Thomas R Groechel

General — E-mail: groechel@usc.edu — Website: https://tgroechel.github.io/

Research Interests — Virtual and Augmented Reality for Human-Robot Interaction (VAM-HRI), Socially Assistive Robotics, Computer Science Education, Computational Modeling for HRI

Technical

Languages: C#, C++, Python, Javascript, R, Bash
Tools: Unity, Robot Operating System (ROS), RosSharp (ROS#), Mixed Reality Toolkit (MRTK), Jupyterlab (pandas, seaborn, sklearn)

Education

University of Southern California, Los Angeles, CA *July 2018 - Present*
- Ph.D. Computer Science: *Expected Dec 2022*
- Master's Computer Science: *Completed Aug 2021*
- Research Advisor: Professor Maja J. Matarić

University of Michigan, Ann Arbor, MI *Sep 2014 - May 2018*
- B.S.E. Computer Science: *Completed May 2018*
- Undergraduate Research Advisor: Professor Odest C. Jenkins

Experience

Ph.D. Researcher, USC Interaction Lab, Los Angeles, CA *July 2018 - Present*
- Created mixed reality robot tutor aiming to teach K-12 students coding through modeling student kinesthetic learning processes
- Developed and deployed telepresence robots in schools for home-bound students
- Supported month-long in-home deployments of robot tutor for students with Autism Spectrum Disorder

Robotics Software Intern, iRobot, Pasadena, CA *May 2021 - Aug 2021*
- Worked on robot behaviors framework
- Virtual internship

UG Researcher, UofM 4Progress Lab, Ann Arbor, MI *May 2016 - May 2018*
- Developed 2D SLAM algorithm using Iterative Closest Point visualization
- Implemented Stochastic Gradient Descent for loop closure based on *Fast Iterative Alignment of Pose Graphs with Poor Initial Estimates* (Olson et al.) using the Fetch

Staff Development Czar and TA, UofM, Ann Arbor, MI *Sep 2016 - May 2018*
- Created Staff Development program for teaching staff of 30 graduate and undergraduate TAs to improve teaching skills of new and returning staff members
- Structured 35-student lab session to review and teach concepts in a specialized alternative to traditional lecture, tailoring for active learning
- Produced class-specific help and tip videos to give students an extra resource to common issues in a newer format

Robotics Software Intern at TRACLabs, Houston, TX *Summer 2017*
- Adapted local mapping and navigation to move TRACBot, a mobile-manipulator, to maneuver dynamically through obstacles such as doors and people in order to reach/use items in Affordance Template library
- Refitted and rebuilt action server nodes into custom system to perform dynamic re-planning based on real time observations

Student Research Mentoring

Current Students

- İpek Göktan — Viterbi Fellow, USC SHINE Program, USC Computer Science
- Karen Ly — Merit Research Fellow, USC Computer Science
- Massimiliano Nigro — Politecnico di Milano Computer Science (MS)

Previous Students

- Chloe Kuo — Merit Research Fellow, USC Computer Science
- Julia Cordero — Merit Research Fellow, USC Computer Science
- Nisha Chatwani — Merit Research Fellow, USC Computer Science
- Adam Wathieu — Northwestern University Computer Science
- Karen Berba — Cal State LA Computer Science (MS)
- Daniel Ramirez — Cal State LA Computer Science
- Jenny Haemin Lee — USC Computer Science
- Radhika Agrawal — Merit Research Fellow, USC Computer Science
- Kartik Mahajan — Merit Research Fellow, USC Computer Science
- Roddur Dasgupta — USC Computer Science
- Annika Modi — USC SHINE Program, High School Student
- Jacob Zhi — USC SHINE Program, High School Student
- Roxanna Pakkar — Merit Research Fellow, USC Electrical Engineering
- Zhonghao Shi — USC Computer Science
- Mena Hassan — USC SHINE Program, High School Student
- Adnan Karim — SURE Student, University of Calgary Computer Science
- Ryan Stevenson — USC Computer Science Games
- Ashley Perez — USC SHINE Program, High School Student
- Bryan Pyo — USC SHINE Program, High School Student

Contributions to Grant Proposals

Amazon Research Awards - Learning User Preferences for In-Home Robots Through In Situ Augmented Reality

- Contributed significant ideas and content to proposal based upon ongoing Ph.D. work in learning SAR preferences using Mixed Reality
- Research grant awarded in Spring 2022

NSF NRI 2.0 - Communicate, Share, Adapt: A Mixed Reality Framework for Facilitating Robot Integration and Customization

- Contributed significant ideas and content to proposal based upon ongoing Ph.D. work in Mixed Reality SAR
- Research grant awarded in Fall 2019

K-12 Educational Outreach

MoveToCode: Pair Programming a Robot in Augmented Reality
John Mack Elementary & Monterey Hills Elementary School — *28 & 29 Apr 2022*

From High School to Robotics Research at USC Panel
USC Robotics Ed Week via Zoom — *6 Apr 2022*

PoseToCode: Embodied Learning for Coding
USC CS Ed Week via Zoom — *7 Dec 2021*

Virtual, Augmented, and Mixed Reality for Human-Robot Interaction
USC Robotics Ed Week via Zoom — *10 Apr 2021*

What is a Socially Assistive Robotics Ph.D.?
Temple City High School Robotics Team Talk via Zoom — *15 Nov 2020*

Microsoft TEALS Teaching Volunteer
Los Angeles Center for Enriched Studies, Los Angeles, CA — *July 2019 - June 2020*

Live Mixed Reality Demo and How it Applies to Socially Assistive Robotics
USC Remote Robotics Open House via Zoom — *19 May 2020*

USC Robotics Academy Judge
University of Southern California, Los Angeles, CA — *Dec 2018 & 2019, Apr 2019*

Robotics Family Night
Monterey Hills Elementary, Los Angeles, CA — *May 2019, Nov 2019*

The Help Group STEM^3 Academy Visit
STEM^3 Academy, Los Angeles, CA — *June 2019*

Mixed Reality and the Kuri Robot
USC Robotics Open House — *10 Apr 2019*

VEX Robotics Team Leader
Clifford Street Elementary, Los Angeles, CA — *Oct 2018 - Feb 2019*

Honors and Awards

USC Computer Science Best Research Assistant — *May 2022*
ASEE PSW Section Graduate Student Award — *May 2022*
National Science Foundation Travel Fellowship — *Nov 2021*
USC Viterbi Undergraduate Research Mentoring Award — *May 2021*
USC Viterbi Undergraduate Research Mentoring Award — *May 2020*
USC Computer Science Best Research Assistant — *May 2020*
USC Robotics George Bekey Service Award — *May 2019*

Publications and Abstracts

* Indicates Co-first Author

[1] **Thomas R. Groechel***, Allison O'Connell*, Massimiliano Nigro*, and Maja J. Matarić. "Reimagining RViz: Multidimensional Augmented Reality Robot Signal Design", Accepted in 2022 IEEE International Symposium on Robot and Human Interactive Communication (RO-MAN 2022), Aug-2022.

[2] Julia Cordero*, **Thomas R. Groechel*** and Maja J. Matarić. "A Review and Recommendations on Reporting Recruitment and Compensation Information in HRI Research Papers", Accepted in 2022 IEEE International Symposium on Robot and Human Interactive Communication (RO-MAN 2022), Aug-2022.

[3] Nisha Chatwani*, Chloe Kuo*, **Thomas R. Groechel*** and Maja J. Matarić. "PoseToCode: Exploring Design Considerations toward a Usable Block-Based Programming and Embodied Learning System", Accepted in the Fifteenth International Conference on Advances in Computer-Human Interactions (ACHI 2022), Porto, Portugal, Jun-2022.

[4] Adam Wathieu*, **Thomas R. Groechel***, Haemin Jenny Lee, Chloe Kuo, and Maja J. Matarić. "RE:BT-Espresso: Improving Interpretability and Expressivity ofBehavior Trees Learned from Robot Demonstrations", Accepted in *2022 IEEE International Conference on Robotics and Automation (ICRA 2022)*, Philadelphia, PA, May-2022.

[5] İpek Göktan*, Karen Ly*, **Thomas R. Groechel***, and Maja J. Matarić "Augmented Reality Appendages for Robots: Design Considerations and Recommendations for Maximizing Social and Functional Perception" In *Refereed ACM/IEEE International Conference on Human Robot Interaction (HRI) Workshop on Virtual, Augmented, and Mixed Reality for Human-Robot Interaction (VAM-HRI 2022)*, Virtual, Mar-2022.

[6] Julia R. Cordero*, **Thomas R. Groechel***, and Maja J. Matarić "What and How Are We Reporting in HRI? A Review and Recommendations for Reporting Recruitment, Compensation, and Gender" In *Refereed ACM/IEEE International Conference on Human Robot Interaction (HRI) Workshop on Fairness and Transparency in HRI: Algorithms, Methods, and Metrics*, Jan 2022

[7] Zhonghao Shi, **Thomas R. Groechel**, Shomik Jain, Kourtney Chima, Ognjen Rudovic, and Maja J. Matarić. "Toward Personalized Affect-Aware Socially Assistive Robot Tutors in Long-Term Interventions for Children with Autism." Accepted in *Transactions on Human-Robot Interaction* (THRI 2022).

[8] **Thomas R. Groechel***, Michael E. Walker*, Christine T. Chang, Eric Rosen, and Jessica Zosa Forde. "A Tool for Organizing Key Characteristics of Virtual, Augmented, and Mixed Reality for Human-Robot Interaction Systems: Synthesizing VAM-HRI Trends and Takeaways." Accepted in *IEEE Robotics and Automation Magazine* (2022).

[9] **Thomas R. Groechel** and Maja J. Matarić "Abstract: Improving Bidirectional Communication in Human-Robot Interaction Through Mixed Reality Modalities", Accepted in Robotics Gordon Research Seminar (Jan 2022)

[10] Christine T. Chang, Eric Rosen, **Thomas R. Groechel**, Michael Walker, Jessica Zosa Forde "Virtual, Augmented, and Mixed Reality for Human-Robot Interaction (VAM-HRI)", Accepted in *Companion of the 2022 ACM/IEEE International Conference on Human-Robot Interaction (Companion-HRI '21)*, Virtual, Mar-2022.

[11] Matthew Rueben, Mohammad Syed, Emily London, Mark Camarena, Eunsook Shin, Yulun Zhang, Timothy S. Wang, **Thomas R. Groechel**, Rhianna Lee, and Maja J. Matarić. "Long-Term, In-the-Wild Study of Feedback About Speech Intelligibility for K-12 Students Attending Class via a Telepresence Robot", In *23rd International Conference on Multimodal Interaction (ICMI)*, Montreal, Canada, Oct-2021.

[12] Zhonghao Shi, Manwei Cao, Sophia Pei, Xiaoyang Qiao, **Thomas R. Groechel** and Maja J. Matarić. "Personalized Affect-Aware Socially Assistive Robot Tutors Aimed at Fostering Social Grit in Children with Autism", In *Refereed Workshop ACM/IEEE International Conference on Human Robot Interaction (HRI) Workshop on Child-Robot Interaction and Child's Fundamental Rights.*, Mar-2021.

[13] **Thomas R. Groechel**, Roxanna Pakkar, Roddur Dasgupta, Chloe Kuo, Haemin Lee, Julia Cordero, Kartik Mahajan, and Maja J. Matarić "Kinesthetic Curiosity: Towards Personalized Embodied Learning with a Robot Tutor Teaching Programming in Mixed Reality", In *17th International Symposium on Experimental Robotics (ISER)*, Virtual, Mar-2021.

[14] Eric Rosen, **Thomas R. Groechel**, Micahel Walker, Christine T. Chang, Jessica Zosa Forde "Virtual, Augmented, and Mixed Reality for Human-Robot Interaction (VAM-HRI)", In *Companion of the 2021 ACM/IEEE International Conference on Human-Robot Interaction (Companion-HRI '21)*, Virtual, Mar-2021.

[15] Kartik Mahajan*, **Thomas R. Groechel***, Roxanna Pakkar, Julia Cordero, Haemin Lee, Maja J. Matarić "Adapting Usability Metrics for a Socially Assistive, Kinesthetic, Mixed Reality Robot Tutoring Environment", In *Proceedings of 2020 International Conference on Social Robotics (ICSR '20)*, Colorado, USA, Nov-2020. *Best Paper Award Finalist (5 nominated out of 113)*

[16] Naomi T. Fitter, Luke M. Rush, Elizabeth Cha, **Thomas R. Groechel**, Maja J. Matarić, and Leila Takayama "Closeness is Key over Long Distances: Effects of Interpersonal Closeness on Telepresence Experience", In *Proceedings of 2020 ACM/IEEE International Conference on Human Robot Interaction (HRI '20)*, Cambridge, UK, Mar-2020.

[17] Tom Williams, Daniel Szafir, Tathagata Chakraborti, Ong Soh Khim, Eric Rosen, Serena Booth, **Thomas R. Groechel**, "Virtual, Augmented, and Mixed Reality for Human-Robot Interaction (VAM-HRI)", In *Companion of the 2020 ACM/IEEE International Conference on Human-Robot Interaction (Companion-HRI '20)*, Cambridge, UK, Mar-2020.

[18] Matthew Rueben, **Thomas R. Groechel**, Yulun Zhang, Gisele Ragusa, Maja J. Matarić "Increasing Telepresence Robot Operator Awareness of Speaking Volume Appropriateness: Initial Model Development", In *Companion of the 2020 ACM/IEEE International Conference on Human-Robot Interaction (Companion-HRI '20)*, Cambridge, UK, Mar-2020.

[19] **Thomas R. Groechel**, Zhonghao Shi, Roxanna Pakkar, and Maja J. Matarić "Using Socially Expressive Mixed Reality Arms for Enhancing Low-Expressivity Robots", In *2019 IEEE International Symposium on Robot and Human Interactive Communication (RO-MAN '19)*, New Delhi, India, Oct-2019.
Robotics Society of Japan and Korean Robotics Society Distinguished Interdisciplinary Research Award Finalist (3 nominated out of 206)

Talks, Demos, and Presentations

Overview of Computer Science Capstone Course: Design and Construction of Large Software Systems
USC Viterbi Corporate Advisory Board Meeting *3 May 2022*

Visualizing Robot Capabilities using Augmented Reality: Designing with Co-Dependent Factors Poster
USC Viterbi Ph.D. Visit Day *3 Mar 2022*

Communicate, Share, Adapt: A Mixed Reality Framework for Facilitation Robot Integration and Customization Virtual Poster Presentation
NSF NRI 2.0 PI Meeting via Hopin *10 Mar 2021*

Guest Lecture: Online Features and Measures for K-12 Robot Computer Science Tutoring Through Mixed Reality Modalities
CSCI 699: Computational Human-Robot Interaction via Zoom *8 Mar 2021*

Robot Operating System (ROS) Tutorial and Demo
USC Makers Club via Zoom *4 Mar 2021*

Planning A Successful Summer Research Experience
USC Summer Research Program Talks via Zoom *1 June 2020*

Communicate, Share, Adapt: A Mixed Reality Framework for Facilitation Robot Integration and Customization Poster Presentation
NSF NRI 2.0 PI Meeting, Arlington, VA *27 Feb 2020*

Human-Robot Interaction & Socially Assistive Robots
Laguna Woods Village, Laguna Woods, CA *19 Feb 2020*

USC Robotics Visions & Voices: Emotionally Intelligent Robots Demo
University of Southern California, Los Angeles, CA *24 Oct 2019*

SAR Through Augmented Reality Extensions Demo and Discussion
Public Affairs Council, Laguna Beach, CA *8-9 Jan 2019*

Professional Service

Workshop Organizer
- "The Fifth International Workshop on Virtual, Augmented, and Mixed Reality for Human-Robot Interaction (VAM-HRI)", In *2022 ACM/IEEE International Conference on Human Robot Interaction (HRI '22)*
- "The Fourth International Workshop on Virtual, Augmented, and Mixed Reality for Human-Robot Interaction (VAM-HRI)", In *2021 ACM/IEEE International Conference on Human Robot Interaction (HRI '21)*
- "The Third International Workshop on Virtual, Augmented, and Mixed Reality for Human-Robot Interaction (VAM-HRI)", In *2020 ACM/IEEE International Conference on Human Robot Interaction (HRI '20)*

Reviewer
- International Conference on Robot Human Interactive Communication 2022
- Robotics: Science and Systems 2022

- Virtual, Augmented, and Mixed Reality for Human-Robot Interaction Workshop at HRI 2020, 2021, & 2022
- Transactions on Human-Robot Interaction 2021 & 2022
- International Conference on Human Robot Interaction 2021 & 2022
- Frontiers in Robotics and AI 2021
- International Conference on Development and Learning 2021
- International Conference on Intelligent Robots and Systems 2021
- International Conference on Robotics and Automation 2021
- International Conference on Social Robotics 2020
- Applied Sciences 2020
- Science Robotics 2018

Women in US Academic Research in Robotics Website *July 2019 - Present*
- Designed and implemented, under Prof. Matarić's supervision, an actively curated and monitored list of current women in US academic robotics research
- Link: `us-women-in-robotics-research.github.io`

MEDIA COVERAGE **Letting Robots Guide The Learning Experience** *Spring 21*
Daniel Druhora, Viterbi Magazine `https://magazine.viterbi.usc.edu/spring-2021/`

CERTIFICATION **USC Center for Excellence in Teaching's Future Faculty Teaching Institute**
USC, Los Angeles, CA *Jan 2020 - May 2020*