

# Jack Collins

POSTDOCTORAL RESEARCHER

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## Education

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### Queensland University of Technology / Commonwealth Scientific and Industrial Research Organisation

*Brisbane, Queensland*

DOCTORATE OF PHILOSOPHY

*2018 - 2022*

- Thesis: Simulation to reality and back: A robot's guide to crossing the reality gap
- Supervisors: Dr. Juxi Leitner, Dr. David Howard and Dr. Ross Brown

### Queensland University of Technology

*Brisbane, Queensland*

BACHELOR OF ENGINEERING(MECHATRONICS)(HON)

*2014 - 2017*

- Major in Robotics
- 1<sup>st</sup> Class Honours
- GPA – 6.25/7.0
- Thesis Title: Automated Artificial Evolution of 3D Hexapod Legs

## Professional Experience

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### University of Oxford

*Oxford, United Kingdom*

POSTDOCTORAL RESEARCHER

*Dec. 2021 - Current*

- Postdoctoral researcher at the Oxford Robotics Institute in the Applied AI lab (A2I).
- Research activities in areas including generative modelling, world models, manipulation (mobile, bimanual, dexterous), learning from demonstration, task planning, sim2real, deployment of robots to care homes and more.
- Supervision of PhD candidates and other lab responsibilities.

### Holovision 3D

*Brisbane, Australia*

R&D ENGINEER

*Sept. 2019 - Nov. 2021*

- Lead developer of cobot welding cell. Deployed in 4 months for steel fabricator, Watkins Steel.
- Exploration of the use of Mixed Reality in the construction industry through visualisation and annotation within Microsoft Hololens 1 and 2, Oculus Quest and Rift headsets.
- Application of additive manufacturing methods to the construction industry.

### Commonwealth Scientific and Industrial Research Organisation

*Brisbane, Australia*

INTERNSHIP

*Aug. 2016 - Oct. 2017*

- Research into the computational evolution of 3D morphologies informed by a multi-physics engine.
- Implementation of an automated, parallelised C++ environment capable of running on a High Performance Cluster.
- Work resulted in the publication of undergraduate thesis in a top-tier evolutionary computation conference.

## Teaching Experience

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### University of Oxford - Lady Margaret Hall

*Oxford, United Kingdom*

LECTURER AND TUTOR

*Aug. 2022 - Current*

- Lecturer of topics within the introductory machine learning summer school.
- Tutor of introductory and advanced machine learning courses. Advanced courses included programs on reinforcement learning, computer vision, unsupervised learning and graph neural networks. Tutoring including running seminars and tutorials on machine learning concepts and marking assessable items.

### King Abdullah University of Science and Technology (KAUST) Academy

*Jeddah, Saudi Arabia*

LECTURER

*Feb. 2024 - Mar. 2024*

- Lecturer of KAUST Academy Advanced AI Course covering the foundations of convolutional neural networks and their application to computer vision, including image classification, segmentation, and object detection.

- Tutor of C19 - Machine Learning, a 4th year subject within the Masters in Engineering Science degree.

## Queensland University of Technology

Brisbane, Australia

- Mechatronics Design 2 - Research, Design, and Implementation of an advanced mechatronic product.
- Mechatronics Design 1 - Culmination of a product requiring mechanical design, electrical design, and embedded software.
- Building IT Systems - Foundation unit taught in Python with topics including APIs, Databases, search patterns and GUIs.

## Publications

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Yamada, J., Zhong, S., Collins, J., & Posner, I. (2024). D-Cubed: Latent diffusion trajectory optimisation for dexterous deformable manipulation. *arXiv preprint arXiv:2403.12861*. (Under Submission)

Newbury, R., Collins, J., He, K., Pan, J., Posner, I., Howard, D., & Cosgun, A. (2024). A review of differentiable simulators. *IEEE Access*. <https://doi.org/10.1109/ACCESS.2024.3425448>

Yamada, J., Rigter, M., Collins, J., & Posner, I. (2023). TWIST: Teacher-student world model distillation for efficient sim-to-real transfer. *arXiv preprint arXiv:2311.03622*. (Accepted and Presented at ICRA 2024)

Collins, J., Robson, M., Yamada, J., Sridharan, M., Janik, K., & Posner, I. (2024). RAMP: A benchmark for evaluating robotic assembly manipulation and planning. *IEEE Robotics and Automation Letters*, 9(1), 9-16. <https://doi.org/10.1109/LRA.2023.3330611>

Wu, Y., de O. Borde, H.S., Collins, J., Jones, O.P., & Posner, I. (2024). DreamUp3D: Object-centric generative models for single-view 3D scene understanding and real-to-sim transfer. *IEEE Robotics and Automation Letters*, 9(4), 3291-3298. <https://doi.org/10.1109/LRA.2024.3362678>

Yamada, J., Collins, J., & Posner, I. (2023). Efficient skill acquisition for complex manipulation tasks in obstructed environments. *arXiv preprint arXiv:2303.03365*. (Accepted to L4DC 2024)

Yamada, J., Hung, C., Collins, J., Havoutis, I., & Posner, I. (2023). Leveraging scene embeddings for gradient-based motion planning in latent space. In *2023 International Conference on Robotics and Automation (ICRA)*.

Howard, D., Collins, J., & Robinson, N. (2023). Taking shape: A perspective on the future of embodied cognition and a new generation of evolutionary robotics. *IOP Conference Series: Materials Science and Engineering*, 1261(1), 012018. <https://doi.org/10.1088/1757-899X/1261/1/012018>

Collins, J., Brown, R., Leitner, J., & Howard, D. (2021). Follow the gradient: Crossing the reality gap using differentiable physics (RealityGrad). *arXiv*. <https://doi.org/10.48550/arXiv.2103.11244>

Collins, J., Chand, S., Vanderkop, A., & Howard, D. (2021). A review of physics simulators for robotic applications. *IEEE Access*, 9, 51416-51431. <https://doi.org/10.1109/ACCESS.2021.3068769>

Collins, J., Brown, R., Leitner, J., & Howard, D. (2021). Traversing the reality gap via simulator tuning. In *Australasian Conference on Robotics and Automation (ACRA)*.

Collins, J., McVicar, J., Wedlock, D., Brown, R., Howard, D., & Leitner, J. (2020). Benchmarking simulated robotic manipulation through a real world dataset. *IEEE Robotics and Automation Letters*, 5(1), 250-257. <https://doi.org/10.1109/LRA.2019.2956758>

Collins, J., Cottier, B., & Howard, D. (2019). Comparing direct and indirect representations for environment-specific robot component design. In *2019 IEEE Congress on Evolutionary Computation (CEC)* (pp. 2705-2712). <https://doi.org/10.1109/CEC.2019.8790093>

Collins, J., Howard, D., & Leitner, J. (2019). Quantifying the reality gap in robotic manipulation tasks. In *2019 International Conference on Robotics and Automation (ICRA)* (pp. 6706-6712). <https://doi.org/10.1109/ICRA.2019.8793757>

Collins, J., Howard, D., Geles, W., & Maire, F. (2018). Towards the targeted environment-specific evolution of robot components. In *GECCO 2018 - Proceedings of the 2018 Genetic and Evolutionary Computation Conference*.

## Honours

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2023 - Current **Research Member**, Oxford Kellogg College research member and student advisor

2022 **Fellow**, DAAD Alnet

Current **Reviewer**, International Journal of Robotics Research, Robotics and Autonomous Letters, Robotics and Autonomous Systems Journal, Conference on Robot Learning, International Conference on Intelligent Robots and Systems, International Conference on Robotics and Automation

# Skills

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## Robot Technologies

### EXPERIENCE WITH:

- Robot Operating System (ROS) and accompanying packages
- Rigid and Soft Body Simulation - Nvidia Isaac, Pybullet, MuJoCo, CoppeliaSim, Project Chrono.
- Motion Capture
- CAD Tools: Solidworks, OnShape
- 3D Printing

## Programming Languages and other relevant technologies

### EXPERIENCE WITH:

- Python - PyTorch, OpenCV, etc.
- C/C++
- Latex
- Git
- High Performance Clusters (HPC) SLURM/RunAI/PBS
- Software Containers (Singularity and Docker)

# Community Activities

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## Oxford Robotics Institute

*Oxford, United Kingdom*

### ORGANIZER, SEMINAR SERIES; COMMITTEE MEMBER, MIDDLE COMMON ROOM

*2023-Current*

- Organised a series of seminars for the Oxford Robotics Institute, facilitating talks and demonstrations from leading researchers in the field.
- Served as a committee member of the Middle Common Room, coordinating events and activities for students and postdocs.

## Community Engagement

*Brisbane, Australia*

### INVITED TALKS AND DEMONSTRATIONS

*2019-2021*

- Promotion of robotics, science and technology at secondary schools:
  - Queensland Academy for Science Mathematics and Technology
  - Holland Park State High
  - Mt Gravatt State High
- Demonstration at public robotics and technology festival for public education and outreach.

## FIRST Lego League Challenge

*Brisbane, Australia*

### JUDGE

*Nov. 2020*

- Feedback on robot design, innovation and team values