

# Age-Related Differences in the Semantic N400 Effect are Unrelated to Semantic Benefits in Episodic Memory

## 1 Introduction

### Theoretical Background

- Older age is characterized by attenuated episodic memory (especially associative memory), and intact semantic memory.<sup>1,2</sup>
- However, online semantic processing, when investigated with verbal stimuli, is attenuated in older age. Evidence for this view is provided by a smaller event-related potential (ERP) N400 effect for predictable vs. unpredictable words in older adults (OA) as compared to younger adults (YA).<sup>3</sup>
- It is still an open issue how the process of healthy aging affects online semantic processing of pictorial materials. Furthermore, not much is known on how age-related differences in online semantic processing impact episodic memory for semantically related pairs.

### Research Questions

- Are there age-related differences in the online semantic processing (N400) of pictorial materials?
- Are such age-related differences in online semantic processing paralleled by differences in a behavioral measure of semantic processing (i.e., semantic congruency judgements)?
- Do such age-related differences transfer to episodic memory performance for semantically related object pairs?

## 2 Methods

**Sample:** 31 OA (19 female,  $M = 71.58$  years) and 32 YA (22 female,  $M = 23.13$  years)

### Procedure:

**Session 1:** CERAD with OA

→ Inclusion criterion: no severe deficits in all subtests (i.e., min.  $-1.5$  SD)

**Session 2:** EEG-experiment with YA and OA

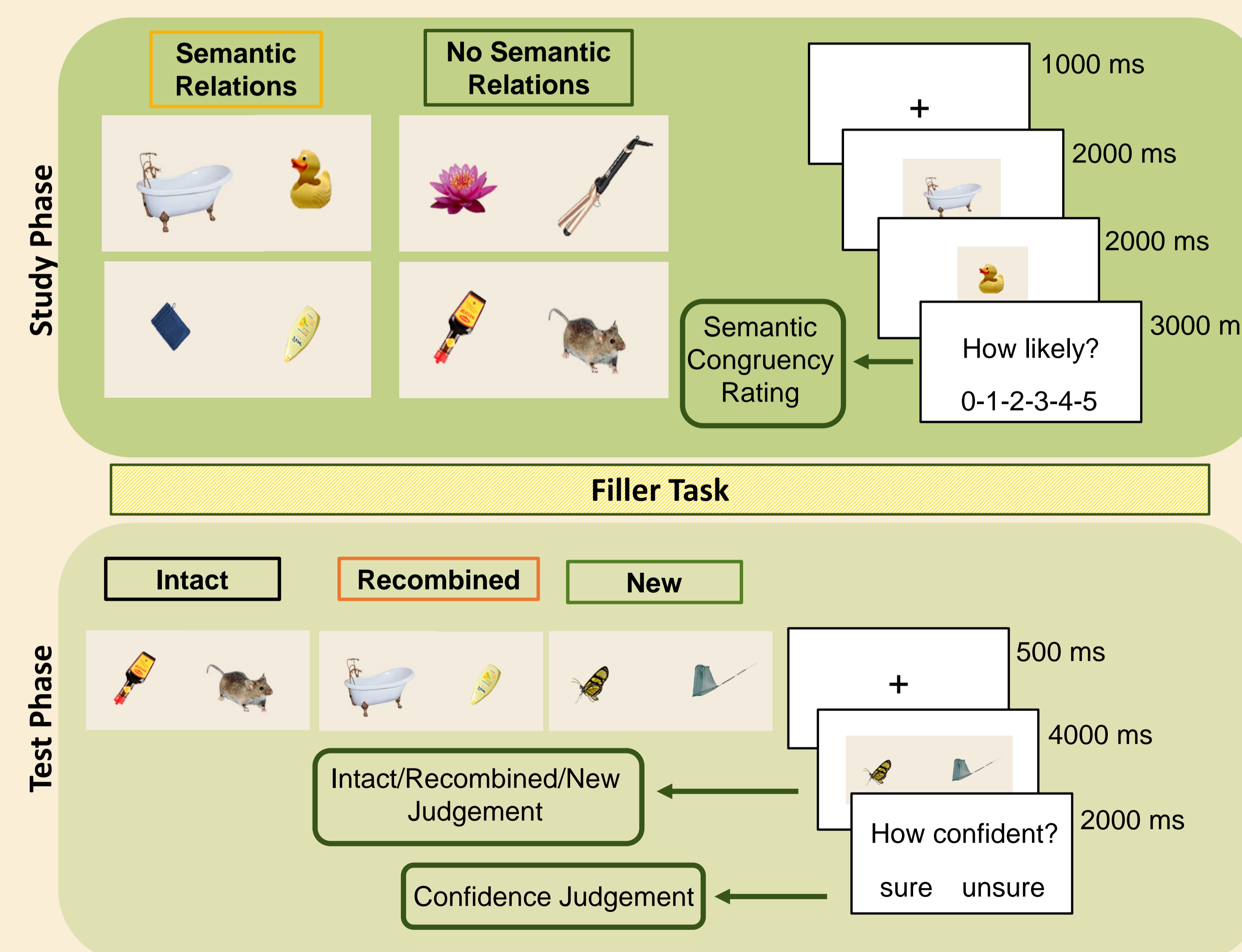
→ Four study-test-cycles with 60 study and 60 test pairs each

### Study phase:

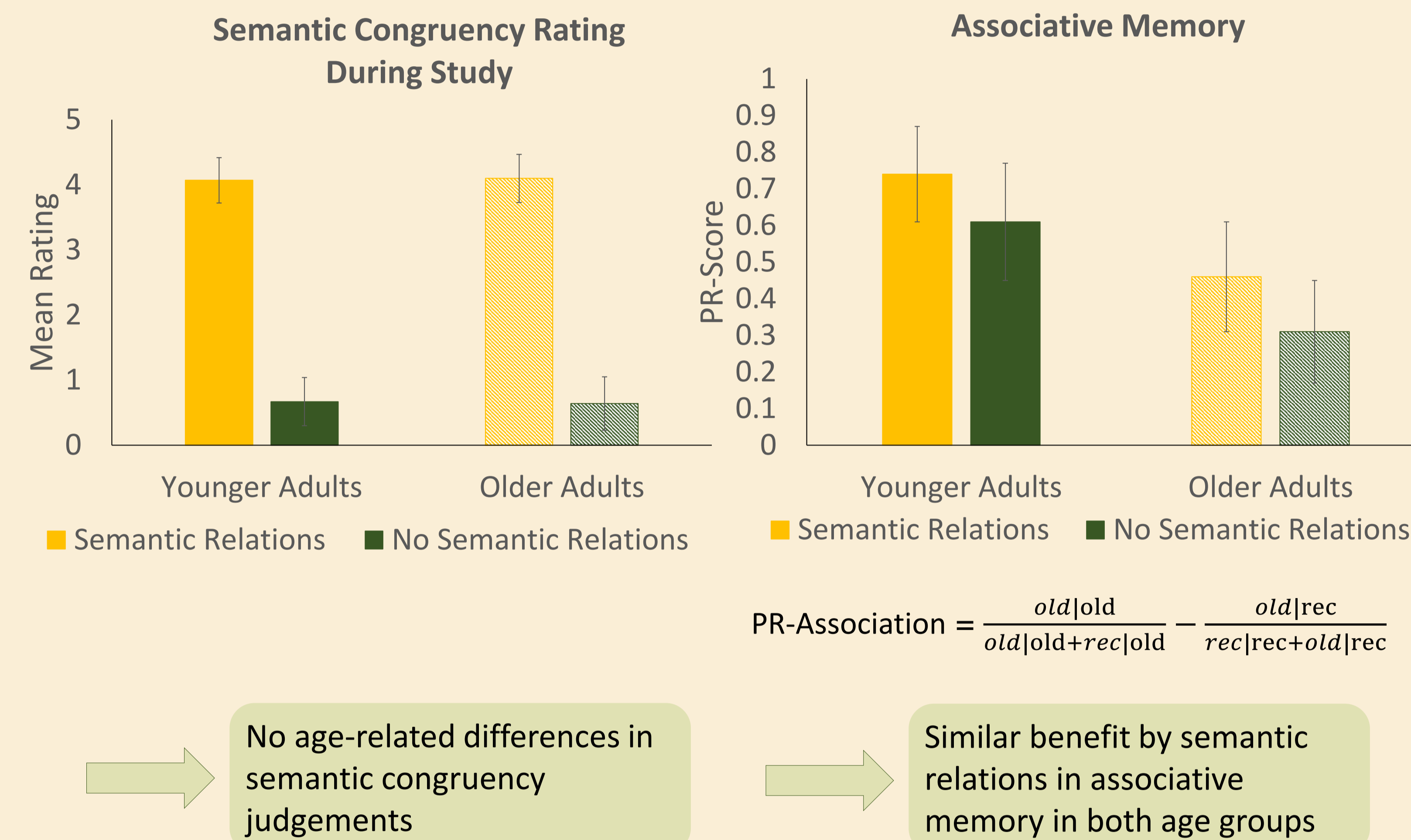
- A total of 240 object pairs (50% semantically related)
- Sequential presentation
- Semantic Congruency Rating: "How likely is it that both objects occur together in daily life?"

### Test phase:

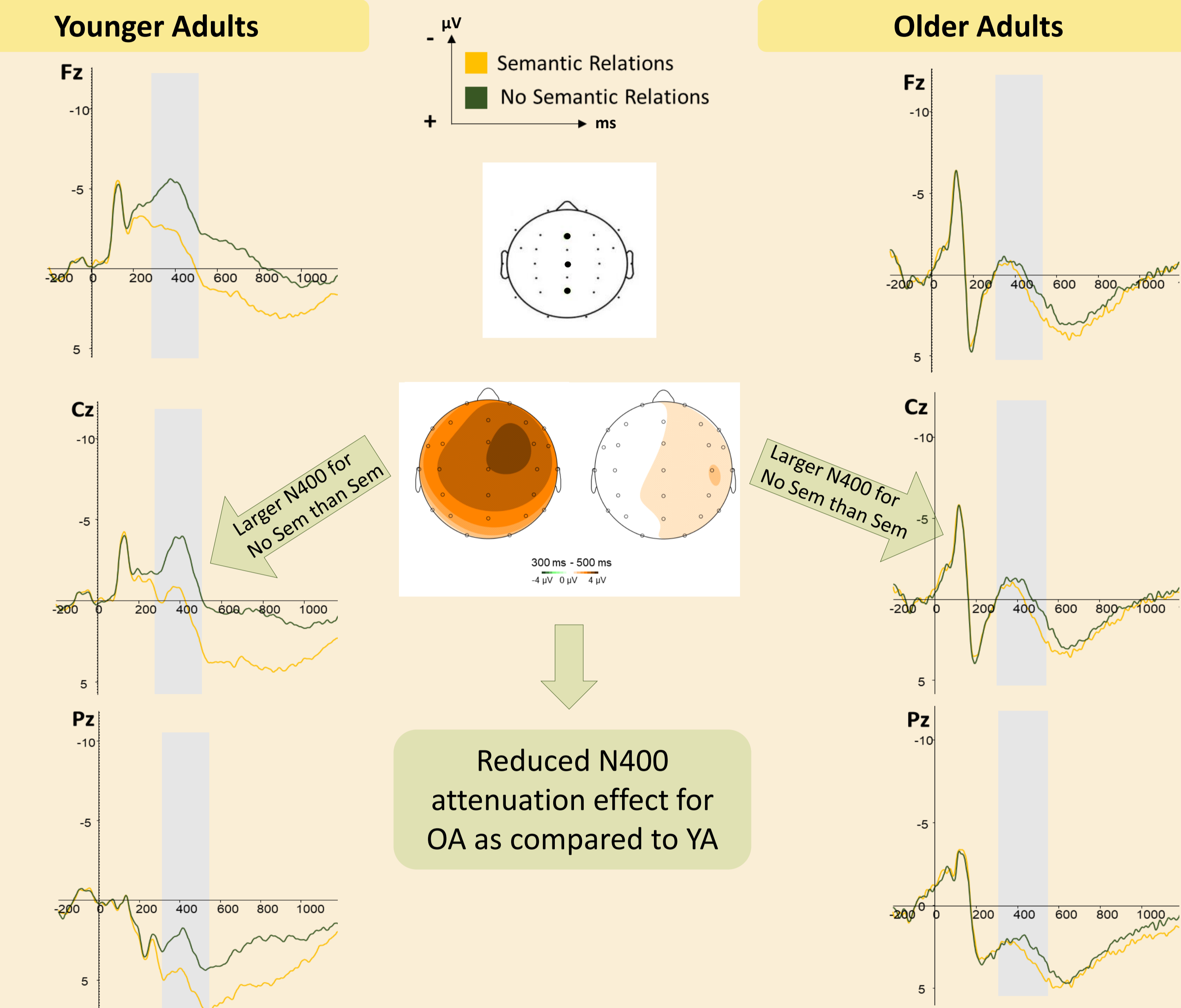
- A total of 240 object pairs (50% semantically related)
- Simultaneous presentation (side by side)
- Memory Task: discrimination between intact (80), new (80) and recombined (80) object pairs



## 3 Behavioral Results



## 4 ERP Results



## 5 Discussion

- To our knowledge, for the first time, we find age-related differences in online semantic processing of picture pairs (i.e., a reduced N400 attenuation effect in OA), which resemble age-related differences in online semantic processing of verbal materials.<sup>3</sup>
- These age-related differences are not paralleled by a behavioral measure of semantic processing, as older adults perceived the semantic relations within the object pairs comparably to the younger adults.
- Interestingly, both age groups showed a similar benefit from semantic relations in their associative memory performance.
  - In OA, online semantic processing seems to be decoupled from the processing that results in associative memory benefits from semantic relations.

Assuming that the N400 effect serves as a proxy for predictive processing and that predictive processing is attenuated in older age, our data contribute to the debate about age-related differences in predictive processing<sup>4</sup>:

- Older adults seem to apply less top-down context-driven predictive processes, but rather seem to rely on bottom-up stimulus-driven integrative processes.<sup>5</sup>
- The observation that OA benefit from semantic relations in their associative memory performance similar as YA, supports the view that the structure of the semantic network is stable in normal aging.<sup>6</sup>

## References

<sup>1</sup> Naveh-Benjamin, M. (2000). *J Exp Psychol Learn Mem Cogn*, 26, 1170-1187.

<sup>2</sup> Horn, J.I. & Cattell, R.B. (1967). *Acta Psych*, 26, 107-129.

<sup>3</sup> Joyal, M., Grolau, C., Bouchard, C., Wilson, M.A., & Fecteau, S. (2020). *Brain Sci.*, 10, 770.

<sup>4</sup> Wlotko, E. W., Federmeier, K.D., & Kutas, M. (2012). *Psychol Aging*, 27 (4), 975-988.

<sup>5</sup> Payne, B. R., & Federmeier, K.D. (2018). *Brain Res.*, 1687, 117-128.

<sup>6</sup> Jongman, S.R. & Federmeier, K.D. (2022). *Lang Cogn Neurosci.*, 37, 805-819.