Arthur W. Juliani, PhD

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Education

- *University of Oregon* (2015 - 2020) - Doctor of Philosophy in Psychology
- *University of Oregon* (2014 - 2015) - Master of Science in Psychology
- *North Carolina State University* (2010 - 2013) - Bachelor of Arts in Psychology

Work Experience

Microsoft (2022 - Present) - <u>Postdoctoral Research Fellow</u>

- Collaborated with research groups within and outside of Microsoft Research on projects related to machine learning theory, computational neuroscience, mental health, and psychedelic science.

- Developed and maintained the Neuro-Nav open source library for deep reinforcement learning research in psychology and computational neuroscience.

Araya Inc. (2021 - 2022) - <u>Senior Research Scientist</u>

- Led a project to develop a novel model of global workspace using a Transformer-like architecture, and validated the model on working memory and attentional control tasks.

- Supervised intern projects performing neural decoding of fMRI and ECoG data to identify candidates for global workspace and BCI intervention targets.

- Developed a theoretical framework for connecting various theories of attentional information access to artificial intelligence in machine learning models.

Unity Technologies (2017 - 2021) - <u>Senior Research Engineer</u>

- Team founder and original developer of ML-Agents Toolkit, a popular open-source project for training deep reinforcement learning agents in virtual environments using the Unity game engine.

- Implemented and shipped various state-of-the-art deep reinforcement learning algorithms, including DRQN, PPO, GAIL, and ICM in both TensorFlow and PyTorch.

- Led a team of engineers and artists to develop Obstacle Tower, a complex 3D virtual environment used to evaluate the generalization performance of deep reinforcement learning algorithms.

- Organized and administered the Obstacle Tower Challenge, an online competition for deep reinforcement learning researchers, which received over 2000 submissions from over 600 teams.

University of Oregon (2014 - 2016) - <u>Graduate Research Assistant</u>

- Prepared and presented dissertation in the area of computational neuroscience, proposing and evaluating various novel models of hippocampal function.

- Lead team of undergraduate research assistants in conducting and publishing human behavioral studies.

- Designed successful human behavioral and perceptual experiments that were displayed in virtual environments.

Duke University Lemur Center (Summer 2013) - <u>Data Science Intern</u>

- Designed and implemented an animal housing visualization system that allowed for more informed animal placement decisions.

- Performed statistical analysis of animal behavior patterns and provided recommendations for animal housing that would reduce conflicts between animals.

Academic Publications

- <u>Juliani, A.</u>, Chelu, V., Graesser, L., Safron, A. (2024) A dual-receptor model of serotonergic psychedelics: therapeutic insights from simulated cortical dynamics. *Biorxiv preprint*. doi.org/10.1101/2024.04.12.589282.

- <u>Juliani, A.</u>, Saffron, A., Kanai, R. (2024). Deep CANALs: A Deep Learning Approach to Refining the Canalization Theory of Psychopathology. *Neuroscience of Consciousness*. doi.org/10.31234/osf.io/uxmz6.

- Milani, S., <u>Juliani, A.</u>, Momennejad, I., Georgescu, R., Rzepecki, J., Shaw, A., ... & Hofmann, K. (2023). Navigates Like Me: Understanding How People Evaluate Human-Like AI in Video Games. *In Proceedings of the 2023 CHI Conference on Human Factors in Computing Systems*.

- <u>Juliani, A.</u>, Barnett, S., Davis, B., Sereno, M., & Momennejad, I. (2022). Neuro-Nav: a library for neurally-plausible reinforcement learning. *In Proceedings of the 5th Multidisciplinary Conference on Reinforcement Learning and Decision Making*.

- <u>Juliani, A.</u>, Arulkumaran, K., Sasai, S., & Kanai, R. (2022). On the link between conscious function and general intelligence in humans and machines. *Transactions On Machine Learning Research*.

- <u>Juliani, A.</u>, Kanai, R., & Sasai, S. S. (2022). The Perceiver Architecture is a Functional Global Workspace. In *Proceedings of the Annual Meeting of the Cognitive Science Society*.

- <u>Juliani, A.</u>, (2020). *Learning and Acting with Predictive Cognitive Maps* [Doctoral dissertation, University of Oregon]. ProQuest Dissertation Publishing.

- <u>Juliani, A.</u>, Khalifa, A., Berges, V. P., Harper, J., Teng, E., Henry, H., Crespi, A., Togelius, J., & Lange, D. (2019). Obstacle tower: A generalization challenge in vision, control, and planning. *International Joint Conferences on Artificial Intelligence*.

- <u>Juliani, A.</u>, Berges, V. P., Vckay, E., Gao, Y., Henry, H., Mattar, M., & Lange, D. (2018). Unity: A general platform for intelligent agents. *arXiv preprint arXiv:1809.02627*.

- Taylor, R. P., <u>Juliani, A. W.</u>, Bies, A. J., Boydston, C., Spehar, B., & Sereno, M. E. (2018). The implications of fractal fluency for biophilic architecture. *Journal of biourbanism*, *6*, 23-40.

- Juliani, A. W., Bies, A. J., Boydston, C. R., Taylor, R. P., & Sereno, M. E. (2016). Navigation performance in virtual environments varies with fractal dimension of landscape. *Journal of environmental psychology*, *47*, 155-165.

- Juliani, A., Leidheiser, W., McLaughlin, A., Allaire, J., & Gandy, M. (2013). Cognitive Ability Predicts Older Adult Performance in a Complex Task but is Moderated by Social Interaction. In *Proceedings of the Human Factors and Ergonomics Society Annual Meeting* (Vol. 57, No. 1, pp. 1740-1744).

Conference Presentations

- Juliani, A., Barnett, S., Davis, B., Sereno, M., & Momennejad, I. (2022). Neuro-Nav: A Library for Neurally-Plausible Reinforcement Learning. *The 5th Multidisciplinary Conference on Reinforcement Learning and Decision Making*.

- Juliani, A. Sereno, M. (2020). A Biologically Inspired Dual Stream World Model. *NeurIPS Workshop on Biological and Artificial Reinforcement Learning*.

- Juliani, A. W., Yaconelli, J. P., & Sereno, M. E. (2019). Learning to Integrate Egocentric and Allocentric Information using a Goal-directed Reward Signal. *Journal of Vision*, *19*(10), 162-162.

- Juliani, A., Bies, A., Boydston, C., Taylor, R., & Sereno, M. (2016). Spatial localization accuracy varies with the fractal dimension of the environment. *Journal of Vision*, *16*(12), 1370-1370.

- Juliani, A. (2013) Aggression Dynamics in Captive Propithecus Coquereli (2013). *Duke University Research Symposium*.

Patents

- Juliani Jr, A. W., & Mattar, M. M. A. (2020). METHOD AND SYSTEM FOR INTERACTIVE IMITATION LEARNING IN VIDEO GAMES. *U.S. Patent Application No. 16/657,868*.

- Meuleau, N. F. X., Berges, V. P. S. M., Ebrahimi, A. P., Juliani Jr, A. W., & Santarra, T. J. (2020). METHOD AND SYSTEM FOR A BEHAVIOR GENERATOR USING DEEP LEARNING AND AN AUTO PLANNER. *U.S. Patent Application No. 16/660,740*.

Teaching Experience

- *Varieties of human-like AI* (Tutorial - Fall 2022) - Presented at Conference on Cognitive Computational Neuroscience 2022. Developed material and presented a tutorial.

- *Neural Networks* (Course - Fall 2019) - Co-authored course materials.

- *Reinforcement Learning* (Tutorial - 2017, 2018) - Presented at O'Reilly AI Conferences in NYC and Beijing.

- *Cognition* (Course - Summer 2015) - Course Co-instructor.

- *Introduction to Psychology* (Course - Spring 2015) - Teaching Assistant.

- *Cognition* (Course - Fall 2014) - Teaching Assistant.

Miscellaneous Activities

- *Learning Transferable Skills* (Workshop, 2019) - Co-organized NeurIPS workshop.

- *IEEE Computational Intelligence Magazine* (Journal, 2019) - Served as reviewer for a special issue of the journal "Deep Reinforcement Learning & Games."

- *Created Augmented & Virtual Realities* (Book Chapter, 2018) – Co-authored chapter on "Character AI and Behaviors."

- *Simple Reinforcement Learning* (Book, 2017) – Published in Korean based on a series of english-language Medium articles written between 2015 and 2016.

Open Source Projects

- *Unity ML-Agents Toolkit* ([Link](), 16.1k stars) - Enables researchers and developers to create and train agents within virtual environments built using the Unity Engine.

- *Simple Reinforcement Learning Tutorials* ([Link]() - 2.1k stars) - A series of tutorials and Tensorflow code describing the implementation and intuition behind state-of-the-art Deep RL algorithms including A3C and DQN.

- *Obstacle Tower Environment* ([Link](), 539 stars) - Complex 3D environment used to evaluate state of the art deep reinforcement learning algorithms.

- *Neuro-Nav Library* ([Link](), 187 stars) - Offers a set of standardized environments and RL algorithms drawn from canonical behavioral and neural studies in rodents and humans.