The schema effect in children: the neuronal mechanism of memory facilitation via prior knowledge

Published: 10-03-2015
Last updated: 21-04-2024

The aim of the study is to examine learning induced changes in brain and behavior.

Ethical review	Approved WMO
Status	Recruitment stopped
Health condition type	Other condition
Study type	Observational non invasive

Summary

ID

NL-OMON41913

Source
ToetsingOnline

Brief title
The schema effect in children

Condition

- Other condition

Synonym
n.a.

Health condition

neuroscientific research

Research involving
Human

Sponsors and support

Primary sponsor: Radboud Universiteit Nijmegen
Source(s) of monetary or material Support: NWO

Intervention

Keyword: Development, Memory, Schema

Outcome measures

Primary outcome

The aim of the current study is to examine the underlying brain mechanism for learning material with and without prior knowledge for children. Our design enables us to reveal functional changes of the brain which relate to the use of prior knowledge to integrate new but related information.

Secondary outcome

In addition we are interested whether the variance in the benefit of prior knowledge for the different participants can partially be explained by differences in verbal IQ, executive function, the brain connectivity at rest or interindividual structural differences in the brain.

Study description

Background summary

Prior knowledge (schemas) facilitates learning and consolidation (Bartlett 1932, Craik & Lockhart 1971): During encoding new related material can be linked to already consolidated memories. This process is thought to be mediated by the mPFC (Tse et al. 2007, van Kesteren 2010): during encoding or retrieval of unrelated items the hippocampus shows increased activity whereas for schema-related items the mPFC gets activated (Van Kesteren 2012).

With the PFC only maturing at the end of adolescence (Gogtay et al 2004, Shaw et al. 2008) it is unclear whether children already use their prior knowledge

as efficiently as adults. Parallel to the time of the maturation of the mPFC children acquire vast amounts of semantically-related material in high school where exactly this capability would be extremely useful.

Compared to children adults show more detailed memories and are in general better in memory tasks (Ofen et al. 2007, Ghetti et al. 2010). The improvement in memory details is linked to changes in the PFC (Ofen et al. 2007) and MTL (Ghetti et al. 2010) whereas the general improvement is hypothesized to be linked to the increased use of strategies and the maturation of the dlPFC (Craik & Tulving 1975, Kapur et al. 1994, Shing et al. 2008, Maril et al. 2011).

Already young children use semantic information to facilitate consolidation of newly learned words (Henderson et al. 2013): Five to nine year old children learned words either coupled to information about its form or its meaning. Immediately after learning there was no difference between the two groups, after a week however the words coupled with semantic information were better integrated indicated by an increase in lexical competition. This suggests that already young children can use semantic information to facilitate consolidation. Different to prior schemas the semantic information was coupled to the word during encoding. Furthermore, children show different activation patterns for shallow versus deep encoding compared to adults (McAuley 2007). How children and young adolescents use the mPFC to benefit from prior knowledge is not known. Recent work has also shown that children are better at converting implicit to explicit knowledge during sleep (Wilhelm et al. 2013). Children and adults implicitly learned motor sequences. After sleep children showed a higher explicit memory of the sequence compared to adults. This could indicate that the children are faster at building a sequence-schema.

Study objective

The aim of the study is to examine learning induced changes in brain and behavior.

Study design

The proposed study has a multi-session within-subject design. Participants will learn object-location associations while playing a *Memory* game on a computer. Over multiple sessions they have to learn locations of 100 items for two boards of cards. For one board the card positions switch between the sessions for the other board positions are constant enabling the formation of a schema. Four days after the last learning session the children perform a cued-recall task in the MRI scanner to test the differences in integration for the schema vs. non schema items.

Study burden and risks

There are no risks associated with participating in this study. The burden of the study mostly comes from the time the task takes, however we expect the task to be engaging and enjoyable for the children. The outcome will increase understanding of brain and behaviour and may lead to advances in education and practice. Participants will not benefit from participating in the study.

Contacts

Public
Radboud Universiteit Nijmegen

Kapittelweg 29
Nijmegen 6525 EN
NL
Scientific
Radboud Universiteit Nijmegen

Kapittelweg 29
Nijmegen 6525 EN
NL

Trial sites

Listed location countries

Netherlands

Eligibility criteria

Age
Children (2-11 years)

Inclusion criteria

9 to 12 years old
right handed

Exclusion criteria

1) Metal parts, that cannot be removed, are present in or on your upper body, e.g. plates, screws, aneurysm clips, metal splinters, piercings or medical plasters. Dental fillings, crowns, a metal wire behind the teeth, tattoos and contraceptive coils are allowed. The researcher will additionally inform you.
2) Clothing on the upper body containing any metal e.g. zips, buttons, hooks, braces, metal yarn (LUREX). This also applies to bras containing a metal brace wire.
3) You have an active implant, a pacemaker, insulin pump, neurostimulator and/or ossicle prosthesis.
4) You have a history of brain surgery.
5) You suffer from epilepsy.
6) You suffer from claustrophobia.

Study design

Design

Study type: Observational non invasive

Masking:	Open (masking not used)
Control:	Uncontrolled
Primary purpose:	Other

Recruitment

NL

Recruitment status:	Recruitment stopped
Start date (anticipated):	23-08-2015
Enrollment:	30
Type:	Actual

Ethics review

Approved WMO

Date:	10-03-2015
Application type:	First submission
Review commission:	CMO regio Arnhem-Nijmegen (Nijmegen)

Approved WMO

Date:	06-07-2015
Application type:	Amendment
Review commission:	CMO regio Arnhem-Nijmegen (Nijmegen)

Study registrations

Followed up by the following (possibly more current) registration

No registrations found.

Other (possibly less up-to-date) registrations in this register

No registrations found.

In other registers

Register	ID
CCMO	NL51573.091.14