

## Professional Experience

Purdue University at West Lafayette, IN	Assistant Professor in the Department of Computer Science	Aug. 2024–Present
Kavraki Lab at Rice University, Houston, TX	Post-Doctoral Researcher and Lab Manager Supervisor: Dr. Lydia Kavraki	Dec. 2021–Aug. 2024 <a href="https://kavrakilab.org/">https://kavrakilab.org/</a>
	Graduate Student Advisor: Dr. Lydia Kavraki	Aug. 2016–Dec. 2021
	Undergraduate Researcher Advisor: Dr. Lydia Kavraki	Feb. 2015–Aug. 2016
Dexterous Robotics Lab at NASA JSC, Houston, TX	NSTRF Fellow Supervisor: Dr. Julia Badger	Aug. 2017–Aug. 2021 <a href="https://er.jsc.nasa.gov/er4/">https://er.jsc.nasa.gov/er4/</a>
	USRA Intern Supervisor: Dr. Julia Badger	Summer 2017
	Guest Researcher Supervisor: Dr. Julia Badger	Summer 2016
Multi-Robot Systems Lab at Rice University, Houston, TX	Undergraduate Researcher Advisor: Dr. James McLurkin	May 2014–May 2015 <a href="http://mrsl.rice.edu/">http://mrsl.rice.edu/</a>

## Education

Rice University Houston, TX	Ph.D. in Computer Science Thesis: <i>Toward Efficient and General Multi-Modal Planning</i> Advisor: Dr. Lydia E. Kavraki	Aug. 2016–Dec. 2021
	M.S. in Computer Science Thesis: <i>A Unifying Framework for Constrained Sampling-Based Planning</i> Advisor: Dr. Lydia E. Kavraki	Aug. 2016–Dec. 2017
	B.S. in Computer Science	Aug. 2012–May 2016

## Publications

All publications are available on my website: <https://zkingston.com>.

### Peer-Reviewed Journal Articles

1. S. Bora Bayraktar, Andreas Orthey, **Zachary Kingston**, Marc Toussaint, and Lydia E. Kavraki. Solving rearrangement puzzles using path defragmentation in factored state spaces. *IEEE Robotics and Automation Letters*, 8(8):4529–4536, 2023. doi:[10.1109/LRA.2023.3282788](https://doi.org/10.1109/LRA.2023.3282788). Presented at ICRA 2024

- J2. **Zachary Kingston** and Lydia E. Kavraki. Scaling multi-modal planning: Using experience and informing discrete search. *IEEE Transactions on Robotics*, 39(1):128–146, 2023. doi:[10.1109/TRO.2022.3197080](https://doi.org/10.1109/TRO.2022.3197080)
- J3. Constantinos Chamzas, Carlos Quintero-Peña, **Zachary Kingston**, Andreas Orthey, Daniel Rakita, Michael Gleicher, Marc Toussaint, and Lydia E. Kavraki. MotionBenchMaker: A tool to generate and benchmark motion planning datasets. *IEEE Robotics and Automation Letters*, 7(2):882–889, 2021. doi:[10.1109/LRA.2021.3133603](https://doi.org/10.1109/LRA.2021.3133603)
- J4. **Zachary Kingston**, Mark Moll, and Lydia E. Kavraki. Exploring implicit spaces for constrained sampling-based planning. *The International Journal of Robotics Research*, 38(10–11):1151–1178, 2019. doi:[10.1177/0278364919868530](https://doi.org/10.1177/0278364919868530)
- J5. Neil T. Dantam, **Zachary Kingston**, Swarat Chaudhuri, and Lydia E. Kavraki. An incremental constraint-based framework for task and motion planning. *The International Journal of Robotics Research*, 37(10):1134–1151, 2018. doi:[10.1177/0278364918761570](https://doi.org/10.1177/0278364918761570)
- J6. **Zachary Kingston**, Mark Moll, and Lydia E. Kavraki. Sampling-based methods for motion planning with constraints. *Annual Review of Control, Robotics, and Autonomous Systems*, 1(1):159–185, 2018. doi:[10.1146/annurev-control-060117-105226](https://doi.org/10.1146/annurev-control-060117-105226)

#### Peer-Reviewed Conference Papers

- C1. Clayton W. Ramsey, Zachary Kingston, Wil Thomason, and Lydia E. Kavraki. Collision-affording point trees: Simd-amenable nearest neighbors for fast collision checking. In *Robotics: Science and Systems*, 2024. URL <https://arxiv.org/abs/2406.02807>. Equal Contribution. To Appear
- C2. Wil Thomason<sup>†</sup>, **Zachary Kingston**<sup>†</sup>, and Lydia E. Kavraki. Motions in microseconds via vectorized sampling-based planning. In *IEEE International Conference on Robotics and Automation*, 2024. URL <https://arxiv.org/abs/2309.14545>. <sup>†</sup> Equal Contribution
- C3. Carlos Quintero-Peña, Wil Thomason, **Zachary Kingston**, Anastasios Kyrillidis, and Lydia E. Kavraki. Stochastic implicit neural signed distance functions for safe motion planning under sensing uncertainty. In *IEEE International Conference on Robotics and Automation*, 2024. URL <https://arxiv.org/pdf/2309.16862.pdf>
- C4. Khen Elimelech, **Zachary Kingston**, Wil Thomason, Moshe Vardi, and Lydia E. Kavraki. Accelerating long-horizon planning with affordance-directed dynamic grounding of abstract skills. In *IEEE International Conference on Robotics and Automation*, 2024. URL <http://khen.io/icra24appendix.pdf>
- C5. Rahul Shome, **Zachary Kingston**, and Lydia E. Kavraki. Robots as AI double agents: Privacy in motion planning. In *IEEE/RSJ International Conference on Intelligent Robots and Systems*, pages 2861–2868, 2023. doi:[10.1109/IROS55552.2023.10341460](https://doi.org/10.1109/IROS55552.2023.10341460)
- C6. Carlos Quintero-Peña, **Zachary Kingston**, Tianyang Pan, Rahul Shome, Anastasios Kyrillidis, and Lydia E. Kavraki. Optimal grasps and placements for task and motion planning in clutter. In *IEEE International Conference on Robotics and Automation*, pages 3707–3713, 2023. doi:[10.1109/ICRA48891.2023.10161455](https://doi.org/10.1109/ICRA48891.2023.10161455)
- C7. Yiyuan Lee, Wil Thomason, **Zachary Kingston**, and Lydia E. Kavraki. Object reconfiguration with simulation-derived feasible actions. In *IEEE International Conference on Robotics and Automation*, pages 8104–8111, 2023. doi:[10.1109/ICRA48891.2023.10160377](https://doi.org/10.1109/ICRA48891.2023.10160377)
- C8. **Zachary Kingston** and Lydia E. Kavraki. Robowflex: Robot motion planning with MoveIt made easy. In *IEEE/RSJ International Conference on Intelligent Robots and Systems*, pages 3108–3114, 2022. doi:[10.1109/IROS47612.2022.9981698](https://doi.org/10.1109/IROS47612.2022.9981698)

- C<sub>9</sub>. **Zachary Kingston**, Constantinos Chamzas, and Lydia E. Kavraki. Using experience to improve constrained planning on foliations for multi-modal problems. In *IEEE/RSJ International Conference on Intelligent Robots and Systems*, pages 6922–6927, 2021. doi:[10.1109/IROS51168.2021.9636236](https://doi.org/10.1109/IROS51168.2021.9636236)
- C<sub>10</sub>. Mark Moll, Constantinos Chamzas, **Zachary Kingston**, and Lydia E. Kavraki. HyperPlan: A framework for motion planning algorithm selection and parameter optimization. In *IEEE/RSJ International Conference on Intelligent Robots and Systems*, pages 2511–2518, 2021. doi:[10.1109/IROS51168.2021.9636651](https://doi.org/10.1109/IROS51168.2021.9636651)
- C<sub>11</sub>. Andrew M. Wells, **Zachary Kingston**, Morteza Lahijanian, Lydia E. Kavraki, and Moshe Y. Vardi. Finite horizon synthesis for probabilistic manipulation domains. *IEEE International Conference on Robotics and Automation*, pages 6336–6342, 2021. doi:[10.1109/ICRA48506.2021.9561297](https://doi.org/10.1109/ICRA48506.2021.9561297)
- C<sub>12</sub>. Constantinos Chamzas, **Zachary Kingston**, Carlos Quintero-Peña, Anshumali Shrivastava, and Lydia E. Kavraki. Learning sampling distributions using local 3D workspace decompositions for motion planning in high dimensions. In *IEEE International Conference on Robotics and Automation*, pages 1283–1289, 2021. doi:[10.1109/ICRA48506.2021.9561104](https://doi.org/10.1109/ICRA48506.2021.9561104)
- C<sub>13</sub>. **Zachary Kingston**, Andrew M. Wells, Mark Moll, and Lydia E. Kavraki. Informing multi-modal planning with synergistic discrete leads. In *IEEE International Conference on Robotics and Automation*, pages 3199–3205, 2020. doi:[10.1109/ICRA40945.2020.9197545](https://doi.org/10.1109/ICRA40945.2020.9197545)
- C<sub>14</sub>. **Zachary Kingston**, Mark Moll, and Lydia E. Kavraki. Decoupling constraints from sampling-based planners. In Nancy M. Amato, Greg Hager, Shawna Thomas, and Miguel Torres-Torriti, editors, *Robotics Research*, pages 913–928. Springer International Publishing, Cham, 2020. ISBN 978-3-030-28619-4. doi:[10.1007/978-3-030-28619-4\\_62](https://doi.org/10.1007/978-3-030-28619-4_62)
- C<sub>15</sub>. Golnaz Habibi, Sándor P. Fekete, **Zachary Kingston**, and James McLurkin. Distributed object characterization with local sensing by a multi-robot system. In Roderich Groß, Andreas Kolling, Spring Berman, Emilio Frazzoli, Alcherio Martinoli, Fumitoshi Matsuno, and Melvin Gauci, editors, *Distributed Autonomous Robotic Systems: The 13th International Symposium*, volume 6, pages 205–218. Springer Proceedings in Advanced Robotics, 2018. doi:[10.1007/978-3-319-73008-0\\_15](https://doi.org/10.1007/978-3-319-73008-0_15)
- C<sub>16</sub>. William Baker, **Zachary Kingston**, Mark Moll, Julia Badger, and Lydia E. Kavraki. Robonaut 2 and you: Specifying and executing complex operations. In *IEEE Workshop on Advanced Robotics and its Social Impacts*, pages 1–8, Austin, TX, March 2017. doi:[10.1109/ARSO.2017.8025204](https://doi.org/10.1109/ARSO.2017.8025204)
- C<sub>17</sub>. Neil T. Dantam, **Zachary Kingston**, Swarat Chaudhuri, and Lydia E. Kavraki. Incremental task and motion planning: A constraint-based approach. In *Robotics: Science and Systems*, Ann Arbor, MI, June 2016. doi:[10.15607/RSS.2016.XII.002](https://doi.org/10.15607/RSS.2016.XII.002)
- C<sub>18</sub>. **Zachary Kingston**, Neil T. Dantam, and Lydia E. Kavraki. Kinematically constrained workspace control via linear optimization. In *IEEE-RAS International Conference on Humanoid Robots*, pages 758–764, Nov 2015. doi:[10.1109/HUMANOIDS.2015.7363455](https://doi.org/10.1109/HUMANOIDS.2015.7363455)
- C<sub>19</sub>. Golnaz Habibi, **Zachary Kingston**, Zijian Wang, Mac Schwager, and James McLurkin. Pipelined consensus for global state estimation in multi-agent systems. In *Proceedings of the 2015 International Conference on Autonomous Agents and Multiagent Systems*, pages 1315–1323. International Foundation for Autonomous Agents and Multiagent Systems, 2015. ISBN 9781450334136. doi:[10.5555/2772879.2773320](https://doi.org/10.5555/2772879.2773320)
- C<sub>20</sub>. Golnaz Habibi, **Zachary Kingston**, William Xie, Mathew Jellins, and James McLurkin. Distributed centroid estimation and motion controllers for collective transport by multi-robot systems. In *IEEE International Conference on Robotics and Automation*, pages 1282–1288, 2015. doi:[10.1109/ICRA.2015.7139356](https://doi.org/10.1109/ICRA.2015.7139356)

## Book Chapters

- B1. **Zachary Kingston.** *Encyclopedia of Robotics*, chapter Planning Under Manifold Constraints, pages 1–9. Springer Berlin Heidelberg, 2020. ISBN 978-3-642-41610-1. doi:[10.1007/978-3-642-41610-1\\_174-1](https://doi.org/10.1007/978-3-642-41610-1_174-1)

## Workshop Papers and Abstracts

- W1. Qingxi Meng, Carlos Quintero-Peña, **Zachary Kingston**, Vaibhav Unhelkar, and Lydia E. Kavraki. Perception-aware planning for robotics: Challenges and opportunities. In *40th Anniversary of the IEEE Conference on Robotics and Automation (ICRA@40)*, 2024
- W2. Carlos Quintero-Peña, Wil Thomason, **Zachary Kingston**, Anastasios Kyrillidis, and Lydia E. Kavraki. Stochastic implicit neural signed distance functions for safe motion planning under sensing uncertainty. In *IEEE ICRA 2024 Workshop—Back to the Future: Robot Learning Going Probabilistic*, 2024. URL <https://arxiv.org/pdf/2309.16862.pdf>
- W3. Clayton W. Ramsey, **Zachary Kingston**<sup>†</sup>, Wil Thomason<sup>†</sup>, and Lydia E. Kavraki. Dynamic motion planning from perception via accelerated point cloud collision checking. In *IEEE ICRA 2024 Workshop—Agile Robotics: From Perception to Dynamic Action*, 2024. <sup>†</sup> Equal Contribution
- W4. Qingxi Meng<sup>†</sup>, Carlos Quintero-Peña<sup>†</sup>, **Zachary Kingston**, Nicole M. Fontenot, Shannan K. Hamlin, Vaibhav Unhelkar, and Lydia E. Kavraki. Monitoring constraints for robotic tutors in nurse education: A motion planning perspective. In *IEEE ICRA 2024 Workshop—Workshop on Nursing Robotics*, 2024. <sup>†</sup> Equal Contribution

## Theses

- T1. **Zachary Kingston.** *Toward Efficient and General Multi-Modal Planning*. PhD thesis, Rice University, Houston, TX, 2021. URL <https://hdl.handle.net/1911/111679>
- T2. **Zachary Kingston.** A unifying framework for constrained sampling-based planning. Master’s thesis, Rice University, Houston, TX, 2017. URL <https://hdl.handle.net/1911/105607>

## Invited Contributor

- I1. Claire Le Goues, Sebastian Elbaum, David Anthony, Z. Berkay Celik, Mauricio Castillo-Effen, Nikolaus Correll, Pooyan Jamshidi, Morgan Quigley, Trenton Tabor, and Qi Zhu. Software engineering for robotics: Future research directions; report from the 2023 workshop on software engineering for robotics, 2024. URL <https://arxiv.org/pdf/2401.12317.pdf>. Invited Contributor



## Selected Funding

### Authored

- G1. Rahul Shome, Jenny L. Davis, **Zachary Kingston**, and Lydia E. Kavraki. Virtues of Robot Inaction: Towards Theories of Automated Reasoning of Inaction in Human Contexts, 2023. URL <https://services.anu.edu.au/research-support/funding-opportunities/computing-for-social-good-seed-grants-2023>. ANU Humanising Machine Intelligence Computing for Social Good Seed Research Grant, AU\$25,000

### Co-Authored

- cG1. Lydia E. Kavraki and Anshumali Shrivastava. A Framework for Manipulation Planning and Execution under Uncertainty in Partially-Known Environments, 2024–2027. URL [https://www.nsf.gov/awardsearch/showAward?AWD\\_ID=2336612](https://www.nsf.gov/awardsearch/showAward?AWD_ID=2336612). NSF CCF 2336612, \$715,312

- cG2. Lydia E. Kavraki and Vaibhav Unhelkar. Collaborative Research: FW-HTF-R: The Future of Robot-Assisted Nursing: Interactive AI Frameworks for Upskilling Nurses and Customizing Robot Assistance, 2022–2023. URL [https://nsf.gov/awardsearch/showAward?AWD\\_ID=2222876](https://nsf.gov/awardsearch/showAward?AWD_ID=2222876). NSF HRD 2222876, \$121,713
- cG3. Lydia E. Kavraki. RI: Small: A Novel Framework for Informed Manipulation Planning, 2020–2023. URL [https://nsf.gov/awardsearch/showAward?AWD\\_ID=2008720](https://nsf.gov/awardsearch/showAward?AWD_ID=2008720). NSF IIS 2008720, \$441,000



## Awards and Honors

- A1. [Rice Innovation Fellow](#), Liu Idea Lab for Innovation and Entrepreneurship, 2024
- A2. [C8](#). Nominated, Best Paper in Industrial Robotics Research for Practicality, IEEE/RSJ IROS, 2022
- A3. [C12](#). Nominated, Best Paper in Cognitive Robotics, IEEE-RAS ICRA, 2021
- A4. [Future Faculty Fellowship](#), Rice Engineering, 2020–21
- A5. Best Presentation in COMP 600, Rice University Computer Science Department, 2018, 2020
- A6. [NASA Space Technology Research Fellowship](#), NASA, 2017–2021
- A7. [NSF Graduate Research Fellowship Program](#), NSF, 2017
- A8. [Graduate Research Fellowship](#), Rice University Computer Science Department, 2016
- A9. [Distinction in Research and Creative Works](#), Rice University, 2016
- A10. [President's Honor Roll](#), Rice University, 2015–16



## Research Supervision

Ph.D. Students	<a href="#">Akshaya Agrawal</a> , <a href="#">Clayton Ramsey</a> <sup>1</sup> , Qingxi Meng, <a href="#">Yiyuan Lee</a>
Masters Students	<a href="#">Weihang Guo</a> , <a href="#">Thomas Herring</a>
Undergraduate Students	Stefan Bukorovic, Sofia Paola Medina-Chica, Andreja Andrejic, Aedan Cullen, Luis Leal <sup>2</sup>

<sup>1</sup> Awarded NSTGRO and NDSEG 2024

<sup>2</sup> Award for Excellence in Poster Presentations, Rice Summer Undergraduate Research Symposium



## Service

Associate Editor:

- ✦ IEEE Robotics and Automation Letters (Planning and Simulation 1) (RA-L), 2024–Present
- ✦ IEEE International Conference on Robotics and Automation (ICRA), 2024

Organizer:

- ✦ [Evaluating Motion Planning Performance Workshop](#), IROS 2022

Referee:

- ✦ Robotics: Science and Systems (RSS), 2024
- ✦ IEEE Robotics and Automation Letters (RA-L), 2020–2024
- ✦ IEEE International Conference on Robotics and Automation (ICRA), 2018, 2022–2024
- ✦ Journal of Artificial Intelligence Research (JAIR), 2024

- ✦ IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS), 2020–2024
- ✦ IEEE Transactions on Robotics (T-RO), 2022–2023
- ✦ IEEE/ASME Transactions on Mechatronics, 2020
- ✦ IEEE Transactions on Automation Science and Engineering (T-ASE), 2020
- ✦ Workshop on the Algorithmic Foundations of Robotics (WAFR), 2020
- ✦ International Symposium on Robotics Research (ISRR), 2017

Maintainer of OMPL Motion Planning Software	Dec. 2021–Present
Core Contributor to the <i>MoveIt</i> Robot Motion Planning Software	Mar. 2019–Jun. 2020
Maintainer of the <i>MoveIt</i> Robot Motion Planning Software	Sep. 2018–Mar. 2019
Computer Science Representative, Graduate Student Association	Mar. 2018–May 2020
Consultant for Rice's <b>Center for Academic and Professional Communication</b>	Aug. 2018–May 2019
Treasurer, Computer Science Graduate Student Association	Aug. 2017–May 2019



## Teaching

Physical Computing <i>COMP 650 at Rice University</i>	Instructor of Record	Spring 2024
Algorithmic Robotics <i>COMP/ELEC/MECH 450/550 at Rice University</i>	Lecturer	Fall 2020 <a href="https://www.clear.rice.edu/comp450/">https://www.clear.rice.edu/comp450/</a>
Algorithmic Robotics <i>COMP/ELEC/MECH 450/550 at Rice University</i>	Teaching Assistant	Fall 2016–2019, 2022 <a href="https://www.clear.rice.edu/comp450/">https://www.clear.rice.edu/comp450/</a>
Intro. to Computer Systems <i>COMP 321 at Rice University</i>	In-Lab Teaching Assistant	Spring 2015, 2018 <a href="https://www.clear.rice.edu/comp321/">https://www.clear.rice.edu/comp321/</a>
Intro. to Computational Thinking <i>COMP 140 at Rice University</i>	In-Class Teaching Assistant	Fall 2015
Intro. to Engineering Systems <i>ENGI 128 at Rice University</i>	In-Class Teaching Assistant	Fall 2014 <a href="https://www.clear.rice.edu/engi128/">https://www.clear.rice.edu/engi128/</a>




## Invited Talks

### *Efficient and General Planning for Robot Manipulation*


UCSD ECE Seminar	at La Jolla, CA	Mar. 2024
Purdue Computer Science Seminar	at West Lafayette, IN	Feb. 2024
Texas A&M Computer Science Seminar	at College Station, TX	Feb. 2024

### *Motions in Microseconds via Vectorized Sampling-Based Planning*

Intelligent Autonomous Systems Group	virtual at TU Darmstadt, w/ Wil Thomason	Jan. 2024
Pumps & Pipes	 at the <b>ION</b> , w/ Wil Thomason	Dec. 2023



## Scaling Multi-Modal Planning

AI, ML, and Friends Seminar	virtual at ANU School of Computing	Feb. 2023
University of Utah Robotics Seminar	virtual	Jul. 2021
Learning and Intelligent Systems Lab	 virtual at TU Berlin	Jul. 2021

## Robonaut 2 and You: Specifying and Executing Complex Operations

International Workshop on AI-Powered Space	at the <i>ION</i>	Nov. 2023
Humanoid Users Conference	at NASA JSC	May 2017

## Robowflex: Simplifying Planning and Benchmarking with MoveIt

2022 MoveIt Community Meeting	 virtual	Feb. 2022
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## Outreach

Museum Exhibit	Consultant	Jan. 2015–May 2015
at the Museum of Science and Industry, Chicago, IL		<a href="http://www.msichicago.org/.../robot-revolution/">http://www.msichicago.org/.../robot-revolution/</a>
Summer Swarm Camp	Summer Camp Staff	Jul. 2014
at Rice University, Houston, TX		<a href="http://mrsl.rice.edu/robot-camp">http://mrsl.rice.edu/robot-camp</a>

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## Open Source Software

### Maintainer

The Open Motion Planning Library (OMPL)	<a href="https://ompl.kavrakilab.org/">https://ompl.kavrakilab.org/</a>
Robowflex	<a href="https://github.com/KavrakiLab/robowflex">https://github.com/KavrakiLab/robowflex</a>
MotionBenchMaker	<a href="https://github.com/KavrakiLab/motion_bench_maker">https://github.com/KavrakiLab/motion_bench_maker</a>
HyperPlan	<a href="https://github.com/KavrakiLab/hyperplan">https://github.com/KavrakiLab/hyperplan</a>
Vector-Accelerated Motion Planner (VAMP)	<a href="https://github.com/KavrakiLab/vamp">https://github.com/KavrakiLab/vamp</a>

### Contributor

MoveIt Robot Motion Planning Software	<a href="https://moveit.ros.org/">https://moveit.ros.org/</a>
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