# Course Guide – Master Cognitive Science

Winter 2017/18

16.10.2017

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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.

FIRST YEAR PROGRAM

Every student is strongly recommended to participate in the preparatory courses. Exceptions have to be approved by Dr. Tobias Starzak (tobias.starzak@rub.de) or by Prof. Dr. Albert Newen (albert.newen@rub.de). The course "Academic English" need not be passed by native speakers of English. The course "Biostatistics" need not be passed by students who have a standard BA in psychology.

Additional Courses

Every student is strongly recommended to consider participation in the following new additional courses:

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<td>SEMINAR</td>
<td>PHILOSOPHY OF PERCEPTION (030 095)</td>
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<td>J. PROF. PETER BRÖSSEL</td>
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<td>TERM:</td>
<td>Winter 2017/18</td>
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<tr>
<td>MEETING TIME:</td>
<td>Thursday 10-12 (First Meeting: 12.10.2017)</td>
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<tr>
<td>ROOM:</td>
<td>GA 04/187</td>
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This research seminar discusses current topics in the philosophy of perception and it concentrates on debates at the intersection between Epistemology and Cognitive Science. In this seminar we will discuss foundational articles in the mentioned areas as well as research papers by members of the department and the Emmy Noether Research Group "From Perception to Belief and Back Again". In addition, students will have the opportunity to present a paper on a topic related to the philosophy of perception and/or epistemology. Requirement for participation is a strong background in analytic epistemology and acquaintance with formal methods (logic, probability theory) in philosophy.
Predictions are currently all over the place in neuroscience and philosophy. Over the last two decades or so, neuroscientists have developed a theory according to which the brain is a sophisticated hypothesis testing machinery that is constantly involved in predicting sensory information based on hierarchical generative models where the central aim is to minimize the error of these predictions. This approach is commonly referred to as Predictive Processing (PP). While the details vary depending on how exactly PP is spelled out, a central tenet of PP is that it is meant to explain perception, cognition, and action singlehandedly. Whether we study visual perception, attention, memory, or delusions, PP arguably describes the mechanism that implements all of these phenomena. As such, it is a powerful theoretical framework not only for neuroscientists aiming to understand the brain but also for philosophers aiming to understand the mind.

Throughout this course we will mainly focus on the version of PP proposed by Jakob Hohwy. We will be reading Hohwy’s “The Predictive Mind” (2013) and discuss about, e.g., what claims PP makes exactly, how it applies to perception, whether and how it may be used to understand other phenomena (e.g. delusions in psychiatry), how we should conceive of the mind according to PP, whether PP is a genuine theory or whether PP describes a concrete mechanism, and how PP squares with other (situated) approaches to cognition.
Preparatory Courses

Academic English

SEMINAR
ENGLISH FOR MASTER COGNITIVE SCIENCE (251 211)
ANNA SOLTYSKA

TERM: Winter 2017/18
MEETING TIME: September 22 – October 6, 8.30 – 10.30
ROOM: GA 03/140

This course takes into account the particular needs of the students of the Master Program in Cognitive Science and covers all competencies that are necessary to study in English. It focuses on productive skills that will be practiced by means of discussions and short presentations on study-related issues. Using a task-based approach, listening, reading, writing and speaking skills will be trained intensively and social and intercultural competencies will be included as well. Authentic lectures and academic texts on chosen topics related to philosophy, psychology and neuroscience will be used throughout the course.

The course will be accompanied by a Blackboard/Moodle component to enhance classroom teaching and self-study at home.
At the end of the course the participants have to write a final test that will comprise all four skills taught in class.

Literature: Materials compiled from a variety of sources will be used.

Biostatistics

SEMINAR
BIOSTATISTICS (119 212)
JAMOL BAHROMOV

TERM: Winter 2017/18
MEETING TIME: September 22 – October 6: 11.00 – 14.30
ROOM: GAFO 04/615 (“Medienraum”)

“Biostatistics” will cover the basic statistical methods used by researchers in the life sciences to collect, summarize, analyze, and draw conclusions from data. The topics include descriptive statistics, univariate statistical tests, and experimental design.
A1. Introduction to Cognitive Science

**OBLIGATORY FOR EVERY FIRST YEAR STUDENT**

**LECTURE & SEMINAR**

**INTRODUCTION TO COGNITIVE SCIENCE (LECTURE 030 007)**

PROF. ALBERT NEWEN, PROF. MARTIN BRÜNE, PROF. ONUR GÜNṬÜRĶÜN, PROF. NIKOLAI AXMACHER, PROF. NIKOL RUMMEL, PROF. SARAH WEIGELT, PROF. TOBIAS SCHLICHET, PROF. GREGOR SCHÖNER, PROF. LAURENZ WISKOTT, PROF. SEN CHENG

**TERM:** Winter 2017/18

**LECTURE:** Wednesday, 10 – 12 (First Meeting: 11.10.2017)

**ROOM:** GA04/187

**SEMINAR:** Wednesday, 12 – 14 (First Meeting: 11.10.2017)

Please notice: The seminar will have some modified times to be announced at the first meeting

**ROOM:** GA04/187

**CP:** 6

**Attention:**

- The time of the lecture will not vary but the time of the seminar will vary somewhat. The details of the seminar plan will be announced later.
- Lecture and Seminar #14 take place in LWL-Universitätsklinik Bochum, Alexandrinenstraße 1, 44791 Bochum

The lecture introduces the interdisciplinary field of cognitive science in combining philosophy, psychology, computational modeling and neuro-sciences. The course has the aim to deliver important basic knowledge from empirical sciences in the framework of theory formation. The credit points are delivered on the basis of a written examination and some active work in the obligatory additional seminar.

**The structure of the lecture:**

1. Introduction: History of Cognitive Science
2. Basic Concepts in Cognitive Science
3. Cognitive Neuroscience of Perception
4. Modeling Vision
5. Consciousness of Perception
6. Development of Vision
7. Enacted and Embodied Cognition
8. Models of Motor Control
9. Cognitive Neuroscience of Emotion
10. Theories of Emotion
11. Psychology of Learning
12. Cognitive Neuroscience of Memory
13. Models of Learning and Memory
BM. Basic Methods

Students are expected to learn (at least) three out of four basic methods: If you have a BA in psychology, you can skip the “Experimental Psychological Lab” but have to pass the three other basic methods. If you have a BA in philosophy you can skip the course “Logic” but have to learn the other three methods. Some with a BA in neuroscience can skip method BM 4. All the other students need to study all basic methods. Exceptions can be made if someone can prove to have already studied the content of a course but need explicit approval by Dr. Tobias Starzak (tobias.starzak@rub.de) or by Prof. Dr. Albert Newen (albert.newen@rub.de).

BM1. Experimental Psychology Lab

TERM: Winter 2017/18
MEETING TIME: Thursday 12-14 (First meeting: 12.10.2017)
ROOM: GAFO 02/365.
CP: 6

The Experimental Psychology Lab course aims at introducing the principles of experimental psychology. The participants will learn how to plan and conduct own experimental studies, and how to analyze the data.

As a result, all participants will write a first scientific report. The lab course will be held in small groups.
This course offers an elementary introduction to classical logic from a philosophical perspective. Students will get familiarized with the formal languages of propositional and predicate logic. The meaning of logical connectives ("and", "or", "implies", "not") and quantifiers ("for all", "there is a") will be discussed in terms of their model-theoretic semantics. A formal proof method will be introduced. A part of the course will be devoted to practical exercises. In this way students have the opportunity to internalize and consolidate their theoretical insights.

A precondition for receiving a certificate is 1.) to submit weekly homework regularly and 2.) to pass the written exam at the end of the course. The certificate can be with or without grade (dependent on the amount of work).

For literature besides the script (which will be available via the moodle online portal), see e.g.,
- Dirk Van Dalen, Logic and Structure, Springer, 2004
A basic course in neural networks is obligatory. The course of Prof. Cheng is the standard course for the students in Cognitive Science. If you are coming with more background in mathematics you feel free to choose other offers. Students only have to pass one course in BM3.

**BM3. Neural Networks**

**SEMINAR**

**COMPUTATIONAL COGNITIVE MODELING (310 024)**

**PROF. SEN CHENG**

**TERM:** Winter 2017/18

**MEETING TIME:** Monday, 14-16 (First Meeting: 16.10.2017)

**ROOM:** NB 3/57

**CP:** 3

Max. 20 students

The human mind is most intimately familiar to us, yet we understand very little about how it functions. To study the mind, the field of cognitive science pursues an interdisciplinary approach. One of the pillars of cognitive science is computational modeling. This seminar will survey models of perception, memory and action. Rather than focusing on the mathematical details, we will discuss the motivation, application and noteworthy properties of the models, including their strengths and shortcomings. Class work will include student presentations and discussions. The topics will be assigned to the students in the first meeting.

**Prerequisites:** Basic knowledge of cognition e.g., “Cognition I + II”, “Learning”.

**Assessment:** Presentation in class

**Course material:** Moodle (sign-up required)

**Textbook:** "The Cambridge Handbook of Computational Psychology" edited by Ron Sun, Cambridge University Press

+ modeling papers announced in class

**Contact:** Prof. Sen Cheng, NB 3/33, sen.cheng@rub.de
This course provides an introduction into the theoretical behavioral and functional neurosciences from a particular theoretical vantage point, the dynamical systems approach. This approach emphasizes the evolution in time of behavioral and neural patterns as the basis of their analysis and synthesis. Dynamic stability, a concept shared with the classical biological cybernetics framework, is one cornerstone of the approach. Instabilities (or bifurcations) extend this framework and provide a basis for understanding flexibility, task specific adjustment, adaptation, and learning.

The course will include tutorial modules that provide mathematical foundations. Theoretical concepts will be exposed in reference to a number of experimental model systems which will include the coordination of movement, postural and configurational stability, the perception of motion, and elementary forms of spatial cognition. In the spirit of Braitenberg’s “synthetic psychology”, autonomous robots will be used to illustrate some of the ideas.

Exercises will be integrated into the lectures. They will consist of elementary mathematical exercises, the design of (thought) experiments and their analysis, and the design of simple artificial systems, all on the basis of the theoretical framework exposed in the main lectures.
Aim of this lecture is to get an insight in the organization of the human brain, functional neuroanatomy and neuropsychology. Starting with an overview of basic methods used in neuroscience, the full brain starting at the occipital lobe and ending at the frontal lobe will be explored with respect to its functional organization. Beside functional organization, neuropsychological syndromes like neglect apraxia and amnesia will be discussed.

Literature:
Kim Sterelny’s ambitious book *Thought in a hostile world* (Blackwell, 2003) pursues four goals: it aims to develop analytic tools for thinking about cognition and its evolution, to develop a theory of human uniqueness, explore the relationship between so-called folk-psychology and an integrated scientific conception of human cognition, and present an alternative to nativist, modular versions of evolutionary psychology. In the seminar we’ll read and critically discuss selected parts of the book covering all four topics.

This seminar is a research-oriented seminar which especially enables the participants to develop a project which leads into a BA-thesis or a master-thesis. It has a focus in philosophy but will involve some psychological texts as well. The main topic is the discussion of modern theories of human self-consciousness and of understanding others. Self-consciousness can be defined as the ability to consciously represent one’s own states, especially (but not only) mental states, as one’s own (Newen, Vogele 2003). Concerning self-consciousness, we can distinguish four central questions which allow us to illustrate the wide range of this central debate:

The epistemological question: Do we have a privileged access to our own mental phenomena such that only we can know with certainty which mental phenomena we have?

The ontological question: Is there a self as an ontologically irreducible entity?

The cognitive question: How can we investigate the natural basis of self-c. with the methods of empirical psychology and cognitive neuroscience?

The question about personal identity: What is the criterion of being a person and of remaining the same person? In the seminar we will discuss texts concerning the first three dimensions of human self-consciousness.

Since the working hypothesis is that self-understanding and understanding others are two sides of the same coin, we will discuss theories of understanding others in the second part of the seminar: For decades we had an intense debate between Theory-Theory (TT) and Simulation-Theory (ST). The central claim of TT is that the process of understanding others is essentially relying on a theory. Simulation-Theory (ST) claims that we understand other by putting “ourselves into the shores of the other”. We will discuss the main deficits of these theories. Then we will discuss more recent developments in theories of understanding other, e.g. the theory of direct perception (Shaun Gallagher 2008), the narrative theory (Dan Hutto 2008) and the person model theory (Newen/Schlicht 2009). A leading background question is whether we can systematically develop the bridges between understanding oneself and understanding others.

Details for receiving a certificate will be presented at the beginning of the seminar. Bachelor-students will receive 4 credit points for a determined package of work while master students will receive 6 credit points for a higher workload. The workload involves the standard tools of oral presentations and essay writing. Presentations and discussions will be in English.

To prepare the participation please read the following texts:
http://plato.stanford.edu/entries/self-consciousness-phenomenological/

Literature: The articles and the seminar plan will be available via moodle for the participants.
Predictions are currently all over the place in neuroscience and philosophy. Over the last two decades or so, neuroscientists have developed a theory according to which the brain is a sophisticated hypothesis testing machinery that is constantly involved in predicting sensory information based on hierarchical generative models where the central aim is to minimize the error of these predictions. This approach is commonly referred to as Predictive Processing (PP). While the details vary depending on how exactly PP is spelled out, a central tenet of PP is that is meant to explain perception, cognition, and action singlehandedly. Whether we study visual perception, attention, memory, or delusions, PP arguably describes the mechanism that implements all of these phenomena. As such, it is a powerful theoretical framework not only for neuroscientists aiming to understand the brain but also for philosophers aiming to understand the mind.

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This lecture presents standard algorithms and new developments of feedforward Artificial Neural Networks, their functioning, application domains, and connections to more conventional mathematical methods. Examples show the potential and limitations of the methods. Supervised as well as unsupervised learning methods are introduced. In detail:

1) Introduction, some biological facts
2) Mathematical foundations: probability theory and partial derivatives
3) One layer networks and linear discriminants
4) Multilayer networks and error backpropagation
5) Universality of two-layer networks
6) Radial basis function networks
7) Neuronal maps: Kohonen network, Growing Neural Gas
8) Optimization methods

Learning objectives:
Theoretical understanding of feedforward neural networks, practical skills in computer implementations

Soft skills:
Each student must present the results of one exercise.

Individual competences:
Programming selected routines in C++, theoretical understanding of feedforward Neural Networks
Perception of sensory inputs can be studied along three different dimensions: modality, description level and methodology. This lecture will discuss several different examples along each dimension and highlight common principles, when possible. Modalities include, for instance, vision, audition, olfaction and proprioception. The description level will range from receptor physiology to Gestalt psychology. The methodology will include psychophysics, electrophysiology and computational modeling.

**Prerequisite:** [no special prerequisite]

**Assessment:** final exam

**Attendance:** optional, but highly recommended

**Course material:** Moodle (sign-up required)

**Textbook:** Sensation and Perception by E. Bruce Goldstein, 8th or 9th ed, Wadsworth

**Contact:** Prof. Sen Cheng, NB 3/33. sen.cheng@rub.de
Of all modalities vision is best studied, perhaps due to the dominance of the visual sense in humans. Even so much is still unknown about the neural basis of vision and visual plasticity. The goal of this seminar is to introduce students to the classic and current research literature. Therefore, a range of experimental approaches will be covered, including electrophysiology and imaging techniques such as fMRI, EEG and MEG.

The topics will be assigned to the students in the first meeting.
The practical course gives an introduction to mobile robotics with a focus on dynamical systems approaches. In the exercises, the computing environment Matlab is used to control e-puck miniature mobile robots, equipped with a differential drive, combined infrared/proximity sensors and a video camera. The course covers elementary problems in robot odometry, use of sensors and motor control. It then teaches basic dynamic methods for robot navigation, in which the robot’s sensors are used for obstacle avoidance and approach to a target location.

Interested students who do not have experience in Matlab should attend the Matlab introduction of the lab exercise Computer Vision (typically the week before this course). Details about availability and credit points have to be clarified early via email.

Contact: mathis.richter@ini.rub.de

Enrollment: 01.12.2017-12.01.2018 e-mail mathis.richter@ini.rub.de
Most of our brain’s processes are executed by different mechanisms in the left and the right hemisphere. Language, spatial orientation, motor control, emotional processing, face perception, and even the ability to comprehend the rhythm of a drum are guided by neural circuits that are differently tuned within the two hemispheres. These asymmetries of mental processing mean that damages of the human brain cannot be understood without a thorough understanding of asymmetries. The lecture aims at explaining the current knowledge about the structure and the mechanisms of cerebral asymmetries by making use of highly interactive teaching methods.
This research seminar discusses current topics in the philosophy of perception and it concentrates on debates at the intersection between Epistemology and Cognitive Science. In this seminar we will discuss foundational articles in the mentioned areas as well as research papers by members of the department and the Emmy Noether Research Group “From Perception to Belief and Back Again”. In addition, students will have the opportunity to present a paper on a topic related to the philosophy of perception and/or epistemology. Requirement for participation is a strong background in analytic epistemology and acquaintance with formal methods (logic, probability theory) in philosophy.
Colors, sounds and tastes accompany us from earliest childhood on and belong to the most familiar things we know. But what are colors, sounds and tastes? Do they even exist? Is there a sense in which we can conceive of them as existing in a mind-independent way even if what they are depends on the structure of the human perceptual system? Do facts about colors, sounds and tastes supervene on physical facts? Does the experience of an object having a certain color or an event making a certain sound add anything new to our knowledge of the physical world? How do those puzzles regarding the metaphysics and epistemology of colors, sounds and tastes relate to psychological and neuroscientific findings?

Another topic of the seminar will be the cross-modal interaction between colors, sounds and tastes. Why are there loud colors, dark sounds and sweet tunes? Aside from linguistic examples of synesthetic metaphors, we will also discuss the phenomenon of synesthetic perception and the interaction of action and perceptual domains.

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

Readings:
In this seminar we will discuss a common variety of motivated and irrational route to belief formation and maintenance commonly known as Self-deception. According to several authors we often deceive ourselves about our own performance and skills. However, the possibility of Self-deception poses serious philosophical problems because it is thought to lead to paradox. We will examine the arguments behind this position and focus on one of the way to avoid the paradoxes, namely, the deflationary view. Afterwards, we will discuss how the deflationary view of Self-deception can be accommodated within the prediction-error minimization (PEM) framework for modelling cognition. As we shall discover, Self-deception may have an important function for adaptive behavior and it can happen according to four main strategies, each of which can be adequately modelled in the PEM framework.

Suggested literature:


Enactivism is a view about cognition, according to which all cognition is essentially an activity, i.e. action-involving. It is also closely related to the claims that cognition is essentially embodied and embedded. Proponents of this view typically criticize the dominant representational approach to mental phenomena, calling for a paradigm shift in the cognitive sciences.

The basis of this seminar will be the book Evolving Enactivism. How Basic Minds meet Content (MIT Press 2017), written by Daniel D. Hutto (Wollongong) and Erik Myin (Antwerp). We will study this book and discuss it with the authors, at a workshop (December 4-6, 2017) at RUB in which Hutto and Myin will present and discuss their manuscript with us in the form of several talks. In this way, students can engage with state-of-the-art research.

About the book:
A powerful new chapter in the emerging radical enactivist story, this book supplies a positive account of how Hutto and Myin’s revolutionary rethink of the roots of mentality can accommodate higher qualities of human cognition. Developing its duplex vision of mind, the book’s detailed analyses show the gains of explaining cognitive phenomena –perceiving, imagining, remembering – as an interface between contentless and content-involving forms of cognition. Crucially, Hutto and Myin explicate how it is possible for contentful minds to arise, through socio-cultural scaffolding, without introducing mysterious gaps in nature. They give fundamental answers to questions about the production of representational meaning in relation to embedded, relational and dynamic forms of embodied engagement, both of which are paramount for understanding human culture.

The target group of the seminar are Master students both from Philosophy and cognitive science. Psychology students are very welcome. All interested students should have an interest in the topic, a reasonable command of the English language and some preliminary knowledge about cognitive science. The text will be supplied in the first session.

Introductory Literature:
Humans represent without a doubt the pinnacle in the evolution of higher cognitive functions. However, other non-human animals, even outside the primate order, also possess surprisingly complex forms of higher cognition. Within this seminar, selected studies on the occurrence of such complex cognitive skills will be presented by students, focusing on species like chimpanzees, parrots, crows and dolphins. Furthermore, the seminar aims to clear up some of the myths about what animals are capable of and what is beyond their reach. In addition to behavioral data, the seminar will also deal with the question what the neuronal underpinnings of such skills are, and if there are any neuronal similarities between species expressing complex cognition. By dealing with these topics, participants of the seminar will get an overview of the cognitive abilities of non-human animals and learn that many of the cognitive skills considered unique to humans actually developed much earlier during evolution. The seminar will be held in English and students are required to give a talk on preselected literature.
This course covers a variety of unsupervised methods from machine learning such as principal component analysis, independent component analysis, vector quantization, clustering, self-organizing maps, growing neural gas, Bayesian theory and graphical models. We will also briefly discuss reinforcement learning.

The mathematical level of the course is mixed but generally high. The tutorial is almost entirely mathematical. Criteria for a certificate for the tutorial are an active participation, in particular presentation of selected exercises, and at least 50% in the final exam.
This practical participation-based course will provide an applied overview of the psychological foundations of learning and behaviour, touching on the neurophysiological basis of learning and memory processes with a view to potential applications in technology, therapy and other areas. Participants will present on various aspects of learning and behaviour such as habituation, sensitization, conditioning and extinction and place our understanding of these mechanisms in a relevant real-world context. This course will aim at an overview of general knowledge, as well as an in-depth look at early and current examples of research studies.

Learning Objectives

1. Acquire general content knowledge about the field of ‘Learning’ and ‘Behaviour’ within a psychological context.
2. Find, read and understand more specific in-depth knowledge related to content by looking at published experiments (primary source materials).
3. Comfortably, clearly and concisely present about both general and in-depth knowledge to peers.
4. Engage in classroom discussion, expanding upon and applying topics to experience.
Traditionally, philosophers and linguists have distinguished between the semantics of a sentence, i.e., what the sentence means, and the pragmatics of an utterance, i.e., what a speaker means by uttering a sentence. Semantics was supposed to explain the intuitive truth-conditions of a sentence. An important constraint was the principle of compositionality according to which the meaning of a complex expression is determined by the meanings of its parts and the way they are combined. Pragmatics was supposed to concern only secondary processes such as implicatures or presuppositions that come with the utterance of a sentence. More recently, however, this line of demarcation between semantics and pragmatics has been challenged. Truth-conditional pragmatists (Recanati, 2010) argue that pragmatic factors can modulate meaning at any stage of sentence meaning composition and thus have a direct influence on the intuitive truth conditions of sentences. Semantic minimalists (Borg, 2004, 2012), in contrast, defend the classical view of bottom-up compositionality. Most recently, this controversy has also been investigated within a probability-theoretic framework (Frank & Goodman, 2012) and with empirical methods such as EEG (Cosentino, Baggio, Kontinen, & Werning, 2017).

The seminar will explore the whole span of the philosophy of pragmatics from its beginnings with Grice (1996a, 1996b) to the most recent debates. Aside from active participation, participants will be expected to give a presentation in English. Assistance regarding the English language will be provided.

Readings:
The study of reasoning – which is closely related to thinking and problem solving – is an integral part of cognitive science. This seminar focuses on central paradigms in this area, such as the Wason selection task and the conditional inference paradigm. Both, empirical investigations and conceptual approaches to these paradigms, are discussed. This includes philosophical approaches, such as semantics for indicative and counterfactual conditionals, as well as accounts from psychology, such as mental model theory. Furthermore, students with a bachelor or master thesis project with a focus on reasoning (broadly construed) will have the opportunity to present and discuss their projects.

References
Further literature references will be given in the first session.
**AM. Advanced Methods**

Advanced methods are usually studied in the second semester. The following two courses are exceptions, while the "fMRI"-course is only offered in the winter term.

**Remarks for AM5**

There is a laboratory lab class on molecular genetics offered within the semester break for students with a background knowledge in biology, molecular biology or psychobiology. The class will be held in German language. Participation in this basic lab class is required for attending the advanced lab class next summer semester.

**Remarks for AM7**

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: rebekka.heinen@rub.de

Students who would like to acquire basic background knowledge in the field of neuroimaging, are recommended to attend the seminar “Bildgebende Verfahren in der Neuropsychologie” (held in german language) from section D1 (lecturer: Prof. Boris Suchan).

Further advanced methods can be found in the program from the last summer semester on our webpage: [http://www.ruhr-uni-bochum.de/philosophy/mcs/program_courses.html](http://www.ruhr-uni-bochum.de/philosophy/mcs/program_courses.html). They will again be offered in the upcoming summer semester.
Language of the lab class is GERMAN.


Vorbesprechung ist am 20.10.2016 um 16:00 Uhr

Der einwöchige Kurs (Mo-Fr 9:00 bis 13:00) findet im Anschluss an das Wintersemester in den Semesterferien statt und ist auf 6 Teilnehmer beschränkt.

Teilnahmevorraussetzung: gute bis sehr gute Kenntnisse in Biologie/Molekularbiologie/Psychobiologie. Praktikumssprache ist Deutsch.
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<tr>
<th>Term:</th>
<th>Winter 2017/18</th>
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<tbody>
<tr>
<td>MEETING TIME:</td>
<td>Monday, 14-16 (First meeting: 09.10.2017)</td>
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<tr>
<td>Room:</td>
<td>GAFO 05/609</td>
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<tr>
<td>Max. participants:</td>
<td>Max. 14 participants</td>
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<tr>
<td>CP:</td>
<td>t.b.a.</td>
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(see remarks for AM7 on page 23)

Practical course and seminar have to be attended both together. They cannot be taken individually.

Please also see remarks for AM7 above.

The practical course will be given in English. It introduces into the practical usage of the advanced neuroscientific imaging technique MRI. It is combined with the following seminar into an educational package. It should be taken by students who aim to do a master project with MRI technique.

Practical course and seminar have to be attended both together. They cannot be taken individually. Please also see remarks for AM7 above.

This seminar is held in English. It introduces into the theory of the advanced neuroscientific imaging technique MRI. It is combined with the practical course above into an educational package. It should be taken by students who aim to do a master project with MRI technique.

D1. Free Selection

There is one free selection module in the program which can take any course of the program you passed and do not need to complete the modules. If there is a problem to complete a module, in principle, the courses in the free selection module can be used for obligatory modules. But this has to be explicitly confirmed in advance by Dr. Tobias Starzak or Prof. Albert Newen. Students are only allowed to take maximally 3 German courses in the whole program up to maximally 12 credit points.

**D1. Free Selection**

**SEMINAR**  
**DISKURS NEUROPSYCHOLOGIE (118 611)**  
**PROF. NIKOLAI AXMACHER**

**TERM:** Winter 2017/18  
**MEETING TIME:** Thursday, 10.00 – 12.00 (First Meeting: 12.10.2017)  
**ROOM:** GAFO 05/609  
**CP:** 3

Die Vorlesung soll einen Überblick über die Lerngesetze, ihre Anwendungsmöglichkeiten in therapeutischen Verfahren und die hirnphysiologischen Grundlagen von Lern- und Gedächtnisprozessen bieten. Soweit möglich, sollen alle drei Aspekte immer zusammen besprochen werden; z.B. werden bei der klassischen Konditionierung zuerst die historischen Entwicklungslinien, dann die Details des eigentlichen Lernphänomens, dann die therapeutischen Anwendungen (z.B. systematische Desensibilisierung) und anschließend die synaptischen Mechanismen referiert.

Begleitend zur Vorlesung "Lernen" von Prof. Dr. Güntürkün soll dieses Seminar verschiedene Fragen zur wissenschaftlichen Auseinandersetzung mit dem Thema Lernen vertiefen. Dazu werden die Studierenden wissenschaftliche Artikel und Kapitel aus Lehrbüchern in Referatsform vortragen.

Literatur:
D1.

SEMINAR

SEMINAR NEUROPSYCHOANALYSE (118 915)
PROF. NIKOLAI AXMACHER

TERM: Winter 2017/18
MEETING TIME: Thursday, 16 – 18 (First Meeting: 12.10.2017)
ROOM: GAFO 05/609
CP: t.b.a.


Eine Literaturliste ist zu Beginn des Seminars erhältlich.
### LECTURE
**SOZIALPSYCHOLOGIE II (112 321)**  
PROF. JENS FÖRSTER

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<td>Meeting Time:</td>
<td>Thursday, 10.00 – 12.00 (First Meeting: 12.10.2017)</td>
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<tr>
<td>Exam:</td>
<td>Thursday, 2018, March 22, 10-12</td>
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<tr>
<td>Room:</td>
<td>HGA 10</td>
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<td>CP:</td>
<td>6</td>
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Einführende Lektüre:
A. Beckermann: Analytische Einführung in die Philosophie des Geistes. 3. Auflage. Berlin 2008
**SEMINAR**

**PHILOSOPHIE DES GEISTES. EINSCHLÄGIGE TEXTE (030 042)**

**PROF. TOBIAS SCHLICHT**

**TERM:** Winter 2017/18  
**MEETING TIME:** Tuesday, 12-14 (First Meeting: 10.10.2017)  
**ROOM:** GA 3/143  
**CP:** 6

In diesem Seminar werden, begleitend zur Vorlesung, zur Vertiefung des Stoffes, zentrale Texte aus der Analytischen Philosophie des Geistes der letzten 50 Jahre studiert, u.a. von Smart, Searle, Millikan, Fodor, Kim u.a.

Begleitende Lektüre:

**VORLESUNG**

**GRUNDLAGEN DER NEURO- UND SINNESPHYSIOLOGIE (112241)**

**DR. TAGRID YOUSEF**

**TERM:** Winter 2017/18  
**MEETING TIME:** Wednesday, 8-10 (First meeting: 18.10.2017)  
**Exam:** Wednesday, 28.03.2018, 8 – 10, HGA 20  
**ROOM:** HGA 10  
**CP:** 3


I. Interdisciplinary Research Module

If a student wants to use a course from C1 to C4 as a substitute for I1 to I4, this is possible if the substitute course is closely connected with the master thesis project.

I1. Cognitive Philosophy

**COLLOQUIUM**

PHILOSOPHY AND THE COGNITIVE SCIENCES – RECENT DEBATES AND LEARNING TO MAKE A PRESENTATION IN ENGLISH (030 127)

PROF. ALBERT NEWEN, PROF. MARKUS WERNING

**TERM:** Winter 2017/18  
**MEETING TIME:** Thursday, 16 – 18 (First Meeting: 12.10.2017)  
**ROOM:** GA 04/187  
**CP:** 6

The colloquium will offer regular presentations given partly by Bochum MA and PhD students and partly by external guests. The presentations will all be in the general domain of theoretical philosophy and the cognitive sciences with a focus on language and concepts. The presentations should ideally, but not necessarily have some interdisciplinary dimension such that perspectives from philosophy, psychology, linguistics and neurosciences can be systematically interconnected. The aim of the colloquium is to offer a platform for the discussion of ongoing research and to support the education of students at the Master and PhD level. Students who are accepted for a presentation in this seminar will receive a special training in preparing presentations in English.

PhD-students who are interested in presentations should write an email to both organizers (albert.newen@rub.de and markus.werning@rub.de) and come to the first meeting. The semester program will be fixed then. PhD-students can receive 2 credit points for an active participation. MA students can receive 4-6 CP for a presentation in the colloquium (to receive a mark, MA students have to write an additional essay). Topics can be freely chosen such that MA students can develop a talk in the area of their MA project.

Language: The presentations in the colloquium and the discussion will be in English. Questions can be raised in German, but will then be translated for the whole audience.
### I2. Cognitive Psychology

#### COLLOQUIUM

**RESEARCH COLLOQUIUM GENETIC PSYCHOLOGY (118 913)**  
**PROF. ROBERT KUMSTA**

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<td>MEETING TIME:</td>
<td>Monday, 16.00 – 18.00 (First Meeting: 09.10.2017)</td>
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<tr>
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This course serves to present the current research work and qualification theses (Bachelor, Master theses, PhD project) of the Genetic Psychology unit. Moreover, invited scientists will present the latest research results in the area of Genetics, Epigenetics and Development Psychobiology. An overview of the topics and speakers will be announced with posters and on the Homepage.

#### LECTURE

**LEFT BRAIN - RIGHT BRAIN (118 111)**  
**PROF. ÖNRÜ GÜNTÜRKÜN**

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| MEETING TIME: | Thursday, 12 – 14 (First meeting: 19.10.2017)  
Exam: Monday, 19.03.2017, 16 – 18, HGA 10 |
| ROOM: | GAFO 03/252 |
| CP: | 3 |

Most of our brain's processes are executed by different mechanisms in the left and the right hemisphere. Language, spatial orientation, motor control, emotional processing, face perception, and even the ability to comprehend the rhythm of a drum are guided by neural circuits that are differently tuned within the two hemispheres. These asymmetries of mental processing mean that damages of the human brain cannot be understood without a thorough understanding of asymmetries. The lecture aims at explaining the current knowledge about the structure and the mechanisms of cerebral asymmetries by making use of highly interactive teaching methods.
The content of this course is to present current research work in the spheres of neuropsychology and talks by guest professors on clinical neuropsychological topics. The schedule with information on the topics and speakers will be posted on the information board and at http://www.ruhr-uni-bochum.de/neuropsy/ before the start of the WS. The central educational goal of this course – and as such the basis for a successful participation and awarding of credits – is regular active contribution to the scientific discourse. Therefore, regular attendance in the scope of at least 2/3 of the sessions is required.
Humans represent without a doubt the pinnacle in the evolution of higher cognitive functions. However, other non-human animals, even outside the primate order, also possess surprisingly complex forms of higher cognition. Within this seminar, selected studies on the occurrence of such complex cognitive skills will be presented by students, focusing on species like chimpanzees, parrots, crows and dolphins. Furthermore, the seminar aims to clear up with some of the myths about what animals are capable of and what is beyond their reach. In addition to behavioral data, the seminar will also deal with the question what the neuronal underpinnings of such skills are, and if there are any neuronal similarities between species expressing complex cognition. By dealing with these topics, participants of the seminar will get an overview of the cognitive abilities of non-human animals and learn that many of the cognitive skills considered unique to humans actually developed much earlier during evolution. The seminar will be held in English and students are required to give a talk on preselected literature.
In this forum, scientific projects (i.e. Master and PhD projects) of the Cognitive Psychology work group will be presented. The main focus is on experimental stress studies. Here we will try to answer the questions, “what makes us stressed” and “how does stress affects our cognitive skills”. In addition, invited guests from our faculty, from other faculties of the RUB and from other universities world wide will present their current research findings on topics that relate to cognitive psychology or psychoneuroendocrinology.

An overview of the schedule will be available on the AE homepage at the beginning of the semester.

The seminar will be held in the English language.

Students in the 3rd semester who think about conducting their master thesis with our AE can participate.
This course covers a variety of unsupervised methods from machine learning such as principal component analysis, independent component analysis, vector quantization, clustering, self-organizing maps, growing neural gas, Bayesian theory and graphical models. We will also briefly discuss reinforcement learning.

The mathematical level of the course is mixed but generally high. The tutorial is almost entirely mathematical. Criteria for a certificate for the tutorial are an active participation, in particular presentation of selected exercises, and at least 50% in the final exam.
This lecture presents standard algorithms and new developments of feedforward Artificial Neural Networks, their functioning, application domains, and connections to more conventional mathematical methods. Examples show the potential and limitations of the methods. Supervised as well as unsupervised learning methods are introduced.

In detail:
1) Introduction, some biological facts
2) Mathematical foundations: probability theory and partial derivatives
3) One layer networks and linear discriminants
4) Multilayer networks and error backpropagation
5) Universality of two-layer networks
6) Radial basis function networks
7) Neuronal maps: Kohonen network, Growing Neural Gas
8) Optimization methods

The course will be given in English upon request.

Grades and credits are given according to the percentage of solved problems in exercise 310012 and presentation of a solution during the exercise.

Literature suggestions:
C. M. Bishop, Neural Networks for Pattern Recognition, 1995 Clarendon Press, Oxford.
S. Haykin, Neural Networks and Learning Machines, 3rd edition, 2003, Pearson, New Jersey
The practical course gives an introduction to mobile robotics with a focus on dynamical systems approaches. In the exercises, the computing environment Matlab is used to control e-puck miniature mobile robots, equipped with a differential drive, combined infrared/proximity sensors and a video camera. The course covers elementary problems in robot odometry, use of sensors and motor control. It then teaches basic dynamic methods for robot navigation, in which the robot’s sensors are used for obstacle avoidance and approach to a target location. Interested students who do not have experience in Matlab should attend the Matlab introduction of the lab exercise Computer Vision (typically the week before this course).

Enrollment: 01.12.2017 – 12.01.2018 e-mail: mathis.richter@ini.rub.de
We will discuss the latest research results in learning and memory at the systems level. Each session will consist of either a journal club based on a published article or a research talk. Journal club meetings will include a presentation of the article by one participant and a discussion by all. Research talks will be given by members of the computational neuroscience group or external invited guests. Some meetings will be held via video conferencing with participants from the USA. To accommodate the schedule of external participants, some meetings might have to be moved to a different date and time.

The topics will include a diverse set of approaches: electrophysiology, imaging, computational modeling, and robotics. They will be selected particularly in the areas of spatial and episodic memory with a focus on the functional role of the mammalian hippocampus. The topics can be selected by the students in agreement with the instructor.

**Enrolment:** VSPL

**Assessment:** presentation in class

**Attendance:** mandatory, min. 66%

**Contact:** Prof. Sen Cheng, NB 3/33, sen.cheng@rub.de

**Office hours:** Thursdays 14-15 or by appointment
The research colloquium is open to all employees and graduate students of the Biopsychology department. The aim is to present and discuss their research. In addition external guests are invited to give talks on different aspects of biopsychology. You can have a look at the schedule at the department’s information board and our homepage: http://www.bio.psy.ruhr-unibochum.de/

In dieser Veranstaltung werden laufende Forschungsprojekte, die sich für eine M.Sc. Arbeit eignen, vorgestellt. Ein zentrales Lernziel dieser Veranstaltung - und damit auch Grundlage für die erfolgreiche Teilnahme und Leistungsbewertung - ist die regelmäßige aktive Beteiligung am wissenschaftlichen Diskurs. Daher ist eine regelmäßige Anwesenheit im Umfang von mindestens zwei Dritteln der Termine notwendig.

Voraussetzungen: Interesse an neurowissenschaftlicher Master-Arbeit
Literatur: wird in der Veranstaltung bekannt gegeben.
We will discuss the latest research results in learning and memory at the systems level. Each session will consist of either a journal club based on a published article or a research talk. Journal club meetings will include a presentation of the article by one participant and a discussion by all. Research talks will be given by members of the computational neuroscience group or external invited guests. Some meetings will be held via video conferencing with participants from the USA. To accommodate the schedule of external participants, some meetings might have to be moved to a different date and time. The topics will include a diverse set of approaches: electrophysiology, imaging, computational modeling, and robotics. They will be selected particularly in the areas of spatial and episodic memory with a focus on the functional role of the mammalian hippocampus. The topics can be selected by the students in agreement with the instructor.

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