

# 16-899D Special Topics: Principles of Human-Robot Interaction

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12 Units

*Monday/Wednesday 1.30PM – 2.50PM, NSH 3002, 17 August - 2 December*

This course focuses on the emerging field of human-robot interaction, bringing together research and application of methodology from robotics, human factors, human-computer interaction, interaction design, cognitive psychology, education and other fields to enable robots to have more natural and more rewarding interactions with humans throughout their spheres of functioning. This course is a combination of state-of-art reading and discussions, focused team exercises and problem-solving sessions in human-robot interaction, and a special team project resulting in the implementation of a human-robot interaction system. This project may be prototyped using your choice of robotic technological systems, and a specific systems will be made directly available to you: the Finch Robot platform.

This new area of inquiry brings together diverse areas of expertise, and so this course will include several guest lectures by top researchers in human factors and in education-psychology (University of Pittsburgh) as well as design, human-computer interaction, drama and robotics (Carnegie Mellon University).

Prerequisites: This is a graduate course intended for those considering serious research in human-robot interaction, with a special emphasis on robotic systems and technologies appropriate for such interaction systems. The course project may involve significant programming, and thus a solid mastery of computer programming languages is a prerequisite for this course as well as a solid understanding of research methodologies. The programming assignments will be team-based as part of the course project; thus, those with less than the required programming skills may consider this course but will need to team together with students who have more programming experience.

Text: There is no text for this course, although a number of textbook sections and many articles will be assigned and read as part of this course. Reading and responses to reading questions is an absolutely significant part of the work intended to be completed for this course.

Method of Evaluation: This course will be evaluated based on the following student responsibilities and deliverables:

- **In-class Participation:** This course is in-class intensive; we have expended considerable effort to line up an interesting set of guest speakers, and so an important class requirement is attendance of those guest speakers' presentations, followed by active discussions with the speakers. This is the most qualitative of all evaluation components, but I care about your ability to engage and probe the speakers; this enriches the class considerably.
- **Reading Assignments:** The readings for this course are diverse, including a sampling of works from design, cognitive psychology, HCI, computer science, robotics, etc. In many cases, the relevant reading is assigned to be done in time for a guest speaker's presentation, so that you can get the most out of the speakers' presentations. In other cases, the readings serve as a backdrop to in-class discussions. Doing the reading late, in either case, is not appropriate. For each reading, a simple set of questions will also be distributed, and answers to these questions are to be emailed to me before the class session begins. Answers should be generated individually- do not work in teams on these. These answers are graded on a pass/fail basis and demonstrate that you took the time to read the assignment. The answers cannot be turned in late or partly done; *partial*

- completion or late completion registers as a fail for that particular assignment. Please email me your answers in plain text, not as sophisticated attachments.*
- Group Semester-long Projects: This represents the majority of your out-of-class work for the semester. You will perform this work in teams of 2 to 4 (to be decided based on class size), consistent throughout the semester. After forming teams early in the class, each team will select a scenario and application for which they will design a human-robot interactive system to address issues of we will choose together. Each team will document their design and prototyping process, as described below. This abbreviated “process documentation” will exist on a web site to be designed by each team. In addition to the creation of the process documentation web site, each team will make two in-class presentations, and all projects will be featured in a final PHRI open house to be held at the end of the semester.

The final presentation and open house shall include a working prototype of the interaction system, which may or may not include audience participation. The range of possible *working prototypes* is very broad, from a wizard-behind-the-curtain mockup to a fully programmed interaction system. The intended form of the working prototype will be selected and approved early in the semester.

The web-based process documentation shall include:

- Problem statement and measures of success / evaluation criteria
- Design and User research results
- A study in form/morphology and material for the physical embodiment
- A study of interaction sequences / storyboarding
- Preliminary mockup evaluation results (base this on testing with classmates, friends)
- Open design and open source for final working prototype system
- Slides from both in-class presentations and final poster for the open house
- Bibliography of sources investigated/used for this inquiry

## Schedule

Wk	Date	Topic	Work Due
1	Mon 24 Aug	Course requirements Semester-long project remarks Course motivation	
1	Wed 26 Aug	First Foundations: Communication	<b>Burke, Barnlund</b>
2	Mon 31 Aug	Action and Embodiment	<b>Dourish</b>
2	Wed 2 Sep	Survey of Social Robotics	Fong
3	Mon 7 Sep	<b>Labor Day; HOLIDAY</b>	Illah out of town
3	Wed 9 Sep	HRI Today: case discussion Project statement quick talks	Robot Teammates /Nass <b>Draft Project Statement due</b>
4	Mon 14 Sep	HRI Today: case discussion	<b>Forlizzi/Elderly, question 2 only</b>
4	Wed 16 Sep	<b>Project Statement briefs</b>	Final Project Statement due
5	Mon 21 Sep	HRI as Design	<b>Carl DiSalvo: Chapter 2</b>
5	Wed 23 Sep	Design Patterns for HRI	<b>Kahn, Design Patterns</b>
6	Mon 28 Sep	Education and HRI: RASC	RASC (read only)
6	Wed 30 Sep	<b>Research Presentations</b>	
7	Mon 5 Oct	<b>Evaluation: Aaron Steinfeld (guest)</b>	<b>Steinfeld, Ethnography</b>
7	Wed 7 Oct	<b>Research Presentations</b> (continued)	
8	Mon 12 Oct	<b>Social Ethical Systems Issues</b>	<b>Sheridan</b>
8	Wed 14 Oct	PER: complete project case discussion	PER <b>PER-RASC comparison</b>
9	Mon 19 Oct	Group updates & rec's from Illah Mobot: complete project case discussion Mid-semester Grades sent out	Mid-term Course Reviews Mobot (Nourbakhsh)
9	Wed 21 Oct	<b>Keepon: Marek Michalowski</b>	<b>Michalowski/Keepon</b>
10	Mon 26 Oct	<b>Art and HRI: Ian Ingram (guest lecture)</b>	
10	Wed 28 Oct	<b>Project Status Presentations</b>	Bananas
11	Mon 2 Nov	<b>Project Status Presentations</b>	Salt & Pepper, InterruptBot
11	Wed 4 Nov	<b>Roboceptionist &amp; Grace: Reid Simmons</b>	<b>Simmons, Roboceptionist &amp; Grace (no study questions to be returned)</b>
12	Mon 9 Nov	HRI Today: case discussion	<b>Authenticity/Turkle</b>
12	Wed 11 Nov	Project open work time	
13	Mon 16 Nov	Robots and Theatre	<b>Brenda Laurel (Computers as Theatre)</b>
13	Wed 18 Nov	Project open work time	
14	Mon 23 Nov	Guest Lecture: Ian Ingram	
14	Wed 25 Nov	<b>Thanksgiving: Holiday</b>	
15	Mon 30 Nov	<b>Project Final Presentations</b>	
15	Wed 2 Dec	<b>Project Final Presentations</b>	

## Project

The first deliverable is a written **Project Statement** from your team that includes the following ingredients:

- Team member names
- Project name
- First draft of the problem statement (crisp description of the problem and solution)
- Measures of success: how will we determine how successful your project is at end?

You will also very informally describe your project topic to the class on the class period when you turn in your statement, both during Draft Due deadline and at the final due date.

The second deliverable is a **Research Presentation** from your team on an agreed-upon topic specialized within Human-Robot Interaction. You will read at least two published papers on the subject, then present a summary and critical analysis of the work in this area in class. Presentation details will be discussed in class.

The **Project Status Presentation** is a progress check mid-semester regarding your project. You will be asked to make a brief presentation regarding your current project status. Plan on 15 minutes of speaking and 15 minutes of Q&A, and plan to use the projector. This presentation should include:

- Tour of the web site in-progress, where the problem statement should be on-line and the studies in form and interaction design should *not* be empty. Bibliography should be populated as well.

- Explanation of what background research you have done thus far (similar products, similar design processes, journal articles, papers, interviews, etc.) and how this has shaped your design process.

- Description of plans for the rest of semester, and what you hope to unveil at semester's end.

The **Project Final Presentation** will be coordinated with all teams and with an open house. More details will be forthcoming.

## Reading List

*This is a partial list in-progress; do not forget to look on the website for web-downloadable readings.*

*A Grammar of Motives*, Burke. Introduction (pp. xv – xxiii), Substance (pp. 29 – 35).

“Communication: the context of change,” Barnlund. pp. 6 – 24.

*Humans and Automation: system design and research issues*, Sheridan. Chapter 1 (pp. 2-13, Introducing human factors), Chapter 2 (pp 23-27, AHS), Chapter 3 (pp 54-68, Analysis and design process), Chapter 6 (pp 115-129, Supervisory control), Chapter 9 (pp 163-181, Social issues of humans and automation).

“Fostering Common Ground in Human-Robot Interaction,” Kiesler.

*Where the Action Is, Foundations of embodied interaction*, Dourish. Chapter 1 (pp. 1-23, History of Interaction), Chapter 2(pp 40-53, Tangible computing), Chapter 4 (pp 99-126, Embodied Interaction).

“Interface Lessons for Fully and Semi-Autonomous Mobile Robots,” Steinfeld.

“The Mobot Museum Robot Installations: A Five Year Experiment...” Nourbakhsh et al.

Chapter 2: Agency. Carl DiSalvo’s PhD thesis, in progress.

“It’s just a Matter of Common Sense”: Ethnography as Invisible Work, Forsythe

“A Survey of Socially Interactive Robots: Concepts, Designs and Applications,” Fong et al.

“The Robotic Autonomy Mobile Robotics Course: Robot design, curriculum design and educational assessment,” Nourbakhsh et al.

“The Personal Exploration Rover: Educational assessment of a robotic exhibit for informal learning venues,” Nourbakhsh et al.

*Computer as Theater*, Laurel. Selection chapters, tbd, of this book.