BIOGRAPHICAL SKETCH

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NAME: Martin Tik

eRA COMMONS USER NAME (credential, e.g., agency login): MARTINTIK

POSITION TITLE: Postdoctoral scholar

EDUCATION/TRAINING *(Begin with baccalaureate or other initial professional education, such as nursing, include postdoctoral training and residency training if applicable. Add/delete rows as necessary.)*

INSTITUTION AND LOCATION	DEGREE *(if applicable)*	Completion Date MM/YYYY	FIELD OF STUDY
University of Vienna, Vienna, Austria	Mag. rer. nat (M.Sc.-equiv.)	10/2014	Psychology
Medical University of Vienna, Vienna, Austria	PhD	12/2019	Medical Physics
Medical University of Vienna, Vienna, Austria	Postdoctoral Scholar	10/2021	Brain Imaging and Stimulation
Stanford University	Postdoctoral Scholar	Present	Clinical Neuromodulation

A. Personal Statement

I hereby state that I have the expertise and personal resources to fulfill the tasks of the proposed research project. During my career as a researcher, I have worked extensively on neural circuits that are involved in affective disorders, especially depression. I have, moreover, set up an interleaved TMS/fMRI framework at the Medical University of Vienna and at Stanford University that allows for high-resolution imaging of brain networks activated by DLPFC stimulation. I have 10 years of experience in non-invasive brain stimulation and brain imaging in healthy subjects and patient populations.

More specifically, I have a background in combining TMS with fMRI (offline and online) [1, 2], connectivity analyses [2, 3], affective disorders (including MDD, PPD and anxiety) [4] and neural habituation effects for different stimuli (pain, emotion) [5, 6]. During my master's thesis in Biological Psychology at the University of Vienna in collaboration with the Medical University of Vienna, I worked with a large sample study to investigate the influence of 10Hz rTMS over left DLPFC on resting-state connectivity after stimulation. After joining the Windischberger lab for my PhD thesis in Biomedical Engineering, I was involved in a variety of projects including fMRI projects conducted in collaboration with the Psychology and Psychiatry departments, an EU project to evaluate stimulation targets for creativity enhancement, and finally my thesis project, setting up and validating an interleaved TMS/fMRI setup. I have continued to optimize this setup further during my postdoctoral phase. After joining Stanford University under Nolan Williams, I have had the opportunity to setup a completely new setup for interleaving TMS with fMRI that allowed me measure the neural effects of the Stanford Neuromodulation Therapy (SNT) in real time. In the future years, I am planning to improve the treatment of neuropsychiatric disorders with TMS by using interleaved imaging to improve and personalize stimulation parameters.

Ongoing projects that I would like to highlight include:

FWF (Austrian Science Fund), Stand-Alone Project
Role: Co-Author
Calibrated brain stimulation via concurrent TMS/fMRI (P 6314)

ÖAW (Austrian Acadamy of Sciences)
Role: Co-Investigator
Improving presurgical language mapping through concurrent TMS/fMRI

FFG (Austrian Research Promotion Agency), Talents
Role: Principal Investigator
Zielregionen für Transkranielle Magnetstimulation (Targets for TMS)

COST Action 18138 (Source of Funding: European Union)
Role: Management of collaborative project
Research Innovation and Sustainable Pan-European Network in Peripartum Depression Disorder

Citations:

1. **Tik M**, Hoffmann A, Sladky R, Tomova L, Hummer A, Navarro de Lara L, Bukowski H, Pripfl J, Biswal B, Lamm C, Windischberger C. "Towards understanding rTMS mechanism of action: "Stimulation of the DLPFC Causes Network-specific Increase in Functional Connectivity." Neuroimage , 162, 289-296. 2017 Nov 15. PMID: 28912081
2. Navarro de Lara L[1], **Tik M**[1], Woletz M, Frass-Kriegl R, Moser E, Laistler E, Windischberger C. "High-sensitivity TMS/fMRI of the Human Motor Cortex Using a Dedicated Multichannel MR Coil." NeuroImage. 2017 Apr 15. PMID: 28254457.
3. Schuler A, **Tik M**, Sladky R, Luft CDB, Hoffmann A, Woletz M, Zioga I, Bhattacharya J, Windischberger C. "Modulations in resting state networks of subcortical structures linked to creativity." Neuroimage. 2019 Mar 29. PMID: 30935909.
4. Kraus C, Klöbl M, **Tik M**, Auer B, Vanicek T, Geissberger N, Pfabigan DM, Hahn A, Woletz M, Paul K, Komorowski A, Kasper S, Windischberger C, Lamm C, Lanzenberger R. "The pulvinar nucleus and antidepressant treatment: dynamic modeling of antidepressant response and remission with ultra-high field functional MRI". Mol Psychiatry. 2018 Feb 8. PMCID: PMC6756007.
5. Geissberger N[1], **Tik M**[1], Sladky R, Woletz M, Schuler AL, Willinger D, Windischberger C. "Reproducibility of amygdala activation in facial emotion processing at 7T". Neuroimage. 2020 May 1. PMID: 31996330.
6. Paul K[1], **Tik M**[1], Hahn A, Sladky R, Geissberger N, Seidel E, Kranz GS, Pfabigan DM, Kraus C, Lanzenberger R, Lamm C, Windischberger C. "Give Me a Pain that I am used to: Distinct Habituation Patterns to Painful & Non-painful Stimulation". Scientific Reports. 2021 Nov 25. PMCID: PMC8617189.

B. Positions, Scientific Appointments, and Honors

Professional experience:

2020 – present	**Postdoctoral faculty**	CMPBME	*Medical University of Vienna, Austria*
2021 – 2023	**Postdoctoral scholar**	Dept. of Psychiatry	*Stanford University*
2019 – 2019	**Graduate Res. Asst.**	Dept. of Psychiatry	*Medical University of Vienna, Austria*
2014 – 2019	**Graduate Res. Asst.**	CMPBME	*Medical University of Vienna, Austria*

Honors:

2021 – Visiting scholarships AI, Bavaria California Technology Center (3000€)
2021 – Travel Award, Bio-X
2021 – Merit Award by the Organization for Human Brain Mapping (OHBM)
2018 – Janssen Special Award for "TMS Treatment system"
2017 – Merit Abstract Award by OHBM (2000$)
2015 – Merit Abstract Award by OHBM (2000$)

Manuscript reviewer:

2022 – present	Nature Mental Health
2018 – present	Human Brain Mapping
2019 – present	Brain Stimulation
2019 – present	Frontiers in Human Neuroscience
2018 – present	Neuropsychologia

2018 – present European Journal of Neuroscience
2018 – present The Veterinary Journal
2018 – present Brain Connectivity
2017 – present Neuroimage

C. Contributions to Science

1. Neural circuit modulation by TMS-fMRI: Throughout my career, I have investigated the neural circuits involved in primary motor cortex (M1), DLPFC and TPJ stimulation [a,b,c,d]. In terms of DLPFC stimulation I have evaluated network effects comparing offline and online stimulation [a,b]. Specifically, I have investigated a specific canonical resting state network and its sgACC connectivity. For TPJ stimulation, the same network showed changes in hippocampus connectivity after stimulation. Furthermore, I have compared differences in dose-response relationships for M1 and DLPFC stimulation. Moreover, I have advanced the method by proposing new methods of motion regulation [e] and interleaving TMS pulses with EPI [f].

a. **Tik M**, Woletz M., Schuler AL, Vasileiadi M, Cash RFH, Zalesky A, Lamm C, & Windischberger C (2023). Acute TMS/fMRI response explains offline TMS network effects - An interleaved TMS-fMRI study. NeuroImage, 267, 119833.
b. **Tik M**, Hoffmann A, Sladky R, Tomova L, Hummer A, Navarro de Lara L, Bukowski H, Pripfl J, Biswal B, Lamm C, Windischberger C. “Towards understanding rTMS mechanism of action: Stimulation of the DLPFC Causes Network-specific Increase in Functional Connectivity.” NeuroImage. 162, 289-296. 2017 Nov 15. PMID: 28912081.
c. Navarro de Lara L[1], **Tik M**[1], Woletz M, Frass-Kriegl R, Moser E, Laistler E, Windischberger C. “High-sensitivity TMS/fMRI of the Human Motor Cortex Using a Dedicated Multichannel MR Coil.” NeuroImage. 2017 Apr 15. PMID: 28254457. ([1] contributed equally)
d. **Tik M**, Bukowski H, Schuler AL, Hummer A, Lamm C, Windischberger C. Theta burst stimulation of TPJ – a new potential target for depression treatment. 24th Meeting of the Organization for Human Brain Mapping, HBM – Singapore. 2018.
e. Woletz M, **Tik M**, N Pratapa, M Prinčič, Schuler A, Windischberger C. Real-time neuronavigation feedback in concurrent TMS-fMRI. 3rd International Brain Stimulation Conference - Vancouver, Canada. 2019. doi: 10.1016/j.brs.2018.12.904.
f. **Tik M**, et al. "Interslice TMS/fMRI enables continuous EPI during clinical rTMS and iTBS protocols." *Brain Stimulation: Basic, Translational, and Clinical Research in Neuromodulation* 14.6 (2021): 1723-1724.

2. Neural effects of antidepressant treatment: During my doctoral training I was involved in a variety of studies in collaboration with the Psychology (University of Vienna) and Psychiatry (Medical University of Vienna) departments. These studies investigated the effects of pharmacotherapy in terms of emotion processing [1], brain plasticity [2], connectivity markers [3] and behavioral changes [4]. To accomplish this I acquired and worked with large samples of acutely depressed and remitted MDD patients as well as healthy controls. This research line helped me to gain extensive insight into the neural mechanisms of action of pharmacological antidepressant treatments.

a. Spies M, Kraus C, Geissberger N, Auer B, Klöbl M, **Tik M**, Stürkat IL, Hahn A, Woletz M, Pfabigan DM, Kasper S, Lamm C, Windischberger C, Lanzenberger R. “Default mode network deactivation during emotion processing predicts early antidepressant response.” Transl Psychiatry. Jan 24;7(1):e1008, 2017. PMCID: PMC5545730.
b. Höflich A, Ganger S, **Tik M**, Hahn A, Kranz GS, Vanicek T, Spies M, Kraus C, Windischberger C, Kasper S, Winkler D, Lanzenberger R. “Imaging the neuroplastic effects of ketamine with VBM and the necessity of placebo control”. Neuroimage. Feb 15;147:198-203, 2017. PMID: 27986606.
c. **Tik M**, Woletz M, G Kranz, D Pfabigan, N Geissberger, R Sladky, C Kraus, B Auer, T Vanicek, K Paul, R Lanzenberger, C Lamm, Windischberger C. “Remission from depression and TMS over left DLPFC share the same network connectivity changes.” 3rd International Brain Stimulation Conference - Vancouver, Canada. 2019.
d. Rütgen M, Pletti C, **Tik M**, Kraus C, Pfabigan DM, Sladky R, Klöbl M, Woletz M, Vanicek T, Windischberger C, Lanzenberger R, Lamm C. “Antidepressant treatment, not depression, leads to reductions in behavioral and neural responses to pain empathy.” Transl Psychiatry. 2019 Jun 7. PMCID: PMC6555809.

3. Brain Connectivity: I have applied multiple approaches to connectivity analyses in health and disease. In a 7 Tesla study, I have investigated variations in dopaminergic networks based on behavioural data. For this purpose I have extracted seed-voxel from a functional localizer task and regressed resulting networks with questionnaire data [1]. Furthermore, I have established a hypothesis-free network analysis leveraging on 20 canonical networks based on a large sample ICA in order to investigate connectivity changes pre and post rTMS and between acute and remitted MDD patients [2, 3].

a. Schuler A, **Tik M**, Sladky R, Luft CDB, Hoffmann A, Woletz M, Zioga I, Bhattacharya J, Windischberger C. "Modulations in resting state networks of subcortical structures linked to creativity." Neuroimage. 2019 Mar 29. PMID: 30935909.
b. **Tik M**, Hoffmann A, Sladky R, Tomova L, Hummer A, Navarro de Lara L, Bukowski H, Pripfl J, Biswal B, Lamm C, Windischberger C. "Towards understanding rTMS mechanism of action: Stimulation of the DLPFC Causes Network-specific Increase in Functional Connectivity." NeuroImage. 162, 289-296. 2017 Nov 15. PMID: 28912081.
c. **Tik M**, Woletz M, G Kranz, D Pfabigan, N Geissberger, R Sladky, C Kraus, B Auer, T Vanicek, K Paul, R Lanzenberger, C Lamm, Windischberger C. "Remission from depression and TMS over left DLPFC share the same network connectivity changes." 3rd International Brain Stimulation Conference - Vancouver, Canada. 2019.

4. Effects of Neural Habituation: I have performed two experiments investigating habituation effects to emotional stimuli and pain. In terms of emotional stimuli, I could show that the bilateral amygdala shows a habituation effect to exposure of emotional stimuli within one session and between two sessions of an emotion discrimination task at 7 Tesla. In another study I could show that different network hubs of the pain matrix habituate to pain stimulation, while other brain areas habituate to none-painful stimulation. These studies provide important implications for flexible adjustments of the brain to different stimuli that are related to neuropsychiatric disorders.

a. Geissberger N[1], **Tik M**[1], Sladky R, Woletz M, Schuler AL, Willinger D, Windischberger C. "Reproducibility of amygdala activation in facial emotion processing at 7T". Neuroimage. 2020 May 1. PMID: 31996330.
b. Paul K[1], **Tik M**[1], Hahn A, Sladky R, Geissberger N, Seidel E, Kranz GS, Pfabigan DM, Kraus C, Lanzenberger R, Lamm C, Windischberger C. "Give Me a Pain that I am used to: Distinct Habituation Patterns to Painful & Non-painful Stimulation". Scientific Reports. 2021 Nov 25. PMCID: PMC8617189. ([1] contributed equally)

5. fMRI reliability/reproducibility: I have conducted or collaborated in a variety of studies evaluating the reliability of fMRI data. First, I could show that the amygdala activates reliably in an emotion discrimination task [1]. Further, by varying the echo time during EPI, we could evaluate that a longer echo time results in more reliable connectivity between ACC and DLPFC, which has important implications on the evaluation of stimulation targets for MDD patients [2]. Finally, we could show that artificial scotoma could be reliably captured in population receptive field mapping [3]. With these studies including task-based and resting-state fMRI I could establish the reproducibility of fMRI in different domains, improving our understanding of this method.

a. Geissberger N[1], **Tik M**[1], Sladky R, Woletz M, Schuler AL, Willinger D, Windischberger C. "Reproducibility of amygdala activation in facial emotion processing at 7T". Neuroimage. 2020 May 1. PMID: 31996330.
b. Vasileiadi M, **Tik M**, Woletz M, Linhardt D, & Windischberger C. (2021). The influence of EPI parameter choice on reliability of sgACC-DLPFC functional connectivity. *Brain Stimulation: Basic, Translational, and Clinical Research in Neuromodulation*, *14*(6), 1608-1609.
c. Linhardt D, Pawloff M, Woletz M, Hummer A, **Tik M**, Vasileiadi M, ... & Windischberger C. (2022). Intra- and Intersession Reproducibility of Artificial Scotoma pRF Mapping Results at Ultra-High Fields. *Eneuro*. PMCID: PMC9512620

List of Published Work in My Bibliography

https://www.ncbi.nlm.nih.gov/myncbi/martin.tik.1/bibliography/public/