




hendrik baier

artificial intelligence researcher

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The Netherlands
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website 
Google Scholar 

research interests

I am interested in creating intelligent autonomous agents that are able to succeed in a wide range of complex decision-making tasks, in order to help human users solve real-world problems. To achieve this, my research focuses on *planning*, required to act toward long-term goals; on *learning*, required to act in unknown environments; and on the *explainability* of planning and learning, required for successful human-AI collaboration.

In order to tackle these challenges, I use the unifying framework of reinforcement learning - of learning by trial and error - and aim at pushing its boundaries, often in a variety of traditional and digital games as testbeds. I then transfer the technology to non-game domains in collaborative projects with industry, in sectors such as logistics and transportation, smart manufacturing, and sustainable energy.

research experience

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|-----------------------------------|--|-----------------------------|
| 2022 – present | Eindhoven University of Technology
<i>Assistant Professor</i>
Information Systems Group
Developing learning, planning, and explainable AI techniques in collaboration with industry partners from sectors such as logistics, energy, and manufacturing | Eindhoven, The Netherlands |
| 2018 – 2021
and 2023 – present | Centrum Wiskunde & Informatica
<i>Researcher</i>
Intelligent and Autonomous Systems Group
In collaboration with industry, took a leading role in applying AI and machine learning to the optimal management of energy producers and consumers on future energy markets with an increasing share of renewable energy; developed a related research vision for explainable search-based AI | Amsterdam, The Netherlands |
| 2016 – 2018 | University of York
<i>Research associate in artificial intelligence and data analytics</i>
Digital Creativity Labs
Explored the integration of search algorithms and machine learning in increasingly complex commercial video games; explored ethical and societal issues around AI in interdisciplinary workshops | York, United Kingdom |
| 2015 – 2016 | European Space Agency
<i>Research fellow in artificial intelligence</i>
Advanced Concepts Team
Worked on “blue sky” research with potential future impact for the space sector, as well as serving as an internal science consultant for the European Space Research and Technology Centre | Noordwijk, The Netherlands |
| 2010 – 2015 | Maastricht University
<i>PhD researcher</i>
Department of Knowledge Engineering
Improved sequential decision making based on Monte Carlo Tree Search both in adversarial as well as single-agent environments | Maastricht, The Netherlands |

education

2007 – 2010	M.Sc. Cognitive Science Grade: “excellent with distinction” Specialization: artificial intelligence and linguistics Thesis title: “Adaptive Playout Policies for Monte-Carlo Go”	Universität Osnabrück, Germany
2006 – 2007	Linguistics	Universität Leipzig, Germany
2001 – 2006	B.Sc. Computer Science Grade: “very good”, ranked top 2% Thesis title: “Der Alpha-Beta-Algorithmus und Erweiterungen bei Vier Gewinnt”	Technische Universität Darmstadt, Germany

teaching experience

2022 – present	Eindhoven University of Technology <i>Lecturer</i> MSc course “Decision making with artificial and computational intelligence” My course redesign in 2023, part of my Dutch University Teaching Qualification, led to this course achieving the highest student evaluation in the study program.	Eindhoven, The Netherlands
2022 – present	Jheronimus Academy of Data Science <i>Lecturer</i> MSc course “Prescriptive Algorithms”	Tilburg, The Netherlands
2021	Utrecht University <i>Guest lecturer</i> Introductory class on reinforcement learning in games	Utrecht, The Netherlands
2013 – 2014	Maastricht University <i>Teaching assistant in computer science</i> Taught “skills class LaTeX” for undergraduates	Maastricht, The Netherlands
2011 – 2013	Maastricht University <i>Teaching assistant in computer science</i> Introduction to data structures and algorithms for undergraduates	Maastricht, The Netherlands
2009 – 2010	IDF Language School <i>English teacher</i> Grammar and conversational courses for individuals and groups	Osnabrück, Germany
2004 – 2005	Technische Universität Darmstadt <i>Teaching assistant in mathematics and computer science</i> Introduction to logic for second-year students, and programming for first-year students	Darmstadt, Germany

project management

2023 – present	Project “PEER” Work package leader of WP3: “Human-AI collaboration on sequential decision-making tasks” (229 person-months total)	Horizon Europe project no. 101120406
2022 – present	Project “ALIGN4Energy” Work package co-leader of WP3: “Aligning human preferences, choices and technical systems” (132 person-months total)	Dutch Research Agenda, NWO-ORC project NWA.1389.20.251

supervision experience

phd students

2024 – present	Riccardo Sepe “Explainable online planning”; role: <i>supervisor</i>	Centrum Wiskunde & Informatica
2024 – present	Chengpeng Hu “Explainable sequential decision-making”; role: <i>supervisor</i>	Eindhoven University of Technology
2023 – present	Bart von Meijenfeldt “Human-centric, collaborative sequential decision-making”; role: <i>supervisor</i>	Eindhoven University of Technology
2023 – present	Gao Peng “Sequential Decision-making for Multi-Agent Interest Alignment in Sustainable Energy Investments”; role: <i>supervisor</i>	Centrum Wiskunde & Informatica
2022 – 2024	Tim de Boer “Preference Elicitation for Multi-Agent Interest Alignment in Sustainable Energy Investments”; role: <i>co-supervisor</i>	Centrum Wiskunde & Informatica
2022 – present	Luca Begnardi “Integration of Planning and Learning: from Online Combinatorial Optimization to Real-World Applications”; role: <i>co-supervisor</i>	Eindhoven University of Technology
2017 – 2018	Daniel Hernandez “Multi-Agent Reinforcement Learning for Game AI and Robotic Control”; role: <i>supervision team member</i>	University of York
2017 – 2018	Peter York “Applying Tree Search and Reinforcement Learning to Competitive and Human-Like MOBA AI”; role: <i>supervision team member</i>	University of York
2016 – 2018	Adam Sattaur “The Use of Gameplay Data to Inform High-level AI Decision Making”; role: <i>supervision team member</i>	University of York

engineering doctorate, master, and bachelor students; interns

List available on request.

admin experience

2024 – present	Jheronimus Academy of Data Science <i>Member of exam committee</i>	Tilburg, The Netherlands
2013 – 2015	Department of Knowledge Engineering <i>PhD coordinator</i> Supported and represented PhD students at the department level	Maastricht, The Netherlands
2011 – 2015	PhD Academy of Maastricht University <i>Member, from 2013 board member, in 2014 chair of PhD Academy</i> Organized social, cultural and academic events for PhD students; funded by Maastricht University	Maastricht, The Netherlands
2013 – 2014	University Council <i>Co-founder of a group representing PhD researchers</i> Elected as one of six representatives of scientific staff in the University Council of Maastricht University	Maastricht, The Netherlands

invited talks and research visits

2023	University of Alberta Talk at the Workshop on Neurosymbolic Programming	Edmonton, Canada
2022	Leiden University Talk at the Belgium-Netherlands workshop on Reinforcement Learning (BeNeRL)	Leiden, The Netherlands
2022	Dutch Institute for Emergent Phenomena (DIEP) Talk at the DIEP seminar	Amsterdam, The Netherlands
2019	Queen Mary University of London Talk at the game AI group seminar	London, United Kingdom
2017	Lancaster University Talk at the PACTMAN workshop on Trust, Identity, Privacy and Security in the Digital Economy	Lancaster, United Kingdom
2017	University of York Talk at the GamesLab Emerging Tech workshop (industry audience)	York, United Kingdom
2017	University of York Talk at the AI group seminar	York, United Kingdom
2017	University of Essex Talk at the School of Computer Science and Electronic Engineering seminar	Colchester, United Kingdom
2016	New York University Tandon School of Engineering Talk at the NYU Game Innovation Lab seminar	New York City, NY, USA
2013	University of Alberta Talk at the AI group seminar	Edmonton, Canada
2012	Reykjavik University Research visit to the Center for Analysis and Design of Intelligent Agents; funded by the Netherlands Organisation for Scientific Research (NWO)	Reykjavik, Iceland

impact and engagement

2023	Vanderlande Tech Day Guest talk for industry audience about human-centered, collaborative learning and planning	Veghel, The Netherlands
2018	Pint of Science Festival Talk about artificial intelligence and games at the “To the future... and beyond” session	York, United Kingdom
2017	Yorkshire Games Festival Talk about artificial intelligence and games at the “Lates: Gaming” session at the National Science and Media Museum	Bradford, United Kingdom
2017	Science out of the Lab Organized the activities of the Digital Creativity Labs at a science outreach event as part of the “York Festival of Ideas”; reached about 2000 people	York, United Kingdom
2016	ESTEC Open Day Co-organized the activities of the Advanced Concepts Team at the open day of the European Space Research and Technology Centre; reached about 9000 people	Noordwijk, The Netherlands

- 2013 **Career Day** Maastricht, The Netherlands
Informed students on academic careers at the Department of Knowledge Engineering's career information day, Maastricht University
- 2012 **DKE Open Day** Maastricht, The Netherlands
Represented the game AI group at the Department of Knowledge Engineering's open day, Maastricht University

other activities

- 2024 **Dagstuhl Seminar "Explainable AI for Sequential Decision Making"**
Co-Organizer
- 2023, 2024 **International Joint Conference on Artificial Intelligence (IJCAI)**
Co-Chair of Workshop on Explainable Artificial Intelligence
- 2024 **European Conference on Artificial Intelligence (ECAI)**
Co-Organizer Workshop "Trustworthy Sequential Decision-Making and Optim."
- 2023 **17th Learning and Intelligent Optimization conference (LION)** Nice, France
Co-Organizer of Special Session "Responsible AI in Practice"
- 2017-2018 **IEEE Conference on Computational Intelligence in Games 2017 and 2018** New York, NY, USA / Maastricht, The Netherlands
Co-Organizer of Text-Based Adventure AI Competition
- 2017 **CHERISH-DE initiative of the EPSRC** Swansea/Edinburgh/London, United Kingdom
Participant of Digital Economy Crucible, a seven-day development program for young academics
- 2013 **Artificial Intelligence and Interactive Digital Entertainment Conference 2012** Stanford, CA, USA
Participant of AIIDE Doctoral Consortium
- 2011 – present **Professional Service**
Program committee member, senior program committee member and/or reviewer for conferences and workshops on AI and related fields, such as IJCAI, AAAI, ECAI, AAMAS, the IEEE Conference on Computational Intelligence and Games, the Multi-disciplinary Conference on Reinforcement Learning and Decision Making, the World Conference on Explainable Artificial Intelligence, the AAAI Conference on Artificial Intelligence and Interactive Digital Entertainment, the International Conference on the Foundations of Digital Games, and the International Conference on Advances in Computer Games; as well as for journals such as the Journal of Autonomous Agents and Multi-Agent Systems, Theoretical Computer Science, Engineering Optimization, the IEEE Transactions on Games, and the ICGA Journal.

awards and funding

2023	Horizon Europe call HORIZON-CL4-2022-HUMAN-02-01 — “AI for human empowerment (AI, Data and Robotics Partnership)” total €7,737,900; work package €637,450 <i>Co-Investigator and work package leader</i> Project title: “PEER – hyPER ExPeRt”	
2023	EWUU Alliance call “AI for Preventive Health and a Circular Society” €40,000 <i>Co-Investigator</i> Project title: “TakePart: An AI-driven Game in Digital Twin Platforms for Circular Green”	
2017	Digital Economy Crucible “Research Priming” Award £5000 <i>Co-Investigator and workshop organizer</i> Project title: “Building Trust in AI – Designing for Consent”	

publications

journal articles

Language Models Speed Up Local Search for Finding Programmatic Policies

Q. A. Sadrine, H. Baier, L. H. S. Lelis
Transactions on Machine Learning Research. 2024

Value Targets in Off-policy AlphaZero: A New Greedy Backup

D. Willemsen, H. Baier, M. Kaisers
Neural Computing and Applications 34.3. Pp. 1801–1814. 2022

The Text-Based Adventure AI Competition

T. Atkinson, H. Baier, T. Copplestone, S. Devlin, J. Swan
IEEE Transactions on Games 11.3. Pp. 260–266. 2019

Emulating Human Play in a Leading Mobile Card Game

H. Baier, A. Sattaur, E. J. Powley, S. Devlin, P. I. Cowling, J. Rollason
IEEE Transactions on Games 11.4. Pp. 386–395. 2019

MCTS-Minimax Hybrids with State Evaluations

H. Baier, M. H. M. Winands
Journal of Artificial Intelligence Research 62. Pp. 193–231. 2018

Time Management for Monte Carlo Tree Search

H. Baier, M. H. M. Winands
IEEE Transactions on Computational Intelligence and AI in Games 8.3. Pp. 301–314. 2016

MCTS-Minimax Hybrids

H. Baier, M. H. M. Winands
IEEE Transactions on Computational Intelligence and AI in Games 7.2. Pp. 167–179. 2015

The Power of Forgetting: Improving the Last-Good-Reply Policy in Monte Carlo Go

H. Baier, P. Drake
IEEE Transactions on Computational Intelligence and AI in Games 2.4. Pp. 303–309. 2010

conference articles

Enabling MCTS Explainability for Sequential Planning Through Computation Tree Logic

Z. An, H. Baier, A. Dubey, A. Mukhopadhyay, M. Ma
27th European Conference on Artificial Intelligence (ECAI 2024). Accepted.

Deep Reinforcement Learning for Two-sided Online Bipartite Matching in Collaborative Order Picking

L. Bagnardi, H. Baier, W. Jaarsveld, Y. Zhang
Asian Conference on Machine Learning 2023 (ACML 2023), pp. 121–136. 2023

BRExit: On Opponent Modelling in Expert Iteration

D. Hernandez, H. Baier, M. Kaisers
32th International Joint Conference on Artificial Intelligence (IJCAI 2023), pp. 3795–3802. 2023

Online Planning in POMDPs with Self-Improving Simulators

J. He, M. Suau, H. Baier, M. Kaisers, F. A. Oliehoek
31st International Joint Conference on Artificial Intelligence (IJCAI 2022), pp. 4628–4634. 2022

ME-MCTS: Online Generalization by Combining Multiple Value Estimators

H. Baier, M. Kaisers
30th International Joint Conference on Artificial Intelligence (IJCAI 2021), pp. 4032–4038. 2021

Guiding Multiplayer MCTS by Focusing on Yourself [nominated for best paper]

H. Baier, M. Kaisers
2020 IEEE Conference on Games (CoG 2020), pp. 550–557. 2020

Opponent-Pruning Paranoid Search [exceptional paper award]

H. Baier, M. Kaisers
2020 International Conference on the Foundations of Digital Games (FDG 2020), 10:1–10:7. 2020

Evolutionary MCTS for Multi-Action Adversarial Games [nominated for best paper]

H. Baier, P. I. Cowling
2018 IEEE Conference on Computational Intelligence and Games (CIG 2018), pp. 1–8. 2018

Evolutionary MCTS with Flexible Search Horizon

H. Baier, P. I. Cowling
14th AAAI Conference on Artificial Intelligence and Interactive Digital Entertainment (AIIDE 2018), pp. 2–8. 2018

Decentralized Online Planning for Multi-Robot Warehouse Commissioning [nominated for best paper]

D. Claes, F. Oliehoek, H. Baier, K. Tuyls
16th International Conference on Autonomous Agents and Multiagent Systems (AAMAS 2017), pp. 492–500. 2017

Monte-Carlo Tree Search and Minimax Hybrids

H. Baier, M. H. M. Winands
2013 IEEE Conference on Computational Intelligence and Games (CIG 2013), pp. 129–136. 2013

Beam Monte-Carlo Tree Search

H. Baier, M. H. M. Winands
2012 IEEE Conference on Computational Intelligence and Games (CIG 2012), pp. 227–233. 2012

Nested Monte-Carlo Tree Search for Online Planning in Large MDPs

H. Baier, M. H. M. Winands
20th European Conference on Artificial Intelligence (ECAI 2012), pp. 109–114. 2012

Time Management for Monte-Carlo Tree Search in Go

H. Baier, M. H. M. Winands
13th International Conference on Advances in Computer Games (ACG 2011), pp. 39–51. 2012

Active Opening Book Application for Monte-Carlo Tree Search in 19x19 Go

H. Baier, M. H. M. Winands
23rd Benelux Conference on Artificial Intelligence (BNAIC 2011), pp. 3–10. 2011

workshop articles and extended abstracts

Combining LLMs with a Logic-Based Framework to Explain MCTS (Extended Abstract)

Z. An, X. Wang, H. Baier, Z. Chen, A. Dubey, T. T. Johnson, J. Sprinkle, A. Mukhopadhyay, M. Ma
24th International Conference on Autonomous Agents and Multiagent Systems (AAMAS 2025). 2025

MOMAland: Benchmarking Multi-Objective Multi-Agent Reinforcement Learning

F. Felten, U. Ucak, H. Azmani, G. Peng, W. Röpke, H. Baier, P. Mannion, D. M. Roijers, J. K. Terry, E.-G. Talbi, G. Danoy, A. Nowé, R. Radulescu
Multi-Objective Decision Making Workshop at ECAI 2024. 2024

Decision Making in Non-Stationary Environments with Policy-Augmented Search (Extended Abstract)

A. Pettet, Y. Zhang, B. Luo, K. Wray, H. Baier, A. Laszka, A. Dubey, A. Mukhopadhyay
23rd International Conference on Autonomous Agents and Multiagent Systems (AAMAS 2024). 2024

Model-Based Reinforcement Learning in Multi-Objective Environments with a Distributional Critic

W. Röpke, D. M. Roijers, A. Nowé, R. Radulescu, H. Baier
Multi-Objective Decision Making Workshop at ECAI 2024. 2024

Novelty and MCTS

H. Baier, M. Kaisers
1st Evolutionary Reinforcement Learning Workshop at GECCO (EVORL 2021), pp. 1483–1487. 2021

Towards Explainable MCTS

H. Baier, M. Kaisers
AAAI 2021 Workshop on Explainable Agency in AI. 2021

Explainable Search

H. Baier, M. Kaisers
2020 IJCAI-PRICAI Workshop on Explainable Artificial Intelligence. 2020

Value Targets in Off-policy AlphaZero: A New Greedy Backup

D. Willemsen, H. Baier, M. Kaisers
2020 Adaptive and Learning Agents Workshop at AAMAS (ALA 2020). 2020

MCTS-Minimax Hybrids with State Evaluations (Extended Abstract)

H. Baier, M. H. M. Winands
27th International Joint Conference on Artificial Intelligence (IJCAI 2018), pp. 5548–5552. 2018

A Rollout-Based Hybrid Unifying MCTS and Alpha-Beta

H. Baier
Computer Games: Fifth Workshop on Computer Games (CGW 2016), pp. 57–70. 2017

Monte-Carlo Tree Search and Minimax Hybrids with Heuristic Evaluation Functions

H. Baier, M. H. M. Winands
Computer Games: Third Workshop on Computer Games (CGW 2014), pp. 45–63. 2014

Nested Monte-Carlo Tree Search for Online Planning in Large MDPs (Extended Abstract)

H. Baier, M. H. M. Winands
24th Benelux Conference on Artificial Intelligence (BNAIC 2012), pp. 273–274. 2012

theses

Monte-Carlo Tree Search Enhancements for One-Player and Two-Player Domains

H. Baier
Ph.D. thesis. Department of Knowledge Engineering, Maastricht University, Maastricht, The Netherlands. 2015

Adaptive Playout Policies for Monte Carlo Go

H. Baier
Master's thesis. Institute of Cognitive Science, Osnabrück University, Osnabrück, Germany. 2010

Der Alpha-Beta-Algorithmus und Erweiterungen bei Vier Gewinn

H. Baier
Bachelor's thesis. Department of Computer Science, Technische Universität Darmstadt, Darmstadt, Germany. 2006