Basic Neuroscience
for Organisational Research and Economics

Course instructors

Name: **Dr. Franziska Emmerling**
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Application procedure

Goal and target audience
PhD students interested in acquiring basic knowledge of neuroscience methods

Application process
e-mail to franziska.emmerling@tum.de

Course aims

What this course is
This seminar aims at teaching the basics of cognitive neuroscience and how it is applied more or less meaningfully in management and organisational research. We will specifically focus on non-invasive brain stimulation, electroencephalogram, and functional Magnetic Resonance Imaging. Graduate students will be enabled to understand these methods, successfully read respective papers and their method section, and to assess the potential as well as the pitfalls of neuroscientific methods in their fields of research.

Course objectives

At the end of the seminar graduate students will be able:

1. …to evaluate if, when, and how it is meaningful to include neuroscientific methods into the methodology of organisational research.

2. … to debate the pros and cons of neuroscience in behavioural science.

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Course objectives

At the end of the seminar graduate students will be able:

1. …to evaluate if, when, and how it is meaningful to include neuroscientific methods into the methodology of organisational research.

2. … to debate the pros and cons of neuroscience in behavioural science.

3. … to understand what non-invasive brain stimulation is and does, as well as to easily read any brain stim paper (including the methods section).

4. … to understand what electroencephalogram is and does, as well as to easily read any electroencephalogram paper (including the methods section).

5. … to understand what functional Magnetic Resonance Imaging (fMRI) is and does, as well as to easily read any fMRI paper (including the methods section).

6. … to familiarise themselves with concrete empirical examples of neuroscientific studies the field of organisational research and behavioural economics and the debates those studies triggered in their respective fields.

The seminar objectives will be achieved by: attending and participating actively in class; reading and discussing the assigned materials; and drafting an oral presentation including slides and hand-outs for one specific paper.

Preliminary schedule

Session I: 09.06., 9:30-12:00 & 13:00-15:00, digital

Session II: 07.09., 9:00-12:00 & 13:00-16:00, digital

Session III: 08.09., 9:00-12:00 & 13:00-16:00, digital

Session IV: 09.09., 9:00-12:00 & 13:00-16:00, digital

Core readings

Session I: *The why and when in social neuroscience*

Please read before the first session:

Cacioppo, J. T., Berntson, G. G., Sheridan, J. F., & McClintock, M. K. (2000). Multilevel integrative analyses of human behavior: social neuroscience and the complementing nature of social and biological approaches. Psychological bulletin, 126(6), 829.

Session II: *Focus non-invasive brain stimulation*

Methodological papers

Nitsche, M. A., Cohen, L. G., Wassermann, E. M., Priori, A., Lang, N., Antal, A., ... & Pascual-Leone, A. (2008). Transcranial direct current stimulation: state of the art 2008. *Brain Stimulation: Basic, Translational, and Clinical Research in Neuromodulation, 1*(3), 206-223.

Hallett, M. (2007). Transcranial magnetic stimulation: a primer. *Neuron, 55*(2), 187-199.

Robertson, E. M., Theoret, H., & Pascual-Leone, A. (2003). Studies in cognition: the problems solved and created by transcranial magnetic stimulation. *Journal of Cognitive Neuroscience, 15*(7), 948-960.

Veniero, D., Strüber, D., Thut, G., & Herrmann, C. S. (2019). Noninvasive brain stimulation techniques can modulate cognitive processing. *Organizational Research Methods, 22*(1), 116-147.

Empirical papers

Knoch, D., Pascual-Leone, A., Meyer, K., Treyer, V., & Fehr, E. (2006). Diminishing reciprocal fairness by disrupting the right prefrontal cortex. *Science, 312*, 829-832.

Strang, S., Gross, J., Schuhmann, T., Riedl, A., Weber, B., & Sack, A. (2014). Be nice if you have to-The neurobiological roots of strategic fairness. *Social cognitive and affective neuroscience*, nsu114.

Gross, J., Emmerling, F., Vostroknutov, A., Sack, A. T. (2018). Manipulation of Pro-Sociality and Rule-Following with Non-invasive Brain Stimulation. *Nature Scientific Reports, 8*(1), 1827.

Session III: *Focus functional Electroencephalogram*

Methodological papers

Teplan, M. (2002). Fundamentals of EEG measurement. Measurement science review, 2(2), 1-11.

Chapter 2 (all other Chapters are also very worth reading) of Dickter, C. L., & Kieffaber, P. D. (2013). *EEG methods for the psychological sciences*. Sage.

Tivadar, R. I., & Murray, M. M. (2019). A primer on electroencephalography and event-related potentials for organizational neuroscience. *Organizational Research Methods, 22*(1), 69-94.

BCI-research

Pfurtscheller, G., Allison, B. Z., Bauernfeind, G., Brunner, C., Solis Escalante, T., Scherer, R., ... & Birbaumer, N. (2010). The hybrid BCI. *Frontiers in neuroscience*, *4*, 3.

Brouwer, A. M., Zander, T. O., Van Erp, J. B., Korteling, J. E., & Bronkhorst, A. W. (2015). Using neurophysiological signals that reflect cognitive or affective state: six recommendations to avoid common pitfalls. *Frontiers in neuroscience*, *9*, 136.

Gerjets, P., Walter, C., Rosenstiel, W., Bogdan, M., & Zander, T. O. (2014). Cognitive state monitoring and the design of adaptive instruction in digital environments: lessons learned from cognitive workload assessment using a passive brain-computer interface approach. *Frontiers in neuroscience*, *8*, 385.

Empirical papers

Balthazard, P. A., Waldman, D. A., Thatcher, R. W., & Hannah, S. T. (2012). Differentiating transformational and non-transformational leaders on the basis of neurological imaging. The Leadership Quarterly, 23(2), 244-258.

Waldman, D. A., Balthazard, P. A., & Peterson, S. J. (2011). Leadership and neuroscience: Can we revolutionize the way that inspirational leaders are identified and developed? The Academy of Management Perspectives, 25(1), 60-74.

Hannah, S. T., Balthazard, P. A., Waldman, D. A., Jennings, P. L., & Thatcher, R. W. (2013). The psychological and neurological bases of leader self-complexity and effects on adaptive decision-making. Journal of Applied Psychology, 98(3), 393.

Session IV: *Focus functional Magnetic Resonance Imaging*

Methodological papers

Schild, H. (1994). MRI made easy (…well almost). Nationales Druckhaus Berlin, Germany.

Amaro Jr, E., & Barker, G. J. (2006). Study design in fMRI: basic principles. Brain and cognition, 60(3), 220-232.

Loued-Khenissi, L., Döll, O., & Preuschoff, K. (2019). An Overview of Functional Magnetic Resonance Imaging Techniques for Organizational Research. *Organizational Research Methods, 22*(1), 17-45.

Empirical papers

Caspers, S., Heim, S., Lucas, M. G., Stephan, E., Fischer, L., Amunts, K., & Zilles, K. (2012). Dissociated neural processing for decisions in managers and non-managers. Plos one, 7(8), e43537.

Hollmann, M., Rieger, J. W., Baecke, S., Lützkendorf, R., Müller, C., Adolf, D., & Bernarding, J. (2011). Predicting

decisions in human social interactions using real-time fMRI and pattern classification. PLoS One, 6(10), e25304.
Laureiro-Martínez, D., Brusoni, S., Canessa, N., & Zollo, M. (2015). Understanding the exploration–exploitation dilemma: An fMRI study of attention control and decision-making performance. Strategic Management Journal, 36(3), 319-338.

Course procedures

The seminar will include four sessions (first session a 4.5 hours, three further sessions a 6 hours).

Session I: The why and when in social neuroscience
During this session, we will discuss when and why it can be useful to apply neuroscientific methodology to behavioural science. We will unravel the empirical potential of neuroscientific methodologies, while not neglecting their limitations. The session will include ppt-Input from the course instructor, group discussion, and a panel debate. During our first session, we will, furthermore, decide together who will present which methodological and empirical literature for the focus-sessions and other organisational questions.

Session II: Focus non-invasive brain stimulation
During this session, we will focus on various forms of non-invasive brain stimulation (in particular Transcranial Magnetic Brain Stimulation and transcranial Current Stimulation). First, we will discuss the method, how it works, the various ways of using it, (dis)advantages, and its risks. We will figure out, how to fruitfully read a paper, which employs non-invasive brain stimulation, without being experts on non-invasive brain stimulation. The afternoon will be dedicated to an in-depth discussion of three empirical papers which employ non-invasive brain stimulation to illuminated egoistic versus altruistic economic decision making.

Session III: Focus functional Electroencephalogram
During this session, we will focus on Electroencephalogram (EEG). First, we will discuss the method, how it works, the various ways of analysing EEG data, (dis)advantages, and its risks. We will figure out, how to fruitfully read a paper, which employs EEG, without being experts on EEG. The afternoon will be dedicated to an in-depth discussion of three empirical papers which employ EEG to illuminated leadership.

Session IV: Focus functional Magnetic Resonance Imaging
During this session, we will focus on functional Magnetic Resonance Imaging (fMRT). First, we will discuss the method, how it works, the various ways of analysing fMRI data, (dis)advantages, and its risks. We will figure out, how to fruitfully read a paper, which employs fMRI, without being experts on fMRI. The afternoon will be dedicated to an in-depth discussion of three empirical papers which employ fMRI to illuminated managerial negotiation.

Assessment

The main delivery is a presentation of ca. 30 minutes on either a methodological or an empirical paper. Graduate students will work on those presentations either on their own or in pairs and they are expected to prepare a) a set of informative and well-designed slides on their topic (no text, but visuals to support their oral presentations) and b) a hand-out for their fellow students which includes all essential information on their topic. Assuming that the postgraduate students participate regularly and actively in class and prepare well for their presentations, they will receive a certificate, passing the seminar.