

# Charley M. Wu

## Curriculum Vitae

AI Research Building  
Maria-von-Linden-Str. 6  
72076 Tübingen, Germany  
☎ 1 (857) 498 8893  
✉ [charley.wu@uni-tuebingen.de](mailto:charley.wu@uni-tuebingen.de)  
📄 [hmc-lab.com](http://hmc-lab.com)  
Nationality: Canadian

## Academic Background

### Current Position

2020 – **Independent Research Group Leader**, *Human and Machine Cognition Lab*, University of Tübingen, Tübingen, Germany.  
Jointly funded by the Excellence Cluster “Machine Learning for Science” and the Tübingen AI center.

### Previous Positions

- 2019 – 2020 **Post-Doctoral Fellow**, *Department of Psychology*, Harvard University, Cambridge, MA.  
Advised by Fiery A. Cushman and Samuel J. Gershman.
- 2019 **Post-Doctoral Fellow**, *Center for Adaptive Rationality (ARC)*, Max Planck Institute for Human Development, Berlin, Germany.
- 2018 **Visiting Research Fellow**, *Computational Cognitive Neuroscience Lab*; hosted by Samuel J. Gershman, Harvard University, Cambridge, MA.
- 2016-2019 **Pre-Doctoral Fellow**, *Center for Adaptive Rationality (ARC) and Center for Adaptive Behavior and Cognition (ABC)*, Max Planck Institute for Human Development, Berlin, Germany.
- 2014-2015 **Research Assistant**, *Center for Adaptive Behavior and Cognition (ABC)*, Max Planck Institute for Human Development, Berlin, Germany.
- 2014 **Student Research Scientist**, *PetaByte Research*, Budapest, Hungary.
- 2013-2014 **Research Assistant**, *Intelligent Software Agents and New Media Group*, Austrian Institute for Artificial Intelligence (OFAI), Vienna, Austria.
- 2009 **Research Assistant**, *Center for Human Evolution, Cognition, and Culture (HECC)*, University of British Columbia, Vancouver, Canada.

## Education

- 2016-2019 **Dr. rer. nat. (Ph.D.) Psychology**, *Humboldt University of Berlin*, Berlin, Germany, *Summa Cum Laude*.
- 2013-2015 **M.Sc. Cognitive Science**, *University of Vienna*, Vienna, Austria, *with Distinction*.
- 2004-2009 **B.A. Philosophy**, *University of British Columbia*, Vancouver, Canada, *Dean's List*.

## Funding

- 2022 **Computational Summer School on Modeling Social and Collective Behavior (COS-MOS) Konstanz 2022**, *William K. and Katherine W. Estes Fund*, Co-Organizer: Wataru Toyokawa, \$18k (USD).

- 2021 **Cumulative Culture in AI** (Postdoc funding), *Tübingen AI Center, supported by the Federal Ministry of Education and Research (BMBF)*, Co-PI: Claudio Tennie, ~ €115k.
- 2021 **Compositionality in Minds and Machines** (Mini-graduate School), *Innovation Fund Program of the Cluster of Excellence "Machine Learning: New Perspectives for Science"*, University of Tübingen, Co-PI: Martin Butz, ~ €114k.
- 2021 **Machine Learning for Education** (Mini-graduate School), *Innovation Fund Program of the Cluster of Excellence "Machine Learning: New Perspectives for Science"*, University of Tübingen, Co-PI: Álvaro Tejero-Cantero, ~ €114k.
- 2019 **Dean's Competitive Fund for Promising Research**, *Harvard University*, Cambridge, MA (written with and awarded to Sam Gershman), \$33,353 (USD).
- 2019 **Glushko and Samuelson Student Travel Grant**, *40th Annual Conference of the Cognitive Science Society*, Montreal, QC, \$500 (USD).
- 2016-2019 **Pre-Doctoral Fellowship**, *International Max Planck Research School on Adapting Behavior in a Fundamentally Uncertain World*, Joint PhD Fellowship in Psychology, Economics, and Law, ~€100k.
- 2011-2012 **Joseph-Armand Bombardier Canada Graduate Scholarship**, *Social Sciences and Humanities Research Council of Canada (SSHRC)*, Canada, \$17,500 (CAD), *Declined*.

## Publications

### In Prep

submitted Collins, R. N., Mandel, D. R., Karvetski, C. W., **Wu**, C. M., & Nelson, J. D. (submitted). The wisdom of the coherent: improving correspondence with coherence-weighted aggregation. *PsyArXiv*. doi:[10.31234/osf.io/fmnty](https://doi.org/10.31234/osf.io/fmnty)

Giron, A. P., Ciranka, S., Schulz, E., van den Bos, W., Ruggeri, A., Meder, B., & **Wu**, C. M. (submitted). Developmental changes in learning resemble stochastic optimization. *PsyArXiv*. doi:[10.31234/osf.io/9f4k3](https://doi.org/10.31234/osf.io/9f4k3)

in press Ludwig, T., **Wu**, C. M., & Schulz, E. (in press). Connecting exploration, generalization, and planning in correlated trees. In *Proceedings of the 44rd Annual Conference of the Cognitive Science Society*. Toronto, Canada: Cognitive Science Society.

### Peer reviewed

2022 Ciranka, S., Linde-Domingo, J., Padezhki, I., Wicharz, C., **Wu**, C. M., & Spitzer, B. (2022). Asymmetric learning facilitates human inference of transitive relations. *Nature Human Behaviour*. doi:<https://doi.org/10.1038/s41562-021-01263-w>

Dezza, I. C., Schulz, E., & **Wu**, C. M. (Eds.). (2022). *The Drive for Knowledge: The Science of Human Information-Seeking*. Cambridge: Cambridge University Press.

**Wu**, C. M., Schulz, E., Pleskac, T. J., & Speekenbrink, M. (2022). Time pressure changes how people explore and respond to uncertainty. *Scientific Reports*, 12, 1–14. doi:<https://doi.org/10.1038/s41598-022-07901-1>

**Wu**, C. M., Vélez, N., & Cushman, F. A. (2022). Representational exchange in human social learning: Balancing efficiency and flexibility. In I. C. Dezza, E. Schulz, & C. M. Wu (Eds.), *The Drive for Knowledge: The Science of Human Information-Seeking*. Cambridge: Cambridge University Press.

- 2021 Humaidan, D., Otte, S., Gumbsch, C., **Wu**, C. M., & Butz, M. V. (2021). Latent event-predictive encodings through counterfactual regularization. In T. Fitch, C. Lamm, H. Leder, & K. Teßmar-Raible (Eds.), *Proceedings of the 43rd Annual Conference of the Cognitive Science Society* (pp. 1726–1731). Vienna, Austria: Cognitive Science Society. eprint: [2105.05894](#)
- Meder, B., **Wu**, C. M., Schulz, E., & Ruggeri, A. (2021). Development of directed and random exploration in children. *Developmental Science*, e13095. doi:[10.1111/desc.13095](#)
- Wu**, C. M., Ho, M. K., Kahl, B., Leuker, C., Meder, B., & Kurvers, R. H. (2021). Specialization and selective social attention establishes the balance between individual and social learning. In T. Fitch, C. Lamm, H. Leder, & K. Teßmar-Raible (Eds.), *Proceedings of the 43rd Annual Conference of the Cognitive Science Society* (pp. 1921–1927). Vienna, Austria: Cognitive Science Society. doi:[10.1101/2021.02.03.429553](#)
- Wu**, C. M., Schulz, E., & Gershman, S. J. (2021). Inference and search on graph-structured spaces. *Computational Brain & Behavior*, 125–147. doi:[10.1007/s42113-020-00091-x](#)
- Zuberer, A., Kucyi, A., Yamashita, A., **Wu**, C. M., Walter, M., Valera, E. M., & Esterman, M. (2021). Integration and segregation across large-scale intrinsic brain networks as a marker of sustained attention and task-unrelated thought. *NeuroImage*, 229, 117610. doi:[10.1016/j.neuroimage.2020.117610](#)
- 2020 Brändle, F., **Wu**, C. M., & Schulz, E. (2020). What are we curious about? *Trends in Cognitive Science*. doi:[10.1016/j.tics.2020.05.010](#)
- Wu**, C. M., Schulz, E., Garvert, M. M., Meder, B., & Schuck, N. W. (2020). Similarities and differences in spatial and non-spatial cognitive maps. *PLOS Computational Biology*, 16, 1–28. doi:[10.1371/journal.pcbi.1008149](#)
- 2019 Analytis, P. P., **Wu**, C. M., & Gelastopoulos, A. (2019). Make-or-break: chasing risky goals or settling for safe rewards? *Cognitive Science*, 43, e12743. doi:[10.1111/cogs.12743](#)
- Schulz, E., **Wu**, C. M., Ruggeri, A., & Meder, B. (2019). Searching for rewards like a child means less generalization and more directed exploration. *Psychological Science*, 30(11), 1561–1572. doi:[10.1177/0956797619863663](#)
- Tump, A. N., **Wu**, C. M., Bouhrel, I., & Goldstone, R. L. (2019). The evolutionary dynamics of cooperation in collective search. In A. Goel, C. Seifert, & C. Freksa (Eds.), *Proceedings of the 41st Annual Conference of the Cognitive Science Society* (pp. 883–889). Montreal, QB: Cognitive Science Society. (Joint first authorship.)
- Wu**, C. M., Schulz, E., Gerbaulet, K., Pleskac, T. J., & Speekenbrink, M. (2019). Under pressure: The influence of time limits on human exploration. In A. Goel, C. Seifert, & C. Freksa (Eds.), *Proceedings of the 41st Annual Conference of the Cognitive Science Society* (pp. 1219–1225). Montreal, QB: Cognitive Science Society. (Joint first authorship.)
- Wu**, C. M., Schulz, E., & Gershman, S. J. (2019a). Generalization as diffusion: human function learning on graphs. In A. Goel, C. Seifert, & C. Freksa (Eds.), *Proceedings of the 41st Annual Conference of the Cognitive Science Society* (pp. 3122–3128). Montreal, QB: Cognitive Science Society.

- Wu**, C. M., Schulz, E., & Gershman, S. J. (2019b). Searching for rewards in graph-structured spaces. In *Proceedings of the 2019 Conference on Cognitive Computational Neuroscience*. doi:[10.32470/CCN.2019.1041-0](https://doi.org/10.32470/CCN.2019.1041-0)
- 2018 Bouhlel, I., **Wu**, C. M., Hanaki, N., & Goldstone, R. L. (2018). Sharing is not erring: pseudo-reciprocity in collective search. In T. T. Rogers, M. Rau, X. Zhu, & C. W. Kalish (Eds.), *Proceedings of the 40th Annual Conference of the Cognitive Science Society* (pp. 156–161). Austin, TX: Cognitive Science Society. (Joint first authorship.)
- Schulz, E., **Wu**, C. M., Huys, Q. J., Krause, A., & Speekenbrink, M. (2018). Generalization and search in risky environments. *Cognitive Science*, 42, 2592–2620. doi:[10.1111/cogs.12695](https://doi.org/10.1111/cogs.12695)
- Wu**, C. M., Schulz, E., Garvert, M. M., Meder, B., & Schuck, N. W. (2018a). Connecting conceptual and spatial search via a model of generalization. In T. T. Rogers, M. Rau, X. Zhu, & C. W. Kalish (Eds.), *Proceedings of the 40th Annual Conference of the Cognitive Science Society* (pp. 1183–1188). Austin, TX: Cognitive Science Society.
- Wu**, C. M., Schulz, E., Speekenbrink, M., Nelson, J. D., & Meder, B. (2018b). Generalization guides human exploration in vast decision spaces. *Nature Human Behaviour*, 2, 915–924. doi:[10.1038/s41562-018-0467-4](https://doi.org/10.1038/s41562-018-0467-4)
- 2017 **Wu**, C. M., Meder, B., Filimon, F., & Nelson, J. D. (2017). Asking better questions: how presentation formats influence information search. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, 8, 1274–1297. doi:[doi:10.1037/xlm0000374](https://doi.org/10.1037/xlm0000374)
- Wu**, C. M., Schulz, E., Speekenbrink, M., Nelson, J. D., & Meder, B. (2017). Mapping the unknown: the spatially correlated multi-armed bandit. In G. Gunzelmann, A. Howes, T. Tenbrink, & E. J. Davelaar (Eds.), *Proceedings of the 39th Annual Meeting of the Cognitive Science Society* (pp. 1357–1362). Austin, TX: Cognitive Science Society.
- 2016 Barkoczi, D., Analytis, P. P., & **Wu**, C. M. (2016). Collective search on rugged landscapes: a crossenvironmental analysis. In A. Papafragou, D. Grodner, D. Mirman, & J. Trueswell (Eds.), *Proceedings of the 38th Annual Conference of the Cognitive Science Society* (pp. 918–923). Austin, TX: Cognitive Science Society.

## Teaching

- 2022 **Cognitive maps and model-based reinforcement learning**, *Graduate Training Center for Neuroscience, Masters Seminar*, University of Tübingen, DE, Co-taught with Philipp Schwartenbeck.
- 2022 **Tutorial on Modeling Social Learning and Collective Behavior**, *The Computational Summer school on Modeling Social and collective behavior (COSMOS)*, Konstanz, DE, [\[Code notebooks\]](#).
- 2022 **Scientific reasoning: Crafting research questions and arguments**, *Computation and Cognition Tübingen Summer Internship (CaCTüS) workshop*, Max Planck Institute for Biological Cybernetics, Tübingen, Germany.
- 2021 **Generalization in Reinforcement Learning**, *Guest lecture: Introduction to Cognitive Psychology*, University of Ghent, Ghent, Belgium (via Zoom) [\[Slides\]](#).
- 2020 **Scientific Thinking: the Art of Communicating Ideas**, *“Becoming a good scientist” workshop*, Max Planck Institute for Biological Cybernetics, Tübingen, Germany (via Zoom).

- 2020 **Computational Modeling**, *Graduate student workshop*, Max Planck Institute for Biological Cybernetics, Tübingen, Germany (via Zoom).
- 2019-2020 **Representation Learning in Reinforcement Learning Seminar**, *Co-organizer and regular Speaker*, Harvard University, Center for Brain Science, Cambridge, MA. [\[Notes\]](#).
- 2015-2019 **Berlin Machine Learning Seminar**, *Regular Speaker*, Berlin, Germany.
- 2018 **Introduction to Computational Modeling**, *Graduate and undergraduate workshop*, MPRG: iSearch Research Retreat, Bensdorf, Germany.
- 2018 **Intro to Cognitive Modeling**, *Course*, Max Planck Institute for Human Development, Berlin, Germany. (Teaching Assistant to Dr. Björn Meder).
- 2017 **Fast-and-frugal Trees and Models of Information Search**, *Workshop*, ABC Research Retreat, Schloss Ringberg, Germany.
- 2017 **Computational Models of Cognition**, *Lecture*, Berlin School of Mind and Brain (PhD Program), Humboldt University, Berlin, Germany.
- 2016-2017 **Math and Methods Tutorial Series**, *Organizer and regular speaker*, Center for Adaptive Behavior and Cognition (ABC), Berlin, Germany.
- 2016 **A Statistical Framework for Model Comparisons**, *Tutorial*, ABC Research Retreat, Gut Gremmelin, Germany.

## Supervision

### Theses Supervised

- Alexandra Witt**. Department of Computer Science, University of Tübingen. PhD Thesis: *The Neural and Behavioral Basis for Social Learning and Theory of Mind Inference*. (2021-Present)
- Mani Hamidi**. Department of Computer Science, University of Tübingen. PhD Thesis: *Keeping it Systematically Simple: Heuristics for the control of representation complexity over the course of learning* (2021-Present)
- Jonas Müller**. Department of Cognitive Science, University of Tübingen. Masters Thesis: *Emerging Social Behavior in Evolutionary Reinforcement Learning Simulations* (2022-Present)
- Sebastian Breit**. Department of Cognitive Science, University of Tübingen. Masters Thesis: *In search of lost memories: modeling forgetful generalization* (2021-Present)
- Anna Giron**. Department of Cognitive Science, University of Tübingen. Masters Thesis: *The Trajectory of Learning and Exploration Over the Lifespan* (2020-2021)
- Theresa Horn**. Department of Cognitive Science, University of Tübingen. Bachelors Thesis: *Use of Visual and Spatial Information in Human Search Behaviour* (2021)
- Kimberly Gerbaulet**. Institute of Cognitive Science, University of Osnabrück. Masters Thesis: *Under pressure: the effect of time pressure on directed and random exploration*. (2018-2019)

### Thesis Advisory Committee

- Andria Smith**. PhD student. Organizational Leadership and Diversity (Max Planck Institute for Intelligent Systems) & Human and Machine Cognition Lab, University of Tübingen. 2022 - present; as co-advisor)
- Hanqi Zhou**. PhD student. Machine Learning Collaboratory & Human and Machine Cognition Lab, University of Tübingen. Co-advisor. (2022 - present; as co-advisor)
- Ori Press**. PhD student. Computational Vision and Neuroscience, University of Tübingen. (2022 - present)
- Manuel Traub**. PhD student. Cognitive Modeling group, University of Tübingen. (2021 - present)
- Ruiqi He**. PhD student. Rationality Enhancement Group, Max Planck Institute for Intelligent Systems. (2020 - present)

**Lovis Hendrich.** PhD student. Rationality Enhancement Group, Max Planck Institute for Intelligent Systems. (2020 - present)

**Christian Gumbsch.** PhD student. Autonomous learning, Max Planck Institute for Intelligent Systems. (2019 - present)

#### Graduate Student Projects

**Frederic Becker.** Masters student. Department of Machine Learning, University of Tübingen. *Analysis of Neural Networks with Linearized Layer Transformations.* (2022-Present)

**Nir Moneta.** PhD student. Max Planck Institute for Human Development, Berlin. *Rewards Distort Neural Representations of Abstract Visual Stimuli.* (2020-Present)

**Susanne Haridi.** PhD student. Max Planck School of Cognition. *The scalability of human inference.* (2020-Present)

**Franziska Brändle.** PhD student. Max Planck Institute for Biological Cybernetics. *A computational theory of fun.* (2020-Present)

**Kornelius Raeth.** Masters student. Department of Machine Learning, University of Tübingen. *Influence of reward structures on Hippocampal sequence generation.* (2021-2022)

**Tobias Ludwig.** Masters student. Graduate Training Center for Neuroscience, University of Tübingen. *Planning and generalization on generative graph-structured bandits.* (2020-2022)

**Simon Ciranka.** PhD student. Center for Adaptive Rationality (ARC), Max Planck Institute for Human Development. *Asymmetric learning facilitates human inference of transitive relations..* (2019-2021)

**Imen Bouhlel.** PhD student. Department of Economics, Université de Nice. *Sharing is not erring: How environments can encourage pseudo-reciprocity in collective human search.* (2016-2019)

**Alan Novaes Tump.** PhD student. Center for Adaptive Rationality, Max Planck Institute for Human Development. *The evolutionary dynamics of cooperation in collective search.* (2018-2020)

**Ahmad Dawud.** Masters Student. Institute of Cognitive Science, University of Osnabrück. *Collective search and rugged landscapes.* (2017-2019)

**Alexander Djamali.** Masters student. Department of Physics, Ludwig Maximilian University of Munich. *Information search: Finding better questions.* (2016-2017)

#### Undergraduate Student Projects

**Grace Deng.** Bachelor student. Brown University. *Cumulative cultural evolution drives the rise and decline of virtual online communities.* (2020-2021)

---

#### Professional Service

**Associate editor.** Open Mind, MIT Press

**Steering Committee Member** of the Cluster of Excellence – Machine Learning for Science, University of Tübingen (2021-Present)

**Co-Organizer** of The Computational Summer school on Modeling Social and collective behavior (COSMOS) 2022, Konstanz, DE

**Neuromatch mentor** (2021)

**Organizer** of Cognition, Collectives, and Human Culture Workshop (part of CogSci 2020), Toronto, Canada (2020)

**Organizer** of the 17th annual Summer Institute on Bounded Rationality, Berlin, Germany (2018)

**PhD Representative** for the Max Planck Institute for Human Development (2017-2018)

**Ad-hoc Reviewer** for Nature Communications, Nature Human Behaviour, Scientific Reports, PLOS Computational Biology, Cognition, Cognitive Psychology, Artificial Intelligence, Computational Brain and Behavior, Journal of Experimental Psychology: Learning, Memory, and Cognition, Cognitive, Affective, and Behavioral Neuroscience, Cognitive Science, Cognitive Computational Neuroscience, Cognitive Science Society, Mind & Society, Futures & Foresight Science, and the National Science Foundation.

---

## Technical Skills

**Programming Languages:** R, Python, Matlab, Julia, JavaScript, HTML, jQuery, PHP, CSS, and  $\text{\LaTeX}$ .

**Additional Software Skills:** MongoDB, MySQL, Singularity, Tensorflow, Redis, and Adobe Creative Suite.

**Languages:** English (Native), German (B2), Chinese (Mandarin/Shanghainese; mother tongue), French (B1), Spanish (B1), and Russian (A1)

---

## References

Prof. Dr. Samuel J. Gershman

Department of Psychology and Center for Brain Sciences, University of Harvard

Northwest Lab Building, 52 Oxford Street, Cambridge, MA 02138

gershman[at]fas.harvard.edu

Prof. Dr. Fiery Cushman

Department of Psychology, University of Harvard

William James Hall, 33 Kirkland Street, Cambridge, MA 02138

cushman[at]fas.harvard.edu

Prof. Dr. Björn Meder

Health and Medical University Potsdam

Olympischer Weg 1, 14471 Potsdam, Germany

bjoern.meder[at]health-and-medical-university.de