Update (March 24): additional course in C4: “Problems in the Philosophy of Semantics” (see p. 13)

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Enrollment for Courses

Students in the first semester will be registered by the lecturers in the first session of each course. Advanced students (from the second semester on) are requested to register with the university’s VSPL-system (info: vspl-support@rub.de) and should be aware of earlier VSPL-deadlines. Exceptions include the courses held by Wiskott, Schöner and Würtz. Here, there will be no VSPL-registration, but a manual enrollment in the first session.
The goal of this seminar is 1) to understand basic electrophysiological properties of neurons and 2) to learn how to implement this knowledge into a computational model of a neuron.

First, students will learn basic electrophysiological properties such as the maintenance of the resting membrane potential and the generation of an action potential through lectures. Students will then build their own neuron model using a programming environment called Matlab. Simulation using computers will not only help solidify the students’ understanding of electrophysiological properties but also will allow them to use this knowledge in the future research. Acquiring this technique will enable students for example to estimate the consequence of a malfunction of certain ionic channel in a disease or to estimate the specific character of specific neuron types of their interest. Advanced students will have the opportunity to expand this single neuron model to a neural network model to simulate a role of a brain region of their interest. This course will also provide necessary skills regarding computational simulation and it does not require previous experience in modeling or programming. Basic knowledge about electric circuit would be of advantage.
The content of the seminar is situated at the border between theoretical and practical philosophy. We will start with discussing theories of self-consciousness. The aim of this start is to situate the cognitive features of agency, ownership and perspectivity within a theory of self-representation. The structure of the acting self is still perplexing and remains an often confounded issue in the recent debates. The starting articles provide a new systematic theory of self-consciousness in general and of two of its main features, the sense of agency and the sense of ownership. Furthermore, the phenomenon of responsibility can be separated from both phenomena. The theoretical framework will be shown to be fruitful in the context of the recent experiments in psychology and neuroscience. Thus, we will not only discuss classical accounts (e.g. deontological or consequentialist accounts) but also study new empirically anchored accounts of attributing moral responsibility.

Gallagher introduced the distinction between agency and ownership. We need this distinction to account for passive movement of my arm since I still have the feeling of ownership in such a case but no feeling of agency. Furthermore, it is shown that we have to distinguish the feeling of agency and the judgment of agency. I can develop a feeling of agency in everyday automatic doings without explicitly judging that I am the agent. The feeling of agency is realized by nonconceptual representations. I may also develop a judgment of agency without any feeling of agency: The judgment of agency is realized by conceptual representations. Furthermore, it will be argued that responsibility is a separate dimension from both aspects. I can judge that I am the agent of an action but deny responsibility by arguing that I just followed a strict order. This indicates that the ascription of responsibility is presupposes a theory of social interaction. Responsibility is relying on meta-representations which are typically involved in the so-called theory-of-mind ability. In a large part of the seminar we will discuss the cognitive foundation of the attribution of moral responsibility.

We presuppose that the attribution of moral responsibility is adequately expressed in the ascription of blame and praise. Given this presupposition, we can discuss recent empirical studies (e.g. Knobe 2003) showing that the actual attribution of moral responsibility is neither
determined by the good or bad consequences only nor by the good or bad intention only but that several other factors have to be considered. The aim of the seminar is to work out an overview of all relevant empirical studies which offer evidence for essential factors modelling the attribution of moral responsibility. Experimental philosophy is one important source.

The seminar is only open for Master Students and for PhD-students. Presentations and discussions will be in English. The literature will be prepared in Blackboard for download at the beginning of the semester.
The seminar gives an overview about current philosophical theories of emotions. We will read mainly philosophical texts, but also encounter theories from neighboring disciplines such as the neurosciences, psychology or cultural anthropology. All readings will be in English. An electronic reader will be available at the beginning of the class. Emotions like happiness, fear, pride or jealousy have been neglected in analytic philosophy of mind for a long time, but they have gained some attention over the last few decades. The project of first-wave analytical philosophy of emotions was to rehabilitate the emotions as intelligent reactions. These so-called cognitivist approaches showed that emotions are not just blind forces but have intentional content like judgments or beliefs. However, cognitivism has subsequently been criticized for over-intellectualizing emotions and for neglecting the central role of the body in emotions. A first section of the seminar will be concerned with the way emotions represent aspects of the world, and with the role both bodily changes and propositional attitudes play here. In a second section, we will be concerned with the origins of emotions: are they mainly a product of biological evolution? Or are they mainly a product of culture? It is very plausible that the emotions of human beings are shaped by both biological evolution and culture. But this contention only raises the question how evolutionary, biological and cultural factors interact in the process of creating emotions. We will have a look at some conceptual issues underlying this question.
Neuroinformatics is concerned with the discovery of new solutions to technical problems of information processing. These solutions are sought based on analogies with nervous systems and the behaviour of organisms. This course focuses on three exemplary problems to illustrate this approach:

(a) Artificial action (autonomous robotics);
(b) Artificial perception (robot vision);
(c) Artificial cognition (simplest cognitive capabilities of autonomous robots such as decision making, memory, behavioural organization).

The main methodological emphasis is on non-linear dynamical systems' approaches and dynamic (neural) fields.
This lecture treats aspects of vision from the computer science, psychophysics, and neurobiological point of view. Starting from a phenomenology of human vision, biological and psychological basics, the foundations of image processing are developed, finally leading to more advanced concepts like multi-scale and wavelet analysis, and algorithms for face and object recognition.
A new theory of perception is taking hold in neuroscience and beginning to get noticed among philosophers as well. It is the theory that the brain is a sophisticated hypothesis-testing mechanism, which is constantly involved in minimizing the error of its predictions about the sensory input it receives from the world (predictive coding). This mechanism is meant to explain perception and action and everything mental in between. We will study and discuss texts by philosophers Andy Clark and Jakob Hohwy as well as neuroscientist Chris Frith in order to assess the theory in providing an explanation of perceptual consciousness.

The readings will be supplied electronically on Blackboard.
Brains [...] are essentially prediction machines. They are bundles of cells that support perception and action by constantly attempting to match incoming sensory inputs with top-down expectations or predictions” A. Clark (2013). In this seminar we first introduce the general idea to understand brains and minds as prediction machines. This requires studying on the one hand under which conditions predictions are successful and how successful predictions are possible and on the other hand how these predictive mechanisms are implemented in the brain. This leads us in particular to focus on a specific approach: the Bayesian approach in Cognitive science. According to this approach, probabilities are the key to understand cognition.

There are many a priori arguments that rational reasoning in general and expectations and predictions in particular should obey the probability calculus and that rational actions should maximize expected utility. Interestingly, there are also empirical findings that demonstrate that the actual human reasoning and behavior is optimal or nearly optimal in the sense that it is very similar to how perfectly rational agents, i.e. probabilistic agent, would reason and act. In the seminar we concentrate on what the Bayesian approach to understanding the mind and the brain has to offer concerning such areas of cognitions as inference, decision-making, categorization, and causal reasoning.
This lecture presents models of self-organization in neural systems, in particular addressing vision (receptive fields, neural maps, invariances, attention) and associative memory (Hopfield network).
When we remember events from our lives, whether they are the once-in-a-lifetime or everyday kind, we use our episodic memory. Although a small region of the brain called the hippocampus was identified to be important for episodic memories a long time ago, the nature and neural basis of episodic memory remain unclear. This class will employ a novel, highly interactive format to introduce the students to the cutting edge of the research into episodic memory. Students will be involved in choosing the literature discussed in class and discuss their views with an invited speaker who will also give a lecture in the Colloquium of the Institute of Cognitive Neuroscience (ICK).
This discourse aims to deepen our understanding of the generation of brain functions. Our focus will be spatial navigation and memory functions in the medial temporal lobe (MTL). Students will learn neural dynamics underlying spatial navigation and memory through single unit recordings, intracellular recordings, functional imaging and theoretical modeling studies. Based on these studies and discussions, students will define their own new research directions and conduct a research regarding what is already known and what could be done as an interesting scientific project. Specific topics of this discourse could include (but not limited to) ‘Place cells’ in the hippocampus that fire dependent on the location of an animal in an environment, head direction cells in the presubiculum that fire dependent on the direction of animals head, and grid cells in the entorhinal cortex fire at many locations to form a hexagonal grid that covers each 2D environment, Theta phase precession of the place cells and the grid cells that provides evidences for phase coding and an optimized firing pattern for synaptic plasticity, and replay of activity of place cells during sleep which provides evidences for the possible role of the MTL in memory consolidation.
The main goal of this course is to introduce students to the field of Natural Language Semantics. This course can be used as a preparation for further research for students who want to specialize in Semantics and related fields such as Philosophy of Language and the Cognitive Neuroscience of Language. To achieve basic semantic literacy, the course will cover the tools and concepts of logic and mathematics currently used in formal semantic research, e.g., basic set theory and lambda calculus. To learn how to apply these tools, the course will examine particular natural language constructions such as quantification and adjectival/adverbial modification. We will also discuss some controversial foundational and philosophical issues regarding the semantic structure of lexical items and the combinatorial operations which determine the meaning of phrases. The main reference text for the course is Irene Heim & Angelika Kratzer’s (1998) "Semantics in Generative Grammar".
Mental concepts are the most fundamental ontological postulate in theories of the mind. They play a central role not only in the philosophy of mind and language, but also in psychology, artificial intelligence and cognitive neuroscience. Mental concepts are assigned a threefold explanatory role: (i) as providers of perceptual categories, (ii) as providers of cognitive content, and (iii) as providers of linguistic meaning. It is commonly assumed that their content is compositional.

In the first part of the seminar the leading theories of concepts are discussed: the classical theory, prototype and exemplar theory, the theory theory, as well as atomism. In the second part of the seminar a more general questions is asked: Are mental concepts a natural kind? Do concepts form a kind class subserves relevant inductive and explanatory purposes and whose members are likely to share a large number of properties because of some uniform causal mechanism? In the third part of the seminar recent neuro-cognitive models of concept are discussed.

Aside from active participation, participants will be expected to give a presentation in English. Assistance regarding the English language will be provided.

Literatur:
Advanced methods are usually studied in the second semester. One exception is the "FMRI"-course which is only offered in the winter. Students who already have basic knowledge in cognitive neuroscience can choose to learn the "FMRI"-technique in the first semester. Necessary background: basic knowledge in cognitive neuroscience. The FMRI-seminar must be integrated into the course program during the first or the third semester; in the case you want to learn the FMRI-technique in the first semester, an individual application for the course is necessary: boris.suchan@rub.de.

The laboratory-class “Neural substrates of memory function” is a flexible whole day course that can be integrated whenever a student is free to do so.

### AM1. Theory Formation & Conceptual Analysis

#### SEMINAR

**PARADIGMS OF MODELLING THE MIND (030087)**

**PROF. ALBERT NEWEN, DR. NIVEDITA GANGOPADHYAY**

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<td>Tuesday, 14.15-15.45 (First Meeting: April 8, 2014)</td>
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Contemporary philosophy of mind is importantly linked to the development of cognitive science, an interdisciplinary investigation into the processes of cognition spanning discussions in artificial intelligence, neuroscience, psychology, anthropology and philosophy. The growth of cognitive science as an interdisciplinary research paradigm is based on the conceptual foundations of information-processing, representationalism, computationalism and functionalism. A paradigmatic example of the meta-theoretical foundation for cognitive science is offered by, for example D. Marr (1982), who described three levels of analysis for studying any information-processing system. These are the levels of computation, algorithm and implementation. The basic idea was that any information-processing system represents input from the environment, as impoverished stimuli, and then the input is processed by various rule-governed manipulations to lead to meaningful content. The mind was considered to be just such an abstract information-processing system, and the representational and computational capacities of the mind could be described independently of the embodiment and situatedness of the cognitive agent. The information-processing paradigm built on the notions of representation and computation became the dominant paradigm for modelling the mind in cognitive science and philosophy of mind.

However, the representational / computational framework soon encountered the ‘hard problem of consciousness’ or the philosophical problem of how to explain the emergence of conscious experience from a description of cognition as abstract information-processing. In order to solve the hard problem of consciousness philosophical theories started exploring alternative paradigms for modelling the mind. These alternative paradigms, heavily influenced by phenomenological philosophy, replace the
notions of information-processing, representationalism, computationalism and functionalism with the notions of embodiment, situatedness, and ‘enaction’ of meaning by agent-environment interactions. They argue for a necessary role of the ‘first-person perspective’ in the study of consciousness as well as in the study of cognition. In this course we will examine in detail the explanatory strengths and weaknesses of the representationalist (information-processing / computationally) and the non-representationalist (embodiment / enaction) paradigms for modelling the mind. We will critically assess the implications of each paradigm for our understanding of cognition and consciousness. We will also discuss how philosophy of mind and cognitive science have been differently influenced by the two paradigms and what this means for an interdisciplinary approach to the study of the human mind.
Epistemic Logic is the logic of operators such as “agent a knows that”, “agent G believes that” (doxastic logic), “the group of agents ? knows that”, and “it is common knowledge that”. Epistemic logic is or ought to be related to epistemology, the general philosophical theory of knowledge. In this introduction to epistemic logic we will first deal with some fundamental topics in epistemology, namely the problem of defining the notion of knowledge and approaches to the concept of epistemic justification. In a second step, the modal logic of knowledge and belief will be introduced. This approach is confronted with a number of problems referred to as problems of logical omniscience. In a third step, familiarity with the modal logic of knowledge will enable us to consider the so-called knowability paradox. This paradox has received much attention in the debate between realistic and anti-realistic conceptions of truth. Also, the notion of common knowledge will be introduced and discussed. Finally, the logical analysis of knowledge will be refined and brought in closer connection with general epistemology by considering so-call justification logics. These systems extend the logical analysis of knowledge by explicitly incorporating a formal representation of justification.

Credits can be obtained by passing an oral examination or writing an essay.
Please note: Capacities for this lab course are limited. Please register via VSPL or by writing a mail to dirk.moser@rub.de.

In diesem Laborpraktikum sollen grundlegende Fähigkeiten molekulargenetischen Arbeitens vermittelt werden. Unter Anleitung lernen die Teilnehmerinnen und Teilnehmer die Isolation von DNA aus verschiedenen Geweben, photometrische Konzentrationsbestimmung von DNA, DNA-Vervielfältigung mittels Polymerasekettenreaktion (PCR), Schneiden von DNA mit Restriktionsenzymen und die gelektrophoretischen Auftrennung der Fragmente. Neben der praktischen Arbeit soll der Umgang mit genetischen Datenbanken erlernt werden.
The unit focuses on the identification of the brain areas that support memory function in healthy subjects, aging and model of amnesia. Several aspects of memory are studied: familiarity versus recollection, memory for single items versus pairs, memory for space versus time. We use a multidisciplinary approach of memory function that includes behavioral, lesion and neuroanatomical imaging techniques in rats and mice. The focus of the project is the study of the functional segregation of the medial temporal lobe, a brain structure damaged in aging and amnesic patients, which leads to severe memory impairments. The project involves the combination of behavioral and molecular imaging techniques. No previous experience is required, highly motivated candidates will be considered.

Contact: magdalena.sauvage@rub.de.

Examination:
Written Lab Report, Paper presentations
This course covers mathematical methods that are relevant for modeling and data analysis. Particular emphasis will be put on an intuitive understanding as is required for a creative command of mathematics. The following topics will be covered: Functions, Hilbert-Spaces, matrices as, transformations, systems of linear differential equations, qualitative analysis of non-linear differential equations, Bayes theory, multiple integrals.
Please note: If you intend to study “EEG-Training” as one of the two obligatory advanced methods, you need to pass each of the following three courses: 118151, 118153 and 118151. In case you only want to get an impression of how EEG works, you are recommended to attend 118151.

**AM6. EEG-Training**

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<th>EXERCISE</th>
<th>EREIGNISKORRELIERTE POTENTIALE IN DER NEUROPSYCHOLOGIE (118151)</th>
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**TERM:** Summer 2014  
Monday, 10:15-11:45  
(First Meeting: April 8, 2013)

**ROOM:** GAFO 05/609

**CREDIT POINTS:** 3

Acknowledgment: The EEG-course will be adequate for English speaking students. An English description will be delivered soon.

Das Seminar beschäftigt sich mit der Technik des Elektroenzephalogramms und den Ereignis Korrelierten Potentiaien. Diese Methode ist in der Neuropsychologie sowohl in Forschung als auch in der klinischen Anwendung sehr wichtig.

Please note: If you intend to study “EEG-Training” as one of the two obligatory advanced methods, you need to pass each of the following three courses: 118151, 118153 and 118151. In case you only want to get an impression of how EEG works, you are recommended to attend 118151.

**AM6. EEG-Training**

| SEMINAR & EXERCISE  
| ANGEWANDTE NEUROPSYCHOLOGISCHE METHODEN  
| (118152 & 118153)  
| SABRINA SCHENK |

**TERM:** Summer 2014  
**SEMINAR:** Monday, 8:15-9:45 (First Meeting: April 14, 2014)  
**EXERCISE:** Monday, 11:45-13:45 (First Meeting: April 14, 2014)  
**ROOM:** GAFO 05/609  
**CREDIT POINTS:** 6

In the seminar and the associated exercise, students will work on an EEG experiment, where they design a study, acquire the data, analyze and interpret them under supervision.
D. Free Selection

D1. Free Selection

**SEMINAR**
**RESEARCH COLLOQUIUM:**
**PHILOSOPHY MEETS COGNITIVE SCIENCE (030127)**
**PROF. MARKUS WERNING**

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In the research colloquium current topics at the interface between Philosophy and Cognitive Science will be discussed. The colloquium hosts talks by visiting leading experts and local researchers as well as presentations by doctoral and master students. Students will be given the (assisted) opportunity to present their projects in English.

Anforderungen für einen kleinen Studiennachweis: Regelmäßige Lektüre und Teilnahme; aktive Mitarbeit; Präsentation und schriftliche Ausarbeitung eines Themas; Portfolio.

Die Gesamtnote konstituiert sich aus einer individuell und schriftlich zu erbringenden Leistung, deren Form von der/dem Lehrenden festgelegt wird. Darüber hinaus werden weitere, jedoch unbenotete Leistungen verlangt, wie zum Beispiel die Vorbereitung einer Sitzung u. a. m.

Literatur: Bekanntgabe der aktuellen Literatur während der Veranstaltung und über Blackboard.

Literatur:
Onur Güntürkün, Biopsychologie, Hogrefe Verlag 2012, Kapitel 5 – 12.

Bekanntgabe weiterer aktueller Literatur während der Veranstaltung und über Blackboard.
D1. Free Selection

VORLESEUNG
KOGNITION UND GEHIRN (112611)
PROF. OLIVER WOLF

TERM: Summer 2014
       Monday, 14.15-15.45  (First Meeting: April 7, 2014)
ROOM:  HGA 30
CREDIT POINTS: 3

In diesem Seminar sollen Möglichkeiten und Grenzen kognitiver neuropsychologischer Rehabilitation am Beispiel verschiedener neuropsychologischer Störungsbilder wie z.B. Schlaganfall, Demenz oder Multiple Sklerose aufgezeigt werden. Es werden aktuelle Konzepte und Inhalte neuropsychologischer Therapien bei Gedächtnis-, Aufmerksamkeitsdefiziten etc. dargestellt. Ebenso werden psychotherapeutische Möglichkeiten zur Bewältigung psychologischer Folgen bei neurologischen Erkrankungen aufgezeigt und diskutiert.
D1. Free Selection

**SEMINAR**
**GENETIK (112912)**  
**PROF. ROBERT KUMSTA**

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In the research colloquium current topics at the interface between Philosophy and Cognitive Science will be discussed. The colloquium hosts talks by visiting leading experts and local researchers as well as presentations by doctoral and master students. Students will be given the (assisted) opportunity to present their projects in English.