Heike Stein

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Laboratoire de Neurosciences Cognitives & Computationnelles/Group for Neural Theory
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Research Interests

Behavioral dynamics, motor control, working memory, dimensionality reduction, data-driven modeling

Current Position

2020 – 24 **Postdoctoral researcher (EMBO fellow)**
ENS Paris
PI: N. Alex Cayco-Gajic, PhD
Projects: Gait adaptation and learning in mice, Covariability in neural datasets and dimensionality reduction

Previous Research Positions

2023 **Visiting researcher**
NYU New York
PI: Cristina Savin, PhD
Project: Switching latent variable models for multi-area neural datasets

2016 – 20 **Predoctoral researcher (Marie Skłodowska-Curie & la Caixa fellow)**
IDIBAPS Barcelona
PI: Albert Compte, PhD
Project: Working memory in anti-NMDA receptor encephalitis and schizophrenia

2013 – 15 **Research assistant**
DFG Center "Volition and Cognitive Control" Dresden
PI: Rico Fischer, PhD
Project: Adaptive regulation of cognitive control in dual-task performance

2014 – 15 **Intern**
Technische Universität Dresden
PI: Katharina Trikojat, PhD
Project: Comorbidity of atopic dermatitis and ADHD

2011 – 12 **Research assistant**
Knowledge Media Research Center Tübingen
PI: Katharina Scheiter, PhD
Project: Knowledge acquisition with multimedia

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Education

2016 – 20 **PhD in Computational Neuroscience**
Universitat de Barcelona
Supervisors: Albert Compte, PhD & Josep Dalmau, MD
Thesis *"Synaptic and circuit mechanisms of working memory and their dysfunction in anti-NMDA receptor encephalitis and schizophrenia"*, defended with Latin honors on November 13th, 2020. Thesis award from the University of Barcelona.

2013 – 16 **MSc in Cognitive and Affective Neuroscience**
Technische Universität Dresden
Thesis in Computational Cognitive Neuroscience, *"A dynamic field theory approach to delayed intentions and intention deactivation"*.

2012 – 13 **Erasmus semester**
Universidad Pontificia Comillas Madrid

2009 – 13 **BSc in Psychology**
Eberhard Karls Universität Tübingen
Thesis in Knowledge and Media Psychology, *"Application of the elaboration likelihood model on learning with wikis"*.

Courses

2023 EMBO Lab Leadership Training (October 2023)

2019 MBL Methods in Computational Neuroscience, Woods Hole, MA (August 2019)

2017 The Computational and Cognitive Neuroscience Summer School, NYU Shanghai (July 2017)

2017 The Mathematics of Memory School, Centre de Recerca Matemàtica Barcelona (January 2017)

2016 Reviewing Core Statistics, Centre de Recerca Matemàtica Barcelona (November - December 2016)

Fellowships, Grants and Awards

2023 EMBO Practical Course award
Organization of BAMB! 2024 summer school

Simons Collaboration on the Global Brain conference award
Organization of BAMB! 2023 summer school

Travel grant, COSYNE
Participation at COSYNE meeting 2023

2022 Extraordinary thesis award, University of Barcelona
Best doctoral thesis at the Faculty of Biomedicine, 2020-21

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2021 EMBO postdoctoral fellowship
Postdoctoral projects at ENS Paris

2019 Travel grant, William Randolph Hearst Foundation
Participation at the MBL Methods in Computational Neuroscience Course

2018 Travel grant, Universidad de Barcelona
Participation at SFN Neuroscience 2018

2017 Marie Skłodowska-Curie/"la Caixa"-INPhINIT fellowship
PhD studies at IDIBAPS Barcelona

Publications

2024 Pellegrino, A.*, **Stein, H.***, & Cayco-Gajic, N.A. Dimensionality reduction beyond neural subspaces with slice tensor component analysis. *Nature Neuroscience, 27*, 1199-1210 (2024).

Stein, H., Barbosa, J., Lozano-Soldevilla, D., Rosa-Justicia, M., Morató, A., Galan-Gadea, A., ..., & Compte, A. Neural signatures of reduced serial dependence in anti-NMDAR encephalitis and schizophrenia. *Psyarxiv* (2024).

2023 Andrianarivelo, A., **Stein, H.**, Gabillet, J., Batifol, C., Jalil, A., Cayco-Gajic, N.A., & Graupner, M. Cerebellar interneuron activity is triggered by reach endpoint during learning of a complex locomotor task. *BioRxiv* (2023).

Barbosa, J.*, **Stein, H.***, Zorowitz, S., Niv, Y., Summerfield, C., Soto-Faraco, S., & Hyafil, A. A practical guide for studying human behavior in the lab. *Behavior Research Methods, 55*, 58-76 (2022).

2022 Guasp, M., Rosa-Justicia, M., Muñoz-Lopetegi, A., Martínez-Hernández, E., Armangué, T., Sugranyes, G., **Stein, H.**, ... & the Spanish anti-NMDAR Encephalitis Study Group. Clinical characterization of patients in the post-acute stage of anti-NMDA receptor encephalitis: a prospective observational cohort study and comparison with patients with schizophrenia spectrum disorders. *The Lancet Neurology 21*, 899-910 (2022).

2021 Ding, X., Lee, D., Grant, S., **Stein, H.**, McIntosh, L., Maheswaranathan, N., &Baccus, S. A. A mechanistically interpretable model of the retinal neural code for natural scenes with multiscale adaptive dynamics. *55th Asilomar Conference on Signals, Systems, and Computers (IEEE)*, 287-291 (2021).

Stein, H.*, Barbosa, J.*, & Compte, A. Towards biologically constrained attractor models of schizophrenia. *Current Opinion in Neurobiology 70*, 163-170 (2021).

Stein, H. Why does the neocortex need the cerebellum for working memory? *The Journal of Neuroscience, 41*, 6368-6370 (2021).

2020 **Stein, H.***, Barbosa, J.*, Rosa-Justicia, M., Prades, L., Morató, A., Galan-Gadea, A., Ariño, H., Martinez-Hernandez, E., Castro-Fornieles, J., Dalmau, J. & Compte, A. Reduced serial dependence suggests deficits in synaptic potentiation in anti-NMDAR encephalitis and schizophrenia. *Nature Communications, 11*, 4250 (2020).

Barbosa, J.*, **Stein, H.***, Martinez, R.L., Galan-Gadea, A., Li, S. Dalmau, J. Adam, K.C.S, Valls-Solé, J., Constantinidis, C. & Compte, A. Interplay between persistent activity and activity-silent dynamics in the prefrontal cortex underlies serial biases in working memory. *Nature Neuroscience, 23*, 1016–1024 (2020).

Talks and Seminars

2024 Seminar at UCL, London, UK (virtual) (Carandini-Harris lab). June, 2024.

2023 Talk at at the Neuroscience and Neural Networks workshop, Colegio Nacional de México (virtual), "Aparición de puntos fijos en la coordinación entre extremidades [...]". November, 2023.

Seminar at Imperial College, London, UK (Gallego lab). June, 2023.

Seminar at the Neural Computation Unit, Bristol, UK (Ponte Costa lab). March, 2023.

2022 Talk at Bernstein conference workshop, Berlin, Germany, "Variability in neural data tensors". September, 2022.

Talk at International Conference on Mathematical Neuroscience (virtual), "Modeling the effects of NMDAR dysfunction on working memory". July, 2022.

Talk at Iberian Conference on Perception, Barcelona, Spain, "Disrupted serial dependence in anti-NMDAR encephalitis and schizophrenia". June, 2022.

Talk at COSYNE main meeting, Lisbon, Portugal, "The emergence of fixed points in interlimb coordination underlies the learning of stable gaits in mice". March, 2022.

2021 Talk at the Neuroscience Ireland Meeting (virtual), "Modeling the effects of NMDAR dysfunction on working memory". September, 2021.

Seminar at Champalimaud Center for the Unknown, Lisbon, Portugal (virtual) (Mainen lab). April, 2021.

2020 Seminar at École Normale Supérieure, Paris, France (Cayco-Gajic lab). January, 2020.

2019 Seminar at Yale University, New Haven, CT (Murray lab). August, 2019.

Talk at the OCNS conference workshop, Barcelona, Spain, "Serial dependence is disrupted in anti-NMDAR encephailitis and schizophrenia" July, 2019.

2018 Seminar at UCSD, San Diego, CA (Serences lab). November, 2018.

Seminar at the Bernstein Center for Computational Neuroscience, Berlin, Germany (Haynes lab). September, 2018.

Seminar at Charité University Hospital, Berlin, Germany (Finke lab). September, 2018.

Conference Posters

2024 **Stein, H.**, Andrianarivelo, A., Gabillet, J., Batifol, C., Jalil, A., Graupner, M. & Cayco Gajic, N. A. Learning coordinated gaits on complex surfaces, NCM, Dubrovnik, Croatia. April, 2022.

Widloski, J., **Stein, H.**, Collina, J., & Foster, D. Fast behavioral learning with an imprecise hippocampal code on a dynamic, multi-step linear maze. COSYNE, Lisbon, Portugal. March, 2024.

2023 **Stein, H.**, Andrianarivelo, A., Gabillet, J., Batifol, C., Cayco Gajic, N. A., & Graupner, M. Cerebellar interneurons encode single steps in locomotion. COSYNE, Montreal, Canada. March, 2023.

2022 Andrianarivelo, A., **Stein, H.**, Gabillet, J., Batifol, C., Cayco Gajic, N. A. & Graupner, M. Acquisition of a complex locomotor task: activity of cerebellar molecular layer interneurons and paw dynamics. SFN, Washington, D.C. November 2022.

Stein, H.*, & Pellegrino*, A., & Cayco Gajic, N. A. SliceTCA disentangles mixed classes of covariability in large-scale neural recordings. Bernstein conference, Berlin, Germany. September, 2022.

Stein, H., Andrianarivelo, A., Gabillet, J., Batifol, C., Graupner, M. & Cayco Gajic, N. A. The emergence of fixed points in interlimb coordination underlies the learning of stable gaits in mice. FENS, Paris, France. July, 2022.

Pellegrino*, A., **Stein, H.***, & Cayco Gajic, N. A. Capturing the evolution of low-dimensional dynamics in large scale neural recordings with sliceTCA. COSYNE, Lisbon, Portugal. March, 2022.

2020 van Welzen, K., Munoz-Lopetegi, A., Rosa-Justicia, M., **Stein, H.**, Morato, A., Arino, H., Martinez-Hernandez, E., ..., & Compte, A. Slow-wave potentiation is age-dependent and characterizes early-night sleep in teenagers and young adults. European Sleep Research Society Conference (virtual). September, 2020.

van Welzen, K., Munoz-Lopetegi, A., Rosa-Justicia, M., Arino, H., Martinez-Hernandez, E., Armangue, T., **Stein, H.**, ..., & Compte, A. Early-night slow-wave sleep potentiation is disrupted in anti-N-methyl-D-aspartate receptor encephalitis and schizophrenia. European Sleep Research Society Conference (virtual). September, 2020.

2019 **Stein, H.**, Barbosa, J., Dalmau, J., & Compte, A. NMDA-receptor dysfunction disrupts serial biases in spatial working memory. Bernstein Conference, Berlin, Germany. September, 2019.

Stein, H., Barbosa, J., Dalmau, J., & Compte, A. NMDA-receptor dysfunction disrupts serial biases in spatial working memory. Cognitive Computational Neuroscience, Berlin, Germany. September, 2019.

Stein, H., Barbosa, J., Galan, A., Morató, A., Prades, L., Rosa, M., Arino, H. Dalmau, J., & Compte, A. Synaptic dysfunctions underlying reduced working memory serial bias in autoimmune encephalitis and schizophrenia. OCNS, Barcelona, Spain. July, 2019.

2018 **Stein, H.**, Lozano-Soldevilla, D., Dalmau, J., & Compte, A. Glutamatergic modulation of working memory precision and serial biases. SFN, San Diego, California. November, 2018.

Stein, H., Lozano-Soldevilla, D., Dalmau, J., & Compte, A. Glutamatergic modulation of spatial working memory. FENS, Berlin, Germany. July, 2018.

2016 **Stein, H.**, Walser, M., & Scherbaum, S. A dynamic field theory approach to prospective memory and intention deactivation. TeaP, Heidelberg, Germany. March, 2016.

Event Organization

2023 – 24 Barcelona Advanced Modeling of Behavior (BAMB!) Summer School, Barcelona, Spain (July 2023, July 2024). Co-organized with Marion Rouault, Alexandre Hyafil, Klaus Wimmer, and Chris Summerfield.

2022 "Distributed computations across brain regions", Bernstein Conference, Berlin, Germany (September 2022). Workshop co-organized with Joao Barbosa.

Teaching

2022 – 23 Barcelona Advanced Modeling of Behavior (BAMB!) Summer School, teaching assistant, Barcelona, Spain.

2021 – 23 Neural Data Science with Python, class on classification and decoding, supervision of final projects, Neuroscience Master's program at Université Paris Cité, France.

Supervision and Mentoring

2024 Mathys Marcellin (MSc Neuroscience): Modeling gait on flat vs. complex surfaces

2022 Paul Marcin (MSc Cognition): Capturing variability in V1 with sliceTCA

Caroline Bouat (MSc Cognition): Modeling motor learning of coordinated gaits as a switching dynamical system

2018 – 20 Alba Morató (BSc Psychology, BSc Statistics): Decoding working memory from fMRI in patients with autoimmune encephalitis and schizophrenia

2018 – 19 Laia Prades (MSc Psychology, BSc Biomedical Science): Working memory biases in patients with schizophrenia

Science Communication

2022 "Growing Up in Science" Series, ENS DEC, Paris
Organization and host of talk series for early-career researchers at the Département d'Études Cognitives, ENS Paris

2018 – 20 "Neurochats" Seminar Series, BARCCSYN, Barcelona
Organization of talk series given by and for early-career researchers in the Barcelona Cognitive, Computational and Systems Neuroscience (BARCCSYN) community (@neurochatsbcn)

2019 Generació Ciència, IDIBAPS, Barcelona
Organization of neuroscience outreach activity for high-school students

2018 Festa de la Ciència, Parc de la Ciutadella, Barcelona
Organization of neuroscience outreach activity for the general public

2017 BARCCSYN Community Retreat
Organization of scientific and extra-scientific program