Mathias Babin, Ph.D.

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Research Interest

- My research interests centre on AI for game development, particularly procedural content generation and NPC behaviour. My work explores hybrid AI techniques, combining rule-based systems, reinforcement learning, and constraint-solving. I have experience designing AI-driven tools for game level generation, balancing, and security, as well as optimizing algorithms and modeling player behavior.

Employment History

2025 – Present · · · ·
- **Developer.** Nomad XR. & CulhamARI Lab, R&D.

2023 – Present · · · ·
- **Lecturer.** CS4482 Game Programming, CS4480 Game Project, UWO, Department of Computer Science.

2018 – 2024 · · · ·
- **Teaching Assistant.** CS1026, CS2209, CS3388, CS4482, CS4483, UWO, Department of Computer Science.

2023 – 2024 · · · ·
- **Developer.** UWO, Department of Education. Software developer and consultant on the development of an AI-based curriculum for students K-12.
- **Developer.** Nomad XR. R&D at Nomad XR. Developed VR environments featuring procedurally generated worlds. Hardware: Kat-VR treadmill and Meta Quest Pro headset.

2021 – 2023 · · · ·
- **Cofounder/Developer.** VR-NR, VR start-up with Dr. Paul Frewen.

2019 – 2023 · · · ·
- **Developer.** UWO, Contract work for the faculty of Psychiatry, required the development of a VR environment in which patients suffering from PTSD would experience a neural-feedback loop driven by real time EEG data influencing aspects of the virtual environment. Hardware: Muse Mind Monitor, Oculus Quest Pro.

2020 – 2021 · · · ·
- **Developer.** UWO, Department of Education. Contract work for the development of a VR environment to serve as a controlled environment for the study autism in children.

2018 – 2019 · · · ·
- **Developer.** UWO, Department of Health Science. Contract work for faculty of the Health Science department called for the development of a VR simulation for several car crash scenarios. The application required synchronization with a motorized platform via operation commands sent over TCP. Hardware: HTC Vive support, Mikrolar R-Series rotopod.
- **Developer.** UWO, Department of Music. Contract work for the faculty of Music, required the development of a VR fantasy environment in which players interacted with music-inspired game elements. Hardware: Oculus Go support.

Education

2020 – 2025 · · · ·
- **Ph.D. Computer Science, UWO** Specialization in AI
  Thesis title: *Hybrid Approaches to Procedural Content Generation for Game Design, Production, and Security*

2018 – 2020 · · · ·
- **M.Sc. Computer Science, UWO** Specialization in AI
  Thesis title: *A Hybrid Approach to Procedural Dungeon Generation*

Education (continued)

2014 – 2018 · · · · **Bachelor of Science, UWO** Honours Specialization in Computer Science

Research Publications

Journal Articles

1. G. Chen, Z. Bao, M. Babin, and P. Frewen, "Virtual reality and neuromodulation in the induction of out-of-body experience (vr-niobe): A proof-of-concept new paradigm for psychological and neuroscientific study of an altered state of consciousness," *Psychology of Consciousness: Theory, Research, and Practice. Advance online publication*, 2024. DOI: https://doi.org/10.1037/cns0000385.
2. M. J. Lukacs, M. Babin, J. P. Dickey, C. W. J. Melling, and D. M. Walton, "Development and tolerability of a novel virtual- and proprioception-based car crash simulator as a new research tool in motor vehicle trauma research," *Frontiers in Virtual Reality*, vol. 4, 2023, ISSN: 2673-4192. DOI: 10.3389/frvir.2023.891423.

Conference Proceedings

1. M. Babin and M. Katchabaw, "Wave function approximation: Performant level generation for games," Accepted to IEEE GEM July 16th, 2025.
2. M. Babin and M. Katchabaw, "Game balance through procedural content generation," in *Proceedings of the 20th International Conference on the Foundations of Digital Games*, ser. FDG '25, Association for Computing Machinery, 2025, ISBN: 9798400718564. DOI: 10.1145/3723498.3723748.
3. M. Babin and M. Katchabaw, "Combating computer vision-based aim assist tools in competitive online games," in *Entertainment Computing – ICEC 2023*, P. Ciancarini, A. Di Iorio, H. Hlavacs, and F. Poggi, Eds., Singapore: Springer Nature Singapore, 2023, pp. 290–305, ISBN: 978-981-99-8248-6.
4. M. Babin and M. Katchabaw, "Leveraging reinforcement learning and wavefunctioncollapse for improved procedural level generation," in *Proceedings of the 16th International Conference on the Foundations of Digital Games*, ser. FDG '21, Montreal, QC, Canada: Association for Computing Machinery, 2021, ISBN: 9781450384223. DOI: 10.1145/3472538.3472541.

Theses/Dissertations

1. M. Babin, "Hybrid approaches to procedural content generation for game design, production, and security," 2025.
2. M. J. Lukacs, "Creation of a virtual interface for stress-trauma investigations through open world navigation: An exploration of tolerability and physiological reactions," M. Babin listed as coauthor of Chapter 3, 2021. URL: https://ir.lib.uwo.ca/etd/8004/.
3. M. Babin, "A hybrid approach to procedural dungeon generation," 2020. URL: https://ir.lib.uwo.ca/etd/7129/.

Miscellaneous Experience

Presentations

2025 · · · · **UWORCS Conference**, UWO, First Place Winner in AI track.

Miscellaneous Experience (continued)

2024 · · · ·
- **AI Education Symposium**, UWO, Ray John Jr from the Oneida nation along with colleagues Mathias Babin and Jodie Williams, shared work exploring applications of AI, and how this can help advance understandings of Indigenous knowledge systems.
- **UWORCS Conference**, UWO, First Place Winner in AI track.

2023 · · · ·
- **ICEC Conference**, ICEC Conference, Bologna Italy.
- **UWORCS Conference**, UWO, First Place Winner in AI track.

2021 · · · ·
- **FDG Conference**, FDG Conference, Virtual.
- **UWORCS Conference**, UWO.

Awards and Achievements

2023 · · · · **NSERC L2M**, UWO.

2018 – 2023 · · · · **Ontario Graduate Scholarship**, UWO.

2014 · · · · **Merit Award**, The Western Scholarship of Distinction.

2014 – 2018 · · · · **Dean's Honour Roll**, UWO.

Projects

2025 · · · ·
- **LoJam x GDS 2025** Solo project: Final Boss Protocol. This project is a proof of concept for a new method of deriving player behaviour for NPC agents. This is an on-going topic of research.
- **Enhancing Player Interactions with LLM-Driven NPCs** Supervisor of Computer Science undergraduate thesis project exploring how to improve NPC dialogue interactions by using Large Language Models (LLMs) in a closed system. Additional work investigating NPC memory storage, retrieval, and the maintenance of social structures to inform NPC behavior and dialogue.
- **Rustborn** Supervisor of Software Engineering undergraduate capstone project. Team of students developing open-world sandbox game featuring procedurally generated world, crafting, and destructible environments.

2024 · · · ·
- **LoJam 2024** Award winning project (Best Gameplay): Swarmancer
- **LoJam x GDS 2024** Solo project: World Omnidirectional Maze: WOM

2023 · · · ·
- **LoJam 2023** Award winning project (3rd place judges pick, 1st place player's pick): Dark Harvest

2022 · · · ·
- **Hack Western 9 Entry: genee**. Hack Western 9 winning project. Project and awards listed on Devpost.
- **Distributed Implementation of Evolutionary Strategies using gRPC**. This work presents a distributed implementation of the evolutionary strategies optimization algorithm. Due to its high degree of parallelizability, this algorithm's core functionality can be easily distributed across multiple remote workers. In order to maintain simple service definitions as well as support for multiple programming languages such as Golang, C++, and Python, communication between nodes is conducted via the gRPC framework.

Miscellaneous Experience (continued)

2021 · · · · **Modeling Player Behaviour in 2D Platformers**. A project aimed at creating believable NPC behavior by emulating player actions in a 2D platformer. I trained four agents in total: two using a behavioral cloning algorithm and two using popular reinforcement learning (RL) algorithms.

2018 · · · · **Asynchronous Network Simulator**. A project which allowed programmers to supply their own C# algorithms to asynchronous network topologies. Code could be dynamically compiled and interact with the simulator at runtime via the .NET framework.

2017 · · · · **Step Block Stereo**. A project developed for CS4436, Step Block Stereo was a music based puzzle game which tied the movement of various puzzle elements to the rhythms of an instrument. As of Winter 2018, it was requested that the game be presented on behalf of the Computer Science department at an event held by Libro Credit Union.

Skills

Coding	Java, Python, C/C++/C#, gRPC
Environments	Unity, Unreal Engine, Visual Studio, Rider, PyCharm, Anaconda, Jupyter
Framework/Packages	Pytorch, Tensorflow, CUDA, Pandas, Numpy
Misc.	Game development, research, teaching, project management