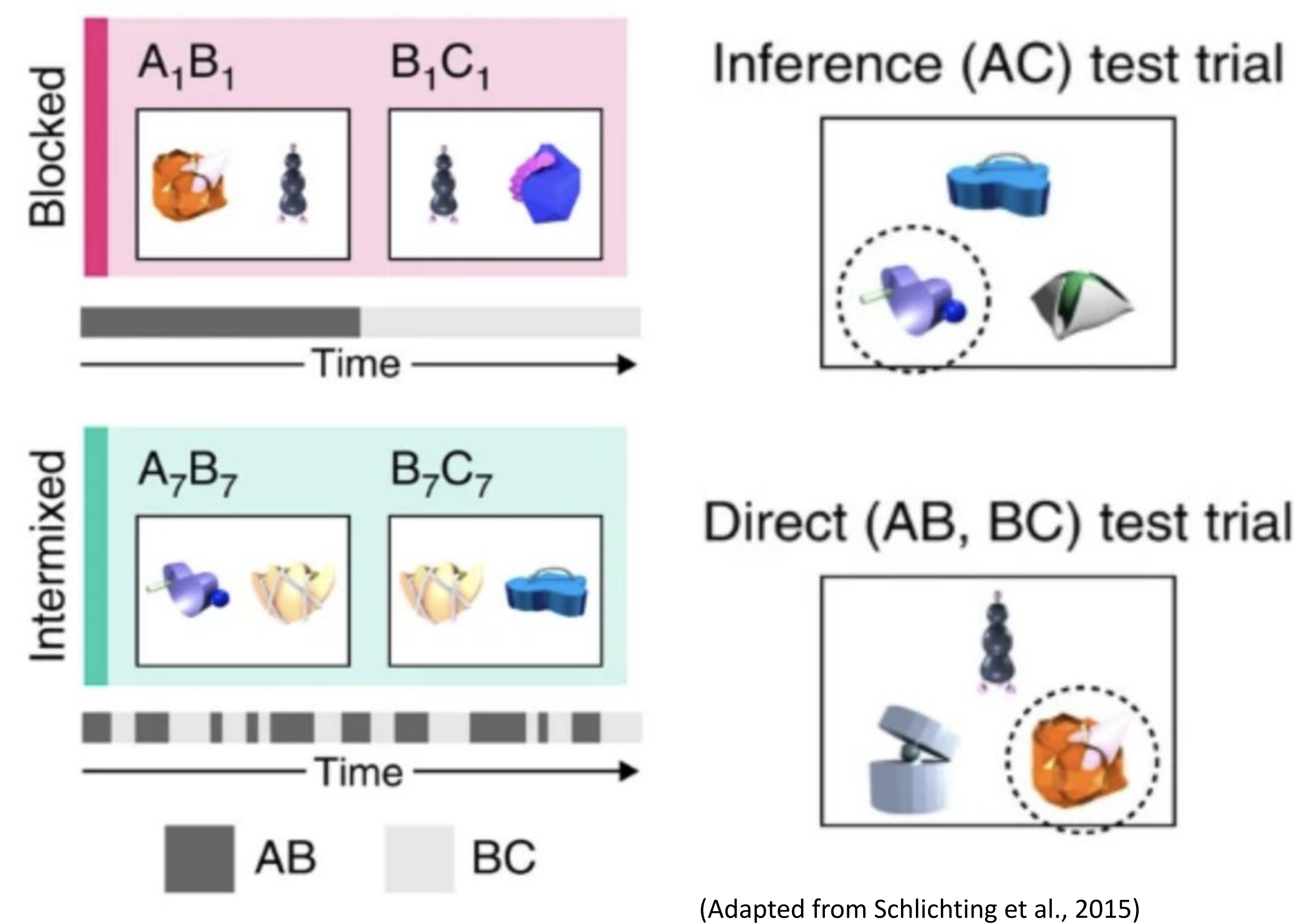
- Participants learned 12 ABC triads using 36 abstract 3D objects (Blender)
- Blocked: A–B pairs learned first, then B–C
- Interleaved: A–B and B–C mixed
- Final tests included direct memory and indirect A–C inference (forced choice)

### Analysis:

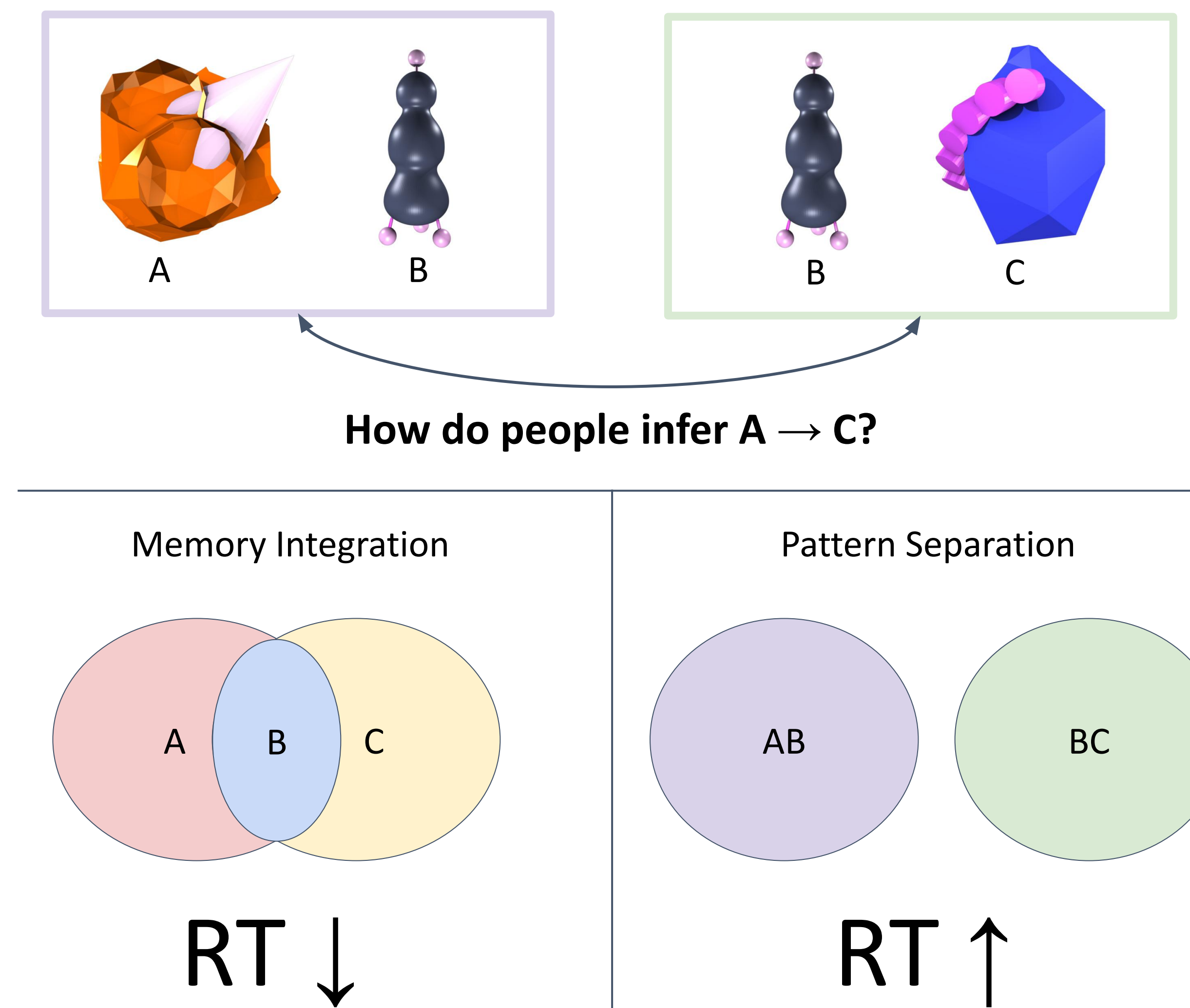
- Excluded trials with RTs <300ms or >10000ms
- Independent sample t-tests between schedule types
- To assess differences in associative inference independent of memory performance, inference analysis was restricted to trials of correctly recalled direct associations

## Key Figures

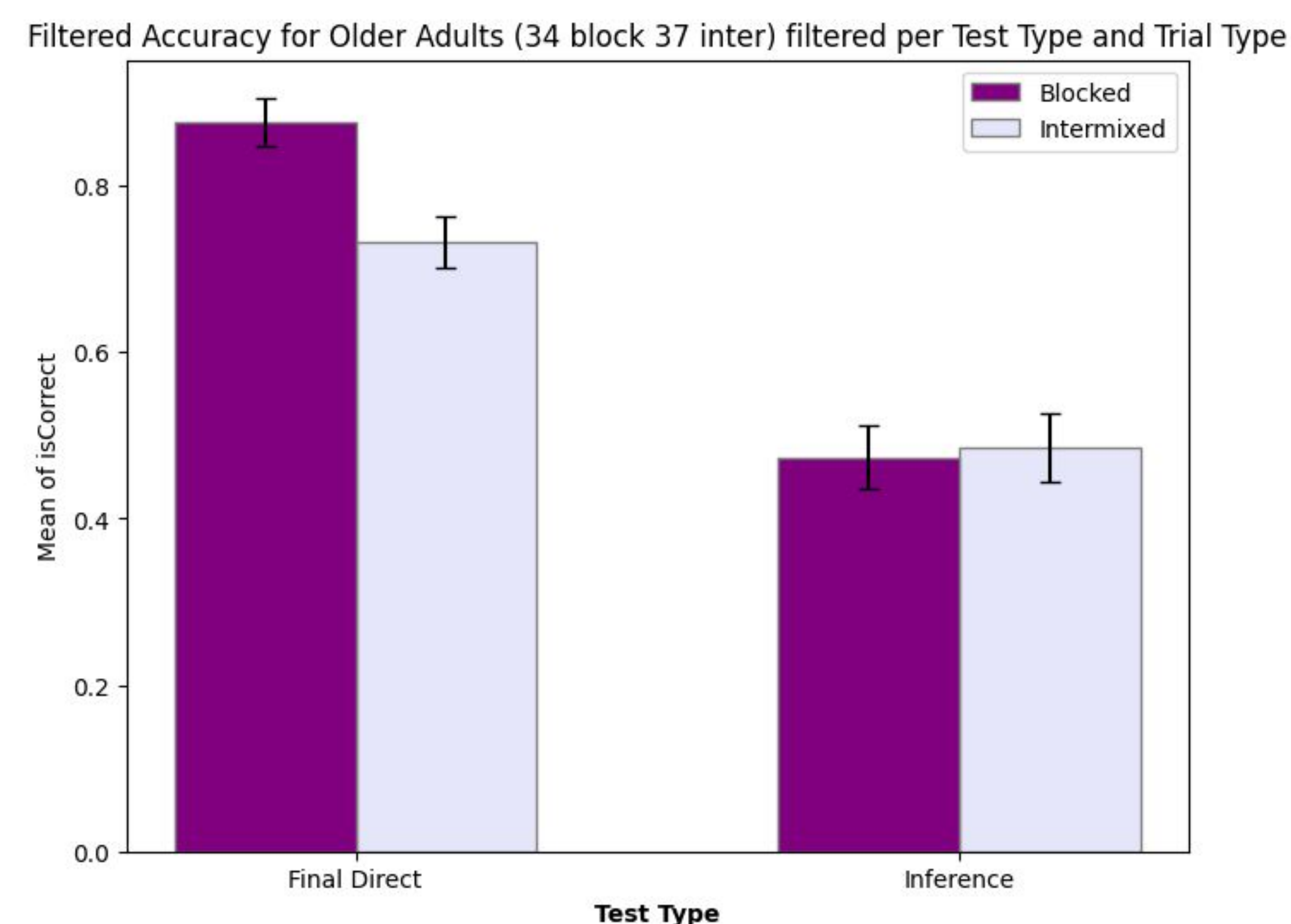
### Task Design



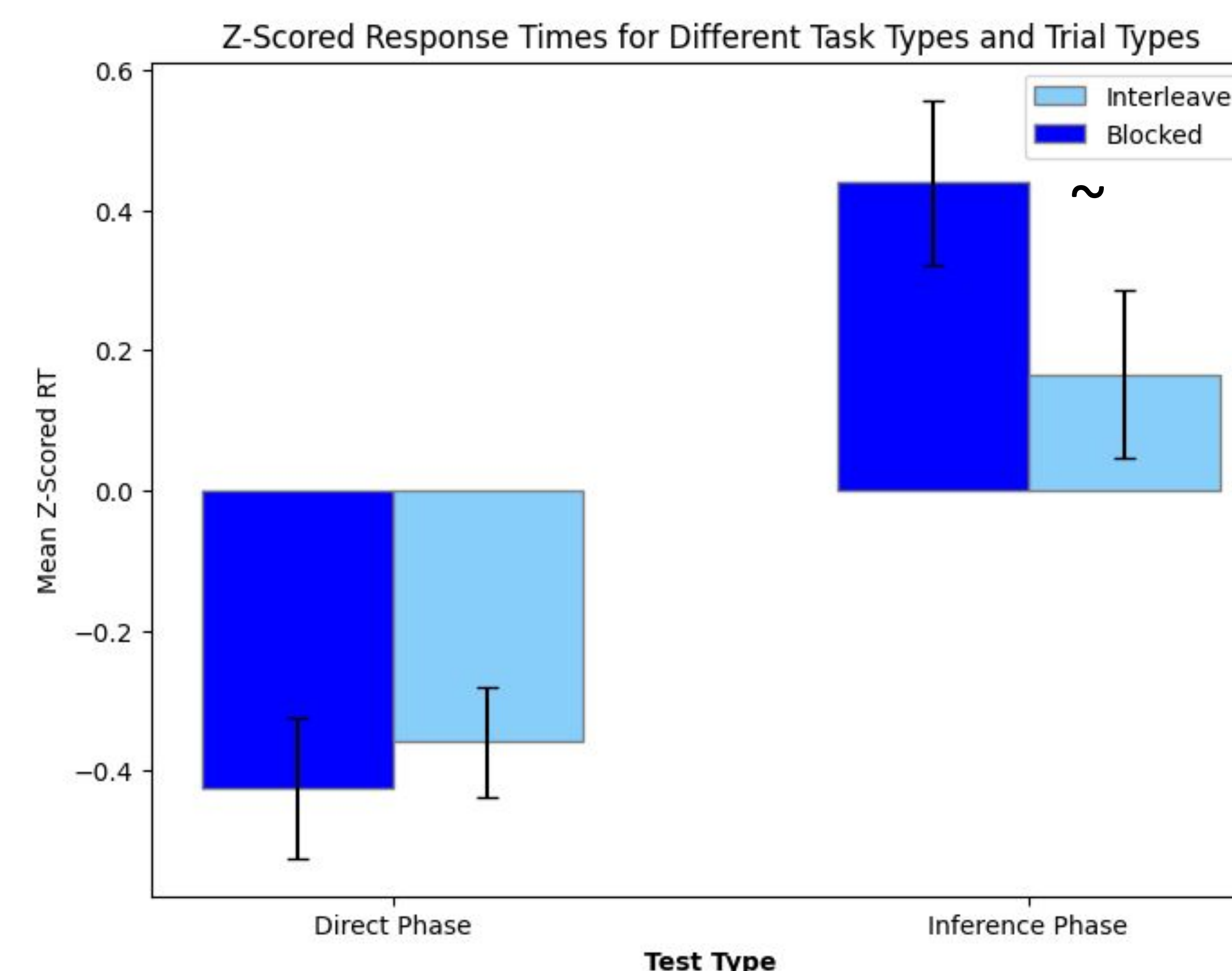
### Pattern Separation vs. Integration



### Filtered Accuracy Between Test Type and Schedule Type



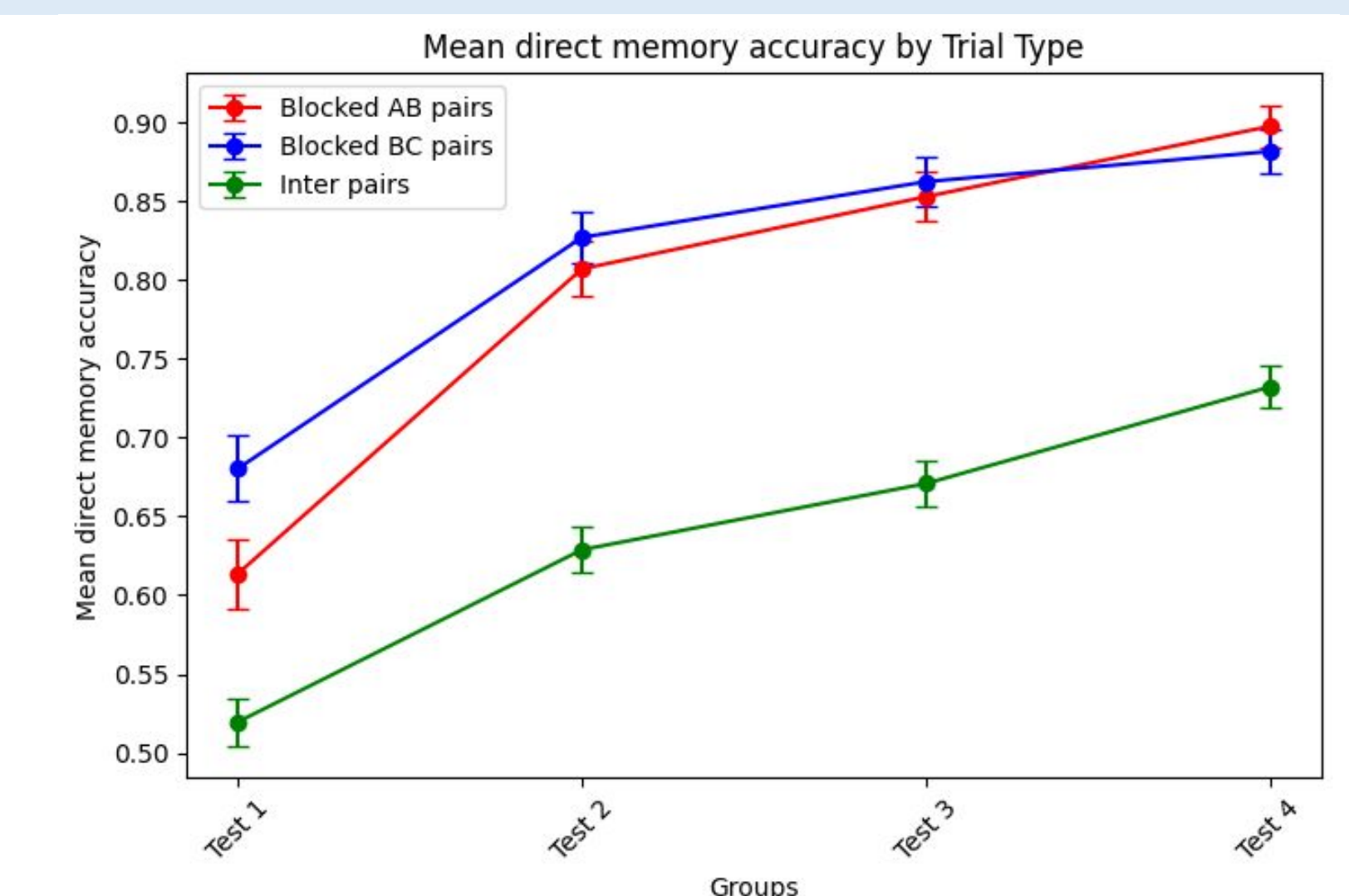
### Response Times Between Test Type and Schedule Type



## Results

- The increased accuracy in the direct memory phase suggests successful learning of individual AB and BC pairs.
- Blocked training improves memory accuracy, but not associative inference performance in older adults.
- The direct phase shows significantly quicker response times compared to the inference phase. Response times were normalized and z-scored to limit skewed RT distributions confounding results.
- Response times show that participants were taking more time during the inference phase, and additionally blocked inference trials take longer than the intermixed ones ( $p = 0.10$ ). More data is needed to better support the trend.

### Direct Memory Testing Result



## Discussion

### Benefit of blocked learning in older adults

- The sequence in which information is presented during learning plays an important role in associative memory for older adults.
- Blocked learning improves memory in older adults, possibly by reducing memory interference between overlapping events.
- Trending response time differences may suggest that blocking and interleaving result in different memory representations: slower RTs after blocked learning may suggest that separate memories have to be retrieved and recombined at time of inference.

### Limitations and future directions

- Online studies can be noisy and more trials would help confirm the trends we have found.
- Only two learning schedules were tested; other forms of task structuring may yield different effects.
- Future research could look into the types of stimuli presented to participants and whether more naturalistic ones could improve associative memory.

## References

- Schlichting, M. L., Mumford, J. A., & Preston, A. R. (2015). Learning-related representational changes reveal dissociable integration and separation signatures in the hippocampus and prefrontal cortex. *Nature Communications*, 6, 8151.
- Yassa, M. A., & Stark, C. E. L. (2011). Pattern separation in the hippocampus. *Trends in Neurosciences*, 34(10), 515–525.
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- Schlichting, M. L., Guarino, K. F., Schapiro, A. C., Turk-Browne, N. B., & Preston, A. R. (2017). Hippocampal structure predicts statistical learning and associative inference abilities during development. *Journal of Cognitive Neuroscience*, 29(1), 37–51. [https://doi.org/10.1162/jocn\\_a\\_01028](https://doi.org/10.1162/jocn_a_01028)

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