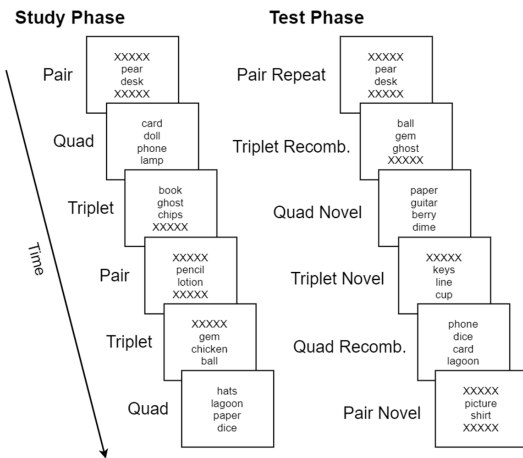


1 Background and Aims

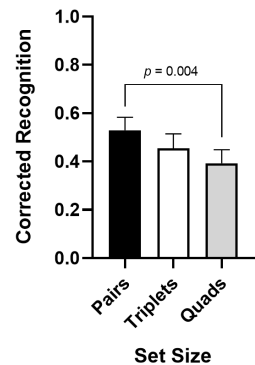
- Numerous studies have indicated that individuals have impaired recognition for pairs versus single items (Foster et al, 2016)
- Studies have also indicated impairments in recognizing which pairs of items were presented together (associative memory) (Addis & McAndrews, 2006)
- However, none have examined behavioral effects of higher memory load on recognition or associative memory, such as memory for word triplets or quadruplets
 - Could provide more information about the effect of increasing demands on binding in memory, especially for associative memory
- As such, we examined recognition and associative memory performance in 21 young adults (18-21 years) who completed a novel Associative Memory Task that manipulated memory load using word pairs, triplets, and quadruplets.

2 Associative Memory Task



- Study Phase:**
 - Participants asked to make a sentence out of each stimulus set
 - 80 stimuli per Set Size: Pairs (3 sec.), Triplets (4 sec.), Quads (5 sec.)
- Test Phase:**
 - Participants asked if they had seen this exact presentation of words during the Study Phase ("yes" = old; "no" = new)
 - 40 stimuli per 9 Conditions (Set Size & Trial Type):
 - Set Size: Pairs, Triplets, Quads (all 5 sec.)
 - Trial Type: repeat, recombined, novel

3 Recognition Impaired with Increased Load

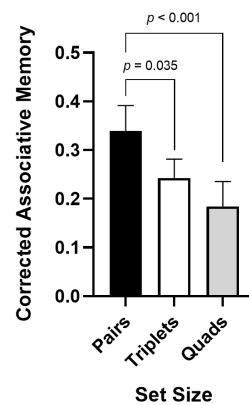


*All error bars indicate Standard Error (SE)

- A repeated measures ANOVA, with Set Size varying within subjects, was conducted to analyze Set Size effects on recognition ("old"|repeat - "old"|novel)
- Results revealed a significant main effect of Set Size, $F(2, 40) = 3.434, p = 0.042, \eta_p^2 = 0.147$
- Performance for Pairs was significantly greater than performance for Quads, (Pairs > Quads; see table)
 - Indicates that greater memory load negatively impacts recognition
- No other comparisons attained significance

	Mean Difference	Standard Error	p-value
Pairs vs. Triplets	0.075	0.053	0.175
Pairs vs. Quads	0.137	0.043	0.004*
Triplets vs. Quads	0.062	0.06	0.311

4 Associative Memory Impaired with Increased Load



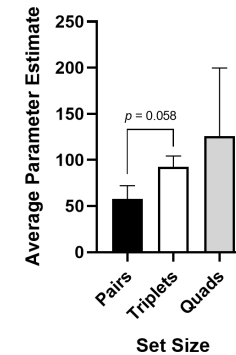
- A repeated measures ANOVA, with Set Size varying within subjects, was conducted to analyze Set Size effects on associative memory ("old"|repeat - "old"|recombination)
- Results revealed a significant main effect of Set Size, $F(2, 40) = 7.508, p = 0.002, \eta_p^2 = 0.273$
- Performance for Pairs was significantly greater than performance for Triplets (Pairs > Triplets) and Quads (Pairs > Quads; see table)
 - Indicates that greater memory load negatively impacts associative memory
- No other comparisons attained significance

	Mean Difference	Standard Error	p-value
Pairs vs. Triplets	0.096	0.043	0.035*
Pairs vs. Quads	0.155	0.028	< 0.001*
Triplets vs. Quads	0.058	0.048	0.235

5 Summary & Interpretations

- Results showed that increasing memory load via the Set Size manipulation lead to impairments in both recognition and associative memory performance
 - Extends earlier work showing worse recognition memory for pairs versus single items and demonstrates that associative memory is similarly affected by increases in memory load (or demands on binding)
 - Could underlie episodic memory deficits for everyday events that are rich in details (i.e., memory load)
- Results also showed that both recognition and associative memory were impaired at the highest memory load (Pairs vs. Quads), but only associative memory showed impairments at the lower memory load (Pairs vs. Triplets)
 - Extends earlier work suggesting that it is more difficult to remember which items were previously presented together (associative memory), rather than simply remembering which items were previously presented at all (recognition)

6 Future Directions: fMRI Investigation



- Future work will examine age group differences in fMRI activity during the Associative Memory Task
- Preliminary analyses conducted on a sample of older adults ($N = 3$) revealed a nonsignificant trend showing increased activation for Triplets compared to Pairs ($p = 0.058$) during recognition ("old"|repeat - "old"|novel) in left caudate
 - Indicates that increased memory load may lead to increased activation in left caudate during recognition
 - Potentially supports caudate involvement in episodic memory in aging
- No other comparisons attained significance
- Our group will continue investigating these findings to examine behavioral and functional relationships with increasing episodic memory load amongst young and older adults