# Interactions Between Memory and Intelligence Ashley Jakubowicz, Taylor Brown, and Michael Dulas **Binghamton University**

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# Introduction

Intelligence: consists of fluid and crystallized intelligence

- Crystallized Intelligence: stored knowledge <sup>2,3</sup>
- Fluid intelligence: ability to think and reason abstractly <sup>2,3,5</sup>

**Memory:** ability to recall, retain, and retrieve information

- Item memory: ability to recall whether you saw an item before <sup>6</sup>
- Relational memory: ability to recall relationship between items <sup>1,4</sup>



# **Research Questions**

1. How are intelligence and relational memory inter-related in young/older adults? 2. Are relational memory and item memory differentially tied to fluid intelligence and crystallized intelligence when using both rea world and abstract objects?

# **Intelligence Tasks**

- 1) Fluid Intelligence: Cattell Culture Fair Intelligence Test
- 2) <u>Crystallized Intelligence</u>:
  - a) WRAT-4: participants ability to correctly pronounce words
  - b) COWA: verbal fluency for items for a given letter (F, A, and S)

# **Overall Cognition**

# 3)

### (MOCA): screening for general cognitive function

# **Spatial Reconstruction Task**

- Study 6 or 8 Real-world vs. Abstract **Objects at a time**
- Then reconstruct their locations, while rejecting 2 additional "lures"

# Measures

1) Item Recognition Accuracy: percent of items correctly discarded in the trash can vs. correctly selected in the array

# 2) <u>Spatial Misplacement</u>:

average distance between an object's studied and its reconstructed location



Set Size



Set Size

2) Spatial reconstruction memory task: assessing relational memory and item recognition memory

### Results



# Methods

1) Intelligence tasks: assessing fluid and crystallized intelligence in addition to neuropsychological tests confirming the participants have normal cognitive functioning

# **Results Summary**

- 1. Real-word Objects had better item and spatial memory than abstract shapes, & Set Size only mattered for abstract
- **2.** Marginal correlation between fluid intelligence and spatial memory for abstract shapes; no others significant
- **3.** No significant gender differences

# Conclusions

Nature of stimuli matter when assessing spatial reconstruction, both with regards to the stimulus type and chosen set sizes

a. In contrast to suggestion that the hippocampus <u>similarly</u> binds "all manner of relations" <sup>6</sup>

2. Spatial memory and may require fluid intelligence processes when unable to rely on semantics, i.e., abstract shapes

# **Future Directions**

 Assessing interaction between these effects and healthy cognitive aging

- Item vs. Relational memory; Fluid vs. **Crystallized** Intelligence in aging
- Assess individual differences in relational memory vs. intelligence to determine whether aging differentially interacts these cognitive domains

### Sources:

1. Barbey, Colom, & Grafman. (2013). Neuropsychologia. 2. Cattell. (1963). Journal of Educational Psychology. 3. Deary., et al. (2010). Nature Reviews Neuroscience. 4. Dulas & Duarte. (2014). JOCN. 5. Johnson, et al. (2018). NeuroImage. 6. Konkel & Cohen. (2009). *Frontiers in Neuroscience*.