Prof. Dr. Heiko Schütt

Curriculum Vitae

University of Luxembourg
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I am associate professor for computational cognitive science and modeling at the Université du Luxembourg. I create models of visual perception and related cognition and behavior based on mechanistic models like deep neural networks and statistical considerations like Bayesian inference and efficient coding. Furthermore, I develop methods to evaluate such models and published two popular toolboxes for such evaluations: Psignifit 4 for fitting psychometric functions and the rsatoolbox for representational similarity analysis.

Employment

2023–today **Associate Professor**, *Université du Luxembourg*, Luxembourg.
Computational Cognitive Science and Modeling

2018–2023 **Postdoctoral Associate**, *New York University & Columbia University*, New York.
Alternatives to Bayesian observer models
Representational similarity analysis
Prof. Wei Ji Ma & Prof. Nikolaus Kriegeskorte

2014–2018 **Research Fellow**, *Eberhardt Karls Universität*, Tübingen.
Early vision and dynamical eye movement models

Education

2014–2018 **PhD. Neural and Behavioural Sciences**, *Graduate Training Center for Neuroscience*, Tübingen, Germany, *summa cum laude*.
"Modelling Early Spatial Vision and its Influence on Eye Movements in Natural Scenes"
Supervisors: Prof. Felix Wichmann & Prof. Ralf Engbert (Uni Potsdam)

2012–2014 **MSc. Neural and Behavioural Sciences**, *Graduate Training Center for Neuroscience*, Tübingen, Germany, *Grade 1.1 (very good,scale: 1-6)*.
"Painless Bayesian Inference for Psychometric Functions"
Supervisor: Prof. Felix Wichmann

2010–2014 **Bsc. Mathematics**, *Eberhardt Karls Universität*, Tübingen, *Grade 1.2 (very good, scale: 1-6)*.
"Maximum Bounds for Elliptic Differential Equations"
Supervisor: Prof. Andreas Prohl

2009–2012 **Bsc. Psychology**, *Justus Liebig Universität*, Gießen, *Grade 0.9 (very good, scale: 0.7-6.0)*.
"Influence of roughness and gloss on perceived light distance"
Supervisor: Prof. Roland Fleming

Professional Activities

2023 **Organizer** *Manhattan Representational Geometry workshop*

2015-2022 **Reviewer** *Attention, Perception & Psychophysics, Behavioural Research Methods, i-Perception, ICLR, ICML, Journal of Experimental Psychology: HPP, Journal of Neurophysiology, Journal of Neuroscience Methods, Journal of Vision, NeurIPS (2019, 2021), NBDT, Plos Computational Biology, Plos One, PNAS, Psychological Review, Psychonomic Bulletin and Review, Vision Research*

Summer Schools

2018 **Computational Neuroscience: Vision**, Cold Spring Harbor Laboratory.
Organizers: Geoffrey Boynton, Marlene Cohen, Gregory Horwitz, Jonathan Pillow

2016 **European Summer School on Visual Neuroscience**, Rauischholzhausen.
Organizers: Jochen Braun, Wolfgang Einhäuser-Treyer, Karl Gegenfurtner

2015 **Computational Vision Summer School**, *Bernstein Center for Computational Neroscience*, Freudenstadt.
Organizers: Matthias Bethge, Michael Black, Roland Fleming, Felix Wichmann

(Co-)supervised theses

2020 **Alexander D. Kipnis**, *Msc. Thesis*, LMU Munich & Columbia University.
Validation of New Methods in Representational Similarity Analysis

2017 **Carlos R. Medina Temme**, *Bsc. Thesis*, Tübingen University.
Comparing deep neural networks against humans: resilience against image manipulations in natural image classification

2016 **Robert Geirhos**, *Bsc. Thesis*, Tübingen University.
Object Recognition in Man and Deep Neural Networks

Languages

German **Mother Tongue**

English **Proficient**

Programming Languages

MATLAB wrote psignifit 4 toolbox in it

Python wrote rsatoolbox in it

R fluent

Pytorch fluent

Teaching experience

WT 23/24 **complete series**, *Messen und Testen* , Université du Luxembourg.

2019-2022 **complete series**, *Representation and Inference reading group*, NYU.

Fall 2019 **single lecture**, *From illusions to inference*, NYU.

Winter 2017-2018 **complete series**, *Introduction to Psychtoolbox*, Tübingen.

List of acquired third-party funding

2018-2021 **Forschungsstipendium**, *German Research Foundation*, Germany, SCHU 3351/1-1.
Full funding for 2 years and 3 Months (100 260.16 €)

2010-2014 **Scholarship**, *Studienstiftung des Deutschen Volkes*, Giessen & Tübingen.
German scholarship of the federal ministry

List of Publications

Preprints

Schütt, H. H. and Ma, W. J. (preprint). Unsupervised learning of features and object boundaries from local prediction. *arXiv: https://arxiv.org/abs/2205.14195*.

Schütt, H. H. , Kim, D. , and Ma, W. J. (preprint). Reward prediction error neurons implement an efficient code for reward. *bioRxiv: https://doi.org/10.1101/2022.11.03.515104*.

Kuperwajs, I. , **Schütt, H. H.** , and Ma, W. J. (preprint). Using deep neural networks as a guide for modeling human planning. *PsyArxiv: https://psyarxiv.com/wh8yu/*.

Golan, T. , Taylor, J. , **Schütt, H. H.** , Peters, B. , Sommers, R. P. , Seeliger, K. , Doerig, A. , Linton, P. , Konkle, T. , van Gerven, M. , and others (preprint). Deep neural networks are not a single hypothesis but a language for expressing computational hypotheses. *PsyArXiv: https://doi.org/10.31234/osf.io/tr7gx*.

Peer Reviewed Research Articles

Schütt, H. H. , Yoo, A. H. , Calder-Travis, J. , and Ma, W. J. (2023). Point estimate observers: A new class of models for perceptual decision making. *Psychological Review*, 130:334–367.

Schütt, H. H. , Kipnis, A. D. , Diedrichsen, J. , and Kriegeskorte, N. (2023). Statistical inference on representational geometries. *eLife*, 12:e82566.

Flachot, A. , Akbarinia, A. , **Schütt, H. H.** , Fleming, R. W. , Wichmann, F. A. , and Gegenfurtner, K. R. (2022). Deep Neural Models for color discrimination and color constancy. *Journal of Vision*, 22:17, 1–24.

Diedrichsen, J. , Berlot, E. , Mur, M. , **Schütt, H. H.** , Shahbazi, M. , and Kriegeskorte, N. (2021). Comparing representational geometries using whitened unbiased-distance-matrix similarity. *Neurons, Behavior, Data analysis, and Theory*, 5:27664.

Schütt, H. H. , Rothkegel, L. O. M. , Trukenbrod, H. A. , Engbert, R. , and Wichmann, F. A. (2019). Disentangling bottom-up versus top-down and low-level versus high-level influences on eye movements over time. *Journal of Vision*, 19(3):1–23.

Rothkegel, L. O. M. , **Schütt, H. H.** , Trukenbrod, H. A. , Wichmann, F. A. , and Engbert, R. (2019). Searchers adjust their eye-movement dynamics to target characteristics in natural scenes. *Scientific Reports*, 9(1):1635.

Geirhos, R. , Temme, C. R. M. , Rauber, J. , **Schütt, H. H.** , Bethge, M. , and Wichmann, F. A. (2018). Generalisation in humans and deep neural networks. In Bengio, S. , Wallach, H. , Larochelle, H. , Grauman, K. , Cesa-Bianchi, N. , and Garnett, R. , editors, *Advances in Neural Information Processing Systems 31*, pages 7538–7550. Curran Associates, Inc.

Wichmann, F. A. , Janssen, D. H. J. , Geirhos, R. , Aguilar, G. , **Schütt, H. H.** , Maertens, M. , and Bethge, M. (2017). Methods and measurements to compare men against machines. *Electronic Imaging*, 2017(14):36–45.

Schütt, H. H. and Wichmann, F. A. (2017). An image-computable psychophysical spatial vision model. *Journal of Vision*, 17(12):12:1–35.

Schütt, H. H. , Rothkegel, L. O. M. , Trukenbrod, H. A. , Reich, S. , Wichmann, F. A. , and Engbert, R. (2017). Likelihood-based parameter estimation and comparison of dynamical cognitive models. *Psychological Review*, 124(4):505–524.

Rothkegel, L. O. M. , Trukenbrod, H. A. , **Schütt, H. H.** , Wichmann, F. A. , and Engbert, R. (2017). Temporal evolution of the central fixation bias in scene viewing. *Journal of Vision*, 17(13):3.

Schütt, H. H. , Harmeling, S. , Macke, J. H. , and Wichmann, F. A. (2016). Painfree and accurate Bayesian estimation of psychometric functions for (potentially) overdispersed data. *Vision Research*, 122:105–123.

Schütt, H. H. , Baier, F. , and Fleming, R. W. (2016). Perception of light source distance from shading patterns. *Journal of Vision*, 16(3):9:1–20.

Rothkegel, L. O. , Trukenbrod, H. A. , **Schütt, H. H.** , Wichmann, F. A. , and Engbert, R. (2016). Influence of initial fixation position in scene viewing. *Vision Research*, 129:33–49.

Theses

Schütt, H. H. (2018). *Modelling early spatial vision and its influence on eye movements in natural scenes*. PhD thesis, Graduate School for Neural and Behavioural Sciences, Eberhardt Karls Universiät Tübingen.

Schütt, H. H. (2014). Painless bayesian inference for psychometric functions. Master's thesis, Graduate School for Neural and Behavioural Sciences, Eberhardt Karls Universiät Tübingen.

Schütt, H. H. (2014). Maximumsabschätzungen für diskretisierungen elliptischer partieller differenzialgleichungen ("maximum bounds for discretizations of elliptic partial differential equations"). Bachelor's thesis (mathematics), Eberhardt Karls Universiät Tübingen.

Schütt, H. H. (2012). Influence of roughness and gloss on perceived light distance. Bachelor's thesis (psychology), Justus Liebig Universität Gießen.

Conference Abstracts

Schütt, H. H. , Kipnis, A. D. , Diedrichsen, J. , and Kriegeskorte, N. (2023). Statistical inference on representational geometries. In *Vision Science Society (VSS), Anual meeting, St. Pete Beach, FL, USA (poster)*.

Schütt, H. H. and Ma, W. J. (2022). A local probabilistic model of features and segmentation learned by optimizing prediction. In *Vision Science Society (VSS), Anual meeting, St. Pete Beach, FL, USA (poster)*.

Kuperwajs, I. , **Schütt, H. H.** , and Ma, W. J. (2022). Improving a model of human planning via large-scale data and deep neural networks. In *The Multi-disciplinary Conference on Reinforcement Learning and Decision Making (RLDM), Providence, RI*.

Kuperwajs, I. , **Schütt, H. H.** , and Ma, W. J. (2022). Improving a model of human planning via large-scale data and deep neural networks. In *Cognitive science society meeting (Cogsci), Toronto*.

Kim, D. , **Schütt, H. H.** , and Ma, W. J. (2022). Reward prediction error neurons implement an efficient code for reward. In *Cognitive science society meeting (Cogsci), Toronto*.

Kim, D. , **Schütt, H. H.** , and Ma, W. J. (2022). Reward prediction error neurons implement an efficient code for reward. In *The Multi-disciplinary Conference on Reinforcement Learning and Decision Making (RLDM), Providence, RI*.

Golan, T. , Guo, W. , **Schütt, H. H.** , and Kriegeskorte, N. (2022). Distinguishing representational geometries with controversial stimuli: Bayesian experimental design and its application to face dissimilarity judgments. In *SVRHM 2022 Workshop @ NeurIPS (Talk, best paper award)*.

Schütt, H. H. and Wichmann, F. A. (2019). A divisive model of midget and parasol ganglion cells explains the contrast sensitivity function. In *Vision Science Society (VSS), Anual meeting, St. Pete Beach, FL, USA (poster)*.

Schütt, H. H. and Ma, W. (2019). Dead Rectangles as a Stimulus for Perceptual Organisation Research. In *2019 Conference on Cognitive Computational Neuroscience*, Berlin, Germany. Cognitive Computational Neuroscience.

Flachot, A. C. , **Schütt, H. H.** , Fleming, R. W. , Wichmann, F. , and Gegenfurtner, K. R. (2019). Color Constancy in Deep Neural Networks. In *Vision Science Society (VSS), Anual meeting, St. Pete Beach, FL, USA (poster)*.

Wichmann, F. A. and **Schütt, H. H.** (2018). Modelling early influences on visual perception. In *European Conference on Visual Perception (ECVP), Trieste, Italy (talk,symposium)*.

Schütt, H. H. , Rothkegel, L. , Trukenbrod, H. A. , Engbert, R. , and Wichmann, F. A. (2018). Predicting the fixation densitiy over time. In *14th Biannual Conference of the German Cognitive Science Society (KogWis), Darmstadt, Germany (talk)*.

Schütt, H. H. , Rothkegel, L. , Trukenbrod, H. A. , Engbert, R. , and Wichmann, F. A. (2018). Predicting fixation densities over time from early visual processing. In *Vision Science Society (VSS), Anual meeting, St. Pete Beach, FL, USA (poster)*.

Schütt, H. H. , Rothkegel, L. , Trukenbrod, H. A. , Engbert, R. , and Wichmann, F. A. (2018). Predicting fixation densities over time from early visual processing. In *European Conference on Visual Perception (ECVP), Trieste, Italy (poster)*.

Schütt, H. H. , Rothkegel, L. , Trukenbrod, H. A. , Reich, S. , Engbert, R. , and Wichmann, F. A. (2017). Likelihood-based parameter estimation and comparison of dynamical eye movement models. In *European Conference on Eye Movements (ECEM), Wuppertal, Germany (talk)*.

Schütt, H. H. , Rothkegel, L. , Trukenbrod, H. A. , Engbert, R. , and Wichmann, F. A. (2017). Using an image-computable early vision model to predict eye movements. In *European Conference on Visual Perception (ECVP), Berlin, Germany (poster)*.

Schütt, H. H. , Rothkegel, L. , Trukenbrod, H. A. , Engbert, R. , and Wichmann, F. A. (2017). Testing an early vision model on natural image stimuli. In *Vision Science Society (VSS), Anual meeting, St. Pete Beach, FL, USA (poster)*.

Rothkegel, L. O. M.and Schütt, H. H. , Trukenbrod, H. A. , Wichmann, F. A. , and Engbert, R. (2017). We know what we can see - peripheral visibility of search targets shapes eye movement behavior in natural scenes. In *Vision Science Society (VSS), Anual meeting, St. Pete Beach, FL, USA (poster)*.

Geirhos, R. , Janssen, D. , **Schütt, H. H.** , Bethge, M. , and Wichmann, F. A. (2017). Of human observers and deep neural networks: A detailed psychophysical comparison. In *Vision Science Society (VSS), Anual meeting, St. Pete Beach, FL, USA (poster)*.

Wichmann, F. A. , Eichert, N. , and **Schütt, H. H.** (2016). An image-based multi-channel model for light adaptation. In *Vision Science Society (VSS), Anual meeting, St. Pete Beach, FL, USA (talk)*.

Schütt, H. H. and Wichmann, F. A. (2016). An image-based model for early visual processing. In *ModVis, St. Pete Beach, FL, USA (talk)*.

Schütt, H. H. and Wichmann, F. A. (2016). An image-based model for early visual processing. In *Vision Science Society (VSS), Anual meeting, St. Pete Beach, FL, USA (poster)*.

Schütt, H. H. , Baier, F. , and Fleming, R. W. (2016). Perception of light source distance from shading patterns. In *Tagung experimentell arbeitender Psychologen (TeaP), Heidelberg (poster)*.

Schütt, H. H. (2016). Likelihood based evaluations for dynamical eye movement models. In *Cambridge Vision Workshop, Cambridge, UK (talk)*.

Rothkegel, L. O. , Trukenbrod, H. , **Schütt, H. H.** , Wichmann, F. A. , and Engbert, R. (2016). Reducing the central fixation bias. In *Vision Science Society (VSS), Anual meeting, St. Pete Beach, FL, USA (poster)*.

Janssen, D. , **Schütt, H. H.** , and Wichmann, F. (2016). Some observations on the psychophysics of deep neural networks. In *Vision Science Society (VSS), Anual meeting, St. Pete Beach, FL, USA (poster)*.

Schütt, H. H. , Trukenbrod, H. A. , Rothkegel, L. , and Engbert, R. (2015). Test of a dynamical model for natural scene exploration. In *2015 European Conference on Eye Movements, Vienna (poster)*.

Schütt, H. H. , Harmeling, S. , Macke, J. H. , and Wichmann, F. A. (2015). Psignifit 4: Pain-free bayesian inference for psychometric functions. In *2015 VSS Annual Meeting, St. Pete Beach, Florida (poster)*.

Schütt, H. H. , Baier, F. , and Fleming, R. W. (2015). Perception of light source distance from shading patterns. In *Tagung experimentell arbeitender Psychologen (TeaP), Heidelberg (poster)*.

Schütt, H. H. and Wichmann, F. A. (2014). Uncertainty effects in visual psychophysics. In *Tagung experimentell arbeitender Psychologen (TeaP), Giessen (poster)*.

Schütt, H. H. , Harmeling, S. , Macke, J. H. , and Wichmann, F. A. (2014). Pain-free bayesian inference for psychometric functions. In *European Mathematical Psychology Group Meeting (EMPG), Tübingen (poster)*.

Schütt, H. H. , Harmeling, S. , Macke, J. H. , and Wichmann, F. A. (2014). Pain-free bayesian inference for psychometric functions. In *Statistical Challenges in Neuroscience, University of Warwick, UK (poster)*.

Schütt, H. H. , Harmeling, S. , Macke, J. H. , and Wichmann, F. A. (2014). Pain-free bayesian inference for psychometric functions. In *European Conference on Visual Perception (ECVP), Belgrad, SRB (poster)*.