

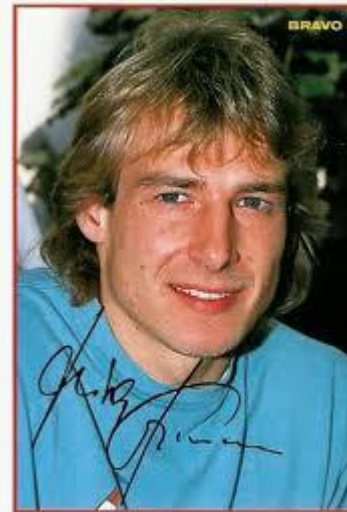
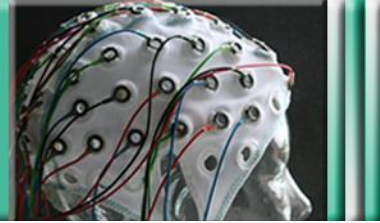
Differential effects of aging on recollection and familiarity: An ERP study

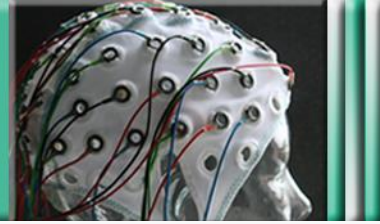
Axel Mecklinger

Experimental Neuropsychology Unit

Department of Psychology

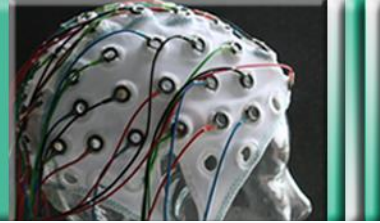
Saarland University







Recognition Memory

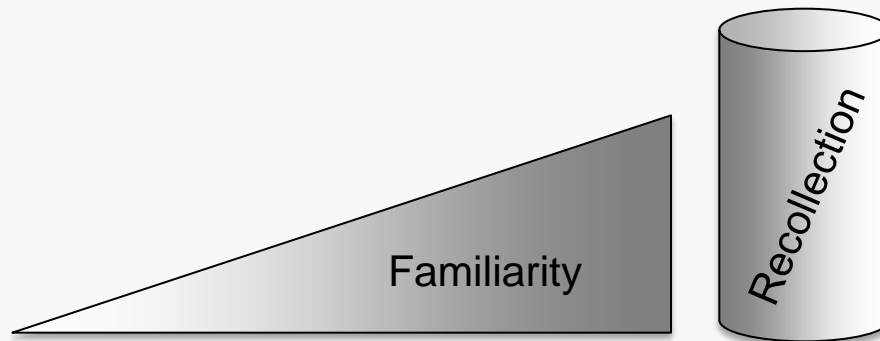


... the ability to identify a stimulus as having been previously encountered



Two processes contribute to recognition memory

- Familiarity assessment
- Recollective processing



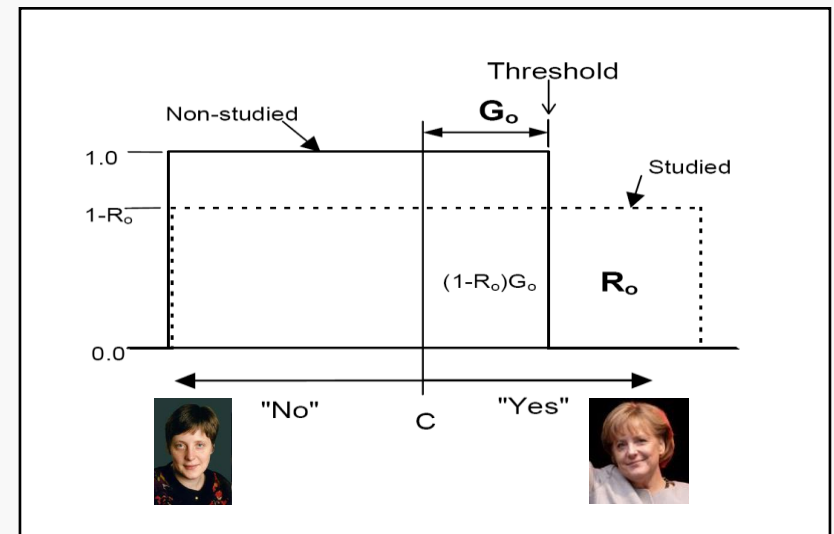
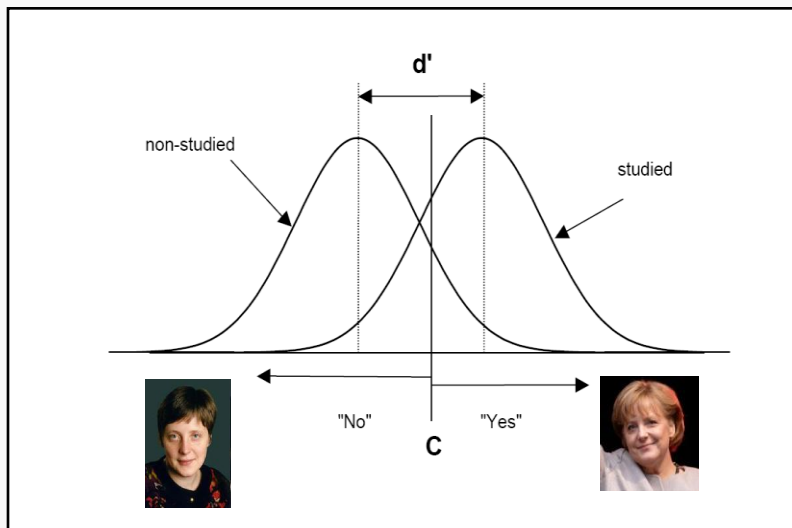


Recognition Memory



Dual process models (DPSD):

Two memory systems contribute to recognition memory judgements.

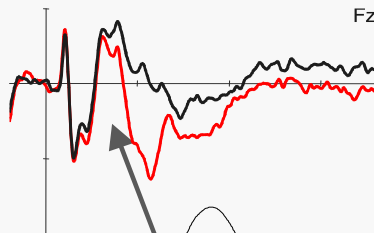




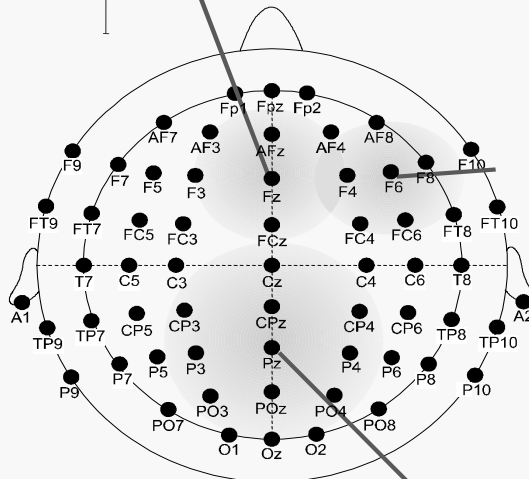
ERP Correlates of Familiarity and Recollection



Mid-frontal old/new effect/ FN400
300-500 ms



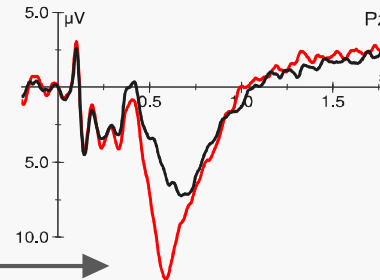
Familiarity



— old
— new

Recollection

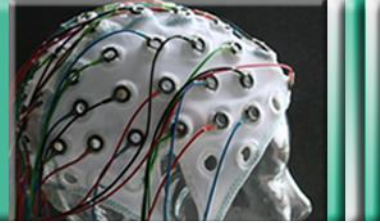
Parietal old/new effect
400-700 ms



Mecklinger (2000; 2006)
Rugg et al (1998)
Rugg & Curran (2007)
Friedman & Johnson (2000)



Aging and Recognition Memory

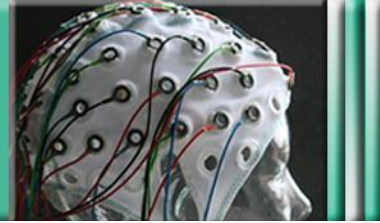


Normal aging impairs recollection but leaves familiarity relatively intact.

- Item memory vs associative memory.
- Remember / know procedure in recognition memory studies.
- Studies using receiver operating characteristics (ROC) or process dissociation methods.



Age differences are modulated by task requirements



Age differences are diminished when demands on self-initiated processing are reduced.

- Unitization at encoding
- Pre-existing semantic knowledge
- Forced-choice recognition format
- Short response deadlines
- Perceptually rich stimulus formats

(Environmental Support Hypothesis; see Craik & Jennings, 1992)



Effects of age on the ERP correlates of familiarity and recollection



Young Adults

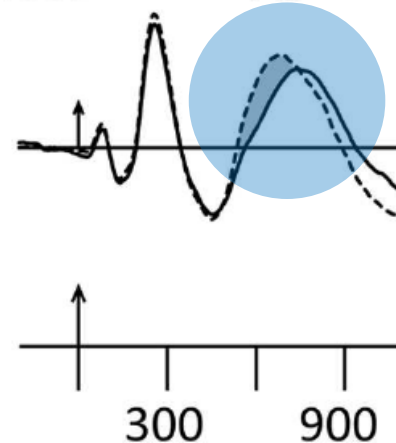
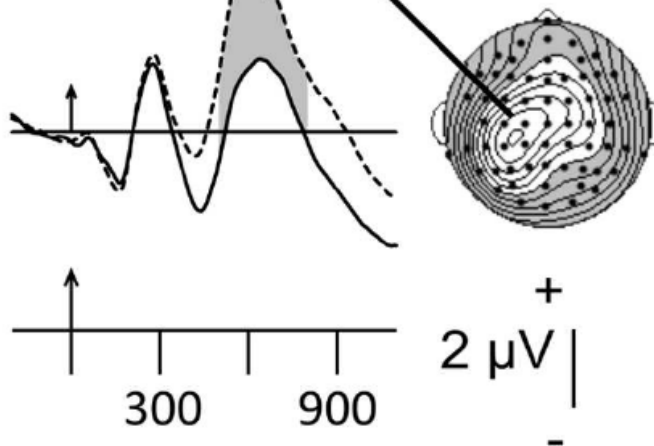
Older Adults

Left parietal (P3)

Left-Parietal EM effect

P3

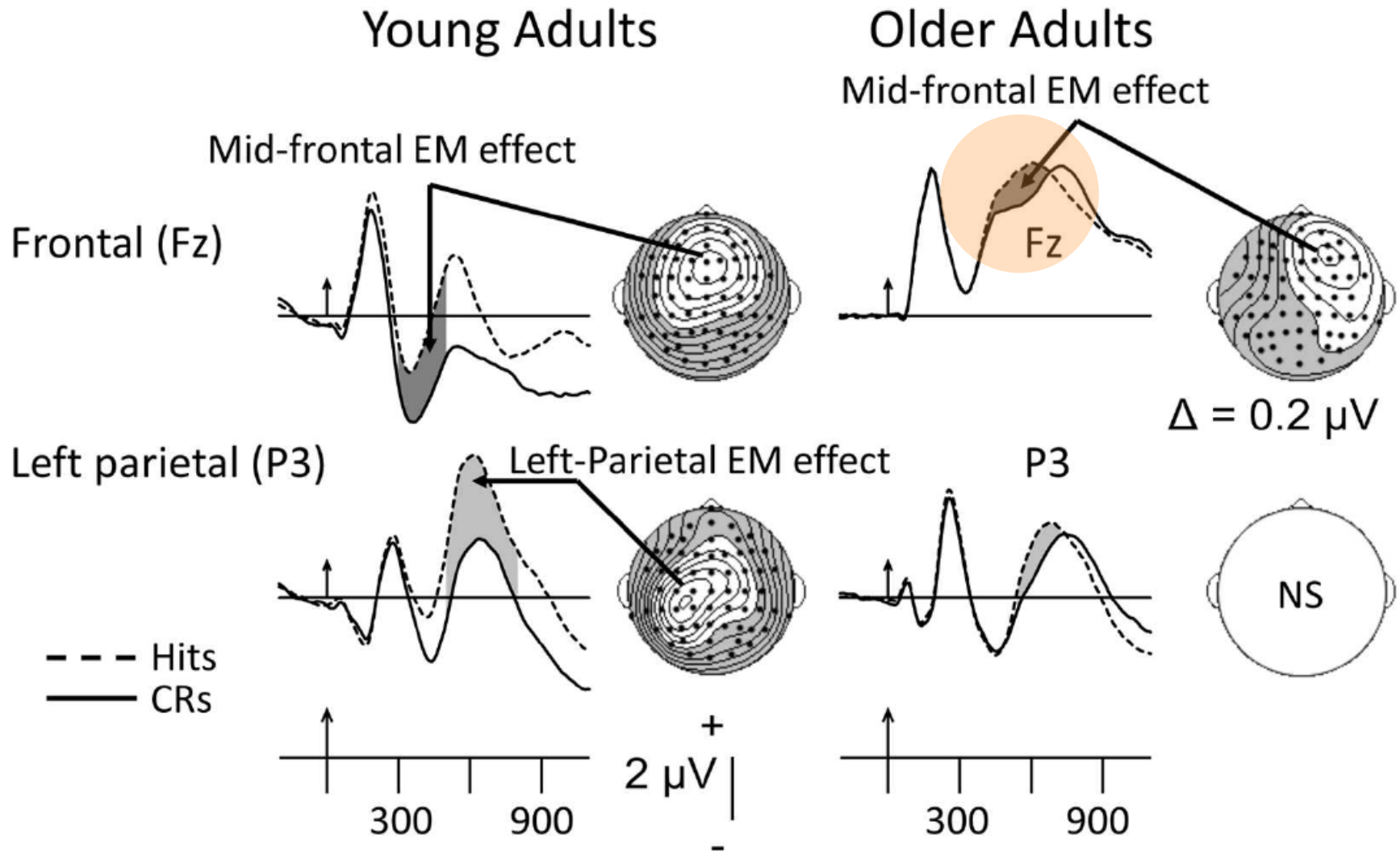
-- Hits
— CRs



Friedmann (2013)

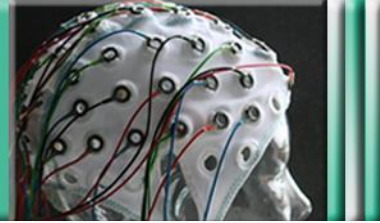


Effects of age on the ERP correlates of familiarity and recollection





The ERP correlate of familiarity in old adults

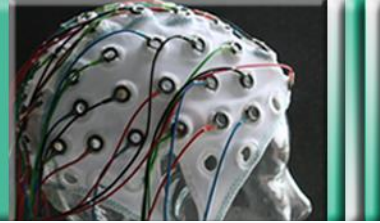


No ERP correlate for recollection in older adults and an inconsistent picture regarding the ERP correlate of familiarity:

- Absence of the effect cannot be attributed to differences in memory strength or task performance across age groups
- Most studies reporting the ERP correlate of familiarity in old adults used perceptually-rich colored stimuli (Eppinger et al. 2010; Ally & Budson, 2007; Ally et al. 2008; Morcom & Rugg, 2004; Friedman et al. 2010; Dulas & Duarte, 2013).
- Studies not finding the effect used greyscale pictures or word stimuli (Duarte et al. 2006; Wolk et al. 2009; Wang et al. 2012; Guillaume et al. 2009).



A goal and a corollary



How is the ERP correlate of familiarity affected by age under conditions that foster familiarity-based recognition?

Are age-related recognition impairments reduced (or even eliminated) under conditions in which recognition is primarily driven by familiarity?



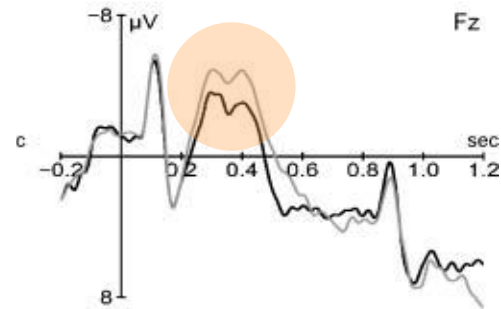
Response deadline and perceptually rich stimuli



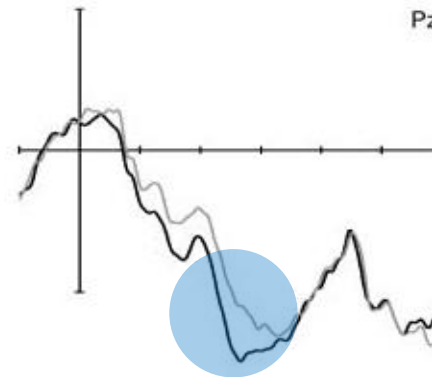
Young Adults

early frontal

nonspeeded



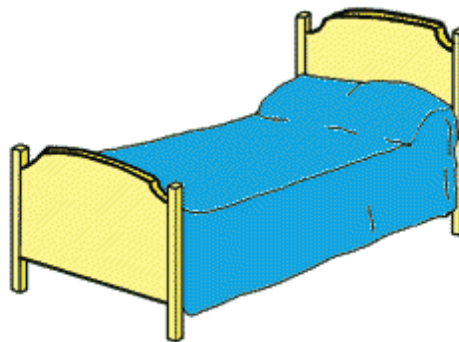
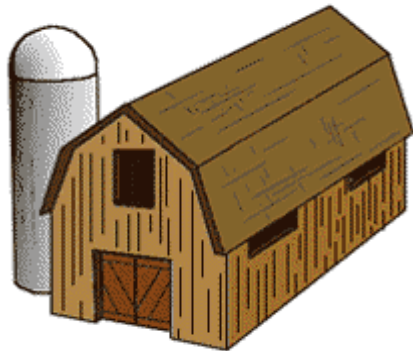
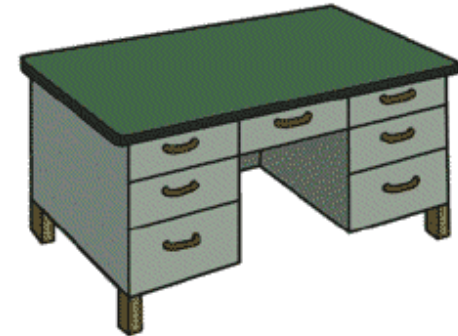
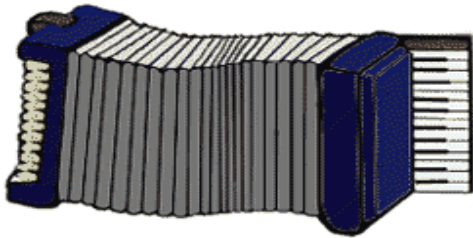
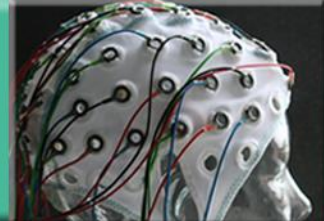
late parietal



Mecklinger et al. (2010)

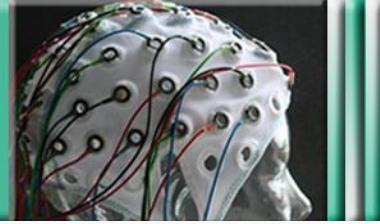


Response deadline and perceptually rich stimuli

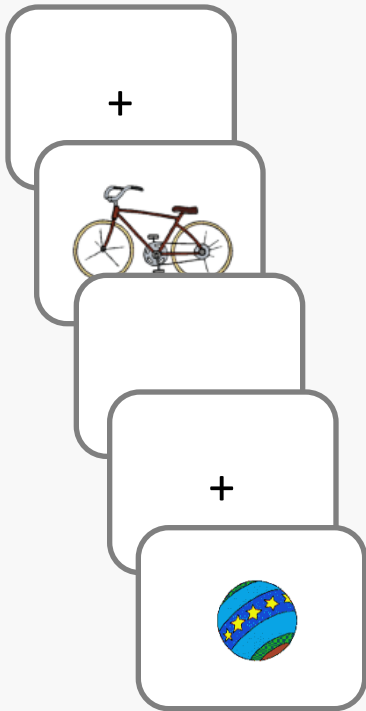




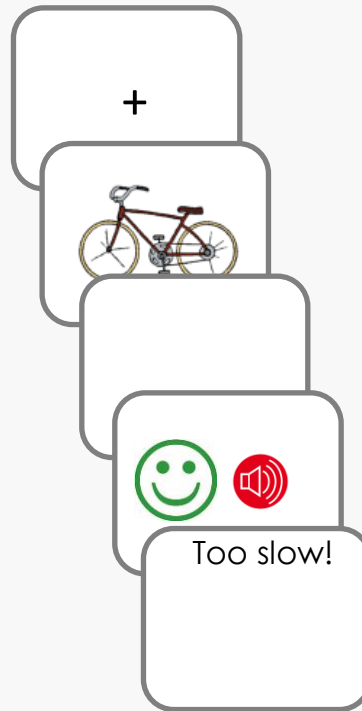
Procedure



Study Trial



Test Trial





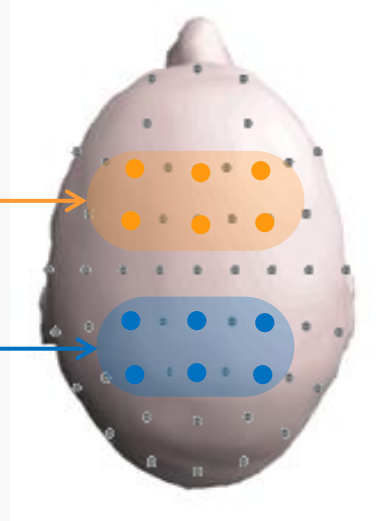
Procedure



	YOUNG	OLD
N	20	36
Mean age (SD)	24,5 (2,9)	71,3 (3,2)
Early time window	300-500 ms	300-500 ms
Late time window	500-700 ms	500-700 ms

frontal + frontocentral

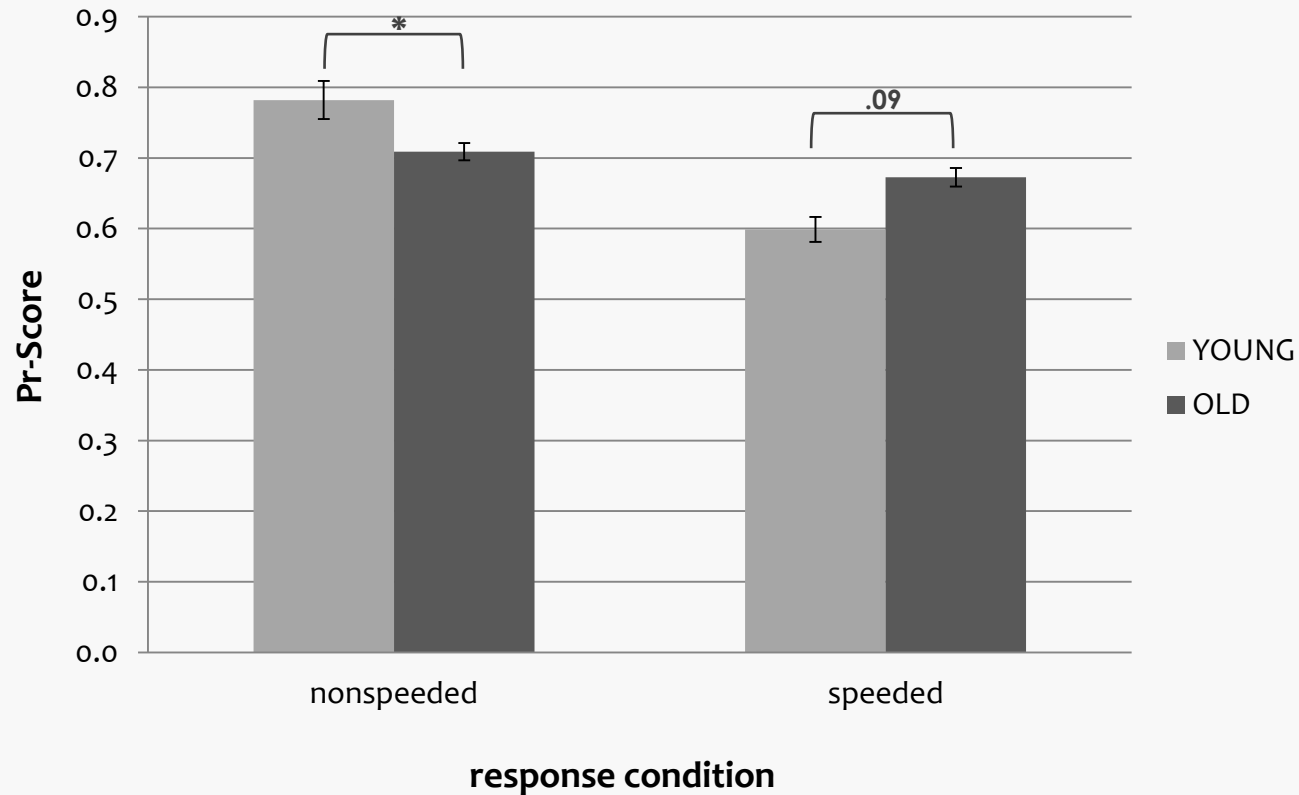
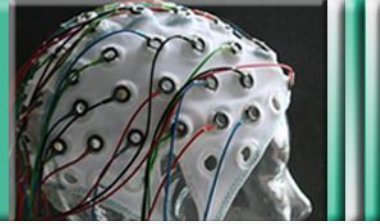
centroparietal + parietal



- 27 scalp electrodes (left mastoid reference).
- Sampling rate: 500 Hz
- Offline Filter: 0,03– 30 Hz
- Ocular artifacts were corrected using a linear regression approach.



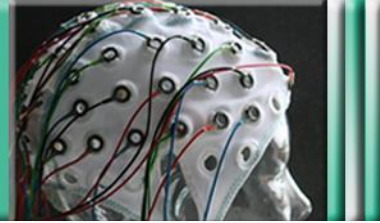
Behavioral results



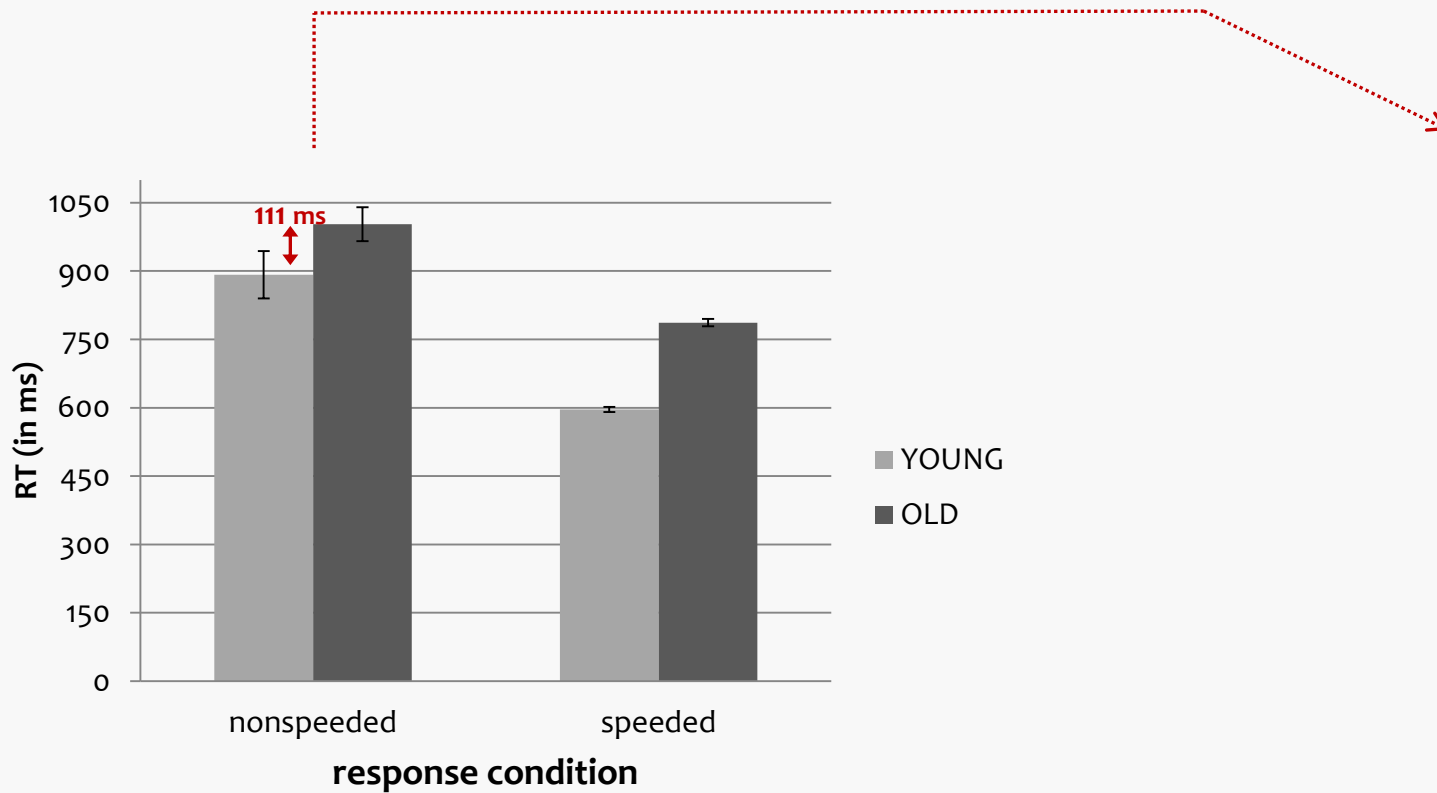
Age-related recognition impairments are eliminated under speeded response conditions



Did old adults benefit from extra response time?

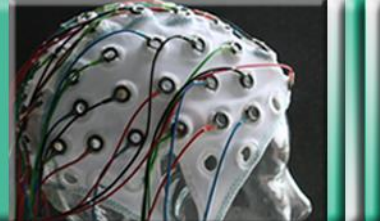


→ Exclusion of „slow responses“ in elderly ($RT > \text{young adult deadline} + 111\text{ms}$)



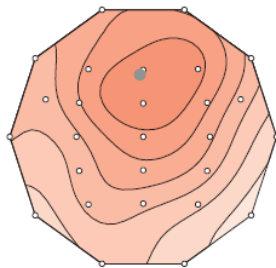


ERP results I

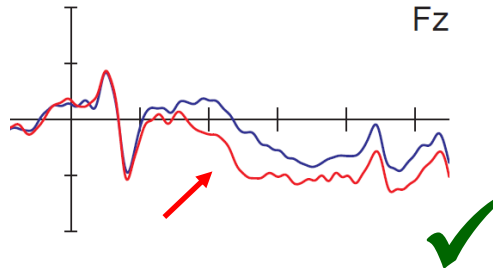


YOUNG

EARLY

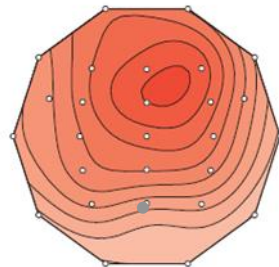


0.250 .. 0.450 s

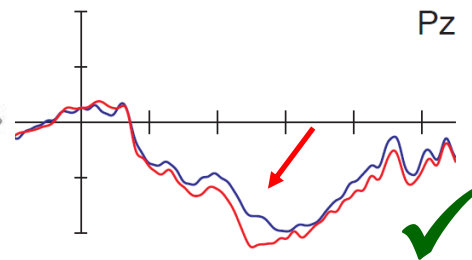


Fz

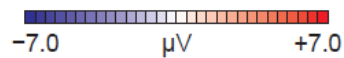
LATE



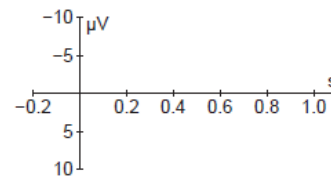
0.450 .. 0.650 s



Pz

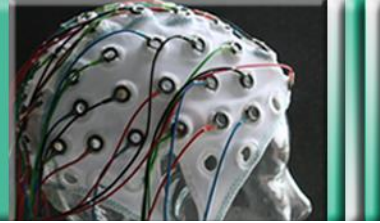


— hit
— cr



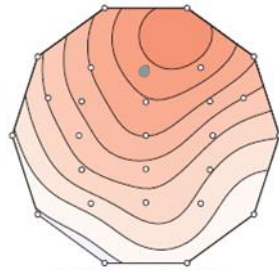


ERP results II

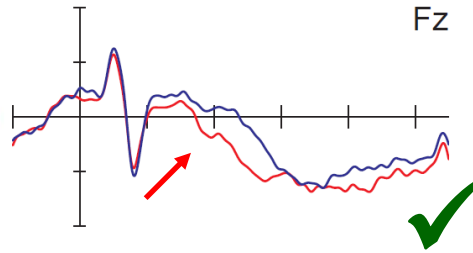


YOUNG

EARLY

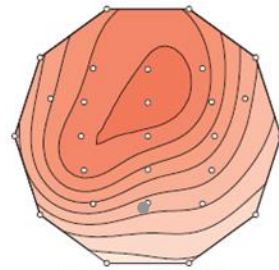


0.250 .. 0.450 s

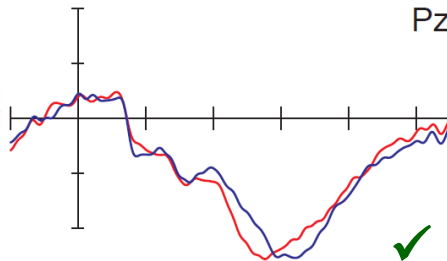


Fz

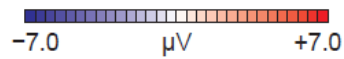
LATE



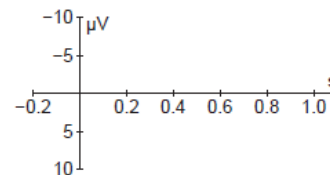
0.450 .. 0.650 s



Pz



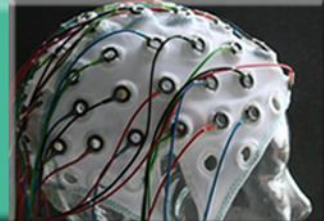
— hit
— cr



SPEEDED



ERP results II

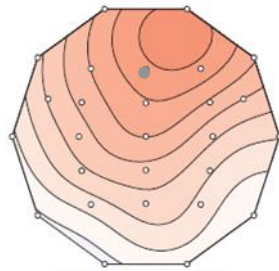


YOUNG

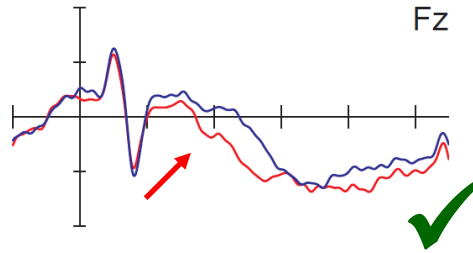
OLD

SPEEDED

EARLY

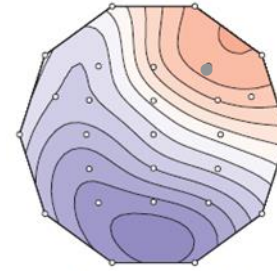


0.250 .. 0.450 s

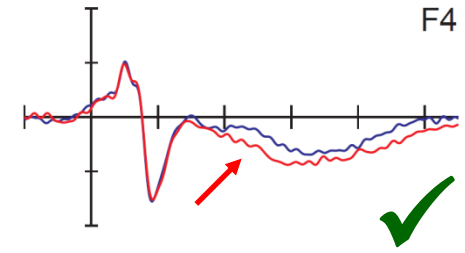


Fz

EARLY

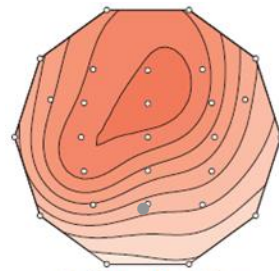


0.350 .. 0.550 s

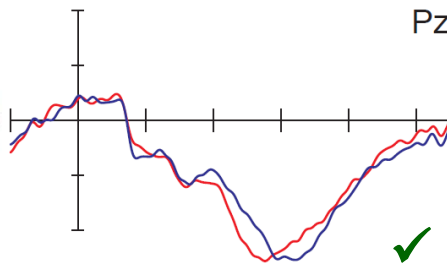


F4

LATE

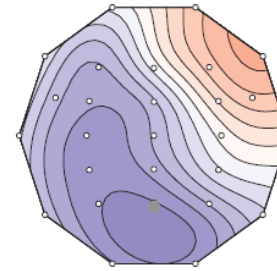


0.450 .. 0.650 s

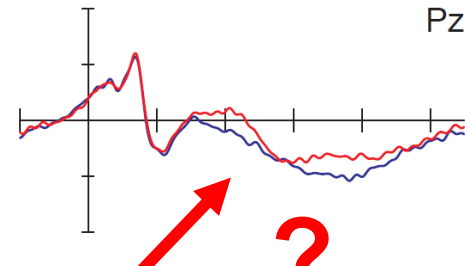


Pz

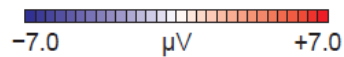
LATE



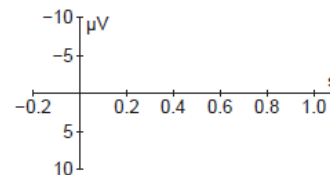
0.600 .. 0.800 s



Pz

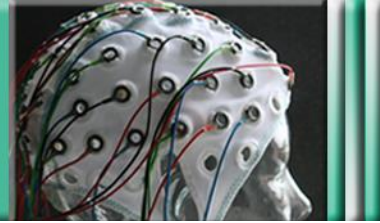


— hit
— cr



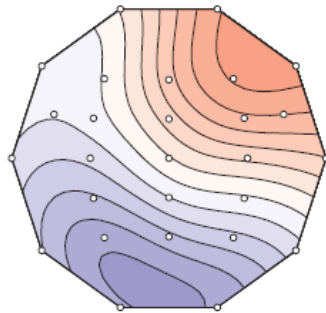


A posterior negativity is larger for low performing old adults

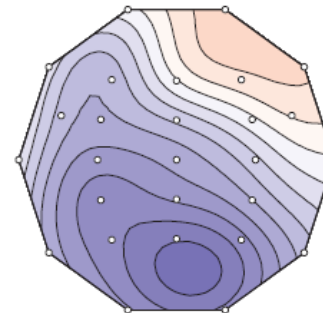


HIGH-OLD

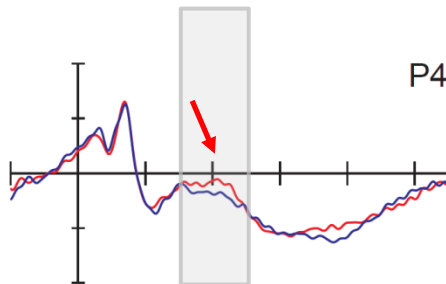
LOW-OLD



0.350 .. 0.550 s

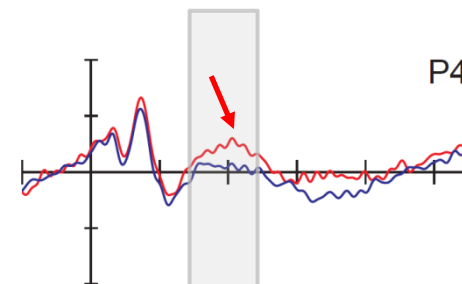


0.350 .. 0.550 s



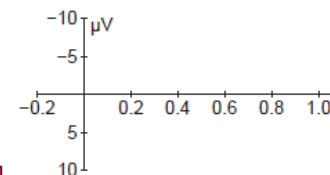
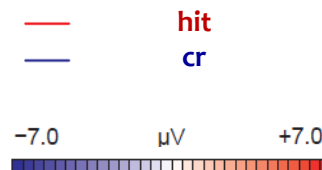
P4

$\eta_p^2 = .29$



P4

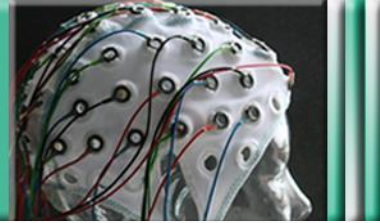
$\eta_p^2 = .62$



SPEEDED



Summary

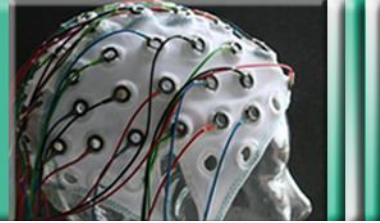


	NONSPEEDED		
Behavior	YOUNG	>	OLD
FAMILIARITY	YOUNG	>	OLD
RECOLLECTION	YOUNG		OLD

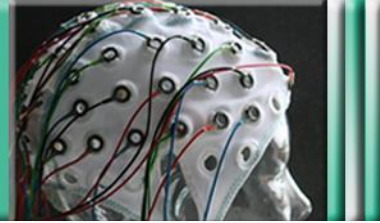
	SPEEDED		
Behavior	YOUNG	<	OLD
FAMILIARITY	YOUNG	>	OLD
RECOLLECTION	YOUNG		OLD
POST. NEGATIVITY	LOW OLD > HIGH OLD		



Take home



- Age-related recognition memory impairments are reduced in conditions that enhance familiarity-based responding.
- Diminished ERP correlate of familiarity in older adults does not result from impaired performance or lower memory strength. Reasons for this disconnect currently unknown.
- Familiarity is an important contributor to memory performance in older adults.



Thanks to

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Nurit Gronau



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