Designing an Introductory HRI Course

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ABSTRACT

Human-robot interaction is now an established discipline. Dozens of HRI courses exist at universities worldwide, and some institutions even offer degrees in HRI. However, although many students are being taught HRI, there is no agreed-upon curriculum for an introductory HRI course. In this workshop, we aim to reach community consensus on what should be covered in such a course. Through interactive activities like panels, breakout discussions, and syllabus design, workshop participants will explore the many topics and pedagogical approaches for teaching HRI. They will then distill their findings into a single example introductory HRI curriculum targeted at undergraduates. Output from this workshop will include a short paper explaining this curriculum and an example syllabus that can be used and adapted by HRI educators.

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1 OVERVIEW

Human-robot interaction has established itself as an independent field of study, with a field-specific conference and journal. Some universities are even beginning to offer Masters and PhD degrees in HRI. Beyond that, dozens of stand-alone HRI courses are taught at universities around the world. In the last fifteen years, there have been published papers [4], workshops [1, 2], and journal special issues [3] discussing what should be taught about this very interdisciplinary field.

Despite these efforts, there is still no agreement on what comprises a well designed fundamental HRI course. Because there is no agreed-upon curriculum, educators are left to put together their own materials, and the content of one course may or may not overlap with the content of another. While educators should always be able to put their own spin on a course, it would help the field to have an idea of what the fundamentals of HRI are and how they could be taught.

In this workshop, we aim to reach community consensus on what should be covered in an introductory university course on HRI. Through panels, breakout groups, and discussions, we will probe the many approaches to teaching HRI and attempt to distill the core concepts that represent the most fundamental HRI knowledge. At the end of the workshop, we hope to produce a short paper describing an example HRI curriculum, as well as a syllabus that can serve as a model for future course development.

2 TOPICS

The workshop day is divided into two modules that address a different part of curriculum development.

Module 1: Needs, goals, and assessments. The first step is to identify the objectives and goals of an introductory HRI course. In this session, we will define the target audience, their needs, and the desired learning outcomes. We will also discuss how to design assessment methods for our stated outcomes, using various formats such as quizzes, projects, presentations, and portfolios. A panel of education and industry experts will describe their needs and expectations for HRI skills of recent graduates. We will apply Bloom's Taxonomy to ensure a hierarchy of learning objectives.

Output: List of learning outcomes, expected skills, and assessment tools.

Module 2: Topics and activities. In this session, we will focus on what happens inside the classroom. Participants will map out key topics, concepts, and skills they think should be included. We will discuss various teaching methods and activities (e.g., lectures, group work, projects, experiential learning), and identify their suitability for different learning goals. We will share knowledge about what tools and platforms (e.g., robots, simulators, and software) are available for teaching HRI. We will also discuss how HRI fits into other degree programs (like Computer Science, HCI, or Design) and identify what pre-requisites students are likely to need.

Output: Mapping of concepts, topics and skills that should be covered in a HRI course; example teaching activities.

3 PARTICIPANTS

This workshop will be most useful for those teaching HRI classes currently or in the future. This includes faculty at universities, postdocs, and students who want to continue to faculty jobs. Given

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the widespread interest, we anticipate about 40 attendees, though we will be able to accommodate any number by creating additional breakout groups. We will recruit participants using our website [1] and by emailing lists like HRI-announcement and robotics-worldwide.

4 DOCUMENTATION

The outputs described above will be collated in a curriculum planning document that will be shared publicly. All activities and assignments included in the document will be open for general use. The document will also include an example syllabus that can be used by any educator as the basis for their HRI class.

Initially these materials will be shared on the workshop website. If there is interest from workshop participants, we will explore publishing part or all of our outputs in a venue like SIGCSE or IEEE Robotics & Automation Magazine.

5 SCHEDULE

The half-day workshop will contain a variety of activities to share knowledge and spark discussion. A draft schedule is listed in Table 1.

Expert panel. Module 1 includes a panel of experts who will help contextualize and frame the discussion. Panelists will each present a short (5 minute) statement to provide their view on the session's topic, and then we will have a panel discussion including audience Q&A. The panel will include people with experience in both academia and industry to speak about what HRI skills and knowledge are important for students to have in their future careers.

Small group discussions/brainstorming. In each module, attendees will be randomly split into small (4-5 person) groups. This will give participants an opportunity to engage in discussions or brainstorming in a relatively low-stakes environment. We hope these small groups will also serve as a networking opportunity, particularly for more junior researchers.

Lightning presentations. People who submitted materials to the workshop will have a chance to present a brief summary of their work.

Closing and reflection. The final activity of the day will help participants reflect on what they learned during the workshop. At this time, we will also collect written materials to be collated into the workshop deliverables.

6 INVITED SPEAKERS

The following list of speakers have been confirmed their participation in our panel.

- Tony Belpaeme
- Carlotta Berry
- Wendy Ju
- Ana Paiva
- Matthias Scheutz

[1] https://sites.google.com/andrew.cmu.edu/hri-education-2024/

Module	Time	Activity
	2:00 PM	Welcome and scoping
Module 1: Needs & goals	2:10 PM	Module introduction
	2:20 PM	Panel
	3:00 PM	Small group brainstorming
	3:30 PM	Coffee break
Module 2: Topics & activities	4:00 PM	Lightning presentations
	4:30 PM	Module introduction
	5:00 PM	Small group brainstorming
	5:30 PM	Topic consolidation
	5:45 PM	Closing & reflection

Table 1: The workshop day is divided into modules that cover different topics. A range of interactive activities will keep participants engaged throughout the day.

7 SUBMISSIONS

We will invite submissions of 1–4 page papers that include a current or planned syllabus for an introductory HRI course. Submissions should include notes, comments, and insights on the course structure, content, and pedagogical strategies employed. Papers may cover (but are not limited to) core concepts and topics in HRI suitable for undergraduate education, teaching methodologies, practical exercises, or case studies enhancing HRI learning, and interdisciplinary approaches and their integration into HRI education.

8 ORGANIZERS

Henny Admoni

- *Current position*: Associate Professor, Carnegie Mellon University
- *Highest degree*: PhD in Computer Science, Yale University, 2016
- *Selected Awards*:
  - Habermann Career Development Chair, 2020–2023
  - RSS Early Career Spotlight, 2022
  - NSF CAREER award, 2020
- *Teaching Experience* (all at CMU):
  - Human-Robot Interaction (graduate), 2017–present
  - Intro to Human-Robot Interaction (undergraduate), 2018, 2020–present
  - Manipulation Algorithms (co-taught), 2016
- *Selected Academic Service*:
  - Organizing Committee, HRI 2018, 2020, 2021
  - Program Committee, HRI 2016–2022
  - IEEE-RAS Women in Engineering Committee, 2022–present

Dan Szafir

- *Current position*: Associate Professor, University of North Carolina at Chapel Hill
- *Highest degree*: PhD in Computer Science, University of Wisconsin, 2015
- *Selected Awards*:
  - Best Paper, HCII 2019 and HRI 2018
  - Forbes 30 Under 30: Science, 2017

  - NASA Early Career Faculty Award, 2016
- *Selected Teaching Experience*:
  - Human-Robot Interaction, UNC, 2021-2022
  - Virtual Reality and Game Development, UNC, 2022
  - Research Methods in Human-Robot Interaction, CU-Boulder, 2016–2019
- *Selected Academic Service*:
  - Organizing Committee, HRI 2017, 2020 and 2023
  - Associate Editor, THRI, 2021–present
  - Steering Committee Member for HRI, 2021–2022

Wafa Johal

- *Current position*: Senior Lecturer, University of Melbourne, Australia
- *Highest degree*: PhD in Applied Mathematics and Computer Sciences, University of Grenoble Alps, 2016
- *Selected Awards*:
  - Women in AI Award-Education in APAC Region, 2023
  - Southern Cross Visiting Fellowship, 2022
  - Early Career Research (GROW) Award, UNSW, 2021
- *Selected Teaching Experience*:
  - Artificial Intelligence, U Melbourne, 2022–present
  - Robotics Vision and Human-Robot Interaction, U New South Wales, 2019–2021
  - Image Formation, Image Processing and Feature Extraction, U New South Wales, 2019–2022
- *Selected Academic Service*:
  - Associate Editor, RA-L, 2020–present
  - Organizing Committee, ACII 2022, HRI 2021, AJCAI 2021, HAI 2020
  - Program Chair, HAI 2021 and 2022

Anara Sandygulova

- *Current position*: Associate Professor, Nazarbayev University, Kazakhstan
- *Highest degree*: PhD in Computer Science, University College Dublin, 2015
- *Selected Awards*:
  - Best Paper, HRI 2023
  - Best Demonstration, HRI 2020
  - Best LBR, HRI 2018 and 2016
- *Selected Teaching Experience*: (all at Nazarbayev University)
  - Research Methods, 2021–present
  - Human-Robot Interaction, 2017–present
  - Signals and Sensing with Lab, 2018–2021
- *Selected Academic Service*:
  - Area Chair, HRI 2021–2023
  - Student Volunteer Co-Chair, HRI 2023
  - Workshop Organizer, IDC 2021, HRI 2021, HRI 2019

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