

## Editorial

Dear Readers,

With this second edition of *The Brainstorm*, we hope to build upon the success of the first newsletter released in December 2007. The present *Brainstorm* is about 'old' and 'new' students, 'old' and 'new' members of the NCP teaching network, some scientific news, while also containing some humorous contributions. Of course, the 'top news' concerns the NCP program itself, which in June 2008 was selected as one of Germany's "Top-Ten International Master Program" (this page). The Editors believe that this award reflects the fact that this novel and interdisciplinary program in Neuro-cognitive Psychology has been established and developed well over 4 years of work at Ludwig Maximilian University and within the Elite Network of Bavaria, and that it enjoys a growing reputation both nationally and internationally.

We say thanks to all those, teaching staff and students alike, who have made the success of NCP possible. To all we say best wishes for the Holidays and a Happy New Year.

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**Thomas Geyer**

**Devika Narain**

**Martin Hebart**

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**Erin Annesley**

# The Brainstorm

ISSUE 2, WINTER 2008

DEC 15TH 2008

## NCP among Germany's Top Ten Programs

In June 2008, NCP received an award, by the German Academic Exchange Service (DAAD), for being among the top ten international graduate programs in Germany. The award was made in an exclusive ceremony in Bad Honnef (near Bonn), Germany. The top ten programs were



selected out of some 80 programs from 63 universities across Germany. The competition and the award was organized and sponsored by the German Donor's Association for the Promotion of Sciences and Humanities (Stifterverband für die Deutsche Wissenschaft) in cooperation with the DAAD. The selected top-ten programs span a wide range of topics, from

forest sciences to media engineering. NCP was the sole successful program from the field of psychology and the only program from Munich.

A small delegation consisting of the program organizers and two students from each of the top ten programs was invited to the two day workshop and ceremony. The main theme of the workshop concerned the increasingly global appeal of German university education at the Master level and beyond. It provided a great opportunity for some of the most successful international programs in Germany to exchange ideas about their course goals, their specific teaching approaches, and recruitment and supervision strategies. Each top-ten program was awarded a prize of 20,000 Euros, intended for further improvement of the course. One student from

each program was invited to provide their experiences and insights in a short address, which was followed by the handing over of the award to the program directors and the student representatives from the director of DAAD, Prof. Stefan Hormuth. On behalf of NCP students, Adam Christensen delivered a short speech, tactfully surmising both the rigors and the joys of the program. Many of the invited students presented their experiences to the audience and a full barrage of press photographers. The prize ceremony was followed by a breathtaking concert, and in the evening by the live telecast of the Germany-Croatia soccer match.



## NCP welcomes new cohort

In fall 2008, a new cohort of NCP students from a variety of academic backgrounds has commenced their studies. The new cohort consists of 9 (out of total of 20) students from abroad, with countries of origin ranging from the USA over Finland to China. Almost all the students found out about the NCP program on the internet. 75% of the students have a background in psychology and the other 25% in different disciplines (ranging from Medicine through Anthropology to Computer Science).

Almost all new students embarking on the course have plans to go into research and do a PhD. While on the course well over half of the students would like to have a chance to undertake one of their compulsory research projects in a partner lab abroad.

We wish all new students enjoyment and success with their course!

## Content

- ★ Interviews: Kathrin Finke, Bruce Bridgeman, Andre Szameitat, Steffen Gais
- ★ NCP Reflections: Werner Schneider
- ★ Evaluation: Results for the Summer Semester
- ★ NCP Students Abroad
- ★ Research: Structure of the Brain
- ★ NCP Students Poster Presentation

# From the north to the south

## Prof. Kathrin Finke



I grew up in the north of Germany in the small town of Kalletal near Hannover which also happens to be where our former Chancellor came from. After school I studied psychology at the University of Bielefeld. During this time I did an internship at the University Clinic of Aachen at the neuropsychology department. I soon realized that I was deeply fascinated by this line of research and this is what eventually brought me to Munich. Also, Munich is the ideal place for someone like me who enjoys escaping to the mountains over the weekends or to travel out of town every so often. For leisure, I try my best to do things like jogging or inline-skating. Sometimes I only find time for this on the weekends when I try to bike away from town. Also, on occasions I like to play the card game 'Doppelkopf'.

## The Researcher

While in Bielefeld, I got involved in experimental cognitive research as a student research assistant ("HiWi"). I also worked in an EEG sleep laboratory. In my Diploma Thesis, I used transcranial Doppler sonography to study blood flow velocity changes during the perception and recognition of music. I was really fascinated by clinical neuropsychology, one of the earliest methodological approaches to study neuro-cognition. Eventu-

ally, I gravitated towards using experimental paradigms in clinical neuropsychology, which promised to be more informative about neuro-cognitive deficits than many 'standard' tests. Even though I and my collaborators are now more involved with cognitive experimental research, it is extremely gratifying that this work has the potential to benefit applied clinical sciences as well. I do believe

*"...it is extremely gratifying that this work has the potential to benefit applied clinical sciences...."*

that the development of innovative diagnostic procedures provides an essential first step for the development and evaluation of effective therapies.

As a PhD student under the supervision of Prof. Zihl, I found an interesting match between neuropsychology here at LMU and the neuropsychiatry division at the Max Planck Institute. My thesis largely involved working memory impairments with respect to object vs. spatial representations. I was investigating, pursuing a lesion-related approach, how these two types of working memory are anatomically and functionally organized in either hemisphere.

## The Lecturer

My first encounter with the NCP program was as a lecturer of "Neuropsychological Assessment". I was very impressed by

the NCP curriculum. Hermann Müller and Werner Schneider had conceived a brilliant new interdisciplinary program with a unique focus on "Neuro-cognitive Psychology". It was important that there were many scientists from outside Munich and Germany who were enthusiastic about contributing to the program, which helped the course to become recognized in the scientific community. The program was designed for students who were highly motivated about research. Luckily, we were and are able to recruit students who look for a research-oriented study program.

## New cohort 2008

In the new, 2008 cohort we have 20 students, almost half of them coming from abroad. My first impression is that the group is highly homogeneous both in their past academic achievements and their expectations of the course. We are particularly impressed by the high motivation displayed by all the students.

## Advice about PhD

I do believe that the research projects prepare the way towards the Masters' Thesis, which ideally should be closely related to the research topic one would like to work on in further, PhD studies. The neurosciences in Munich offer a host of opportunities for advanced research within and beyond neuro-cognitive psychology.

# Evaluation Summer Semester

Every semester, students have and take the opportunity to provide feedback about the NCP courses they attended by filling in a course evaluation form. This contains 21 items concerning the quality of the lectures and their associated tutorials. Each item is rated on a five-point scale, with higher values reflecting greater satisfaction. The results for five selected items are displayed for the summer semester 2008 courses (the numbers express satisfaction scores in %). Overall course G (Basic Neurosciences 2) excelled at the items “knowledge acquired,”

“interest generated,” and “encouragement to think about material critically.” Course F (Basic Neuro-cognitive Psychology 2) obtained the highest ratings for “coherent lecture structure,” but also Courses H (Classical Psychological Methods 2) and I (Neuro-cognitive Methods 2) received positive feedback. With regard to overall lecture quality, Courses F and I received the top ratings. Thus, congratulations to Prof. Deubel, Prof. Schubert, Dr. Szameitat, and Prof. Finke for their excellent teaching!

Courses	F	G	H	I
Overall quality of lecture	84	88	74	82
Knowledge acquired	84	93	62	92
Interest generated	87	83	68	86
Coherent lecture structure	86	94	63	80
Overall	87	76	69	82

## In the News

### New Professorship

A new professorship in “Experimental Neurocognition for Technical Systems“, in the first instance funded by the Excellence Cluster CoTeSys, will be established at the Department Psychology (LMU Munich). The professorship is intended to provide links from experimental psychology to the engineering sciences to build intelligent (‘cognitive’) technical systems such as cognitive robots. A number of excellent candidates have applied for this innovative position; the appointment is expected for early 2009.

### Second Munich Visual Search Symposium

The second installment of the international symposium on “Visual Search & Selective Attention” took place in Murten (Switzerland), in July 2008, jointly organized by J. Krummenacher & H. Müller. The symposium was thematically subdivided into four inter-related topics that ranged from bottom-up vs. top-down control of attention through the dynamics of attention across space and time, and the brain mechanisms of attention to computational modelling.

Invited talks (as well as poster presentations by their research groups) were given by some 30 leading experts from a variety of neuro-cognitive disciplines - ranging from experimental psychology through electro- and neurophysiology, and functional imaging to computational neurosciences. Selected presentations will be published in a Special Issue of “Vision Research” (Editors: J. Krummenacher, H. J. Müller, & H. Deubel).

### NCP Lecturer of Neuroimaging Starts at Siemens Medical

The former NCP lecturer Dr. Ignacio Vallines has accepted a job offer from Siemens Medical in Erlangen. Dr. Vallines was the lecturer of the NCP courses on functional neuroimaging and the organizer of the NCP research projects. “I very much enjoyed the time in Munich and I enjoyed interacting with the students”, so Dr. Vallines. “On the other hand, the job offer provides additional experience I did not want to miss.” He also mentioned that he did not say goodbye to research forever. Dr. Vallines still lives in Regensburg, but commutes back and forth between the two Bavarian cities. The editors of The Brainstorm wish him all the best with his new career!

### Alumni Initiative

The Elite Network Bavaria (including NCP) will initiate an Alumni Network around February 2009, strengthening the links within and across the various ENB study programs. Further information will be provided soon.

# Reflections - Prof. Werner Schneider

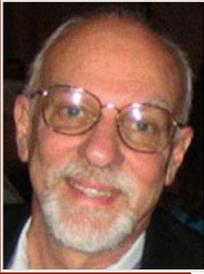
About six months ago I worked as a co-director of the NCP program being heavily involved in the everyday organization of the program. My new job as the head of the Neuro-cognitive Psychology unit at Bielefeld University implies a similar full time commitment. So sentimental feelings in terms of NCP do not have time to arise. Nevertheless, when I explain colleagues and students here in Bielefeld what NCP is, how it evolved and what its future may be then my natural response is an enthusiastic speech praising on the one hand all the exciting aspects of the program and stating

traditions of the multidisciplinary members of the teaching staff/students are not always the same – mediation was sometimes required. Moreover, special administrative pitfalls were – I guess are – arising from the fact that NCP is a new M. Sc. program at the LMU with worldwide recruiting – without Petra, Thomas, Heinz-Gerd, Kathrin und Hermann I would have been completely lost during the last three years. Many exciting aspects of NCP – from the perspective of a teacher – emerge from the international and multidisciplinary group of students – students that make teaching a lot of fun (at least most of the time) and that serve as very stimulating partners in conducting basic research – my special thanks go to Agnieszka, Michael, Christian, Timo, Markus, Johanna, Kathi, Charles and many others. I wish the NCP program and its members all my best and I am confident that the time to come will be a good one.



on the other hand the special challenges of implementing and keeping such a program going. A major challenge comes from the fact that the scientific values and

## Californian Academic Summer



**Prof. Bruce  
Bridgeman,  
University of  
California,  
Santa Cruz**

### **Tell us something about the old days in Munich...**

I guess although I first travelled to Munich twenty years ago, academically it really began when I was appointed to the council of the Max Planck Seewiesen. After that I visited German for brief periods over several years and became acquainted with Wolfgang Prinz. Later, he was invited to Bielefeld and then to Munich. I also worked with Heiner Deubel, who back then was at the Max Planck here in Munich. Sometime we were able to produce a couple of papers just during the summers. And now here I am again on an invitation by the Humbolt Stiftung, collaborating with Heiner.

### **How do you find the German academic environment? Is it much different from the United States?**

Well, this varies among universities

and in Germany depends heavily on the personality of the professors in charge. Also, I think the presence of Max Plancks affect the research at the universities a lot. In the American system, if you can call it a system, young professors get a blank check to do anything relatively early. In Germany, you have other commitments as a professor and perhaps things do move a little more slowly as a result. Back home research collaborations occurs in smaller groups compared to here in Germany.

### **You are the co-editor of the Journal of Consciousness and Cognition and also the author of the book 'Evolution of Consciousness'. Would you share with us your views on consciousness and its purpose?**

Well, consciousness started out as the whole content of psychology

until people decided that it was actually a private experience. In the last generation, we've developed neuroimaging methods that allow us to look at this problem objectively and to see what it is good for. There is the evolutionary argument that consciousness must have a function else it will get selected out of existence. The argument however says nothing about what the function is. But one could say the consciousness is necessary for one to be able to produce goals and behaviour not because of planned contingencies but in spite of them. It makes long term planning possible. In humans, language magnifies the power of consciousness. Humans enjoy the advantage of being able to externalize their thoughts in speech and then further to internalize them. The important part is the contents of the consciousness.

## Two Hands are Better than One



### **Andre Szameitat**

With the beginning of the summer semester 2008, Andre Szameitat took over a position in NCP providing links to fMRI in teaching and research. Andre studied psychology at the University of Braunschweig (Germany); between 2002 and 2003 he had a position at the Max Planck Institute for Psychological Research in Leipzig. Following his PhD, in 2004 he moved to the University of Surrey (Guildford; UK) from where he directly came to Munich. In his research Andre is concerned with variety of issues ranging from basic research questions (e.g., dual task performance) to applied issues (e.g., stroke therapy).

### **The Interview**

#### **Andre, what are your reflections about the NCP program?**

The NCP program is a fantastic opportunity for highly motivated students to specialize on the still growing field of neuroscience. As a lec-

turer I enjoy the enthusiasm of the students.

#### **Which courses do you teach in NCP?**

fMRI methods, research methods, and statistics.

#### **Could you please describe one aspect of your research in more detail?**

One line of research I am interested in is bimanual coordination, in particular of ecologically valid everyday actions. Such bimanual actions are characterised by a synergetic co-operation of both hands to achieve a single action goal, such as tying shoelaces.

Opposed to this, most previous research on bimanual coordination focused on the concurrent performance of two independent tasks, such as performing circular movements with different phases or frequencies. We suppose that these two types of bimanual tasks are supported by different neural mechanisms. In a recent fMRI study we found that coordination of synergetic bimanual tasks firstly requires processing of proprioceptive information to assess the position of the hands in space. This information is then made available to the premotor areas to enable fine-grained motor control of each hand in relation to the respective other hand. These findings are in line largely ignored theories about human movement control such as the idea of bimanual coordination as a kinematic chain or the functional dominance theory of handedness.



*"The NCP program is a fantastic opportunity for highly motivated students to specialize on the still growing field of neuroscience."*

# NCP Student Poster Presentation Winners

(Posters are based on the second research project of the second-year NCP students)

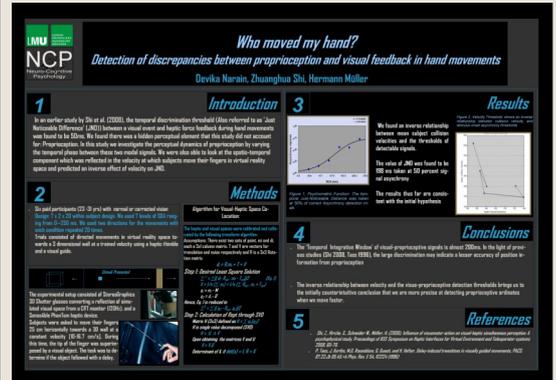
1<sup>st</sup>

## Who moved my hand? Discrepancies between proprioceptive and visual feedback in hand movements

**Devika Narain**

The study investigates a hidden perceptual element which surfaced when multimodal integration studies on visual-haptic inputs also included movements : Proprioception. We studied the temporal dynamics of the proprioceptive signals as they integrated with visual information that was presented in graded asynchronies. The point at which the

subjects were able to make an accurate assessment was taken as the time at which both signals were integrated and available for comparison. This window was found to be about 200 ms. The results also elucidated an initially counterintuitive understanding about the relationship between velocity and accurate proprioceptive judgements. It was found that the higher the speed of movement, the more accurate the prediction of the asynchrony.



**Nick Myers**

## Auditory Cueing of Precise Locations in the Visual Field

The integration of sound and vision is an essential aspect of coherent perception. We investigated whether sound cues with interaural time differences are sufficient to modulate the perception of upcoming visual targets. With a short cue-target onset asynchrony, subjects discriminated oriented visual stimuli more accurately at visual field locations indicated by the preceding sound cue. Interestingly, visual discrimination at nearby visual field locations remained unaffected by sounds. With long cue-target delays, visual discrimination performance decreased at the cued location but not at nearby locations. Our results suggest direct associations between auditory maps representing interaural time differences and corresponding sites in visual field maps.

2<sup>nd</sup>

## The blink in the saccade : Dual-task interference between short-term consolidation and reflexive saccade

We explored the role of central processes in the preparation of reflexive saccades in a dual task paradigm. The unspeeded Task 1 required the identification of a briefly peripherally presented target (T1) during central fixation. Task 2 consisted in a speeded eye movement execution to a saccade target that appeared 5° left or right from the center at varying SOAs. In a control condition subjects were instructed to ignore T1 and concentrate solely on saccade execution. Substantial dual-task interference was reflected in significantly longer saccade latencies at short compared to long SOAs. These results speak in favor of the proposition that shared central processes are involved in both tasks. If saccade preparation is subject to a central structural bottleneck, knowledge about brain mechanisms controlling eye movements can be used to gain an understanding of the nature of capacity limitations in our information processing system.

**Kathi Seidl**

3<sup>rd</sup>

**Charles Rathkopf**

## Oculomotor Behavior and Mental State Attribution: Insights into theory of mind

The cognitive mechanisms which allow for mental state attribution were investigated with an eye-tracking paradigm. In two experiments, Happé and Frith animations were shown with and without the instruction to predict object locations. Fixation durations as well as predictive saccade latencies increased in the presence of intentional action.

Competing explanatory models are discussed and an interpretation is offered according to which eye movement patterns during mental state attribution result from increases in cognitive load.

## Brain Science and the World

By Martin Hebart

As neurologist John Mazziotta from UCLA was flying from Los Angeles to the East Coast a couple of months ago, it happened that he got upgraded on United Airlines to a first class seat. Next to him sat a very attractive blond woman in her late twenties. Everyone getting on the plane said things like: "Great show!", "I love your show!", "You are a great actress!" This went on and on, including the stewardesses and flight attendants. Finally everybody was settled and the plane was taxiing on the runway. Although John Mazziotta had recently read a lot of gossip magazines for some fund raising activities, he did not recognize that woman, at least not in a T-shirt and jeans. So he said to her: "Obviously you are an actress, but I don't recognize you. So who are you?" The woman replied: "Oh, I'm Catherine Heigl." For those who don't know, Catherine Heigl plays a doctor on the TV show "Grey's Anatomy". Mazziotta cheerfully replied: "Really, well that is great!" Heigl studied him for a second, and then asked: "Have you seen the show?" Mazziotta couldn't lie. So he submissively noted: "You know, actually I haven't seen the show." And with a grin he added: "But I read the book!"

Of course Heigl had no idea what Mazziotta was talking about. That the famous medical handbook "Gray's Anatomy" had actually lent its name to the TV show. It is not so important. The brain is not a simple matter (in fact, it is grey and white matter). Indeed everything related to the brain is still a great mystery in the eyes of the public. And we are perceived as magicians that can read minds and control thoughts. The three most common responses when you introduce yourself as a psychologist or brain scientist are:

1. "Oh my god, we have spoken for two minutes and now you know everything about me!" (very popular at parties)
2. "Oh my god, you just want to understand your own problems!" (very popular at parties after a few drinks)
3. "Oh my god, that is so interesting! ... You know, I have *this friend* who has a problem..." (very popular at parties after a few drinks too many. Note the faint focus on "*this friend*").

After these comments people either leave without awaiting a response. Or, even worse, they indulge in their great knowledge of the brain. "I find it fascinating that you use only 10% of your brain". "I tune my synapses with fish oil". "I heard monkeys are just as smart as humans". This is the right time to get another drink. It is not easy to change the view of the brain sciences in the public. Perhaps, the difficulty lies in the fact that understanding the brain is not black and white, but this murky color of grey. So indeed, my Gray isn't the same as your Grey.

# Research of Second-Year NCP Students

## Dominique Goltz

investigated how trauma-specific stimuli influence the neuronal underlying of memory and inhibition in patients with post traumatic stress disorder (PTSD) using a think/no think paradigm. Subjects were trained in word pairs with an emotional load and when one word from the pair was displayed, they were asked to either recall the other word or to suppress it. It was found that patients with PTSD have more problems inhibiting negative emotion-arousing words.

## Patricia Graf

investigated the inhibitory dysfunction that is believed to play a crucial role in Border Personality Disorder psychopathology in a Stroop paradigm with emotionally arousing words that were negative or neutral. In this task, participants had to indicate as fast as possible if the ink color of the word corresponds to (congruent) or is different from (incongruent) the meaning of the nearby presented word indicating a color. The results indicate that BPD patients are better than previously expected in inhibiting negative words.

## Michael Hegenloh

investigated modulations of saliency on visually guided pointing movements based on the Dimension Weighting Account (DWA). The task was to locate a pop-out target by pointing to it as fast as possible. The findings were consistent with the predictions of DWA and same

dimensions in consecutive trials did elicit faster pointing motions. This was also the case for redundant targets in the same dimension.

## Kathrin Herbst

investigated problem solving capabilities in expert chess players using the tower of Hanoi/London tasks. It was found earlier that the measures of chess experience (DWZ scores, playing time) were unrelated to performance in the tower tasks. It is however plausible that there is a general improvement in performance merely due to chess-playing. The study reveals that chess players show advantages in the tower tasks compared to a control group.

## Marcin Leszynynski

examined the electrophysiological correlates of this global-local search asymmetry using Kaniza figures. The results indicate that the similarity between targets and nontargets is reflected in modulations of the N2pc amplitude. These results suggest that orienting attention towards a target is faster for a globally bound object than for a local element grouping.

## Alex Soutschek

examined if social facilitation effects improve task performance in joint action and whether this performance depends on passive/interactive relationships. Participants were asked to build a modular ball track in a joint activity. The findings from the experiments show that per-

formance is enhanced in the joint action condition.

## Marco Schmidt

investigated the comprehension of the seeing-knowing relationship in 18 month old children. Participants were trained in implicit and explicit hide-and-seek tasks with a control condition in which no training was administered. It was found that there were significant learning effects in the trained group when compared to the untrained group.

## Ilena Tsankova

investigated the impact of cardiovascular training on cognitive performance in the elderly in an fMRI study. The participants that underwent the comprehensive physical training program displayed a significant benefit in cognitive performance compared to the control group. The study was supervised by Prof. Benjamin Godde of Jacobs University, Bremen.

## Magdolna Tardy

investigated the seeing-knowing relation in 18 month old infants in an interaction and eye tracking study. Infants viewed an animated film with one of two people seeing a hiding procedure and the other person looked away. The interactive study required active participation in searching a hidden object in one of two boxes. The findings suggest that by 18 month, infants do not yet have a full understanding of the link between seeing and knowing.

## A Blink of the Brain

By Timo Stein

About 14,000 times a day you are blinded for 300 to 400 ms – you blink. Similarly, attention in time can lapse and makes you behave just as if you have made such an eye blink: You miss a brief event occurring at the time of the attentional lapse. Until recently, it has been believed that this "attentional blink" refers to a limitation of high order processes such as encoding a visual object in work-

ing memory, which is thought to happen somewhere in frontoparietal cortex. However, during my second NCP research project in collaboration with the fMRI facility at Regensburg me and my supervisors discovered that the neural signature of attentionally blinked events can be traced back even to very early visual processing at the stage of primary visual cortex (V1). We presented stimuli at different locations in the visual field which allowed separation

of signals in time across different retinotopically mapped locations in V1. These V1 clusters mirrored the identification accuracy during the attentional blink. These results are the first evidence for effects of behavioral performance on fMRI responses in V1 under conditions of the attentional blink and are now published (Stein, Vallines, & Schneider (in press). Primary visual cortex reflects behavioral performance in the attentional blink. *Neuroreport*).

## Neuro-cognitive Psychology Abroad

Science is not only about investigation, but also exchange. For that reason many NCP students of the second year chose to go to different laboratories and institutions, all around the world. The Brainstorm interviewed some of the students that went abroad and asked them how they liked their work.



**Maria, you conducted your Master Thesis at the University College London, in which department?**  
The Institute of Behavioural Neuroscience.

At the IBN the research is focused around the basic principles of learning and memory.

**How did you get the position?**

I got in touch with Robin Murphy, who agreed to take me on. [Editors' Note: Placements for Research Projects and Master Theses in an international NCP partner laboratory need to be agreed and arranged through the Munich-based (co-) supervisor.]

**Sounds too simple to be true.**

He wrote back to me and asked for a little

more information about myself and my studies. I sent him all relevant forms and a couple of days later we spoke on the phone about a possible project. Two months later I was in London.

**That is just fantastic. Are you happy that it worked out that way?**

Yes, I am really glad that I got this opportunity! It has been a very exciting time and I learned a lot. Thanks to the very supportive team at IBN!

**Tell us more about what you have learned.**

Robin is an expert in associative learning in humans. He taught me a lot about this field of research. In addition I got the chance to deepen my programming and data analysis skills.

**Was your Master project what you expected?**

Yes, it was just great! It was about the "depressive realism" phenomenon, which

states that dysphoric people were found to be more "realistic" in their judgement about the amount of control over their environment than non-dysphoric people. Our study observed participants in different mood states, experiencing a contingency learning paradigm in which they had to learn about two different contingencies - a positive and a zero contingency - in two different contexts.

**This sounds like a very sophisticated project. So how did you like it in London? Do you think you could stay there after NCP?**

London is a very exciting place to live, there are a lot of great opportunities to spend your spare time, such as theatres, museums and of course the famous pubs! Although it is quite expensive to live in this city, I enjoyed this experience a lot and I could imagine to stay here for a PhD.



**Sven, I heard you found an apartment right at Lac Léman, the beautiful lake of Lausanne. Was it your plan to go to a place that is not only scientifically attractive or a big coincidence?**

Let's say it was a bit of both. I very much like the French culture and its lifestyle. And I needed a fresh breath of air, doing something in cognitive neuroscience I had not encountered much before. The lab here at the Swiss Federal Institute of Technology was very

tempting - too tempting to resist. Not only the great location near the lake contributed to my choice, but also the interesting and unusual research topics, such as 'out-of-body' experiments, and the fMRI facilities with several high-field MRI scanners contributed to my choice.

**This brings us to your project. The title of your Master thesis is 'Self in time: FMRI activity related to mental time travel'. Tell us a bit more about it.**

It was basically about the human ability to remember the past and predict the future, generally referred to as 'mental time travel', short MTT. We used a novel behavioral paradigm in combination with fMRI to investigate two different cognitive processes: absolute-MTT, meaning the location of the self to

different points in time), and relative-MTT, the location of one's self with respect to the experienced event.

**That sounds very interesting. So you are looking at how you represent yourself (or your self) in relation to your personal past?**

And also your future! For example: My 20th birthday is past from the actual situation of myself now, but if I locate myself back to the year 2000 then this same event is the future. As a control condition we didn't use personal events in time, but historical events, such as September 11th. In addition to the events, I used faces of each subject and of George Clooney, changed with a software to make them appear younger or older. As you can see, it was a lot of fun!

**Timo, you chose to go to one of the most renowned universities in the world, Princeton University, and the lab of Sabine Kastner, very well known for her work on attention and the brain. What did you expect before you went to Princeton?**

For me the major reason to conduct my Master's thesis in Sabine's lab was the fact that her scientific work motivated me to study cognitive neuroscience in the first place and actually even to participate in the NCP program. I expected to gain insights into top neuroscience research of basic visual processes, using state-of-the-art fMRI methods, such as retinotopic mapping or "cognitive mapping", to name only a few.

**Seems that you came to the research place of your dreams! Were your expectations met?**

I felt very much involved in the fMRI research community, in a way difficult to find in conti-

mental Europe. The resources at Princeton University like scanner slots or MRI access were amazing! The techniques used in Sabine's lab were unique in the world and it was a great feeling to have access to them. But to be honest, during the first weeks and months, it was really tough. The work attitude is drastically different to what I experienced in Germany. Besides creativity and intelligence what matters is the sheer amount of work. But in general it was a very interesting experience for me to live in this "ivory tower" Princeton and to be a part-time member of a highly acknowledged institution such as Princeton University.

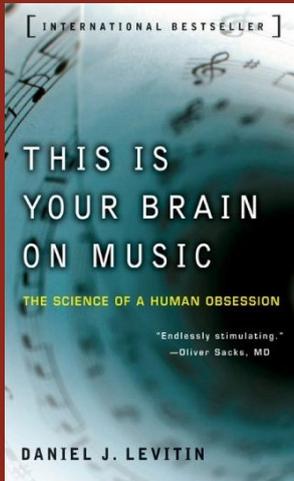
**Did your project have to do with these unique techniques you just mentioned?**

I conducted a project on numerical representations in posterior parietal cortex. Based on delayed saccade tasks, the Kastner lab has constructed objectively defined maps of different subparts of the large intraparietal

sulcus which is involved in numerical processing, besides a bunch of other functions. This allowed me to look into predefined regions of interest which enabled a more direct comparison to the monkey brain.

**Do you think NCP was helpful for your Master thesis? Could you apply knowledge you have gained during your coursework in Munich?**

Probably I would not have been able to work there if I had not gone through the intensive and thorough NCP training. Especially the previous knowledge from my fMRI research projects and the knowledge from reading various papers for the NCP debating clubs and methods courses were very helpful. What seems also quite important is that I was familiarized with lab environments and the research atmosphere in general by the NCP program. So yes, I think NCP was extremely helpful!



## This is your Brain on Music

The human obsession with music manifests itself in many ways. Everything from Beethoven to Harlem Rap can have the same ensnaring effect in different people. Perhaps sometimes we stop to think about how listening to an old song takes us back in time and space to memories long past. For those of us who do not pursue the research of music for a living and for those who care about the neural underpinnings of music, there exists an interesting book that captures music through the realms of neuroscience. *This is your Brain on Music*, a New York times bestseller by Daniel Levitin, describes in remarkable simplicity the intricate complexity of the neural mechanisms that encode and account for music.

The author uses formal neuroimaging evidence to relate in great detail how music may help co

-ordinate signals from disparate parts of the brain, synchrony between affect producing systems, and how music sounds are broken down into the bottomless chasms of our memory.

The book also begins with a subtle introduction to some music theory, so being a theoretical musician is not a pre-requisite to the book. Being a psychologist isn't necessary either, but it does add that extra selfish motivation of puzzling out the cognitive mysteries surrounding music. Perhaps the solution is merely an illusion. Who is John Galt?

For more information and fMRI videos on the brain responding to music visit:  
<http://yourbrainonmusic.com/>

## Is there a smart way to study?

The new collaborator Steffen Gais, entering the units of General/Neuro-cognitive Psychology via a 5-years research grant of the German Research Council ("Emmy Noether Program"), examines whether long-term learning can improve through sleep.

### Steffen - does sleep enhance memory?

During sleep, the brain enters into an entirely different state of functioning. Patterns of neurotransmitter release are changed and the brain shows altered electrophysiological activity. These changes probably serve a number of functions, one of which relates to long-term memory. Our memory has two opposing requirements to fulfil: On the one hand, it has to acquire new information quickly. It must therefore be extremely plastic. On the other hand, learned information should be kept safe for a long time without being disturbed by new, interfering information. Therefore, new information must be integrated only slowly into existing semantic memory. In



consequence, the brain needs two memory stores: a fast and a slow learning system. One role of sleep is the transfer of memories between these two systems. During sleep, the brain is assumed to switch from the "acquisition mode" into a "replay mode", which allows a recurrent repetition of recent memories and thus a slow integration of information into existing memory networks. In our new group (comprising of me and up to now 2 PhD students), we look for signs of this memory transfer, and how sleep provides a setting which is favourable for its occurrence.

# What is the Fundamental Architecture of the Brain?

This seemingly simple question has caused many debates in the history of cognitive neuroscience. While about 30 years ago one could only make vague assumptions about the exact neural structure, today with techniques such as functional magnetic resonance imaging (fMRI) the interest in cognitive neuroscience research has risen tremendously. And so has the understanding of the brain. It has long been assumed that there are many functionally specialized subsystems in the brain called modules. For example, in object perception there are a number of very selective modules. The lateral occipital complex (LOC) can process an object somewhat independently from its position and size and maybe even orientation. Individual objects, however, can be functionally localized only in a small number of brain areas. Most prominent are the fusiform face area, processing preferentially faces, and the parahippocampal place area, preferring places and buildings.

Apart from modules, many scientists have discovered topographical maps in the brain. Very interesting is the behavior of primary visual cortex. Apart from the well known columnar structure of V1, even color maps, spatial frequency maps and motion direction maps have been discovered. Recent reports by A. Basole and colleagues, however, suggest that many of these maps can best be understood in their conjunction. The authors manipulated several stimulus properties at once and found that primary visual cortex as a whole seems to respond to spatiotemporal energy, rather than to individual properties of the stimuli. In other words: The overlapping maps cannot be identified anymore when they are combined.

This result has been confirmed in a number of other studies. But what if the opposite is true for higher visual

areas? What if the seemingly modular organization of object selective brain areas, like fusiform face area, is in fact only caused by a weighted sum of several object feature maps? This stunning hypothesis has recently been suggested by Hans Op de Beeck from the University of Leuven in Belgium and Nancy Kanwisher from the MIT. However, at present evidence is weak for their hypothesis. Only a



## If objects are represented in brain maps, what is the average of a face and a body part?

small amount of the signal change can be explained by any single feature, such as the shape or the eccentricity of the object. But maybe only the combination of several features can explain the whole picture, just as there isn't a single gene explaining intelligence to more than a few percent.

So how should we test the idea of a 'pseudo-modular structure' of the brain? And to what degree does it exist? Across objects? Or even across senses? Here a recent development in cognitive neuroscience comes in and makes the theory much easier to test. Multivoxel pattern analysis (MVPA) takes the whole fMRI response into account in one step and is thus much more sensitive in detecting such

stimulus maps across larger brain areas. But unfortunately there is another caveat.

One property of maps in the brain is that a continuous variation of stimulus properties results in continuous changes in the pattern of brain activity. But while simple stimulus properties such as orientation are very easy to manipulate continuously it turns out that the story is not so simple for objects. What would a mixture of a face and an arm look like in object space? The solution to this problem can be found in a mathematical approach normally used in personality psychology: multidimensional scaling (MDS). With MDS stimulus similarities can be assessed by participants and can create an  $n-1$  dimensional space. This space in turn can be mapped onto patterns of brain activity which can result in the discovery of object maps. This means that in principle this idea is testable, but only if the rated similarities can be translated to brain activity. And this test is more difficult to carry out.

It remains to be seen in the future whether this theory holds true or is just a clever, but possibly wrong idea. Recent results from the research group of Kanwisher are promising. Right or wrong, this theoretical approach by Op de Beeck and Kanwisher can tell us one thing: Sometimes it helps looking at the whole and tackling even knowledge that seemed to be most basic and a fundamental principle of our science.

### Further readings:

Op De Beeck et al. (2008). *Nat Rev Neurosci* 9, 123-135.

Basole et al (2003). *Nature* 423, 986-990.

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The 'M.Sc. in Neuro-cognitive Psychology (NCP)' was established in 2004 by the *Elite Network Bavaria*. The aim of the four-semester program is to educate a select group of students per annum (recruited worldwide) in *Neuro-cognitive Psychology*, an emerging field at the intersection of *Psychology* and the *Cognitive Neurosciences*. The course focuses on the fundamental concepts and methods of this field (psychophysics, EEG, fMRI, patient studies) as well as their application in selected fields, such as 'Neuro-cognitive Ergonomics'. Students undertake two years of course work in small groups, comprising lectures, methodology, and independent research projects. Most graduates of the initial cohorts successfully applied for prestigious international PhD programs such as the 'Graduate School for Systemic Neurosciences'.



## Graduation Ceremony 2008

In November 2008 the Elite Network Bavaria (ENB) hold a Celebration Ceremony, offering 230 students from the various elite study programs (including NCP) with their ENB (Master) Graduation Certificates. The Editors of *the Brainstorm* wish the NCP Graduates all the best for their future career.

