

CURRENT POSITION**Postdoctoral Associate, Cornell University**

2021 - present

Supervisor: Kirstin Petersen, Collective Embodied Intelligence Lab
 Department: Electrical and Computer Engineering
 Interim PI: I served as interim Principal Investigator for the Collective Embodied Intelligence lab as part of the NSF Career Life Balance program, from August through October 2022. Responsibilities included providing feedback on experiment design, modelling choices, and conference submissions for four Ph.D. students.

EDUCATION**University of Illinois at Urbana-Champaign (UIUC)**

2015 - 2020

Degree: Ph.D. in Computer Science
 Thesis Title: *Designing Boundary Interactions for Simple Mobile Robots*
 Committee: Steven M. LaValle(advisor), Sayan Mitra, Nancy Amato, Todd Murphey (Northwestern University)

Colorado School of Mines (CSM)

2011 - 2015

Degree: B.S. in Engineering Physics. GPA 3.93/4.0
 Minor in Computational and Applied Mathematics
 Minor in Public Affairs, McBride Honors Program

AWARDS AND HONORS

- Cyber-Physical Systems Rising Star, Link Lab and NSF (34 selected of 117 applicants) 2023
- Microsoft Future Leader in Robotics and AI, Maryland Robotics Center 2023
- Cornell Postdoc Leadership Program 2021-2022
- Mentor Stipend, Illinois Scholars Undergraduate Research Program 2019
- Leung Student Venture Fund Award, UIUC ECE Department 2019
- IEEE MRS (Multi-Robot Systems) Travel Grant 2019
- Workshop on Algorithmic Foundations of Robotics (WAFR) Robot Guru Travel Grant 2018
- Saburo Muroga Endowed Fellowship, UIUC CS Department 2015-2016
- Physics Faculty Distinguished Graduate Award, CSM May 2015
- Leo Borasio Outstanding Junior Award, McBride Honors Program, CSM May 2014
- President's Undergraduate Scholarship, CSM 2011-2015

PUBLICATIONS**Journal Articles**

1. **A. Nilles**, P. Bardunias, K. Petersen. "Mechanisms for Collective Construction of Ramification Patterns in Resistive Media," in preparation, 2023. Can view at alli.nilles.info/files/Termites_draft.pdf
2. **A. Nilles**, Y. Ren, I. Becerra, S. M. LaValle. "A Visibility-Based Approach to Computing Nondeterministic Bouncing Strategies," in *The International Journal of Robotics Research*, 2021.
3. A. LaViers, C. Cuan, C. Maguire, K. Bradley, K. B. Mata, **A. Nilles**, I. Vidrin, N. Chakraborty, M. Heimerdinger, U. Huzaifa, R. McNish, I. Pakrasi, and A. Zurawski. "Choreographic and Somatic Approaches for the Development of Expressive Robotic Systems," in *MDPI – Arts*, 2018.

Conference Articles

1. **A. Nilles**, E. Garner, J. Prieto, K. Petersen. “Morphology-Induced Separation and Active Clustering of Wild Bodies,” in preparation, 2023.
2. J. A. Defay, **A. Nilles**, and K. Petersen. “Characterization of the Design Space of Collective Braitenberg Vehicles,” in the *16th International Symposium on Distributed Autonomous Robotic Systems (DARS)*, 2022.
3. **A. Nilles**, S. Ceron, N. Napp, and K. Petersen. “Strain-Based Consensus in Soft, Inflatable Robots,” in the *IEEE 5th International Conference on Soft Robotics (RoboSoft)*, 2022.
4. S. Ceron, M. A. Kimmel, **A. Nilles**, and K. Petersen. “Soft Robotic Oscillators With Strain-Based Coordination,” in *IEEE Robotics and Automation Letters (RAL)*, 2021.
5. **A. Nilles**, A. Pervan, T. Berrueta, T. Murphey, S. M. LaValle. “Information Requirements of Collision-Based Micromanipulation,” in the *14th Workshop on the Algorithmic Foundations of Robotics (WAFR)*, 2021.
6. M. Suomalainen, **A. Nilles**, S. M. LaValle. “Virtual Reality for Robots,” in *IEEE Conference on Intelligent Robots and Systems (IROS)*, 2020.
7. **A. Nilles**, J. Wasserman, A. Born, C. Horn, J. Born, S. M. LaValle. “A Hardware and Software Testbed for Underactuated Self-Assembling Robots,” in the *IEEE International Symposium on Multi-Robot and Multi-Agent Systems (MRS)*, 2019.
8. **A. Nilles**, Y. Ren, I. Becerra, S. M. LaValle. “A Visibility-Based Approach to Computing Nondeterministic Bouncing Strategies,” in the *13th Annual Workshop on the Algorithmic Foundations of Robotics (WAFR)*, 2018.
9. **A. Nilles**, C. Gladish, M. Beckman, and A. LaViers. “Improv: Live Coding for Robot Motion Design,” in *Proceedings of the 5th International Conference on Movement Computing (MOCO)*, ACM, 2018.
10. **A. Nilles**, I. Becerra, and S. M. LaValle. “Periodic Trajectories of Mobile Robots,” in *IEEE Conference on Intelligent Robots and Systems (IROS)*, 2017.

Research Abstracts

1. P. Bardunias, **A. Nilles**, R. G. Greenberg, D. Goldman, and K. H. Petersen. “Emergent tunnel branching in *coptotermes formosanus* (shiraki) through group interaction and stigmergic signalling.” In *Integrative and Comparative Biology*, vol. 62, pp. S22-S23. Journals Dept, Oxford Univ Press Inc, 2023.
2. A. Nilles, A. Pervan, T. Berrueta, T. Murphey. “Corralling Active Brownian Particles with Active Billiard Particles.” In the *Bulletin of the American Physical Society*, vol. 65, 2020.

Workshop and Poster Presentations

1. A. Nilles, K. Petersen. “Design of Scalable, Robust Robotic Collectives with Embodied and Stigmergic Coordination,” in *Collective Intelligence: Foundations + Radical Ideas Symposium & Short Course* at the Santa Fe Institute, June 2023.
2. A. Nilles, S. M. LaValle. “Robust Combinatorial Planning over Simple Boundary Interactions,” in *Workshop on Robust Task & Motion Planning* at RSS 2019.
3. A. Nilles, D. A. Shell, J. M. O’Kane. “Robot Design: Formalisms, Representations, and the Role of the Designer,” in *Workshop on the Autonomous Design of Robots* at ICRA 2018.
4. A. Nilles, I. Becerra, and S. M. LaValle. “Controllable Billiards: Characterizing the Paths of Simple Mobile Robots,” poster in *Dynamics Days*, 2018.
5. A. Nilles, “Partially Coherent Transport: Computational Analysis and Overcoming Anderson Localization,” 2014 CSM Physics poster session.
6. A. Nilles, “Teaching the Smart Grid: Why Data Management is Essential to the Future of Electricity,” Washington Internships for Students of Engineering Journal of Engineering and Public Policy.

INVITED TALKS

- “Agent-Environment Interactions for Uncertainty Reduction and Communication”, Microsoft Future Leaders in Robotics and AI: Celebrating Diversity and Innovation Seminar Series, Maryland Robotics Center, University of Maryland, 24 February 2023, recording available on MRC YouTube Channel.
- “Is Less More? Characterizing resource trade-offs for simple mobile robots with embodied intelligence.” Autonomy Talks, Institute for Dynamic Systems and Control, ETH Zürich. 8 February 2021, recording available on ETH Zürich Frazzoli YouTube Channel.
- “Is Less More? Characterizing Resource Trade-offs When Designing Robot-Boundary Interactions.” Cornell Robotics Seminar, 12 May 2020, talk given via Zoom.
- “Towards Self-Assembly and Collective Manipulation with Extremely Underactuated Robots,” NxR Group Meeting, Northwestern University. 1 March 2019.
- “Interesting Trajectories of Mobile Robots in Polygons,” 2017 Midwest Robotics Workshop (MWRW). May 18 2017.

MENTORING

- Anthony Chavez (2023): rising 4th year undergraduate, supervised simulation-based research through the Cornell Engineering Sibley School of Mechanical and Aerospace Engineering Future Leaders in Aerospace and Mechanical Engineering (FLAME) program.
- Elizabeth Garner (2021-2023): undergraduate, assisted with design of light-weight 3D printed robot platform and simulation, co-authored a paper.
- Steven Ceron (2021): Ph.D. student, I advised on signal processing and algorithmic approach to FoamBot platform and co-authored a paper.
- Emily Hall and Max Altman (2019-2020): 4th year undergraduates, I supervised on a funded undergraduate research project (a robotic pen) through the Illinois Scholar Undergraduate Research (ISUR) Program.
- Jordan Parker (2018): 1st year undergraduate, supervised her development of Improv features and assisted with user study. I also connected her with a paid research position in the RAD Lab.
- Chase Gladish (2018): 4th year undergraduate, I supervised her senior thesis on programming languages for robotics. Co-authored on 2018 MoCo paper.
- Samara (Yingying) Ren (2017-2020): undergraduate co-author on one WAFR paper and IJRR paper. She continued to a Ph.D. program at EPFL.
- Austin Born, John Born, Chris Horn, Justin Wasserman (2017-2019): supervised team of undergraduates, recieved \$1000 undergraduate research award from ECE department and co-authored 2018 MRS paper. J. Wasserman wrote his senior thesis on “Controlling, Modeling, and Scaling Underactuated, Non-deterministic Robot Structures” and continued to a Ph.D. program at UIUC.
- Michael Zeng (2016): 3rd year undergraduate, collaborated on dynamics of bouncing robots.
- Oluwami Dosunmu-Ogunbi (2015-2016): 4th year undergraduate, I supervised her work on CAD, microcontrollers, IMU data collection and analysis. Continued to a Ph.D. at University of Michigan.

TEACHING EXPERIENCE

UIUC Teaching Assistant

July-December 2019

- One of five TAs for **ECE 470: Introduction to Robotics** (90 students)
- Class topics included state estimation and filtering, forward and inverse kinematics, motion planning, control, and introductory computer vision.
- Individually supervised a twice-weekly 15-student lab section, using Universal Robots UR3 robot arms and computer vision.

- Gave two 75-minute guest lectures on inverse kinematics for the full ninety-student class.
- Developed homework and test problems using the online learning platform PrairieLearn.

Colorado School of Mines Math Learning Center

Description: Tutored for all classes in Math department. Primarily calculus, differential equations, and linear algebra.

Dates: Jan 2015 - May 2015

North American Network of Science Labs Online (NANSLO)

Description: Developed, monitored, and troubleshot remote-controlled robotic physics, chemistry, and biology experiments for college students in online classes. Served as a TA and equipment technician while classes were running. This was innovative distance learning research funded through the Department of Labor.

Dates: Feb 2012 - May 2014

PROFESSIONAL SERVICE

- Reviewer for IROS, ICRA, CGTA, RA-L, T-RO, MRS, Nature Communications
- Publication Chair for DARS 2024
- Co-organizer for ICRA full day workshop, “Compositional Robotics: Mathematics and Tools,” held virtually in 2021, hybrid in 2022 and 2023.
- Co-organizer for ICRA full day workshop, “Robotics and Art: Automating Expressions,” hybrid workshop, 2022.
- Co-organizer for Robotic Science and Systems (RSS) full day workshop, “Minimality and Trade-offs in Automated Robot Design.” July 16 2017.
 - Recruited and communicated with speakers, helped develop The Robot Design Game, facilitated workshop and discussions.
- President of Computer Science Graduate Students Organization (2017 - 2018), member 2015 - 2020.
 - Organized social events, discussed and advocated for graduate student needs, planned logistics and cultural events for annual prospective PhD student visit weekend.
- Head of student committee organizing an semester-long internal Robotics@UIUC seminar (Fall 2016).
 - Recruited student speakers, advertised weekly talks, maintained wiki.

OUTREACH AND DIVERSITY SERVICE

- 2019-2020: Mentor for Illinois Scholars Undergraduate Research (ISUR) Program. Supervised two URM undergraduate students in robotics research.
- 2019: WAFR Robot Guru Mentor - six month remote mentorship of undergraduates interested in robotics research
- 2014: Founding member of Equality Through Awareness (ETA) at CSM, a group promoting student well-being and diversity in STEM through discussion, mentoring, and invited speakers.
 - I facilitated weekly group reading club discussions on understanding issues faced by underrepresented groups in STEM
 - In 2018, ETA was awarded the Martin Luther King Jr. Recognition Award from CSM
- 2012-2015: Society of Physics Students, CSM - participated in outreach events such as interactive physics demonstrations at local elementary and middle schools.

OTHER EMPLOYMENT

Petronics internship: Development of small, agile mobile robot

Description: Worked closely with engineers at a small start-up to develop hardware and software for a robotic mouse cat toy, funded by NSF SBIR.

Dates: May 2016 - August 2016

Complexity Sciences Center, UC Davis

Description: NSF REU with Dr. Jim Crutchfield. I implemented and analyzed an information-theoretic learning algorithm for exploratory robots with limited sensing capabilities. In collaboration with the Berkeley Redwood Center for Theoretical Neuroscience.

Dates: June - Aug 2014

Institute of Electrical and Electronics Engineers (IEEE)

Description: Washington Internships for Students of Engineering (WISE) program: researched smart grid data management and policy alternatives; published an overview and policy recommendation.

Dates: June - Aug 2013

REFERENCES

- Professor Steven M. Lavalle
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University of Oulu, Oulu, Finland
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- Professor Kirstin H. Petersen
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- Professor Sayan Mitra
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- Professor Todd Murphey
Professor of Mechanical Engineering
Director of the Master of Science in Robotics Program
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