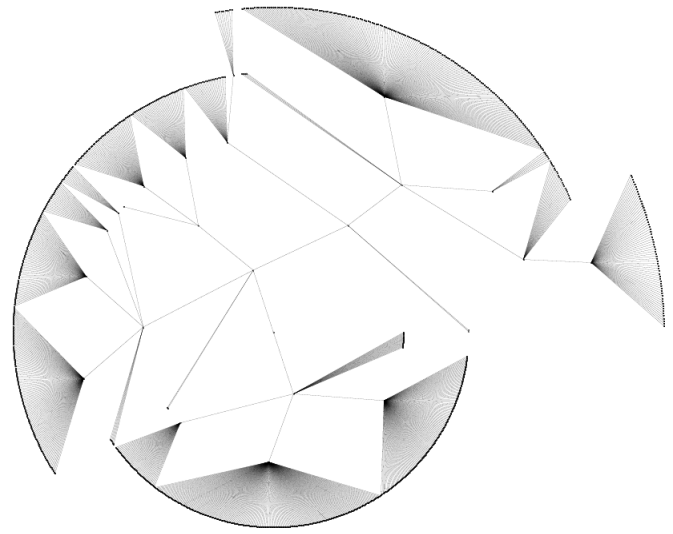


# Nigel Stepp

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## Education

*Ph.D., Experimental Psychology*, Jan 2012  
Perception, Action, & Cognition  
University of Connecticut  
Storrs, CT

*B.S., Materials Science & Engineering*, May 2001  
Carnegie Mellon University  
Pittsburgh, PA

**Professional Societies** International Society for Ecological Psychology, Institute of Electrical and Electronics Engineers

**Research Interests** Emergent Computation, Anticipatory Systems, Perception & Action, Spiking Neural Networks, Criticality & Self-Organization

## Professional Experience

08/2010–present    Research Scientist, HRL Laboratories, LLC  
06/2003–06/2005    Software Developer, IMAKE Financial Consulting, Inc.  
05/2001–05/2002    Software Developer, United States Steel

## Technical Skills

**Programming Languages** AWK & friends, C/C++, C#, Fortran, Haskell, Java, Matlab, Python, Rust, UNIX Shells, x86 Assembly

**Hardware and Software** Electromagnetic motion tracking, IR controlled robotics, Goniometric motion tracking, Eye tracking, Simulink, Surface EMG, Neuromorphic hardware & simulation

**DevOps** Git{,Hub,Lab}, Agile management, Docker/Docker-Compose

## Agency Projects

*Other projects performed on include directed research for Boeing and GM, and internal HRL research that cannot be disclosed publicly.*

**DARPA-L2M** Consulting role: homology-based task detection and labeling in an online machine learning setting; context detection using self-organizing spiking neural networks.

**DARPA-ASED** Multi-network clustering techniques for threat-actor identification; Visualizations and UIs for demonstration; DevOp support.

**IARPA-HFC** Election model integration into a hybrid human-machine forecasting system; frontend and UI support; DevOps support.

**DHS-MobileTech** Hardware-based spiking neural network topologies for mobile user identification through IMU signals; UI for hardware demonstration.

**DARPA-UPSIDE** High-level software simulation of custom convolution circuits; system-level programming for hardware interface, UI for hardware demonstration

**DARPA-SyNAPSE** System-level programming for interfacing with custom neuromorphic hardware; development of functional spiking neural network topologies and UI for hardware demonstration; maintenance and enhancement of a large-scale neuromorphic hardware simulator, including routing and placement.

**DARPA-PhysicalIntelligence** Partial differential equation simulation of thermodynamic systems; reservoir computing; self-tuning critical spiking neural networks.

## Publications

Washburn, A., Kallen, R. W., Lamb, M., Stepp, N., Shockley, K., & Richardson, M. J. (2019). Feedback delays can enhance anticipatory synchronization in human-machine interaction. *PloS one*, *14*(8), e0221275.

Stepp, N. & Jammalamadaka, A. (2018). A Dynamical Systems Approach to Neuromorphic Computation of Conditional Probabilities. In Proceedings of the International Conference on Neuromorphic Systems (ICONS '18). Association for Computing Machinery, New York, NY, USA, Article 7, 1–4.

Stepp, N., & Turvey, M. T. (2017). Anticipation in manual tracking with multiple delays. *Journal of Experimental Psychology: Human Perception and Performance*, *43*(5), 914.

Salas, S. M., Patrick, R. J., Roach, S. M., Stepp, N. D., Cruz-Albrecht, J., Phillips, M. E., De Sapio, V., Lu, T., & Sritapan, V. (2017, April). Neuromorphic and Early Warning behavior-based authentication in common theft scenarios. In 2017 IEEE International Symposium on Technologies for Homeland Security (HST) (pp. 1-6). IEEE.

- Voss, H. U., & Stepp, N. (2016). A negative group delay model for feedback-delayed manual tracking performance. *Journal of computational neuroscience*, 41(3), 295-304.
- Srinivasa, N., Stepp, N. D., & Cruz-Albrecht, J. (2015). Criticality as a set-point for adaptive behavior in neuromorphic hardware. *Frontiers in neuroscience*, 9, 449.
- Stepp, N., & Turvey, M. T. (2015). The muddle of anticipation. *Ecological Psychology*, 27(2), 103-126.
- Stepp, N., Plenz, D., & Srinivasa, N. (2015). Synaptic plasticity enables adaptive self-tuning critical networks. *PLoS computational biology*, 11(1), e1004043.
- Stepp, N. & Srinivasa, N. (2012). A formal model for autocatakinetic systems. *Ecological Psychology*, 24, 204–219.
- Moreno, M., Stepp, N. & Turvey, M. T. (2011). Whole body lexical decision. *Neuroscience Letters*, 490, 126–129.
- Stepp, N., Chemero, A. & Turvey, M. T. (2011). Philosophy for the Rest of Cognitive Science. *Topics in Cognitive Science*, 3, 425–437.
- Stepp, N. & Turvey, M. T. (2010). On Strong Anticipation. *Cognitive Systems Research*, 11, 148–164.
- Stepp, N. (2009). Anticipation in feedback-delayed manual tracking of a chaotic oscillator. *Experimental Brain Research*, 198, 521–525.
- Stepp, N. & Frank, T. D. (2009). A data-analysis method for decomposing synchronization variability of anticipatory systems into stochastic and deterministic components. *European Physical Journal B: Condensed Matter Physics*, 67, 251–257.
- Stephen, D. G., Stepp, N., Dixon, J. A. & Turvey, M. T. (2008). Strong anticipation: Sensitivity to long-range correlations in synchronization behavior. *Physica A*, 387, 5271–5278.
- Stepp, N. & Turvey, M. T. (2008). Anticipating synchronization as an alternative to the internal model. *Behavioral and Brain Sciences*, 31, 216–217.

## Patents & Patent Applications

- De Sapio, Vincent, et al. "System for continuous validation and threat protection of mobile applications." U.S. Patent No. 10,986,113. 20 Apr. 2021.

- Jiang, Qin, et al. "System and method for synthetic aperture radar target recognition utilizing spiking neuromorphic networks." U.S. Patent No. 10,976,429. 13 Apr. 2021.
- Patrick, Richard J., et al. "Neuromorphic system for authorized user detection." U.S. Patent No. 10,902,115. 26 Jan. 2021.
- Martin, Charles E., et al. "Method and system for detecting change of context in video streams." U.S. Patent No. 10,878,276. 29 Dec. 2020.
- Huber, David J., Nigel D. Stepp, and Tsai-Ching Lu. "Aircraft maintenance message prediction." U.S. Patent No. 10,787,278. 29 Sep. 2020.
- Stepp, Nigel D., David J. Huber, and Tsai-Ching Lu. "System of structured argumentation for asynchronous collaboration and machine-based arbitration." U.S. Patent Application No. 16/724,130.
- Jammalamadaka, Aruna, and Nigel D. Stepp. "Neuronal network topology for computing conditional probabilities." U.S. Patent No. 10,748,063. 18 Aug. 2020.
- Huber, David J., et al. "System and method for human-machine hybrid prediction of events." U.S. Patent Application No. 16/708,166.
- Stepp, Nigel D., and Aruna Jammalamadaka. "Network composition module for a bayesian neuromorphic compiler." U.S. Patent Application No. 16/792,791.
- Skorheim, Steven W., Nigel D. Stepp, and Ruggero Scorcioni. "Artificial neural networks having competitive reward modulated spike time dependent plasticity and methods of training the same." U.S. Patent Application No. 16/661,637.
- Chang, Hao-yuan, Aruna Jammalamadaka, and Nigel D. Stepp. "Spiking neural network for probabilistic computation." U.S. Patent Application No. 16/577,908.
- Stepp, Nigel D., and Aruna Jammalamadaka. "Programming model for a bayesian neuromorphic compiler." U.S. Patent Application No. 16/294,886.
- Pilly, Praveen K., Nigel D. Stepp, and Narayan Srinivasa. "Sparse inference modules for deep learning." U.S. Patent Application No. 15/079,899.

## **Conference Presentations**

- Stepp, N. (Jul, 2012). Anticipation through coupling. Mathematical Psychology, Columbus, OH.
- Stepp, N. (Aug, 2009). Circadian synchronization: dynamical account of a 'representation-hungry' problem. Dynamics in Cognition, Storrs, CT.

Stepp, N. (Mar, 2009). Synchronizing with the future of a chaotic time series, New England Sequencing and Timing. New Haven, CT.

Stepp, N. (Aug, 2007). Strong anticipation, weak anticipation, and predictive homeostasis. Dynamics in Cognition, Storrs, CT

Stepp, N. & Turvey, M. T. (Jul, 2007). Strong anticipation, weak anticipation, and ecological theory. International Conference on Perception and Action. Yokohama, Japan.