UNIVERSITY OF FRIBOURG / FACULTY OF SCIENCE

Fribourg Day of Cognition

12 September 2012

Pérolles II – Salle A140

Fribourg Centre for Cognition

Program

9 :15 Welcome

9 :25 A. Khani & G. Rainer, Department of Medicine, University of Fribourg

9 :40 E. Hartmann & F. Studer, Department of Special Education, University of Fribourg

9 :55 C. Martin-Soelch, Department of Clinical Psychology, University of Fribourg

10 :15 P. Barrouillet, E. Vergauwe & V. Camos University of Fribourg

10 :30 Pause

11 :00 D. Lalanne, Department of Informatic, University of Fribourg

11 :15 E. Schmidlin, Department of Medicine, University of Fribourg

11 :30 R. Caldara, Department of Psychology, University of Fribourg

11 :45 P. Gygax & P. Wagner, Department of Psychology, University of Fribourg

12 :00 Pause

14 :00 S. Dieguez, J Zumbuehl, L Spierer & JM Annoni, Department of Medicine, University of Fribourg

14 :15 Keynote lecture: A.Guggisberg, Clinical Neurosciences, Geneva University Hospital

15 :00 Poster viewing

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Lecture et acceptation du PV 2011

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A. Khani & G. Rainer

Recognition memories are formed during perceptual experience and allow subsequent recognition of previously encountered objects as well as their distinction from novel objects. As a consequence, novel objects are generally explored longer than familiar objects by many species. This novelty preference has been documented in rodents using the novel object recognition (NOR) test, as well is in primates including humans using preferential looking time paradigms. Here, we examine novelty preference using the NOR task in tree shrew, a small animal species that is considered to be an intermediary between rodents and primates. Our paradigm consisted of three phases: arena familiarization, object familiarization sessions with two identical objects in the arena and finally a test session following a 24-h retention period with a familiar and a novel object in the arena. We employed two different object familiarization durations: one and three sessions on consecutive days. After three object familiarization sessions, tree shrews exhibited robust preference for novel objects on the test day. This was accompanied by significant reduction in familiar object exploration time, occurring largely between the first and second day of object familiarization. By contrast, tree shrews did not show a significant preference for the novel object after a one-session object familiarization. Nonetheless, they spent significantly less time exploring the familiar object on the test day compared to the object familiarization day, indicating that they did maintain a memory trace for the familiar object. Our study revealed different time courses for familiar object habituation and emergence of novelty preference, suggesting that novelty preference is dependent on well-consolidated memory of the competing familiar object. Taken together, our results demonstrate robust novelty preference of tree shrews, in general similarity to previous findings in rodents and primates.

Keywords: Novel object recognition test, Tree shrew, Long term memory, Familiarization

E. Hartmann & F. Studer

Department of Special Education, University of Fribourg

Effects of preschool phonological awareness training for children with primary speech or language impairments: Meta-Analysis of controlled group studies

Background and purpose: There is ample evidence that preschoolers and kindergarteners with specific speech or language impairment show robust deficits in phonological awareness that put these children at (additional) risk for problems in early reading and writing acquisition. In order to prevent such difficulties, it is often recommended to teach metaphonological skills in children with language-based risks before the beginning of formal reading and writing instruction. This recommendation and practice are based on theoretical considerations as well as on empirical data showing that an early PA training has positive effects on PA and subsequent literacy development in the first school years. However, in previous research synthesis on this topic (e.g. Bus/Van Ijzendoorn 1999; Ehri et al. 2001), little or no attention has been given to speech-language impaired children who might have the most severe metaphonological deficits. Therefore, the central question remains, if there is a solid empirical evidence for early PA intervention as an effective approach to prevent written language disabilities in this at-risk-population. To address this question, we conducted a systematic review and meta-analysis of international evidence.

Method: We conducted a comprehensive literature search to locate published or unpublished controlled group studies (randomized or quasi experimental) on the effect of early PA-training in children with oral language disorders. Of 484 *identified papers*, *only seven met* our inclusion criteria and were included in the research synthesis (6 independent studies). The internal and external validity of these studies were assessed by means of 32 criteria described by Troia (1999). To estimate the short-term and long-term effects (*unbiased Hedges's g*) of PA-intervention on phonemic awareness and on literacy skills, we performed meta-analytic calculations comparing the different outcomes of experimental and control groups using a random model of analysis.
Results: The results support the hypothesis that early PA-training has positive significant short-term effects (ES: 0.77; $p = 0.00$) as well as long-term effects (ES: 0.38; $p < 0.02$) on PA of speech/language impaired children. In contrast, t*he analysis did not yield* a significant long-term effect on reading and writing skills of trained children at-risk in grade 1(ES: 0.29; $p = 0.2$). Furthermore, only the subgroup analysis for the literacy outcome did reveal a significant effect of instructional variables (kind of training/orthography) and methodological study characteristics (e.g. kind of control group).
Discussion: The *results are in accordance with* previous research synthesis showing that an early PA-intervention has a significant impact on phonemic awareness in normal learners and in children at risk for reading disability. However, our results from studies specially focusing on speech-language impaired children do not support the assumption that such trainings are beneficial with respect to subsequent literacy acquisition in this at-risk population. Certainly, the presented results must be considered with caution due to the restricted set of analyzed studies calling for more research that we would like to evaluate in a prospective cumulative meta-analysis.

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The role of dopamine in pleasure and pain: a 11C-raclopride bolus plus constant infusion PET-study of unpredictable monetary rewards in chronic pain

Recent findings suggest that pain and reward are mediated by similar neural pathways in the central nervous system, and that these pathways are related to both the dopamine (DA) and the opioid system. It is well documented that DA is involved in the processing of rewarding information, and several findings point to a role of DA in pain regulation. However, the exact role of DA in the perception of pain and pain relief is still unknown. A dysfunction of the central DA system was evidenced in chronic pain patients, including patients with neuropathic pain and patients with fibromyalgia (FMS). Additionally, there is extensive co-morbidity between chronic pain and depression, which often includes anhedonia, i.e. the reduced ability to enjoy pleasurable activities.

Anhedonia has been hypothesized to be related to a hypofunction of the DA system that could affect the neural processing of rewarding information. Finally, the neuropathology of FMS is still poorly understood and the role of the observed reduction in DA presynaptic function in the pathophysiology of FMS is unclear. We investigated here the modulation of pain perception and pain relief by dopamine (DA) in patients with FMS compared to healthy controls using the [11C] raclopride PET method. A second aim is to investigate whether the DA response to rewarding stimuli can differentiate between FMS patients with and without depression in order to understand whether an alteration of the neural responses to reward could contribute to the depressive symptoms that are often associated with FMS. We tested differences between FMS patients and healthy subjects in striatal DA release in response to unpredictable monetary rewards using the bolus plus infusion (B/I) PET-method. We expected FMS patients to show a reduced endogenous DA release, expressed by increased [11C] raclopride binding and expected these changes to correlate with depression and pain scores. Eighteen female FMS patients and sixteen healthy subjects were measured at rest and while performing a slot machine task consisting of a sensorimotor control condition and a monetary reward condition where subjects randomly received monetary rewards in an unpredictable fashion. Regional PET measures were acquired in MRI-based striatal regions of interest. Percent of change in [11C] raclopride binding was computed as the difference in ratio region/cerebellum. We found significant higher [11C] raclopride binding ratios in FMS patients than in healthy subjects across the different measurement conditions in the right ventral striatum ($p=0.04$). The percent of change between sensorimotor and reward condition was significantly larger in FMS than in healthy participants. No significant correlations with pain and depression scores emerged. These results point to an involvement of the DA function in the pathophysiology of FMS consisting in a reduced DA function at rest and unexpectedly in a hypersensitive reaction to rewards.

P. Barrouillet, E. Vergauwe & V. Camos

Structure and functions of working memory in the time-based resource-sharing model

This talk will present a new theory of working memory that embeds the Time-Based Resource-Sharing model within a multi-level cognitive architecture in which a central system, conceived as a self-regulated executive loop involving an episodic buffer and a production system, integrates information from peripheral domain-specific buffers and long-term memory. The executive loop is responsible for constructing working memory representations, for maintaining these representations in the face of decay and interference, and for goal-directed processing by triggering executive functions that modify the content of these representations. Apart from a phonological loop able to maintain a limited amount of verbal information through verbal rehearsal, peripheral buffers are conceived of as passive sensory memories with no specific mechanisms of maintenance. Assuming a sequential functioning of the executive loop and the temporal decay of working memory representations, the theory makes a series of predictions about the time-related effect of processing on concurrent maintenance and the postponement of processing by maintenance activities. Empirical findings supporting these predictions are provided by a review of previous studies and a new experimental paradigm that permits to precisely quantify the structural and temporal constraints that limit working memory.

D. Lalanne

The Human-IST project: Human-Centered Interaction Science & Technology

Technology is changing the way people live, learn and interact. As new technologies become ever more critical to people's lives, it is important to consider humans at the center of technology design and to support them in their roles of learners, explorers, and workers. To this end, not only computer science expertise is necessary but also knowledge about human behaviour and cognition in order to fully capture people's needs and capabilities, as individuals and as groups, and adapt technology accordingly. The Human-IST institute will develop advanced user interfaces and design methodology, and will systematize cross-disciplinary approaches (close collaboration between computer scientists, psychologists, sociologists, and designers). This talk will briefly introduce Human-IST vision and approach, as well as related
research projects currently performed at the university of Fribourg.

E. Schmidlin

Behavioral and anatomical consequences of a lesion of primary motor cortex in non-human primate

A lesion of the primary motor cortex (M1) results most of the time in intractable motor deficits depending on the extent and the location of the lesion. Two therapeutic approaches are candidates to enhance functional recovery: regeneration of cortical tissue damaged by the lesion (treatment using the Anti-Nogo-A antibody to block the growth inhibition of axons induced by the myelin environment) and/or modulation of cortico cortical interactions between M1 and premotor secondary areas such as the premotor cortex.

The first aim of our study is to assess the behavioral changes occurring after a permanent lesion of M1 hand area in macaque monkeys by quantifying several parameters during a complex motor performance such as the "reach and grasp" drawer task: the different forces needed to perform the task, the timing of the movement sequences and the electromyographic activity of the main involved muscles. In the context of brain injury affecting the motor cortex, this task allows the distinction between distal movements of the forelimb (grip force) to grasp the knob of the drawer and more proximal movements (load forces) to pull the drawer and provides useful quantitative results about possible functional recovery.

Preliminary results show, as expected, a correlation between the increase of force required when the resistance to pulling is increased and the EMG activity of the hand muscles.

A second aspect of this study is to assess the anatomical changes following permanent lesion of the primary motor cortex before and at regular time points after the infusion of ibotenic acid. MRI analysis showed pronounced differences in the temporal evolution of the hypersignal observed at the lesion site between a group of animals treated with a control antibody and one animal treated with the Anti-Nogo-A antibody.

R. Caldara

iBMLab: past, present and future

The human visual system is equipped with the most sophisticated machinery to effectively adapt to the visual world. *Where*, *when* and *how* human eyes are moved to gather information to adapt to the visual environment has been a question that has fascinated scientists for more than a century. The use of the eye tracking technology is

rapidly proliferating into all aspects of visual and cognitive sciences to address this question. The relatively recent advent of non-invasive functional neuroimaging technique, *where*, *when* and *how* the human brain achieve (visual) information processing has become also a topical field in science. A long-term challenge of my laboratory is to bridge the gap between these fields, to investigate the dynamics of visual information processing, by tracking simultaneously eye movements and neural responses, and to develop novel computational data analyses. Our mainstream work aims at isolating culture-invariants and -specific mechanisms of the normal and impaired visual system.
Here, I will briefly present our previous work, our current projects and challenges, as well as the main lines of our research agenda.

P. Gygax & P. Wagner

Example of research from the psycholinguistic and social psychology team
"When cognitive psychology meets social psychology at a sport psychology party"
When cognitive psychologists, or any cognition scientist, lay their eyes on processes a the very heart of human processing, they often fail to consider their participants as part of a social construct. In fact, it is not unusual, in cognitive science, to consider some of the variance in the examination of cognitive processes as "noise" (hopefully drowned in increased sample size) without truly trying to understand possible meanings of it. In our team, we try to take a somewhat different perspective, by examining cognitive processes, at times even seemingly automatic, and the way they may be modulated by social factors. If the processes under investigation in our lab often entail a language component (the psycholinguist part), for example when we try to understand the factors involved when people process journal titles, we also very much interested in applied cognition, especially when it may be heavily modulated by social factors (the social psychology part), for example when we examine the speed by which a football referee makes a decision on a foul.

S. Dieguez

Julie Zumbuehl, Lucas Spierer & Jean-Marie Annoni, *Laboratory for Cognitive and Neurological Sciences, Neurology Unit, Department of Medicine, University of Fribourg, Fribourg, Switzerland*

Putting randomness under control

Feeling (or not) in control has been shown to influence a wide range of behavioral and cognitive processes, including the perception of chance outcomes and random patterns. However, to date, no study has examined the influence of control on the voluntary production of randomness, a notoriously difficult task for humans. In 3 experiments, we show that manipulating the feeling of control influences random number generation (RNG) in a task of mentally producing sequential dice throws (i.e. uttering random digits from 1-6 at a paced time). Study 1 found that merely providing agency (imagining throwing a die vs imagining someone else throwing a die) effectively suppressed the pervasive tendency to count in ones, a widespread measure of RNG performance. Study 2 manipulated the sense of control within participants by having right-handers perform the task with their dominant or less dominant hand. Counting suppression was found for both hands, but mental throws with the left hand additionally suppressed backwards counts in ones, suggesting an embodied spatial contribution to RNG. Study 3 tested whether the sense of control more generally, rather than motor control, also influences RNG. Participants were previously deprived of their sense of control by performing an impossible task, while a control group performed a neutral task. It was found that lacking control subsequently yielded a compensatory

suppression of counting. Collectively, our findings show that feeling in control or needing to restore the sense of control, somewhat paradoxically, improve the production of randomness. "Ongoing and future projects focus on investigating the neural underpinnings of the generation of random sequences. We notably use single-trial EEG classification methods to determine whether some properties of the randomly generated numbers can be predicted from the electrophysiological activity preceding their production."

A. Guggisberg

Adrian Guggisberg, Clinical Neurosciences, Geneva University Hospital, Geneve
Network mechanisms of behaviour and disease
The brain is a network of massively interconnected processing elements. Recent advances in functional imaging provide first insights into neural communication among network nodes. Spontaneous fluctuations of brain activity at rest are highly organized and coherent within specific neuro-anatomical systems. Network function can therefore also be assessed from resting-state recordings, which is of particular advantage in patients with brain disease who are often unable to perform tasks. The magnitude of coherence within a network at rest is highly correlated with performance in tasks dependent on this network, thus demonstrating its behavioral relevance. Brain pathologies such as tumors, stroke, and Alzheimer's disease induce a disruption of network coherence, but also adaptive increases in network coherence related to repair and preserved task performance. Network imaging thus opens an exciting and accessible window to the intrinsic brain organization with numerous applications in clinical practice as well as for the understanding of brain physiology.

Posters

A. Bhattacharrya, Julia Veit, Robert Kretz, Gregor Rainer

Effects of basal forebrain activation on orientation tuning in tree shrew primary visual cortex

The basal forebrain cholinergic system originates from nucleus basalis and sends cholinergic projections throughout the neocortex, it has implications in several cognitive functions and in a number of neuropsychiatric disorders. To ascertain better the role of basal forebrain circuit on sensory processing, we investigated the influence of basal forebrain activation on neural responses in different layers of primary visual cortex(V1). The location of recording sites was verified by making electrolytic lesions and reconstructing their location using cytochrome oxidase immunohistochemistry. The recordings were done using a triplet of tetrodes. We recorded neural activity from 82 neurons in 6 anesthetized tree shrews during visual stimulation using drifting sinusoidal grating stimuli with 8 different orientations and various contrast levels. Each neuron was studied under pre-stimulation and stimulation phase. Stimulation of the nucleus basalis lead to an enhancement in the firing rate in the spontaneous activity (population average: Baseline: 9.7Hz; Stimulation: 29.7Hz, paired t-test: $p << 0.01$). The firing rate was also elevated during visual stimulation (population average: Baseline: 33.6Hz; Stimulation: 80.6Hz, paired t-test: $p << 0.01$). We fitted a wrapped Gaussian function to the mean neuronal responses for each orientation to determine the tuning width (TW) and tuning height (difference between response to preferred and antipreferred orientation). The tuning height (TH) was increased following stimulation (population average: Baseline: 27.8 Hz; Stimulation: 38.02 Hz, paired t-test: $p << 0.01$), but the tuning width too was increased (population average: Baseline: 52.5° ; Stimulation: 57.1° Hz, paired t-test: $p << 0.01$). Although few neurons showed an increase in orientation selectivity after stimulation, across the population the orientation selectivity, as assessed by an orientation tuning index (OTI) was significantly decreased (population average: baseline OTI: 0.16, stimulation OTI: 0.11, ttest $p << 0.01$). The OTI values were negatively correlated to the tuning width (r: -0.91). We compared these results to our previous findings of nicotinic and muscarinic effects on orientation selectivity, where we found reduced OTI values and increased TW for local applications of nicotine, whereas muscarinic activation had the opposite tendency. These findings show that the effects of basal forebrain stimulation more resemble nicotinic than muscarinic effects on orientation tuning pointing towards a dominance of nicotinic actions of endogenous acetylcholine. Our results help in a better understanding of the relationship of nucleus basalis activation on sensory processing.

S. Badoud

Individual Detection of Patients with Parkinson Disease using Support Vector Machine Analysis of Diffusion Tensor Imaging

Data: Initial Results

BACKGROUND AND PURPOSE: Brain MR imaging is routinely performed in the work-up of suspected PD, yet its role is essentially limited to the exclusion of other pathologies. We performed a pattern recognition analysis based on DTI data to detect subjects with PD at the individual level.

MATERIALS AND METHODS: We included 40 consecutive patients with Parkinsonism suggestive of PD who had DTI at 3T, brain 123I ioflupane SPECT (DaTSCAN), and extensive neurologic testing including follow-up (17 PD: age range, 67.8 _ 6.7 years; 9 women; 23 Other: consisting of atypical forms of Parkinsonism; age range, 67.2 _ 9.7 years; 7 women). Data analysis included group-level TBSS and individual-level SVM classification.
RESULTS: At the group level, patients with PD versus Other had spatially consistent increase in FA and decrease in RD and MD in a bilateral network, predominantly in the right frontal white matter. At the individual level, SVM correctly classified patients with PD at the individual level with accuracies up to 97%.
CONCLUSIONS: Support vector machine–based pattern recognition of DTI data provides highly accurate detection of patients with PD among those with suspected PD at an individual level, which is potentially clinically applicable. Because most suspected subjects with PD undergo brain MR imaging, already existing MR imaging data may be reused; this practice is very cost-efficient.

J. Winkes, C. M. Müller & S. Neugebauer°

Do students with specific types of reading/spelling disorders differ in their reported adjustment problems?

Converging evidence supports the correlation between problem behaviors and reading difficulties (Al Otaiba & Fuchs, 2002). Prior studies of reading and adjustment difficulties have explored a variety of behavior topographies; yet, in the area of language and literacy the majority of studies have only explored composite or word-level reading outcomes (Hagan-Burke et al., 2011). Less clear is the potential relationship between adjustment problems and reading and writing difficulties in combination and separately; the latter domain being increasingly important for academic success as students matriculate (Snow & Biancarosa, 2003). In order to provide descriptive information about the relationship among adjustment and specific literacy-related skills, the present study explores the presence of adjustment problems for students with reading/spelling disorder (RSD), isolated reading disorder (IRD) and isolated spelling disorder (ISD). Such evidence is necessary for developing interventions that can moderate the negative effects of problem behaviors on reading/spelling-related outcomes and vice versa.

The total sample included 855 6th-grade students (421 girls) from Swiss schools. Criteria for RSD, IRD or ISD was determined based on student performance on German standardized reading (SLRT II; LGVT 6-12) and spelling (HSP) tests. Selected students included 18 RSD, 19 ISD and 20 controls. Reading and/or spelling deficit designation was based on a performance of <1.5 SD from the mean of the total sample. Students who met criteria for the isolated disorders (ISD or IRD) demonstrated a clear discrepancy between reading and spelling, which was tested using a regression based procedure. A random sample of typically developing students (e.g., reading and spelling abilities above -1.5 SD) was selected from the total sample. All participating students had an IQ of over 70. In order to assess self-reported adjustment, a standardized German version of the RAASI was conducted.

The characteristics of the subgroups are presented in table 1. Results from a MANOVA across groups on the five adjustment subscales showed no significant group effect (Wilks Lambda=.76, $F(12,167)=1.49$, $p=.13$). ANOVAs of each of the five dependent variables showed anger control and adjustment total score to be significant (see table 2). This finding

remained even after controlling for sex and socioeconomic status. Post-hoc analyses revealed that students with RSD had higher problem scores than those with IRD with respect to anger control ($p<.05$, $d=.86$), positive self ($p<.05$, $d=1.00$) and total adjustment score ($p<.05$, $d=.99$). Subjects with RSD reported more adjustment problems in total than CG students ($p<.05$, $d=.84$).

Our results did not support a strictly linear relationship between the amount of academic problems and adjustment difficulties. RSD students did report more adjustment difficulties than those with IRD and the CG. However, RSD students did not differ from students with ISD nor did students with isolated disorders report more adjustment difficulties than the CG. Subsequent research should explore these distinct domains with a larger sample and a diversity of behavioral outcomes. Particularly promising may be an exploration of the potentially differing associations among reading and spelling difficulties and specific underlying mechanisms leading to low adjustment (e.g. social stigmatizing processes).

A.-L. Oftinger, & V. Camos

Developmental improvement of articulatory rehearsal and attentional refreshing between 6 and 9 years

In adults, two mechanisms have been highlighted to maintain verbal information in working memory: articulatory rehearsal and attentional refreshing. The first, described in Baddeley's model is already in use at 7 years of age (Tam, Jarrold, Baddeley, & Sabatos-DeVito, 2010). At that age children also use attentional refreshing mechanism described in time-based resource-sharing (TBRS) model (Barrouillet, & Camos, 2010).The present study evaluated the interplay between these two mechanisms and its changes from 6 to 9. In a Brown-Peterson task, children had to maintain digit, while they performed a concurrent task. Consecutively, in a delayed span task they had to maintain digit and wait the same time as that required for the concurrent task. The opportunity for attentional refreshing was manipulated by varying the different tasks and the attentional demand of the concurrent task. This task was performed either silently or aloud, the latter involving an additional articulatory suppression. As expected, recall performance increased with age. The articulatory suppression had a detrimental effect only on recall of children over 7 years. Moreover, increasing the attention demand of the concurrent task reduced recall, and this effect interact with age, and with articulatory suppression, and this regardless of age. To conclude, the articulatory rehearsal appeared at around 7 and the attentional refreshing is already in use at 6. As previous results, the efficiency of both improves from 6 or 7 to 9.

F. Ribordy, B. Lavenex & Lavenex P.

The development of single-trial allocentric spatial memory in 3.5- to 7-year-old children

Spatial memory is a fundamental component of episodic or autobiographical memory, and single-trial learning is fundamental for forming episodic memories. Here, we studied the developmental progression of single-trial, short-term allocentric spatial memory in children from 3.5 to 7 years of age.
Children were tested on a trial-unique, allocentric spatial memory task. Rewards were hidden beneath cups distributed in an arena. Children participated in 3 sessions with 1, 2 or 3

rewarded locations, respectively. Each session consisted of 10 trial-unique locations or arrays of rewarded locations. Children learned the rewarded locations on a first encoding phase in which the rewarded location(s) were indicated by (a) red cup(s). In a subsequent recall phase (after a 1- minute interval), children were asked to re-visit the rewarded location(s) now covered by white cups, and thus visually indistinguishable from the other cups in the arena.
Across all children, performance (number of errorless trials, number of correct choices before error) decreased with increasing numbers of rewarded locations. Furthermore, older children (63-86 months) exhibited better performance on all measures than younger children (43-63 months). Interestingly, no younger children were capable of remembering three locations simultaneously, whereas older children could be divided into high and low performers.
These findings indicate that children 3.5 years of age are capable of single-trial spatial learning, the age at which the first episodic memories emerge.
Furthermore, single-trial spatial learning improved from 3.5 to 7 years of age.
Starting at 5.3 years of age, some children were able to perform as well as adults.
The ability to distinguish individual episodes (as measured in single-trial learning experiments) might underlie the progressive development of human episodic memory.

Keywords: short-term memory, children, single-trial learning, allocentric, episodic memory

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B. Perriard & V. Camos

Language switching in a complex span task in bilinguals

The two functions of working memory being processing and storage, some models propose they both require a limited resource, attention (e.g. Cowan, 2005). The Time-Based Resource- Sharing model (Barrouillet & Camos, 2010) suggests information is maintained by a fast switching of attention between processing and storage, allowing attentional refreshment of memory traces. Thus, cognitive load is the amount of time attention is occupied by a task, thus impeding the maintenance of memory items.
In the present study, we investigated whether language switching among bilinguals increased cognitive load in a working memory task. Twenty-four early bilinguals and 24 monolinguals completed a complex span task consisting of memorizing digits while naming shapes. Participants had to name aloud digits and shapes either in the same language or in two different languages. Thus, bilinguals completed four conditions: the two tasks in their dominant language (L1), in their secondary language (L2), naming digits in L1 and the concurrent task in L2, and vice versa. If language switching increased cognitive load, recall performance when the two tasks were in the same language should be better than when each task was performed in a different language. Results support this hypothesis, confirming an increased cognitive load from language switching.

J. Lao, L. Vizioli, H. Rodger & R. Caldara

Neural Adaptation Reveals Early Cultural Tunings in Perceptual Sensitivity to Local/Global Shapes

The way humans sample information while interacting with the visual world has been consistently reported being tuned by culture. Westerners display an *analytical/local*

processing style, attending to focal objects and their features. By contrast, Easterners show interest in context and relationships between objects, which is indicative of *holistic/global* processing. Although much behavioural evidence supports the existence of these cultural processing styles, the dynamics and the neural mechanisms underlying such perceptual biases are still poorly understood. Navon figures consists of hierarchically organised visual stimuli displaying *global* and *local* elements, representing therefore an optimal probe to investigate the existence of neural sensitivity to global/local perceptual tunings.
Here we used a neural adaptation single-trial EEG paradigm while recording eye movements of Western and Eastern observers performing a visual categorization task on geometric Navon shapes. In each trial, observers sequentially viewed a Navon shape (adapter) followed by a target shape, which could be either *identical,* completely *different* or contain *local* or *global* changes. We quantified the differences of repetition suppression with a data-driven approach and found a significant interaction at around 90ms in a right occipito-temporal electrode cluster. Western observers consistently showed decreasing adaptation over the P1 (*identical* > *global changes* > *local changes* > *different*), whereas Easterners didn't adapt to *local changes*. This effect was not modulated by the microsaccade spikes following the adaptor or target onsets. Our data are consistent with the perceptual biases contrasting Western and Eastern observers, providing an early neural signature for cultural perceptual tunings in cultural independent objects.

J. Savidan, T. Wannier, M-L. Beaud, J. Bloch & E.M. Rouiller

Reorganization of sensory afferents in the nucleus cuneatus following spinal cord hemisection in monkeys

Cortical areas, subcortical nuclei and pathways of the motor and sensory systems exhibit various changes following spinal cord hemisection, depending on the position and the size of the lesion. The dorsal column somatosensory ascending pathway, transmitting inputs from cutaneous mechanoreceptors and proprioception, terminates and makes synapses in the nucleus cuneatus in the brainstem. In this study, we assessed the possible structural changes and reorganizations occurring in the nucleus cuneatus following cervical cord hemisection in adult non-human primates and in relation to different treatments. Anti-Nogo-A antibody treatment has been shown to improve recovery of motor function following spinal hemisection in both rats and monkeys. In parallel it has been shown that brain-derived neurotrophic factor (BDNF) may improve functional recovery after spinal cord injury in the same manner. Two groups of adult macaque monkey subjected to cervical hemisection (C7/C8) were compared, one treated with both the anti-Nogo-A antibody and BDNF and one treated with a control antibody. For reference, a third group of intact monkeys was included in the study. In all monkeys, the anatomical tracer Cholera Toxin B subunit was injected subcutaneously in the toes (hindlimb) and fingers (hand) bilaterally for trans-ganglionic transport in order to label the axon terminals of the primary sensory neurons in the nucleus cuneatus. The position, extent and density of labeling of axonal terminal fields in the nucleus cuneatus were analyzed using image analysis software. We test the hypothesis that labeling is decreasing in the ipsilesional nucleus cuneatus of the control monkeys subjected to the cervical hemisection, as compared to intact monkeys, whereas the treatment is expected to attenuate the effect of the lesion. The anatomical data in the cuneate nucleus are confronted with the behavioral data reflecting the functional recovery from the cervical cord lesion.

Aurelie L. Manuel[1,*], Leila Chouiter[2], Françoise Colombo[3], Titus Bihl[3], Stephanie Clarke[1], Jean-Marie Annoni[2] and Lucas Spierer[1,2]
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Impairments in the imitation of meaningless gestures after right cortico-subcortical lesions revealed by a large scale voxel-based lesion symptom mapping study.

Imitation of meaningless gesture (MGI) is a widely used task to assess apraxia following brain lesion. MGI requires a visuo-spatial analysis of the model's body configuration, its transformation into body-centered coordinates and the production of the gesture. Putatively due to differences in the specific body part implicated in the imitation and in patients' selection criterion across studies, MGI deficits have been inconsistently associated with right and left hemispheric damage and to anterior or posterior lesion sites. Here, we conducted a large-scale voxel-based lesion-symptom mapping statistical analysis on a group of 68 unselected unilateral right and left stroke patients and their respective scores in MGI collected during the subacute stage. Our results reveal that MGI is associated with a right hemispheric parieto-basal network and the white matter tracts connecting these two regions. This pattern provides strong evidence for a right hemispheric dominance in MGI and underlines the critical involvement of cortico-subcortical tracts in the transformation of the visual analysis of new body configurations into motor action required for accurate MGI.

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An online cognitive intervention for relatives of individuals with mental illness: first results

Introduction: Mental illness imposes a considerable burden on the patient's families. However, less than 10% of them benefit from specific psychoeducational groups. We have developed an online *self-help* skills training and psychoeducational program that promotes caregivers' empowerment through interactive information and skills practice. Our main questions concern its usability and first outcomes.
Methods: 17 caregivers had an access to the program for 16 weeks. They have completed baseline and post-intervention questionnaires (measuring e.g. psychological distress, emotion regulation, mindfulness, coping strategies) as well as online satisfaction's questionnaires. Program use (time spent, progress, etc.) was automatically recorded.
Results: *(a) Usability data*. During the 16-weeks, they have spent between 12' to 19:21' on the program (m=4:11'). They have completed 44.9% (32.3) [2-100%] of it. Subjects who have spent more time online are those who reported a lower access to emotion regulations' strategies at baseline (r=.68) and who were more satisfied with the introductory module (r=.60). *(b) Outcomes.* First analyses show significant medium beneficial effects on emotional clarity, mindfulness skills (observe, describe, non-judgmentally) and functional coping strategies.

Conclusions: These first results are encouraging but raise many questions that will be discussed: how can we achieve a higher proportion of program completers? Is a mostly "cognitive" intervention sufficient to motivate subjects to keep using the program after the first weeks?

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Reading strategies across languages in bilinguals revealed by eye-movement patterns

Reading strategies, as indexed by variations in eye-movement patterns during reading, should be different across languages. Different reading strategies are most notably evident when reading transparent vs. opaque languages, respectively involving direct vs. complexes grapheme/phoneme conversions. The literature so far, however, investigated this question using between-subject factors design which where potentially confounded by differences across groups unrelated to reading per se. In the current project, we will examine reading strategies across language in the same bilingual individuals. Participants will be high-proficient French/German bilinguals with an age of language acquisition before seven years for the second language. We will focus on how bilingual readers are able to use preferentially lexical/addressing reading in an opaque language context (in French) and transcoding/assembling reading in a transparent language context (in German). We plan to record eye movement in early bilinguals reading aloud isolated words and pseudowords in French or German. The stimuli were matched between languages in terms of neighbourhood size, summated bigram frequency and word frequency. We will measure the Landing Position of the first fixation location (FFL). Because of the language typology, we expect that the FFL might be done nearer to the stimulus center when the task is performed in an opaque than in a transparent context. This procedure was evaluated in a preliminary pilot study.

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The Influence of Existing Semantic Representations on Age-Related Deficiencies in Attentional Refreshing in Working Memory

The assumption that working memory is embedded within long-term memory suggests that the effectiveness of switching information between activated states in working memory (i.e., attentional refreshing) depends on whether that information is semantically relevant. Given that older adults often have greater semantic knowledge than younger adults, age-related deficits in working memory and episodic memory could be ameliorated by studying information that has existing semantic representations compared to unknown information. In the current study, younger and older adults completed a modified operation span task that varied the number of refreshing opportunities. We also included memoranda equally known to younger and older adults (neutral words; e.g., father), better known to older adults than younger adults (dated words; e.g., mirth), or unknown to both groups (unknown words; e.g.,

opie). Results indicated that attentional refreshing opportunities strongly predicted retrieval from episodic memory for both age groups, but these relationships were altered when information lacked semantic representations. Thus, the effectiveness of attentional refreshing in working memory is constrained by the influences of age and existing long-term semantic representations. This also implies that working memory is embedded within the larger context of long-term memory.

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High-density scalp somatosensory evoked potentials in macaque monkeys as follow-up of functional recovery from motor cortex lesion

The goal of this study was to develop a simple and minimally invasive method to record somatosensory evoked potentials (SSEPs) from the whole scalp surface in anaesthetised adult macaque monkeys, with the prospect of allowing repeated assessment of the cortical activity in the context of a central nervous system lesion. It is expected that SSEPs will allow to assess post-lesion cortical reorganisation of neuronal networks and relate it to functional recovery, following a motor cortex lesion.

Experiments were conducted on three adult macaque monkeys (Macaca fascicularis), using a customised EEG cap containing 33 electrodes regularly distributed over the scalp while the animal was anaesthetised (2.5% sevoflurane). Electrical stimulations were delivered separately either to the median nerve or to the tibial nerve, successively on each side.

When the animals reach a behavioural plateau, they are subjected to a cortical lesion, requiring a craniotomy. Consequently, to evaluate the effect of the craniotomy itself on SSEPs, a “sham lesion” consisting in the craniotomy alone was first performed, with the bone flap put back in place. There was no SSEPs change related to the “sham lesion”. The next step is to perform a permanent unilateral lesion of the hand representation of the motor cortex.
A k-means cluster analysis of the voltage maps was applied to the SSEPs data (data-driven approach revealing a series of scalp topographies reflecting the steps in information processing). The LAURA (local autoregressive average) inverse solution algorithm with LSMAC (Locally Spherical Model with Anatomical Constraints) head model was used for source estimation of the scalp voltages.
The pre-lesional voltage topography of the SSEPs obtained after either median or tibial nerve stimulations is in line with the somatotopic organisation of the sensorimotor cortex. Post-craniotomy data are presented, as well as source localisation results.

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