

# Does everyday cognitive activity over the lifespan have differential effects on neuronal activity during item- vs. associative encoding in older adults?

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Altersunterschiede in neuronaler Funktion: Einfluss von Alltagsaktivitäten auf neue Gedächtnisspuren (AnFAnG)

## Introduction

- Aging affects episodic memory for associations more strongly than episodic memory for items (Old & Naveh-Benjamin, 2000).
- Older adults who have been involved in numerous cognitive or musical activities across the lifespan show an advantage in cognitive functioning over those who have been less active (e.g. Bamidis et al., 2014; Hanna-Pladdy & MacKay, 2011).
- Enriching activities may affect cognition through a direct impact on neurocognitive functioning.
- Since associative memory is particularly vulnerable to age-related decline, its neural mechanisms may benefit more strongly from enriching activities than those supporting item memory.

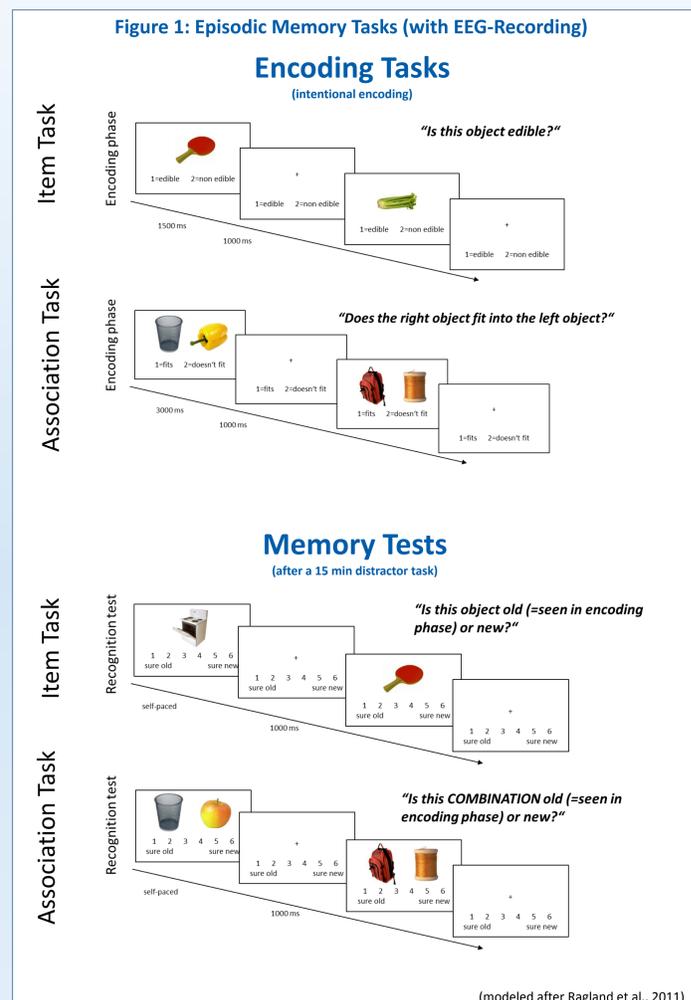
### Enriching activities in the focus of the present study:

- General levels of activity over the lifespan (composite over cognitive, physical, social... activity)
- Current and previous musical activity

## Methods

### Participants of the AnFAnG-Study

Young ( $M=24.73$ ;  $N=30$ ) and older ( $M=70.2$ ;  $N=51$ ) adults



### Additional measures:

**Cognitive activity** („lifetime of experiences questionnaire“ LEQ; Valenzuela & Sachdev, 2006)

- **Example:** “How often would you practice speaking a second language?”
- Three subscores: childhood and adolescence (13-30 years), middle adulthood (30-65 years), late life (65+)

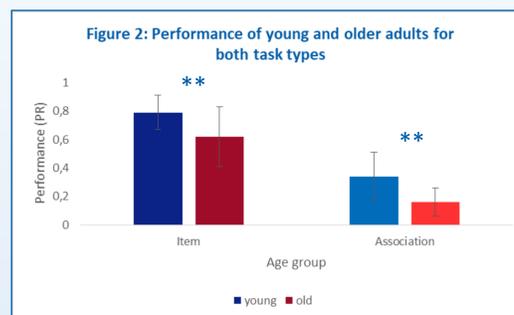
**Musical activity** (self-constructed questionnaire)

- **Example:** “How often do you currently play an instrument / sing?”
- Subdivision of participants in three groups: current regular musical activity, past regular musical activity, no musical activity

### Neuropsychological test measures

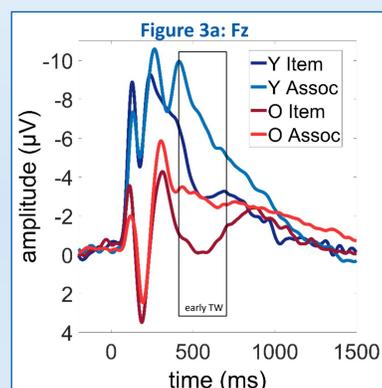
## Results and Discussion

### 1. Episodic memory performance



- Young adults perform better than elderly in both episodic memory tasks
- Both age groups perform better in the item than in the association task
- No Age \* Task type interaction
- Behavioral results do not replicate the associative deficit.
- Potential reason: Floor effect in associative memory.

### 2. Event-related potentials during episodic encoding

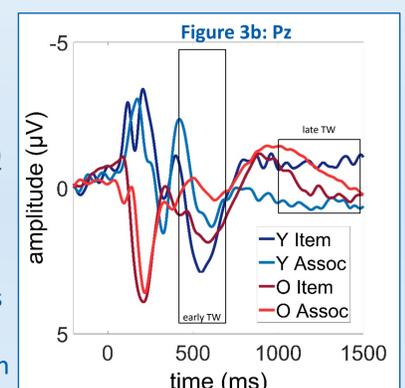


#### Early time window (P300, 450-700 ms)

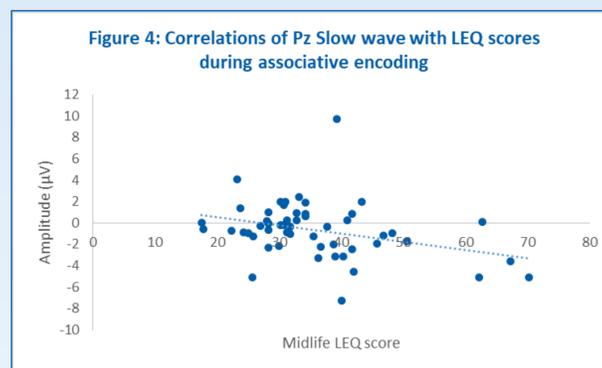
- Both age groups show a larger positivity in the item than the association task (Figures 3a and 3b).

#### Late time window (slow wave, 1000-1500 ms)

- Young, but not older adults show a centro-parietal task effect (Figure 3b).
- Assuming that the slow wave supports associative encoding (e.g., Kamp & Zimmer, 2015), the ERPs may reflect an „associative deficit“ at a neural level.



### 3. Correlations of ERPs with LEQ scores in the older adults

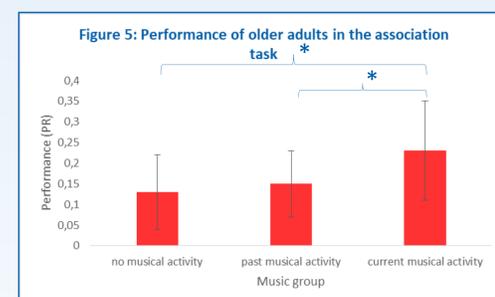


- More enriching activity in middle adulthood (age 30 to 65) is associated with less positive-going centro-parietal slow waves (Figure 4).
- A similar correlation is not evident for the P300 or for behavioral performance.

- Enriching activities over the lifespan appear to selectively affect ERP correlate of associative encoding in older adults.

### 4. Effect of Musical Activity on Associative Memory Performance

- Older adults who are currently musically active exhibit higher associative (but not item) memory performance than those who are not.
- No evidence of beneficial effect of past musical activity in the present study.



## Summary and Conclusions

- Higher levels of cognitive, physical and social activity over the lifespan appear to have a stronger impact on the ERP correlate of episodic associative-, compared to item encoding.
- There does not appear to be a direct relationship to behavioral task performance (in the present study, the associative deficit was apparent in the ERP- but not in the behavioral data).
- Possible interpretation: Age-related changes in associative memory are preceded by modifications of slow wave activity, and cognitive reserve delays this effect.
- There may be a selective benefit of associative memory from musical activity in older age. In the present study, we did not observe a similar effect for past musical activity.

### References and Funding Information

Bamidis, P. D., Vivas, A. B., Styliadis, C., Frantzidis, C., Klados, M., Schlee, W., ... & Papageorgiou, S. G. (2014). A review of physical and cognitive interventions in aging. *Neuroscience & Biobehavioral Reviews*, 44, 206-220.

Ragland, J. D., Ranganath, C., Barch, D. M., Gold, J. M., Haley, B., MacDonald III, A. W., ... & Carter, C. S. (2011). Relational and Item-Specific Encoding (RISE): task development and psychometric characteristics. *Schizophrenia bulletin*, 38(1), 114-124.