Mechanisms of Strategic Elaboration and Associative Binding in Episodic Memory: A Lifespan Developmental Approach

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Background

Memory for the recollection of past life events, event relations, and their context (i.e., episodic memory; EM) is essential for accomplishing most daily tasks.

EM efficiency is lower in children as well as in older adults compared to younger adults. This may seem to suggest similar mechanisms underlying child development and aging in EM performance.

However, EM is not a unitary ability but consists of different components that might have a different impact on maturational- and senescence-related changes in memory performance.

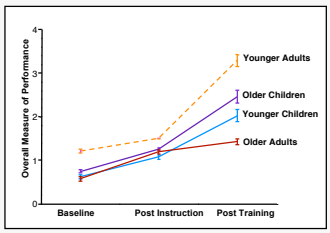
Recent studies have introduced the concept of strategic and associative components of EM.

Strategic component refers to the selection, organization, and elaboration of episodic information during encoding and retrieval (neuronally related to prefrontal cortex areas, which mature last during childhood and are affected first in old age).

Associative component refers to binding mechanisms that link different types of information in a memory episode into a coherent representation (neuronally related to medio-temporal areas, which are functional in middle childhood but impaired in old age).

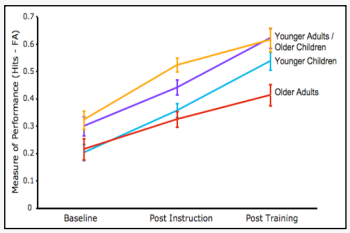
Prior Behavioral Work

Episodic Memory Plasticity Across the Lifespan



Brehmer et al., 2007, Dev. Psych.

Interactions Between Strategic and Associative Component Across the Lifespan



Shing et al, in press, JEP: General

Note. In both studies, instruction gains are more related to the strategic component of EM, while training gains are more related to the associative component of EM.

1. Instruction and training in a task-relevant imagery strategy improves EM performance in all individuals.
2. Children and older adults show reduced baseline performance in comparison to younger adults.
3. Children and older adults profit similarly from instruction. However, children profit from additional training (make use of their efficient associative component). Older adults do not improve from additional training due to their associative binding deficit.

Project Aims and Hypotheses

The proposed project will investigate:

(a) the relative importance of strategic and associative components in affecting age differences in EM performance across the lifespan,

(b) the neural correlates of age-related memory changes across the lifespan.

To investigate the underlying neuronal correlates of the strategic and associative components of episodic memory performance and how they might differ among children, younger and older adults will allow for clear predictions on unique and shared maturational and senescence-related memory changes across the lifespan.

Furthermore, it allows developing specific and effective age-based interventions that improve individuals' daily cognition, learning ability, well-being, and independence, particularly for older adults

Hypotheses:

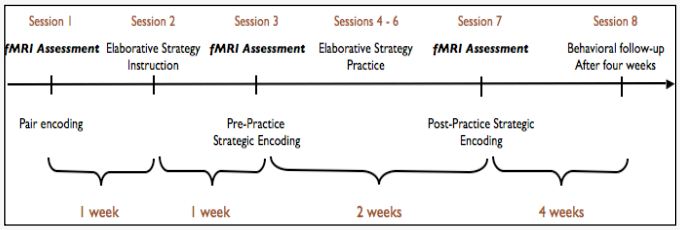
1. Young children's suboptimal episodic memory performance primarily originates from low levels of strategic involvement, and predominantly reflects the protracted development of prefrontal cortex.
2. Older adults' episodic memory deficits originate from impairments in both strategic and associative components, and reflect mostly senescent changes in both the prefrontal cortex and the medio-temporal lobes.

Methods

Participants

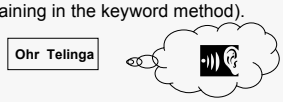
3 age groups (n = 24 in each group): children (9-10 years), younger adults (20-25 years), and older adults (65-70 years).

Design for the Multi-Session Episodic Memory Study



Procedure

Study Phase: Individuals receive German-Malay word pairs and are asked to encode them as word pairs. Strategic instruction will be manipulated across the study (instruction and training in the keyword method).



Test Phase: 3 different types of word-pairs are presented: (a) intact study word pairs, (b) rearranged study word pairs, (c) new word pairs. Individuals are asked to only say yes to the intact study word pairs.

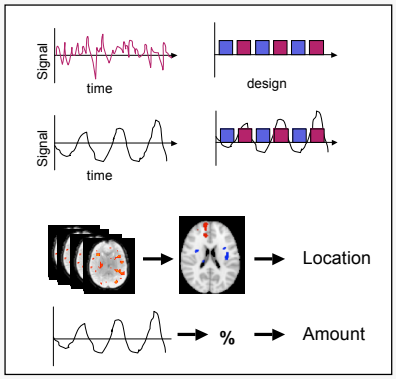
Functional Magnetic Resonance Imaging

Behavioral data

Reaction Times

Number of Correct Responses

Type of Errors



Research Activities During the Funding Period

Home institution: Aging Research Center, Karolinska Institute, Stockholm

Guest Institution: Center for Lifespan Psychology, Max Planck Institute for Human Development, Berlin

Year	Months	Empirical Work	Institute
2008	Jan. – Jun.	Adjusting behavioral study design to the requirements of the fMRI assessment	ARC, Stockholm
	Jul. – Aug.	Small scale behavioral pilot studies for fine tuning of task parameters	MPI, Berlin
	Oct. – Dec.	Small scale fMRI pilot study of neural correlates of age differences in episodic memory for estimation of design efficiency	MPI, Berlin
2009	Jan. – Aug.	Actual fMRI data collection (3 fMRI assessments per person + strategic training)	MPI, Berlin
	Sep. – Dec.	Data analysis, fMRI and behavioral tasks	ARC, Stockholm
2010	Jan. – Dec.	Data analysis, fMRI and behavioral tasks Report writing and paper submissions	ARC, Stockholm

Note. During the entire funding period, there will be an intensive exchange between the home and guest institutions. Several meetings have already taken place and are planned for the near future.

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