

# Theia Henderson (she/her)

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## Education

- 2020-Present **Ph.D. Candidate in Compute Science, MIT** (Advisor: David Karger) *Cambridge, MA*
- 2018-2019 **M.Eng. in Computer Science, MIT** (Advisors: Sertac Karaman and Vivienne Sze) *Cambridge, MA*  
Thesis: “A Continuous Approach to Information-Theoretic Exploration with Range Sensors”  
GPA: 4.8/5.0
- 2013-2017 **B.S. in Computer Science, MIT** (Advisor: Justin Solomon) *Cambridge, MA*  
Thesis: “Audio Transport”  
GPA: 4.8/5.0
- 2010-2013 **The Knox School** *St. James, NY*

## Research Experience

- 2020-Present **Haystack Group**, PI: David Karger *MIT CSAIL*  
*Research Assistant*: Studying mechanisms that make online discussion more productive by mitigating polarizing behavior. Presenting findings at weekly group meetings.
- 2020-Present **Mechanism Design for Social Good: Civic Participation Working Group** *Zoom*  
Prepared bi-weekly group presentations on novel forms of democracy: sortition, deliberation, liquid democracy, quadratic voting, etc. Currently, co-authoring a survey paper on these topics.
- 2018-2020 **Low-Energy Autonomy and Navigation (LEAN) Group**, PIs: Sertac Karaman&Vivienne Sze *MIT LIDS*  
*Research Assistant*: Designed efficient algorithms for autonomous exploration using techniques from robotics, information theory and computer graphics; proved the algorithms lead to optimal exploration. Experimentally validated results on the “MIT Racecar” platform, a 1/10th-scale, open-source autonomous vehicle; implemented the entire software stack including control, localization, planning, vision and mapping; primary developer and maintainer of the MIT Racecar codebase and hardware. Collaborated with other researchers at MIT and Lincoln Labs; presented findings at conferences and weekly group meetings.
- Spring 2017 **Geometric Data Processing Group**, PI: Justin Solomon *MIT CSAIL*  
*Undergraduate Researcher*: Applied optimal transport theory to audio, resulting in a generalized portamento (musical glide) between any two audio sources; this is the first time optimal transport had been used to synthesize audio. Developed novel signal processing techniques to mitigate phasing; created a real-time hardware interface for the effect; presented findings at a conference and in the MIT News.
- Summer 2016 **Applied Cryptography Group**, PI: Sébastien Canard *Orange Labs, Caen, France*  
*Researcher Intern*: Designed algorithms for efficient computation of arbitrary nonlinear functions, like division, under homomorphic encryption. Proved the algorithms met complexity lower bounds; implemented the algorithms in C++; prepared a formal write-up of the results with experiments.
- Summer 2015 **Genesis Group**, PI: Patrick Winston *MIT CSAIL*  
*Undergraduate Researcher*: Developed a module for the artificial story understanding system, Genesis, that determines the personality of characters in a text. These personalities can be used to predict character actions and motives; implemented in Java.
- 2014-2015 **Pigtronix**: Guitar Pedal Manufacturer *Port Jefferson, NY*  
*Intern (Summer 2014), Software Engineer (Summer 2015)*: Developed the computer-pedal GUI for the Echolution 2 digital delay in Xojo. Aided design of the Echolution 2 and Infinity Looper pedals. Debugged and repaired analog and digital effect pedals.
- Fall 2014 **Opera of the Future**, PI: Tod Machover *MIT Media Lab*  
*Undergraduate Researcher*: Sampled and processed audio used in the composition *A Symphony for Lucerne*. Developed 16-channel ambiophonic (3D sound) audio effects in Max/MSP for a live performances.

## Teaching Experience

- 2018-2019 **Robotics: Science and Systems (6.141/16.405J)** *MIT*  
*TA (Spring 2018), Lead TA (Spring 2019):* Led hands-on labs involving the MIT Racecar for MIT's flagship robotics software course targeted to juniors and seniors. Gave lectures on software practices, coordinate transforms and autonomous exploration; designed the labs on wall following, line following, Monte Carlo localization and maze solving; designed software tools, including a Racecar simulator; these labs and tools are now also used at Harvey Mudd and the University of Pennsylvania.
- Fall 2018 **Mens et Manus (6.a01): Racecar Seminar** *MIT*  
*Co-Instructor:* Co-designed and co-taught a new freshman seminar introducing programming and robotics software with hands-on MIT Racecar labs. The first half-semester covered python, ROS and control; the second half covered vision and deep learning.
- Summer 2017 **Beaverworks Summer Institute: Autonomous Racecar Grand Prix** *MIT / Lincoln Laboratory*  
*TA:* Led hands-on robotics software labs for 40 high school juniors and seniors using the MIT Racecar platform. Labs covered python, ROS, control, vision, localization, and planning, culminating in an autonomous race combining the specialties. Designed the labs on line following and Monte Carlo localization.
- Spring 2016 **Mathematics for Computer Science (6.042)** *MIT*  
*LA:* Led 2 hour problem solving sessions 3 times per week. Topics spanned discrete math: proofs, sets, graphs, counting, probability, etc.

## Tutorials and Demonstrations

- 2019 **MIT Racecar Tutorial at ICRA** *Montreal, CA*  
*Co-Instructor:* Led a day-long interactive tutorial on the MIT Racecar platform. Approximately 20 participants entered with no knowledge of the platform and at the end of the day they had programmed their cars to complete an autonomous race. Built a cross-platform Docker image so participants could use ROS/rviz.
- 2018 **Demo of the Navion Visual Inertial Odometry Chip at the Symposium on VSLI Circuits** *Honolulu, HI*  
*Developer:* An MIT Racecar autonomously explored the conference space while using the Navion chip for localization. Augmented the Racecar hardware and software to interface with the chip.

## Awards

- 2020 Vice Chancellor's Inclusive Excellence Fellowship *MIT*
- 2020 First Place David Adler Memorial Thesis Award (Best EECS M.Eng. Thesis), [4] *MIT*
- 2019 Best Student Paper at the 22nd International Conference on Digital Audio Effects, [3] *Birmingham, UK*

## Publications

(Note that I publicly changed my name from Trevor to Theia in late 2019. The legal changes are not yet finalized.)

- [1] Theia Henderson, Vivienne Sze, and Sertac Karaman. "An efficient and continuous approach to information theoretic exploration". In: *The 2020 International Conference on Robotics and Automation (ICRA)*. IEEE. May 2020, pp. 8566–8572. URL: <https://ieeexplore.ieee.org/document/9196592>.
- [2] Zhengdong Zhang, Theia Henderson, Sertac Karaman, and Vivienne Sze. "FSMI: Fast computation of Shannon mutual information for information-theoretic mapping". In: *The International Journal of Robotics Research* 39.9 (2020), pp. 1155–1177. URL: <https://journals.sagepub.com/doi/abs/10.1177/0278364920921941>.
- [3] Trevor Henderson and Justin Solomon. "Audio transport: A generalized portamento via optimal transport". In: *The 22nd International Conference on Digital Audio Effects (DAFx)*. Sept. 2019. URL: [http://dafx.de/paper-archive/2019/DAFx2019\\_paper\\_56.pdf](http://dafx.de/paper-archive/2019/DAFx2019_paper_56.pdf).
- [4] Trevor Henderson. "A continuous approach to information-theoretic exploration with range sensors". M.Eng. Thesis. Massachusetts Institute of Technology, Aug. 2019. URL: <https://dspace.mit.edu/handle/1721.1/124248>.

- [5] Zhengdong Zhang, Trevor Henderson, Sertac Karaman, and Vivienne Sze. “FSMI: Fast computation of Shannon mutual information for information-theoretic mapping”. In: *The 2019 International Conference on Robotics and Automation (ICRA)*. IEEE. May 2019, pp. 6912–6918. URL: <https://ieeexplore.ieee.org/document/8793541>.
- [6] Trevor Henderson and Sébastien Canard. “Algorithms for Evaluating Nonlinear Functions Under Homomorphic Encryption”. Pre-print. Aug. 2016. URL: <https://tfh.mit.edu/publications/homomorphic.pdf>.

## Press

- [7] Rob Matheson. “Using math to blend musical notes seamlessly”. In: *MIT News* (2019). URL: <https://news.mit.edu/2019/math-portamento-music-0927>.

## Other Activities

2020	Volunteer for the Erika Uytterhoeven for State Representative Campaign	<i>Somerville, MA</i>
2020	Concert Series Organizer for the Bernie Sanders Campaign	<i>Somerville, MA</i>
2019-2020	Volunteer for the Bernie Sanders Campaign	<i>MA/NH</i>
2013-2018	Muralist, work presented at “Murals of Senior Haus”	<i>MIT</i>
Fall 2017	Photojournalism road trip; lived in car for 4 months.	<i>North America</i>
2014-2017	Radio host of “Story Time” and volunteer at the WMBR Radio Station	<i>MIT</i>
2017	Lead producer, “G-Funk Limericks: Volume 1” (hip-hop album)	<i>Cambridge, MA</i>
2016	Organist, “Imagination of the Charts: Jacob Collier at MIT”	<i>MIT</i>
2014	Score and sound design, “Delirium” (feature-length student film)	<i>Kings Park, NY</i>
2012-2013	Organist and choir director at the Grace Lutheran Church	<i>Uniondale, NY</i>