BERLIN SCHOOL OF MIND AND BRAIN

An Issue on

HUMAN SOCIALITY AND THE BRAIN

Newsletter

Nº VI

OCTOBER 2012

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CONTENTS

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Human sociality and the brain

Editorial by Henrik Walter, faculty member of the Berlin School of Mind and Brain

Until lately, cognitive neuroscience has treated people as isolated units. Clearly, such an approach does not account for the fact that humans are inherently social beings. Doing justice to this observation, a new interdisciplinary field, social neuroscience, has emerged in the last decade and has now become one of the most productive fields in understanding mind and brain issues. Moreover, in philosophy neuro-centered views have been criticized for ignoring the embeddedness of the human mind in the external world in general and the social world in particular. This and the recruitment of new scientists in this field are the reasons that "Human sociality and the brain" has been added as a sixth topic and new research focus to the portfolio of the Berlin School of Mind and Brain.

Some of the phenomena investigated in social neuroscience, like the ability to mentalize about the thoughts, intentions and feelings of others (theory of mind), seem to be uniquely human, and the networks underlying this function are now understood in some detail. Many social phenomena have an affective character: empathy, the ability to feel for others, has become a major research topic in recent years. All of these phenomena emerge in childhood and adolescence and seem to require social interaction in order to develop adequately.

Social emotions like shame, guilt, regret, empathy, compassion and love have also been investigated within social cognitive neuroscience in patients with emotional disorders. These investigations are directly related to

studies concerning patients with borderline personality disorder, depression or psychopathy. Game theoretic paradigms like the dictator game, the ultimatum game, or prosocial behavior play a key role in behavioral studies as well as in neuroscientific investigations.

However, not only humans but also many animals are social beings. They share proximate mechanisms of cooperation, competition, and affiliation with humans, in particular with respect to neuroendocrinology and neuropeptides like oxytocin and vasopressin.

Moral behavior and cognition are also social phenomena sui generis. Research has shown that neural processes supporting moral behavior, cognition, and emotions overlap heavily with the mentalizing network. Research on the moral brain has stimulated intensive cooperation between neuroscientists, psychologists and philosophers, particularly in Berlin.

To sum up, social neuroscience is a new and exciting field covering cognition, emotion, decision-making, and mental disorders, and bringing together neuroscientific, developmental and philosophical approaches. As a consequence, applications for this field tend to be highly interdisciplinary and are welcomed at the Berlin School of Mind and Brain. ●

Q & A

Bérengère Thirioux

Q *What is your main research topic? Which questions are you trying to answer in your work?*

A My current research is in the field of social neuroscience, namely empathy. I started to work on empathy for my PhD, and I am still working on it for my second post-doc in Professor Walter's laboratory. Empathy is a critical socio-cognitive skill in our daily life as it enables us to react to and interpret the experiences of others, generating concern and subsequent helping behaviour. In my research, I try to understand the neural mechanisms underlying empathy. For this, I use "scalp electroencephalography" (EEG, i.e. recording the electrical activity of the brain by means of electrodes placed on the scalp) with healthy participants as well as "intracranial EEG" (iEEG) that enables a recording of the electrical activity within the brain by means of depth electrodes which are temporary implanted in very specific brain regions of patients with pharmaco-resistant epilepsy in order to identify seizure loci for potential surgical treatment. I also focus my work on the dysfunction of empathy in psychiatric patients suffering from schizophrenia or in depressive patients.

Empathy is for me – as well as for many other researchers – a very interesting subject matter as it relies upon both automatic and controlled mechanisms. Indeed, the observation of what another individual is experiencing automatically generates autonomic and somatic responses in the observer and, potentially, comparable mental states, e.g. observing the sadness of another person generates specific activations in the brain structures sustaining the processing of emotions and potentially a feeling of sadness. To describe this process, we usually speak about a "first-person grasp of the other's experience" as if we were ourselves experiencing this emotion. The simulation mechanisms in one's own body and mind, which are considered low-level mechanisms, are also associated with cognitive mechanisms. This cognitive component of empathy enables us to take the other's perspective (or third-person perspective) and be aware that the observed emotion (or motor action, intention, sensation etc.) was primarily initiated in another individual. Perspective-taking and self-other distinction are fundamentally necessary for the emergence of empathy, and this

cognitive component is defined as a "third-person grasp of the other's experience". In my research, I try to understand how these automatic (first-person) and controlled (third-person) mechanisms work together in empathy and are integrated at the neural level.

Q Which challenges does social cognition face as a relatively new research topic?

A I believe that social cognition faces challenges on two main and interconnected levels: on a phenomenological level, the challenge lies in the complex nature of self-other interaction. Indeed, when two individuals are interacting, a dynamic, inter-subjective relationship is established, i.e. information is exchanged in a bidirectional way between two brains. It renders this specific relationship much more complex than any other relationship based on a unidirectional way of processing information, as, for example, that established between a single perceiving brain and a perceived object in the environment. Its complex nature also depends upon the richness of information contents which are exchanged and diversely related to, e.g., actions, emotions, intentions, or beliefs. Furthermore, a genuine self-other interaction – to be possible – must embrace two distinct subjects whose status as subject is continuously maintained, i.e., a relation in which neither subject is processed as the mere reduplication of the other. On a methodological level, appropriate investigation of self–other interactions requires the development of new approaches and paradigms, i.e. the so-called "two-person neuroscience", which allows for testing two people at the same time. Such two-person neuroscience brings about major methodological challenges because the brain activities of two subjects have to be measured simultaneously.

Q What experiences in school science, if any, drove you to pursue a career in science?

A I cannot say that specific experiences in school science drove me to pursue a career in science. What I would say is that I was often impressed by the capacity of different teachers I met to ask good questions … the kind of questions that we sometimes face and which cause

Bérengère Thirioux

us to think: "This question really deserves to be asked". One thing that I also regularly heard from teachers was: "Try to always remain surprised when looking at the world …". This advice strongly influenced me and came to be a rule in my life and not only in science.

Q *What is the best part of the work you do – the part that gives you the most satisfaction?*

A The part that gives me the most satisfaction is the EEG and iEEG recording sessions, that is, when I am recording participants and especially patients. For instance, with implanted epileptic patients, when I look at the monitor displaying the brain signals being recorded by the depth electrodes and when at the very same time I observe the behaviour of the patients and interact with them, I really do get this incredible satisfaction of experiencing a "hic et nunc neuro-phenomenology".

Q *What is your biggest hope for the future (of science)?*

A My biggest hope has more to do with the conditions of doing science in the future, that is, more positions, more funding etc. It is also a sweet dream …

Q *To your mind, what has been the most interesting discovery in your field so far?*

A The discovery of neurons with mirror properties in the hippocampus (Mukamel et al., 2010) by the Itzhak Fried's group (UCLA). ●

Q&A

Dar Meshi

Q *What is your main research topic? Which questions are you trying to answer in your work?*

(A) I'm studying the neurocognitive aspects of making decisions in social contexts. For example, a recent project of mine examined how we're influenced by expert and novice advice during the decision-making process.

Q *How would you explain what you do to a non-expert?*

(A) I usually explain what I do by describing the overall process of cognitive neuroscience research and mention that certain parts of the job are actually similar to what an architect does. To begin with, we get to come up with a question about the brain; we ask about how it functions and how this function relates to human behavior. We then design an experiment to answer the question. This part is quite similar to what an architect does. An architect is tasked with designing a specific kind of building and has to work within the bounds of certain constraints (e.g., financial budget, space needed, number of people expected to frequent the building, etc.). Within these bounds, however, there's great opportunity for creativity and imagination. Designing a research experiment is similar because we have specific constraints as well, such as previous relevant scientific knowledge, and the technology and resources we have at our disposal. We also have lots of opportunity for creativity and imagination within the aforementioned constraints. After we've designed the experiment, to implement our ideas (we actually build the buildings as well) we program a "video game" which study participants will "play". This game will make participants behave in a certain way while we image their brain activity (not really brain activity, but blood flow in the brain

Dar Meshi

which is a proxy for brain activity). After the experiment, we use statistical software to analyze the brain imaging data we collected. This results in multi-colored heat-maps on the brain that you sometimes see published in newspapers. Hopefully our analysis will have allowed us to answer our initial research question, which we then write up and publish in a research report.

Q *What is the best part of the work you do – the part that gives you the most satisfaction?*
A There are two aspects of my work that really appeal to me. The first is the process of creating a research study. It can be quite satisfying to come up with a great scientific question and then realize you've designed the perfect study to answer the question (see the architect example above). Another satisfying aspect of my work concerns the output of data analysis. It's that "eureka" moment when a scientist analyzes his or her data and realizes the hypothesis was correct.

Q *What is your biggest hope for the future (of science)?*
A I'm looking forward to better imaging methods. I use functional magnetic resonance imaging (fMRI) as a research technique. At the moment, fMRI has fairly poor spatial and temporal resolution. Neuroscience will get even more exciting when we can image each neuron in the human brain firing in real time. With this technology we'll be able to answer questions we can only dream of now, and have an even greater impact on the health and happiness of society.

Q *What classes from undergraduate study do you wish you could still take now or wish you had taken?*
A Without a doubt, I wish I had taken more statistics.

Q *As a scientist, what do you find especially appealing about Berlin?*
A The neuroscience community in Berlin is quite close. There's a lot of mixing between people from different institutes, which happened far less in other cities I've lived in. In addition, Berlin is a great place to live. It has everything you could ever want from a major metropolitan area: amazing food, nightlife, a wide variety of culture, and very easy access to nature outside of the city. ●

Q&A

Anna Kuhlen

Q *What is your main research topic? Which questions are you trying to answer in your work?*

A My research focuses on how people coordinate with each other in social interactions – including how an addressee's feedback, speech-accompanying gestures, and non-verbal cues shape, and are shaped by, the conversational partner. To fully understand these processes it can be useful to go beyond the individual, and study how two minds and brains relate to each other.

Trained within the experimental tradition of cognitive and social psychology, I received my PhD in psycholinguistics at Stony Brook University in New York in 2010. As a postdoc at the Berlin School of Mind and Brain I have begun investigating neurophysiological markers of interpersonal coordination, and the neural underpinnings of processing nonverbal cues.

Q *What do you find most interesting about your research?*

A My topic, social interactions, is designated for interdisciplinary collaborations. In the past I have worked together with and integrated the work of linguists, computer scientists, ethno-methodologists, philosophers and even dance therapists. In my current position at Mind and Brain, I work in an interdisciplinary team with computational neuroscientists, theoretical physicists, and social anthropologists. I find it very exciting to learn about other disciplines' perspectives and methodological approaches. Even the judgment regarding what qualifies as a proper research question can differ tremendously across disciplines, let alone the question of how one would go about studying it.

Q *How would you explain what you do to a non-expert?*

A I am interested in social interactions. In particular, I am interested in the cognitive and neural processes that can explain how two or more people coordinate with each other in social interactions. Not only verbal behavior, but also subtle nonverbal cues play an important role.

Q *What experiences in school science, if any, drove you to pursue a career in science?*

A I have always been interested in science and the study of human social interaction. What has changed

over the years is my methodological approach towards studying social interactions. I started off with ethnomethodological investigations, closely observing and describing how people interact "in the wild". During my psychology studies I was introduced to an experimental approach for studying human behavior. Influenced by social psychology and studies of small group processes, I began with investigating social interaction using questionnaires, probing the participants' perception of the situation. But something was missing! So I began looking for ways to study the interaction processes themselves. And I turned to the field of experimental pragmatics and gesture studies, which incorporates methods from a diverse range of disciplines, including cognitive psychology, linguistics, ethnology and dance studies. This is the area in which I pursued my PhD. For my postdoc, the Berlin School of Mind and Brain offered me the unique opportunity to integrate this approach with social neuroscience, which offers exciting new opportunities to study the processes underlying social interaction.

Anna Kuhlen

Q *As a scientist, what do you find especially appealing about Berlin?*
A Berlin and its surroundings offer a large number of different research groups and research institutes. This provides many opportunities for fruitful exchanges and collaborations. Mind and Brain, for instance, is one institution that clusters and brings together many of these groups. In addition, the excitement and quality of Berlin urban life is appealing and has acquired a certain international reputation. This is of great advantage when trying to convince guest researchers to come and visit! ●

Q&A

Andrew Wold

Q *What motivated you to apply for the program at the Berlin School of Mind and Brain?*

(A) I had heard about the Mind and Brain from colleagues and was interested in seeing what the program was all about. In the end I applied because the program spoke to my interests as an interdisciplinary scientist – and it was in Berlin, a place I've always wanted to live in.

Q *What is your research topic? Which questions are you trying to answer in your work?*

(A) I'm working on emotional regulation and how prediction affects social cognition. I use the rather non-conventional approach of combining non-invasive brain stimulation techniques with emotional regulation and social cognition. I use transcranial magnetic stimulation (TMS) and transcranial direct current stimulation (tDCS), which are two techniques used to modulate neural activity. You can stimulate with TMS in such a way that the stimulated cortical region is temporarily knocked out, 'virtual lesion approach', and with as little as 20 minutes, tDCS can be used to facilitate or hinder (depending on the electrode placement) neural activity for up to an hour.

Q *Which do you see as the challenges of an interdisciplinary study of the mind and brain?*

(A) Finding a way to address philosophical issues within the realm of measurable science is often a problem. Although, finding the bridge between your idea and how to turn it into an experiment is a struggle most scientists are familiar (but not comfortable) with.

Q *What classes from undergraduate study do you wish you could still take now or wish you had taken?*

(A) It would have been useful to have more high level mathematics and computer programming. I still had enough to work with, but it would make the design building phase a lot quicker if I didn't have to relearn MatLab every year.

Q *What do your parents think you are doing?*

(A) Mad science. I tell them that I research emotions and social interaction by attaching battery powered electrodes to people's heads while showing them graphic pictures

depicting accidents, violence, and war. Although in that context, it does sound like I dabble in mad science.

Q *What do you like to do in your free time, away from studying the human mind and/or brain?*
A I just recently had a baby boy and he keeps me pretty busy. Besides that, I'm a fairly active martial artist. I practice kickboxing and jujitsu and even recently competed in a fighting tournament here in Berlin. I like to think that I'm balancing out my studies of mind and brain by adding in the element 'body'.

Q *If you could do one thing differently in your academic career, what would it be?*
A I would like to be more involved with patient populations. I like to get the sense that my research has a positive effect on society, and that it can be used to improve the lives of individuals. If I could go back I would pursue an applied project that is closer to working with patients and therapies directly designed to help people/society. ●

Andrew Wold

Q&A

Julia Rodríguez-Buritica

Q *What motivated you to apply for the program at the Berlin School of Mind and Brain?*

A I started studying biochemistry at the Freie Universität Berlin after attending a school which had a strong focus on natural sciences. I noticed early on that this molecular-level perspective did not cover all my interests, so I started searching for something else and attended lectures in different fields. At my first lecture in psychology I was totally fascinated by the empirical way of thinking about questions that I thought at the time were mainly philosophical, like the existence of free will. This first lecture was not to be my last and I shifted my focus to more human behaviour. Still today I am fascinated by the idea of combining brain and mind sciences. The Mind and Brain program, with its opportunities not only to get additional teaching but also to have students and researchers from various fields interacting with each other seemed to me to be what I was looking for.

Q *What is your research topic?*

A I am interested in the developmental differences in adaptive social decision-making. Effective decision-making in social contexts depends on the development of the ability to understand the mental states and emotions of others and predict the future actions of others. Given that children have a less developed understanding of the mental states of others, and are differentially sensitive to the example of others, I expect that their interaction in social contexts is guided by expectations which are different from those of adults.

Julia Rodríguez-Buritica

Q *Which questions are you trying to answer in your work?*
(A) The project aims to find out how these developmental differences impact on expectations during social decision-making and how their underlying neuronal correlates further our understanding of human decision-making and the impact of social interactions during development.

Q *What do you see as the challenges of an interdisciplinary study of the mind and brain?*
(A) The greatest challenge of interdisciplinary research is complementing the expertise of different fields that are reaching their limits and finding a common language to talk about the same problems we are investigating from different viewpoints albeit often with the same motivation of searching for the answers.

Q *As a scientist, what do you find especially appealing about Berlin?*
(A) Berlin is becoming more and more of an important landmark on the scientific map. That might be due to the fact that doing research is more fun in a city that offers such a high quality of life as Berlin, where the openness of the city is also reflected in the scientific discussions and exchanges between various institutions. The heterogeneity, creativity and fast rhythm of the city keeps you going, ever open to and curious about new perspectives. ●

Q & A

Evgeny Bobrov

Q *What motivated you to apply for the program at the Berlin School of Mind and Brain?*

A I wanted to get to know people from very diverse backgrounds and discuss neuroscience with them, and also to learn about fields not directly related to my work. A certain structure in the doctoral program also seems to me to be a good thing. In addition, the number of scholarships available at the time was a further motivation to apply.

Q *How would you explain what you do to a non-expert?*

A Rats like to touch each other with their long facial hairs, and I am investigating whether this is a means of communication. At the same time, I also observe the activity of their brains in a brain area that is responsive to touch signals. I do this by inserting hair-thin wires so that the responses of single neurons can be recorded. In doing so, I try to find the neuronal basis of these behaviors and how touch could contribute to the overall information that rats have about their conspecifics.

Q *What has been the biggest surprise or most interesting discovery so far?*

A I really hadn't thought that I would manage to learn MatLab and, even less so, that I would sometimes even enjoy it! The biggest surprise seen from my undergrad point of view, however, is that all of this programming is in fact part of my research – I had never wanted to do this, and always sought to reduce it.

Q *What experiences in school science, if any, influenced you to pursue a career in science?*

A My fascination with animals predates even elementary school, and it was at its height when I was 9 or 10 and went to the zoo every other day, doing every possible children's course there. Even at that age, I used to tell people that I wanted to become a biologist. I also always liked school science, but I think this early experience meant the decision was already made.

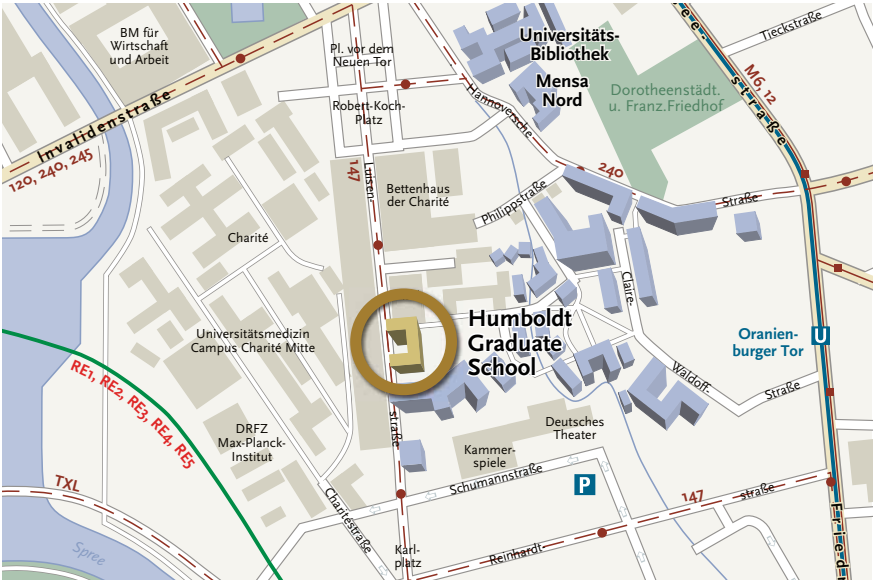
Evgeny Bobrov

Q *What classes from undergraduate study do you wish you could still take now or wish you had taken?*
A Ideally, I think one should involve students in scientific projects early on, so that they see the immediate need to learn proper scientific writing, programming, statistics, etc. – all the things that many tend to ignore. At least for me, when I was an undergraduate it was both more interesting and more rewarding to go to lectures and memorize facts, whereas now I wish I had taken more methodological courses.

Q *As a scientist, what do you find especially appealing about Berlin?*
A There's a great neuroscience community, with a lot of lectures, seminars and courses going on. But the best thing for me about being a scientist in Berlin is that there are a million things to do, so that you rapidly forget about your day-to-day problems in the lab.

Q *What do you like to do in your free time, away from studying the human mind and/or brain?*
A I really like big cities and everything that you can do there: eating or drinking out, going to museums, cinemas, and theatres, or just walking around getting to know new parts of town.

But once I'm out of Berlin, I also really enjoy being outdoors, especially hiking. I also run a lot and I'm currently part of a theatre group. ●



CONTACT

If you would like to talk to us about research at the Berlin School of Mind and Brain and our doctoral program, please get in touch!

Berlin School of Mind and Brain
Humboldt Graduate School
Humboldt-Universität zu Berlin
Luisenstraße 56, Haus 1, 10117 Berlin

E-mail mb-admission@hu-berlin.de
Telephone +49 30 20 93-81 05
Fax +49 30 20 93-18 02

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Alexander von Humboldt (1769–1859), natural scientist and explorer, co-founder of Berlin University. Younger brother of Wilhelm (1767–1835), scholar of comparative linguistics and Prussian statesman, whose portrait was on the cover of Newsletter IV & V.
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15 January

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