IVY X. HE

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RESEARCH SUMMARY

My research investigates how humans and robots establish shared understanding through multimodal behavior. I study how robots interpret human behavioral cues to guide decisions and actions, and how robot behavior and embodiment can support legible, expressive, and meaningful interaction.

EDUCATION

Brown University, Providence, RI — 2023–Present
Ph.D. Candidate (4th year) in Computer Science — *Advisor: Prof. S. Tellex | GPA: 4.00/4.00*

Carnegie Mellon University, Pittsburgh, PA — 2019–2023
B.Sc. in Mechanical Engineering, Additional Major in Robotics — *GPA: 3.91/4.00*

RESEARCH I: GROUNDING HUMAN CUES IN ROBOT DECISION-MAKING

FetchHound: Learning Social Attention from Human–Canine Interaction — 2026–Now
Embodied AI & Trustworthiness in HRI — *Advised by Prof. S. Tellex*

- Formulated social attention in collaborative object search as a learning problem: deciding when, where, and what to look at using the human partner's attention, where standard active perception only maximizes information gain.
- Developed a pipeline that reconstructs 3D gaze and joint attention from multi-camera human–canine search video and replays these patterns in a Unity simulation, generating clean gaze signals in place of noisy real gaze tracking.
- Trained closed-loop quadruped attention policies on the simulated views and gaze (PyTorch; MLP, LSTM, Transformer); preliminary results at an ICRA 2026 Workshop.

LEGS-POMDP: Language and Gesture Conditioned Object Search — 2024–2025
Multimodal Instruction Grounding in HRI — *Advised by Prof. S. Tellex*

- Designed a POMDP framework that fuses 3D gesture cones, language prompts, and visual grounding into a joint observation model for multimodal object search.
- Combined gesture + language input reached 89% success, outperforming either modality alone by over 18%.

HRI 2026 Full Paper; ICRA 2025 Late Breaking Results

UniTac: Whole-Robot Touch Sensing Without Tactile Sensors — 2024–2025
Tactile Sensing in HRI — *Advised by Profs. S. Sridhar & S. Tellex*

- Designed and implemented the HRI component: touch-driven interaction paradigms and robot behavior design.
- Built and evaluated interaction scenarios that use whole-body touch localization for expressive robot responses on quadruped and manipulator platforms.

Fu, W., Li, H., **He, I. X.**, *Tellex, S., & Sridhar, S. CVPR 2026 Sense of Space Workshop (***Outstanding Paper Award***); RSS 2025 HRCM Workshop*

Find It Like a Dog: Using Gesture to Improve Object Search — 2023–2024
HRI–Cognitive Science Research — *Advised by Profs. S. Tellex & D. Buchsbaum*

- Compared five pointing-vector representations of human intent and integrated gesture understanding into a POMDP-based object search framework.
- Showed that a combined arm-based vector significantly improves search accuracy; validated in real-robot experiments and a cross-species evaluation with domestic dogs.

Published at CogSci 2024; presented at the RSS 2024 TaskSpec Workshop

RESEARCH II: EXPRESSIVE AND LEGIBLE ROBOT BEHAVIOR

UMBRA: The Puppeteer with No Hands — Multi-Robot Shadow Art — 2026–Now
Expressive Embodiment & Multi-Robot Whole-Body Control — *Advised by Profs. A. Schulz & S. Tellex*

- Formulated multi-robot shadow art as projection-space whole-body control: posing general-purpose arms so the union of their full-body shadows renders a target silhouette, treating the entire articulated body as an expressive medium.
- Designed a solver that assigns image-space regions of the target to arms, runs staged gradient-free search (CMA-ES) per arm with joint refinement, and warm-starts from a library of past solutions; exceeds monolithic search's best accuracy with 3.8× fewer renders.
- Evaluated on UMBRA-Bench (562 silhouettes, mean IoU 0.771) and deployed on three physical SO-101 arms; in a 34-participant forced-choice study, viewers identified 85.8% of simulated and 68.8% of physically cast shadows (chance: 20%).

  Under review at ICRA 2027. Supported by the National Endowment for the Arts (NEA)

Social Environment for Autonomous Navigation 2.0 (SEAN 2.0) 2021–2023
Social Navigation & Simulation Research *Advised by Profs. H. Admoni & A. Steinfeld*

- Built and curated interactive social navigation scenarios in the SEAN simulator (ROS + Unity) using real-world pedestrian datasets.
- Designed dynamic restaurant environments and legibility metrics for evaluating robot behavior and interaction quality.

Related publications

Rajko, J., Iyengar, V., Merlin, M., **He, I.**, & Lennington, E. (2026). Choreographic and Improvisational Approaches to Interrogating Robotic Systems. *ACM MOCO 2026*.

Wang, K., **He, I.**, Li, J., Asadipour, A., & Sun, Y. (2024). Exploring Fungal Morphology Simulation and Dynamic Light Containment from a Graphics Generation Perspective. *SIGGRAPH Asia Art Papers*.

SERVICE & OUTREACH

Providence WaterFire Robot Activation Booth	Brown Booth Organizer	Aug. 2026
RoboBoston: 8th Annual Robot Block Party	Brown Booth Organizer	Sep. 2025
Conference for Research on Choreographic Interfaces 2025	Workshop Organizer	Jun. 2025
Point It Out: Using Gesture to Improve Object Search	Honors Thesis Mentor	2023–2024
ICRA 2026, RSS 2026, IROS 2025–26, ACM 2024	Reviewer	2024–2026
Bristol BookFest 2025	Speaker	2025
Veritas AI Fellowship: High School Research Program	Research Mentor	2023–Now
MindMatters: LLM-Powered Teen Wellness Support Platform	Technical Mentor	2025–Now
CMU Student Academic Success Center	Academic Coach	2020–2021

LEADERSHIP & INDUSTRY EXPERIENCE

Iris Lunar Rover: The First American University-Built Lunar Nano-Rover 2020–2023
Systems Integration & Creative Lead *CMU Space Robotics*

- Systematized Do-No-Harm test documentation (V&V Matrix, Corrective Action Plan, Deviation Report), performed FMEA, and led media, branding, and outreach.

PotBot: Autonomous Pothole Detection and Repair Robot 2022–2023
Lead Systems Engineer & Documentation Lead *CMU Robotics Major Capstone*

- Led system design and team coordination; fine-tuned a YOLOv5 pothole detector on a custom dataset.

Argo AI Summer 2022
Integration & Testing Engineer Intern *Pittsburgh, PA*

- Designed, ran, and analyzed a lidar probability-of-detection test; supported testing of radar, cameras, calibration, and cleaning systems.

RE2 Robotics Summer 2020
Mechanical Engineering Intern *Pittsburgh, PA*

- Compiled the initial release of user manuals; inspected and assembled prototype robot joints for testing.