Course Guide

Master Cognitive Science

Summer 2024

Version as of 08.04.2024

Enrollment for Courses

Students are requested to register with the university's eCampus-system and should be aware of the deadlines. Exceptions include the courses in neural computation, e.g. held by Prof. Wiskott and Prof. Schöner. Here, there will be **no eCampus registration**, but a manual enrollment in the first session/ enrolment via e-learning platform.

Please notice that one and the same course can only be used to be part of one module for each student. Double use of the same course is not allowed.

If you have studied at the RUB during your Bachelor's, please be aware that you are not allowed to take classes you have already completed in the Bachelor program again in the Master program.

IMPORTANT: The summer term starts on 01.04.2023. Please consult eCampus for up-to-date information regarding the course format, starting dates and further detail.

Please remember always to check time, place, and CP for your classes in eCampus and/or with the respective course instructor. These details in the course guide are subject to change and for your convenience only.

FIRST YEAR PROGRAM

Remarks for Essay Writing

For all students who need to learn how to write an essay or still feel insecure about it, we recommend in the summer term the following seminar:

"Writing a Bachelor or Master Thesis in English" by Prof. Dr. Christian Straßer and Prof. Dr. Dunja Šešelja. It can be evaluated as AM1 course.

C. Topics Selection

C1

C1. Social Cognition & Meta-Science

SEMINAR

SOCIAL NEUROSCIENCE (11902)

LAURA STEVENS

TERM:	Summer 2024
MEETING TIME:	Thursday, 10.30 – 12.00 (First Meeting: 18.04.2024)
ROOM:	GAFO 04/425
CP:	3

Social neuroscience is a rapidly growing field that integrates principles from psychology, sociology, and neuroscience to understand the neural basis of social behavior and interactions. The aim of this seminar is to provide an overview of this interdisciplinary field and the methods commonly used, as well as to discuss current research and future directions. The seminar will cover topics such as empathy, emotion recognition and contagion, social connection (e.g., loneliness and love), and social touch. It will also address neural mechanisms of impaired social functions due to trauma or psychological disorders. Methods such as behavioral tasks, neuroimaging (fMRI, fNIRS), EEG, tDCS, and psychophysiological measures will be explored and illustrated by discussing recent papers critically.

C1

C1. Social Cognition & Meta-Science

SEMINAR

EINFÜHRUNG IN DIE PHILOSOPHIE DER KÜNSTLICHEN INTELLIGENZ (030109)

JUN. PROF. DR. JOACHIM HORVATH

TERM:	Summer 2024
MEETING TIME:	Wednesday, 14-16 (First Meeting: 10.04.2024)
ROOM:	GABF 05/707
CP:	3 or 6

Language of instruction: German

In diesem einführenden Seminar wollen wir uns mit grundlegenden philosophischen Fragen und Problemen beschäftigen, die sich aus der rasanten Entwicklung und stark zunehmenden alltäglichen Anwendung von Systemen der Künstlichen Intelligenz (KI) ergeben. Dabei werden wir unter anderem die folgenden Themen behandeln: Was ist KI, wie funktioniert sie und was kann sie schon? Welche Risiken und Chancen ergeben sich aus ihrer Anwendung? Führt der Einsatz von KI zum „Ende der Arbeit" – und welche Fragen der sozialen Gerechtigkeit ergeben sich daraus? Kann aus KI eine Superintelligenz entstehen, die eine existenziellen Bedrohung für uns darstellt? Können KI-Systeme Geist und Bewusstsein entwickeln – und kann vielleicht auch unser eigener Geist „digitalisiert" werden? Welche Bedeutung haben KI-Systeme im Bildungsbereich und für unser Verständnis von geistiger Urheberschaft?

C1

C1. Social Cognition & Meta-Science

SEMINAR

DISKURS JOURNAL CLUB SOCIAL NEUROSCIENCE (118164)

PROF. DR. DIRK SCHEELE

TERM:	Summer 2024
MEETING TIME:	Wednesday, 12 – 14 (First Meeting: 10.04.2024)
ROOM:	GAFO 04/425
CP:	3

Language of instruction: German

In diesem Seminar wird über aktuelle Forschungsergebnisse der sozialen Neurowissenschaften diskutiert. Der Schwerpunkt liegt auf Studien, welche den Einfluss von sozialer Bindung und traumatischen Erfahrungen auf sensorische und interozeptive Wahrnehmung (bspw. Berührungen), episodisches Gedächtnis und soziale Synchronizität bei gesunden Proband*innen und Patient*innen mit psychischen Erkrankungen untersuchen. Neben den Befunden von klassischen univariaten Analysen werden die Ergebnisse von multivariaten fMRT-Auswertungen (bspw. MVPA) und innovative Protokolle von nicht-invasiver Hirnstimulation besprochen. Die genaue Auswahl der Literatur findet in Absprache mit den Teilnehmer*innen statt. Aktuelle Publikationen werden besprochen und methodenkritisch analysiert.

C1

Social Cognition & Meta Science

LECTURE

SOCIAL EPISTEMOLOGY OF SCIENCE (030007)

PROF. DR. DUNJA ŠEŠELJA

TERM: Summer 2024

MEETING TIME: Thursday, 16:00 – 18:00 (First Meeting: 11.04.2024)

ROOM: GABF 04/358

CP: 3 or 6

This course provides a systematic introduction to social epistemology of science, which studies the interplay between social dynamics (within science and at the interface of science and society) and scientific inquiry. Through interactive lectures, you will learn about the central problems in this field and explore philosophical discussions situated at the intersection of philosophy of science and social epistemology. The themes covered in the course range from the relationship between science and society and the role of values in scientific inquiry to the social organization of science, responsibilities of scientists and issues pertaining to expert disagreements. In preparation for each class, your task is to read (parts of) scholarly papers and to complete a short assignment (which will be provided via Moodle).

Literature: The reading list will be provided during the course.

C1

C1. Social Cognition & Meta-Science

SEMINAR

EINFÜHRUNG IN DIE TIERKOGNITION MIT BLICK AUF DIE MENSCH-TIER-BEZIEHUNG (030102)

MAJA GRIEM, M.A.

TERM:	Summer 2024
MEETING TIME:	Tuesday, 10 – 12 (First Meeting: 09.04.2024)
ROOM:	GABF 05/703
CP:	3 or 6

Language of Instruction: German

Tiere genießen seit jeher einen hohen Stellenwert in unserem Alltagsleben. Sie werden für unterschiedlichste Aufgaben eingesetzt, vom Pflügen der Felder bis hin zu Schutz- und Assistenzhunden. Nicht zuletzt sind sie für viele von uns zu Freunden, Gefährten und Familienmitgliedern geworden. Doch, was denken die Tiere eigentlich von uns? Träumen sie und wenn ja, wovon? Wie können wir andere Arten ideal für beide Seiten in unseren Alltag einbinden und wie können wir bedrohte Arten schützen und Tieren in Gefangenschaft ein besseres Leben ermöglichen? Um diese spannenden Fragen zu beantworten, müssen wir uns erst einmal damit beschäftigen, was Tiere überhaupt denken und fühlen und welche Fähigkeiten einzelne Spezies haben. Deshalb bietet dieses Seminar einen kleinen Einblick in die aktuelle empirische Forschung bezüglich Spielverhalten, Kommunikation, Empathie, und anderen soziokognitiven Verhaltensweisen. Der Fokus liegt auf Affen, Rabenvögeln, Ratten und Hunden, wird aber durch weitere Arten ergänzt und darf gerne von Teilnehmenden erweitert werden.

C1

C1. Social Cognition & Meta Science

SEMINAR

EPISTEMOLOGY OF INQUIRY (030103)

PROF. DR. DUNJA ŠEŠELJA

TERM:	Summer 2024
MEETING TIME:	Thursday, 14:00 – 16:00 (First Meeting: 11.04.2024)
ROOM:	Wasserstr. 221/4
CP:	3 or 6

How should we inquire to achieve epistemic goals? This question is situated at the intersection of the epistemology of inquiry, social epistemology and philosophy of science.

On the one hand, the recent "zetetic" turn in epistemology kick-started a series of papers examining the relationship between epistemic norms, which guide rational belief formation, and zetetic norms, which guide rational inquiry. On the other hand, norms of inquiry have long been discussed in philosophy of science within the theme of pursuit-worthiness of scientific theories (what makes theories worthy of pursuit?), and in social epistemology within the theme of social organization of science and the division of cognitive labor.

In this seminar we will discuss central papers from each of these domains, aiming to identify links between them, issues under dispute and open research questions. The seminar aims to connect traditional discussions in philosophy of science and social epistemology with the frontier of research in zetetic epistemology.

Literature: The reading list will be provided at the start of the semester.

C1

C1. Social Cognition & Meta Science

SEMINAR

HANS JONAS' (1966) PHENOMENON OF LIFE: A CONTEMPORARY REAPPRAISAL (030078)

BARTOSZ RADOMSKI

TERM:	Summer 2024
MEETING TIME:	Monday, 14 – 16 (First Meeting: 08.04.2024)
ROOM:	GABF 04/609
CP:	3 or 6

The central theme of this seminar revolves around the biophilosophy of Hans Jonas as outlined in his 1966 seminal work, "The Phenomenon of Life." Jonas proposed interpreting biological facts, such as life and mind existing in a "lifeless" universe, through the prism of existentialist philosophy. Jonas's philosophy criticized a nihilistic view of life as being devoid of intrinsic value, indifferent to its own existence, and not worth caring for. He saw the root of nihilism in a divide proclaimed by contemporary philosophy and science between a concernful human, isolated and alone, and an indifferent universe. Jonas attempted to show that, instead of a divide, there is an uninterrupted continuity between matter, life, and mind, and that all the aspects that existentialists assume to be unique to humans are already rooted in organic existence.

Jonas' views on life-mind continuity have had a major impact on generations of philosophers, finding their most clear expression in the enactive approach in the philosophy of mind. In the last few years, Jonas' biophilosophy has drawn renewed interest, and various elements of his work are being reappraised. In this seminar, we will familiarize ourselves with Jonas' analysis of metabolism, as well as contemporary interpretations, to better understand the role of the life-mind continuity thesis and its various versions in the philosophy of mind.

Students can receive either 3 CP graded for giving a presentation or 6 CP graded for submitting an essay.

Literature:

Jonas, Hans (2001). *The Phenomenon of Life: Toward a Philosophical Biology*, Evanston, IL: Northwestern University Press. ISBN 0-8101-1749-5.
Di Paolo, Ezequiel A. (2005). "The phenomenon of life" by Hans Jonas. Journal of the British Society for Phenomenology 36 (3).
Barbaras, Renaud (2010). 'Life and Exteriority: The Problem of Metabolism'. In *Enaction*, eds. John Stewart, Olivier Gapenne, and Ezequiel Di Paolo. The MIT Press, 88–122. https://academic.oup.com/mit-press-scholarship-online/book/23577/chapter/184740280 (September 29, 2023).
Coyne, Lewis (2017). Phenomenology and Teleology: Hans Jonas's Philosophy of Life. Environmental Values 26 (3):297-315.
Prokop, Mirko (forthcoming). Hans Jonas and the phenomenological continuity of life and mind. Phenomenology and the Cognitive Sciences:1-26.

C1

Social Cognition & Meta Science

SEMINAR

SOCIAL EPISTEMOLOGY OF BAD BELIEFS: FILTER BUBBLES, INFORMATIONAL CASCADES, AND IDENTITY BELIEFS (030116)

MATTEO MICHELINI, PROF. DR. DUNJA ŠEŠELJA

TERM:	Summer 2024
MEETING TIME:	Tuesday, 14:00 – 16:00 (First Meeting: 09.04.2024)
ROOM:	GABF 04/609
CP:	3 or 6

Why do individuals harbor false beliefs? Frequently, people lack the necessary evidence to form accurate ones. However, in specific instances, individuals possess ample evidence and yet persist in adopting bad beliefs—false beliefs held in contradiction to the available evidence. Think of climate change deniers. Empirical evidence indicates that most climate change deniers are aware that scientific results contrast their beliefs, but they hold them nonetheless. Why is that so? What brings people to form bad beliefs?

This course embarks on the quest to unravel this very question, drawing from the rapidly expanding philosophical literature on the subject. We'll begin by exploring what it means to respond appropriately to evidence. Subsequently, we'll review the most important philosophical accounts of bad beliefs.

These accounts take for granted that the cause of bad beliefs is not to be found in the cognitive deficiencies of the individuals, but rather in their socio-epistemic environment. Think again of climate change deniers. May it be that they hold such false beliefs because they trust the wrong experts? Or maybe because by doing so, they will get some benefits from others in the group? Or could they be stuck in a filter bubble, in which scientists are regarded as charlatans?

While the primary focus of our literature exploration will be social epistemology, we'll also draw insights from social science and social psychology. Moreover, a brief section of the course will be dedicated to examining computational models that simulate the formation of bad beliefs.

The course aims at fostering discussions among students through activities and "games" during the lectures. You will be encouraged to write and discuss various aspects of the topic. The course will be conducted in English, and the reading list will be provided as the course progresses. No prior knowledge is required to enroll.

References

Cassam, Quassim (2019). Conspiracy theories. John Wiley & Sons.
Funkhouser, Eric (2017). “Beliefs as signals: A new function for belief”. In:Philosophical Psychology 30.6, pp. 809–831.
— (2022). “Dangerous beliefs, effective signals”. In: Philosophical Psychology, pp. 1–21.
Levy, Neil (Jan. 2019). “Due deference to denialism: explaining ordinary people’s rejection of established scientific findings”. In: Synthese 196.
— (2021). “Bad beliefs: Why they happen to good people”. Oxford University Press.
— (2023). “Echoes of covid misinformation”. In: Philosophical Psychology 36.5, pp. 931–948.
Nguyen, C Thi (2020). “Echo chambers and epistemic bubbles”. In: Episteme 17.2, pp. 141–161.
Williams, Daniel (2021). “Socially adaptive belief”. In: Mind & Language 36.3, pp. 333–354.
— (2023a). “Bad Beliefs: Why They Happen to Highly Intelligent, Vigilant, Devious, Self- Deceiving, Coalitional Apes”. In: Philosophical Psychology 36.4, pp. 819–833.
— (2023b). “The marketplace of rationalizations”. In: Economics & Philosophy 39.1, pp. 99–123.

C1

C1. Social Cognition & Meta-Science

SEMINAR

PHILOSOPHY OF ARTIFICIAL INTELLIGENCE: CONCEPTS, COMPUTATION, & CONNECTIONISM (030111)

PROF. DR. MARKUS WERNING

TERM:	Summer 2024
MEETING TIME:	Wednesday 14 – 16 (First Meeting: 10.04.2024)
ROOM:	GA 04/187
CP:	3 or 6

This seminar delves into the philosophical questions surrounding Artificial Intelligence (AI), with a focus on the fundamental concepts it employs, the computational nature of intelligence, and the role of connectionism in AI development.

Key questions explored:

- What is intelligence? Can it be replicated in machines?
- What is the nature of computation? How is it related to thought and reasoning?
- Do AI systems possess concepts. Do they have cognition?
- What are the philosophical implications of symbolic and connectionist approaches to AI?
- Can AI achieve consciousness, free will, and true understanding?
- What are the ethical and societal implications of advanced AI?

Through critical discussions, readings, and presentations, you will engage with:

- Classical philosophers like Turing, Fodor, Searle
- Contemporary thinkers in AI and cognitive science
- Symbolic AI: Knowledge representation, reasoning systems, and compositionality
- Connectionist AI: Artificial neural networks, deep learning, and large language models
- Philosophical debates on consciousness, intentionality, and the mind-body problem

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

Literature:

- Buckner, C. J. (2024). *From deep learning to rational machines: What the history of philosophy can teach us about the future of artifical intelligence*. New York, NY: Oxford University Press.
- Horgan, T., & Tienson, J. (1996). *Connectionism and the Philosophy of Psychology*. Cambridge, MA: MIT Press.
- Macdonald, C., & Macdonald, G. (Eds.). (1995). *Connectionism*. Cambridge, MA: Blackwell.
- Werning, M., Hinzen, W., & Machery, M. (Eds., 2012). The Oxford Handbook of Compositionality. Oxford: Oxford University Press.

C1

C1. Social Cognition & Meta-Science

LECTURE

PHILOSOPHIE UND WISSENSCHAFT DES BEWUSSTSEINS (030008)

PROF. DR. TOBIAS SCHLICHT

TERM:	Summer 2024
MEETING TIME:	Thursday, 10 - 12 (First meeting: 11.04.2024)
ROOM:	HGA 30
CP:	3

Language of Instruction: German

Das bewusste Erleben gilt als das zentrale Rätsel in der modernen Philosophie des Geistes. Zudem wird es als empirischer Forschungsgegenstand in den Kognitions- und Neurowissenschaften intensiv erforscht. Zu den zentralen Fragen in den interdisziplinären Debatten gehören die folgenden, die wir in der Vorlesung behandeln werden: Wie können wir die für das Bewusstsein charakteristische Subjektivität adäquat analysieren? Wie muss die Verbindung zwischen Bewusstsein und Selbstbewusstsein spezifiziert werden? Kann dies Gegenstand empirischer Forschungen sein und wenn ja, wie können wir uns dem bewussten Erleben methodisch experimentell nähern? Wie können empirische Befunde über Bewusstseinsphänomene wie pathologische Defizite sinnvoll in eine philosophische Theorie des Bewusstseins integriert werden? Welche Theorien des Bewusstseins werden derzeit diskutiert? Was lehrt uns die Beschäftigung mit dem Bewusstsein über die Beziehung zwischen Geist und Körper bzw. Gehirn? Wie stellt sich das Bewusstsein gemäß unterschiedlichen Paradigmen in der Kognitionswissenschaft wie dem Funktionalismus oder der Neurophänomenologie dar?

Zu jeder einzelnen Vorlesung wird eine vorbereitende Lektüre empfohlen, die in einem Moodlekurs zur Vorlesung bereitgestellt wird. Es gibt zur Vorlesung auch ein begleitendes Seminar, in dem einschlägige Texte zum Thema genauer studiert werden.

C1

Social Cognition & Meta-Science

SEMINAR

PHILOSOPHISCHE PROBLEME DES BEWUSSTSEINS (030047)

PROF. DR. TOBIAS SCHLICHT

TERM:	Summer 2024
MEETING TIME:	Friday, 10 - 12 (First meeting: 12.04.2024)
ROOM:	GABF 04/716
CP:	3

Language of instruction: German

Dieses Seminar begleitet die Vorlesung zum Thema (030008), kann aber auch isoliert davon gewinnbringend besucht werden. Wie studieren einschlägige Texte zur zeitgenössischen philosophischen Bewusstseinsforschung. Diese werden in einem Moodlekurs rechtzeitig bereitgestellt.

C1

C1. Social Cognition & Meta-Science

SEMINAR

INTRODUCTION TO SOCIAL EPISTEMOLOGY (030113)

PROF. DR. CHRISTIAN STRASSER, DR. MINKYUNG WANG

TERM:	Summer 2024
MEETING TIME:	Monday 14 – 16 (First Meeting: 15.04.2024)
ROOM:	GA 3/143
CP:	3 or 6

This course introduces selected topics in social epistemology, which addresses epistemological problems on a societal level. The primary focus will be on mathematical models of belief aggregation problems, which can vary depending on the input or output data type, logical relations of issues, incorporation of (shared) evidence or peer respect, and considerations of dynamic factors or long-term effects. Specifically, this course will cover topics such as judgment aggregation, probabilistic opinion pooling, Condorcet's jury theorem, the wisdom of crowds, Aumann's agreeing to disagree, consensus formation, and Bayesian merging of opinions. A prerequisite for this course is first-order logic. Some familiarity with basic set theory and probability calculus would be beneficial. The course will be conducted in English. As there is no standard textbook for mathematical social epistemology except for judgement aggregation, the course will follow my lecture notes referencing important papers in social epistemology.

C2

C2. Perception & Action

LECTURE
WAHRNEHMUNG (PERCEPTION) (118311)
PROF. DR. JONAS ROSE

TERM:	Summer 2024
MEETING TIME:	Wednesday, 10 – 12 (First Meeting: 10.04.2024)
ROOM:	IA 02/461
CP:	3

In this lecture, we will cover the neural basis of different sensory modalities. Starting with the physical stimulus and its detection at the receptor we will then continue along the sensory hierarchy in the brain. Finally, the modulation of the stimulus through attention, categorization and multimodal integration will be covered. In addition to our focus on human sensory systems, we will compare the sensory systems and capabilities of different species.

The lecture will be held in English.

C2

C2. Perception & Action

SEMINAR
WAHRNEHMUNG (PERCEPTION) (118312)
PROF. DR. JONAS ROSE

TERM:	Summer 2024
MEETING TIME:	Friday, 10 – 12 (First Meeting: 19.04.2024)
ROOM:	GA 04/187
CP:	3

This seminar complements the lecture 'perception' by adding a more hands-on approach. You will give short lectures and conduct mini-experiments to highlight specific topics and deepen the understanding of selected mechanisms.

C2

C2. Perception & Action

SEMINAR

JOURNAL CLUB: NEUROBIOLOGY (190573)

[WISSENSCHAFTLICHE PRÄSENTATIONEN IN ENGLISCH]

PROF. DR. MELANIE MARK

TERM:	Summer 2024
MEETING TIME:	Wednesday, 11- 12
ROOM:	ND6/56a
CP:	3

This course is a weekly journal club with focus on neuroscience. Please contact sekretariat@neurobiologie.ruhr-uni-bochum.de or Melanie.Mark@rub.de for further information.

Requirements: basic understanding of neurosciences

C2

C2. Perception & Action

SEMINAR

COGNITIVE SYSTEMS AND THE EXTENDED MIND (030099)

DR. ELMARIE VENTER

TERM:	Summer 2024
BLOCK:	Tuesday, 14 - 16
ROOM:	GABF 04/354
CP:	3 or 6

In this course, we will work through Rob Rupert's 2009 'Cognitive Systems and the Extended Mind'. The book is a survey of philosophical issues that are faced by situated cognition with a particular focus on extended cognition – the view that cognitive processes extend beyond the boundary of the agent. The book deals, amongst other issues, with the problem of demarcation – the question about what is cognitive and what is not. Rupert argues that an extended approach to this problem is implausible. He posits a systems-based approach, i.e., the view that "a state is cognitive if and only if it consists in, or is realized by, the activation of one or more mechanisms that are elements of the integrated set members of which contribute causally and distinctively to the production of cognitive phenomena" (Rupert, 2009). We will critically examine this debate and evaluate the implication for both the situated and classical views in cognitive science.

Students can receive either 3 CP (ungraded) or 6 CP (graded). For 3 CP graded, please ask Dr. Venter in the first meeting.

Literature:

Rupert, R. (2009). Cognitive Systems and the Extended Mind. United Kingdom: Oxford University Press. Further literature will be provided on Moodle.

C2

C2. Perception & Action

SEMINAR

ANDY CLARK, "THE EXPERIENCE MACHINE: HOW OUR MINDS PREDICT AND SHAPE REALITY" (030095)

DR. WANJA WIESE

TERM:	Summer 2024
MEETING TIME:	Wednesday, 14 – 16 (First Meeting: 10.04.2024)
ROOM:	GA 3/143
CP:	3 or 6

About a decade ago, Andy Clark published an influential paper in which he argued for an approach to understanding the mind that he called "predictive processing" (Clark, 2013). According to predictive processing, the brain uses a probabilistic model of its environment to make predictions about sensory signals and their hidden causes. Predictive processing does not constitute a novel approach to studying the mind, but seeks to unify many existing approaches under a single principle: prediction error minimization.
In this seminar, we will read and discuss Clark's most recent book, *The Experience Machine*. While Clark's earlier (2016) book on predictive processing, *Surfing Uncertainty*, mostly addressed cognition and action, Clark (2023) also considers conscious experience.

If possible, it is recommended that you purchase a copy of the book (Clark, 2023).

Literature:

Clark, A. (2012). Dreaming the Whole Cat: Generative Models, Predictive Processing, and the Enactivist Conception of Perceptual Experience. *Mind*, *121*(483), 753–771. https://doi.org/10.1093/mind/fzs106
Clark, A. (2013). Whatever Next? Predictive Brains, Situated Agents, and the Future of Cognitive Science. *Behavioral and Brain Sciences*, *36*(3), 181–204.
Clark, A. (2016). *Surfing Uncertainty*. Oxford University Press.
Clark, A. (2019). Consciousness as Generative Entanglement. *The Journal of Philosophy*, *116*(12), 645–662. https://doi.org/10.5840/jphil20191161241
Clark, A. (2023). *The Experience Machine: How Our Minds Predict and Shape Reality*. Allen Lane.
Clark, A., Friston, K., & Wilkinson, S. (2019). Bayesing Qualia: Consciousness as Inference, Not Raw Datum. *Journal of Consciousness Studies*, *26*(9–10), 19–33.

C2

C2. Perception & Action

SEMINAR

INTRODUCTION TO ACTIVE INFERENCE (030080)

BARTOSZ RADOMSKI

TERM:	Summer 2024
MEETING TIME:	Monday, 10 – 12 (First meeting: 08.04.2024)
ROOM:	GABF 04/609
CP:	3 or 6

In this seminar, we will read and discuss the 2022 book "Active Inference: The Free Energy Principle in Mind, Brain, and Behavior" by Thomas Parr, Giovanni Pezzulo, and Karl J. Friston. Active Inference is a theory that promises to unify the explanation of heterogeneous biological and cognitive phenomena under a single principle of free-energy minimization.This course is designed for learners of all backgrounds and assumes no prior familiarity with mathematics, statistics, or physics. The goal of the course is twofold: to introduce basic concepts of Active Inference and to provide a detailed account of the philosophical issues surrounding the Active Inference framework.

Students can receive either 3 CP graded for giving a presentation or 6 CP graded for submitting an essay.

Literature:

Thomas Parr, Giovanni Pezzulo, Karl J. Friston, (2022). *Active Inference: The Free Energy Principle in Mind, Brain, and Behavior* , The MIT Press.
DOI: https://doi.org/10.7551/mitpress/12441.001.0001 (Open Access)

C2

Perception & Action

SEMINAR

IMAGINATION, INTUITION AND THOUGHT EXPERIMENTS. EPISTEMOLOGICAL PERSPECTIVES (030089)

PROF. DR. MARKUS WERNING

TERM:	Summer 2024
MEETING TIME:	Thursday 12 – 14 (First Meeting: 11.04.2024)
ROOM:	GA 04/187
CP:	3 or 6

Join us for an engaging and thought-provoking seminar exploring the fascinating topics of imagination, intuition and thought experiments. This seminar is specifically designed for philosophy and cognitive science students seeking to understand the epistemological significance of imagination and intuition, and their role in thought experiments.

The seminar will commence by discussing some contributions in contemporary epistemology of imagination. Do we learn from imagination? What kind of knowledge can we achieve through imagination? Is it justified and how? These are only a few of the central questions we are going to investigate.

Building upon these epistemological foundations, we will then shift our focus to the notion of intuition. We will critically examine its problematic nature and delve into a central "epistemological tool": thought experiment. We will finally examine the roles and interplay of imagination and intuition within some of the most famous (philosophical) thought experiments.

By the end of this seminar, participants will have gained a comprehensive understanding of the nature and epistemic powers of imagination and intuition. They will have the tools to critically evaluate and contribute to ongoing debates surrounding the epistemology of imagination, intuition and thought experiments. Students will also have the opportunity to link up with our DFG research group "Constructing Scenarios of the Past".

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

Teaching will be assisted by Sofia Pedrini.

Literature:

Badura, C. and Kind, A. (eds.). (2021). *Epistemic Uses of Imagination*, New York: Routledge

Gendler, T. S. (2000). *Thought Experiment: On the Powers and Limits of Imaginary Cases*, New York: Garland Press (now Routledge).

Gendler, T. S. and J. Hawthorne (eds.). (2002). *Conceivability and Possibility*, New York: Oxford University Press.

Kind, A. (Hrsg.). (2017). *The Routledge handbook of philosophy of imagination* (First issued in paperback). Routledge.

Kind, A. and P. Kung (eds.). (2016). *Knowledge Through Imagination*, New York: Oxford University Press.

C2

C2. Perception & Action

LECTURE & EXERCISE

AUTONOMOUS ROBOTICS: ACTION, PERCEPTION, AND COGNITION (211048)

PROF. DR. RER. NAT. GREGOR SCHÖNER, LUKAS BILDHEIM

TERM:	Summer 2024
LECTURE:	Thursday, 14.15 – 16.00 (First Meeting: 11.04.2024)
EXERCISE:	Thursday, 16.15 – 17.00 (First Meeting: 11.04.2024)
ROOM:	NB 3/57
CP:	6

If this seminar is used for Module I3, it cannot be used for C2.

Autonomous robotics is an interdisciplinary research field in which embodied systems equipped with their own sensors and with actuators generate behavior that is not completely pre-programmed. Autonomous robotics thus entails perception, movement generation, as well as core elements of cognition such as making decisions, planning, and integrating multiple constraints. The main focus of the course are solutions to autonomous movement generation that are inspired by analogies with how nervous systems generate movement.

This course touches on various approaches to this interdisciplinary problem. The first half of the course focusses on movement generation for autonomous vehicles. The main emphasis will be on dynamical systems methods (attractor dynamics) for that problem, reviewing related approaches as well. The second half of the course will study motion in robot arms, including motion planning, timing, and control. Analogies with human movement will be exploited to illustrate ideas and problems, including the degree of freedom problem, coordination, and reflex control of muscles.

Requirements

The emphasis of the course is on learning concepts, practicing interdisciplinary scholarship including reading and writing at a scientific and technical level. Mathematical concepts are used throughout, so understanding these concepts is important. Mathematical skills are not critical to mastering the material, but helpful. The mathematics is mostly from the qualitative theory of dynamical systems, attractors and their instabilities. Short tutorials on some of these concepts will be provided.

Registration

You can register for the course here: https://www.ini.rub.de/elearning/

Further reading

Readings will be posted on the INI web page. Also have a look at the web page of the Dynamic Field Theory community that is interested in related problems and solutions: https://dynamicfieldtheory.org/

There you find more exercises, reading material, slides and lecture videos that have some overlap with the lecture.

C2

C2. Perception & Action

SEMINAR

BEWUSSTSEIN UND WELT: PHÄNOMENOLOGIE UND KOGNITIONSWISSENSCHAFTEN (030098)

DR. ELMARIE VENTER

TERM:	Summer 2024
MEETING TIME:	Wednesday, 14 – 16 (First Meeting: 10.04.2024)
ROOM:	GABF 04/709
CP:	3 or 6

Find more information on the INI web page: https://www.ini.rub.de/teaching/courses/autonomous_robotics_action_perception_and_cognition_summer_term_2024/

Language of instruction: German

Students can receive either 3 CP ungraded or 6 CP graded. If you would like to receive 3 CP graded, please ask Dr. Venter in the beginning of the course.

Klarheit über die Natur unseres Bewusstseins zu erlangen ist eine der zentralen Fragen der Philosophie und Kognitionswissenschaften. Dieses Seminar konzentriert sich auf das Buch "Bewusstsein und Welt" von Gallagher und Zahavi, das eine faszinierende Untersuchung über die Beziehung zwischen Bewusstsein und der umgebenden Welt bietet. Die Autoren erkunden die Komplexität des Bewusstseins und dessen Verhältnis zur Welt, indem sie verschiedene philosophische Ansätze und wissenschaftliche Erkenntnisse integrieren. Sie gehen auf die Phänomenologie ein und diskutieren eine Auswahl von Themen, die für gegenwärtige Diskussionen in der Philosophie des Geistes und der Kognitionswissenschaften von besonderer Bedeutung sind. Wir werden uns intensiv mit diesen Themen auseinandersetzen, indem wir die Ansichten von Gallagher und Zahavi analysieren und diskutieren. Unser Ziel ist es, zu verstehen, wie die phänomenologische Methode zur Klärung komplexer Fragen in den Kognitionswissenschaften beitragen kann.

Literature:

Gallagher, S. & Zahavi, D., 2023. Bewusstsein und Welt: Phänomenologie und Kognitionswissenschaften. Übersetzt von Thiemo Breyer. Verlag Karl Alber.
(zur Anschaffung und Vorbereitung empfohlen)

Weitere Texte werden zu Semesterbeginn auf Moodle bereitgestellt. Die weitere Texte sind teils englischsprachig.

C3

C3. Memory, Learning & Decision Making

SEMINAR

DISCOURSE NEURAL BASIS OF LEARNING (118161)

PROF. DR. JONAS ROSE, JUAN MEDINA PESCHKEN

TERM:	Summer 2024
MEETING TIME:	Monday, 9 - 11 (First Meeting: 08.04.2024)
ROOM:	GA 04/187 (first meeting via Zoom)
CP:	3

Current literature in cognitive neuroscience will be presented and discussed in depth. We aim to follow up on novel approaches, interesting angles and to have a critical discussion of research methods and interpretations.

C3

C3. Memory, Learning & Decision Making

SEMINAR

JOURNAL CLUB - NEUROCOGNITION OF SPACE AND MEMORY (118915)

DR. MARKUS WERKLE-BERGNER

TERM:	Summer 2024
MEETING TIME:	Preliminary meeting: 11.04.2024, 16:15 Thursday, 16 – 18
ROOM:	online via webex
CP:	3

Since Toman introduced the idea of a cognitive map, there is the idea that cognition and memory in humans have a special relationship to space. With the discovery of specialized neural coding schemes in the hippocampus (e.g., place cells, grid cells etc.), the search for common underlying principles that connect cognition, space, and memory was further fueled. In this course, we will read into the literature underlying the key ideas of common representations for space, concepts, and memory.

Literature: will be provided at the start of the course

C3

C3. Memory & Learning

SEMINAR

AGING, DEMENTIA AND MEMORY DISORDERS (118163)

DR. KHAZAR AHMADI

TERM:	Summer 2024
MEETING TIME:	Tuesday, 14 – 16 (First meeting: 09.04.2024)
ROOM:	IA 02/452
CP:	3

Human life expectancy has increased at a rapid pace over the last century. This longevity is due to improved medical care, healthier lifestyle and technological advancements. However, population aging is a major concern since advancing age is associated with a gradual decline in cognitive capabilities and the level of independence, leading to higher demands for health and social care services. While some elderly individuals maintain their cognitive functioning within the normal range, others experience severe alterations of cognition that may cause dementia.

Dementia is a chronic degenerative condition that affects key mental functions including memory, language, orientation, decision-making and visual recognition. Accumulating evidence suggests that the prevalence of dementia increases exponentially with age and more rapidly in females. This course will provide an overview of 'normal' and 'pathological' cognitive changes that accompany aging. We will first discuss the neurophysiological changes that normally occur with aging in the brain from a neuroimaging perspective. Subsequently, the underlying mechanisms of several neurodegenerative diseases including Alzheimer's disease, Parkinson's disease, fronto-temporal dementia, vascular dementia, amyotrophic lateral sclerosis, and dementia with Lewy bodies will be addressed. Upon completion of this course, the students will have a better understanding of the neurobiological underpinnings of cognitive changes in the late adulthood.

The seminar will be graded.

C3

C3. Memory & Learning

LECTURE + EXERCISE

MACHINE LEARNING: SUPERVISED METHODS (211024)

PROF. DR. TOBIAS GLASMACHERS

TERM:	Summer 2024
MEETING TIME:	Thursday, 10 - 14 (First meeting: 11.04.2024)
ROOM:	IA 0/158-79 PC-Pool 1
CP:	6

Please note the requirements and enrolment in this class on the page after (*more detailed than in ecampus)*

Content:
The field of machine learning constitutes a modern approach to artificial intelligence. It is situated in between computer science, neuroscience, statistics, and robotics, with applications ranging all over science and engineering, medicine, economics, etc.
Machine learning algorithms automate the process of learning, thus allowing prediction and decision making machines to improve with experience.

This lecture will cover a contemporary spectrum of supervised learning methods. All lecture material will be in English.

The course will use the inverted classroom concept. Students work through the relevant lecture material at home. The material is then consolidated in a 4 hours/week practical session.

Learning Outcomes:
After the successful completion of the module

- participants understand the basics of statistical learning theory,
- participants know the most important algorithms of supervised statistical learning and can apply them to learning problems,
- participants know strengths and limitations of different learning methods,
- participants are able to use standard machine learning software to solve new problems.

Assessment: written exam (90 min.)

[Course: Machine Learning: Supervised Methods – Prof. Dr. Tobias Glasmachers]

Requirements:
The course requires a relatively deep understanding of basic mathematical tools from linear algebra, calculus, and especially probability theory. Therefore, it is in most cases not suitable for students holding a Bachelor of Arts but a background in engineering or natural sciences can be a suitable for this class.

More advanced mathematical material will be introduced as needed. The practical sessions involve programming exercises in Python. Participants need basic programming experience in Python. They are expected to bring their own devices (laptops).

Enrollment: In order to participate in the exam, please contact informatik-pruefungsamt@rub.de before registration deadline. Information about the date of the exam and the registration deadline can be found here: https://informatik.rub.de/studium/pruefungsamt/

Please do not contact the lecturer for course registration.

Please include the following details in your e-mail to the examination office:

- surname, name
- student ID
- study program (MSc. Cognitive Science)
- current certificate of enrolment
- exam that you want to register for + date of the exam

C3

C3. Memory & Learning

SEMINAR

THE ETHICS OF ALGORITHMIC OUTSOURCING (030104)

DR. INKEN TITZ

TERM:	Summer 2024
MEETING TIME:	Wednesday, 16 - 18 (First meeting: 10.04.2024)
ROOM:	GABF 04/511
CP:	3- 6

We inhabit a world where an extensive array of algorithmic tools is employed to incentivize, regulate, guide, and manipulate human behavior. Whether it is mapping out a route using Google Maps, tracking workouts and sleep patterns with a FitBit, or perusing film and book selections on platforms like Amazon or Netflix, it is hard to escape the influence of these algorithmic tools. Their widespread use raises crucial ethical questions.

This seminar focuses on the moral philosophical repercussions of these algorithmic tools on our day-to-day personal activities. What happens when we delegate or share numerous daily tasks and objectives with digital assistants and other algorithmic tools? More specifically, how does this impact our autonomy and freedom of choice? Algorithmic tools shape our choice environments by pre-filtering and highlighting options; they send reminders or incentives, and at times, they may even make decisions on our behalf. Does this pose a substantial new technological threat to individual autonomy? Another central question concerns their impact on our moral or intellectual abilities. While some delegation to technologies might make us more efficient in moral or cognitive terms, it has been argued that excessive reliance on algorithms threatens to undermine our (intellectual) virtue development and leads to deskilling. In this seminar, we will address these and related issues while also keeping an eye on the positive potential of algorithmic outsourcing.

Literature: The literature will be made available in the Moodle course at the beginning of the semester.

C3

C3. Memory, Learning & Decision Making

LECTURE & EXERCISE

INTRODUCTION TO COMPUTATIONAL NEUROSCIENCE (211046)

PROF. DR. SEN CHENG

TERM:	Summer 2024
LECTURE:	Monday, 16 – 18 (First Meeting: 08.04.2024)
ROOM:	NB 3/57
EXERCISE:	Friday, 10 – 12 (First Meeting: 08.04.2024)
ROOM:	NB 3/72
CP:	6

If this course is used for Module AM4, it cannot be used for C3.

Computational neuroscience uses quantitative methods to describe what nervous systems do, study how they function, and explain the underlying principles. This class introduces the basics of the mathematical and computational methods used in contemporary neuroscience research. These methods are applied to problems in perception, motor control, learning, and memory.

Knowledge of calculus, linear algebra, and statistics is required for this class, knowledge of neuroscience is not.

Assessment written final exam - 120 min - date: TBA

Course material available on Moodle (registration required)

Literature “Theoretical Neuroscience” by Dayan and Abbott, MIT Press

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

Office hours: Thursdays 14:00-15:00

Enrollment: eCampus/Flexnow

C3

C3. Memory & Learning

SEMINAR

FROM BIOLOGICAL TO ARTIFICIAL NEURAL NETWORKS (211131)

PROF. DR. SEN CHENG

TERM:	Summer 2024
MEETING TIME:	Tuesday, 10 – 12 (First meeting: 09.04.2024)
ROOM:	NB 3/72
CP:	3

Artificial neural networks were not only inspired by the brain, but were created in an effort to understand and model the functioning of the brain. In this seminar, we will read and discuss historic scientific articles that track the development of neural networks from the 1940s to the present. Specific topics include:

- McCulloch-Pitts Neurons/ Boolean networks
- Perceptron
- Hubel and Wiesel
- NeoCognitron
- Convolutional Neural Networks
- Hopfield
- Reservoir Computing
- LSTM
- RBM
- NetTalk
- AlexNet

Learning Outcomes:
After successful completion of this seminar, students will be able to

- read and understand scientific articles in neural network research
- know in which situations neural networks are applied
- understand and discuss the advantages and disadvantages of specific neural networks
- understand the historical development of neural networks
- present the results of research in neural networks to an audience

Examination: Oral Presentation

Requirements:
Solid knowledge of calculus, linear algebra, and statistics are required, e.g. Mathematik 1 und 2, Statistik. Knowledge of artificial neural networks.
Students should have taken the class “Artificial Neural Networks”, or something equivalent, before enrolling in this seminar.

Literature:
The articles will be announced in the first meeting.
Background reading: “Neural Networks and Deep Learning” by Charu C. Aggarwal, Springer

C4

C4. Language, Logic & Categories

SEMINAR

PHILOSOPHY OF FILM (030091)

JUN. PROF. DR. KRISTINA LIEFKE

TERM:	Summer 2024
MEETING TIME:	Thursday, 14 – 16 (First Meeting: 18.04.2024)
ROOM:	GA 04/187
CP:	3 or 6

This course introduces current topics in the philosophy of communication and mind through the lens of (the philosophy of) film. Following an introduction to pictorial representation and its properties, we will explore different ways of influencing representation in film. This influence is exerted, e.g., through storytelling (the particular choice of narrator/protagonist, their reliability, and the temporal order of narration), through the position and angle of the camera (as well as the location of cuts between scenes), and through the inclinations and inhibitions of the audience (e.g. in cases of imaginative resistance, where the viewer fails to take a filmic representation at face value). The bulk of the course will be concerned with discussing these influences. All discussions will be supported by film clips (e.g. from *Fight Club* (1999), *Fear and Loathing in Las Vegas* (1998)). Since some relevant topics stem from the philosophy of fiction and video games, the course will take detours into these areas.

Literature:

Selected readings: All readings will be made available on Moodle.

Greenberg, G. (2013). Beyond resemblance. *Phil. Review 122*(2): 215-287.
Cumming, S., G. Greenberg, E. Kaiser, and R. Kelly (2021). Showing seeing in film. *Ergo 7*(27): 730-756.
Van de Mosselaer, N. and S. Gualeni (2022). The fictional incompleteness of digital gameworlds. *Transactions of the Digital Games Research Association 6*(1): 61-94.

Assessment:

Students can receive 3 CP for active participation and giving a presentation.
Students can receive 6 CP for giving a presentation + essay/oral exam.

C4

C4. Language, Logic & Categories

LECTURE & EXERCISE

INTRODUCTION TO ARTIFICIAL INTELLIGENCE (211045)

PROF. DR. SEN CHENG, PROF. DR. RER. NAT. LAURENZ WISKOTT, PROF. DR. TOBIAS GLASMACHERS, PROF. DR. RER. NAT. GREGOR SCHÖNER, PROF. DR. CHRISTIAN STRAßER, PROF. DR. ROBERT SCHMIDT, PROF. DR. NILS JANSEN, PROF. DR.-ING. SETAREH MAGHSUDI

TERM:	Summer 2024
LECTURE:	Friday, 10 – 12 (First Meeting: 12.04.2024)
EXERCISE:	Friday 12-14 (First Meeting: 12.04.2024)
ROOM:	HGD 20
CP:	6

This course gives an overview over representative methods in artificial intelligence: formal logic and reasoning, classical methods of AI, probabilistic reasoning, machine learning, deep neural networks, computational neuroscience, neural dynamics, perception, natural language processing, and robotics.

Requirements: Basic knowledge of calculus and linear algebra.

Learning outcomes: After successful completion of this course, students will be able to

- summarize a number of fundamental methods in artificial intelligence,
- explain their mathematical basis and algorithmic nature,
- apply them to simple problems,
- decide which methods are suitable for which problems, and
- communicate about the above aspects in English.

Examination: Condition for granting the credit points: Passing grade on final written exam (120 minutes).

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

Office hours: Thursdays 14:00-15:00

C4

C4. Language, Logic & Categories

SEMINAR

RESEARCH SEMINAR ON CONTRADICTORY LOGICS (030100)

PROF. DR. HEINRICH WANSING

TERM: Summer 2024

MEETING TIME: Tuesday, 14 – 16

ROOM: GABF 04/358

CP: 6

This seminar is related to the ERC-Advanced Grant project ConLog, Contradictory Logics: A Radical Challenge to Logical Orthodoxy, and contributes to the idea of research-based learning. The seminar is open to M.A. students with an interest in philosophical logic, the philosophy of logic, and the philosophies of language and of science. Students are invited to suggest papers and topics related to negation inconsistent logics.

In the 20th century, many systems of non-classical logic have been developed, including inconsistency-tolerant logics, which are typically all subsystems of classical logic. There are, however, logical systems that are radically different from classical logic insofar as they are non-trivial but contradictory. These logics are in glaring conflict with logical orthodoxy since Aristotle, who called the Principle of Non-Contradiction the firmest of all principles. Non-trivial contradictory logics not only permit inconsistencies in theories, but contain provable contradictions.

A prerequisite for a successful attendance in the seminar is some knowledge of non-classical logic and modal logic, including familiarity with Gentzen-style proof systems and Kripke models. We will discuss ongoing research into non-trivial contradictory logics and their applications in the philosophy of logic, and will read research papers, old and new, dealing with the notions of contradictoriness, consistency, negation, triviality, and related concepts. These papers may range from rather informal to formal studies. Students can earn credits by presenting a paper and will get detailed feedback. The seminar will continue to run over several semesters.

Students interested in experimental work on the endorsement or rejection of certain logical principles that play a crucial role in obtaining non-trivial negation-inconsistent logics are also very welcome.

C4

C4. Language, Logic & Categories

SEMINAR

INTRODUCTION TO FORMAL EPISTEMOLOGY (030114)

PROF. DR. CHRISTIAN STRASSER, DR. MINKYUNG WANG

TERM:	Summer 2024
MEETING TIME:	Wednesday, 16 – 18 (First meeting: 17.04.2024)
ROOM:	GD 1/236
CP:	3 or 6

Formal epistemology aims to address both old and new epistemological problems using mathematical methods. This introductory-level course will cover selected topics in formal epistemology. The main focus will be on different types of formal representation models of qualitative and quantitative beliefs and their rational relations. Specifically, the course will explore basic epistemic and doxastic logic, AGM belief revision theory, the Dutch book argument, epistemic decision theory, and the Lottery paradox. Moreover, this course aims to balance breadth and depth of understanding. Students will learn how to read formal theorems and proofs and play with mathematical concepts. A familiarity with first-order logic is a prerequisite. Some knowledge of basic set theory and probability calculus would be beneficial, though these will be taught during class. The course will be conducted in English. In principle, there will be no required readings. I will give lectures on important concepts and theorems with my lecture notes referencing the following literature.

References

Pettigrew, R. et al. (Eds.), Open Handbook for Formal Epistemology, Online.
Arlo-Costa, H. et al. (Eds.), Readings in Formal Epistemology Source Book, 2016, Springer.
Gärdernfors, P., Knowledge in Flux, 1988, MIT.
v. Ditmanrsch, H. et al., Dynamic Epistemic Logic, 2008, Springer.
Bradley, D., Critical Introduction to Formal Epistemology, 2011, Bloomsbury.
Titelbaum, M., Fundamentals of Bayesian Epistemology I, II, 2022, OUP.
Halpern, J., Reasoning about Uncertainty, 2017, MIT.
Pettigrew, R., Accuracy and the Law of Credence, 2016, OUP.
Leitgeb, H., Stability Theory of Belief, 2017, OUP.
Douven, I. (Eds.), Lotteries, Knowledge, and Rational Belief, 2021, CUP.

C4

C4. Language, Logic & Categories

SEMINAR & EXERCISE

FORMAL ARGUMENTATION AND DEFEASIBLE REASONING (030105 & 030107)

PROF. DR. CHRISTIAN STRASSER

TERM:	Summer 2024
SEMINAR:	Wednesday, 14.30 – 16.00 (First meeting: 10.04.2024)
EXERCISES:	Wednesday, 16:15 - 17:45
ROOM:	Wasserstraße 221, Seminar room: 1
CP:	Seminar: 3 or 6, Exercise: 3

This course introduces into formal argumentation theory. Formal argumentation provides formal models of defeasible reasoning and argumentative exchanges.

We reason defeasibly whenever our conclusions don't necessarily follow from our assumptions, but rather typically, or probably, or plausibly. In unexpected circumstances we may have to retract these kind of inferences. For instance, although we had assumed that it rained during the night on the bases of observing wet streets, only to later learn that the streets have been cleaned. Typically we reason in this way when we lack information or the given information is uncertain. As such, this type of reasoning is central in everyday as well as in expert reasoning. Argumentation provides a natural way to think about defeasible reasoning since in cases in which we have to retract inferences can be expressed in terms of counter-arguments.
In this course we will cover basic approaches in formal argumentation, starting from Dung's seminal theory of abstract argumentation to systems of logic-based argumentation.

In this way students get introduced into an important and highly unifying sub-family of nonmonotonic logics (i.e., logics for defeasible reasoning) and, more generally, into a central paradigm in contemporary symbolic artificial intelligence.

A basic knowledge in formal logic is presupposed (such as a basic introductory lecture). Other than that, any student in the 5th+ term of a Bachelor program resp. in a master program can follow the course. The course has an exercise unit in which weekly exercises are discussed.

For the theoretical part students can receive 3 or 6 CPs and a grade; for the exercises 3 CPs but no additional grade. The exercise can count for module AM2, too. In this case, it must be combined with another AM2 class which is graded.

AM. Advanced Methods

Advanced methods are usually studied in the second semester. Solely the "fMRI"-course is only offered during the winter term.

AM1

AM1. Theory Formation & Conceptual Analysis

SEMINAR, ESSAY WRITING COURSE

WRITING A BACHELOR OR MASTER THESIS IN ENGLISH (030106)

PROF. DR. CHRISTIAN STRAßER, PROF. DR. DUNJA ŠEŠELJA

TERM:	Summer 2024
MEETING TIME:	Friday, 14 – 17:30 (First Meeting: 14.04.2023)
ROOM:	Wasserstr. 221/4 (online tutoring in between)
CP:	3 or 6

This is an Essay Writing Course in Philosophy: For all students who did not study philosophy during the BA program but need to learn how to write an essay or still feel insecure about it, we recommend this seminar.

In this course we will cover the basics of academic writing of philosophy theses and essays (including seminar papers, BA and MA theses), focusing on the following issues: How to structure and organize an academic article? How to concisely express the main theses and aims of the paper? How to develop strong arguments? How to find the relevant sources? And so forth.

The seminar is targeted at students who are in the process of writing a Bachelor or Master thesis, or who will do so soon.

Students have opportunities to present ideas and drafts of chapters. In the seminar these contributions will be examined in terms of academic language, argumentative structure, style, etc. Students will give (guided) peer review of the contributions.

The seminar will take place in five blocks (April 12, April 19, May 17, May 31, June 28), each time at 14:15-17:30. In addition, students will have individual (online) coaching sessions in between the blocks.

Literature: The reading list will be provided at the start of the course.

AM1

AM1. Theory Formation & Conceptual Analysis

BLOCK SEMINAR

INTEGRATED HISTORY AND PHILOSOPHY OF SCIENCE (030115)

PROF. DR. DUNJA ŠEŠELJA

TERM:	Summer 2024
MEETING TIME:	Block: 18.05., 08.06., 13.07., 10:00 - 16:00
	(online tutoring in between)
ROOM:	Wasserstr. 221/4
CP:	3 or 6

The method of historical case studies is one of the central methodological approaches employed by philosophers of science. As Imre Lakatos famously put it "Philosophy of science without history of science is empty; history of science without philosophy of science is blind". But how and why do we conduct historical case studies? Which philosophical questions can benefit from such inquiry, and which conceptual tools can help us to formulate fruitful answers?

In this course students will learn the basics of Integrated History and Philosophy of Science (HPS). In particular, they will learn how to conduct historical case studies to tackle philosophical questions. The seminar will consist of three main blocks, as well as online coaching sessions in between them:

1) First block (May 18) will be dedicated to the employment of the HPS approach to the study of values in the context of scientific inquiry.
2) Second block (June 8) will be dedicated to the employment of the HPS approach to the study of scientific pluralism.

After the second block, you will choose a historical case-study, which you will investigate for the remainder of the course.

3) Third block (July 13) will be dedicated to student presentations in which each student will present the results of their work.

Before each block, you will have to complete an assignment, which will consist of writing short reviews of the assigned readings (Blocks 1 & 2) or slides for your presentation (Block 3). Moreover, at each block you will have to complete an additional assignment during the class: a team-work presentation of one of the readings (Blocks 1 & 2) or the presentation of your research (Block 3).

Literature: The reading list will be provided at the start of the semester.

AM1

AM1. Theory Formation & Conceptual Analysis

SEMINAR

PHILOSOPHICAL METHODS: AN INTRODUCTION (030110)

JUN.PROF. DR. JOACHIM HORVATH

TERM:	Summer 2024
MEETING TIME:	Thursday, 10 – 12
ROOM:	GAFO 04/619
CP:	3 or 6

In this introductory seminar, we will discuss both general questions about methods, such as “What are methods in the first place?” and “How should methods be evaluated?”, and specific questions about philosophical methods, like “Are there any philosophical methods at all?”, “Are there uniquely or distinctively philosophical methods?”, “What are the main philosophical methods?”. In this context, we will also consider some philosophical methods in more detail, for example, argumentation, conceptual analysis, experimental philosophy, formal methods, and thought experiments. The course will be based on a manuscript version of the introductory volume Methods in Analytic Philosophy: A Primer and Guide (edited by Joachim Horvath, Steffen Koch, and Michael G. Titelbaum), which is forthcoming as an open access book with the PhilPapers Foundation. There will be some flexibility for the participants of the seminar to decide which philosophical methods they want to focus on, and for these selected methods we will also discuss a few further readings. Apart from the ability to read philosophical texts in English, some prior experience with actually doing philosophy would be very helpful for a seminar that aims to reflect on methods as a key aspect of philosophical practice.

AM2

AM2. Advanced Analysis of Language & Logic

SEMINAR

EXERCISES: FORMALARGUMENTATION AND DEFEASIBLE REASONING (030107)

PROF. DR. CHRISTIAN STRASSER

TERM:	Summer 2024
MEETING TIME:	Wednesday, 16.15 – 17.45
ROOM:	Wasserstraße 221, Seminar room: 1
CP:	3 (ungraded)

If the course is used for C4, it cannot be used for AM2. For using the course in AM2, it must be combined with another graded class in AM2.

This is the exercise unit for the course "Formal Argumentation and Defeasible Reasoning" (030105).

AM3

Behaviour Studies & Data Analysis

LAB COURSE

OPEN NEURAL DATA (211426)

PROF. DR. ROBERT SCHMIDT

TERM:	Summer 2024
MEETING TIME:	Tuesday, 10 – 12 (First Meeting: 09.04.2024)
ROOM:	NB 3/57
CP:	3

In November 2022 the International Brain Laboratory has released an unprecedented Big Open data set with brain recordings. In an international collaboration between 12 different research groups neural activity in 194 different brain regions (that's basically all of them!) was recorded in mice performing a standardized decision-making task. The data contains activity of 32784 neurons, which allows, for the first time, to examine how activity in any part of the brain is related to sensory, cognitive, and motor processing. For the published data the Open Neurophysiology Environment (ONE) API is available to access and process the different types of data files. In this computer programming practical you will learn about the research questions surrounding this exciting dataset and how to access and process the data. First, we will study the available documentation about the data set and the provided API, and learn the basics about brain recordings. Second, we will access and process the data so that it can be analysed. Finally, we will apply modern data science methods (such as clustering, dimensionality reduction, or computational statistics) to analyse the data and learn about information processing in the brain.

Learning Outcomes:

- obtain hands-on skills in accessing and processing of Big Open Data
- acquire relevant domain knowledge at the intersection of computer science and neuroscience
- become familiar with neural signals and how they are processed using data science methods
- visualize and interpret the results of data analysis

Examination: Exercises and reports during the semester

Requirements: Programming in Python, APIs

Registration: Seats are limited. If you want to participate, please send an e-mail to Prof. Schmidt: robert.schmidt@rub.de

Literature: Link to the IBL dataset: https://int-brain-lab.github.io/iblenv/notebooks_external/data_release_brainwidemap.html

AM4

Computational Modeling

SEMINAR

PROGRAMMIEREN IN MATLAB (118155)

DR. ROLAND PUSCH, PROF. DR. JONAS ROSE

TERM:	Summer 2024
MEETING TIME:	Thursday, 14– 18 (First Meeting: 11.04.2024)
ROOM:	PC-Pool IB 02/109
CP:	6

Programming in Matlab

The aim of this seminar is to learn programming in Matlab. The course is suitable for students without prior programming experience. It consists of several components: During a lecture you will learn and practice new concepts, in the exercises following the lecture you will present and discuss demanding assignments that are to be prepared weekly at home. In an additional block seminar you will prepare the theoretical background of a small experiment that you will also program in Matlab, run, analyze and document with a protocol. For questions regarding the programming part of the seminar contact: jonas.rose@rub.de. For the theoretical part of the seminar contact: roland.pusch@rub.de

AM4

Computational Modeling

SEMINAR

WORKSHOP COMPUTATIONAL NEUROLOGY (200012)

PROF. DR. MED. XENIA KOBELEVA

TERM:	Summer 2024
MEETING TIME:	05.06., 19.6., 3.7., 17.7., 7.8. (last one: optional)
	15:00 – 18:00
ROOM:	MB, Floor 6, Seminar Room (ring the bell "Worldfactory")
CP:	3

This is a perfect starter course to understand more about modeling and computational concepts in neurology. Hands-on guidance and practice ensure mastery of critical concepts in neuroscience, while we correct different levels of previous knowledge in the first two sessions. Our group projects help you to develop real life experience and your own ideas into models! The course is open to students from various disciplines and thus gives an opportunity for interdisciplinary team work.

First day (5.6): Intro to fMRI and Neuroanatomy (1) and Intro to Python (2).
The first day will be divided into two consecutive tracks. The first track is designed to provide students with a limited background in neuroscience a comprehensive introduction to fMRI and neuroanatomy. This session will cover what fMRI is, what it measures, and (some of) its various applications. The second track, on the other hand, is tailored for students with little or no prior experience in programming. This track will introduce fundamental concepts related to using Jupyter Notebooks and the basics of some widely used Python libraries (e.g., Numpy and Pandas), as well a small introduction to loading and plotting images. It serves as a gentle entry point for those who are new to programming. You are welcome to follow both tracks (Intro to Python from 15:00-16:30, Intro to fMRI & Neuroanatomy from 16:45-18:00).

Second day (19.6): Single Node Neural Mass Models.
On the second day, we will use different types of models, i.e., neural mass (e.g., Jansen-Rit) and phenomenological (e.g., Hopf) models, to simulate the activity of a single brain region. We will evaluate its dynamics (e.g., oscillations) and their change according to the different model parameters. Through hands-on exercises, you will have the opportunity to work with these models and gain practical experience in their application.

Third day (3.7): Whole Brain Neural Mass Modeling of Healthy Subjects.
On the third day, we will create a real brain simulation. We will connect neural masses into a network, and we will fit this network to real empirical data so that the simulated brain activity resembles the real empirical one. We will also delve deeper into model fitting, and we will learn how to use both static and dynamic functional connectivity to make our brain simulations more realistic.

Fourth day (17.7): Whole Brain Neural Mass Modeling of Neurological Disorders.
The fourth and last day will be focused on developing a group project. You will be divided into small groups and given empirical timeseries of real patients (e.g., Alzheimer's disease, stroke, epilepsy, etc.). You will be asked to develop some hypotheses on disease-related changes in brain activity and you will be able to test them on the provided data.
(more information next page)

[Workshop Computational Neurology (118155), Prof. Dr. Xenia Kobeleva]

Final day (virtual outro session with optional presentations for those requiring a graded assessment of the course): As an output of the work, we ask you to prepare short presentations of the group work and reflections on interdisciplinary team work and modeling of diseases.

Why attend?
This is a perfect starter course to understand more about modeling and computational concepts in neurology. Hands-on guidance and practice ensure mastery of critical concepts in neuroscience, while we correct different levels of previous knowledge in the first two sessions. Our group projects help you to develop real life experience and your own ideas into models! The course is open to students from various disciplines and thus gives an opportunity for interdisciplinary team work.
If you read until here and you are ready to embark on a journey from "Novice to Neurostars", we've got a litle surprise for you! While this workshop will indeed boost your neuroscience skills, becoming a "Neurostar" doesn't happen overnight. In fact, "Neurostar" here refers to a website where you'll be posting questions related to your work for years to come :-) This workshop will nonetheless empower you to ask the right questions!

Further Information:
Additional details regarding software to be installed before the workshop will be provided in due course.
Registration Information:
For registration (and inquiries), please send us an email with your university, full name, field of study + semester, 1 sentence about why you want to attend and 1 sentence on your previous knowledge in neuroscience + programming and which tracks you want to attend on the first day to: mail@computationalneurology.com

AM4

Computational Modeling

SEMINAR

INTRODUCTORY MATH AND PROGRAMMING FOR COMPUTATIONAL PHILOSOPHY (030054)

SOONG HWAN YOO, M.A.

TERM:	Summer 2024
MEETING TIME:	Tuesday, 10 – 12 (First Meeting: 09.04.2024)
ROOM:	GABF 04/609
CP:	3 or 6

This course, conducted in English, is complementary to "Agent-based Simulations in Philosophy" course (winter semester).

In recent years, many philosophical developments have made use of heavy computer simulations and gigantic data sets. However, it is a big challenge for philosophy students to engage in such studies, especially for those who lack the required foundations, such as computer programming or probability theory. This course aims to equip students with these foundational tools in programming and math, thus empowering students to engage in contemporary philosophical literature.

Thanks to the advances in modern technology and measurement techniques, scientists can carry out theoretical analyses that involve intense computations. Yet, these tools use large data sets and computer calculations and therefore come with the burden of mathematics and computer programming skills. Philosophers, too, have started to adopt methods relying on computers. For instance, epistemologists have started using computer simulation tools to examine knowledge in a social context where multiple agents interact with each other. The main points made in these works are accessible for a broader philosophical audience. But still, they require basic understanding of math and coding for a good comprehension, and furthermore replicating their arguments. This course aims to provide some of those basic requirements.

Participants are not expected to have taken prior math courses. We plan to proceed step-by-step by starting with some seminal papers in the discipline of network epistemology. From then on, we go through matrix algebra, calculus, statistics, and graph theory. An introduction to Julia programming and practices will be included as we conclude each section.

Evaluation (both graded and non-graded credits) is done by an exam focusing on key concepts: eigenvalues, differentiation, probability distribution, and centrality measures. Participants can earn extra exam points by submitting their Julia coding practices on these key concepts.

References

(Introduction)
Page, S. E. (2018). *The Model Thinker: What You Need to Know to Make Data Work for You*. Basic Books, Ch. 2.
Grim, Patrick and Daniel Singer, "Computational Philosophy", *The Stanford Encyclopedia of Philosophy* (Fall 2022 Edition), Edward N. Zalta & Uri Nodelman (eds.), URL = <https://plato.stanford.edu/archives/fall2022/entries/computational-philosophy/>.
O'Connor, C., & Weatherall, J. O. (2019). *The Misinformation Age: How False Beliefs Spread*. Yale University Press, ch.2, pp 46-92.

(Programming Julia)
Lauwens, B., & Downey, A. (2019). *Think Julia: How to Think Like a Computer Scientist*. O'Reilly Media. https://benlauwens.github.io/ThinkJulia.jl/latest/book.html
Kalicharan, N. (2021). *Julia - Bit by Bit: Programming for Beginners*. Springer International Publishing.
Sherrington, M. (2015). *Mastering Julia*. Packt Publishing.

(Matrix Algebra, Calculus, Statistics)
Chiang, A. C., & Wainwright, K. (2005). *Fundamental Methods of Mathematical Economics* (4th ed.). McGraw-Hill Education.
Knut S., Peter H., Arne S., Andrés C. (2022). *Essential Mathematics for Economic Analysis* (6th ed.). Pearson
Burden, R. L., & Faires, J. D. (2011). *Numerical Analysis* (9th ed.). Cengage Learning.
Strang, G. (2009). *Introduction to Linear Algebra* (4th ed.). Wellesley-Cambridge Press.
Calculus for Beginners (mit.edu) [https://math.mit.edu/~djk/calculus_beginners/]
Dennis D. Wackerly, William Mendenhall, Richard L. Scheaffer - Mathematical Statistics with Applications-Cengage Learning (2008)

(Graph Theory)
Barabási, A.-L. (2016). *Network Science*. Cambridge University Press. http://networksciencebook.com/
Menczer, F., Fortunato, S., & Davis, C. A. (2020). *A First Course in Network Science*. Cambridge University Press. https://doi.org/10.1017/9781108653947
Jackson, M. O. (2010). *Social and Economic Networks*. Princeton University Press. https://doi.org/10.2307/j.ctvcm4gh1
Easley, D., & Kleinberg, J. (2010). *Networks, Crowds, and Markets*. Cambridge University Press. https://doi.org/10.1017/CBO9780511761942

(Computational Epistemology)
Rubin, H. (2022). Structural causes of citation gaps. *Philosophical Studies*, *179*(7), 2323–2345. https://doi.org/10.1007/s11098-021-01765-3
Weatherall, J. O., O'Connor, C., & Bruner, J. P. (2020). How to Beat Science and Influence People: Policymakers and Propaganda in Epistemic Networks. *The British Journal for the Philosophy of Science*, *71*(4), 1157–1186. https://doi.org/10.1093/bjps/axy062
Weatherall, J. O., & O'Connor, C. (2021). Conformity in scientific networks. *Synthese*, *198*(8), 7257–7278. https://doi.org/10.1007/s11229-019-02520-2
Zollman, K. J. S. (2007). The communication structure of epistemic communities. *Philosophy of Science*, *74*(5), 574–587. https://doi.org/10.1086/525605

AM4

Computational Modeling

LAB COURSE

AUTONOMOUS ROBOTICS (211423)

PROF. DR. RER. NAT. GREGOR SCHÖNER, STEPHAN SEHRING

TERM:	Summer 2024
MEETING TIME:	Preliminary Meeting: 29.08.2024 10.00 – 11.00 (NB 02/77)
	Block: 02.09.2024 - 06.09.2024, 10 – 18
ROOM:	NB 02/77
CP:	3

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.

Assessment:

The practical part of the lab course consists of a week of full-time work in which students solve programming tasks with simulated mobile robots. In the two weeks following the practical part, the students then write reports in which they describe and analyze the work they have done. The grade for the lab course is based on both the practical work and the report. Students will get support during programming.

Registration:

Limited number of participants! Please enroll through our e-learning system on www.ini.rub.de from 1st of April to 17th of May 2024. A decision on participation will be published shortly afterwards.

AM4

Computational Modeling

LECTURE & EXERCISE

COMPUTATIONAL NEUROSCIENCE: SINGLE-NEURON MODELS (211039)

PROF. DR. ROBERT SCHMIDT, GERGÖ GÖMÖRI

TERM:	Summer 2024
LECTURE:	Thursday, 10.15 – 11.45 (First Meeting: 11.04.2024)
ROOM:	ID 03/401
EXERCISE:	Thursday, 12.30 – 14.00 (First Meeting: 11.04.2024)
ROOM:	MB 2/90
CP:	6

If this course is used for Module I3, it cannot be used for AM4.

This module starts with a primer on neuroscience and the role of computational neuroscience. The next part of the module covers biologically-grounded models of single neurons, including leaky-integrate-and-fire and conductance-based neurons, but also more abstract models of neural activity and spike trains. You will learn how these different computational models describe and simplify the underlying biological processes to a different degree. We will examine in detail how these different neuron models can be used in numerical simulations to address research questions on computation in single neurons and circuits. In the exercises accompanying the lectures you will gain hands-on experience in implementing the different neuron models in Python, running numerical simulations, and performing calculations related to analytical solutions of the model equations and biophysics. The focus is on single neuron models, but we will also make use of available software (e.g. NEST Desktop) to examine how single neuron models can be integrated into simulations of neural networks. While the emphasis throughout the module is on methodological issues, how models can be built, tested and validated at each level, we will also draw connections to specific brain regions to motivate and illustrate the models.

Learning Outcomes:

- apply techniques from computational neuroscience to simulate neural activity
- become familiar with different types of single neuron models, their mathematical description, and their different levels of biological abstraction
- acquire skills in modelling neurons, synapses and circuits and connect these models to biology and computation
- understanding of the biological basis for computation in neurons

Assessment: written exam at the end of the semester (120 min)
Requirements: Programming in Python, mathematical knowledge (linear algebra and calculus) and an interest in neurobiology

Literature:

Gerstner, W., Kistler, W. M., Naud, R., & Paninski, L. (2014). Neuronal dynamics: From single neurons to networks and models of cognition . Cambridge University Press.
Dayan, P., & Abbott, L. F. (2005). Theoretical neuroscience: computational and mathematical modeling of neural systems . MIT press.

AM4

AM4. Computational Modeling

LECTURE & EXERCISE

MATHEMATICS FOR MODELING AND DATA ANALYSIS (211047)

PROF. DR. LAURENZ WISKOTT

TERM:	Summer 2024
LECTURE:	Thursday 10.30 – 12.00 (First Meeting: 11.04.2024)
EXERCISE:	Thursday 12.15 – 13.45 (First Meeting: 11.04.2024)
ROOM:	NB 3/57
CP:	6

If this course is used for Module I3, it cannot be used for AM4.

Content:

This course covers some mathematical methods that are relevant for modeling and data analysis. Particular emphasis is put on an intuitive understanding as is required for a creative command of mathematics. The following topics are covered:

- Functions and how to visualize them
- Vector spaces
- Matrices as transformations
- Systems of linear differential equations
- Qualitative analysis of nonlinear differential equations
- Bayesian theory
- Markov chains

Teaching format:

This course is given with the flipped/inverted classroom concept. First, the students work through online material by themselves. In the lecture time slot we then discuss the material, find connections to other topics, ask questions and try to answer them. In the tutorial time slot the newly acquired knowledge is applied to analytical exercises and thereby deepened. I encourage all students to work in teams during self-study time as well as in the tutorial. In particular I expect that students have worked through the material of the first unit when they come to the first session.

Learning outcomes: After the successful completion of this course the students

- know the material covered in this course, see Content,
- do have an intuitive understanding of the basic concepts and can work with that,
- can communicate about all this in English.

[Course: MATHEMATICS FOR MODELING AND DATA ANALYSIS, Prof. Dr. rer. nat. Laurenz Wiskott]

Exam:

The course is concluded with a digital written exam for 90 minutes within a 100 minutes time slot. We offer two dates in the semester of the course and none in the next semester. You are free to pick either of the two dates, but if you pick the second and you fail, the next opportunity to retry the exam is only about one year later.

The exam will be in presence, and it will be a closed book exam, thus you are not allowed to use any tools except for a one sided DIN A4 handwritten page of formulary that you create yourself.

Registration for the exam with us happens at the end of the course. In addition to being registered for the regular Moodle course you also have to register for the Exam Moodle, and then you simply take the exam. You might also have to register for this exam in your examination office, but this is something you'll have to figure out yourself. Registering with us and with the examination office are independent of each other. If possible we will report your grade to the examination office in any case, whether you have registered there or not. There are no prerequisites for the exam, like 50% points in tutorials or the like.

A mock exam will be available towards the end of the course. It will be shorter than the final exam. The main purpose is to give you a good impression of the style of the exam and therefore facilitate exam preparation.

Condition for granting the credit points:

You need at least 50% in the final exam. Percentage takes the chance level into account (as 0%) and is derived as follows: Each exam has a chance level C if you would do pure guessing and a maximal number of points M if you answer everything correctly. The default mapping from exam points to the 100% grading scheme is 100*(P-C)/(M-C), where P is your individual number of points you have got in the exam. So, with pure guessing, you would get P=C and therefore 0% on average, and with perfect answers, i.e. P=M, you get 100%. The percentage grades will then be translated into the grading schemes required for your study program, e.g. grades from 0.7 or 1.0 to 5.0.

AM4

Computational Modeling

LECTURE & EXERCISE

INTRODUCTION TO COMPUTATIONAL NEUROSCIENCE (211046)

PROF. DR. SEN CHENG

TERM:	Summer 2024
LECTURE:	Monday, 16 – 18 (First Meeting: 08.04.2024)
ROOM:	NB 3/57
EXERCISE:	Friday, 10 – 12 (First Meeting: 08.04.2024)
ROOM:	NB 3/72

If this course is used for Module C3, it cannot be used for AM4.

Computational neuroscience uses quantitative methods to describe what nervous systems do, study how they function, and explain the underlying principles. This class introduces the basics of the mathematical and computational methods used in contemporary neuroscience research. These methods are applied to problems in perception, motor control, learning, and memory.

Knowledge of calculus, linear algebra, and statistics is required for this class, knowledge of neuroscience is not.

Assessment written final exam - 120 min - date: TBA

Course material available on Moodle (registration required)

Literature "Theoretical Neuroscience" by Dayan and Abbott, MIT Press

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

Office hours: Thursdays 14:00-15:00

Enrollment: eCampus/Flexnow

AM4

Computational Modeling

SEMINAR

SEMINAR COMPUTATIONAL NEUROSCIENCE (211130)

PROF. DR. SEN CHENG

TERM: Summer 2024

MEETING TIME: Wednesday, 10 – 12 (First Meeting: 10.04.2024)

ROOM: NB 3/57

CP: 3

Computational neuroscience uses quantitative methods to describe what nervous systems do, study how they function, and explain the underlying principles. This seminar will cover recent scientific publications in the field of computational neuroscience.

Specific topics:

- Neural Encoding
- Neural Decoding
- Information Theory
- The Action Potential
- Dynamics of Neural Networks
- Synaptic Plasticity
- Associative Networks
- Continuous Attractor Networks
- Associative Learning
- Classification
- Competitive Learning
- Generative Models

Learning Outcomes:
After successful completion of this seminar, students will be able to

- read and understand scientific articles in computational neuroscience
- apply computational models to describe the functioning of the nervous system
- understand the advantages and disadvantages of specific computational models
- discuss how neuroscience experiments are used to test computational models
- present the results of studies in computational neuroscience to an audience

Examination: Oral presentation

Requirements:
Knowledge of calculus, linear algebra, and statistics are required, e.g. Mathematik 1 und 2, Statistik.
Knowledge of biology is not necessary, but basic computational neuroscience is.

Students should have taken the class „Introduction to Computational Neuroscience“, or something equivalent, before enrolling in this seminar. It is also possible to take this seminar in parallel with „Introduction to Computational Neuroscience“.

Literature:
The articles will be announced in the first meeting.
Background reading: “Theoretical Neuroscience” by Dayan and Abbott, MIT Press

AM4

Computational Modeling

LECTURE

MENSCHENZENTRIERTE ROBOTIK (136070)

JUN. PROF. DR. LAURA KUNOLD, PROF. DR.-ING BERND KUHLEN-KÖTTER, PROF. DR. ANNETTE KLUGE

TERM:	Summer 2024
MEETING TIME:	Tuesday, 14 – 17 (First Meeting: 09.04.2024)
ROOM:	LPS Lern- und Forschungsfabrik; Industriestraße 38c, 44894 Bochum
CP:	6

Language of instruction: German

Details im Moodle-Kurs: https://moodle.ruhr-uni-bochum.de/course/view.php?id=34716

Im Rahmen der Lehrveranstaltung werden die Studierenden in fachübergreifenden Gruppen an konkreten Problemstellungen im Bereich der menschenzentrierten Robotik arbeiten. Zur Gestaltung des soziotechnischen Systems aus Mensch(en) und Roboter(n), werden sowohl ingenieurwissenschaftliche als auch psychologische Fragen berücksichtigt. Dabei wird vor allem auf die mobile Servicerobotik und die Mensch-Roboter-Kollaboration eingegangen.

Zur menschengerechten Gestaltung der Interaktion mit der Roboterplattform, wird eine Einführung in psychologische Effekte der Mensch-Technik-Interaktion gegeben, sowie die soziale Robotik und ihre Anwendungsfelder vorgestellt.

Auf dieser Basis bearbeiten die Studierenden dann in interdisziplinären Gruppen individuelle Problemstellungen unter wissenschaftlichen Gesichtspunkten zur Behindertenhilfe. Hierbei steht thematisch die erfolgreiche Kommunikation und Interaktion zwischen Mensch und Roboter (und der Eindruck des Roboters auf dem Menschen) im Vordergrund. Es besteht die Möglichkeit die ausgearbeiteten Lösungsansätze zu implementieren und somit eine Validierung des Konzeptes durchzuführen.

AM4

Computational Modeling

LAB COURSE

AN INTRODUCTION TO PYTHON FOR DATA ANALYSIS (211421)

PROF. DR. RER. NAT. LAURENZ WISKOTT, SHIRIN REYHANIAN MASHHADI

TERM:	Summer 2024
MEETING TIME:	Block (Mo-Fr): 26.08. - 06.09.2024, 10.30 – 16.30
ROOM:	IC 04/440
CP:	3

Python is a programming language that is widespread among scientists due to its readability and powerful standard libraries. This practical course teaches Python to students with prior experience in other programming languages. In addition to introducing the language itself, we will focus on scientific computing including vectors and matrices as well as data processing and mild machine learning. During the second week, participants will implement a project in Python.

Content

- **Python basics:** syntax, interpreter, control structures, data types, OOP
- **Scientific computing:** NumPy, Matplotlib, scikit-learn
- **Project:** realization of a project in Python

Grading

Grading is based on the project in the second week. If crucial components of Python are not covered in your project, we might also test your knowledge on the subject.

Requirements:

We expect fluency in one other programming language and familiarity with concepts like

- control structures
- data types
- functions
- object-oriented programming

These concepts will not be taught separately.

Furthermore, the course will be taking place in a room without PCs, meaning that students are required to use their own laptops during the course.

Registration:

Enroll by sending an email to python@ini.rub.de with the info below.

In your mail please include:

name, student ID number (Matrikelnummer), study program and semester (e.g., "Bachelor Angewandte Informatik PO13, 3rd semester"), a short explanation about your coding experience (one or two sentences)

5 seats are reserved for CogSci Students.

Enrollment period: https://informatik.rub.de/studium/pruefungsamt/pruefungstermine/

AM5

AM5. Special Methods in Neuroscience & Genetics

SEMINAR

BIRDS IN SCIENCE (110013)

FARINA LINGSTÄDT, PROF. DR. JONAS ROSE

TERM:	Summer 2024
MEETING TIME:	Wednesday, 12 – 14 (First Meeting: 10.04.2023)
ROOM:	GABF 04/253
CP:	3

Birds are part of a wide range of scientific studies. This course will provide an overview on the cognitive abilities of birds and how they are studied in the laboratory. We will start looking at the evolutionary history, that made bird brains vastly different from ours. From there on, each week we will talk about a different cognitive ability and how birds use their bird brains to exhibit them. We will look at purely behavioral as well as electrophysiological studies. In a short presentation, the students introduce each week's topic, which will be the basis of the course grade.

AM5

AM5. Special Methods in Neuroscience & Genetics

SEMINAR

TIERMODELLE IN DER PSYCHIATRIE (112636)

PATRICK REINHARDT

TERM:	Summer 2024
MEETING TIME:	Wednesday, 14 – 16 (First Meeting: 10.04.2024)
ROOM:	IA 02/452
CP:	3

Language of instruction: German

Wie verhalten sich schizophrene Mäuse? Können Ratten depressiv werden? Und warum werden Hamster nicht alkoholabhängig?
Tiermodelle sind in den Neurowissenschaften weit verbreitet, aber besonders im Kontext psychiatrischer Störungen nicht unumstritten. In diesem Seminar sollen unterschiedliche Tiermodelle psychiatrischer Störungen, ihre Aussagekraft und Limitationen besprochen werden. Ziel des Seminars ist es, den Teilnehmenden einen Überblick über Tierforschung im Kontext Psychiatrie zu geben, sowie sie in die Lage zu versetzen Studien methodenkritisch zu analysieren.
Die Basis des Seminars werden Impulsvorträge zu unterschiedlichen Modellen, sowie Gruppenarbeiten und Diskussionen im Plenum bilden.
Grundlegende Kenntnisse der klinischen Psychologie werden zur Teilnahme vorausgesetzt.
Literatur wird zu Beginn des Seminars bekanntgegeben.

Kontakt: patrick.reinhardt@rub.de

AM5

AM5. Special Methods in Neuroscience & Genetics

SEMINAR

INTRODUCTION TO NON-INVASIVE BRAIN STIMULATION (NIBS) TECHNIQUES AND THEIR APPLICATIONS (118313)

SUMIT ROY [PROF. DR. JONAS ROSE]

TERM:	Summer 2024
MEETING TIME:	Wednesday, 14 – 16
ROOM:	IA 1/161
CP:	3

In this course we will be exploring in detail different non-invasive brain stimulation techniques like transcranial magnetic stimulation (TMS) and transcranial electrical stimulation (tES). We will also talk about their current applications and recent developments in stimulation techniques. In the later weeks, students will be designing and presenting their research ideas pertaining to these techniques on which they will be graded.

Students can receive 3 CP graded or ungraded.

Lecturer: Sumit Roy (roy@ifado.de)

AM5

AM5. Special Methods in Neuroscience & Genetics

PRACTICAL COURSE

MOLEKULARE PSYCHOLOGIE: MOLEKULARGENETISCHES GRUNDPRAKTIKUM 1A (118156) OR 1B: (118159)

DR. DIRK MOSER

TERM:	Summer 2024
MEETING TIME:	Preliminary Meeting: Monday, 15.04.2024, 13.00 (IB 5/103)
	both blocks: 1 week at the start of the summer semester break
	Monday to Friday, 9 – 13
ROOM:	IB 5/103
CP:	3

Language of instruction: German

Es kann nur eine der beiden Veranstaltungen belegt werden.

Das Grundpraktikum "Molekulare Psychologie" soll interessierten Studierenden die Schnittmenge zwischen Psychologie und Biologie experimentell begreifbar machen. Hierzu wird jeder PraktikumsteilnehmerIn aus eigenem Blut DNA extrahieren und diese im Verlauf der Woche auf verschiedene, in der psychobiologischen Forschung prominente Genvarianten überprüfen. Hierzu finden eine Vielzahl molekularbiologischer Methoden Anwendung. Praktikumsbegleitend werden molekulare Grundlagen sowie experimentelle Möglichkeiten, sowie die Ergebnisse der eigenen praktischen Versuche in Spezialvorträgen präsentiert und diskutiert.

Voraussetzungen: Teilnahmevorraussetzung sind gute bis sehr gute Kenntnisse in Biologie/ Molekularbiologie/Psychobiologie

Literatur: Skript (wird nach der Vorbesprechung verteilt)

AM6

AM6. EEG-training

BLOCK SEMINAR & PRACTICAL COURSE
NEUROPSYCHOLOGICAL METHODS: EEG
(118157 + 118158)
DR. LAURA-ISABELLE KLATT & DR. JULIAN ELIAS REISER

TERM:	Summer 2024
PRELIMINARY MEETING:	10.04.2024, 10.00 online via Zoom
SEMINAR:	13.05.2024, 27.05.2024, 10.06.2024, 17.06.2024, 15.07.2024, 10-14
PRACTICAL COURSE:	13.04.2024 & 14.04.2024, 9-18
ROOM:	Leibniz Institut für Arbeitsforschung in Dortmund
CP:	6

This course takes place at the *Leibniz Institut für Arbeitsforschung* in Dortmund (Ardeystr. 67, 44139 Dortmund).

Please make early decision and contact the lecturers running the courses: Please notice the entry conditions of the courses.

SEMINAR: Seminar course neuropsychological methods: EEG (118158)
& LAB (Laboratory Course): Practical course neuropsychological methods: EEG (118157):

Students must enroll for both the "practical course" and the "seminar course". The practical laboratory course is directly linked to the accompanying seminar course (also 2 SWS). Participation in both courses is mandatory to complete the module.
Participants will learn how to collect and preprocess EEG data and how to conduct basic EEG analyses. On the basis of published neuroscientific literature students will develop a basic research questions and analyze the data accordingly. The course language is English. In-person lectures will be accompanied by materials and asynchronous video lectures on Moodle. Data collection (practical course) will take place as a blocked weekend session (Saturday and Sunday). In addition, 5 in-person sessions - 4 h each - will take place throughout the semester. The whole course takes place at the IfADo in Dortmund. The grade will be based on intermitting assignments throughout the semester.

Requirements:
Pract. Course "MATLAB for Beginners" attendance mandatory OR check with course instructors if you have equivalent programming experience; Basic knowledge of statistical analyses (ANOVAs, t-tests, GLM) is required.

Literature:
An Introduction to the Event-Related Potential Technique, 2nd Edition (2014, MIT Press)
Steven J. Luck

AM6

AM6. EEG-training

SEMINAR

NEUROPSYCHOLOGISCHE VERHALTENSSTUDIEN ENTWICKELN UND DURCHFÜHREN (118151)

DR. RER. NAT. JOHANNES JUNGILLIGENS

TERM:	Summer 2024
MEETING TIME:	Wednesday, 08 – 10 (First Meeting: 10.04.2024)
ROOM:	IA 02/460
CP:	3

Language of instruction:
German; depending on the group composition this seminar can also be held in English.

How to develop and implement neuropsychological behavioral studies

The objective measurement of behavioral aspects has an important role in cognitive neuroscience as a complement to questionnaires and neurobiological measures, for example in the context of clinical neuropsychological and basic research studies. In this seminar, a neuropsychological behavioral paradigm will be independently developed and practically implemented in OpenSesame (no programming knowledge required). From the development of the research question, the use of AI tools for research, the selection of stimuli to ethical aspects, insight into all relevant steps in study planning will be given.

Focus areas:

- Developing your own behavioral paradigm: Under guidance, participants will develop their own study with a behavioral paradigm.
- OpenSesame programming: The paradigm will be implemented in OpenSesame (no prior knowledge required).

The aim of the course is to enable participants to independently develop and conduct a study involving neuropsychological behavioral measurement.

D. Free Selection

Please notice that under the category "free selection" we only list courses held in German as additional offers. Please notice that you are only allowed to have maximally 15 CP from courses in German in the whole program.

Furthermore, any other course of the Cognitive Science Master Program can be counted as part of the free selection module, i.e., if you have completed (or have a clear plan of how you will complete) the obligatory modules, you may choose any additional courses from any module and credit them as part of the free selection module.

Additionally, it is possible to credit internships with up to 10 CPs in the category of free selection. The internship must of course be equivalent in working hours to the number of credit points and it must qualify for the Cognitive Science Master Program (ideally supporting your master thesis). If you aim to credit an internship as part of this module, then please contact the program coordinator (cogsci-info@rub.de) in advance.

D1 Free Selection

LECTURE

KOGNITION UND GEHIRN (112611)

PROF. DR. CHRISTIAN MERZ, PROF. DR. OLIVER WOLF

TERM:	Summer 2024
MEETING TIME:	Tuesday, 16 – 18 (First Meeting: 09.04.2024)
ROOM:	HZO 50
CP:	3

Language of instruction: German

Die Vorlesung ist für Studierende ab dem 4. Semester geeignet. Sie bietet einen Überblick über Befunde und Theorien zu aktuellen Themen der kognitiven Neurowissenschaft. Die Vorlesung setzt Grundkenntnisse der Kognitionspsychologie und der Biopsychologie voraus, die bis zum 4. Semester vermittelt werden.

Literatur: wird zu Beginn der Veranstaltung bekannt gegeben und wird im Moodle zur Verfügung gestellt.

D1

Free Selection

SEMINAR

PSYCHIATRIE: NEUROPSYCHOLOGISCHE ASPEKTE (118125)

PROF. DR. PATRIZIA THOMA

TERM:	Summer 2024
MEETING TIME:	Monday, 08.30 – 10.00 (First Meeting: 08.04.2024)
ROOM:	IA 02/445
CP:	3

Language of instruction: German

Bei dieser Veranstaltung haben die Studierenden der Master Psychologie Vorrang.

In diesem Seminar sollen die neuropsychologischen Veränderungen bei Schizophrenie, Depression, Sucht und anderen wichtigen Störungen dargestellt und diskutiert werden. Dabei erfolgt zunächst eine Darstellung allgemeiner Gesichtspunkte (Definition, Diagnose etc.) und eine Beschreibung zerebraler Veränderungen. Ausgehend von den zerebralen Veränderungen wird das kognitive Profil im Hinblick auf die kognitiven Bereiche Aufmerksamkeit, visuell-räumliche Leistungen und exekutive Funktionen erläutert.

Literatur: Eine Literaturliste ist zu Beginn des Semesters erhältlich.

D1

Free Selection

LECTURE

EVOLUTION UND EMOTION (112251)

PROF. DR. PHIL. DR. H.C. ONUR GÜNTÜRKÜN

TERM:	Summer 2024
MEETING TIME:	Thursday, 16 – 18 (First Meeting: 11.04.2024)
ROOM:	HIA
CP:	3

Language of instruction: German

Wie verlief bisher die Geschichte des Lebens? Innerhalb welchen Gesamtszenarios bettet sich die Entstehung des Menschen ein und welche Anteile unseres heutigen Denkens, Handelns und Fühlens reflektieren die Gesetzmäßigkeiten, die bei der Phylogenese unseres Gehirns wirksam waren? Wie determiniert die Interaktion von Umweltfaktoren und genetischer Anlage unsere Entwicklung? Um solche Fragen beantworten zu können, müssen wir die Evolutionstheorie mit allen ihren Implikationen kennenlernen.

In der Vorlesung sollen folgende Themen behandelt werden:

1) Mechanismen der Genetik und Epigenetik
2) Verhaltensgenetik
3) Entwicklung des Lebens und des Menschen
4) Emotionsmechanismen
5) Soziobiologie

Literatur: Bekanntgabe der aktuellen Literatur während der Veranstaltung und über Moodle

D1

Free Selection

LECTURE

BIOPSYCHOLOGIE (112631)

PROF. DR. PHIL. DR. H.C. ONUR GÜNTÜRKÜN

TERM:	Summer 2024
MEETING TIME:	Monday, 16 – 18 (First Meeting: 08.04.2024)
ROOM:	HIA
CP:	3

Language of instruction: German

Das Wissen um Hirnaufbau und Hirnfunktion ist die Grundlage für das Verstehen sämtlicher bio- und neuropsychologischer Fragestellungen. In dieser Vorlesung wollen wir uns exemplarisch das Sehsystem des Menschen vornehmen. Wir wollen seine Funktionen verstehen, indem wir die Anatomie und Physiologie des Sehsystems kennenlernen und neuropsychologische Ausfälle anschauen. Danach wollen wir kennenlernen, wie die visuelle Information in die Prozesse des präfrontalen Cortex integriert wird, sodass die Fähigkeit zum Behalten, Planen und Handeln entsteht. Kurz gesagt, wollen wir die neuralen Grundlagen des Wahrnehmens und Erkennens kennenlernen.

Literatur:

Onur Güntürkün, Biopsychologie, Hogrefe Verlag 2012, Kapitel 5 - 12

Bekanntgabe weiterer aktueller Literatur während der Veranstaltung und über Moodle.

D1

Free Selection

BLOCK SEMINAR

NEUROPSYCHOLOGISCHE REHABILITATION I (118121)

PROF. DR. PATRIZIA THOMA

TERM:	Summer 2024
BLOCK:	Preliminary Meeting: Tuesday, 09.04.2024, 9.00-10.00 (IA 02/460)
	Friday, 03.05.2024, 9 – 17 (IC 04/109)
	Saturday, 04.05.2024, 9 - 17 (GABF 04/514)
CP:	3

Language of instruction: German

Bei dieser Veranstaltung haben die Studierenden der Master Psychologie Vorrang.

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.

Literaturhinweise: Eine Literatur ist zu Beginn des Seminars erhältlich

SECOND YEAR PROGRAM

I. Interdisciplinary Research Module

Choosing a course from C1 - C4 as a substitute for I1 - I4 is only possible if the substitute course is closely connected to your master thesis project.

Please notice that one and the same course can only be accepted as part of a single Module. It is prohibited to use the same course for two different Modules.

Usually, the interdisciplinary research modules should be completed in the third semester (winter semester). To keep flexibility for the students we offer some courses for these modules in the summer semester as well. Please check individually with the lecturer whether the colloquium will be held in English.

I1

I1. Cognitive Philosophy

COLLOQUIUM

RESEARCH COLLOQUIUM: RATIONALITY AND COGNITION (030125)

JUN. PROF. DR. PETER BRÖSSEL

TERM:	Summer 2024
MEETING TIME:	Wednesday, 17 – 19 (First Meeting: 10.04.2024)
ROOM:	GABF 04/609
CP:	3 or 6

In this seminar, we study research articles (some of which will be work-in-progress) from the intersection of normative epistemology and descriptive epistemology (i.e., psychology and cognitive science). We investigate formal models of perception, rational reasoning, and rational action. Students at the master's or doctoral level will be given the opportunity to present their research in English.

I1

Cognitive Philosophy

COLLOQUIUM

EXTRA RESEARCH COLLOQUIUM "METAPHILOSOPHY, EXPERIMENTAL PHILOSOPHY, AND ARGUMENTATION THEORY" (030126)

JUN. PROF. DR. JOACHIM HORVATH

TERM:	Summer 2024
MEETING TIME:	Wednesday, 16:30 – 18:00 (First Meeting: 10.04.2024)
ROOM:	GAFO 04/619
CP:	3 or 6

In this colloquium in seminar-style, we will discuss current topics from argumentation theory, epistemology, experimental philosophy, and metaphilosophy, broadly construed. The colloquium will also host a number of talks by external guests, many of which are leading experts in their field. Students at the advanced bachelor, master, or doctoral level are especially welcome in the colloquium, and they can also acquire the normal range of credit points. Moreover, student participants will have the option of presenting their own work, e.g., related to their thesis, in English.

I1

Cognitive Philosophy

COLLOQUIUM

PHILOSOPHY MEETS COGNITIVE SCIENCE: MEMORY AND LANGUAGE (030132)

PROF. DR. MARKUS WERNING

TERM:	Summer 2024
MEETING TIME:	Tuesday, 12 – 14 (First Meeting: 09.04.2024)
ROOM:	GA 04/187
CP:	3 or 6

In cooperation with the German Language Department (RUB) and the Center for Philosophy of Memory (Grenoble)

In the research colloquium current topics at the interface between Philosophy and Cognitive Science will be discussed. The colloquium hosts talks by leading international 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.

This semester the sessions of the research colloquium will alternate in a bi-weekly rhythm between the topics “Memory” and “Language”. A detailed schedule will be published in due course at https://www.ruhr-uni-bochum.de/phil-lang/colloquium.html. Talks will be held either online via Zoom or in person.

Assessment:

Students can receive either 3 CP by giving a presentation or 6 CP by giving a presentation and writing an essay.

Additional Exercise

Students can attend the exercise “Philosophy meets cognitive science: memory and language” (030112) in addition to the colloquium. It takes place Wednesday 12-13 in GA 04/187. No further CPs can be gained by attending the exercise.

I1

Cognitive Philosophy

SEMINAR

TOPICS IN PHILOSOPHY OF LANGUAGE, LOGIC, AND INFORMATION: ATTITUDES AND THEIR OBJECTS

JUN. PROF. DR. KRISTINA LIEFKE, PROF. DR. DOLF RAMI

TERM:	Summer 2024
MEETING TIME:	Wednesday, 16 – 18 (First Meeting: 17.04.2024)
ROOM:	GA 04/187
CP:	3 or 6

Assume that Gregor imagines turning into a beetle. Intuitively, this is different both from Gregor imagining a beetle and from Gregor imagining (turning into) a vermin (even if all beetles are vermin). This seminar introduces current philosophical research on mental states like imagination and their metaphysical objects (e.g. possibilities, fictional entities). To facilitate access to this area, the seminar will combine topical introductions (by Kristina Liefke and Dolf Rami) with presentations by well-known researchers (e.g. Alex Grzankowski, Justin D'Ambrosio, Friederike Moltmann). Students will have the opportunity to earn a 'kleine Studienleistung' [3 CPs] (by writing a summary of one of the expert presentations, or by giving an in-class talk) and a 'große Studienleistung' [6 CPs] (by additionally writing a research paper).

I1

Cognitive Philosophy

COLLOQUIUM

COLLOQUIUM: PHILOSOPHY OF INFORMATION AND COMMUNICATION (030119)

JUN. PROF. DR. KRISTINA LIEFKE

TERM:	Summer 2024
MEETING TIME:	Tuesday, 12 – 14 (First Meeting: 09.04.2024)
ROOM:	GABF 04/358
CP:	3 or 6

This colloquium (co-organized with Prof. Daniel Gutzmann, Germanistik) serves the discussion of current topics in semantics, pragmatics, and the philosophy of language. The colloquium combines talks by international experts with presentations of local researchers and (PhD/MA) students. Students will be given the opportunity to present their (ongoing) work in English. A detailed schedule will be available by mid-March at https://www.ruhr-uni-bochum.de/phil-inf/colloquium/index.html.en.

Assessment:
Students can receive 3 CP for active participation and giving a presentation.
Students can receive 6 CP for giving a presentation + essay/oral exam.

I1

Cognitive Philosophy

COLLOQUIUM

INTERDISCIPLINARY READING CLUB: RECENT DEBATES IN PHILOSOPHY OF MIND AND SITUATED COGNITION (030136)

PROF. DR. ALBERT NEWEN

TERM:	Summer 2024
MEETING TIME:	Tuesday, 14 – 16 (First meeting: 09.04.2024)
ROOM:	GA 04/187
CP:	3 or 6

The colloquium is organized for PhD students and for advanced Master Students only (of several programs) who are already working on their Master thesis or at least have decided to work out the master thesis in the area of theoretical philosophy. We will offer regular presentations half from master- and PhD-students from Bochum and half from external guests. The presentations will all be in the general domain of theoretical philosophy and cognitive sciences, many of them discussing problems in philosophy of mind or in the area of 'Situated Cognition'. 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 discussion of ongoing research in the RTG-group 'Situated Cognition' and further research projects on social understanding, the self, episodic memory, the perception-cognition divide and many more.

Master students can receive standard CPs (ungraded certificate) for a presentation in the colloquium (in the case of an additional essay, Master students can receive standard CPs and a graded certificate).

I2

Psychology

COLLOQUIUM

RESEARCH COLLOQUIUM: INTERDISCIPLINARY PERSPECTIVES ON EPISODIC MEMORY (212102)

PROF. DR. SEN CHENG

TERM:	Summer 2024
MEETING TIME:	Friday, 14.00 – 16.00
ROOM:	IC 04/440
CP:	3

This research colloquium covers the range of topics in the interdisciplinary research unit FOR 2812 "Constructing scenarios of the past: A new framework in episodic memory". Presentations will focus on the cognitive and neuronal mechanisms underlying scenario construction in episodic memory. The discussed studies employ and integrate approaches from philosophy, psychology, as well as experimental and computational neuroscience. The colloquium hosts talks by leading international experts and local researchers as well as presentations by doctoral and master students. In addition, students will read journal articles and book chapters related to the topics of the talks.

Link: https://for2812.rub.de/events/

Assessment: term paper

Contact: Prof. Dr. Sen Cheng, NB 3/33, sen.cheng@rub.de
Office hours: Thursdays 14:00-15:00

Capacity: max. 15 students
Enrollment: eCampus

Requirements: advanced knowledge of learning and memory

I3

I3. Computational Modeling

LECTURE & EXERCISE

COMPUTATIONAL NEUROSCIENCE: SINGLE-NEURON MODELS (211039)

PROF. DR. ROBERT SCHMIDT, GERGÖ GÖMÖRI

TERM:	Summer 2024
LECTURE:	Thursday, 10.15 – 11.45 (First Meeting: 11.04.2024)
ROOM:	ID 03/401
EXERCISE:	Thursday, 12.30 – 14.00 (First Meeting: 11.04.2024)
ROOM:	MB 2/90
CP:	6

If this course is used for module AM4, it cannot be used for module I3.

This module starts with a primer on neuroscience and the role of computational neuroscience. The next part of the module covers biologically-grounded models of single neurons, including leaky-integrate-and-fire and conductance-based neurons, but also more abstract models of neural activity and spike trains. You will learn how these different computational models describe and simplify the underlying biological processes to a different degree. We will examine in detail how these different neuron models can be used in numerical simulations to address research questions on computation in single neurons and circuits. In the exercises accompanying the lectures you will gain hands-on experience in implementing the different neuron models in Python, running numerical simulations, and performing calculations related to analytical solutions of the model equations and biophysics. The focus is on single neuron models, but we will also make use of available software (e.g. NEST Desktop) to examine how single neuron models can be integrated into simulations of neural networks. While the emphasis throughout the module is on methodological issues, how models can be built, tested and validated at each level, we will also draw connections to specific brain regions to motivate and illustrate the models.

Learning Outcomes:

- apply techniques from computational neuroscience to simulate neural activity
- become familiar with different types of single neuron models, their mathematical description, and their different levels of biological abstraction
- acquire skills in modelling neurons, synapses and circuits and connect these models to biology and computation
- understanding of the biological basis for computation in neurons

Assessment: written exam at the end of the semester (120 min)

Requirements: Programming in Python, mathematical knowledge (linear algebra and calculus) and an interest in neurobiology

Literature:

Gerstner, W., Kistler, W. M., Naud, R., & Paninski, L. (2014). Neuronal dynamics: From single neurons to networks and models of cognition . Cambridge University Press.

Dayan, P., & Abbott, L. F. (2005). Theoretical neuroscience: computational and mathematical modeling of neural systems . MIT press.

I3

I3. Computational Modeling

LECTURE & EXERCISE

AUTONOMOUS ROBOTICS: ACTION, PERCEPTION, AND COGNITION (211048)

PROF. DR. RER. NAT. GREGOR SCHÖNER, LUKAS BILDHEIM

TERM:	Summer 2024
LECTURE:	Thursday, 14.15 – 16.00 (First Meeting: 11.04.2024)
EXERCISE:	Thursday, 16.15 – 17.00 (First Meeting: 11.04.2024)
ROOM:	NB 3/57
CP:	6

If this seminar is used for Module C2, it cannot be used for I3.

Autonomous robotics is an interdisciplinary research field in which embodied systems equipped with their own sensors and with actuators generate behavior that is not completely pre-programmed. Autonomous robotics thus entails perception, movement generation, as well as core elements of cognition such as making decisions, planning, and integrating multiple constraints. The main focus of the course are solutions to autonomous movement generation that are inspired by analogies with how nervous systems generate movement.

This course touches on various approaches to this interdisciplinary problem. The first half of the course focusses on movement generation for autonomous vehicles. The main emphasis will be on dynamical systems methods (attractor dynamics) for that problem, reviewing related approaches as well. The second half of the course will study motion in robot arms, including motion planning, timing, and control. Analogies with human movement will be exploited to illustrate ideas and problems, including the degree of freedom problem, coordination, and reflex control of muscles.

Requirements

The emphasis of the course is on learning concepts, practicing interdisciplinary scholarship including reading and writing at a scientific and technical level. Mathematical concepts are used throughout, so understanding these concepts is important. Mathematical skills are not critical to mastering the material, but helpful. The mathematics is mostly from the qualitative theory of dynamical systems, attractors and their instabilities. Short tutorials on some of these concepts will be provided.

Registration

You can register for the course here: https://www.ini.rub.de/elearning/

Further reading

Readings will be posted on the INI web page. Also have a look at the web page of the Dynamic Field Theory community that is interested in related problems and solutions: https://dynamicfieldtheory.org/

There you find more exercises, reading material, slides and lecture videos that have some overlap with the lecture.

Find more information on the INI web page: https://www.ini.rub.de/teaching/courses/autonomous_robotics_action_perception_and_cognition_summer_term_2024/

I3

I3. Computational Modeling

LECTURE & EXERCISE

MATHEMATICS FOR MODELING AND DATA ANALYSIS (211047)

PROF. DR. LAURENZ WISKOTT

TERM:	Summer 2024
LECTURE:	Thursday 10.30 – 12.00 (First Meeting: 11.04.2024)
EXERCISE:	Thursday 12.15 – 13.45 (First Meeting: 11.04.2024)
ROOM:	NB 3/57
CP:	6

If this course is used for Module I3, it cannot be used for AM4.

Content:

This course covers some mathematical methods that are relevant for modeling and data analysis. Particular emphasis is put on an intuitive understanding as is required for a creative command of mathematics. The following topics are covered:

- Functions and how to visualize them
- Vector spaces
- Matrices as transformations
- Systems of linear differential equations
- Qualitative analysis of nonlinear differential equations
- Bayesian theory
- Markov chains

Teaching format:

This course is given with the flipped/inverted classroom concept. First, the students work through online material by themselves. In the lecture time slot we then discuss the material, find connections to other topics, ask questions and try to answer them. In the tutorial time slot the newly acquired knowledge is applied to analytical exercises and thereby deepened. I encourage all students to work in teams during self-study time as well as in the tutorial. In particular I expect that students have worked through the material of the first unit when they come to the first session.

Learning outcomes: After the successful completion of this course the students

- know the material covered in this course, see Content,
- do have an intuitive understanding of the basic concepts and can work with that,
- can communicate about all this in English.

[Course: MATHEMATICS FOR MODELING AND DATA ANALYSIS, Prof. Dr. rer. nat. Laurenz Wiskott]

Exam:

The course is concluded with a digital written exam for 90 minutes within a 100 minutes time slot. We offer two dates in the semester of the course and none in the next semester. You are free to pick either of the two dates, but if you pick the second and you fail, the next opportunity to retry the exam is only about one year later.

The exam will be in presence, and it will be a closed book exam, thus you are not allowed to use any tools except for a one sided DIN A4 handwritten page of formulary that you create yourself.

Registration for the exam with us happens at the end of the course. In addition to being registered for the regular Moodle course you also have to register for the Exam Moodle, and then you simply take the exam. You might also have to register for this exam in your examination office, but this is something you'll have to figure out yourself. Registering with us and with the examination office are independent of each other. If possible we will report your grade to the examination office in any case, whether you have registered there or not. There are no prerequisites for the exam, like 50% points in tutorials or the like.

A mock exam will be available towards the end of the course. It will be shorter than the final exam. The main purpose is to give you a good impression of the style of the exam and therefore facilitate exam preparation.

Condition for granting the credit points:

You need at least 50% in the final exam. Percentage takes the chance level into account (as 0%) and is derived as follows: Each exam has a chance level C if you would do pure guessing and a maximal number of points M if you answer everything correctly. The default mapping from exam points to the 100% grading scheme is 100*(P-C)/(M-C), where P is your individual number of points you have got in the exam. So, with pure guessing, you would get P=C and therefore 0% on average, and with perfect answers, i.e. P=M, you get 100%. The percentage grades will then be translated into the grading schemes required for your study program, e.g. grades from 0.7 or 1.0 to 5.0.

I3

I3. Computational Modeling

SEMINAR

JOURNAL CLUB: LEARNING AND MEMORY (211125)

PROF. DR. SEN CHENG

TERM:	Summer 2024
MEETING TIME:	Tuesday, 12-14 (First Meeting: 09.04.2024)
ROOM:	NB 3/72
CP:	3

This course can be assigned to module I2, too.

We will discuss the latest research results in learning and memory at the systems level. Each session will consist of either a presentation based on a published article or a research talk. Presentations will be given by one participant and will be followed by a group discussion. 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 to be discussed will focus on the functional role of the mammalian hippocampus in spatial navigation and episodic memory. They will cover a diverse set of approaches: electrophysiology, imaging, computational modeling, and robotics. Students will select articles to present in consultation with the instructor.

Assessment: presentation in class

Prerequisites: advanced knowledge of learning and memory

Course material: available on Trello (www.trello.com/b/ETW0pTnY)

Capacity: max. 15 students

Enrollment: eCampus

Literature: journal articles to be selected by students in consultation with the instructor

Contact: Prof. Sen Cheng, NB 3/33, sen.cheng@rub.de
Office hours: Thursdays 14:00-15:00

I3

I3. Computational Modeling

COLLOQUIUM

FORSCHUNGSKOLLOQUIUM COMPUTATIONALE NEUROLOGIE (200011)

JUN.-PROF. DR. MED. XENIA KOBELEVA

TERM:	Summer 2024
MEETING TIME:	Thursday, 16-18
ROOM:	partly Zoom, partly in building MB; OE Neurostimulation
CP:	tba

For registration, please write an e-Mail to Prof. Kobeleva: xenia.kobeleva@rub.de

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I4. Cognitive Neuroscience

COLLOQUIUM

COLLOQUIUM: NEURAL BASIS OF LEARNING (118923)

PROF. DR. JONAS ROSE, DR. JESÚS BALLESTEROS CARRASCO

TERM:	Summer 2024
MEETING TIME:	Friday, 12 – 14 (First meeting: 12.04.2024)
ROOM:	GA 04/187 (first meeting online)
CP:	3

A broad range of current research topics in cognitive neuroscience will be covered by internal and external speakers. Our focus lies in a mechanistic understanding of crucial processes that in turn form the basis of higher cognition.

A schedule will be available on the homepage from the beginning of April.

https://www.ngl.psy.ruhr-uni-bochum.de/ngl/

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I4. Cognitive Neuroscience

COLLOQUIUM

BIOPSYCHOLOGY RESEARCH COLLOQUIUM (118914)

PROF. DR. PHIL. DR. H.C. ONUR GÜNTÜRKÜN

TERM:	Summer 2024
MEETING TIME:	Monday, 13 – 15 (First meeting: 08.04.2024)
ROOM:	IB 6/127
CP:	3

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-uni-bochum.de/.

14

I4. Cognitive Neuroscience

COLLOQUIUM

RESEARCH COLLOQUIUM NEUROPSYCHOLOGY (118912)

PROF. DR. NIKOLAI AXMACHER

TERM:	Summer 2024
MEETING TIME:	Thursday, 14 – 16 (First Meeting: 11.04.2024)
ROOM:	IB 6/127
CP:	3

Presentation of ongoing research, as well as lectures by guest lecturers on clinical neuropsychological topics. A schedule with information about topics and speakers will be announced at the beginning of the semester via notice board and on the homepage: http://www.ruhr-uni-bochum.de/neuropsy/.

An important aim of this course, and basis for successful participation and grading, is a regular and active participation in the scientific discourse.

14

I4. Cognitive Neuroscience

COLLOQUIUM

COLLOQUIUM: BRAINS IN SPACE: AN INTERDISCIPLINARY RESEARCH COLLOQUIUM ON SPATIAL NAVIGATION (212164)

PROF. DR.SEN CHENG

TERM:	Summer 2024
MEETING TIME:	Tuesday, 16 – 17.30 (First Meeting: 09.04.2024)
ROOM:	virtually
CP:	3

In this colloquium, speakers will present their research in various areas of spatial navigation, including behavioral, neuroscientific, and theoretical approaches. The goal is to foster interdisciplinary discussions along the lines of the review article "A Map of Spatial Navigation for Neuroscience" (Parra-Barrero et al., 2023) that proposes a taxonomy of spatial navigation processes in mammals. The talks will cover a diverse range of topics, from the neural underpinnings of navigation to complex navigation behaviors. Attendees will gain a better understanding of how the mammalian brain represents and navigates through space, as well as learn about several cognitive processes such as learning and memory through the lens of spatial navigation.

Assessment: Literature review on a topic of a lecture including a summary of the lecture.

Literature: Englisch: Parra-Barrero, E., Vijayabaskaran, S., Seebrook, E., Wiskott, L., Cheng, S. (2023). A map of spatial navigation for neuroscience. *Neuroscience & Biobehavioral Reviews, 152.* https://doi.org/10.1016/j.neubiorev.2023.105200