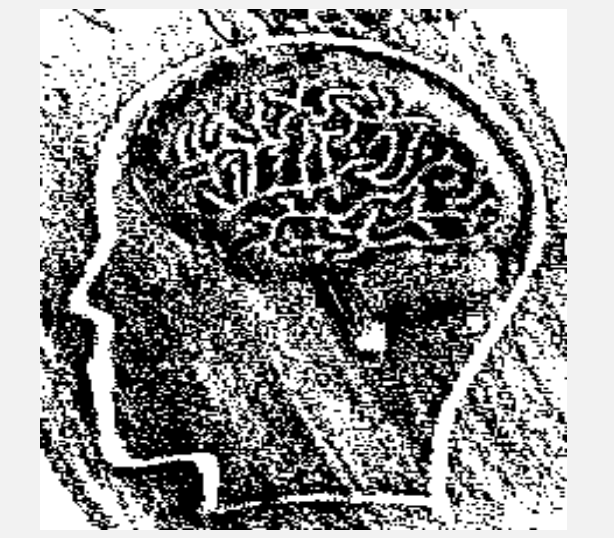


# Use of Redundant Multimodal Stimuli to Facilitate Associative Memory in Older Adults



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## BACKGROUND

**Sensory and Cognitive Aging:** Decline in sensory ability with age is highly correlated with decline in cognitive functionality, including fluency, knowledge, reasoning, perceptual speed, and memory (Lindenberger & Baltes, 1994; Baltes & Lindenberger, 1997). One of several potential explanations for this decline asserts that increased cognitive resources are required to perceive stimuli, leaving fewer resources for processing. This may differentially affect memory for associations over items, as the associative memory deficit seen in older adults can be simulated in younger adults using degraded stimuli (Naveh-Benjamin & Kilb, 2014).

**Multimodal Perceptual Benefits:** Use of audio (word recordings) and visual (lip movements) stimuli together can increase perceptual accuracy for both older and younger adults (Sommers, Murray, & Spehar, 2005). Additionally, this benefit appears to be from an interaction between modalities, rather than the simple addition of a second modality increasing the odds of correctly perceiving one of the two modalities (Stevenson et al., 2014). This increase in perceptual accuracy has been associated with an increase in working memory ability (Frtusova, Winneke, & Phillips, 2013). It has not been determined how multimodal presentation helps long-term memory, or memory for associative information.

**Purpose:** To determine if multimodal presentation of stimuli improves associative memory in older adults under normal conditions, and younger adults in degraded conditions.

## METHODS

41 younger adults, 41 older adults

### Study Phase:

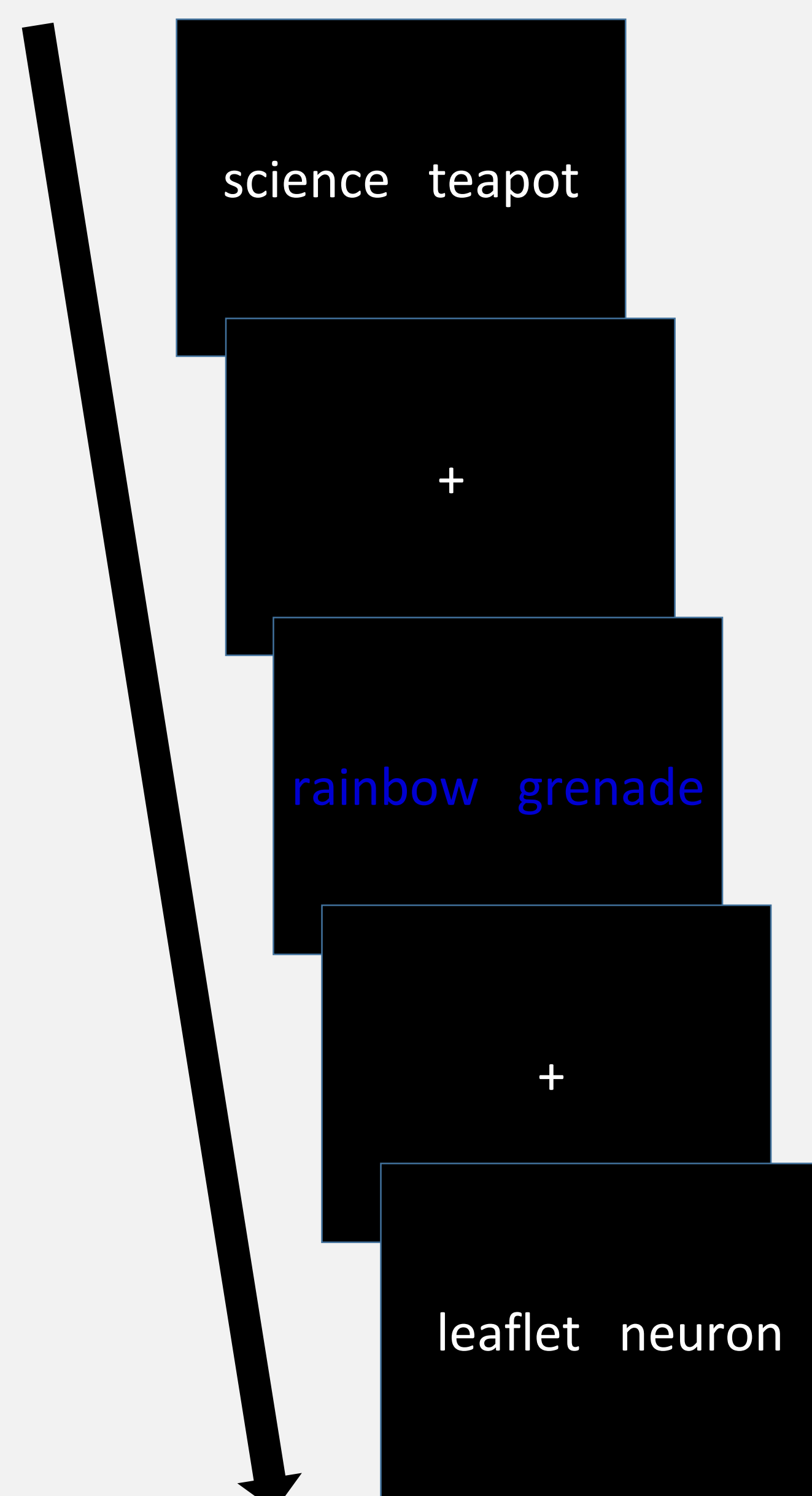
- Six study lists of 34 unrelated word pairs each, in three different conditions:
  - Visual – Pairs presented as text, half white (non-degraded), half navy blue (degraded), on a black background.
  - Audio – Pairs presented as spoken recordings, half clean (non-degraded), half with added white noise (degraded).
  - Audiovisual – Visual and Audio conditions presented together.
- Study pairs presented for 2,000 ms each, with a 2,000 ms gap between pairs.

### Test Phase:

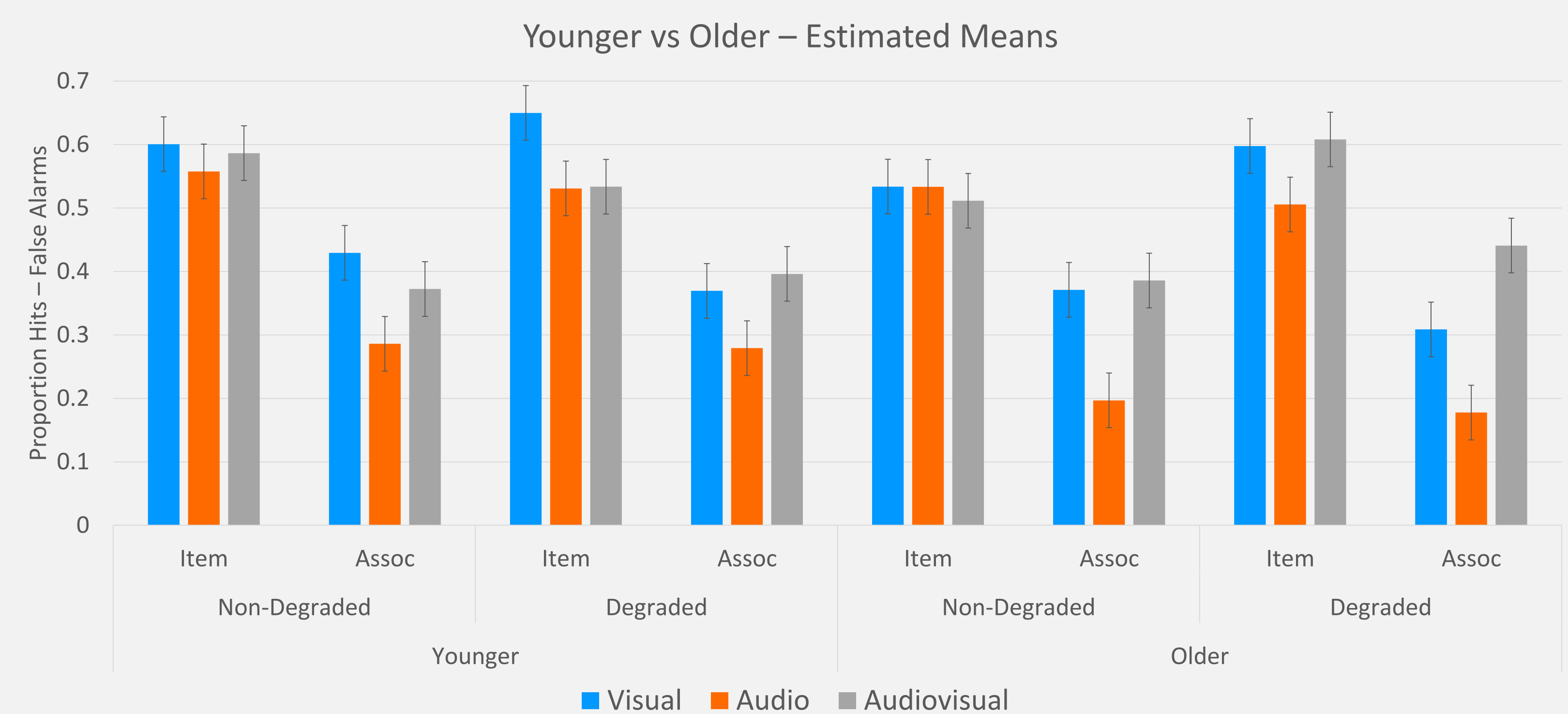
- Old vs new item recognition tests for individual words.
- Intact vs recombined word pairs associative test.

### Analysis:

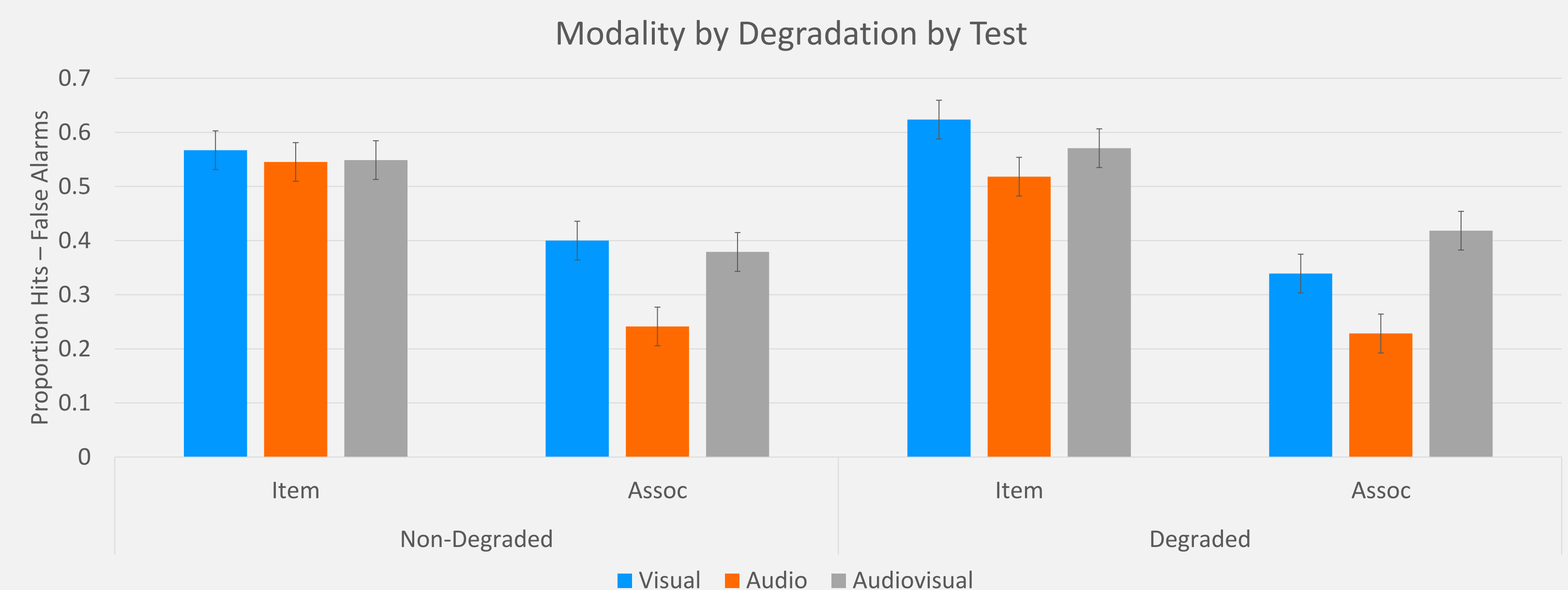
- Hits minus False-Alarms rates across modality, degradation level, test type, and age group.



## RESULTS



Repeated measures ANCOVA, with gender as a covariate, showed a significant effect of modality, with audio being lower than visual or audiovisual. A near significant age by modality interaction showed this decline to be worse for older than younger adults. Importantly there was a significant modality by degradation by test interaction.



The modality by degradation by test interaction shows an increase in associative memory performance in the degraded condition for multimodal stimuli over both the audio and visual conditions.

## CONCLUSIONS

- Both younger and older adults are able to show multimodal associative gains.
- Perceptual gains for multimodal stimuli can translate to long-term memory gains.
- Older adults do not show a multimodal benefit when visual stimuli are high-contrast non-degraded, but for more degraded stimuli they show potential gains

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