Relational machines are technological artifacts that interact with people on an ongoing and extended basis to the benefit of its user. Sample applications include learning companions for children, assistive robots for the elderly, software agents that act as trainers or assistants, interactive game characters that engage in social relationships, or machines that cooperate with humans as members of human-robot teams. In these scenarios, the user interacts with the machine as a peer rather than as a tool. Furthermore, the social rapport between human and machine has positive impact on performance gains. This raises the question of how to design for a successful human-machine relationship over the long-term. What kinds of relationships can be established and maintained between humans and technological artifacts? How might one model such a relationship, reliably measure its important aspects, and modify them in order to create successful interactions over time? What kinds of relationships have been explored and how will they evolve in the future?

This course examines the issues, principles, and challenges toward building relational machines through a combination of studio-style design and critique along with lecture, lively discussion of course readings, and assignments. Insights from social psychology, human-computer interaction, and design will be examined, as well as how these ideas are manifest in a broad range of applications for software agents and robots. Student projects explore selected course themes in depth. There will be a final project due at the end of the semester.

Grading:

- Weekly written critiques of readings 25%
- Class participation / presentations 25%
- Term Project/Paper 50%

Weekly readings:

- 1-2 page critique or reaction to the readings:
  - What did you like about the ideas?
  - What did you not like about them?
  - Was it useful? Interesting?
  - How might the ideas inform your own work?
How do the readings relate to one another?

- Due at noon, the day before class meets

Readings can be downloaded from and your critiques can be posted to the course wiki: [http://wiki.media.mit.edu/bin/view/MAS965/WebHome](http://wiki.media.mit.edu/bin/view/MAS965/WebHome)

**Student participation/presentations:**

This class will be a combination of lecture/discussion with a project studio format. The first hour shall be comprised of review and discussion of course readings. The second hour will consist of in-class exercises to small design problems followed by short presentation and discussion.

- In-class exercises/presentations are intended to get you to work creatively with others in the class on a design concept, to share ideas, and to integrate ideas from the readings/discussion.
- Homework will be a larger or more in-depth version of the in-class exercise, and will also be presented in class. People can work in teams or alone.

Homework assignments must be posted to the course wiki: [http://wiki.media.mit.edu/bin/view/MAS965/WebHome](http://wiki.media.mit.edu/bin/view/MAS965/WebHome)

**Term Project:**

One goal of this course is to go through a full design cycle of a relational artifact. This includes developing a design concept of a relational artifact, getting feedback from focus groups, implementing technical aspects of it, evaluating those aspects, and possibly revising the design. A working demo at the end of the semester is ideal.

- If your research already involves building a relational artifact, you are welcome to use this course as a vehicle for furthering its design and realization.
- The term project can be a full design presentation summarizing the semester’s activities and final outcome and evaluation
- OR, you can propose a different project with approval from the instructor. For instance, you may want to write a conference-style paper on relational artifacts, or you may want to focus on implementing specific technical capability.

**Complete Reading List (actual readings will be posted each week)**

**Week 1**  
**Introduction: Design Considerations**


**Week 2**  
**Defining Relationships**


**Week 3**  
**Representing and manipulating relationships**


**Week 4**  
**Measuring relationships**


**Week 5**  
**Special Population interaction issues (elderly, children, dementia…)**


**Week 6**  
**Interactions with assistive and therapeutic agents**


**Week 7**  
**Spring Break**
Week 8  Interactions with machine teammates


Week 9  Interactions with learning companion and tutorial agents

S. Jackson, J. Kracik, E. Soloway “The design of guided learner-adaptable scaffolding in interactive learning environments”

Week 10 Interactions with trainers and assistant agents


Week 11 Interactions with wearable or ambient agents
McCarthy, C. E. and M. E. Pollack, A Plan-Based Personalized Cognitive Orthotic, 6th International Conference on AI Planning and Scheduling, Apr., 2002


Week 12 Interactions with entertainment agents


Week 13 Sponsor Week

Week 14 Final presentations
Extended Reading List (for further reference or for use in class presentations)

**Defining Relationships**


**Representing and Manipulating Relationships**


Pautler, D. (1998). A Computational Model of Social Perlocutions. COLING/ACL. (One of the few examples of a system that tries to reason deeply about the social effects of communicative actions.)


**Measuring Relationships**


*Designing for people (trust, persuasion, social interaction etc.)*


Breazeal, Cynthia. Designing Sociable Robots.


Breazeal, Cynthia. Designing Sociable Robots. Chapter 4: Designing Sociable Robots.

**Interaction and Healthcare Issues for the Elderly**


**Interaction with Eldercare Agents**


Interaction with Machine Teammates


Interaction with Assistive & Therapeutic technologies


Interaction with Wearable Agents
Pollack, M. E., Planning Technology for Intelligent Cognitive Orthotics, 6th International Conference on AI Planning and Scheduling, Apr., 2002


Interaction with Learning Companion and Tutorial Agents


Interaction with Trainers and Assistant Agents


Klein, J., Y. Moon, et al. (2002). "This Computer Responds to User Frustration: Theory, Design, Results, and Implications." Interacting with Computers 14: 119-140. (or any version of Jonathan’s work)

Interaction with Entertainment Agents & Synthetic Pets


H. Prendigner, M. Ishizuka “Evolving social relationships with animate characters”

B. MacNamee and P. Cunningham “Creating socially interactive non player characters: the μ-SIC system.”


Friedman, Batya, Peter H. Kahn Jr., Jennifer Hagman: Hardware companions?: what online AIBO discussion forums reveal about the human-robotic relationship. CHI 2003: 273-280