John F. Morrow IV

ROBOTICS ENGINEERING PHD CANDIDATE

Oregon State University, Corvallis, OR

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***Creative, Precise, & Thorough**. John has a demonstrated ability for prototyping and delivering complex robotic systems and for succeeding within a variety of disciplines. Current work is on benchmarking robot hand designs for distal, in-hand manipulation and understanding human in-hand manipulation strategies.*

Education

PhD in Robotics Engineering
Corvallis, OR

OREGON STATE UNIVERSITY (OSU)
Expected Graduation: June 2022

- Topic: studying human object manipulation strategies using robot hands [5] and crafting metrics to quantify robot hand performance at in-hand manipulation [4, 8]

M.S. in Robotics Engineering
Corvallis, OR

OREGON STATE UNIVERSITY (OSU)
March 2018

- Topic: Direct 3D Printing of Elastomer Robots without Support [3, 2, 9].

B.S. in Robotics Engineering
Worcester, MA

MINOR IN ELECTRICAL AND COMPUTER ENGINEERING | WORCESTER POLYTECHNIC INSTITUTE (WPI)
May 2015

- Senior Project Topic: Improving Soft Pneumatic Actuator fingers through integration of soft sensors, position and force control, and rigid fingernails [6].

Research Experience

Studying Human Manipulation Strategies to Measure Robot Hand Design
OSU

ADVISORS: CINDY GRIMM AND RAVI BALASUBRAMANIAN
PhD Career

- Pinpointed control and design improvements to underactuated hands for manipulative tasks using human study experiments [5, 1].
- Developed metrics to quantitatively assess in-hand manipulation performance of robot hand designs: Asterisk Test (in-hand manipulation) [4, 8], and human-intuitive robot hand measurements to communicate graspable region of hand and actuation space [7].
- Assessed a robot hand's upper potential of versatile in-hand manipulation performance using the above metrics and human study design (to be published).

Open-source Software
OSU

ADVISORS: CINDY GRIMM AND RAVI BALASUBRAMANIAN AND KYLE NIEMEYER
PhD Career

- Github usage, used standard model: forked development repositories from upstream. Used pull-requests to modify upstream.
- *Mojograsp: Tools for Simulated Grasping & Manipulation* — Developing a suite of tools to simplify grasping and manipulation simulations in the Pybullet simulator. Integrated tools for implementing reinforcement learning. Primarily designed for lab-use.
- *ArUco-tool* — Developed a suite of tools to simplify ArUco code usage.

3D Printing Soft Robots
OSU

ADVISOR: YIGIT MENGUC
Masters Career

- Developed process to 3D print long-cure rubbers [2].
- Built prototype 3d printer system utilizing external hardware components with a custom g-code system.
- Demonstrated printing hollow bodied silicone robots with no support [3, 2, 9].

Closed Loop Control of Custom Soft Robot Actuators
WPI

ADVISOR: DMITRY BERENSON
Undergraduate Career

- Developed custom soft robotic gripper with embedded liquid metal sensors and fingernails in each finger [6].
- Presented project at Intel/Cornell Cup in 2015 (Team Soft Robot Hand). Won a first prize.

Research Interests

Robot hand design & actuation • Benchmarks for grasping & in-hand manipulation • Autonomous grasping & in-hand manipulation • Human grasping & in-hand manipulation strategies • Simulated grasping & in-hand manipulation • Human-in-the-loop control • Teleoperation & interface design • Systems engineering for robotics • Engineering/robotics pedagogy • Robotics policy

Teaching, Mentoring, & Management Experience ———————

Mentoring & Management of Research Projects *OSU*
ROBOTICS AND HUMAN CONTROLS SYSTEMS LAB *2017-Present*
- Managed and mentored masters and undergraduate students (30 students, cumulatively) across 4 lab projects during PhD work.
- Participated as mentor in REU program for 3 years — 10 students, cumulatively.
- Administrated research lab — ordering equipment, maintaining existing robotic systems, and managing students.
- Completed coursework in management: Engineering Project Management (IE 582) and Systems Engineering (IE 584) courses. Systems Engineering training is in Peter Checkland's Soft Systems Methodology.

Instructor, ME351: Introduction to Instrumentation *OSU*
DEPARTMENT OF MECHANICAL ENGINEERING *Fall 2020, Spring 2022*
- Organized and lectured course in Fall 2020 (120 students, in-person) and Spring 2022 (100 students, hybrid teaching but primarily in-person). In Fall 2020, reorganized lecture content.
- Managed a team of 3 graduate TAs and 3 undergraduate assistants.
- Communicated expectations and assignments to students.
- Effectively communicated complex topics to students about a field that is not in their discipline. I taught Mechanical Engineering students coding and electronics.

Graduate Assistant, ME351: Introduction to Instrumentation *OSU*
DEPARTMENT OF MECHANICAL ENGINEERING *2015-2019*
- Developed lab curriculum as graduate assistant - shifting labs from using National Instruments Labview to using Arduino UNO. Lab curriculum utilized strain gauges, accelerometers, basic computer vision techniques, time of flight, pid motor control, hardware and software filtering, and other basic sensors and techniques.
- Proctored lab sections, 20-30 students each.
- Head TA 2016-2019. Proctored 2 hour long lab sections. Managed group of 3 Teaching Assistants. Organized class projects.

Table Tennis Club President *OSU*
OREGON STATE SPORTS AND RECREATION DEPARTMENT *2017-2019*
- Grew club attendance from an average of 3 members per practice to an average of 15 members.
- Organized competitive team, held tryouts, organized local tournaments.
- Maintained club budget. Established yearly club sponsorships (Paddle Palace) and acquired 2 coaches for the team. Organized yearly fundraisers for club budget.
- Worked and thrived within OSU's bureaucratic administration for sport clubs. Grew club annual funding by 100% at end of tenure.

Other Relevant Experience ———————

WORKSHOPS/SYMPOSIUM PRESENTATIONS

2018	**Hands in the Real World,** IROS, on [5]	*Madrid*
2022	**NW Robotics Symposium,** on [4] and [7].	*Seattle*

POSITIONS

2012 - 2015	**Tour Guide,** Crimson Key	*WPI*
2013 - 2014	**Undergraduate Teaching Advisor,** Robotics Department	*WPI*

ACCOLADES

2018	**1st Prize, Best Poster** MIME Graduate Research Expo, Robotics Department	*OSU*
2018	**Best Paper Finalist** IEEE Robosoft Conference [9]	*OSU*
2015	**1st Prize** Team Soft Robot Hand — Intel/Cornell Cup	*WPI*

TECHNICAL SKILLS

Equipment: Advanced Arduino | Soldering | 3D printers | Pneumatics | Silicone Casting | Basic Tools
Training: Basic Machining | Laser Cutting | Basic Rheology | EGaIn Sensor Fabrication | Systems Thinking
Software: ROS | RTOS | SOLIDWORKS | Git | LINUX | Googling | Pybullet
Programming (Proficient): Python | C | Matlab | Julia | LaTeX | Gcode
Languages (Proficient): English (Fluent) | Russian | Latin
Relevant Hobbies: Custom Flashlights | Human Psychology | Interface Design

Publications

[1] Ammar Kothari, **Morrow, John**, Victoria Thrasher, Kadon Engle, Ravi Balasubramanian, and Cindy Grimm. Grasping objects big and small: Human heuristics relating grasp-type and object size. In *2018 IEEE International Conference on Robotics and Automation (ICRA)*. IEEE, 2018.

[2] **J. Morrow**, S. Hemleben, and Y. Menguc. Directly fabricating soft robotic actuators with an open-source 3-d printer. *IEEE Robotics and Automation Letters*, 2(1):277–281, Jan 2017.

[3] **John F. Morrow IV**. Direct 3d printing of silicone elastomer soft robots without support. Master's thesis, Oregon State University, Corvallis, OR, 2018.

[4] **Morrow, John**, Joshua Campbell, Ravi Balasubramanian, and Cindy Grimm. Benchmarking a robot hand's ability to translate objects using two fingers. *IEEE Robotics and Automation Letters*, 7(1):588–593, 2021.

[5] **Morrow, John**, Ammar Kothari, Yi Herng Ong, Nathan Harlan, Ravi Balasubramanian, and Cindy Grimm. Using human studies to analyze capabilities in underactuated and compliant hands in manipulation tasks. In *2018 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*. IEEE, 2018.

[6] **Morrow, John**, Hee-Sup Shin, Calder Phillips-Grafflin, Sung-Hwan Jang, Jacob Torrey, Riley Larkins, Steven Dang, Yong-Lae Park, and Dmitry Berenson. Improving soft pneumatic actuator fingers through integration of soft sensors, position and force control, and rigid fingernails. In *Robotics and Automation (ICRA), 2016 IEEE International Conference on*, pages 5024–5031. IEEE, 2016.

[7] [ARXIV] **Morrow, John**, Joshua Campbell, Nuha Nishat, Ravi Balasubramanian, and Cindy Grimm. Measuring a robot hand's graspable region using power and precision grasps, 2022.

[8] [IN REVIEW] **Morrow, John**, Joshua Campbell, Ravi Balasubramanian, and Cindy Grimm. Benchmarking planar rotation capabilities of robot hands. *IEEE Robotics and Automation Letters*, 2022.

[9] Osman Dogan Yirmibesoglu, **Morrow, John**, Stephanie Walker, Walker Gosrich, Reece Aidan Canizares, Hansung Kim, Uranbileg Daalkhaijav, Chloe Fleming, Callie Branyan, and Yigit Menguc. Direct 3d printing of silicone elastomer soft robots and their performance comparison with molded counterparts. In *Proceedings of the 2018 IEEE/RAS International Conference on Soft Robotics*. IEEE, April 2018.