

# Thomas Samuel Binns

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## EDUCATION

**09/2021 – Present** Charité – Universitätsmedizin Berlin, Germany

**Ph.D. Neuroscience Fellow**

For my fellowship-funded Ph.D. I am investigating biomarkers of Parkinson's disease for use in brain-computer interfaces for next generation adaptive deep brain stimulation treatments, with a focus on connectivity between the cortex and basal ganglia, supervised by Prof. Wolf-Julian Neumann (Charité – Universitätsmedizin Berlin) and Prof. Stefan Haufe (Technische Universität Berlin).

**09/2016 – 07/2021** University of Aberdeen, UK

**M.Sci. (Hons) Neuroscience with Psychology with Industrial Placement, First-Class Honours**

**Master's (Industrial Placement) thesis** – "Investigating neural precursors of self-initiated action using machine learning techniques". Placement at the Bernstein Center for Computational Neuroscience, Germany. Supervisors: Dr. Matthias Schultze-Kraft and Prof. John-Dylan Haynes. First-Class.

**Bachelor's (Honours) thesis** – "Investigating the neuromodulation of striatal activity *in silico*". Supervisor: Dr. Antonio Gonzalez. First-Class.

## SELECTED WORK EXPERIENCE

**07/2021 – Present** Cognitive Neuromodulation Group, Charité – Universitätsmedizin Berlin, Germany

**Role: Researcher** Supervisors: Prof. Wolf-Julian Neumann, Prof. Stefan Haufe


I am studying cortical-subthalamic connectivity using invasive recordings from Parkinson's disease patients, with the goal of identifying biomarkers for use in adaptive deep brain stimulation. Through this work, I am developing my data analysis and programming skills, including with the contribution to and development of open-source packages for advanced signal analyses.

**08/2019 – 08/2020** Haynes Group, Bernstein Center for Computational Neuroscience, Germany

**Role: Researcher** Supervisors: Dr. Matthias Schultze-Kraft, Prof. John-Dylan Haynes

I investigated choice-predictive brain signals and movement initiation using machine learning techniques and brain-computer interfaces. My tasks involved designing and conducting experiments, with extensive data analysis. Accordingly, I developed an in-depth understanding of brain-computer interfaces and machine learning techniques. Additionally, I co-authored a research article published in *eNeuro*.

## SELECTED PUBLICATIONS

**Binns, T.S., Köhler, R.M., Vanhoecke, J., ..., Kühn, A.A., Haufe, S., Neumann, W.-J. (2023).** Dopamine and stimulation distinctly modulate cortico-subthalamic communication in Parkinson's disease. *ReTune Fall School*, Apolda, Germany.  **Winner of best poster prize**

**Binns, T.S., Pellegrini, F., Jurhar, T., Haufe, S. (2023).** PyBispectra: an open-source toolbox for advanced electrophysiological signal processing based on the bispectrum. *Bernstein Conference*, Berlin, Germany. DOI: 10.12751/NNCN.BC2023.149.

Köhler, R.M., **Binns, T.S.**, Merk, T., ..., Kühn, A.A., Haynes, J.-D., Neumann, W.-J. (Pre-print). Dopamine and neuromodulation accelerate the neural dynamics of volitional action in Parkinson's disease. DOI: 10.1101/2023.10.30.564700.

## FUNDING

**2021 – 2024** *Ph.D. Fellowship, €63,000.* Einstein Center for Neurosciences Berlin.

**2019 – 2020** *Investigating choice-predictive brain signals using EEG-based brain-computer interfaces, €5,000.* Erasmus+ Traineeship grant, British Council.

**2018** *Free Will and Neural Activity in Consequential Action, £2,000.* Biomedical Vacation Scholarship, Wellcome Trust.

## **MEMBERSHIPS**

**12/2022 – Present    Code Clinic, ReTune International Research Consortium, Germany**

**Role: Co-founder**

I co-founded the Code Clinic of the ReTune International Research Consortium, with the goal of improving the quality and openness of programming to address issues with the quality and reproducibility of research. Towards this, the clinic organises reviews for code being used for data analysis projects and open-source packages, promoting programming best practices to ensure efficient, understandable, and error-free code.

**09/2018 – 09/2021    British Neuroscience Association, Bristol, UK**

**Role: Member**

As a member of the British Neuroscience Association I took full advantage of the organisation's activities, attending talks and symposia to broaden my understanding of various neuroscience topics. Furthermore, I contributed an article examining the neuroscientific study of free will to the Association's Summer 2020 Bulletin, allowing me to demonstrate and further hone my academic writing skills.

## **RELEVANT SKILLS**

### **Technical & Programming**

I am highly confident programming in Python and MATLAB, and have further experience with C++, Java, and HTML. I am also familiar with Git, SPSS, and Microsoft Office programmes. Crucially, I can quickly familiarise myself with new software and programming languages, and learn new techniques to add to my repertoire.

### **Research & Data Analysis**

Through my Ph.D. Fellowship, Honours project, industrial placement, and work as a researcher, I have been involved in all facets of the research process, from literature review, experimental design, and writing ethics proposals, to data collection, data analysis, and write-up. This has instilled within me the confidence, independence, and critical thinking required to devise and undertake successful, rigorous research projects.

### **Communication & Teamwork**

Proficient communication and teamwork skills have played an essential part of my work in academic and professional settings, such as in my roles as Class Representative, House Captain, and in the Youth Philanthropy Initiative. With this diverse experience, I am able to communicate information effectively to a range of audiences, as well as work cohesively with others in both smaller and larger groups.

## **ACHIEVEMENTS AND INTERESTS**

### **Open-Source Software**

I am an active developer of open-source software, including: contributions to the MNE signal analysis toolbox, referenced in over 4,000 peer-reviewed articles; lead developer of PyBispectra, a toolbox for advanced time- and frequency-domain signal analyses; and lead developer of PyPARRM, a signal analysis package for handling periodic artefacts in time-series data. Accordingly, I have experience with software development, including in large teams where the use of continuous integration and deployment are a necessity.

### **Neuroscience Student Prize**

Upon completion of my M.Sci. degree I was honoured to receive the University of Aberdeen's prize for best neuroscience student, a yearly prize presented to a student on the Neuroscience degree programme in recognition of the individual's excellent performance during their time at the university.

### **Music**

I have played the drum kit for sixteen years, achieving a Distinction at Grade 8 in 2016. Currently I am a drummer for the Berlin Pipe Company, for which I have regular performances, and whilst studying at Aberdeen I was the drummer for the University's Jazz Band where I played at numerous concerts, including yearly performances at the Aberdeen Jazz Festival. I was also involved in the African Drumming Group and Samba Band of my borough's music centre in London. My participation in these activities has enhanced my communication and teamwork skills greatly, and attests to my dedication and well-rounded character.

**References Available Upon Request**