Kognitive Neuropsychologie

03.11. Geschichte der kognitiven Neurowissenschaft

10.11. Funktionelle Neuroanatomie

17.11. Methoden der kognitiven Neuropsychologie I

24.11. Methoden der kognitiven Neuropsychologie II

01.12. Visuelle Wahrnehmung

08.12. Objekterkennung

15.12. Auditive Wahrnehmung

05.01. Sprache

12.01. Aufmerksamkeit und Selektion

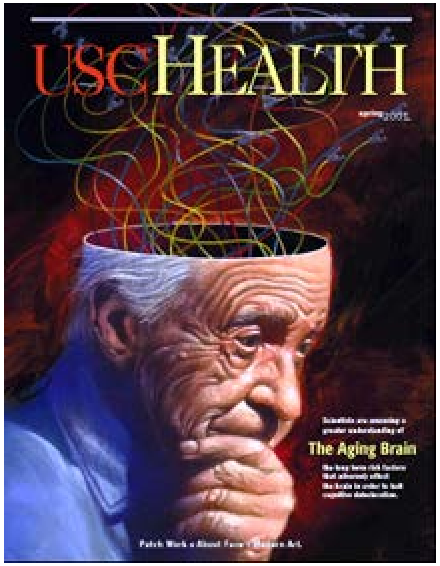
19.01. Kognitive Kontrolle

26.01. Gedächtnis & Lernen

02.02. Kognitives Altern

Heutige Themen

- Was ist kognitives Altern?
- Altern und das Gehirn
- Das episodische Gedächtnis
- Erfolgreiches Altern
- Unterstützung der Umwelt
- Der Positivitäts-Bias
- Kognitives Training



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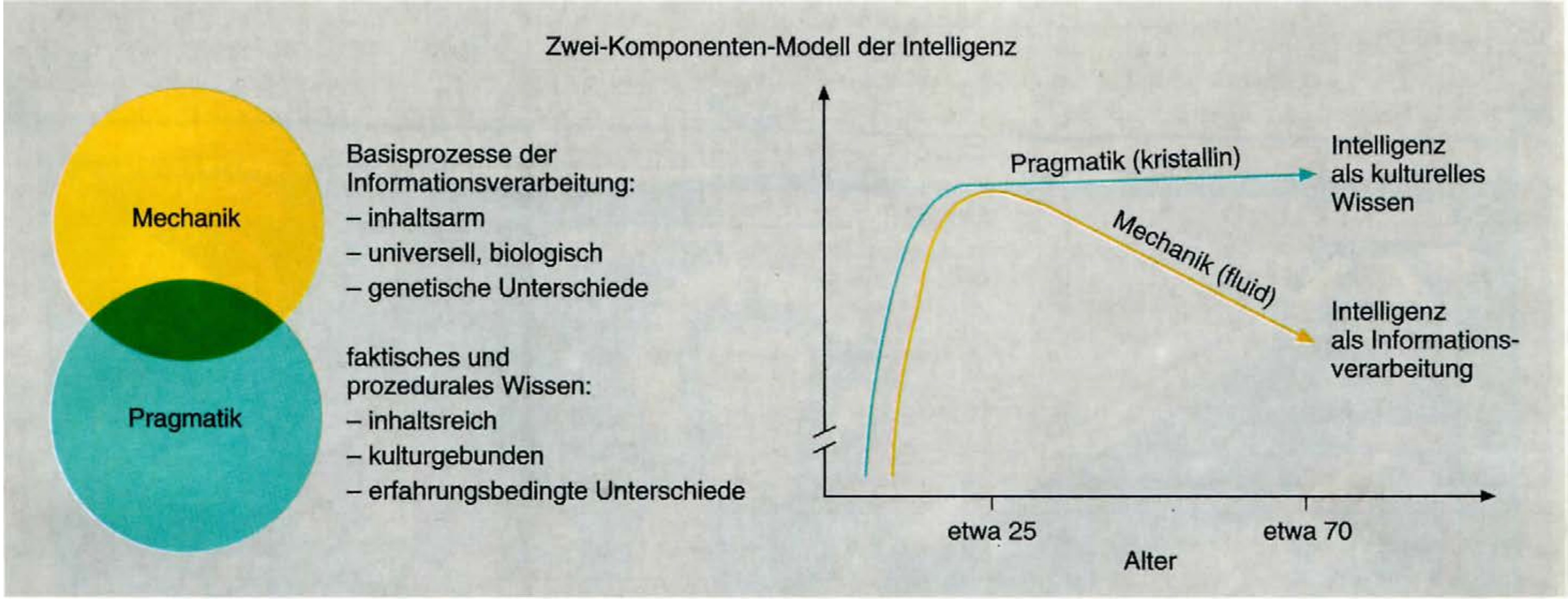
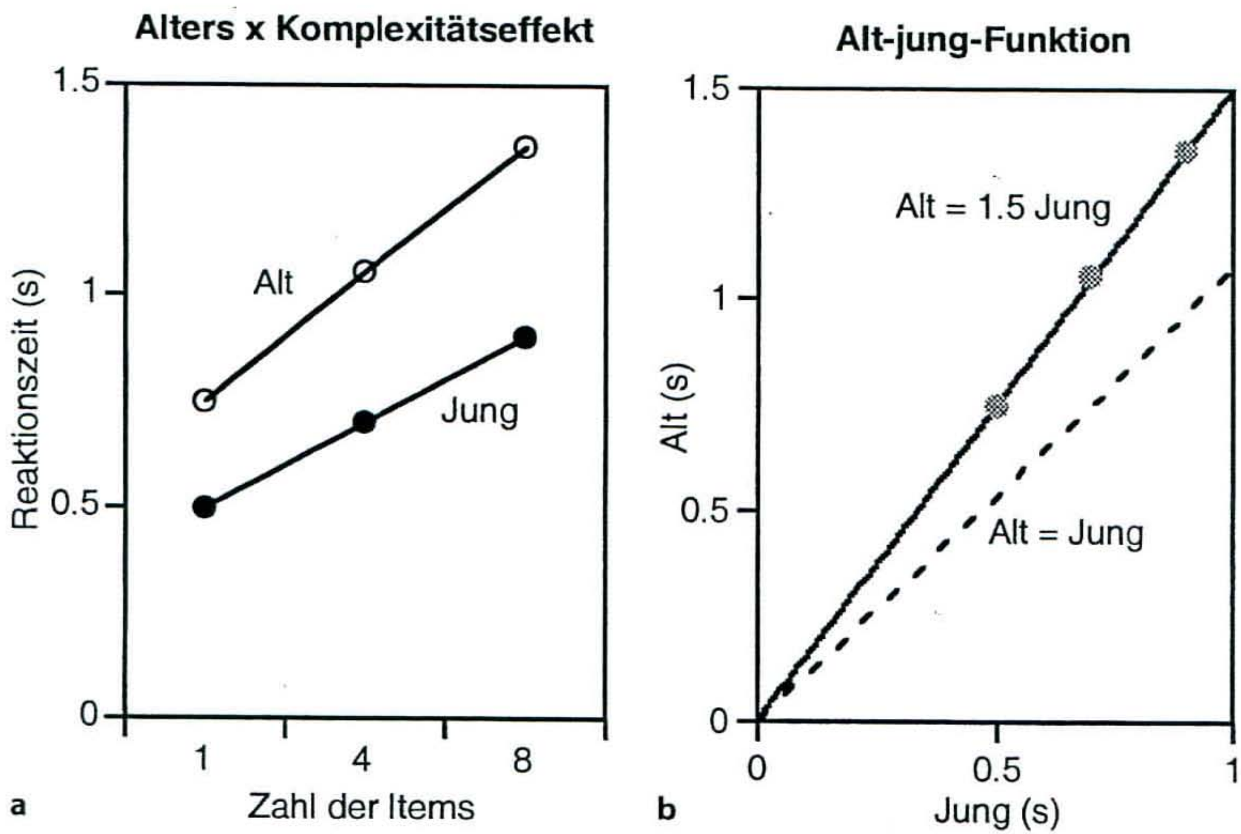
Das Zwei-Komponenten-Modell der Intelligenz



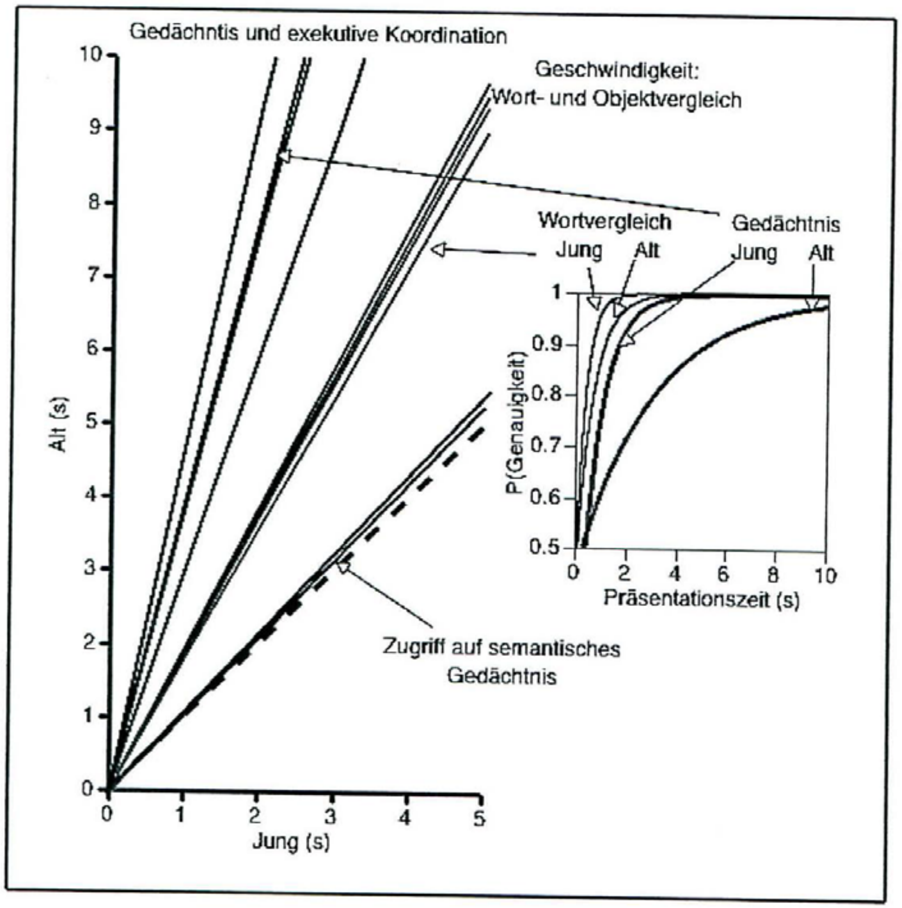
Baltes et al. 1995

Was ist kognitives Altern?

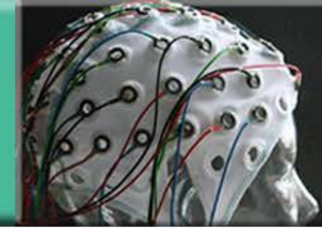


Mayr (2006)

Gibt es einen Generalfaktor des kognitiven Alterns?



Mayr (2006)



Übung und Bildung können LS und QS Daten verfälschen

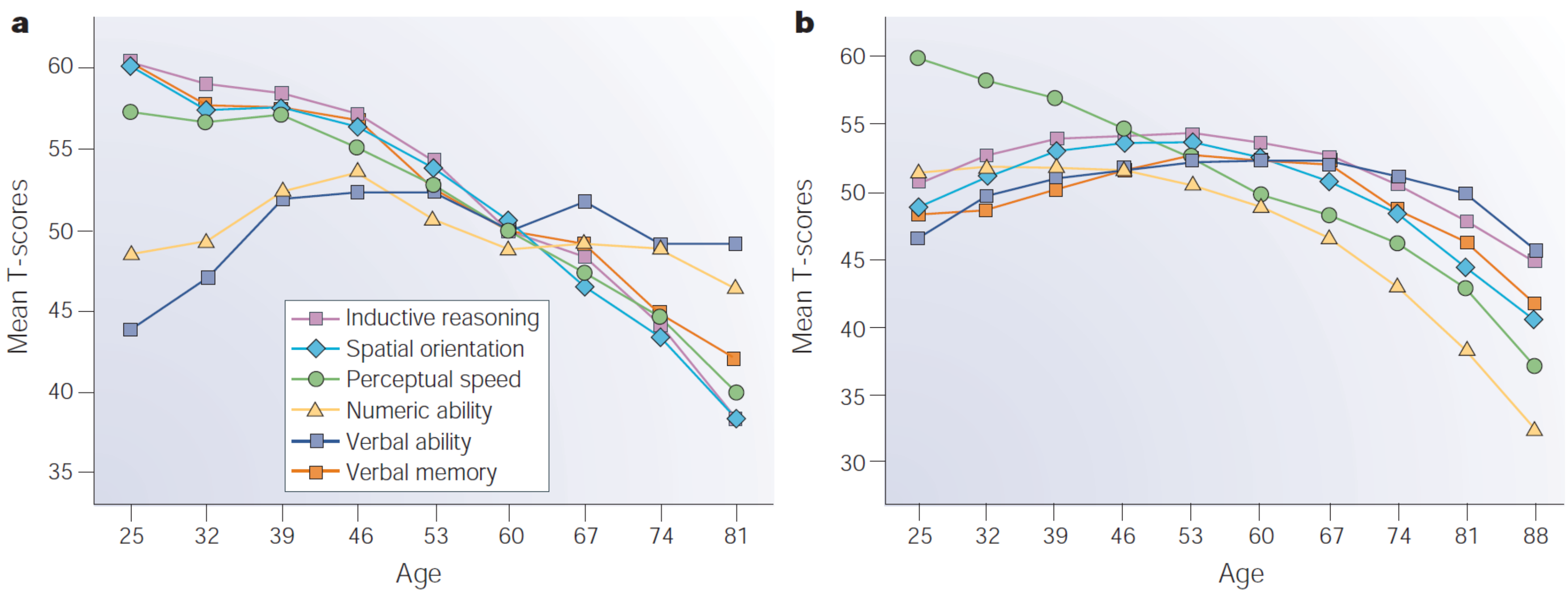


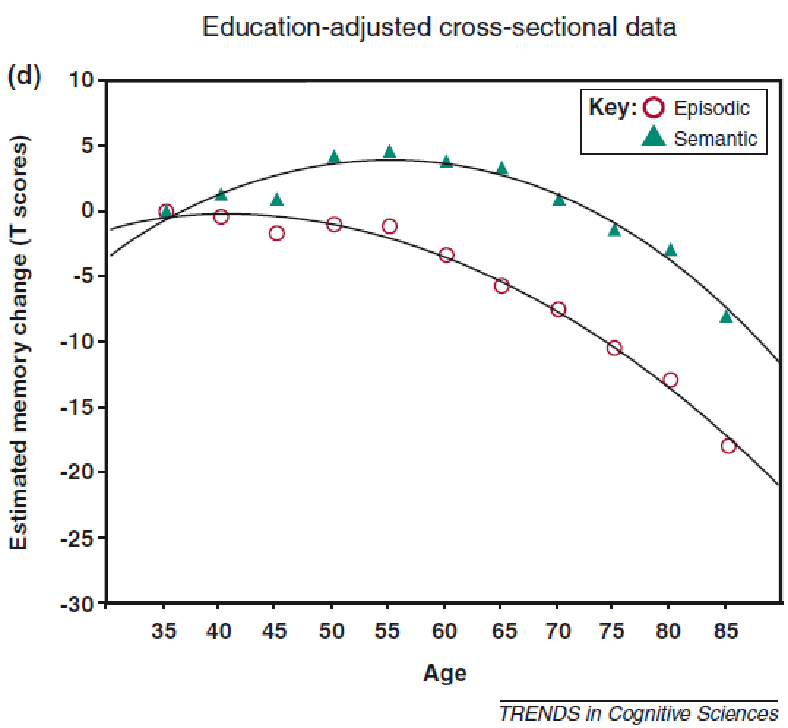
Figure 1 | **Cross-sectional and longitudinal estimates of age-related change in cognition. a** | Cross-sectional data from the Seattle Longitudinal Study. Declines are evident in all domains, with the exception of preserved verbal and numeric ability. **b** | Seven-year longitudinal data from the same study. Declines are evident in all domains after age 55, with only processing speed displaying declines before 55. Reproduced, with permission, from REF. 5 © (1996) Cambridge University Press.

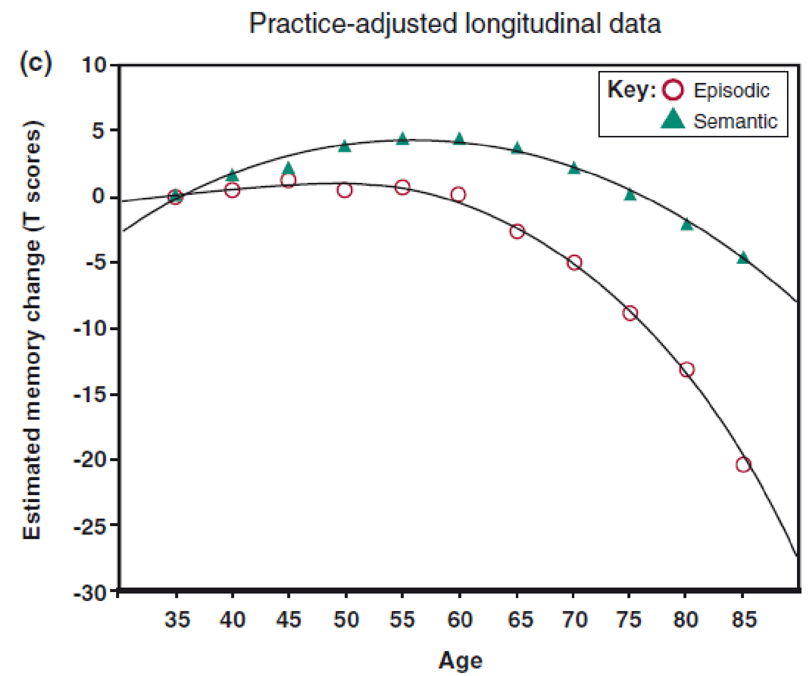
Hedden & Gabrieli, 2004

Längsschnitt- vs. Querschnittanalysen des kognitiven Alterns

Übung und Bildung können LS und QS Daten verfälschen,

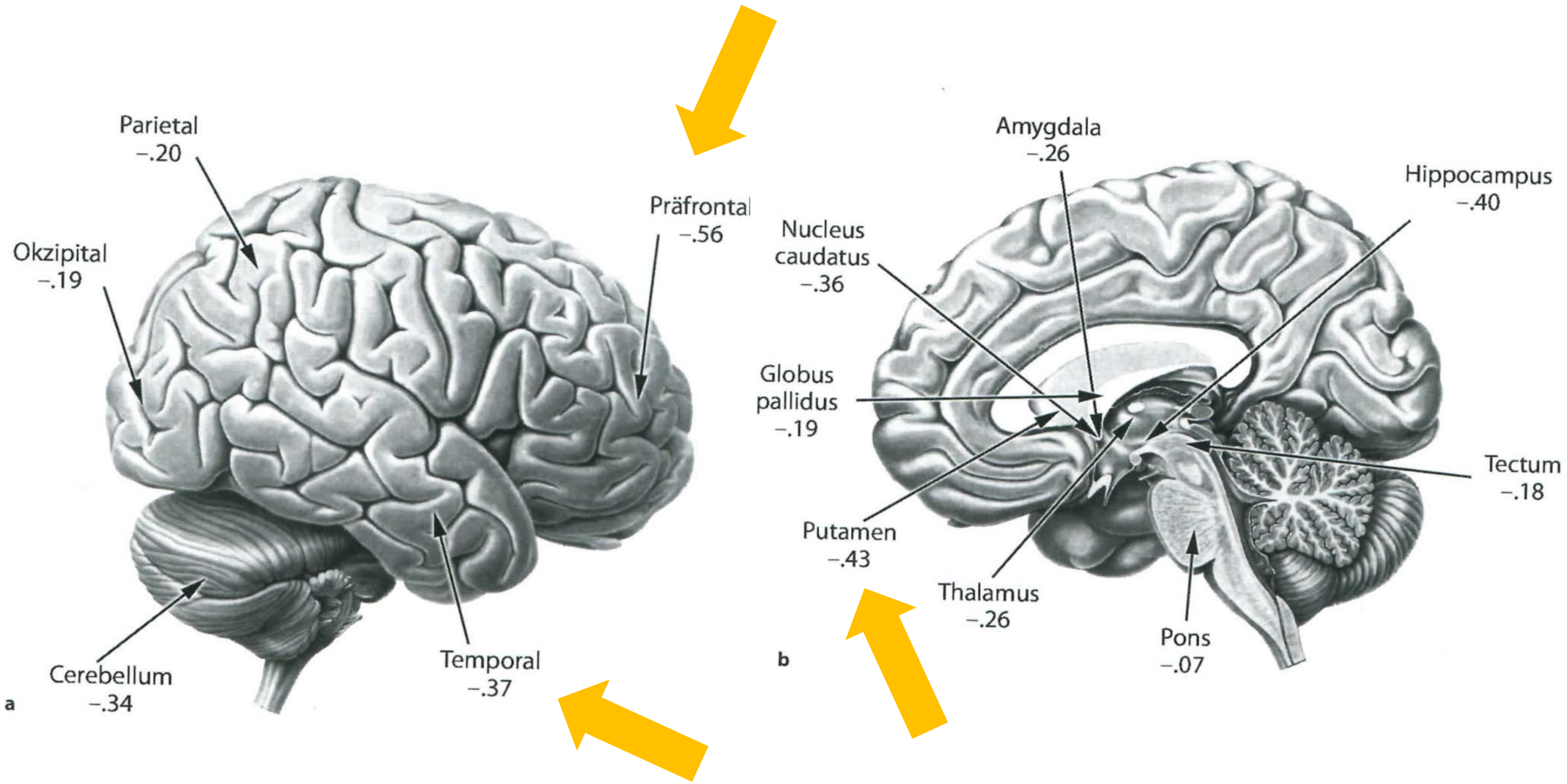
ABER:





Nyberg et al (2012)

Altern und Gehirn:



Mayr, 2006

Altern und Gehirn: Querschnitt

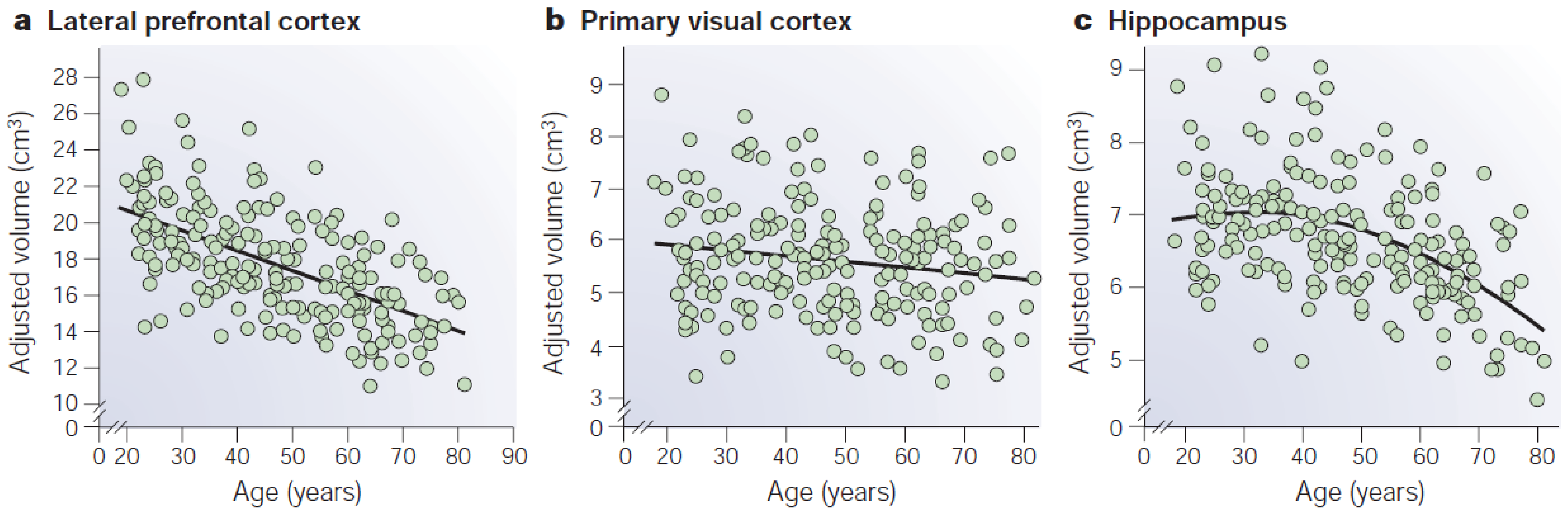
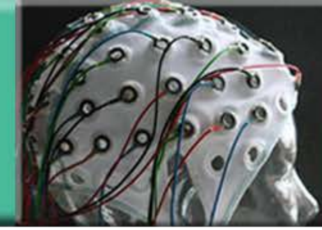
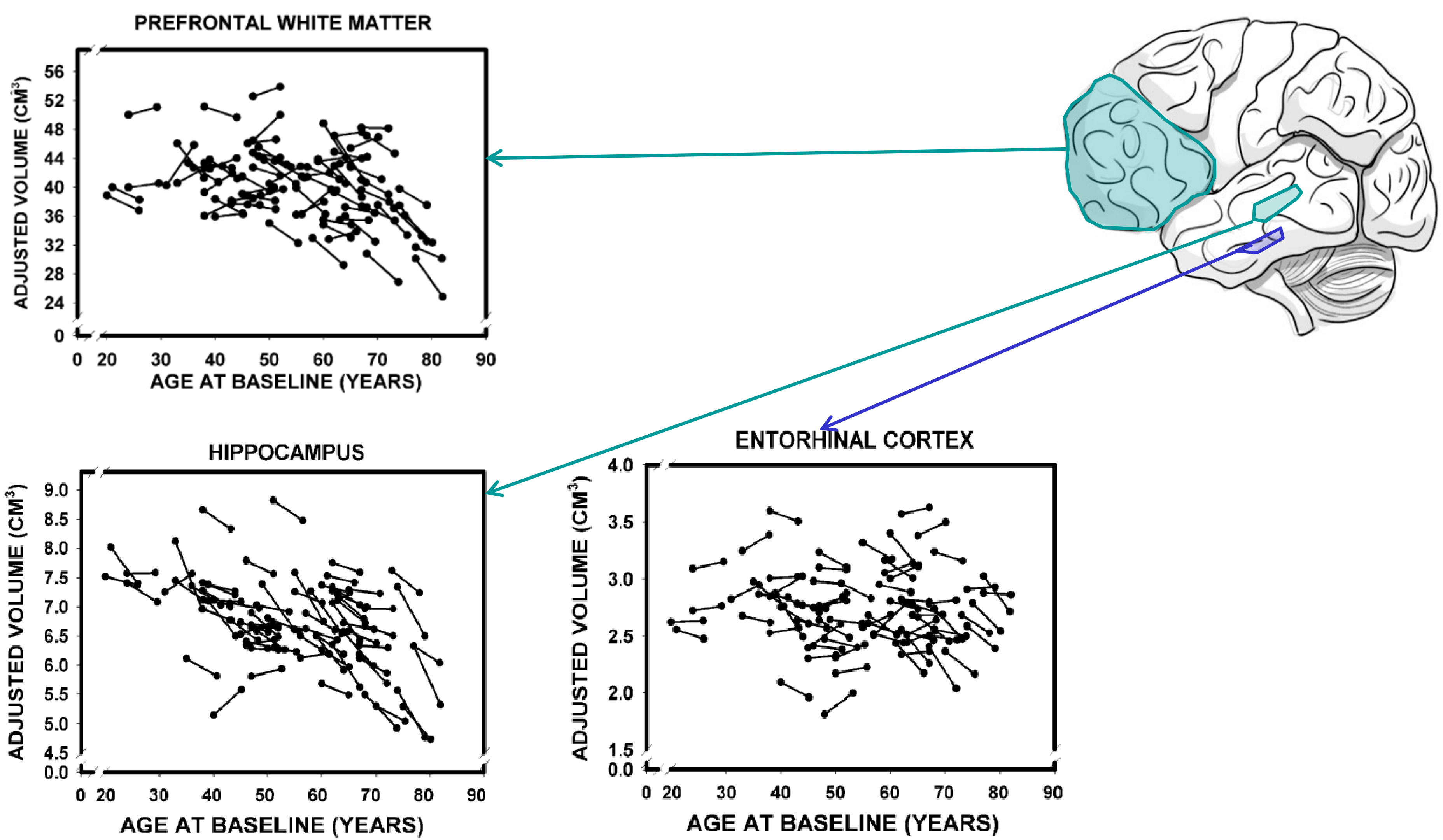


Figure 2 | **Cross-sectional estimates of age-related volumetric change in lateral prefrontal cortex, visual cortex and hippocampus measured with magnetic resonance imaging.** Points on each scatterplot indicate volumetric estimates from individuals, and the line of best fit is shown. Lateral prefrontal cortex volume declines steadily across the adult lifespan, while hippocampal volume has a curvilinear slope, with its largest declines occurring after age 60. Other areas, such as primary visual cortex, have only slight age-related volume declines. Data from REF. 25; figure courtesy of N. Raz.

Hedden & Gabrieli, 2004

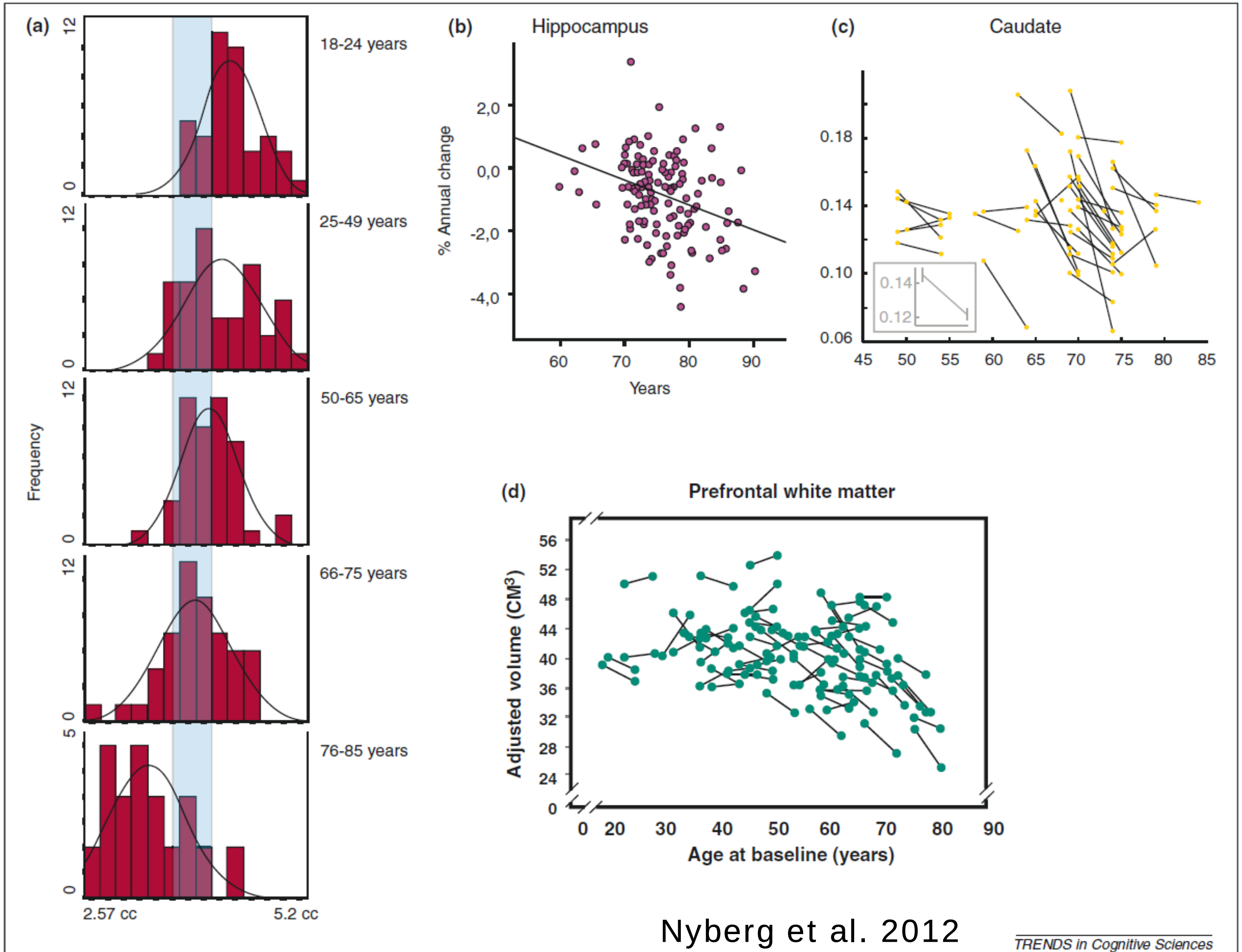
Altern und Gehirn: 5 Jahre Längsschnitt





Raz et al. (2005)

Interindividuelle Variabilität



Nyberg et al. 2012

Diffusion Tensor Imaging (DTI): Veränderung der Faserverbindungen

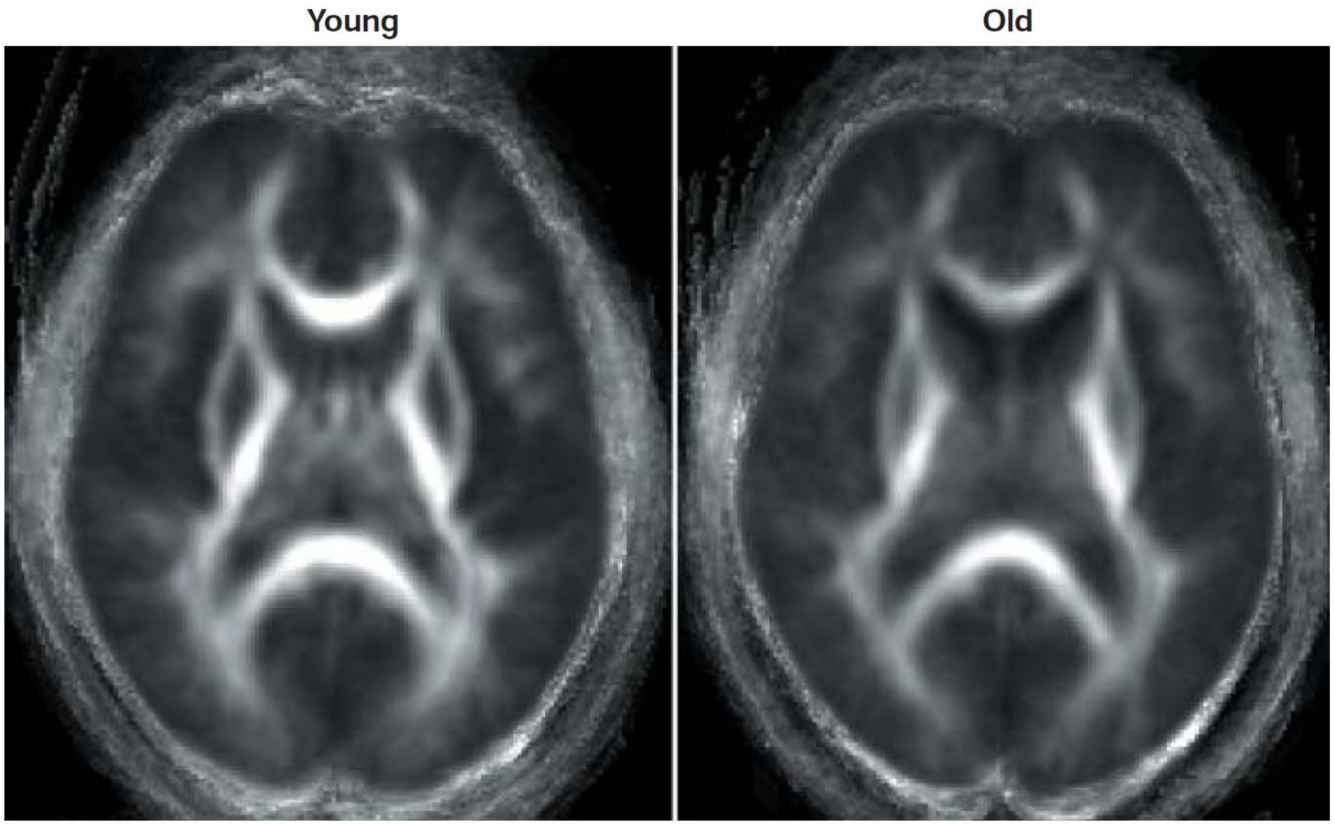
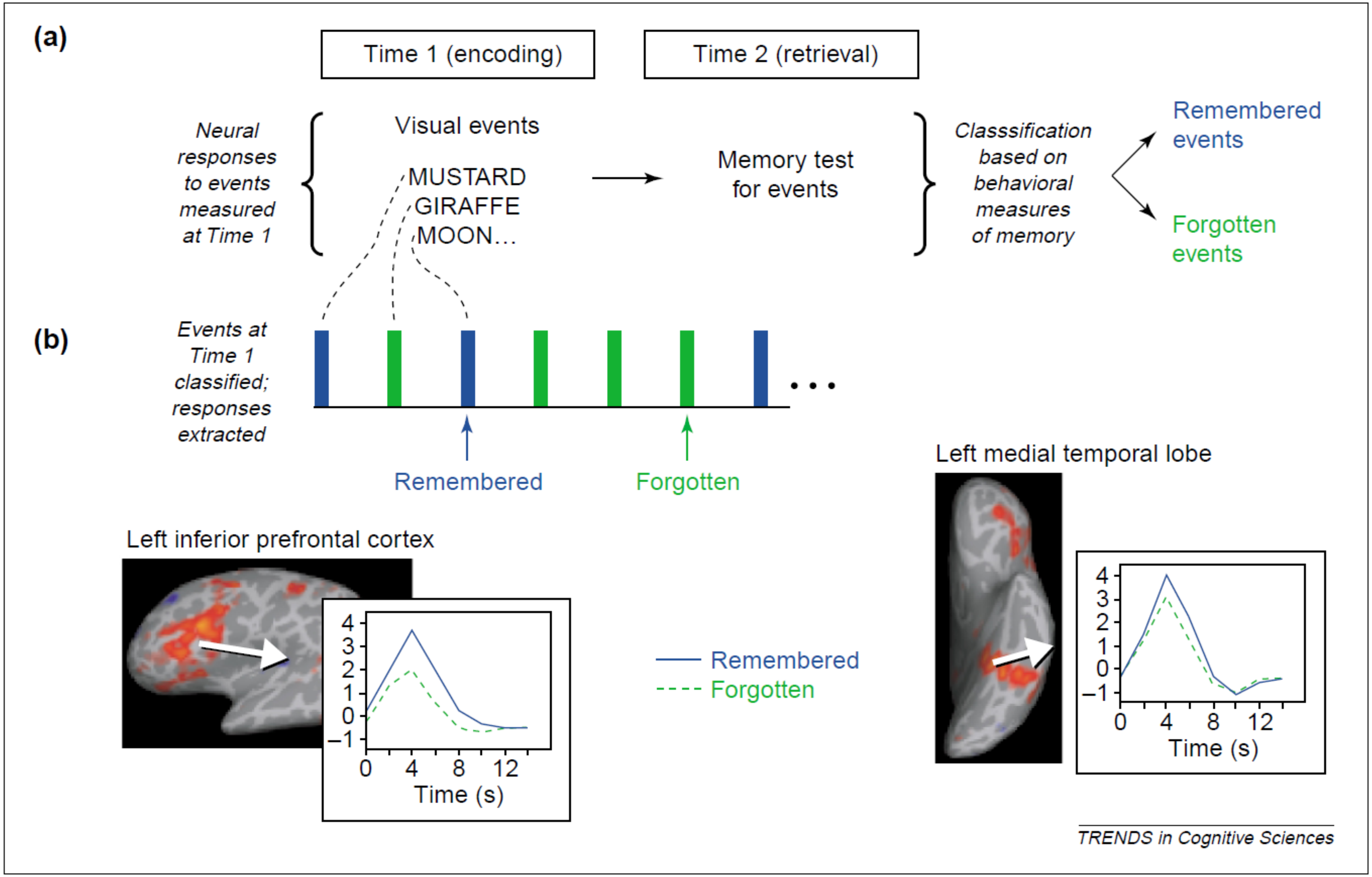


Figure 3 | **Diffusion tensor images of anisotropy of white matter in young and normal elderly subjects.** Group-averaged diffusion tensor images of anisotropy of white matter in young and normal elderly. Parallel movement of water molecules through white matter results in anisotropic diffusion, with greater anisotropy (and so greater white matter density) indicated by brighter areas. Older adults tend to show decreased white matter integrity compared with younger adults, with the greatest age-related declines occurring in anterior cortex. Data from REF. 30; figure courtesy of R. Buckner.

Hedden & Gabrieli, 2004

Subsequent Memory Effects



Paller & Wagner, 2002

Less efficient memory encoding and reduced memory in old adults

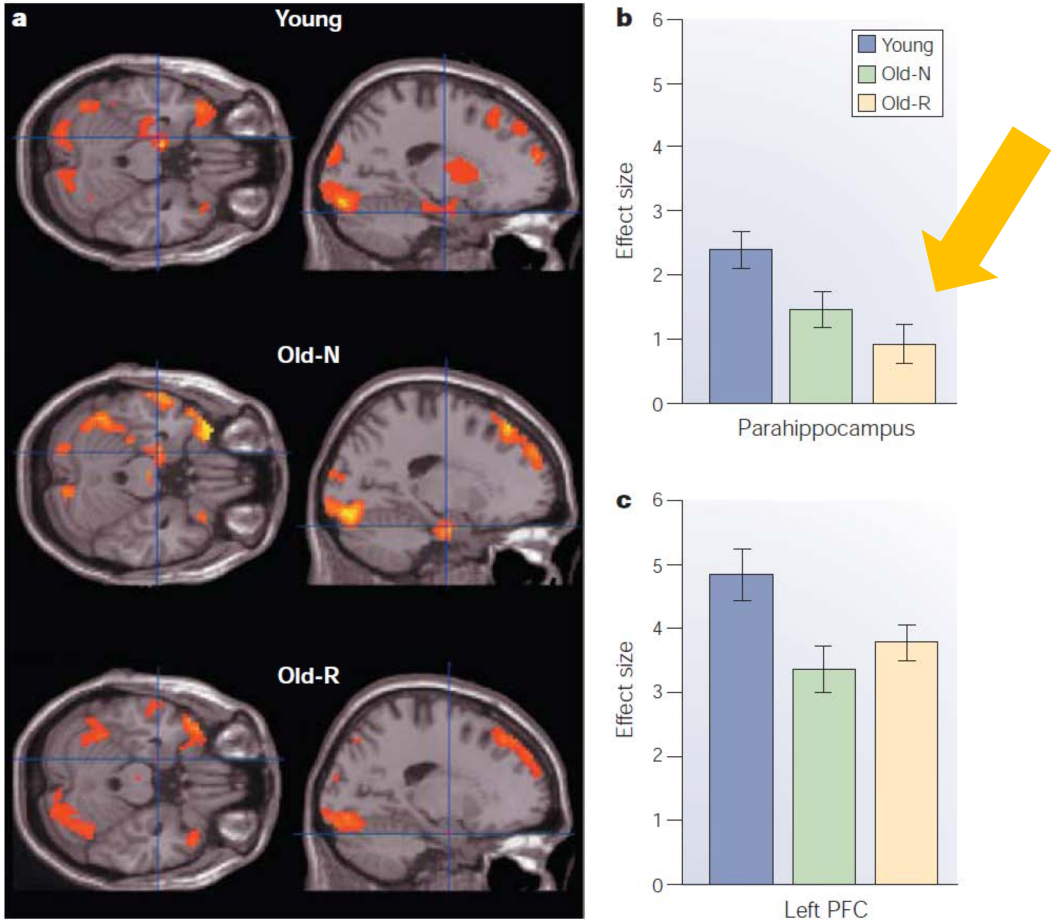


Figure 4 | **Functional magnetic resonance imaging activations for subsequently remembered words. a** | Young adults and older adults with normal memory performance (old-N) exhibit similar activation in the parahippocampus, while older adults with reduced memory (old-R) exhibit less parahippocampal activation. **b**, **c** | Group comparison of effect sizes (percent signal change) in parahippocampus (**b**) and left prefrontal cortex (PFC) (**c**). Bars indicate standard errors. Modified, with permission, from REF. 87 © (2003) Oxford University Press.

Hedden & Gabrieli, 2004

What characterizes successful seniors?

Cognitive Reserve: Individual differences in how people process tasks allow some to cope better than others with brain pathology.

High performing old adults show enhanced brain activity in brain regions not activated in young adults.

?? Compensatory engagement of general purpose mechanisms to assist in resolving high task demands. **??**

Hedden & Gabrieli, 2004

Efficient memory encoding due to compensatory activity in old adults?

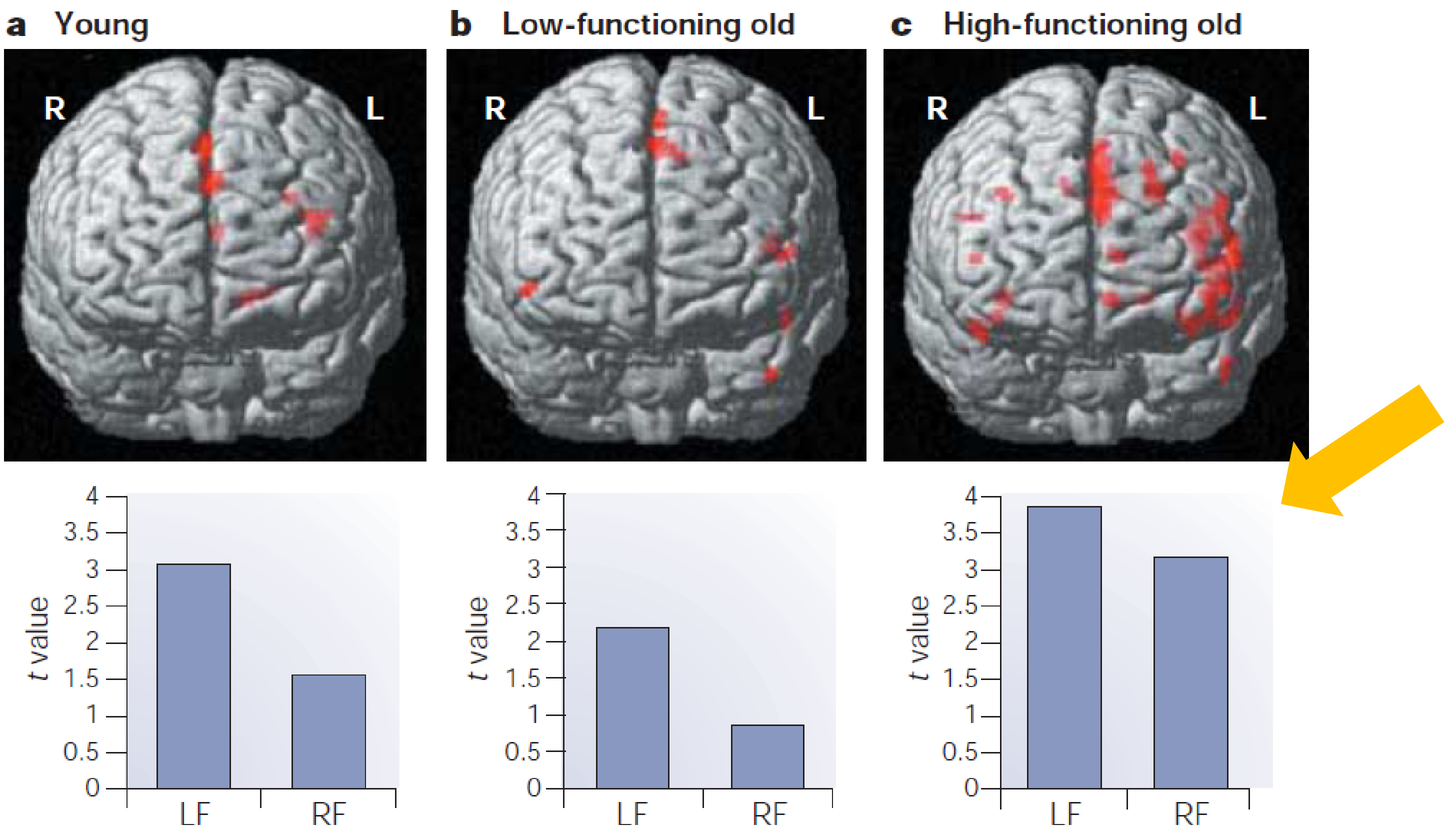


Figure 5 | **Neural activations in prefrontal cortex during a memory encoding task.** Activations are shown for young adults, low-performing older adults and high-performing older adults. Low-performing older adults exhibit a similar pattern as do young adults, with lower overall levels of activation. High-performing older adults exhibit greater bilateral activation. RF, right frontal; LF, left frontal. Data from REF. 93.

Hedden & Gabrieli, 2004

What characterizes successful seniors?

Compensatory engagement of general purpose mechanisms to assist in resolving high task demands.

But:

There is also evidence for non-selective recruitment: Could be a reflection of brain pathology: e.g. a break down of inhibitory connections between both hemispheres. Over-recruitment in this case is associated with poorer performance.

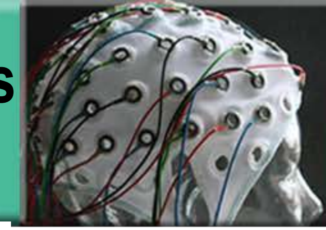
Hedden & Gabrieli, 2004

What characterizes successful seniors?

- Brain reserve: Individual differences in the brain itself allow some people to cope better than others with brain pathology’ ([33], p. 2016).
- Cognitive reserve: ‘Individual differences in how people process tasks allow some to cope better than others with brain pathology’ ([33], p. 2016).

Nyberg et al. 2012

Brain reserve: Cortical thinkness predicts executive control in old age



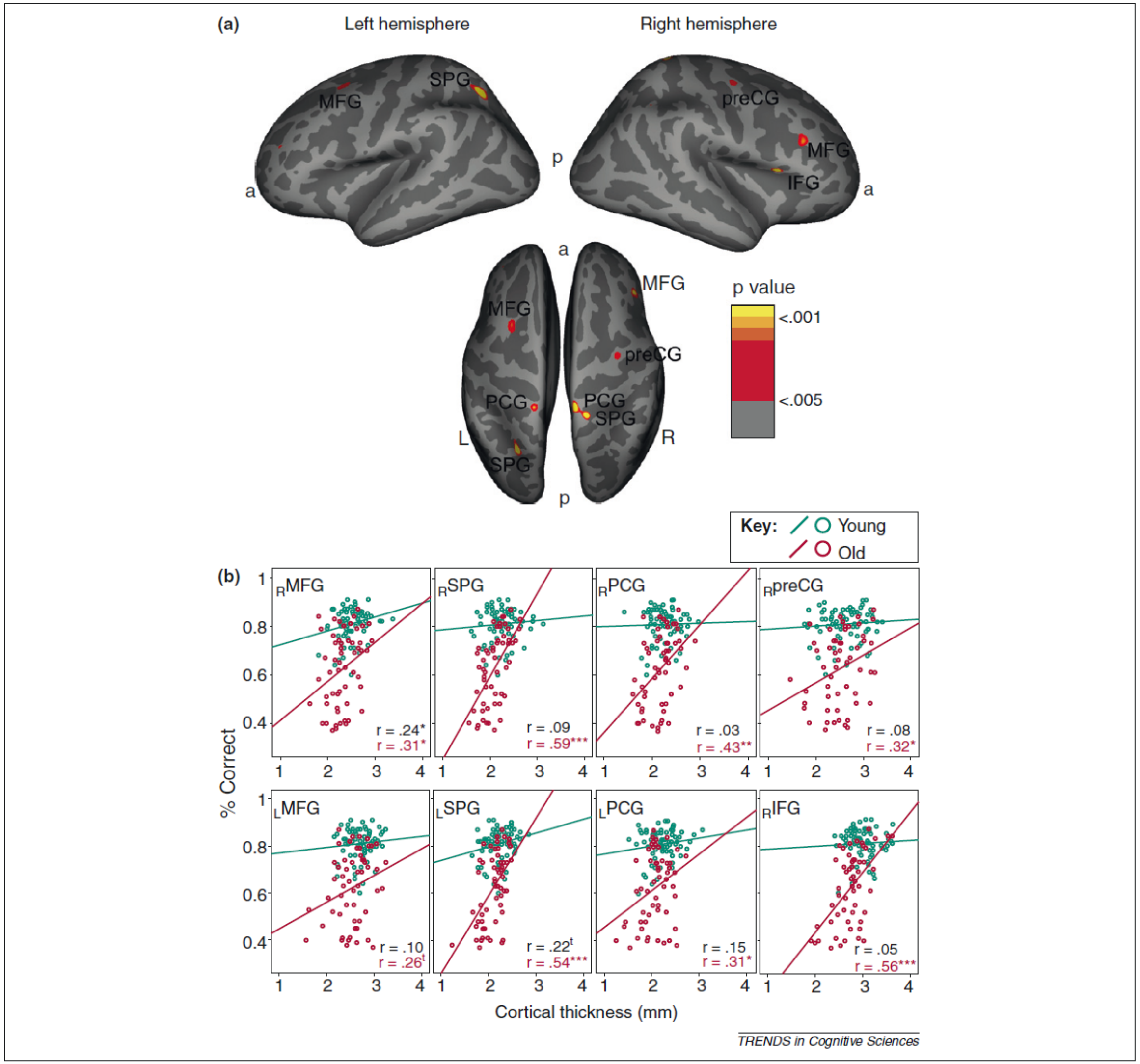


Figure 4. The relation between cortical thickness and executive control increases from early to late adulthood, suggesting that individuals who experience less cortical thinning are more likely to maintain high levels of executive control in old age. **(a)** Areas where a thicker cortical mantle is associated with better performance on the Wisconsin Card Sorting Test (WCST), a measure of executive control in the total sample, statistically controlling for age. **(b)** Mean cortical thickness regressed on WCST performance. x-axis: cortical thickness in mm; y-axis: WCST accuracy (% correct); *r*: Pearson's correlation coefficient, $*p < .05$, $**p < .01$, $***p < .001$, ^{t} = trend ($.07 > p > .05$). MFG, middle frontal gyrus; IFG, inferior frontal gyrus; SPG, superior parietal gyrus; preCG, precentral gyrus; PCG, post-central gyrus; a, anterior; p, posterior; L, left; R, right. Adapted, with permission, from [47].

Nyberg et al. 2012

Brain reserve: Upregulation of PFC activity in high performing old adults

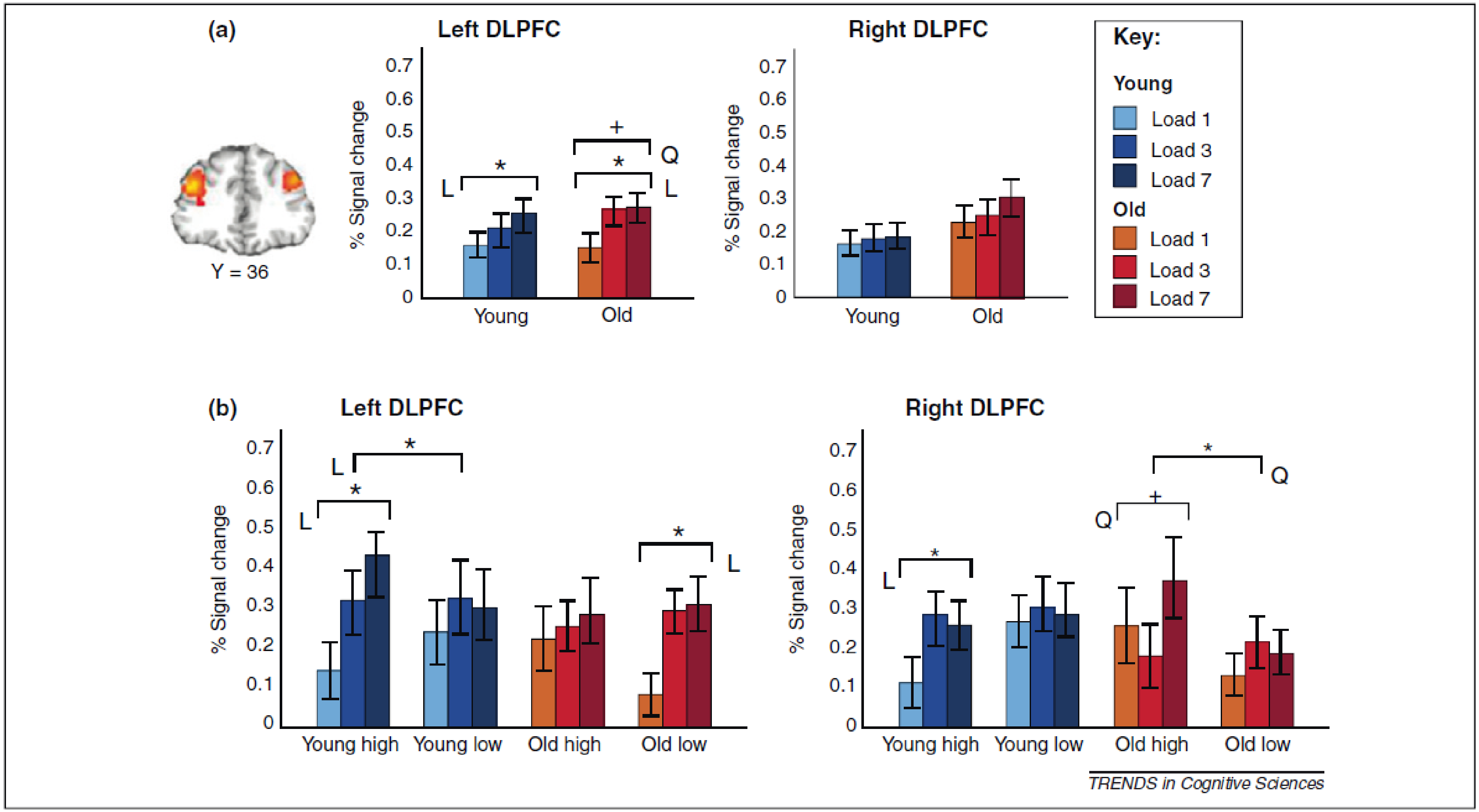


Figure 5. Age-related reduction in load-dependent modulation of working-memory related BOLD responses. **(a)** This panel shows that younger adults have a linear up-regulation of frontal BOLD responses as a function of load, whereas older adults show no up-regulation from load 3 to load 7. **(b)** This panel shows that high-performing elderly persons exhibit a load-dependent BOLD response that mimics that of younger adults. DLPFC, dorsolateral prefrontal cortex. Reproduced, with permission, from [59].

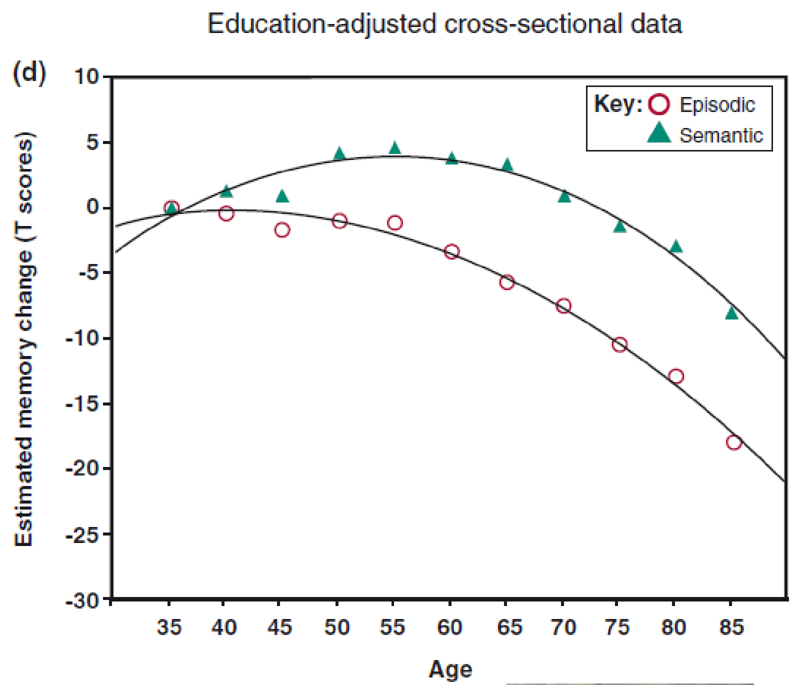
Nyberg et al. 2012

Cognitive reserve:

- Episodic memory declines steadily through the adult years.

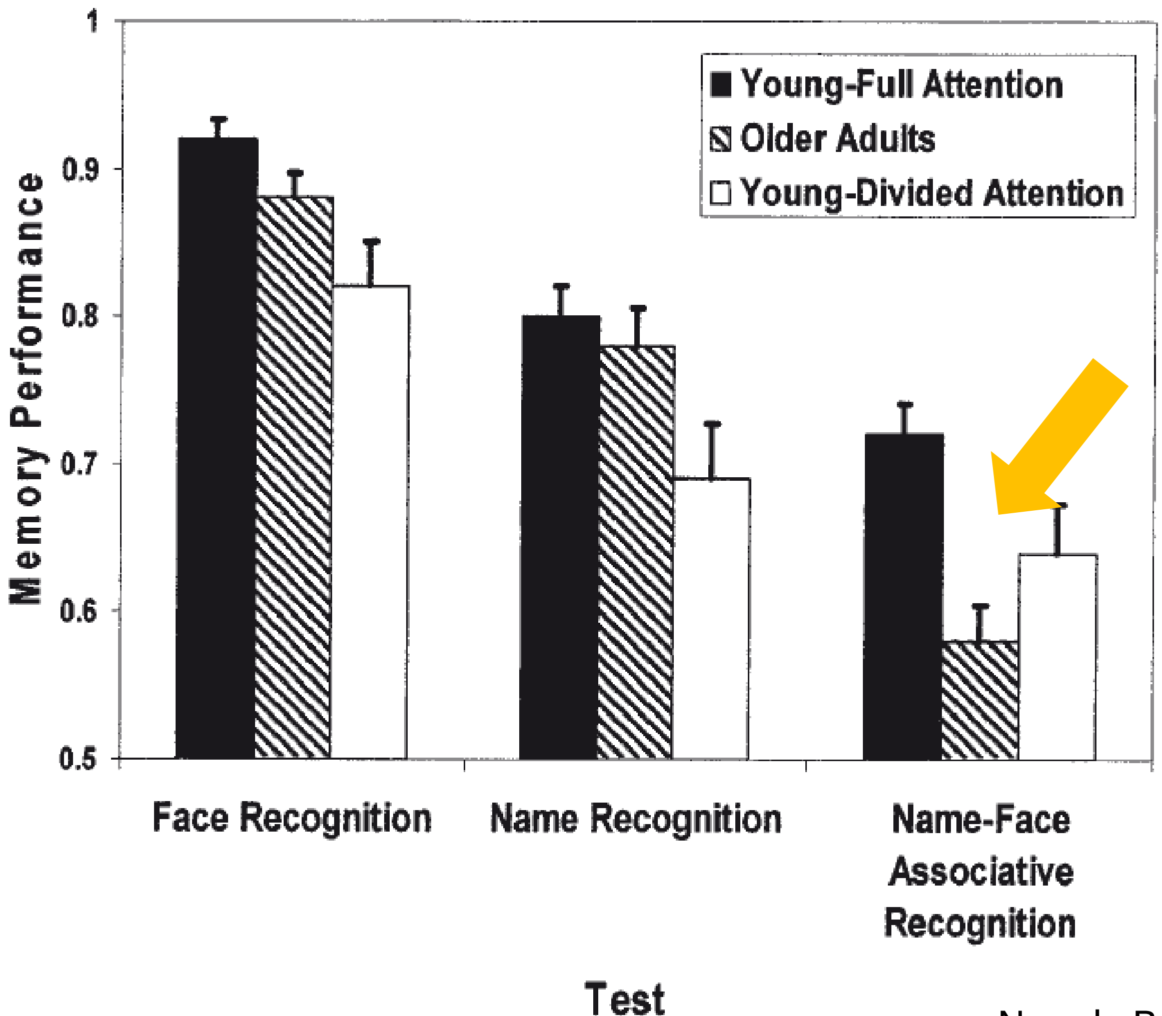
- Associative deficit hypothesis:

„The age deficit in memory comes from an impaired capacity to form associations between previously unrelated stimuli“

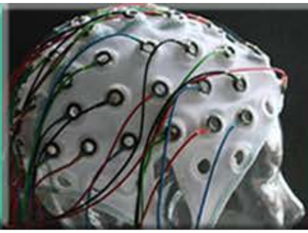


Naveh-Benjamin et al. 2004

Associative deficit hypothesis:



Naveh-Benjamin et al. 2004



Environmental support

Characteristics of a retention test that support retrieval:

-Semantically related items

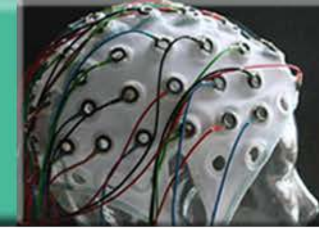
-Pictures vs. words: The amount of figurative details at learning

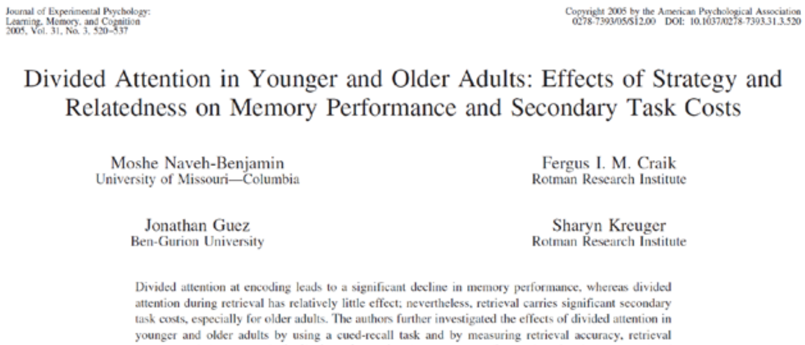
- Strategy utilization

- Availability of familiarity signals

Naveh-Benjamin et al. 2004

Environmental support




Journal of Experimental Psychology:
Learning, Memory, and Cognition
2005, Vol. 31, No. 3, 520–537

0278-7393/05/$12.00 DOI: 10.1037/0278-7393.31.3.520

Divided Attention in Younger and Older Adults: Effects of Strategy and Relatedness on Memory Performance and Secondary Task Costs

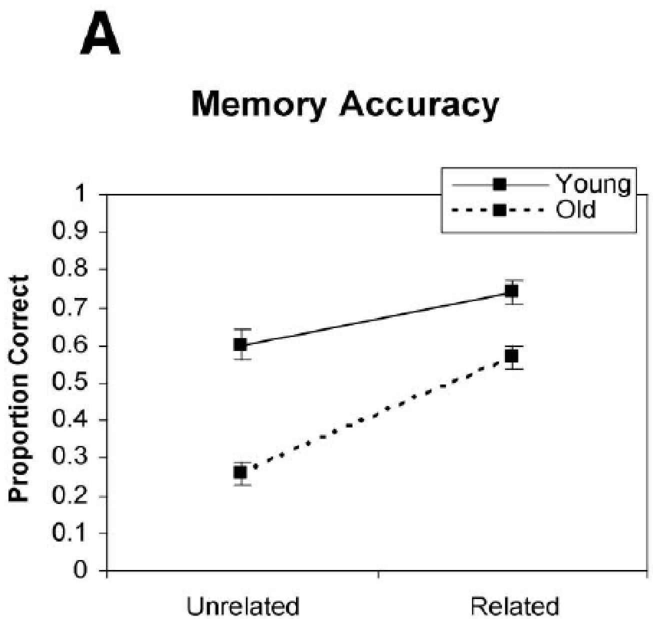
Moshe Naveh-Benjamin
University of Missouri—Columbia

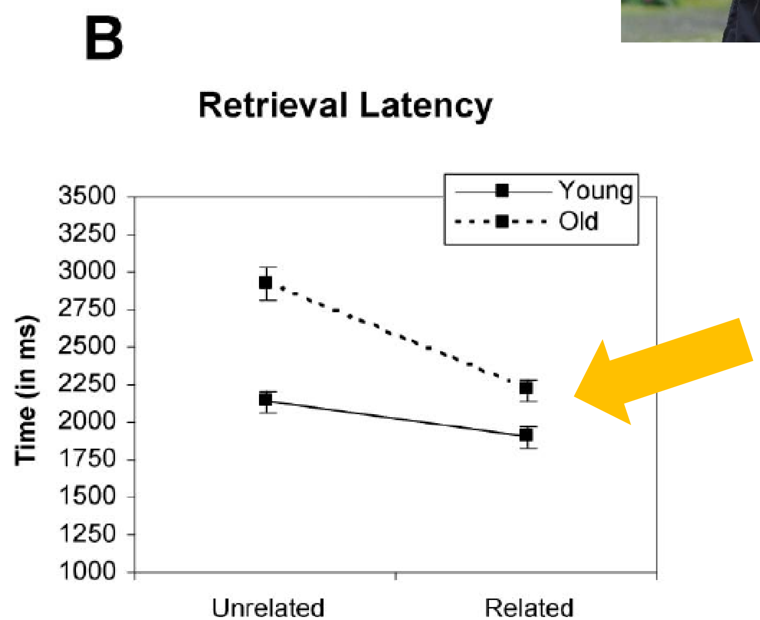
Fergus I. M. Craik
Rotman Research Institute

Jonathan Guez
Ben-Gurion University

Sharyn Kreuger
Rotman Research Institute

Divided attention at encoding leads to a significant decline in memory performance, whereas divided attention during retrieval has relatively little effect; nevertheless, retrieval carries significant secondary task costs, especially for older adults. The authors further investigated the effects of divided attention in younger and older adults by using a cued-recall task and by measuring retrieval accuracy, retrieval





Environmental support

Characteristics of a retention test that support retrieval:

-Semantically related items

-Pictures vs. words: The amount of figurative details at learning matters

- Strategy utilization

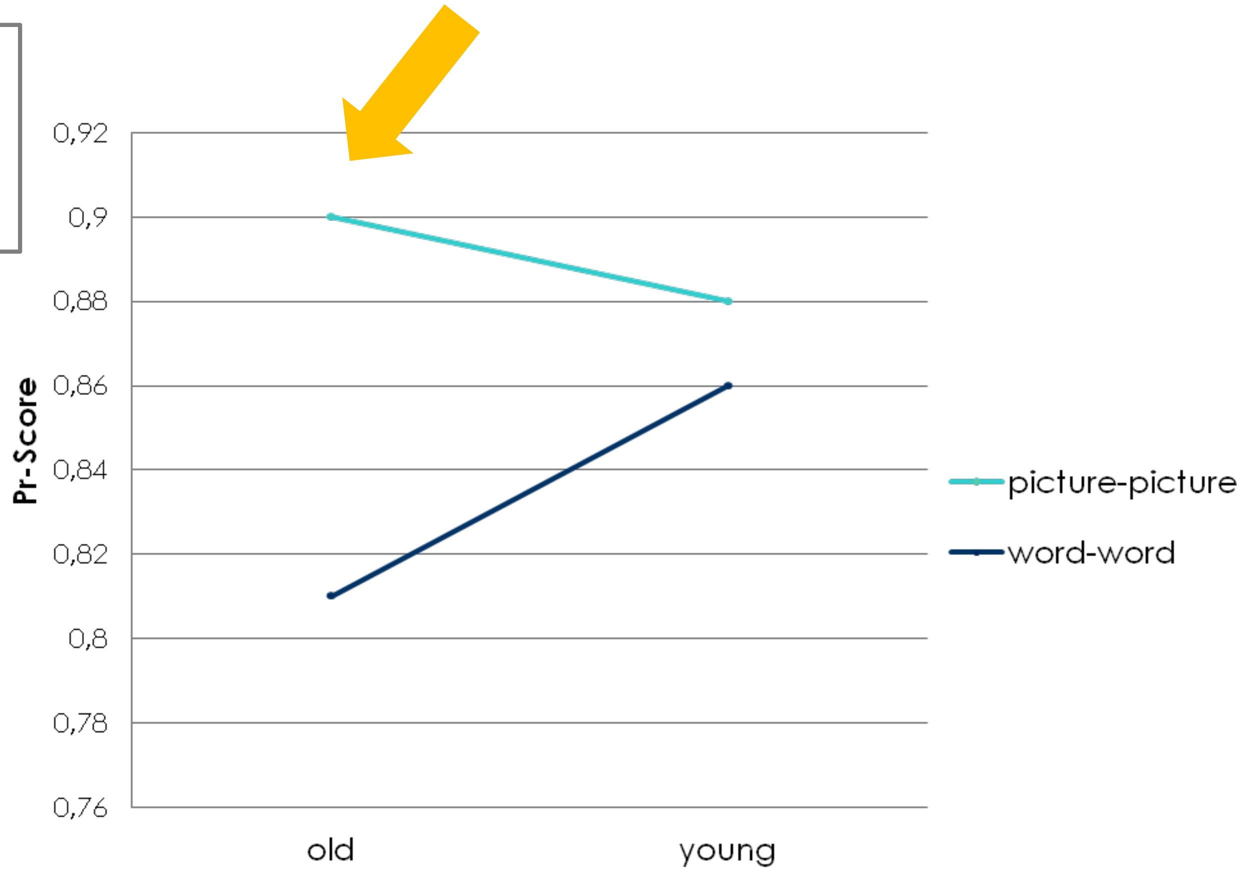
- Availability of familiarity signals

Naveh-Benjamin et al. 2004

Environmental support: Pictures vs Words

Learning and Test Format

BALL



Ally et al. 2008

Environmental support

Characteristics of a retention test that support retrieval:

-Semantically related items

-Pictures vs. words: The amount of figurative details at learning

- Strategy utilization

- Availability of familiarity signals

Naveh-Benjamin et al. 2004

Environmental support: Strategy Utilization

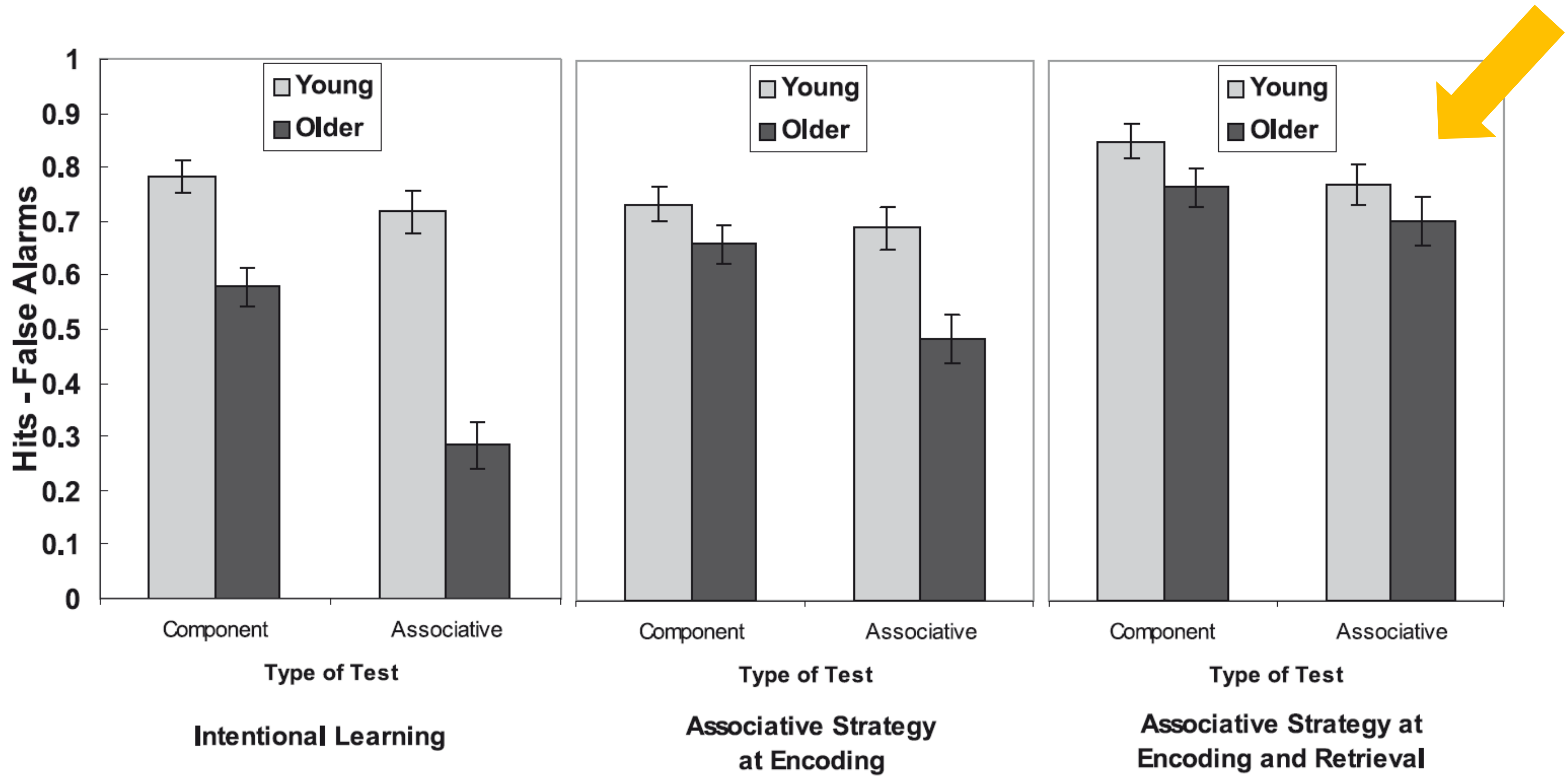


Figure 1. Proportion hits minus proportion false alarms in the component and the associative recognition tests for young and older participants in each of the instruction conditions. Bars depict standard errors.

Naveh-Benjamin et al. 2007

Environmental support

Characteristics of a retention test that support retrieval:

-Semantically related items

-Pictures vs. words: The amount of figurative details at learning

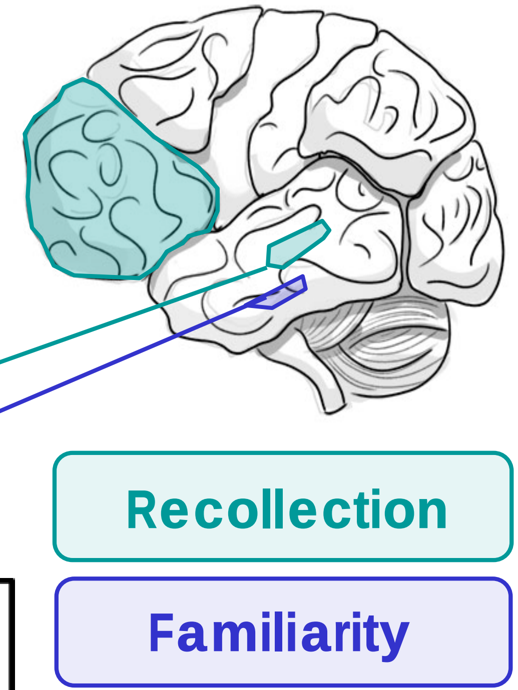
- Strategy utilization

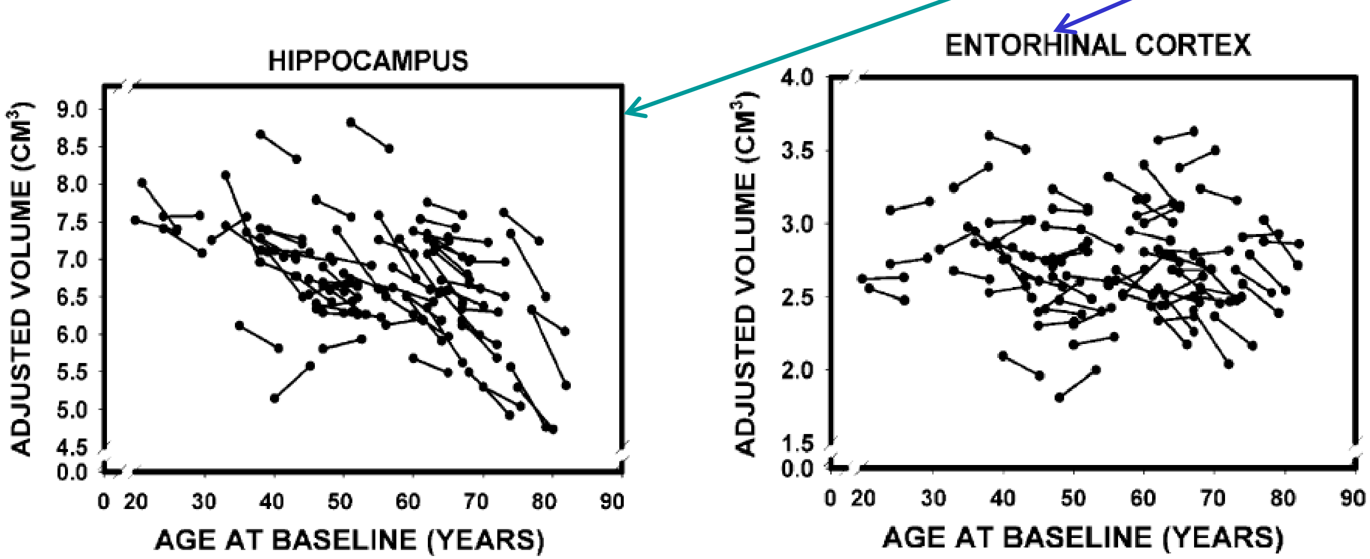
- Availability of familiarity signals

Naveh-Benjamin et al. 2004

Environmental support: Availability of familiarity signals

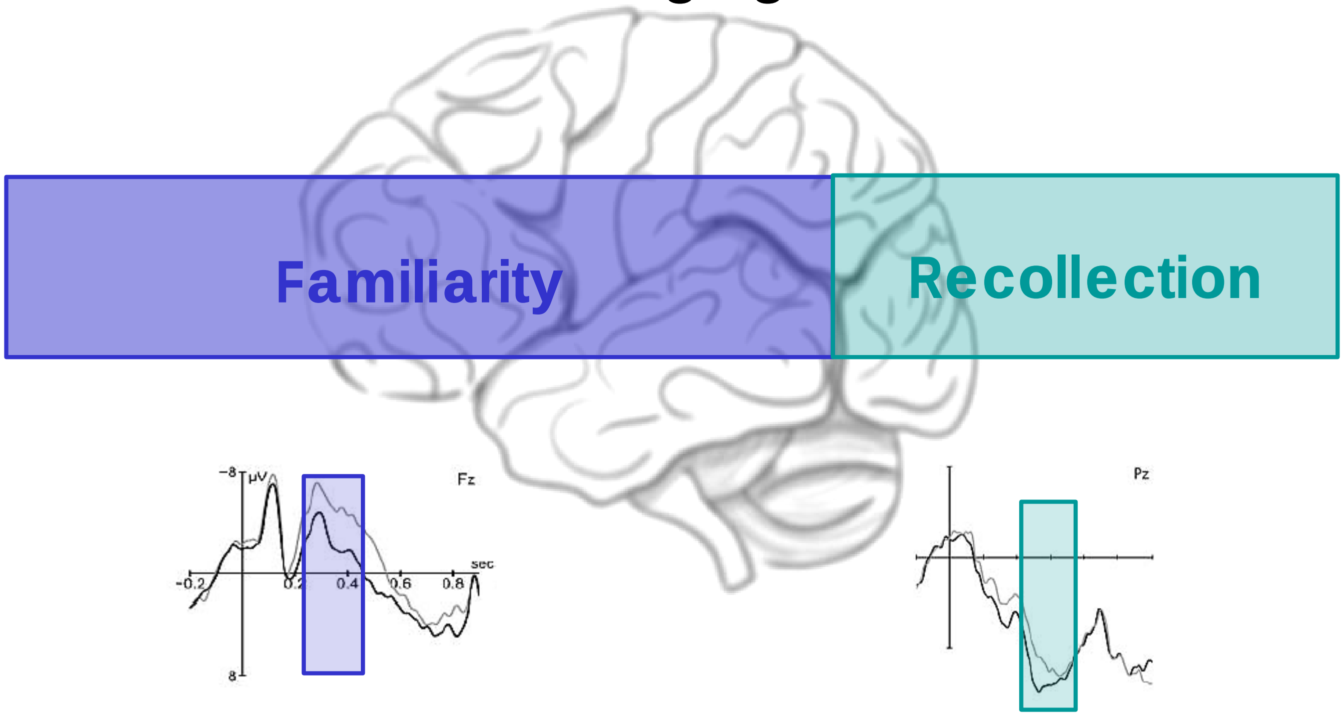
Dual Process Models of Recognition Memory: Familiarity & Recollection





Recollection is attenuated but familiarity is preserved in old age

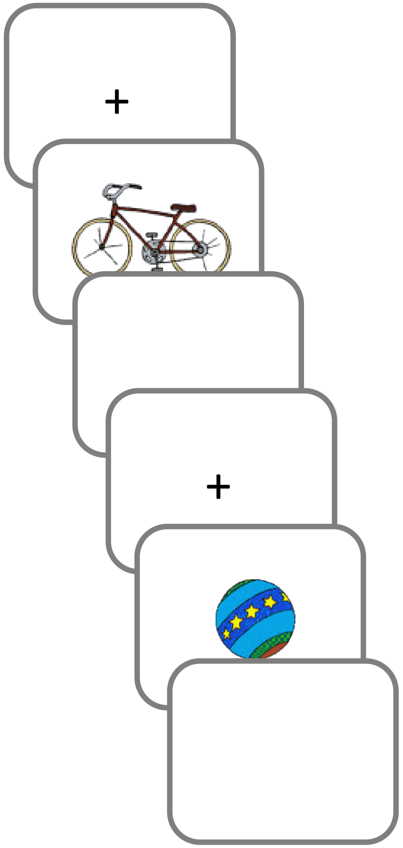
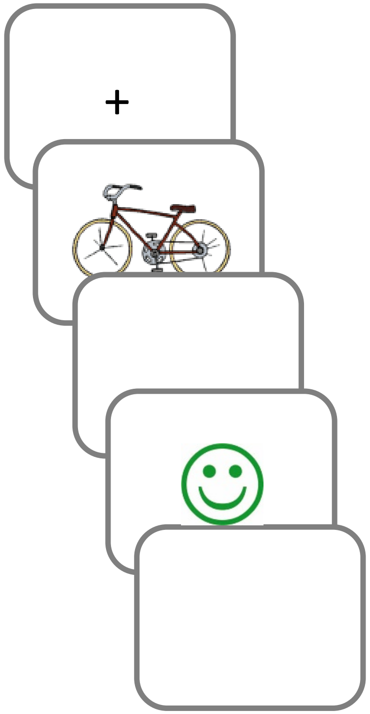
Normal aging brain



✔

✘ absent or diminished

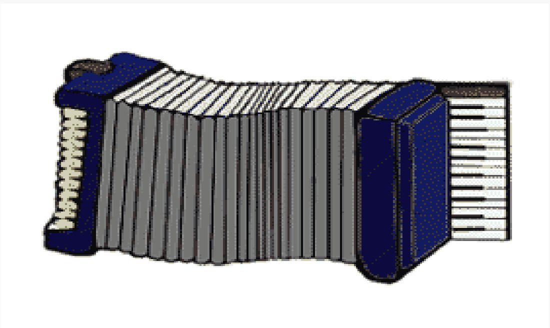
Response speed paradigm

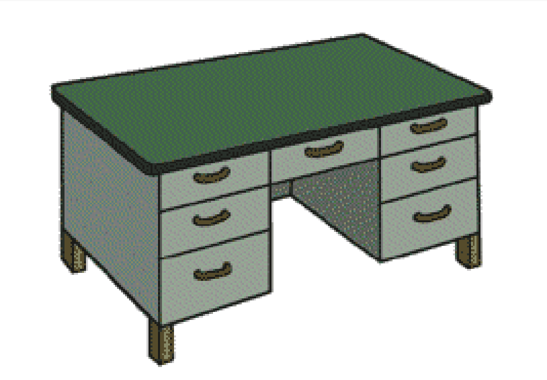
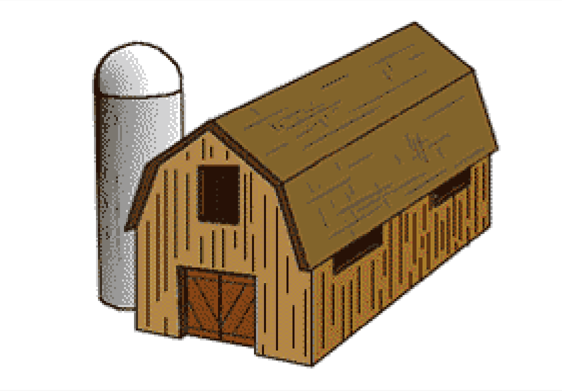
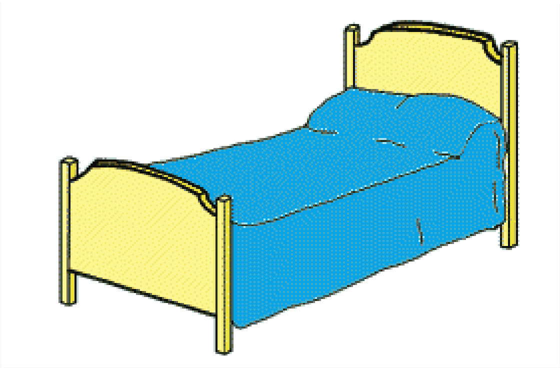
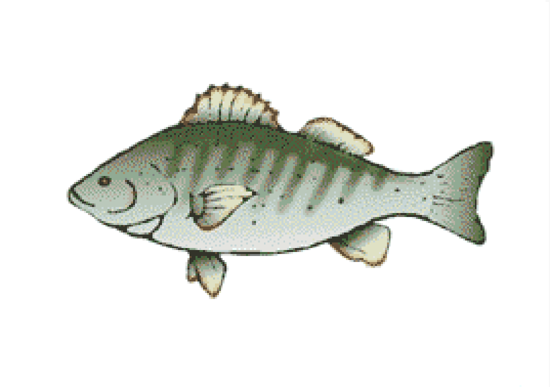
Study Trial	Test Trial		
			

nonspeeded	speeded
500 ms	500 ms
750 / 1050 ms	950 / 1250 ms
5000 + 200 ms	200 ms
1000 ms	1000 ms
2000 ms	2000 ms
recollection & **familiarity**	mainly **familiarity**

adapted from *Mecklinger, Brunnemann & Kipp (2010)*

Response deadline and perceptually rich stimuli

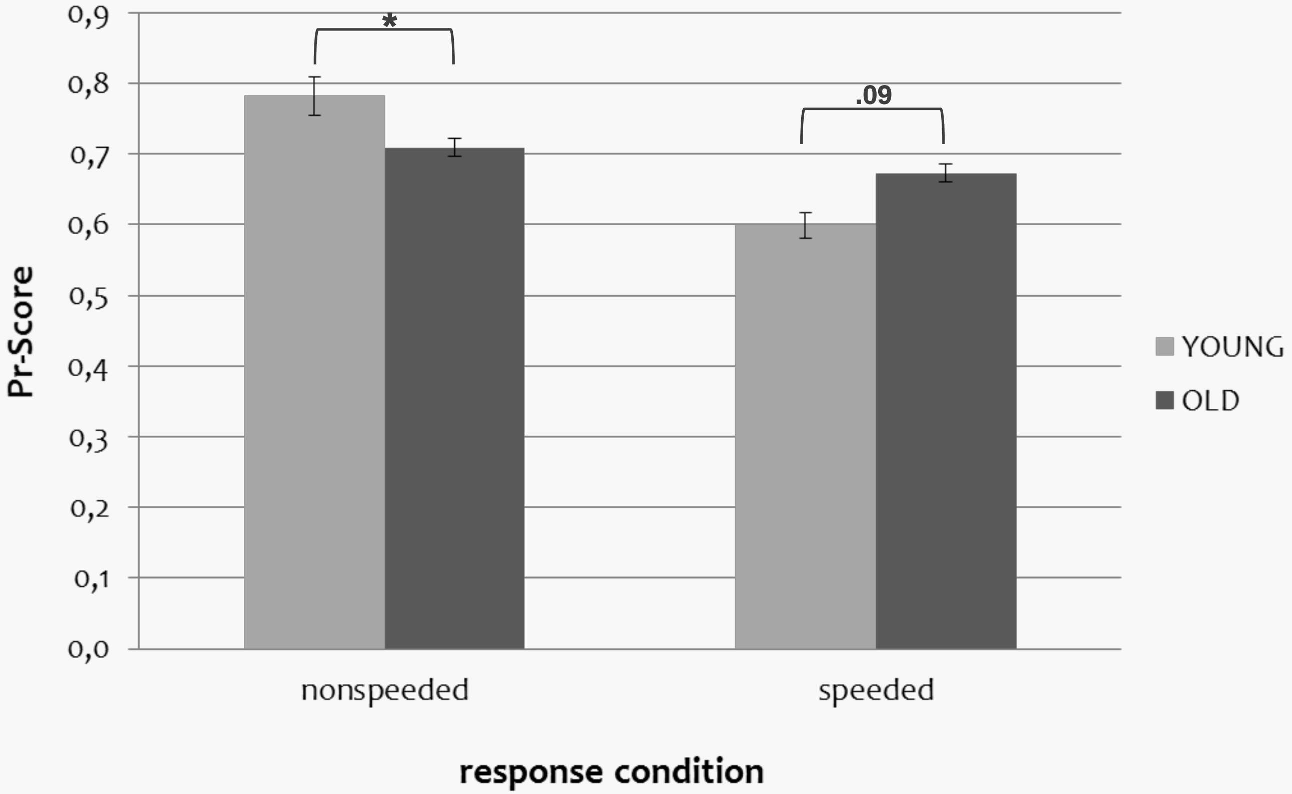


Hypotheses

	NONSPEEDED	SPEEDED
Behavioral	young > old	young = old

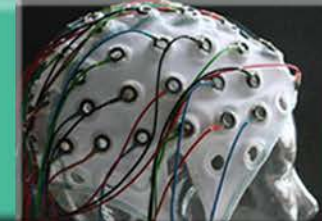
Behavioral results



Age-related recognition impairments are eliminated under speeded response conditions

Scheuplein, Bridger & Mecklinger, 2014

ERP results I

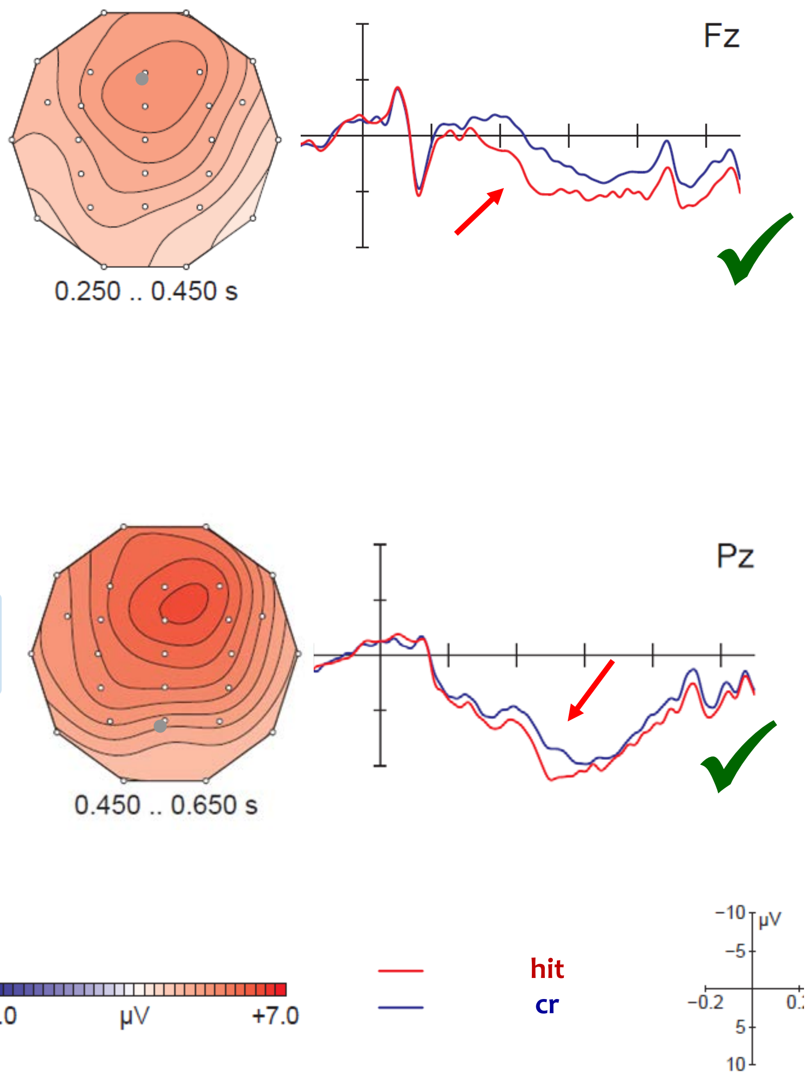


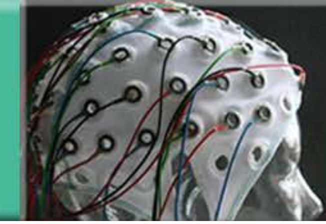
YOUNG	OLD

NONSPEEDED

EARLY

LATE



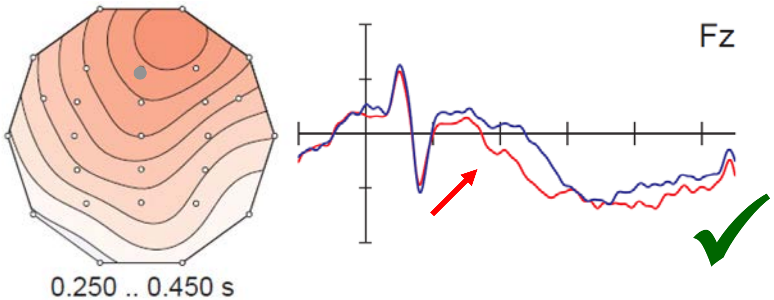


ERP results II

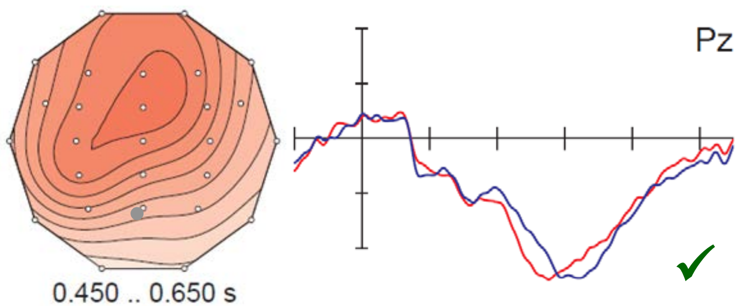
YOUNG	OLD

SPEEDED

EARLY



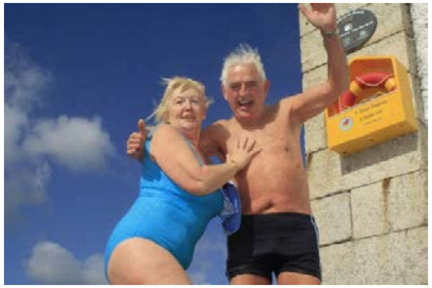
LATE



Summary: Environmental support

- Semantically related items
- The amount of figurative details at learning
- Strategy untilization
- Availability of familiarity signals

Old people are happier



Socioemotional Selectivity Theory:

- Enhanced emotion regulation with old age
- If time is perceived as limited ->

  optimization of emotional meaningfulness

Mather & Carstensen, 2005

Old people are happier

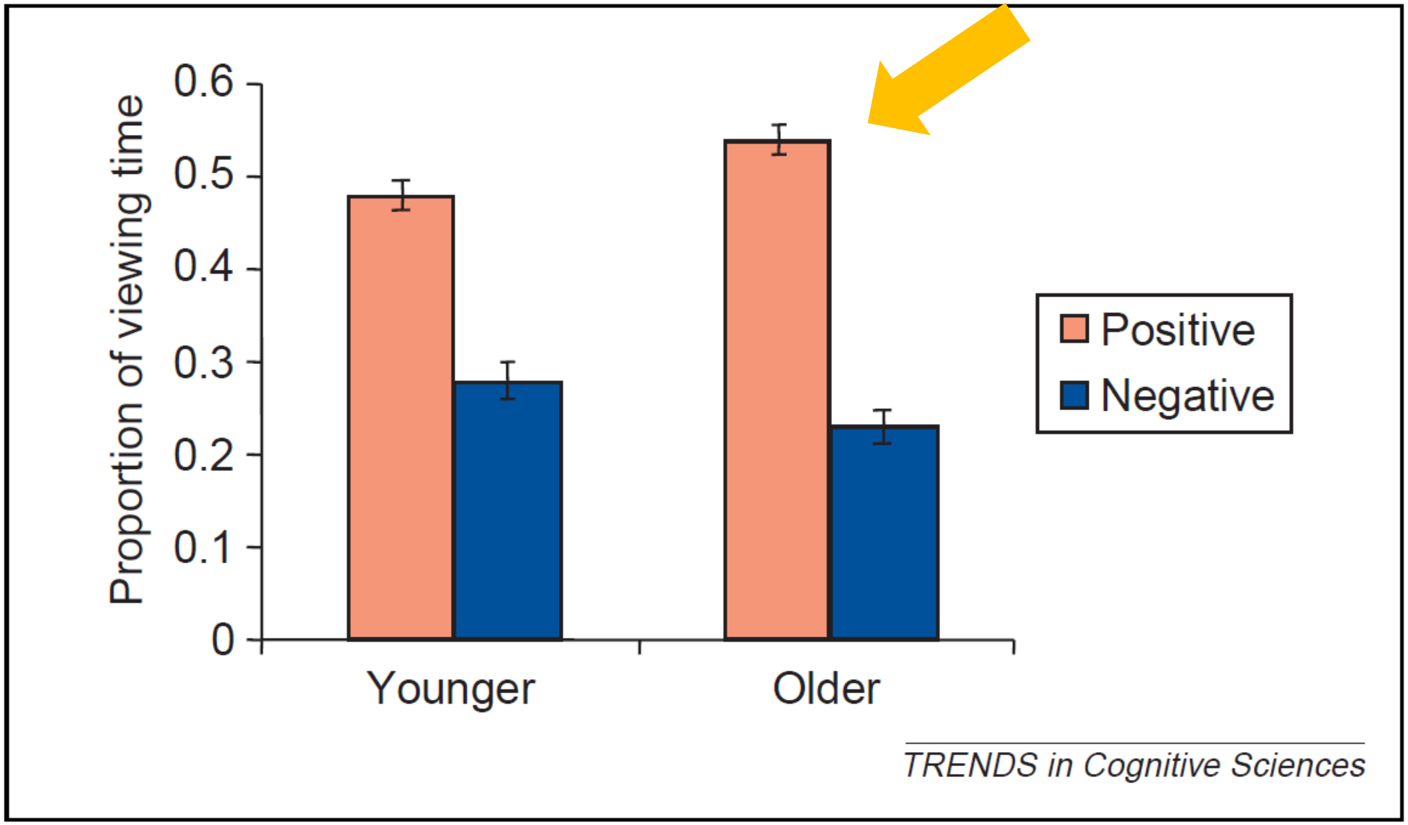
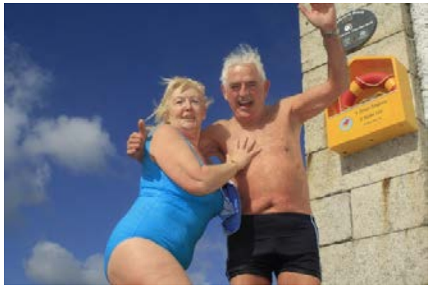


Figure 2. Total viewing time of older and younger adults for positive and negative car option features, when asked to choose a car [20]. Error bars show the standard error of the mean.

Mather & Carstensen, 2005

Old people are happier



Socioemotional Selectivity Theory:

- enhanced emotion regulation with old age
- time is perceived as limited ->
- optimization of emotional meaningfulness

? Maintenance of positive affect and decrease in negative affect

Mather & Carstensen, 2005

Old people are happier

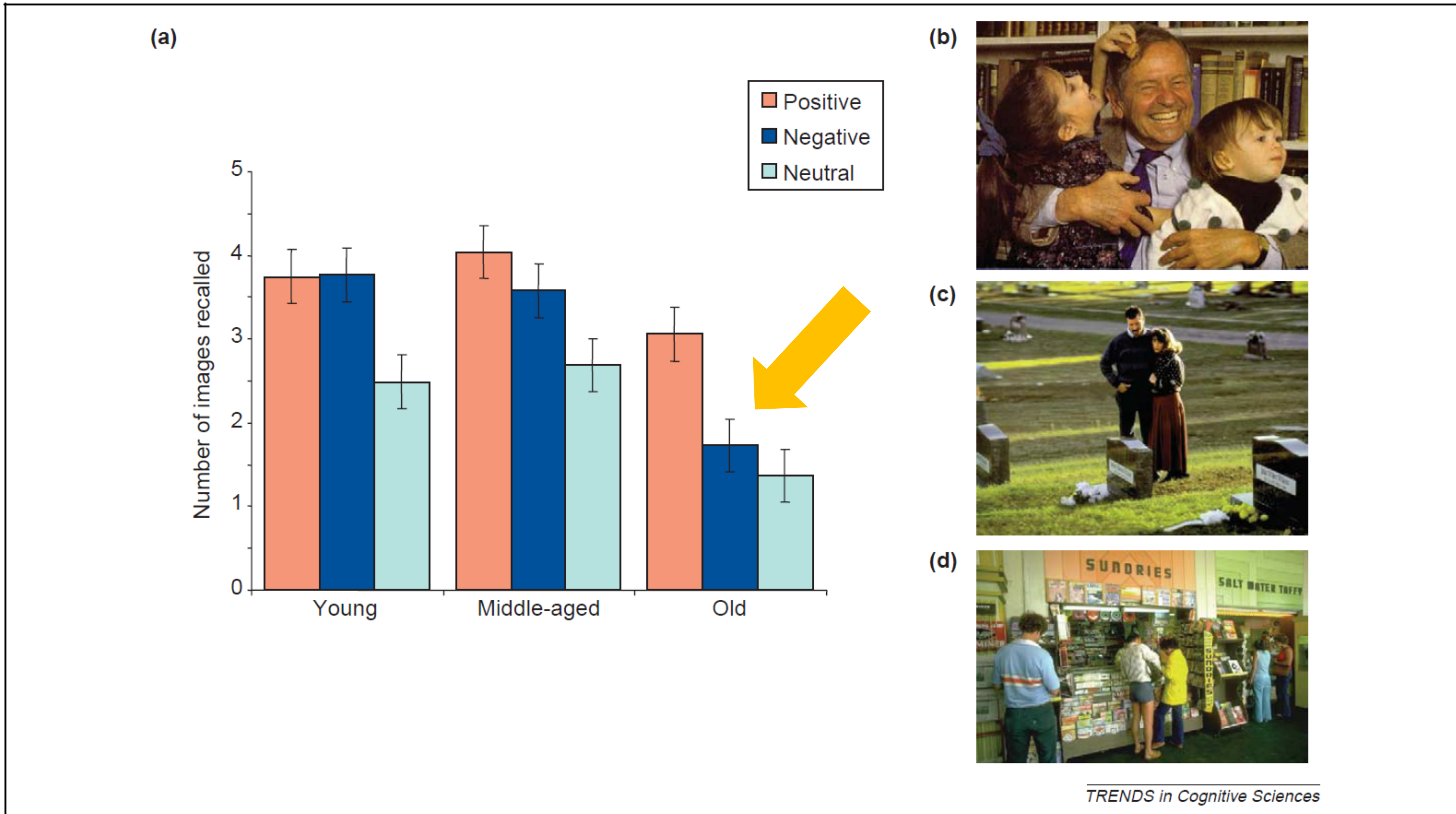


Figure 3. **(a)** Total number of pictures recalled by younger (18–29 years old), middle-aged (41–53 years old), and older (65–80 years old) adults [32]; examples of **(b)** positive, **(c)** neutral and **(d)** negative pictures seen in the experiment. Error bars show the confidence interval for the age-by-valence interaction.

Mather & Carstensen, 2005

Summary

- Zwei Komponenten Modell des kognitiven Alterns.
- Altern und Abbauprozesse im Gehirn.
- Brain Reserve & Cognitive Reserve.
- Unterstützung der Umwelt.
- Optimierung emotionaler Bedeutsamkeit.

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