Marcel Binz

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Research Interests

Cognitive Science; Machine Learning; Meta-Learning; Resource Rationality; Large Language Models; Deep Learning; Bayesian Inference; Information Theory; Decision-Making; Reinforcement Learning

Upcoming Position

Helmholtz Munich **starting 12/2023**
Research scientist

Current Positions

Max Planck Institute for Biological Cybernetics, PI: Dr. Eric Schulz **2021 - 2023**
Postdoctoral researcher

Education

Philipps-Universität Marburg, PI: Prof. Dominik Endres **2018 - 2021**
Dr. rer. nat. (Psychology)

KTH Royal Institute of Technology, Stockholm **2015 - 2018**
M.Sc. (Machine Learning)

Eberhard Karls Universität Tübingen **2012 - 2015**
B.Sc. (Cognitive Science)

Experience

Harvard University, PI: Prof. Samuel Gershman **09/2019 - 12/2019**
Research visit

Facebook Inc. **06/2016 - 12/2016**
Research internship

Eberhard Karls Universität Tübingen, PI: Prof. Martin Butz **04/2015 - 08/2015**
Research assistant

Awards

German Cognitive Science Society Best Publication Award **2018 - 2022**
Best publication in cognitive science by a young investigator

EuroCogSci 2019 Best Poster Award **2019**
Best poster presentation

DMV-Abiturpreis **2010**
Excellent performance in high school mathematics

Publications

Coda-Forno, J., **Binz, M.**, Akata, Z., Botvinick, M., Wang, J. X. and Schulz, E., 2023. Meta-in-context learning in large language models. *37th Conference on Neural Information Processing Systems* (*NeurIPS 2023*).

Saanum, T., Éltető, N., Dayan, P., **Binz, M.** and Schulz, E., 2023. Reinforcement Learning with Simple Sequence Priors. *37th Conference on Neural Information Processing Systems* (*NeurIPS 2023*).

Schulze Buschoff, L. M., Schulz, E. and **Binz, M.**, 2023. The Acquisition of Physical Knowledge in Generative Neural Networks. *Fortieth International Conference on Machine Learning* (*ICML 2023*).

Binz, M. and Schulz, E., 2023. Using cognitive psychology to understand GPT-3. *Proceedings of the National Academy of Sciences*.

Binz, M. and Schulz, E., 2022. Reconstructing the Einstellung Effect. *Computational Brain & Behavior*.

Binz, M. and Schulz, E., 2022. Modeling Human Exploration Through Resource-Rational Reinforcement Learning. *36th Conference on Neural Information Processing Systems* (*NeurIPS 2022*). **Selected as Oral**.

Binz, M., Gershman, S.J., Schulz, E. and Endres, D., 2022. Heuristics From Bounded Meta-Learned Inference. *Psychological Review*.

Brändle, F., **Binz, M.** and Schulz, E., 2022. Exploration Beyond Bandits. *The Drive for Knowledge: The Science of Human Information Seeking. Cambridge University Press.*

Preprints

Jagadish, A. K., **Binz, M.**, Saanum, T., Wang, J. X. and Schulz, E., 2023. Zero-shot compositional reinforcement learning in humans. *In review at Nature Human Behaviour*.

Demircan, C., Saanum, T., Pettini, L., **Binz, M.**, Baczkowski, B. M., Kaanders, P., . . . and Schulz, E., 2023. Language Aligned Visual Representations Predict Human Behavior in Naturalistic Learning Tasks. *In review at PNAS*.

Binz, M. and Schulz, E., 2023. Turning large language models into cognitive models. *In review at ICLR*.

Coda-Forno, J., Witte, K., Jagadish, A. K., **Binz, M.**, Akata, Z. and Schulz, E., 2023. Inducing anxiety in large language models increases exploration and bias. *In revision at Nature*.

Binz, M., Dasgupta, I., Jagadish, A., Botvinick, M., Wang, J. X. and Schulz, E., 2023. Meta-learned models of cognition. *In review at Behavioral and Brain Sciences*.

Non-archival Publications

Schubert, J. A., Jagadish, A. K., **Binz, M.** and Schulz, E., 2023. A Rational Analysis of the Optimism Bias using Meta-Reinforcement Learning. *Conference on Cognitive Computational Neuroscience* (*CCN 2023*).

Jagadish, A. K., Saanum, T., Wang, J. X., **Binz, M.** and Schulz, E., 2022. Probing Compositional Inference in Natural and Artificial Agents. *5th Multidisciplinary Conference on Reinforcement Learning and Decision Making* (*RLDM 2022*).

Demircan, C., Pettini, L., Saanum, T., **Binz, M.**, Baczkowski, B. M., Doeller, C., . . . and Schulz, E., 2022. Decision-making with naturalistic options. *Proceedings of the Annual Meeting of the Cognitive Science Society*.

Binz, M. and Endres, D., 2019. Emulating human developmental stages with bayesian neural networks. *Proceedings of the Annual Meeting of the Cognitive Science Society*.

Binz, M. and Endres, D., 2019. Where do heuristics come from?. *Proceedings of the Annual Meeting of the Cognitive Science Society*.

Butz, M. V., Simonic, M., **Binz, M.**, Einig, J., Ehrenfeld, S. and Schrodt, F., 2016. Is it Living? Insights from Modeling Event-Oriented, Self-Motivated, Acting, Learning and Conversing Game Agents. *Proceedings of the Annual Meeting of the Cognitive Science Society*.

Binz, M., Otte, S. and Zell, A., 2015. On the applicability of recurrent neural networks for pattern recognition in electroencephalography signals. *Workshop New Challenges in Neural Computation*.

Teaching

Computational Cognitive Science, Eberhard Karls University of Tübingen **2022, 2023**
Lecturer

International Interdisciplinary Computational Cognitive Science Summer School **2022, 2023**
Lecturer

Bayesian Statistics and Machine Learning, Philipps-Universität Marburg **2020**
Lecturer

Theoretical Neuroscience, Philipps-Universität Marburg **2019, 2020**
Lecturer

Deep Learning in Data Science, KTH Royal Institute of Technology **2017**
Teaching assistant

Reviewing

Nature **2023 - present**
Nature Human Behaviour **2023 - present**
International Conference on Learning Representations (ICLR) **2023 - present**
Conference on Neural Information Processing Systems (NeurIPS) **2023 - present**
Behavior Research Methods **2023 - present**
Trends in Cognitive Sciences **2023 - present**
Conference on Cognitive Computational Neuroscience **2023 - present**
Proceedings of the National Academy of Sciences (PNAS) **2022 - present**
Psychological Review **2022 - present**
Computational Brain & Behavior **2022 - present**
Annual Meeting of the Cognitive Science Society **2021 - present**

Supervision (PhD students)

Julian Coda-Forno (co-supervised with Eric Schulz and Jane Wang) **2022 - present**
Meta-Learning in Large Language Models

Akshay Kumar Jagadish (co-supervised with Eric Schulz) **2021 - present**
Reverse-Engineering Adaptive Principles of Cognition

Supervision (Master and Bachelor students)

Johannes Schubert **2023**
Investigating the Optimism Bias Using Meta-Reinforcement Learning

Luca Schulze Buschoff **2022**
Development as Decompression

Akshay Kumar Jagadish **2021**
Compositional Generalization in Meta-Reinforcement Learning

Gwen Hirsch **2020**
Comparing Meta-Learners with Human Performance in a Continual Learning Framework

Hauke Niehaus **2019**
Simulating Decision-Making Deficits in a Deep Meta-Reinforcement-Learning Agent

Invited Talks

Digital Change Symposium, Kloster Seeon **2023**
International Interdisciplinary Computational Cognitive Science Summer School **2023**
Language Models in Judgment and Decision Making Research Symposium, Vienna **2023**
Large Language Models Meet Cognitive Science Workshop, Sydney **2023**
Neuro-Cognitive Modeling Group Lab Meeting, Tübingen **2023**
International Titisee Conference on NeuroAI, Titisee **2023**
Colloquium of the Institute of Cognitive Science, Osnabrück **2023**
Reinforcement Learning and Decision-Making Seminar, Tübingen **2023**
Conference on Neural Information Processing Systems, New Orleans **2022**
Memory, Judgement and Decision-Making Seminar, Mannheim **2022**
International Interdisciplinary Computational Cognitive Science Summer School **2022**
Conference of the German Cognitive Science Society, Freiburg **2022**
Human and Machine Cognition Lab Meeting, Tübingen **2022**
Reinforcement Learning and Decision-Making Seminar, Tübingen **2021**
Joint Lab Retreat: Summerfield, Schuck, Schulz **2021**
Colloquium of the Institute for Neuroinformatics, Bochum **2019**
KFZ Science Slam, Marburg **2019**

Grants

Scientific Inference and Statistical Inference Conference **2023**
Funding for travel and accommodation

International Titisee Conference on NeuroAI **2023**
Funding for travel and accommodation

German Academic Exchange Service (DAAD) Scholarship **2019**
Funding for a three month research visit at Harvard University

Summer Institute on Bounded Rationality **2019**
Funding for travel and accommodation