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Electrophysiological correlates of competitor activation predict individual differences in retrieval-induced forgetting

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IV Dubrovnik Conference on Cognitive Science

DuCog IV

MEMORY CONTROL AND RETRIEVAL

Organized by the **Central European Cognitive Science Association** (CECOG)

Keynote speakers

Paul W. Burgess, Martin A. Conway, Ken A. Paller, Lars Nyberg

Invited speakers

Antonino Vallesi, Simon Hanslmayr, Ines Wilhelm, Mihály Racsmány

DUBROVNIK, 10-13, MAY, 2012

Centre for Advanced Academic Studies (CAAS) Dubrovnik

University of Zagreb

SVEUČILIŠTE U ZAGREBU

Budapest University of Technology and Economics (BME)

RICHTER GEDEON

PROGRAMME

Thursday, May 10

17:00 - 19:00	Registration
19:00 - 19:30	Welcome words, reception
20:00	Dinner at a downtown restaurant

Friday, May 11

8:00 - 9:00	Coffee and registration
9:00 - 10:00	Keynote I - Paul W. Burgess
10:00 - 10:30	Short talk I - Antonino Vallesi
10:30 - 11:00	Coffee
11:00 - 12:30	Poster I
12:30 - 14:00	Lunch
14:00 - 15:00	Keynote II - Lars Nyberg
15:00 - 15:30	Short talk II - Simon Hanslmayr
15:30 - 15:45	Student talk I - Jasmin Kizilirmak
15:45 - 16:15	Coffee
16:15 - 17:30	Poster II
18:00	Dubrovnik Cable Car trip

Saturday, May 12

8:00 - 9:00	Coffee
9:00 - 10:00	Keynote III - Ken Paller
10:00 - 10:30	Short talk III - Ines Wilhelm
10:30 - 11:00	Coffee
11:00 - 12:30	Poster III
12:30 - 14:00	Lunch
14:00 - 15:00	Keynote IV - Martin A. Conway
15:00 - 15:30	Short talk IV - Mihály Racsmány
15:30 - 15:45	Student talk II - Kate Bailey
15:45 - 16:15	Coffee
16:15 - 17:30	Poster IV
17:30 - 18:00	Farewell words
18:00 - 19:00	Assembly meeting
20:00	Party and dance

Sunday, May 13

8:00 - 10:00	Checking out

POSTER SESSIONS

Poster session I.: Friday, May 11, 11:00 - 12:30

A preliminary study on the trail making test in arabic-english bilingual adults
Rima Abdul Razzak

Lateralization of different executive functions
Mónika Albu, Mihály Racsmány

Emotions, anxiety and cognitive control - how do they go together
Anna Anzulewicz, Maciej Taraday

Criterion-setting in the left prefrontal cortex: the roles of process and domain
Laura Babcock, Laura Riontino, Antonino Vallesi

Serial position effects influence 7-month-olds' word learning
Silvia Benavides-Varela, Jacques Mehler

Working memory and short-term memory in L2 learners at different levels of proficiency
Adriana Biedroń

Different effect of sleep on different memory processes
Eszter Csábi, Mária Várszegi-Schulz, Karolina Janacsek, Dezső Németh

Training and long-term retention of visual tasks by two species of emydid turtles, *Pseudemys nelsoni* and *Trachemys scripta*
Karen M. Davis, Gordon M. Burghardt

Obsessed not to forget: no retrieval induced forgetting in obsessive compulsive disorder (OCD)
Gyula Demeter, Attila Keresztes, András Harsányi, Katalin Csigó, Mihály Racsmány

The impact of trait and state anxiety on the inhibition of memory
Paula Fischer, Mónika Albu

Memory processes behind children's social skills
Zita Gál, Karolina Janacsek, Dezső Németh

Not all forgetting functions are created equal – Insights from mathematical modeling
David M. Gómez, Pablo Dartnell

Poster session II.: Friday, May 11, 16:15 - 17:30

Newborn infants' left brain hemisphere is sensitive to syllable well-formedness
David M. Gómez, Silvia Benavides-Varela, Ricardo A. H. Bion, Francesco Macagno, Marina Nespor, Iris Berent, Jacques Mehler

Interference effects of working memory in language: embodiment gradation as plausible framework for senstence processing
Sebastian Günnel

Analysis of behavioral traits in the rat HXB/BXH recombinant inbred strains in Carousel maze, a hippocampus dependent task
Hana Hatalova, Anna N. Grzyb, Tomas Petrasek, Rupert Overall, Jan Silhavy, Vaclav Zidek, Karel Vales, Gerd Kempermann, Michal Pravenec, Ales Stuchlik

The role of working memory in the processing of transparent and non-transparent compound words in the different age groups
Ágnes Heilmann, Janacsek Karolina, Dezső Németh

Electrophysiological correlates of competitor activation predict individual differences in retrieval-induced forgetting
Robin Hellerstedt, Mikael Johansson

Representation of facial identity information in the medial and anterior temporal lobe
Petra Hermann, Éva M. Bankó, Zoltán Vidnyánszky

Probabilistic approach to computational modeling of human autobiographic memory: an overview
Rudolf Kadlec, Michal Čermák, Zdeněk Behan, Cyril Brom

Did I turn-off the stove? Good inhibitory control can protect from influences of repeated checking
Eyal Kalanthroff, Omer Linkovski, Gideon Anholt, Avishai Henik

Spatial-temporal memory: integration of spatial sequence and temporal order information
Judit Kárpáti, Anikó Kónya, Roland Boha, Ildikó Király

Linguistic abilities of the first grade students with reading difficulties
Maja Kelić, Jelena Kuvač Kraljević

Oxytocin enhances implicit but not explicit social memory for negative emotional faces
Kinga Kemerle, Anna Hernádi, Anna Kis, József Topál

Neuroimaging evidences of testing effect
Attila Keresztes, Daniel Kaiser, Kriszta Nagy, Gyula Kovács, Mihály Racsmány

Poster session III.: Saturday, May 12, 11:00 - 12:30

Visual feature binding during long-term memory retrieval
Patrick H. Khader, Anna Seemüller, Frank Rösler

No evidence of spatial memory in the axolotl *(Ambystoma mexicanum)*
Anna Kis, Katie Meads, Anna Wilkinson, Oliver Burman

Electrophysiological correlates of the different hierarchical levels of visual word processing
Balázs Knakker, Béla Weiss, István Kóbor, Petra Hermann, Zoltán Vidnyánszky

A short course in superior memory: Significant digit memory increase after a short mnemonic training
Boris N. Konrad, Lisa Genzel, Kristina Hennig-Fast, Michael Czisch, Martin Dresler

The development of associative memory between 6-, 7-, 8-, 9-, 10-year-olds and young adults
Márton Nagy, Ildikó Király

Spatio-temporal dynamics of semantic priming effects on words and word stems
Nevena Padovan, Burke Q. Rosen, Sanja Kovacevic, Ksenija Marinkovic

Repetitive thinking and stimulus-independent thought: are they related?
Péter Pajkossy, Mihály Racsmány

Boosting human learning by hypnosis: Evidence for the competition between memory systems
Bertalan Polner, Karolina Janacsek, Zoltán Ambrus Kovács, Dezső Németh

2 case studies of sigh recovery patients: assessment of functional vision
Michaela Porubanova, Radovan Sikl, Micahl Simecek

Age-related conflict resolution deficit: compensatory roles of intelligence, cognitive reserve and education
Olga Puccioni, Antonino Vallesi

The effect of task on the electrophysiological correlates of visual categorization
Adrienn Aranka Rokszin, Dóra Győri-Dani, Attila Krajcsi, Gábor Csifcsák

Electrophysiological trace of mirror neurons
Jan Silar

Disturbed dreaming and sleep quality: altered sleep architecture in subjects with frequent nightmares
Péter Simor, Klára Horváth, Ferenc Gombos, Róbert Bódizs

Poster session IV.: Saturday, May 12, 16:15 - 17:30

Survival processing and long-term retention
Eszter Somos

Successful memory encoding depends on context reinstatement at retrieval – behavioral and oscillatory evidence
Tobias Staudigl, Simon Hanslmayr

Double effect of curiosity deficiency on memory impairment with dementia syndrome
Tina Štukelj

Is dreaming merely a cognitive performance? Analysis of the content and narrative structure of children's dreams
Sára Szakadát, Piroska Sándor, Orsolya Péntek, Róbert Bódizs

The selective effect of intentional inhibition for informations at event-boundaries
Ágnes Szőllősi, Mihály Racsmány

Age-related changes in verbal fluency from early childhood until late adulthood
Tímea Tánczos, Dezső Németh

The role of echo in understanding verbal irony
Anett Tóth

Suppression of auditory event-related potential with voluntary movement – contingency and contiguity
Annamária Tóth, János Horváth

Gender differences in sleep EEG correlates of superior intelligence
Péter Przemyslaw Ujma, Róbert Bódizs

Brain oscillations indicate inhibition of interfering visual memories
Gerd T. Waldhauser, Mikael Johansson, Simon Hanslmayr

Alerting can interact with executive control by increasing the influence of irrelevant spatial distractors
Noam Weinbach, Avishai Henik

Cognitive control processes in word retrieval
Lilla Zakariás, Enikő Ladányi, Ágnes Lukács

Tutorial I.

ROLE OF ROSTRAL PREFRONTAL CORTEX IN MEMORY CONTROL

Paul W. Burgess

Institute of Cognitive Neuroscience, University College London, UK

The most anterior portion of the prefrontal cortex (rostral PFC, approximating Brodmann Area 10) is a very large brain region in humans, approximately 30 cubic cms in volume. Until about 15 years ago, we knew virtually nothing about it. However, we now know that rostral PFC has some fascinating properties. For instance, it is relatively bigger in humans than in any other animal, and in humans has an unusually low neuronal density. It develops very late in life, and then seems to reduce in volume quicker than other brain regions through to middle age. There are several distinct cytoarchitectonic subregions, which seem to support different mental abilities, each having distinct patterns of interaction with different brain regions, varying in special cases according to the nature of the task.

From the very earliest cognitive neuroscience investigations into the role of this region in human cognition, a paradox quickly emerged: Activation of this region as assessed by functional neuroimaging occurs during a very wide variety of tasks, from the very simplest (e.g. eyeblink conditioning) to the most complex (e.g. fluid intelligence tests). But lesions to rostral PFC in humans do not usually cause deficits in a correspondingly wide range of tasks. Indeed, neurological patients with huge excisions of rostral PFC may perform extremely well on nearly all traditional neuropsychological measures of e.g. language, perception, recognition and semantic memory, and IQ tests. A major question for the field has therefore been to reconcile these apparently conflicting results. We are now beginning to see a solution. Rostral PFC supports a range of forms of mental processing, some of which are not tested by traditional neuropsychological tests, and some which co-occur with, or are directly prompted by, a task, but may be only tangentially related to actual performance of it. Three of these are particularly relevant to memory controls, and all might be considered different forms of "metacognition". The first is "meta-organisation" of behaviour: prioritisation, scheduling and carrying out intended plans over long periods of time (e.g. multitasking and prospective memory). The second is metamemory, where one has to re-configure, edit, or reflect upon one's memories, rather than just recall them (e.g. context and source memory, and reality monitoring). The third domain is "meta-attending", which refers to the ability to exert control over whether one is attending to the one's inner thoughts, or to the external world. This talk will give an overview of the evidence related to these findings, and attempt to explain how they might be related to other mental faculties known to be supported by this region, but not traditionally thought of as "memory" (e.g. prospection, or "future thinking").

Keywords: prefrontal cortex, metamemory, neuroimaging, neuropsychology
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Tutorial II.

THE PROBLEM OF ACCESS: HOW I CAN REMEMBER SO MUCH OF TODAY THIS EVENING, BUT IN A WEEK'S TIME I'LL REMEMBER VIRTUALLY NOTHING? UNLESS I HAVE SOME RATHER UNUSUAL HELP

Martin A. Conway

Department of Psychology, City University, London, UK

One of the main ways in which memory is rendered usable is by forgetting. One type of forgetting, perhaps the most common, involves loss of access to memories rather than loss of memory themselves. It is suggested that loss of access occurs when executive control processes fail to generate effect cues with which to access highly specific episodic memories represented in long-term memory, i.e. a failure of generative retrieval. However, memories may still be accessed directly if an effective cue enters the search process. Cues contained in photographs taken by the neck-worn camera 'SenseCam' provide direct access to otherwise inaccessible memories of everyday events. I describe our recent work with two amnesic patients in reinstating access to their memories.

Keywords: forgetting, memory cues, SenseCam
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Tutorial III.

COGNITIVE CONTROL OF EPISODIC MEMORY: THE HIGH AND LOW ROUTES TO MEMORY

Lars Nyberg

Umea Center for Functional Brain Imaging, Sweden

Episodic memory retrieval has been associated with a large-scale brain network including prefrontal regions, material-specific association areas, and regions in the medial temporal lobe. In the first part of this presentation, data from an experiment contrasting intentional and incidental episodic retrieval will be reviewed. Both fMRI and ERP recordings were made. Intentional retrieval was associated with activation increase in the dorsolateral prefrontal cortex. By contrast, incidental retrieval was associated with a reduced fMRI signal in posterior brain regions, including extrastriate and parahippocampal cortex, and a modulation of a posterior ERP component 170 ms after the onset of visual retrieval cues. Successful retrieval under both intentional and incidental conditions was associated with increase of activation in the hippocampus, as well as increased amplitude of the P600 component of the ERP. These results demonstrate how early bottom-up signals from the posterior cortex can lead to reactivation of episodic memories in the absence of strategic retrieval attempts. In the second part of the presentation, data from a large-scale fMRI experiment (N=292) will be presented, where a main goal was to separate more general cognitive-control processes from encoding and retrieval networks. A multivariate partial-least-squares (PLS) statistical technique was used to analyze fMRI data from a face-name paired-associates task and an active baseline task. The PLS analysis revealed two significant latent variables (LVs). The first LV reflected a process-general encoding-retrieval network that included fronto-parietal cortices and posterior bilateral hippocampus. The second LV dissociated process-specific encoding and retrieval networks. Prefrontal regions were asymmetrically engaged with a stronger left frontal contribution during encoding and a stronger right frontal contribution during retrieval. In addition, anterior hippocampus was differentially engaged during episodic encoding. Finally, results will be presented from a study of genes related to episodic-memory retrieval. The KIBRA T allele was found to be associated with superior episodic memory performance, and T carriers showed increased hippocampal activation. Collectively, these results highlight a critical role of fronto-hippocampal circuits in episodic memory retrieval.

Keywords: episodic retrieval, fronto-hippocampal circuit, fMRI, PLS, KIBRA T
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Tutorial IV.

HIDDEN ASPECTS OF MEMORY: PRIMING, CONSOLIDATION, AND SLEEP REACTIVATION

Ken A. Paller

Northwestern University, USA

Recognition is widely thought to encompass two explicit-memory expressions, recollection and familiarity, both of which entail the conscious appreciation of prior occurrence. Contrary to these views, our research has shown that recognition responses sometimes reflect a special type of guessing corresponding to neither recollection nor familiarity. We ascribe these remarkably accurate responses to "implicit recognition," which may arise from visual fluency that, in other circumstances, supports the implicit-memory expression known as perceptual priming. Features of implicit recognition are sometimes strikingly unlike those of explicit memory. Other times, fluency signals may promote familiarity memory. Investigations of circumstances when various types of fluency impact recognition judgments suggest that familiarity should not be considered a unitary phenomenon with a unitary neural basis. Rather, multiple yet-to-be-elucidated neurocognitive mechanisms underlie familiarity. To understand recognition and its neurocognitive substrates, it is important to take into account implicit-memory processing that can drive behavioral expressions commonly taken to reflect explicit memory alone. Another hidden aspect of memory that I will discuss concerns consolidation during sleep. Several novel strategies have been used to demonstrate that memory processing during sleep influences accuracy of memory retrieval at a later time, without concomitant awareness of that processing.

Keywords: implicit recognition, visual fluency, familiarity, sleep, consolidation
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Short Talk I.

HOW THE PREFRONTAL CORTEX ORCHESTRATES NEURAL SYNCHRONY TO UPDATE EPISODIC MEMORIES

Simon Hanslmayr [1, 2, 3], Gregor Volberg [1], Maria Wimber [4], Nora Oehler [2], Tobias Staudigl [2], Thomas Hartmann [2], Markus Raabe [1], Mark W. Greenlee [1], Karl-Heinz T. Bäuml [1]

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Neural synchronization between distant cell assemblies is crucial for successful episodic memory formation. To date, however, it is unclear whether neural synchrony can be controlled by higher-order brain regions to control memory processing, as required during voluntary updating of episodic memories. Such updating mechanisms are required during everyday life, e.g. when we get a new computer password, and keep our memory system flexible and adaptive. We explored the role of the prefrontal cortex in regulating neural synchrony during episodic memory updating in two multimodal neuroimaging experiments using a voluntary forgetting task. In the first experiment, we simultaneously recorded electroencephalography (EEG) along with functional magnetic resonance imaging (fMRI); we show that a reduction in neural synchrony goes hand-in-hand with a BOLD signal increase in the left dorsolateral prefrontal cortex (dlPFC) when participants are cued to forget previously studied information. In the second experiment, we directly stimulated the left dlPFC with repetitive transcranial-magnetic-stimulation (rTMS) during the same task, and show that such stimulation specifically boosts the behavioral forgetting effect along with a reduction in neural synchrony. These results suggest that the dorsolateral PFC gains control of contents in episodic memory by regulating long-range neural synchronization between distant neural assemblies.

Keywords: neural synchrony, episodic memories, updating, forgetting, rTMS
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Short Talk II.

GOAL ATTAINMENT AND INHIBITION IN EPISODIC MEMORY

Mihály Racsmány

Department of Cognitive Science, Budapest University of Technology and Economics, Budapest, Hungary

Memories are shaped and edited by various encoding and retrieval processes, we can forget previously successfully encoded memories if we are instructed to do so. The experimental procedure called directed forgetting (DF) demonstrates this relevant aspect of human memory.

Three experiments provided evidence that in a directed forgetting experiment participants might use the 'forget' instruction as an explicit cue for terminating a previous learning event. Replacing the forget instruction with a memory test we managed to show that intentional forgetting phenomena can be simulated by a test which informs participants that the learning event is finished. According to our results an event cancellation memory task can simulate the effect of forget instruction (i.e. lower recall rate of to be forgotten items compared to baseline items). We suggest that a forget instruction in a learning task is an effective task completion cue.

In four further experiments participants observed a model who took part in directed forgetting experiment. In Experiment 1 and 2 observers saw a movie about the experiment, whereas in Experiment 3 and 4 the observers and the models took part together in a real laboratory experiment. The observed memory experiment was a directed forgetting experiment where the models learned two lists of items and were instructed either to forget or to remember the first list.

In Experiment 1 and 3 observers were instructed to simply observe the experiment ("simple observation" instruction). In Experiment 2 and 4, observers received instructions aimed to induce the same learning goal for the observers and the models ("observation with goal-sharing" instruction). A directed forgetting effect (the reliably lower recall of to-be-forgotten items) emerged only when models received the "observation with goal-sharing" instruction, and it was absent when observers received the "simple observation" instruction. These results demonstrate that directed forgetting effect in the observer was only present if the goal to encode specific memories was the same or similar for the observer and the model.

In sum, these results demonstrate that the 'forget' instruction will carry the future importance of studied information only if it targets goal-relevant aspects of the previous event. In other words, the forget instruction will trigger inhibitory processes for to-be-forgotten information, because it informs the participant that these items are no longer relevant from the perspective of the present goal of the learner.

Supported by OTKA K84019

Keywords: directed forgetting, task-completion, goal, inhibition

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Short Talk III.

COGNITIVE CONTROL IN THE ADULT LIFE-SPAN

Antonino Vallesi

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A number of cognitive deficits are associated with aging, including an increased distraction produced by non-target information in the environment. The cognitive and neural mechanisms underlying this deficit are still unclear. Recent event-related potential (ERP) studies show age-related differences in the ability to suppress the processing of non-target stimuli and the preparation of a response to them. A first study showed an age-related increase in the precentral nogo-P3 component to non-target stimuli which are supposedly easy to discriminate from target information since they belong to a different semantic domain (numbers vs. letters). This finding was replicated in a subsequent study, in which go and nogo stimuli were matched for frequency and conflict level in order to minimize the impact of task difficulty, probability monitoring, or conflict detection and resolution on the age-related ERP differences. The amplitude of the central nogo-P3 negatively correlated with go-RTs, suggesting that a partial response preparation to nogo events is strongly suppressed in older adults (as marked with nogo-P3), especially faster ones. In a third study, despite matched performance in two age groups, older adults showed an early sub-threshold response preparation, as marked with the Lateralized Readiness Potential (LRP), for both high- and low-conflict nogo stimuli. These results indicate that, even without age-related performance differences, older individuals show enhanced response preparation to non-target stimuli that can be detected with more sensitive measures such as the LRP. Negative correlations between nogo-LRPs and P3 on one side, and go-RTs on the other, in the older group only, suggest that inappropriate response preparation (LRP) and subsequent suppression (P3) for nogo stimuli is the cost to pay to maintain optimal response speed to targets in normal aging. Corroborating this account, the amplitude of the LRP to low-conflict nogo stimuli was also positively correlated with that of the following nogo-P3. Do age-related differences in suppressing non-target material impact subsequent performance? To assess this issue, younger and older adults first performed a go/nogo task with coloured letters used as conflicting go/nogo stimuli, and two coloured numbers as low-conflict nogo stimuli. Then, they performed another go/nogo task. A previous number was re-used as a nogo stimulus and the other number as a go stimulus, with new numbers serving as go/nogo baselines. In a first block, younger adults showed transfer costs, that is, slower responses to previous-nogo/now-go numbers than new go numbers, an effect not shown by older adults. These results suggest a tonic suppression of non-target information in younger adults, which gives rise to transfer costs, when this information becomes relevant, while older adults are unable to keep tonic inhibition.

In conclusion, the present data show that, to compensate for general slowing, older adults start processing every environmental stimulus, independently of its target/non-target status, and then reactively suppress pre-activated responses to non-target stimuli. Possible underlying mechanisms include a difficulty in maintaining a task-set,

for instance by means of a proactive and tonic suppression of inappropriate processing of non-target information.

Keywords: aging, go-nogo, conflict detection, Lateralized Readiness Potential (LRP)
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Short Talk IV.

THE INTERPLAY BETWEEN SLEEP AND MEMORY DURING EARLY DEVELOPMENTAL PERIODS

Ines Wilhelm

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Studies in adults have extensively shown that sleep supports the consolidation of memories. Although children sleep longer and deeper, with distinctly greater amounts of slow wave sleep (SWS), the effect of sleep on memory consolidation in children has so far been rarely investigated. In a series of studies, we tested the impact of sleep on declarative and procedural memory consolidation in children, presenting them learning tasks before retention intervals filled with sleep or wakefulness and testing retrieval later on. Two initial studies (Fischer et al., J Cogn Neurosci, 2007; Wilhelm et al. Learn. Mem., 2008) in 6-11 yrs old children revealed a clear improving effect of post-learning sleep on consolidation of declarative memories (word-pairs) but, unexpectedly, we found no effect on the consolidation of procedural memories (finger sequence tapping, serial reaction time task). We suspected that this lack of any sleep-dependent gain in motor skill memory is caused by the preferential consolidation of explicit over implicit aspects of the motor task such that after retention sleep explicit knowledge about the task starts to interfere with implicit motor regulation and slows task performance. Thus, in a further study (Wilhelm et al., Dev Sci, 2012) children (8-11 yrs) and adults (20-35 yrs) were trained on a serial reaction time task under implicit conditions (without explicit knowledge about the underlying sequence), and their explicit knowledge about the sequence was tested after retention sleep or wakefulness. Sleep enhanced explicit knowledge in both age-groups, but to a distinctly larger extent in the children. Slow wave activity was significantly correlated to the amount of explicit knowledge after sleep. Further on, we tested whether sleep benefits procedural motor memories in children (4-6 yrs) if training is intensified leading to more automated and implicitly rather than explicitly controlled motor performance. In fact, a daytime nap in comparison to wakefulness significantly enhanced motor performance in these children only after extensive training of the task. In the control children with less extensive training, sleep did not benefit motor skill memory. Taken together, our work suggests a preferential benefit of explicit over implicit memories from sleep in children, possibly related to their greater amounts of SWS. Accordingly, the children's profit from sleep is comparable to that in adults for declarative (i.e. explicit) memories, whereas benefits for procedural skills depend on the pre-sleep training level, occurring only when pre-sleep performance has achieved already a high level of implicitness.

Keywords: memory consolidation, procedural, declarative, finger tapping, serial reaction time task
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Short Talk I.

CHOOSING TO FORGET: DIRECTED FORGETTING OF EMOTIONAL IMAGES IN RELATION TO ATTENTIONAL ORIENTING AND ENGAGEMENT

Kate Bailey, Peter Chapman

University of Nottingham, UK

The ability to intentionally forget selected information has clear adaptive advantages, and has been studied experimentally by use of the directed forgetting (DF) paradigm. A number of studies have found that DF is attenuated for emotional material, but it remains unclear whether the cause of this interaction is best described in terms of factors at encoding, storage, or retrieval. To investigate the possibility that attentional processes during encoding underlie this interaction, we introduce a new DF paradigm in which multiple items are presented concurrently, allowing attention orienting and engagement to be assessed directly by eye-movement recording. In two experiments, stimuli of varying emotional content were presented simultaneously, some with instructions to remember and some with instructions to forget. Both experiments showed a substantial DF effect in recognition, and this was primarily a function of recollection, rather than familiarity. Emotional biases in attention orienting and engagement were evident during the study phase, but only those relating to engagement predicted subsequent memory enhancements. Although we found substantial influences on memory of both DF instructions, and the emotional content of the pictures, we did not find evidence of reduced DF for emotional material. Reasons for this in terms of memory control are considered.

Keywords: directed forgetting, emotion, attention
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Short Talk II.

TRIAL-BY-TRIAL ADJUSTMENTS OF CONTROL DURING SELECTIVE LONG-TERM-MEMORY RETRIEVAL ARE MEDIATED BY A FRONTO-PARIETAL NETWORK

Jasmin Kizilirmak, Patrick H. Khader

Philipps-University Marburg, Germany

We investigated neural processes controlling selective long-term-memory retrieval when different associations with a cue have to be accessed consecutively by employing a paradigm that varied whether the cue, the to-be-retrieved association, or the number of to-be-retrieved associations changed from trial to trial. We found trial-by-trial adjustments of retrieval control to be mediated by a fronto-parietal network: (1) Bilateral supramarginal gyri (SMG, BA 40/39) and left middle frontal gyrus (MFG, BA 10) showed stronger activation when a single association had to be retrieved after all associations with the same cue had been accessed compared to having accessed only one other association previously. (2) The same condition revealed activation of right inferior frontal gyrus (IFG, BA 46/45/44) and bilateral, more anterior parietal regions (BA 40) compared to when the relevant associations in consecutive trials related to different cues. These results suggest that left MFG handles episodic interference from previously accessed associations, while SMG activation reflects increased demands to focus attention on a single association after all associations with the cue had been active. Furthermore, right IFG and additional parietal regions seem to be involved in controlling the specific interference arising from switching between relevant associations within one and the same cue-associations net.

Keywords: long-term memory, retrieval, fMRI, selection, cognitive control
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A PRELIMINARY STUDY ON THE TRAIL MAKING TEST IN ARABIC-ENGLISH BILINGUAL YOUNG ADULTS

Rima Abdul Razzak

Arabian Gulf University (AGU), Kingdom of Bahrain

Cutoff scores for cognitive impairment are based on normative data. For cognitive tests, specific normative data that consider issues such as culture and bilingualism is important. Specifically, norms for the frequently used neuropsychological test, the Trail Making Test (TMT) are lacking for all Arab countries. The aim of this study is to obtain TMT norms for Arabic-English bilinguals and compare it to other published norms.

An Arabic TMT was constructed with Hindi numerals and Arabic letters. 135 young adults from three Arabian Gulf nations participated (83 English and 52 Arabic TMT). Arabic TMT data differ from other countries' norms for the same age and educational level. The mean completion time was 29.76 - 7.94s for Arabic TMT-A and 71.83 - 17.42s for Arabic TMT-B. English TMT scores were significantly better than Arabic TMT (Arabic TMTA: 29.76 - 7.94s; English TMT-A: 25.74 - 7.67s; and Arabic TMT-B: 71.83 - 17.42s; English TMT-B: 58.77 - 12.12s).

Applicability of the English TMT is restricted to bilinguals, and Arabic TMT norms stratified by age and education are required to reduce discrepancies that occur when using English or other normative data. This will increase reliability of Arabic TMT, and its utility in clinical practice.

Keywords: trail making test, culture, bilingual, cognition
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LATERALIZATION OF DIFFERENT EXECUTIVE FUNCTIONS

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In the past few decades, the nature of the executive function and its neural implementation has arisen as one of the most important issues in understanding higher order cognitions. Despite the substantial number of studies on the topic, the concept of executive function remains elusive. Recent models have suggested a view of the executive functions as a conglomerate of largely independent, but interacting, control processes such as interference resolution, attention-shifting, updating, and inhibition. Thus, the main purpose of the present study was to examine the role of the two

hemispheres in various executive and memory processes, trying to find common executive components in classic neuropsychological tests and in newly developed, experimental memory- and executive tasks.

First, we have identified some of the executive processes and marshaled evidence for their relationship to specific frontal regions. Five clear separable executive processes were defined with correlation and PCA analyses: Inhibition, Updating, Shifting, Monitoring and Production (strategy generation).

Summarizing the results, they provide evidence for an anatomically and functionally discrete cognitive architecture to the prefrontal lobes. Two components of our executive model is dependent on right frontal lobe functioning: the Inhibition and Monitoring components. Our lesion study provided further evidence for the left frontal involvement in the Production factor and the role of bifrontal areas in the Shifting and Updating factors.

As a conclusion we are proposing a possible integrative-executive model, but we would like to leave open to empirical investigation the question whether the organization is hierarchical, with one or more subsystems dominating, or whether a more heterarchical structure is involved.

Keywords: Inhibition, Updating, Shifting, Monitoring, Production
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EMOTIONS, ANXIETY AND COGNITIVE CONTROL - HOW DO THEY GO TOGETHER?

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Several theories have been proposed to explain the detrimental impact of anxiety on cognitive performance. The most recent theory suggests that anxiety disrupts two key executive functions: shifting and inhibition (Derakshan & Eysenck 2009).

It is still not clear, in what ways emotions influence cognitive performance in individuals varying in the level of trait anxiety. The present study investigated the influence of emotional stimuli on attentional control in individuals varying in trait anxiety level. An antisaccade task with emotional cues (angry vs neutral faces) was used. The task consisted of three conditions: prosaccade, antisaccade and mixed. According to attentional control theory (Eysenck et al.2007) the authors hypothesised that individuals with high trait anxiety will display inhibition deficit in antisaccade condition and in mixed condition, while there will be no difference between high and low anxiety individuals in prosaccade condition.

The results do not support the attentional control theory, sugesting that trait anxiety could affect the attentional control only under certain conditions. We claim that attentional control theory, although generally accepted, is too specific to explain all the anxiety-related cognitive problems. At the moment the authors are trying find a new framework that would allow them to explain these findings.

Keywords: attentional control, anxiety, antisaccade task
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CRITERION-SETTING IN THE LEFT PREFRONTAL CORTEX: THE ROLES OF PROCESS AND DOMAIN

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A large amount of previous evidence suggests that criterion-setting processes can be localized to the left prefrontal cortex (PFC). However, others point out that these results may be confounded by the task domain, namely verbal. Indeed, some studies show that right PFC activation is seen with spatial tasks. This study used fMRI to test the domain generality of the left PFC in a novel rule discovery task in both the verbal and spatial domains. Twenty healthy young adult participants were asked to discover the rule underlying the presentation of a series of letters in varied spatial locations. Twenty rules were presented in separate blocks: ten verbal rules, in which the letters formed words pertaining to a single semantic category, and ten spatial rules, in which the letters formed geometric figures. Additionally, in half of the blocks the domain to which the rule belonged was indicated, while in the other half the domain was not indicated and the participant needed to search both domains (parallel search). A conjunction analysis of the three search types (verbal, spatial, parallel) revealed that the left ventrolateral PFC is involved in all three search types. These data support a domain general role of the left PFC.

Keywords: rule acquisition, prefrontal cortex, fMRI
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SERIAL POSITION EFFECTS INFLUENCE 7-MONTH-OLDS' WORD LEARNING

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We investigated whether general mechanisms of verbal memory, similar to those observed in adults, affect vocabulary learning during infancy. In particular, we explored whether 7 months-old infants experience serial position effects (SPE) when learning a new multisyllabic word. Crucially, like any other sequential learning tasks, remembering a new word requires memory for the contents and the order of the elements that composed the sequence. We used an eye-tracker paradigm (adapted from Kovacs & Mehler, 2009) in which infants (N=22) were familiarized with a pentasyllabic word. The word was paired with a puppet appearing in a specific location of the screen. In the test, participants heard words that differed from the familiarization word in either the edge or the middle syllables. Recognition was measured through the infant's looking behavior while searching for the puppet after the presentation of each test word. The results showed that infants stored more accurately the first and the last syllables than those located in the middle positions. These results support previous artificial-grammar studies in adults showing a fundamental role of the edges in

language learning (e.g., Endress et al., 2009). In addition, our study suggests that edges may also serve as anchors for word representation during development.

Keywords: serial position effects, word learning, language development
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WORKING MEMORY AND SHORT-TERM MEMORY IN L2 LEARNERS AT DIFFERENT LEVELS OF PROFICIENCY

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The present study investigated the role of working memory (WM) and short-term memory (STM) in 126 foreign language learners (44 accomplished multilinguals and 82 mainstream English philology students). The study hypotheses were the following: (H1) The accomplished multilinguals will obtain very high scores on all STM and WM tests; (H2) Their scores on memory tests will be significantly higher than the scores of the mainstream English philology students. Three instruments were used in the study: the Polish Reading Span - PRSPAN (Biedroń & Szczepaniak 2012), the Wechsler Adult Intelligence Scale - WAIS-R (PL) (Arithmetic, Digit-Span, Digit-Symbol Coding) - an adaptation for use with the Polish population by Brzezinski et al. (1996), and the Modern Language Aptitude Test - MLAT (Part One - Number Learning) and (Part Five - Paired Associates) (Carroll and Sapon 2002). The analyses applied in the study included descriptive statistics, Pearson's correlation and t-test of differences. The research hypotheses were confirmed. Moreover, the differences between the samples were higher on tests based on verbal material than on tests based on numerical material. The findings are discussed in the context of the role of WM as a significant variable in determining the outcomes of learning a foreign language.

Keywords: working memory, short-term memory, accomplished multilinguals, foreign language learning
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DIFFERENT EFFECT OF SLEEP ON DIFFERENT MEMORY PROCESSES

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Growing body of evidence suggests enhancing effect of sleep on the long term storage of memory representation by facilitates the neuronal plasticity which contribute to the memory traces became to more stable and resistant to interference and forgetting. Even so, the beneficial effect of sleep on formation of procedural memory is debated. In

the present study we examined the relationship between sleep and implicit skill learning by testing patients with obstructive sleep apnea syndrome (OSA), which is an ideal population to investigate the effect of sleep deprivation on implicit skill learning. We used Alternating Serial Reaction Time (ASRT) task that enables us to separate the formation of general motor knowledge and sequence-specific knowledge. Eighteen OSA patients and eighteen healthy controls participated in this study. Our data show differences in offline changes of general motor memory consolidation between the OSA and control groups. Control group showed offline improvement from evening to morning, while OSA group did not. In the consolidation of sequence-specific knowledge we failed to find differences between the groups in offline changes. Our findings draw attention that different memory processes are differentially affected by sleep.

Keywords: memory consolidation, sleep, sleep deprivation, procedural memory
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TRAINING AND LONG-TERM RETENTION OF VISUAL TASKS BY TWO SPECIES OF EMYDID TURTLES, *PSEUDEMYS NELSONI* AND *TRACHEMYS SCRIPTA*

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Turtles are an important group for studying the evolution of cognitive abilities in vertebrates and as a long-lived species are expected to have long-term memory capabilities. We tested nine Florida Red-bellied Cooters, *Pseudemys nelsoni,* on their retention for both a novel procedural food acquisition task and visual discrimination task learned through a shaping procedure we developed. The turtles were tested and retrained after two months, after another 7.5 months, and finally after 36 months of no interaction with the test apparatus during the intervening periods. Turtles retained memory for the choice task and needed little retraining throughout. Furthermore, in a different visual discrimination task, both *P. nelsoni* and *Trachemys scripta* turtles showed 100% retention after 3.5 months of no testing. Odor-controlled tests confirmed that turtles were using visual cues to solve the task. Thus, in a laboratory context turtles demonstrate long-term memory of visual discrimination tasks, which relates to apparent abilities in natural environments.

Keywords: long-term retention; turtles; reptiles; learning; behavior
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OBSESSED NOT TO FORGET: NO RETRIEVAL INDUCED FORGETTING IN OBSESSIVE COMPULSIVE DISORDER (OCD)

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There is data showing that the act of retrieving memories involves some form of executive act that diminishes the accessibility of rival memory traces, leading to retrieval induced forgetting (RIF). It is debated whether RIF is due to executive control process which resolves rivalry among memories during competitive retrieval or is it simply due to strengthening of retrieved memories. Our goal was to acquire evidence regarding the role of executive functions in RIF, using a clinical sample (OCD) where executive, mainly inhibitory, impairment constitutes the core cognitive deficit. We assessed RIF among OCD patients and controls using the retrieval practice paradigm while controlling for working memory, trait and state anxiety, and symptom severity. Nineteen OCD patients and nineteen healthy age and education matched adults took part. Results show that retrieval of some memories led to enhancement in both groups, but forgetting of related memories (RIF) occurred only among controls. This finding was not due to different levels of anxiety, working memory and symptom severity. We suggest that the lack of RIF effect might be explained by the dysfunction of conflict detection processes frequently observed in OCD. The potential role of prefrontal and anterior cingulate cortex (ACC) dysfunctions are discussed.
Supported by OTKA 84019

Keywords: memory, retrieval induced forgetting, obsessive compulsive disorder, executive control
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THE IMPACT OF TRAIT AND STATE ANXIETY ON THE INHIBITION OF MEMORY

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I have selected a sample size of 40 people, out of which I seperated the ones with high trait anxiety levels from the those with low trait anxiety levels. Then I randomly put them into test and control groups. I increased the trait anxiety level of the test group by stress induction, for which I applied a scene from a film, which enhanced anxiety. The control group was not subjected to stress induction. After watching the scene, they had to learn words from four different lists, including neutral and threatening words. To test the inhibition of memory I applied the direct forgetting paradigm.

Interestingly enough, I found no significant differences between the test and control groups. Neither the people with high state anxiety, nor the people with high trait anxiety recalled proportionally more threatening words from the forgetting list than the members of the control group. However, the threatening words had greater impact.

As a consequence, we suppose that - if people with extraordinarily high trait anxiety level are not involved in the experiment - words with greater emotional charge have a greater impact, regardless of the test situation.

Keywords: anxiety, stress, inhibition, memory
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MEMORY PROCESSES BEHIND CHILDREN'S SOCIAL SKILLS

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Procedural memory with its statistical probabilities underlies the development of not only motor, but also cognitive and social skills. However, the cognitive processes behind social skills are not comprehensively characterized. The aim of our study was to examine the relationship between procedural memory processes and social behavior in typically developing children. We investigated 45 children from the age of 8 to 10 years old. A modified version of Serial Reaction Time task was administered to examine procedural memory processes. General cognitive functions were measured by tests of working memory (counting span) and executive functions (Stroop task). We used sociometric status, defined by the number of positive and negative choices for evaluating social skills. We formed three groups 1) popular 2) controversial and 3) rejected children based on peer judgments. We found no relationship between general cognitive functions and peer acceptance. In contrast, there was a link between sociometric status and the performance on procedural memory task: popular children performed significantly better on the procedural memory task, than their rejected peers, while controversial children's results were between these two groups. Our results suggest that procedural memory, learning the statistical properties of the environment implicitly and responsiveness for social information are partly based on similar cognitive domains.

Keywords: procedural memory, statistical learning, sociometry, social skills
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NOT ALL FORGETTING FUNCTIONS ARE CREATED EQUAL – INSIGHTS FROM MATHEMATICAL MODELING

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Most work on forgetting functions has been conducted with a goodness-of-fit approach: The wealth of studies comparing forgetting functions in terms of their descriptive power contrasts with the scarcity of deeper analyses of structural properties inherent to these functions. We present a mathematical model of learning with memory decay that allows for the analysis of some of such structural properties. This model is based on an abstract probability-learning task, where an agent must estimate the probability of occurrence of a random event by recurrent sampling. Based on this model – which we study via mathematical analysis and computer simulations – we show a stark division of forgetting functions into classes that either impede or promote learning the unknown probability. Furthermore, this division turns out to separate two classic antagonistic models for memory decay: exponential and power functions. We discuss our results in the context of the longstanding debate on the nature of the forgetting function.

Keywords: Forgetting function, modeling, memory decay, learning s
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NEWBORN INFANTS' LEFT BRAIN HEMISPHERE IS SENSITIVE TO SYLLABLE WELL-FORMEDNESS

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The sonority hierarchy (SH) is a linguistic account of a set of regularities widely shared across languages in the world. It relates to the organization of consonant clusters within syllables, ranking possible syllables into a scale ranging from "ill-formedness" (e.g. /lbif/) to "well-formedness"; (e.g. /blif/). Previous research showed that the SH modulates responses of adult speakers of languages poor in consonant clusters, suggesting that its influence is independent of productive language experience. For a stronger test of whether the SH relies on language experience, perceptual or productive, we tested newborn infants (age range 2–5 days) with functional near-infrared spectroscopy – a brain imaging technique that records variations in blood flow

from several points of the brain cortex. In two experiments, newborns listened to CCVC (C: consonant, V: vowel) syllables with varying degrees of well-formedness. We observed that left perisylvian areas (known to be involved in speech processing at birth) display different activation patterns for speech that is well- or ill-formed according to the SH, suggesting that the SH is based on perceptual mechanisms partly independent from experience.

Keywords: sonority hierarchy, human newborns, auditory perception, functional near-infrared spectroscopy
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INTERFERENCE EFFECTS OF WORKING MEMORY IN LANGUAGE: EMBODIMENT GRADATION AS PLAUSIBLE FRAMEWORK FOR SENSTENCE PROCESSING

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Concluding from imaging studies performed for action-and-body-related words that alter perceptive awareness, this study focuses on how implicit presentation of concepts influences awareness and performance. Participants were evaluating nouns on a concret-abstract scale, then they were asked to name associated words for the most abstract of these. Context-sensitive reading times were recorded for concret and abstract nouns. In a second experiment, participants had to fulfil a series of tasks after reading concept-and-association charged texts. Preliminary results show that there is a significant distinction in accuracy and speed within the group of abstract nouns that is absent in the control group. A mental representation's activation of a concept within the semantic net it is embedded in facilitates activation of associated concepts. Since basic conceptual frames are predominantly spatial or force-dynamic, we predict a developmental axis of embodiment to be a reasonable and evolutionarily plausible substitution to the existing concret-abstract terminology.

Keywords: working memory, language, embodiment, concret nouns, abstract nouns
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ANALYSIS OF BEHAVIORAL TRAITS IN THE RAT HXB/BXH RECOMBINANT INBRED STRAINS IN CAROUSEL MAZE, A HIPPOCAMPUS DEPENDENT TASK

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This project investigates the spatial learning of HXB/BXH recombinant inbred strains in the Carousel maze – a learning task requiring hippocampus-based spatial memory, cognitive coordination and inertial stimulation. Animals were to avoid a stable sector on a rotating arena, where errors are punished by mild foot shocks. Four daily acquisition sessions were conducted, followed by a 10-min non-reinforced session. Three sessions of reinforced reversal learning followed. Number of errors, maximum time avoidance and time to the first entrance were selected as spatial parameters. Locomotor activity, open-field behavior and beam walking results were recorded as possible indicators of sensorimotor deficits or anxiety with possible contribution to learning. None of these exerted an influence on Carousel maze performance, however, some exploratory parameters in the open-field ethographs positively correlated with number of errors in the retention testing. Result of the learning task displayed a significant between the strain differences and suggested approx. 40% heritability. Genetic determinants of this parameter using a web-based tool www.genenetwork.org were analyzed. Although no significant QTL was detected, several suggestive loci indicated the polygenic basis on the trait.

Keywords: inbred strains, QTL, spatial memory, behavior, heretability
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THE ROLE OF WORKING MEMORY IN THE PROCESSING OF TRANSPARENT AND NON-TRANSPARENT COMPOUND WORDS IN THE DIFFERENT AGE GROUPS

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The aim of our study was to explore the possible factors influencing the processing of compound words. Psycholinguistics theories differ markedly with respect to how transparent and non-transparent compound words are represented and processed in the mental lexicon. The main question of our study was to investigate how the capacity of short-term and working memory affects the processing of transparent and non-transparent words. While short-term memory reflects only a short-term passive storage, working memory requires more attentional demand and executive components. In our study we found that the capacity of short-term memory had no significant effect on lexical decision either in adolescents or in adults. In contrast,

working memory had significant effect, adolescents with lower working memory capacity were slower on transparent words compared to non-transparent and control words. In adults there were no working memory effects. In sum, we found dissociation between short-term and working memory in young ages suggesting that executive and attentional components of cognitive system are necessary for processing compound words. We can conclude that in young ages the processing of compounds words appears to be more domain-general, while these processes become more automatic and independent from working memory and other cognitive systems in adults.

Keywords: short-term memory, working memory, compound words, development
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ELECTROPHYSIOLOGICAL CORRELATES OF COMPETITOR ACTIVATION PREDICT INDIVIDUAL DIFFERENCES IN RETRIEVAL-INDUCED FORGETTING

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Retrieval can cause forgetting of related memories. The most influential theoretical model of this retrieval-induced forgetting (RIF) phenomenon is the inhibitory control account. According to this account, memories associated with a common cue compete for retrieval when the cue is presented. Inhibitory control mechanisms are theorized to resolve such interference and facilitate retrieval of the target memory. The present study aimed at testing a fundamental tenet of the inhibitory control account; namely the interference dependence assumption. Event-related potentials (ERPs) were recorded while participants engaged in a competitive retrieval task. Interference levels were manipulated by varying the cue-item associative strength of competing items. With an aim to temporally separate ERP-correlates of competitor activation and target retrieval, memory was probed with a sequential presentation of two cues: a competitor cue and a target cue. As predicted by the inhibitory control account, items with strong compared to weak cue-item associative strength were more susceptible to RIF. Moreover, interference-sensitive ERP modulations were observed, over anterior electrodes, following presentation of the competitor-cue and interacted with individual differences in RIF. The present study provides strong support for the inhibitory control account and presents electrophysiological correlates of competitor activation during competitive retrieval.

Keywords: Retrieval-induced forgetting, interference, inhibition, ERP
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REPRESENTATION OF FACIAL IDENTITY INFORMATION IN THE MEDIAL AND ANTERIOR TEMPORAL LOBE

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It has been shown that face processing involves several regions of the medial and anterior temporal lobe, including the perirhinal cortex and the temporal pole. It was suggested that these face responsive temporal lobe regions - located downstream from the well known fusiform face area - represent the highest stage of face processing and are critical for face identity discrimination and memory. An unresolved question is whether and to what extent facial identity information in these higher-level temporal lobe regions is represented in an abstract, feature-invariant manner. Here we addressed this question by measuring fMRI responses to intact and noisy (phase randomized) face stimuli. It was found that fMRI responses to the noisy face images were strongly reduced as compared to the intact faces in both the medial and anterior temporal regions, even though identity categorization was easy both in the case of intact and noisy stimuli. In contrast to this, fMRI responses to noisy images in the occipital face area and in the fusiform face area (OFA and FFA, two cortical regions involved in the structural processing of faces) were not altered or only moderately reduced, respectively. This excludes the explanation of reduced medial and anterior temporal fMRI responses in the case of noisy images based on a diminished input from OFA and FFA. Our results revealed that face-specific responses in the medial and anterior temporal lobe are highly sensitive to the quality of structural/contour information of the face stimuli and thus provide evidence against an abstract, feature invariant representation of the facial identity information in these regions.

Keywords: face memory, identity discrimination, fMRI, medial temporal lobe, temporal pole
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PROBABILISTIC APPROACH TO COMPUTATIONAL MODELING OF HUMAN AUTOBIOGRAPHIC MEMORY: AN OVERVIEW

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There are various approaches to computational modeling of human autobiographic memory (AM). Probabilistic generative models (PGM) present a promising approach in

this regard because they can capture well intrinsic features of AM: fallibility, forgetting, generalization, and false memories. At the same time, they are generalizations of (verbal) dual trace models employing "gist" and "verbatim" encoding/retrieving processes. However, PGMs were rarely used for AM modeling, neither in psychological, nor neurobiological, nor artificial agents/robotic communities. Here, we present our three computational models capitalizing on this approach, two of which we have already implemented using an artificial agent acting in a virtual reality environment and used for replicating data from several psychological experiments, e.g. longitudinal "diary studies". We also discuss the third model, a work in progress, which uses dynamic Bayesian networks (DBNs). DBNs directly account for the flow of time and different levels of abstractions that can be used for representing an episode. There are also out of the box inference algorithms that can be used to model reconstructive processes in episodic recall. We also made a link between our models, and dual trace models in general, and internals of some state of the art compression algorithms.

Keywords: episodic memory, probabilistic models, artificial agents, DBNs
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DID I TURN-OFF THE STOVE? GOOD INHIBITORY CONTROL CAN PROTECT FROM INFLUENCES OF REPEATED CHECKING

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Obsessive-compulsive disorder (OCD) is an anxiety disorder characterized by compulsions aimed to reduce anxiety. Cognitive theories suggest a vicious cycle in which compulsions increase intrusive thoughts that in turn cause more compulsions. Van den Hout and Kindt (2004) showed that compulsive-like behavior increase obsessions and memory doubts in healthy subjects.

Recent studies illustrate that OCD patients have inhibitory deficits, demonstrated mainly by poor performance in the stop-signal task. The current study aims to exhibit the protective effect of inhibitory control on developing obsessions resulting from compulsive behaviors.

In Experiment 1, healthy participants performed a stop-signal task followed by van den Hout and Kindt's compulsive-like checking task. Subjects with lower inhibitory capabilities were more negatively affected by the repeated checking. These results suggest that deficits in inhibitory control can cause execution of irrelevant behaviors that trigger the obsessive-compulsive vicious cycle.

In Experiment 2, we found a strong negative correlation between compulsive symptoms (measured by various OCD questionnaires) and the efficiency of the task conflict control mechanism (i.e., the conflict between relevant tasks and irrelevant automatic associative tasks). This mechanism was measured by various cognitive tasks

(e.g., Stroop-like task, object interference task). This calls for re-evaluation of the vicious cycle etiology and specifically, its triggers. Clinical implication will be discussed.

Keywords: obsessive-compulsive disorder; memory certainty; inhibition; stop signal; task conflict
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SPATIAL-TEMPORAL MEMORY: INTEGRATION OF SPATIAL SEQUENCE AND TEMPORAL ORDER INFORMATION

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Taking the dual nature of temporal information into account, we have separated the spatial sequence and temporal order information from each other in the visual memory tasks. The computerized tasks assess memory span in spatial localization of images, sequential organization of images and temporal order of verbal concepts. The complex tasks witch integrate multiple information are based on the simple spatial and temporal tasks. After demonstrating the complex task, the recall integrates all three aspects of memory (spatial, sequential and temporal order). In the control version of complex task the demonstration phase was unchanged on the principle that discarding images from the recall phase leads to disappearance of verbal-temporal order organization. The research groups consisted of preschool children, elementary school children and young adults. The results of the dynamic spatial tasks highlight the difference of the verbal-temporal order and sequential temporality as well as the necessity of the integration of these information in a real-life situation. In consequence, these findings point out verbal and non-verbal aspects of spatial-temporal organization of memory. From a developmental view, the spatial information is prior to temporal information even at the expense of language based order information.

Keywords: spatial-temporal memory, spatial localization, sequential memory, order memory
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LINGUISTIC ABILITIES OF THE FIRST GRADE STUDENTS WITH READING DIFFICULTIES

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Although in the past dyslexia and specific language impairment were treated as distinct disorders, new approaches emphasize that there is a two-sided overlap between these impairments (Bishop, Snowling, 2004): Many researchers reported

language impairment in children with dyslexia where the accent is on phonological skills as a potential cause of the reading and spelling problems. On the other hand, there is much evidence that children with specific language impairment develop reading difficulties even when the main cause of their impairment is not inadequate phonological processing.

The focus of this study is a group of first grade students which after eight months of formal reading instruction haven't developed reading at expected level. This group is in educational system recognized as children with reading difficulties. The aim of the study is to examine their linguistic skills in order to single out children at risk for reading impairment with and without language impairment. Children in this study were tested on two levels: (1) reading assessment where speed, accuracy and comprehension were evaluated after children had read a text; (2) language assessment where receptive vocabulary, comprehension of various grammatical constructions and the prerequisites of reading and writing were assessed. The results obtained in this research will be used in planning the longitudinal study of the relationship of language abilities and reading impairment.

Keywords: reading, specific language impairment
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OXYTOCIN ENHANCES IMPLICIT BUT NOT EXPLICIT SOCIAL MEMORY FOR NEGATIVE EMOTIONAL FACES

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Oxytocin has been proved to impact on several aspects of social cognition, with social memory being one of them. In the present study the effect of oxytocin on memory for emotional faces was tested using both explicit and implicit measures. We recruited subjects (N=28) on a voluntary bases (age: 18 - 30 years, only males) and presented them a set of faces with expressions of different valence (negative, neutral, positive) following intranasal administration of oxytocin/placebo. On the next day subjects' recognition memory was tested on a set of neutral faces and additionally they had to rate each face for trustworthiness. Subjects in both groups (oxytocin/placebo) showed a similar rate of explicit face recognition ($t_{(26)}=0.44$, $p=0.65$), and this was true regardless of the emotion displayed on the previous day (negative: $t_{(26)}=1.01$, $p=0.21$; neutral: $t_{(26)}=0.74$, $p=0.46$; positive: $t_{(26)}=0.85$, $p=0.39$). However trustworthiness rating for previously negative faces was influenced not only by whether subjects remembered the face ($\chi^2=4.45$, $p=0.03$), but also by whether they had received oxytocin/placebo ($\chi^2=3.589$, $p=0.05$) (Generalized Estimating Equations). This effect was not found for the neutral and positive faces.

In sum our findings suggest that oxytocin might act through enhancing implicit social memory and the storage of social information.

Keywords: oxytocin, social memory
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NEUROIMAGING EVIDENCES OF TESTING EFFECT

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A test is usually considered as an assessment of previously acquired knowledge. However it is now widely established that a test can also be a powerful learning event itself. Previous studies suggest that retesting a material can be more efficient in memorizing it for the long run than restudying it, a phenomena called testing effect. In our current experiments we asked participants (n=12) to learn the meaning of 60 suaheli words' in their native language. Half of the words were then repeatedly retested, the other half were repeatedly restudied. A final test was administered for all words either 30 minutes (short delay) or a week later (long delay) in a functional magnetic resonance imaging (fMRI) scanner. We measured the blood oxygen level dependent (BOLD) signal of participants using an event-related design. Successful retrieval was accompanied by different activation patterns for retested versus restudied words. Specifically, the left superior parietal cortex (identified in a separate working-memory functional localizer run) were differently activated for previously restudied vs. retested stimuli during successful recall for both short and long delay. Our result support the suggestion that retest and restudy conditions lead to anatomically distinct processes of memory consolidation.

Keywords: memory, testing effect, retrieval, consolidation, learning strategies
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VISUAL FEATURE BINDING DURING LONG-TERM MEMORY RETRIEVAL

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The binding of visual features into a coherent object representation has been thoroughly investigated in perception. However, what control processes are required in

cases when the features have to be retrieved from long-term memory (LTM)? To address this issue, we developed a paradigm that required the binding of a varying number of to-be-retrieved object features into a coherent representation. Participants learned associations between letters and different object features. During retrieval, two, three, or four letters were presented and participants had to retrieve and bind together the respective features. A control group with no binding requirement learned to associate letter strings with objects consisting of two, three, or four features and had to retrieve these objects as a whole. Results showed a systematic increase of response times and error rates with the number of to-be-retrieved features for both the experimental and the control group. This shows that it is more effortful not only to retrieve and bind together increasingly more features, but also to retrieve object representations consisting of an increasing number of features that are already bound together. Furthermore, preliminary EEG results suggest that these increases are mirrored by corresponding parametric modulations of alpha-band coherence across the occipital-to-parietal cortex.

Keywords: visual feature binding, binding in memory, control processes of memory retrieval, Alpha oscillations
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NO EVIDENCE OF SPATIAL MEMORY IN THE AXOLOTL *(AMBYSTOMA MEXICANUM)*

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Navigating in space is crucial to the survival of virtually all animal species. Thus it is not surprising that members of all vertebrate classes have been reported to possess spatial memory. In the present study our subjects were N=8 captive bred, juvenile, wild type axolotls *(Ambystoma mexicanum).* The axolotl is a neotenic amphibian species (they reach sexual maturity without undergoing metamorphosis), that makes them especially interesting to study, as little is yet known about how this special ontogeny affects cognitive capacities. After extensive habituation subjects were trained in a T-maze to turn either left or right in order to gain a food reward. A total of 50 trials were administered for each subject in sessions of 5. Following this procedure no evidence of spatial learning was found, as none of the subjects reached criterion (4/5 correct trials in three consecutive sessions; Binomial test, test proportion: 0.5, p=0.035) but they all chose left/right side randomly. Half of the subjects (N=4) were then given 70 additional trials each using a different type of reward (shelter), but they still did not show any evidence of spatial learning. A possible explanation for these negative results might be that axolotls lack spatial memory as due to their behavioural ecology (sit and wait predators) they do not need this cognitive skill.

Keywords: axolotl, spatial learning
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ELECTROPHYSIOLOGICAL CORRELATES OF THE DIFFERENT HIERARCHICAL LEVELS OF VISUAL WORD PROCESSING

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The ventral occipito-temporal cortex plays a critical role in the perception of written words. Previous functional magnetic resonance imaging studies suggested that in the ventral occipito-temporal cortex (with a left hemisphere dominance) words are encoded through a posterior to anterior hierarchy of neurons tuned to increasingly more complex orthographic features, such as single letters, bigrams, and possibly whole words. Although, in line with this, the results of neurophysiological research revealed that visually presented letters and words evoke a left hemisphere lateralized N1 component, which part/component of orthographic feature processing is reflected in N1 is still an unresolved question. Here we investigated this question by measuring how word rotation - which is known to impair parallel letter processing and thus results in serial letter-by-letter reading - affects the N1 component. Our stimuli consisted of: 1. horizontal words composed of vertical letters (HW-VL); 2. horizontal words composed of horizontal letters (HW-HL); 3. vertical words composed of horizontal letters (VW-HL). It was found that N1 amplitudes over the right hemisphere were strongly increased both in the HW-HL and VW-HL conditions. The latency of N1 was also affected by rotation: N1 peaks, especially over the right hemisphere, were delayed in the HW-HL condition compared to the HW-VL condition. These results suggest that the left hemisphere N1 component of the ERP responses reflect both single letter as well as global, whole word orthographic processing, whereas the right N1 might be associated primarily with the visual processing demands at the stage of single letter processing.

Keywords: visual word perception, reading, event-related potentials, hemispheric lateralisation
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A SHORT COURSE IN SUPERIOR MEMORY: SIGNIFICANT DIGIT MEMORY INCREASE AFTER A SHORT MNEMONIC TRAINING

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Mnemonic techniques allow for strong improvements in memory capacity. However, the necessary amount of training to achieve outstanding results has been cited as a limiting factor in answering questions on efficiency of mnemonics and setting up neuroscientific studies on superior memory. We show that a superior memory capacity can be achieved in a limited time by training gifted students in mnemonic techniques including the phonetic mnemonic and the method of loci. In two different groups they either studied the techniques over the course of just six training sessions of 90 minutes each or did a weekend course followed by six weeks of at-home training monitored by an online-platform. Participants significantly increased their performance for memorising words and digits in self-paced tasks after training and achieved results above the 2nd standard deviation of the baseline mean value. Some outperformed published data on superior memorizers. Our findings demonstrate that superior memory skills can be achieved in less time than previously proposed. Hence, further studies on the efficiencies of mnemonic techniques and on basic principles of superior memory performance can take this as a basis. This research was supported by a fellowship from the Friedrich-Ebert-Stiftung awarded to Boris N. Konrad.

Keywords: memory training, superior memory, skill acquisition, digit span, mnemonics
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THE DEVELOPMENT OF ASSOCIATIVE MEMORY BETWEEN 6-, 7-, 8-, 9-, 10-YEAR-OLDS AND YOUNG ADULTS

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In our study we present a new method to measure the development of associative memory abilities, which can be linked to episodic recollection. We designed a pair recognition task to measure item and associative memory. The participants had to study picture pairs and after a short retention interval they had to complete a recognition task. The recognition task consisted of 4 different stimuli: new-new, old-new, rearranged and intact pairs. Their task was to make an old-new recognition decision to each item of the pairs and then decide whether they see a rearranged or an intact pair of pictures. Associative memory was the ability of participants to discriminate between rearranged and intact pairs. To do that they are not able to rely on pure item familiarity but they need to retrieve associative information. We tested 6-,

7-, 8-, 9-, 10-year-olds and young adults and found no age differences on item recognition but a significant development of associative memory. These results suggest that there is an important development of associative memory, while item recognition abilities stay stable during this age period. We interpret the results that the increase in associative ability is a fundamental part of the developing episodic memory system.

Keywords: associative memory, episodic memory, memory development, visual pair recognition task
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SPATIO-TEMPORAL DYNAMICS OF SEMANTIC PRIMING EFFECTS ON WORDS AND WORD STEMS

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Despite extensive neuroimaging studies of lexical-semantic processing, the neural mechanisms of the process that underlies "building meaning" from partially available information is still poorly understood. The aim of the present study was to investigate the spatio-temporal stages of brain involvement in the processing of complete words or word stems while providing contextual facilitation by single-word primes. Primed and unprimed word stems or real words were visually presented and participants had to indicate whether they rhymed with the last word in each triad (open - cl□□□ - expose; tile - story - score).
High-density magnetoencephalography (MEG) signal was recorded with a whole head device (Elekta Neuromag) and analyzed with an anatomically-constrained MEG (aMEG) approach. Noise-normalized distributed minimum norm inverse solutions of activity to target words or word stems were constrained to each person's cortical surface reconstructed from anatomical MRI scans and averaged across participants. Starting in the visual cortex, the estimated activity spread in the anterior direction and was left-dominant for words and right-dominant for word stems after ~200ms. The priming effect was observed in the left fronto-temporal areas as the N400 larger to incongruously primed stimuli. Conversely, the N400 to congruously primed word stems was greater in the right temporal cortex. These findings suggest that two hemispheres are differentially sensitive to words and word-like stimuli. Even though the lexical-semantic processing is primarily subserved by the left temporo-prefrontal cortical areas, the right hemisphere contributes to semantic processing of incomplete words.

Keywords: semantic priming, “building meaning”, spatio-temporal dynamics, lateralization
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REPETITIVE THINKING AND STIMULUS-INDEPENDENT THOUGHT: ARE THEY RELATED?

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Repetitive thinking about one's concerns is a common human experience, which involves the processing of self-generated information. The Gateway Hypothesis (Burgess, 2006) states that the rostral part of the prefrontal cortex is responsible for switching between stimulus-oriented (SO) and stimulus-independent (SI) processing. To test whether subjects with a propensity to engage in repetitive thinking are prone to shift to SI-processing, we investigated how different indices of repetitive thinking (worry, rumination and obsessions) are related to performance in four event-based prospective memory tasks. In the first task, the identification of the prospective cue required SO-processing (three dots on the screen are in a line), whereas in the second, it required SI-processing (both numbers on the screen are even). In the third and fourth task, the prospective cues were combined and subjects had to check both dots and numbers: so the switch between SI and SO processing could be investigated. Although we could not demonstrate the predicted relationship between repetitive thinking and SI-processing, we found that after controlling trait anxiety, worrying was associated with better PM performance at the late phases of the tasks. This result suggests that high worriers are efficient in maintaining their intentions while engaging in an ongoing task.
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Keywords: gateway hypothesis, repetitive thinking, worry, stimulus-independent processing
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BOOSTING HUMAN LEARNING BY HYPNOSIS: EVIDENCE FOR THE COMPETITION BETWEEN MEMORY SYSTEMS

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Human learning and memory depend on multiple cognitive systems related to separable brain structures. These systems interact not only in cooperative but sometimes competitive ways in order to optimize performance. Previous studies demonstrated that manipulations reducing the engagement of frontal lobe-mediated explicit, attentional processes could lead to improved performance in striatum-related procedural learning. In our study, hypnosis was used as a tool to reduce the competition between these two systems. Fourteen highly hypnotizable young adults participated in the experiment. Procedural learning was measured by the Alternating

Serial Reaction Time (ASRT) task. All participants performed the ASRT task in hypnosis and in the alert state, with one month delay between the two sessions. The order of the conditions was counterbalanced. According to our results, participants showed better learning in hypnosis compared to the alert state. Since frontal lobe-dependent processes are primarily affected by hypnosis, this finding could be attributed to the disruption of the explicit, attentional processes. Our finding sheds light not only on the competitive nature of brain systems in cognitive processes, but also could have important implications for training and rehabilitation programs, especially for developing new methods to improve human learning and memory performance.

Keywords: hypnosis, procedural memory, functional connectivity, prefrontal cortex, striatum
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2 CASE STUDIES OF SIGH RECOVERY PATIENTS: ASSESSMENT OF FUNCTIONAL VISION

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Cases of sight recovery are rather rare. Up to now, 30 cases in history have been documented. Sight recovery has ethical, medical and psychological aspects. Here, we report two cases of sight recovery of patients with 33 and 18 years of acquired blindness. Two main hypotheses were explored: to what extent visual representations are still flexible and intricate; and whether visual perception is characterized as serial (as typical for blind subjects) and analytical. The following visual skills were assessed: object recognition, face recognition, basic form perception, parsing and also resistance to visual illusions. The results are discussed within the context of other reported cases of sight recovery (Fine et al., 2003; Ostrovsky et al., 2006; Ostrovsky et al., 2009).

Keywords: case study, sight recovery, functional vision
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AGE-RELATED CONFLICT RESOLUTION DEFICIT: COMPENSATORY ROLES OF INTELLIGENCE, COGNITIVE RESERVE AND EDUCATION

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The aim of this study was to investigate whether resolution of conflict in different domains is affected by normal aging and whether factors such as cognitive reserve, years of education and intelligence compensate for age-related deficits. Two experiments with partially overlapping samples, both including non-demented older

adults (65-79 years old, N=23 and 17) and younger controls (18-34 years old, N=22 and 18), performed verbal and spatial Stroop tasks with no feature repetitions to minimize priming-related effects. Moreover, Intelligence Quotient (IQ) and Cognitive Reserve (CR) were assessed. Older adults were impaired in verbal interference resolution (Stroop effect), but their verbal Stroop effect negatively correlated with verbal IQ. Moreover older adults' general performance speed was correlated with education and CR. Conversely, spatial interference resolution did not significantly differ between age groups. Nonetheless, we found that CR correlated with various aspects of task performance in the spatial domain: general accuracy and conflict resolution in both speed and accuracy. Our results are compatible with a compensatory role of IQ, CR and education on age-related deficits in information processing and conflict resolution. The nature and extent of this compensatory influence partially changes according to the domain.

Keywords: Cognitive aging, conflict resolution, attention, cognitive reserve
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THE EFFECT OF TASK ON THE ELECTROPHYSIOLOGICAL CORRELATES OF VISUAL CATEGORIZATION

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When investigated by electroencephalography, category-specific modulations of the visual P1 and N1 event-related potentials can be detected in a categorization task. Here, we investigated how the nature of task modulates this category effect and how its time course and topography changes. Eleven subjects participated in two sessions: a car vs. bird categorization task and a simple target-detection task. We recorded a 32-channel EEG and assessed changes of the P1 and N1 components. Moreover, scalp maps of category-specific neural activities were compared between the two tasks in the 100-600 ms time interval. As expected, we found a car vs. bird category effect over occipital regions around 140 milliseconds in both tasks. Furthermore, the type of task did not influence the category-related modulation of the N1 component. In spite of this, while in the categorization task the car vs. bird amplitude difference was present over the parieto-occipital regions almost for 600 ms, in the target-detection task it disappeared around 300 ms. Frontal effects also differed between the two tasks after 300 ms. These results suggest that early category effects are task-independent, while only active categorization is characterized by a sustained amplitude shift both over anterior and posterior regions in the 300-600 ms interval.

Keywords: EEG, visual categorization, task dependency
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ELECTROPHYSIOLOGICAL TRACE OF MIRROR NEURONS

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Mirror neurons are multimodal association neurons with motor properties in premotor and posterior parietal cortex that increase activity and fire not only during action execution, but also while observing or hearing another individual performing the same or a similar action. Mirror neurons play important role in action recognition, imitation, empathy and also theory of mind. Electrophysiological index of mirror neuron system (MNS) activity is EEG oscillation called μ-rhythm. Our EEG experiment focused on μ-rhythm as the indicator of MNS activity. The basic expectation was to find the highest μ power the in relax condition and similar μ suppressions in self motor movement, and the same observed movement condition. In addition we expected to find contralateral correlations in μ-rhythm strength according to hand in nonrest conditions and hemispheric differences in μ power also in nonrest conditions. The results showed statistically significant suppression from baseline in μ oscillations over both hemispheres during nonrest conditions, what supports our first expectation. Results for our second question were statistically insignificant, what contradicts our expectation. However, from this finding we can assume that MNS activity is not hemispherically differentiated for distinguishing left and right side movement, but rather approximate to distinguish and understand any kind of movement.

Keywords: mirror neuron system, EEG, movement
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DISTURBED DREAMING AND SLEEP QUALITY: ALTERED SLEEP ARCHITECTURE IN SUBJECTS WITH FREQUENT NIGHTMARES

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Nightmares are intense, emotionally negative experiences that usually occur during late-night sleep and result in abrupt awakenings. While nightmares are generally conceptualized as a secondary symptom of an underlying mental disorder, research indicates that the direct relationship between nightmares and psychopathology is far from being uncontroversial. In contrast, questionnaire-based studies showed consistently that nightmares were related to impaired sleep quality; however, the polysomnographic profile of nightmare subjects was only scarcely investigated. We hypothesized that nightmare sufferers will exhibit altered sleep architecture that will be independent from the effects of waking psychopatholgy. We examined the sleep of

17 individuals with frequent nightmares and 23 control subjects based on polysomnographic recordings. Nightmare subjects, in comparison to controls were characterized by impaired sleep architecture, as reflected by reduced sleep efficiency, increased wakefulness, a reduced amount of slow wave sleep and increased nocturnal awakenings, especially from Stage 2 sleep. While these differences were independent of the effects of waking anxiety and depressive symptoms, nightmare subjects exhibited longer durations of REM sleep, which were fully mediated by heightened negative affect. Our results support that nightmare subjects are characterized by altered sleep architecture showing impaired sleep continuity and an emotion-related increase in REM propensity.

Keywords: nightmares, sleep, dreaming, EEG, polysomnography, sleep quality
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SURVIVAL PROCESSING ANG LONG-TERM RETENTION

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Evolutionary approach becomes increasingly significant in memory research. Nairne et al. (2007) demonstrated that retention was enhanced when information was processed according to their relevance for a grassland-survivor scenario. This effect was replicated by subsequent researches using a wide range of control scenarios. But while focusing on the scenarios' properties, other elements of the paradigm, as the use of a maximum 10 minutes long distractor task before retrieval remained untouched. Hence the effects of long-term retention and changes in the contextual cues are still underexamined.

The aim of the present study was to examine whether the advantage of survival processing could be replicated with a 24 hours delay before retrieval which could tell us more about the proximate mechanisms responsible for this phenomenon.

In the experiment adults rated common nouns either by a surviving scenario or by a moving-to-a-foreign-land scenario. This was followed by an unexpected recognition test without feedback in 5 minutes and then once again 24 hours later. Hits and reaction time were measured.

Results show that survival processing enhances not only immediate but also delayed retrieval. This supports the domain general theories explaining the surviving effect.

Keywords: adaptive memory, long-term retention
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SUCCESSFUL MEMORY ENCODING DEPENDS ON CONTEXT REINSTATEMENT AT RETRIEVAL – BEHAVIORAL AND OSCILLATORY EVIDENCE

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Reinstating the context during retrieval that was present at encoding has a strong influence on memory performance. Yet, the neural underpinnings of such context-dependent memory effects are not well understood. We addressed this issue by manipulating the overlap of contextual features during encoding and retrieval. Participants encoded words superimposed on short movies while MEG was recorded. During recognition testing, words were either presented in the same or a different context. Due to their crucial role in item-context binding, we hypothesized that high theta power during encoding would be beneficial for retrieval if encoding and retrieval contexts matched. The opposite pattern was expected if the contexts did not match, as strong item-context binding should impede retrieval of items which are presented with a different context. Behavioral results confirmed that the context manipulation was successful. Memory performance was enhanced if the contexts of encoding and retrieval were matched. Time-frequency analyses revealed a context-dependent subsequent-memory effect, indicating that high theta power during encoding predicted successful retrieval of words in the context match condition, whereas low theta power predicted successful retrieval of words in the context mismatch condition.

Keywords: episodic memory, context reinstatement, MEG, oscillations
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DOUBLE EFFECT OF CURIOSITY DEFICIENCY ON MEMORY IMPAIRMENT WITH DEMENTIA SYNDROME

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The number of people suffering from dementia syndrome is likely to double every 20 years, thus leading to over 80 million diagnosed people by 2040. Memory impairment is one of the main deteriorations within this syndrome and curiosity might have double effect on it - both direct and mediated by emotions.

Desire to learn and known, with the aim of fulfilling the gap between what one knows and wishes to know, is one of the basic elements of curiosity and gives great emphasis on the process of acquiring and maintaining information. Yet, curiosity can also be related to depression and apathy, both being common expressions of psychiatric disturbances within population of people with dementia. Curiosity, motivation and interest are similar concepts with some overlapping characteristics, and are all arising from individual's energy to act. Through the loss of interest, one of the basic elements

of depression, and lack of motivation, related to apathy, we can point out another, perhaps more indirect, relation between curiosity and memory.

In conclusion, stimulation of curiosity could therefore have some influence on slowing down the progression of memory impairment within patients with dementia.

Keywords: curiosity, dementia, memory, depression, apathy
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IS DREAMING MERELY A COGNITIVE PERFORMANCE? ANALYSIS OF THE CONTENT AND NARRATIVE STRUCTURE OF CHILDREN'S DREAMS

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Inspired mainly by the longitudinal studies of Foulkes the mainstream of developmental psychology considers dreaming a cognitive performance deriving it solely from children's cognitive abilities. In contrast, the current neurocognitive approaches see the function of REM sleep and dreaming in the consolidation of emotional memories and in affective regulation.

This study investigates the ontogeny of dreaming, evaluates the frequency, content and narrative structure of dreams together with the cognitive and affective development in children.

In our content analysis we followed the rules described by Foulkes, but the method of dream collection was fundamentally different: instead of interviews after awakening from sleep in the laboratory, over 6 weeks children would report their dreams at home to their pre-trained parents in the form of tape-recorded dream-diaries based on provided questionnaires.

The initial content analysis (n=12, age=4-8 years) revealed differences to earlier results: dreams are longer in every age group compared to the previous findings, self-representation is more frequent (79%), movement (84%) and living emotions (43%) are common in the dream experience; furthermore the number of dream reports does not change significantly with age (one dream per week in all age groups).

The current study is a part of a bigger research project, which aims to widen our knowledge about this seldom investigated field of developmental studies and dream science - evaluating it in a new, emotional development-centered context and using different methodology.

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Keywords: infant, dreaming, cognitive, affective
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THE SELECTIVE EFFECT OF INTENTIONAL INHIBITION FOR INFORMATIONS AT EVENT-BOUNDARIES

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People can segment ongoing activities into clearly separated events during information-processing. Zacks and his colleagues (2009) pointed out, that segmentation selectively encodes information at event-boundaries, and episodic cues match event-boundaries. Racsmány and Conway (2006) explained that intentional inhibition effects only episodic representations. Therefore we assumed that inhibitory control act only on representations at event-boundaries. We tested this hypothesis in a directed forgetting experiment. Participants (n = 24) watched two videos of everyday activities, and their task was to press a button when an event ends and a new begins. But participants in the "forget" group were instructed to forget the first film, because it was just practice, and try to memorize as many objects from the second video, as they can. In opposite, participants in the "remember" group were instructed to note objects from both of the two films. The two groups' performance showed typical directed forgetting effect for objects presented near event-boundaries: the forget group recalled fewer objects from the first film compared two the second video, and they retrieved fewer objects from the first film, than did participants in the remember group. In contrast, there was no directed forgetting effect for objects presented inside the events.
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Keywords: event-segmentation, event-boundary, intentional inhibition, directed forgetting
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AGE-RELATED CHANGES IN VERBAL FLUENCY FROM EARLY CHILDHOOD UNTIL LATE ADULTHOOD

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In the cognitive psychology often used the verbal fluency tasks to measure executive functions, the manipulation, the controlling processes and verbal working memory. The letter and semantic fluency tests are very useful in the clinical practice, because we can get substantial information about how the specific domain of the brain areas working and what if they get damaged. The specific differentiation has a serious role to understand the process behind learning and developmental disorders. Several studies have assessed that frontal cortex is crucial for phonemically driven word retrieval, while temporal cortex underlies semantically based word retrieval. The aim of the study was to investigate age-related differences from early childhood until old ages in

the letter and sematic fluency and their relationships with working memory and other executive function tasks. We found that both letter and category fluency showed strong age-related changes. Semantic fluency develops earlier, the participants show better performance on it compared to the letter fluency. The semantic fluency is more stable and resistant to the effects of aging, whereas the letter fluency is more sensitive to deficits of the frontal lobe. We discuss the age-related changes of both word retrieval strategies and lexico-semantic networks during childhood and adulthood.

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Keywords: letter fluency, semantic fluency, learning and developmental disorders, executive function
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THE ROLE OF ECHO IN UNDERSTANDING VERBAL IRONY

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In order to clarify the role of echo in verbal irony, I conducted three studies with children aged 5 to 8.

In the first study, short stories containing a simple true or false statement, true or false delusion and true or false irony were shown to the children. I found that subjects understood the beliefs of the speaker better in case of false irony than in case of false delusion, even though understanding of both communicational situations requires second-order mentalization. In the second study, half of the false ironic and false delusive utterances were echoic, and half of them were not. The results showed that the echoic nature of an utterance facilitates its understanding, even if the utterance itself is not ironic. In the last study, I analyzed the children's capacity to understand echoic and non-echoic irony and delusion, related to their performance in first- and second order mentalization tasks. Logistic regression did not show any relationship between second-order mentalization skills and the understanding of explicitly echoic verbal irony.

These results show that children tend to apply an echo-based, heuristic interpretational strategy, and therefore are able to interpret ironic statements, even if they are not yet capable of higher-order mentalization.

Keywords: verbal irony, echoic mention, theory of mind
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SUPPRESSION OF AUDITORY EVENT-RELATED POTENTIAL WITH VOLUNTARY MOVEMENT – CONTINGENCY AND CONTIGUITY

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A number of studies reported that the amplitude of the N1 component of the event-related potential is attenuated when it is elicited by self-initiated sounds. This N1-suppression effect is generally interpreted in the framework of a mechanism predicting the sensory consequences of one's own actions.

Because all studies investigating this phenomenon used contingent stimulation (that is, the participants' action consistently triggered a sound), it is possible that action-effect contingency in not a necessary prerequisite of N1-suppression, but rather, contiguity (temporal proximity) of the action and the sensory event is sufficient.

To test this hypothesis, we presented a sequence of sinusoid tones with random, 2-6 s onset-to-onset intervals. When Participants' key-presses accidentally coincided with sounds (approximately 3% of the time), N1-suppression occurred. This result shows that action-stimulus contiguity is sufficient to attenuate the N1 response to sounds.

Keywords: efference copy, ERP, forward model, N1, selfinitiated sound
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GENDER DIFFERENCES IN SLEEP EEG CORRELATES OF SUPERIOR INTELLIGENCE

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Introduction. Sleep EEG spectra are individual characteristics with a strong hereditability and biological foundation, therefore they may be connected to IQ. It is unclear if superior IQ compared to normal is related to similar biological differences as low IQ to average. Alternatively, studies found gender differences in wakefulness EEG correlates of high IQ. Methods. Sleep EEG spectra were calculated from 17 Hungarian Mensa members and 17 controls. Power spectra of REM and NREM sleep were compared binwise, both between the two groups as a whole and group members of each gender. Results. Gender-independent differences between the two groups are modest in both REM and NREM sleep. In Mensa females NREM alpha and REM beta powers are significantly increased. Mensa males show significantly increased REM theta activity around 6 Hz, and a tendency of higher NREM theta and sigma activity. Discussion. Superior IQ does not appear to have a general fingerprint in sleep EEG, but

differences appear in gender-separated comparisons. Location of higher activity in Mensa males corresponds to frequencies usually connected to higher learning and memory performance. There is less clarity about the observed high alpha and beta activity in Mensa females, which is usually a sign of sleep disturbances.

Keywords: sleep EEG, intelligence, gender differences, Mensa, power spectrum
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BRAIN OSCILLATIONS INDICATE INHIBITION OF INTERFERING VISUAL MEMORIES

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Selective retrieval of a specific target memory is often challenged by the interference of related, but irrelevant memories. Measuring brain oscillatory activity in a novel experimental design, the present study provides direct neural evidence for the claim that competing memory representations can be inhibited by mechanisms similar to those employed in selective attention. Our experiment was designed so that each cue used to search memory was associated with a target memory and a competitor memory stored in separate brain hemispheres. In accordance with previous findings on retrieval-induced forgetting, competitor memories were more likely to be forgotten when they interfered with retrieval of a target memory. The amount of retrieval-induced forgetting was predicted by increased oscillatory alpha/beta power (11.5-20 Hz), observed over the hemisphere housing the sensory representation of the competitor memory trace. Our findings are in line with studies on selective attention, suggesting that cortical inhibition is mediated by increased brain oscillatory activity in the alpha/beta frequency band. The results provide the first direct evidence for inhibition of competing memories during episodic memory retrieval. They are indicative of a generic, cross-domain mechanism mediating inhibition in both selective visual attention and episodic memory retrieval.

Keywords: brain oscillations, inhibition, forgetting
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ALERTING CAN INTERACT WITH EXECUTIVE CONTROL BY INCREASING THE INFLUENCE OF IRRELEVANT SPATIAL DISTRACTORS

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Researchers have suggested that distinct attentional systems can interact under certain conditions. Specifically, the alerting system has been found to increase interference of cognitive conflict in the flanker task. This was interpreted as an inhibition of cognitive control following an alerting cue. In Experiment 1 we show that alerting cues do not modulate measures of executive control when the relevant and irrelevant features of the task are integrated into one object. Experiment 2 reveals that the mere spatial separation of the relevant and irrelevant stimuli in the same task is sufficient to expose an interaction between alerting and congruency; namely, a larger congruency effect following alerting cues. We suggest that alerting modulates the allocation of attention by prioritizing processing of spatial information presented in the visual field. This process can be adaptive under many circumstances but it comes at a cost. Alerting may reduce our ability to select among competing events in the spatial field.

Keywords: Attentional networks, executive control, alerting, selective attention
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COGNITIVE CONTROL PROCESSES IN WORD RETRIEVAL

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According to the lexical competition hypothesis, speakers take longer to name repeated series of pictures from the same semantic category vs. semantically mixed categories, because semantic similarity exerts an interfering influence. Competition can also arise in the form of undetermined response conflict, for instance when the stimulus activates many response options and the speaker has to select from them. Resolving both types of conflicts requires cognitive control. To replicate these effects, and to further explore them developmentally, a novel picture-naming task was designed where the context of pictures (homogeneous vs mixed blocks) and naming agreement was manipulated. The task was performed by 8-year-olds and young adults. In accordance with cognitive control theories, we expected that picture-naming results will correlate with more general cognitive control measures. Our results show that in children, naming latencies are significantly longer in the homogeneous than in the mixed and in the low versus high agreement conditions. Also, as we expected, inhibition measures on the naming task (RT difference between low and high agreement

conditions) showed a significant correlation with measures on the Stroop task. Preliminary results show that RT differences are smaller but present in adults as well, but age effects need further investigation.

Keywords: naming, lexical competition, conflict resolution, inhibition, word retrieval
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