

# Curriculum Vitae, July 14, 2023

Joscha Bach, PhD

joscha.bach@gmail.com

*Cognitive scientist/AI researcher; main focus on AGI, cognitive architectures, models of emotion and motivation. Principal author of the cognitive architecture MicroPsi. Wrote the book "Principles of Synthetic Intelligence" (OUP 2009).*

Address: 7 E Creek Place  
Menlo Park, CA 94025  
USA

Phone: +1 617 669 0337

married, two children (born on July 7th, 2010 and August 19th, 2013)

Date of Birth: 21st of December, 1973 in Weimar, Germany

Nationality: German

Education: 2007 PhD in Cognitive Science, University of Osnabrück  
1994–2000 Humboldt University of Berlin  
(Diploma of Computer Science, equiv. MA)  
Major: Computer Science  
Secondary subject: Philosophy  
1998/1999 University of Waikato; Hamilton, New Zealand  
(Graduate studies in Computer Science)  
1990–1992 Institute for Preparation of International Studies, Halle  
1988–1990 School for Mathematics, Technology and Natural Sciences  
"Carl Zeiss", Jena

Current Position: Research scientist, Thistledown Foundation  
2021–2023: Principal Research Engineer, Cognitive AI, Intel Labs  
2019–2021 VP of Research, AI Foundation  
2016–2019 Research Scientist, Harvard Program for Evolutionary Dynamics  
2014–2016 Research Scientist, MIT Media Lab  
2013–2014 Research Fellow, Humanity Plus foundation  
2011–2013 AI scientist/development lead at Hotheaven AG

2011–2012 Postdoctoral Fellow at Berlin School of Mind and Brain,  
Humboldt-University of Berlin

Entrepreneurial work:

2012 Co-Founder, MicroPsi Industries GmbH

2011 Co-Founder, Hotheaven AG

2008–2010 Co-Founder, Product Manager at txtr GmbH

2007 Co-Founder of Wizpac Ltd

2005 Founder of Bookpac GbR

Academic Positions:

2003–2005 Researcher and Lecturer at University of Osnabrück  
Institute for Cognitive Science:  
Development of a Cognitive Architecture

2000–2003 Research Assistant at Humboldt University of Berlin,  
Department of Computer Science,  
Artificial Intelligence Group:  
Lead of Socionics Project, MicroPsi Project and  
Robotic Soccer Simulation Team

Other Occupations: 06/99–12/99 (during studies)

System administration, project planning in an  
E-Commerce company (GV-Net GmbH, Berlin)

10/95–06/98 subsequent positions at department  
as tutor, WWW administrator and student advisor

10/94–03/00 Member of students' self administration of the department

04/93–06/94 Civil Service  
(working with foreign refugees in Germany)

Honors:

2015 MIT Media Lab Templeton Award

2008 Weser-Ems-Wissenschaftspreis 2008

2007 Summa cum laude PhD  
Award for Best Dissertation of 2008, IKW, University of

Osnabrück

1995–2000 Scholarship of Friedrich-Ebert-Stiftung

### *Peer-reviewed publications:*

- Achterberg, J. Arel, R., Chaibi, A., Bach, J., Tzagkarakis, N. (2023). Generative Image Model Benchmark for Reasoning and Representation (GIMBRR). Proceedings of Workshop on Evaluation and Design of Generalist Systems (EDGeS 2023), AAAI 2023 Spring Symposium
- Singer, G., Bach, J., Grinberg, T. (2022). Thrill-K Architecture: Towards a Solution to the Problem of Knowledge Based Understanding. Proceedings of International Conference for Artificial General Intelligence 2022
- Bach, J. (2022). Functionality and phenomenology of consciousness. Models of Consciousness MoC3, Stanford 2022
- Bach, J. (2021). Virtualism as a perspective on consciousness. Philosophy and Computing Conference at IS4SI 2021
- Bach, J. (2020). When Artificial Intelligence Becomes General Enough to Understand Itself. Journal for Artificial General Intelligence, <https://doi.org/10.2478/jagi-2020-0003>
- Bach, J., Coutinho, M., Lichtinger, L. (2019). *Extending MicroPsi's Model of Motivation and Emotion for Conversational Agents*. Proceedings of International Conference for Artificial General Intelligence 2019
- Bach, J. (2019). *Phenomenal Experience and the Perceptual Binding State*. Proceedings of Workshop on Artificial Consciousness, AAAI Spring Meeting 2019
- Bach, J. (2018). *Attention Based Learning as a Foundation for Conscious Agents*. Procedia of Computer Science; Postproceedings of the 9th Annual International Conference on Biologically Inspired Cognitive Architectures, BICA 2018
- Bach, J., Gallagher, K. (2018). *Request Confirmation Networks in MicroPsi 2*. Proceedings of Proceedings of International Conference for Artificial General Intelligence 2018
- Stranegård, C., Svängård, N., Bach, J., Steunebrink, B. (2017). Generic Animats. In Proceedings of AGI 2017, Melbourne.
- Stranegård, C., Svängård, N., Lindström, D., Bach, J., Steunebrink, B. (2017). *The Animat Path to Artificial General Intelligence*. In Proceedings of WS on Architectures for Generality and Autonomy, IJCAI 2017, Melbourne.
- Bach, J. (2017). *The Cortical Conductor Theory: Towards Addressing Consciousness in AI Models*. In Proceedings of WS on Architectures for Generality and Autonomy, IJCAI 2017, Melbourne.
- Bach, J. (2017). *Consciousness as a Memory of Coordinating Attention: The Conductor Model of Consciousness*. In Proceedings of Science of Consciousness Conference, San Diego 2017
- Bach, J., Herger, P. (2015). Request Confirmation Networks in the MicroPsi Cognitive Architecture. WS Neural Information Processing, NIPS 2015, Montreal, QC
- Bach, J. (2015). Modeling Motivation in the MicroPsi Architecture. Proceedings of AGI 2015, Berlin.
- Bach, J. (2014). Computationalism and Cognitive Science. Proceedings of Fifth Annual Conference on Biologically Inspired Cognitive Architectures (BICA 2014), Cambridge, MA
- Bach, J. (2014). Artificial General Intelligence as a Foundational Discipline in Cognitive Science. Seventh Conference on Artificial General Intelligence (AGI 2014), Quebec, CA
- Bach, J. (2012). MicroPsi 2: The Next Generation of the MicroPsi Framework. Proceedings of the Fifth Conference on Artificial General Intelligence (AGI 2012), Oxford, UK: 11-20
- Bach, J. (2012). A Framework for Emergent Emotions, Based on Motivation and Cognitive Modulators. International Journal of Synthetic Emotions (IJSE), 3(1), 43-63
- Bach, J., Verdicchio, M. (2012). What Kind of Machine is the Mind? To appear in Proceedings of Turing-100, the Alan Turing Centenary Conference, Manchester, UK.
- Bach, J. (2012). Functional Modeling of Personality Properties Based on Motivational Traits. Proceedings of ICCM-7, International Conference on Cognitive Modeling, Berlin, Germany. 271-272
- Adams, S. S., Bach, J., Coop, R., Hall, J. S., Schlesinger, S., Arel, I., Furlan, R., Samsonovich, A., Shapiro, S. C., Goertzel, B., Scheutz, M., Sowa, J. (2012). Mapping the AGI Landscape (to appear in Journal of Artificial Intelligence)
- Bach, J. (2012). Modeling Motivation and the Emergence of Affect in a Cognitive Agent. In Wang, P. (ed). Theoretical Foundations of Artificial General Intelligence. Atlantis Press
- Bach, J. (2011). A Motivational System for Cognitive AI. In Schmidhuber, J., Thórisson, K. R., Looks, M. (Eds.) Artificial General Intelligence. Proceedings of 4th International Conference, Springer Berlin, Heidelberg. 232-242

- Bach, J. (2011). No Room for the Mind: Enactivism in Artificial Intelligence. Proceedings of International Conference on the History and Philosophy of Computing, Ghent.
- Bach, J. (2011). Requirements for Cognitive Artificial Intelligence. Proceedings of Philosophy & Theory of Artificial Intelligence, Thessaloniki, Greece.
- Bach, J. (2011). Enactivism Considered Harmful. Proceedings of Philosophy & Theory of Artificial Intelligence, Thessaloniki, Greece
- Bach, J. (2011). Modeling Emotion as an Interaction between Motivation and Modulated Cognition. Workshop on Standards in Emotion Modeling, Leiden, Netherlands
- Bach, J. (2010): Artificial General Intelligence and Organizational Intelligence (On the Singularity of AI). Proceedings of 8th European Conference on Computing and Philosophy, ECAP 10, Munich, Germany
- Bach, J. (2009): Principles of Synthetic Intelligence. An architecture for motivated cognition. Oxford University Press, New York
- Bach, J. (2009): Community Reading, Electrified. Proceedings of re:publica Conference 2009, Berlin
- Bach, J. (2008): Seven Principles of Synthetic Intelligence. Proceedings of 1st Conference on Artificial General Intelligence, Memphis: 63-74
- Bach, J. (2007): True Feelings: Functionalist and Descriptivist Modeling of Emotion. Proceedings of Workshop on Artificial Emotion, KI 2007, Osnabrück, Germany
- Bach, J. (2007): Motivated, Emotional Agents in the MicroPsi Framework. Proceedings of 8th European Conference on Cognitive Science, Delphi, Greece: 458-461
- Bach, J., Dörner, D., Vuine, V. (2006): Psi and MicroPsi. A Novel Approach to Modeling Emotion and Cognition in a Cognitive Architecture. Tutorial at ICCM 2006, Stresa, Italy
- Bach, J., Bauer, C., Vuine, R. (2006): MicroPsi: Contributions to a Broad Architecture of Cognition. In Proc. of KI2006, Bremen, Germany
- Bach, J. (2006): MicroPsi: A cognitive modeling toolkit coming of age. In Proc. of 7th International Conference on Cognitive Modeling: 20-25
- Bach, J., Dörner, D., Gerdes, J., Zundel, A. (2005): Psi and MicroPsi, Building Blocks for a Cognitive Architecture. Symposium at the Conference of the German Society for Cognitive Science, KogWis 05, Basel, Switzerland
- Bach, J. (2005). Representations for a Complex World. Combining Distributed and Localist Representations for Learning and Planning, in: Wermter, S. & Palm, G. (eds.): Biomimetic Neural Learning for Intelligent Robots. Springer.
- Bach, J. Vuine, R. (2004). A neural implementation of plan-based control, in: Proceedings of Workshop on Neurobotics at KI 2004, Ulm.
- Bach, J. (2003): Voraussetzungen der Kommunikation zwischen Intelligenten Systemen. M. Schetsche (ed.): Proc. "Der maximal Fremde", IGPP, Freiburg
- Bach, J. (2003): The MicroPsi Agent Architecture. Proceedings of ICCM-5, International Conference on Cognitive Modeling Bamberg, Germany (pp. 15-20)
- Bach, J. (2003): Emotionale Virtuelle Agenten auf der Basis der Dörnerschen Psi-Theorie. In Proceedings of ASIM 03, Workshop Modellierung und Simulation menschlichen Verhaltens, Berlin, Germany (pp. 1-10)
- Bach, J. (2003): Connecting MicroPsi Agents to Virtual and Physical Environments Bach, J. (2003): Applications of the AEP Toolkit. In Workshops and Tutorials, 7th European Conference on Artificial Life, Dortmund, Germany. (p. 128-132)
- Wendler, J., Bach, J. (2003): Recognizing and Predicting Agent Behavior with Case-Based Reasoning. In D. Polani et al. (eds.) RoboCup 2003, Proceedings of Robot Soccer World Cup VII. LNAI 3020, pp. 729-738, Springer.
- Wendler, J., Bach, J. (2003): Assessing Behavior of Agents in the RoboCup Domain using Case Based Reasoning. In Proceedings of ASIM 03, Workshop Modellierung und Simulation menschlichen Verhaltens, Berlin, Germany: 1-10
- Lötzsch, M., Bach, J., Burkhard, H.-D., Jünger, M. (2003): Designing Agent Behavior with the Extensible Agent Behavior Specification Language XABSL. Proceedings RoboCup 2003
- Bach, J., Vuine, R. (2003): The AEP Toolkit for Agent Design and Simulation, Proceedings of MATES 2003, Conference on Multi Agent System Technologies, LNAI 2831, Springer, Berlin, Heidelberg (p. 38-49)
- Bach, J., Vuine, R. (2003): Designing Agents with MicroPsi Node Nets. In Proceedings of KI 2003, Annual German Conference on AI. LNAI 2821, Springer, Berlin, Heidelberg. (p. 164-178), 2003

- Burkhard, H.-D., Bach, J., Berger, R. (2002): Using a Deliberative Architecture for Robotic Soccer, Proceedings of Workshop on Multi-Agent Interoperability (MAI) at KI 2002, p. 101ff
- Bach, J., Jünger, M. (2002): Using a Flexible Grid for Image Recognition, Workshop Concurrency, Specification & Programming, 2002
- Bach, J. (2002): Enhancing Perception and Planning of Software Agents with Emotion and Acquired Hierarchical Categories, Proceedings of MASHO 02 at KI 2002, p. 3ff
- Bach, J., Gollin, M. (2001): Self-Localization Revisited, Proceedings of Robocup 2001, Springer
- Burkhard, H.-D., Bach, J., Berger, R., Gollin, M.: (2001) Mental Models for Robot Control. Advances in Plan-Based Control of Robotic Agents, 2001, pp. 71-88
- Bach, J. (2000): Using Concurrent Entropy Models for Textual Interfaces, Workshop Concurrency, Specification & Programming, Humboldt-Universität Berlin, Informatik-Bericht 140, 2000, pp. 1-8
- Bach, J. (2000): Supporting Textual Input by Using Multiple Entropy Models, Fundamenta Informaticae 48, IOS Press 2001, pp. 1-9
- Bach, J., Janning, F., Schultz-Schaeffer, I. (2000): Multi-Agent Systems in Hybrid Organisations, Workshop Concurrency, Specification & Programming, Informatik-Bericht 140, Humboldt-Universität Berlin, 2000, pp. 9-17
- Bach, J. (2000): MUDs seen as Multi Agent Systems, ECAI 2000 WS on Modelling Artificial Societies and Hybrid Organisations, pp. 1-9
- Bach, J., Witten, I. H. (1999): Lexical Attraction for Text Compression. Data Compression Conference 1999: 516

### *Other publications:*

- Ruff, B., Beck, T., Bach, J. (2019). Mean Shift Rejection: Training Deep Neural Networks Without Minibatch Statistics or Normalization. arXiv:1911.13173
- Bach, J. (2016): Everything is Computation. Response to Edge Question 2016: What do you consider the most interesting recent scientific news? <http://edge.org/response-detail/26733>
- Bach, J. (2015): The Age of the New Machines. In Brockman, John (ed): What to think about machines that think? Harper Collins: 187-190
- Bach, J. (2015): The Age of the New Machines, or Every society will get the Artificial Intelligence it deserves. Response to Edge Question 2015: What do you think about Machines that Think? <http://edge.org/response-detail/26205>
- Bach, J. (2010): Kybernetik. In Sandkühler, H. J. et al. (Ed.) Enzyklopädie Philosophie, Felix-Meiner-Verlag, Hamburg
- Bach, J. (2008): Interview mit Dietrich Dörner. KI 22(1): 34-36
- Bach, J. (2007): Principles of Synthetic Intelligence. Building Blocks for an Architecture of Motivated Cognition. PhD Thesis, University of Osnabrück, March 2007
- Bach, J. (2005). MiniPsi, der Mac-Roboter. B. Schwan (ed.): MetaMac Magazin, Berlin, Vol. 46/05 (pp. 11-16)
- Bach, J., Vuine, V. (2003): The AEP Handbook. A Tutorial on Using the MicroPsi toolkit. Online version available at <http://www.micropsi.com>
- Wendler, J., Bach, J. (2003): Case Based Behavior Assessment in Simulated Robotic Soccer. Modellierung und Simulation Menschlichen Verhaltens. Informatik Bericht 163, Humboldt-Universität zu Berlin, March 2003
- Bach, J. (2000): Vorhersagegestützte Texteingabe durch Modellierung der Entropie, Diplomarbeit, Institut für Informatik, Humboldt-Universität Berlin, April 2000
- Bach, J., Witten, I. H. (1999): Lexical Attraction for Text Compression. University of Waikato Computer Science Working Papers

## *Research positions:*

Humboldt University of Berlin:

- DFG-Schwerpunktprogramm “Sozionik”, Grant Nr. 1077.  
Project initiated by Prof. Dr. Hans-Dieter Burkhard and Prof. Dr. Werner Rammert  
Research position from April 2000 to April 2001
- DFG-Schwerpunktprogramm “Cooperating teams of mobile robots in dynamic environments”,  
Grant Nr. 1125.  
Project initiated by Prof. Dr. Hans-Dieter Burkhard  
Leader of simulation group from May 2001 to August 2003

University of Osnabrück:

- Research position Artificial Intelligence from September 2003 to March 2005

## *Conference organization:*

Chair of Machine Consciousness Track, Philosophy and Computing Conference at IS4SI 2021

Chair of German Annual Conference on Artificial Intelligence, KI 2011, Berlin, Germany

Chair of Conference of Artificial General Intelligence, AGI 2012, Oxford, UK

## *Teaching experience:*

MIT Media Lab:

- Course MAS.S66 “Future Destination of Artificial Intelligence”, Fall 2015
- Course MAS.S63 “Cognitive Integration”, Spring 2016

Humboldt University of Berlin, Artificial Intelligence:

- Seminar “Socionics and Cognition”, Autumn/Winter 2000/2001
- Seminar “Emotional Agents”, Spring/Summer 2001
- Seminar “The Workshop of Emotions”, Autumn/Winter 2001/2002
- Seminar “Perception and Action Control of Virtual Cognitive Agents”, Autumn/Winter 02/03
- Seminar “Introduction to Mindbuilding”, Autumn/Winter 03/04
- with Prof. Dr. H.-D. Burkhard: Course “Cognitive Robotics”, Academic Year 01/02, 03/04

University of Osnabrück, Cognitive Science:

- Seminar “Introduction to Mindbuilding”, Autumn/Winter 2003/2004
- with Prof. Dr. K. Kühnberger: Course “Methods of Artificial Intelligence”, Autumn/Winter 2003/2004
- Seminar “Mindbuilding: Cognition and Representation”, Spring/Summer 2004
- with Prof. Dr. K. Kühnberger: Course “AI Perspectives on Learning”, Spring/Summer 2004
- Course “Cognitive HCI”, Autumn/Winter 2004/2005
- Seminar “Mindbuilding: Models of Perception in a Cognitive Architecture”, Autumn/Winter 2004/2005
- Course “Multi-Agent Systems”, Spring/Summer 2005
- Seminar “Mindbuilding: The Symbol Grounding Problem”, Spring/Summer 2005
- Course “Cognitive HCI”, Autumn/Winter 2005/2006
- Seminar “Mindbuilding: Topics in Cognitive Architectures”, Autumn/Winter 2005/2006
- Course “L’Homme Machine: An AI Perspective on Cognitive Science”, Summer 2008

Humboldt University of Berlin, Institute for Philosophy:

- Seminar “Computation and the Mind”, Summer 2012

other:

- Course at the Summer School on Artificial Intelligence, Xiamen University, Fujian, China: “The MicroPsi Cognitive Architecture”, 2009
- Lecture at Summer School of Icelandic Institute of Intelligent Machines, Reykjavik, Iceland: “Modeling Motivation and Affect in AI agents”, 2012
- with Prof. Dr. D. Dörner: Course at Summer School of Studienstiftung des Deutschen Volkes, Rot an der Rot, Germany: „Der Geist als Maschine. Auf dem Weg zur künstlichen Seele?“, 2012

- Course at Interdisciplinary Sprint School for Cognitive Science and Neuroscience (IK 2013), Günne am Möhnesee, Germany: “Minds as Machine: Cognitive Systems and Artificial Intelligence”, March 2013

### *Thesis supervision:*

- Colin Bauer (2004): The Categorization of Compositional Structures Applied to the MicroPsi Architecture.  
Diploma Thesis, Technische Universität zu Berlin
- Christian Ziech (2004): Anwendungsmöglichkeiten von Case Based Reasoning in Computerspielen.  
Diploma Thesis, Humboldt-Universität zu Berlin
- David Salz (2005): 3DView2: Eine dreidimensionale Visualisierungs- und Steuerungskomponente für die MicroPsi-Agentenplattform. Diploma Thesis, Humboldt-Universität zu Berlin
- Markus Dietzsch (2008): Agentenentwicklung mit dem MicroPsi-Framework.  
Diploma Thesis, Humboldt-Universität zu Berlin
- Shoshannah Tekofski: (2017): You are what you play you are. PhD thesis at Tilburg University/ MIT Media Lab (committee)
- Nader Chmait (2017): Understanding and measuring collective intelligence across different cognitive systems. PhD thesis, Monash University (committee)