PSY546 Selected topics in contemporary neuroscience

Lecturers:

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Extent and Intensity

4 blocks per 3 lectures (á 90 min)

4 credits

Type of completion: z (credit)

Course objectives

The aim of this course is to introduce students to selected topics and latest advances in social neurosciences. As a part of the course, students will visit Multimodal and Functional Imaging Laboratory (MAFIL) at Central European Institute of Technology, where various neuroimaging techniques will be demonstrated.

At the end of the course, students will understand the basics of neuroimaging techniques and the practical aspects of research in neuroscience. They will have knowledge about recent advances in selected areas of social neuroscience research

Schedule & Syllabus:

- 6.10. at 8.00 (U32);
    - Introduction to Contemporary Neuroscience
      Will discuss basic principles of the nervous system functioning and the recent advances and findings from human brain mapping.
      Zimmer, C., & Clark, R. (2014). Secrets of the brain. Nat. Geogr, 28-58.

    - Biomarkers and underlying mechanisms of psychiatric diseases

      Will discuss the DSM vs. RDoC approach to study mental health disorders and the related biomarkers and include examples from my research.
      Cuthbert, B. N., & Insel, T. R. (2013). Toward the future of psychiatric diagnosis: the seven pillars of RDoC. BMC medicine, 11(1), 126.

    - Impulsivity
      Impulsivity can be defined as acting without thinking about possible alternatives and consequences. In fact, it is very heterogenous term which can manifest in personality traits, cognitive and emotional processes and behaviour control. Neural correlates of impulsivity as well as cooccurrence with various mental disorders will be discussed.

- 20.10. at 8.00 (at CEITEC at University Campus at Bohunice; further instructions will be given at first lecture);
    - Introduction to imaging techniques and brain stimulation
      We will briefly discuss the nature of the data obtained from the two most commonly used forms of brain imaging, and the logic behind experiment design in both of them and what each technique is best at. Additionally, we will introduce brain stimulation, a promising tool for research and treatment.
      Luck, S. J. (2005). Ten simple rules for designing ERP experiments. Event-related potentials: A methods handbook, 262083337.

    - Magnetic resonance imaging

      Magnetic resonance imaging (MRI) is a non-invasive imaging method used routinely in the clinic and in research. In this lecture, the theoretical basis, examples of methods and applications of structural MRI and functional magnetic resonance imaging (fMRI) will be presented. In this lecture we will also visit Multimodal and Functional Imaging Laboratory at CEITEC MU, in order to show you how an actual fMRI experiment looks like.
      Logothetis, N. K. (2008). What we can do and what we cannot do with fMRI. Nature, 453(7197), 869.

    - EEG, TMS & MRI demonstrations

- 10.11. at 8.00 (U35);
    - The probabilistic nature of the nervous system
      Over the last 20 years many neuroscientists and psychologists have been comparing different forms of behaviour, overt and covert, to the propositions of Baye's theorem. This theorem, in short, refers to the probability of two events being related to one another. An observer would use their prior knowledge to make assumptions about the relatedness of these events, and then update their knowledge for future inference. We will analyse the proposition and its applications, and how it can be an useful tool for thinking about the brain and behaviour.
      Bowers, J. S., & Davis, C. J. (2012). Bayesian just-so stories in psychology and neuroscience. Psychological bulletin, 138(3), 389.

o   Ambiguity in social cognition

Inherent ambiguity of social cues makes effective functioning in our social world relatively challenging. The more ambiguous the situation, the higher the risk of misinterpretation and reliance upon cognitive bias. Here we will discuss the mechanisms and neural correlates of social cognitive bias in healthy population, as well as in mental disorders where cognitive bias plays crucial role in the development and maintenance of the disease (e.g., anxiety disorder, major depression, eating disorders).
Todorov, A., Harris, L. T., & Fiske, S. T. (2006). Toward socially inspired social neuroscience. Brain research, 1079(1), 76-85.

o   Social cognition in schizophrenia

Schizophrenia is a neurodevelopmental disorder with severe difficulties in social functioning. Various approaches to studying neural substrate of social cognition deficits will be discussed.
Green, M. F., Horan, W. P., & Lee, J. (2015). Social cognition in schizophrenia. Nature Reviews. Neuroscience, 16(10), 620

- 8.12. at 8.00 (U35);
    o   Meta-analysis in neuroscience

    Meta-analysis is an important tool for quantitatively summarizing results from studies. Advantages include higher statistical power but are prone to biases. Various methods in context of neuroscience will be discussed.

    o   Altruism, cooperation & competition
    We will discuss neural mechanisms of prosocial behaviour, empathy, cooperation & competition. Results from recent hyperscanning research on competition and cooperation will be presented.

    o   Presentations & Discussions

Literature

- Green, M. F., Horan, W. P., & Lee, J. (2015). Social cognition in schizophrenia. *Nature Reviews. Neuroscience*, *16*(10), 620.
- Bowers, J. S., & Davis, C. J. (2012). Bayesian just-so stories in psychology and neuroscience. *Psychological bulletin*, *138*(3), 389.
- Luck, S. J. (2005). Ten simple rules for designing ERP experiments. *Event-related potentials: A methods handbook*, *262083337*.
- Logothetis, N. K. (2008). What we can do and what we cannot do with fMRI. *Nature*, *453*(7197), 869.
- Krakauer, J. W., Ghazanfar, A. A., Gomez-Marin, A., MacIver, M. A., & Poeppel, D. (2017). Neuroscience needs behavior: correcting a reductionist Bias. *Neuron*, *93*(3), 480-490.
- Zimmer, C., & Clark, R. (2014). Secrets of the brain. *Nat. Geogr*, 28-58.
- Cuthbert, B. N., & Insel, T. R. (2013). Toward the future of psychiatric diagnosis: the seven pillars of RDoC. *BMC medicine*, *11*(1), 126.
- Todorov, A., Harris, L. T., & Fiske, S. T. (2006). Toward socially inspired social neuroscience. *Brain research*, *1079*(1),   76-85

Assignments

- Reading: 1-2 papers prior to each block (see section above)
- Writing: a neuroscience research proposal OR presentation of a neuroscientific topic
- Attendance: absence on 1 lecture is allowed, if you need to skip an entire block, you will be asked to write an additional assignment

Neuroscience research proposal

Select any topic (can be ideas for your diploma thesis, old assignments of other courses, current interests in psychology) and propose a way to do neuroscientific research based on it.

These sections are expected to be covered:

Introduction

- Motivation for the research
  (what new and interesting discoveries could come about if we implement your proposal?)
- Brief overview of the literature
  (what has been done in the field so far, what did you base your hypotheses on)
- Hypotheses

Methods

- Participants
- Methods, tasks
- Physiological/ neuroimaging/ behavioural/ or computational modelling techniques used

Discussion

- Expected results & their interpretation.
- Significance of the results, possible applications

Literature

3-5 standard pages (5400-9000 characters, literature not included)

Presentation on a neuroscientific topic

Introduce a neuroscientific topic that wasn't covered on the lectures (we can help you come up with an idea)

10-minute presentation (+ 5 minutes for discussion)
Short handout with the take-home messages of the presentation
Interact with your audience, prepare some questions.
Make a nice story of it

Both assignments are due to 9.11., you will get feedback by the end of November and you will have a chance to resubmit by 5.12.

Assessment methods

Students will be given their credits based on attendance and writing assignments.