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## 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

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## Experience

Kavraki Lab at Rice University, Houston, TX	Post-Doctoral Researcher and Lab Manager Supervisor: Dr. Lydia Kavraki	Dec. 2021–Present <a href="https://kavrakilab.org/">https://kavrakilab.org/</a>
Kavraki Lab at Rice University, Houston, TX	Graduate Student Advisor: Dr. Lydia Kavraki	Aug. 2016–Dec. 2021 <a href="https://kavrakilab.org/">https://kavrakilab.org/</a>
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>
Dexterous Robotics Lab at NASA JSC, Houston, TX	USRA Intern Supervisor: Dr. Julia Badger	May. 2017–Aug. 2017 <a href="https://er.jsc.nasa.gov/er4/">https://er.jsc.nasa.gov/er4/</a>
Dexterous Robotics Lab at NASA JSC, Houston, TX	Guest Researcher Supervisor: Dr. Julia Badger	Jul. 2016–Aug. 2016 <a href="https://er.jsc.nasa.gov/er4/">https://er.jsc.nasa.gov/er4/</a>
Kavraki Lab at Rice University, Houston, TX	Undergraduate Researcher Advisor: Dr. Lydia Kavraki	Feb. 2015–Aug. 2016 <a href="https://kavrakilab.org/">https://kavrakilab.org/</a>
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>

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## Publications

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

### Preprints Under Review

- P1. Clayton W. Ramsey, **Zachary Kingston**<sup>†</sup>, Wil Thomason<sup>†</sup>, and Lydia E. Kavraki. Title withheld for double-blind review. In *Robotics: Science and Systems*, 2024. <sup>†</sup> Equal Contribution. Under Review

### Peer-Reviewed Journal Articles

- J1. 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. 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
- 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
- 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
- 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
- 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

### Peer-Reviewed Conference Papers

- C1. 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. To Appear
- C2. 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>. To Appear
- C3. 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. To Appear
- C4. 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
- C5. 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
- C6. 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
- C7. **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
- C8. **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

- C<sub>9</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>10</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>11</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>12</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>13</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>14</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>15</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>16</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>17</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>18</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>19</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

- B<sub>1</sub>. **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

- W<sub>1</sub>. 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>. To Appear
- W<sub>2</sub>. 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. Under Review
- W<sub>3</sub>. 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. Under Review

## Theses

- T<sub>1</sub>. **Zachary Kingston**. *Toward Efficient and General Multi-Modal Planning*. PhD thesis, Rice University, Houston, TX, 2021
- T<sub>2</sub>. **Zachary Kingston**. A unifying framework for constrained sampling-based planning. Master’s thesis, Rice University, Houston, TX, 2017

## Invited Contributor

- I<sub>1</sub>. 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>



## Selected Funding

### Authored

- G<sub>1</sub>. 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

- cG<sub>1</sub>. 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
- cG<sub>2</sub>. 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
- cG<sub>3</sub>. 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. [C7](#). Nominated, Best Paper in Industrial Robotics Research for Practicality, IEEE/RSJ IROS, 2022
- A3. [C11](#). 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="#">Clayton Ramsey</a> <sup>1</sup> , <a href="#">Qingxi Meng</a> , <a href="#">Yiyuan Lee</a>
Masters Students	<a href="#">Weihang Guo</a> , <a href="#">Xiaoyu Yuan</a> , <a href="#">Thomas Herring</a>
Undergraduate Students	<a href="#">Stefan Bukorovic</a> , <a href="#">Sofia Paola Medina-Chica</a> , <a href="#">Andreja Andrejic</a> , <a href="#">Aedan Cullen</a> , <a href="#">Luis Leal</a> <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 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 <a href="#">Center for Academic and Professional Communication</a>	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	<i>at La Jolla, CA</i>	Mar. 2024
Purdue Computer Science Seminar	<i>at West Lafayette, IN</i>	Feb. 2024
Texas A&M Computer Science Seminar	<i>at College Station, TX</i>	Feb. 2024

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

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

### ***Scaling Multi-Modal Planning***

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

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

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

### ***Rowflex: Simplifying Planning and Benchmarking with MoveIt***

2022 MoveIt Community Meeting 	<i>virtual</i>	Feb. 2022
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## Outreach

Museum Exhibit      Consultant      Jan. 2015–May 2015  
at the Museum of Science and Industry, Chicago, IL      <http://www.msichicago.org/.../robot-revolution/>

Summer Swarm Camp      Summer Camp Staff      Jul. 2014  
at Rice University, Houston, TX      <http://mrsl.rice.edu/robot-camp>



## Open Source Software

### Maintainer

*The Open Motion Planning Library (OMPL)*      <https://ompl.kavrakilab.org/>  
*Robowflex*      <https://github.com/KavrakiLab/robowflex>  
*MotionBenchMaker*      [https://github.com/KavrakiLab/motion\\_bench\\_maker](https://github.com/KavrakiLab/motion_bench_maker)  
*HyperPlan*      <https://github.com/KavrakiLab/hyperplan>  
*Vector-Accelerated Motion Planner (VAMP)*      <https://github.com/KavrakiLab/vamp>

### Contributor

*MoveIt Robot Motion Planning Software*      <https://moveit.ros.org/>