Course Description

Course topics:

This course provides both theoretical overview and hands on experience with autonomous expressive objects. Students will be presented with a range of topics including the design aspects and behavioral principles relevant for the development and implementation of expressive objects. The course will cover a variety of topics related to social intelligence and expressiveness of robotic objects. The course will cover known aspects of social expressive objects and the state-of-the-art approaches to building...
computational systems with this type of social ability.

Design Aspects:

1. **Tangible interfaces basic concepts to radical atoms:** From GUI through TUI to Radical. The motivations, visions that drive the tangible interaction community.
2. **Shape changing interfaces:** The Radical Atoms vision and Shape Changing Current trends and challenges
3. **New materials for interaction:** The role of materiality in interaction and specifically in shape changing, expressive. Cutting edge cases in the field exploring textiles, liquids, biological matter and more.
4. **Robot design methods - shape, movement and materiality:** Design process and considerations in developing a robotic object. Developing with interaction and movement design in mind.
5. **Skills used for course work:** Butter system for robotic object prototyping - building a robot, controlling using animations and WoZ tools; Dynamixel motors; and basic Blender - build project for Butter, rigging and exporting.

Behavioral principles:

1. **What is a robot:** Definition, humanoid robots; non-humanoid robots; Robots by functions (industrial, home use, autonomous cars, robots for education); Robots by populations (children, older adults, clinical populations, therapy); Robots by complexity (DoF, number of functions, speech, and language).
2. **Robot types:** Assistive, socially assistive, companion. The functions robots can fulfill to improve well-being; Adding social aspects to robots - why & how?; Verbal vs. nonverbal social aspects of a robot; Social functions of humanoid vs. non-humanoid robots.
3. **HRI & HHRI:** HRI research areas (understanding robot's intent, robots' acceptance, Robot as a social agent, disclosure of personal experience to robots, safety and robot proximity); HHRI research areas (Robots and groups, robots in conversations, robots regulating children's play, robots regulating human–human dynamics).
4. **Robot Ethics:** Criticism on social robots; using social robot aspects for taking advantage of
clinical populations; sex robots and the way they may affect human behavior; robots abuse; should we formally define robots as slaves?

5. **Non-humanoid robots**: Defining non-humanoid robots; Every-day objects as expressive non-humanoid robots; Abstract objects as expressive non-humanoid robots; Nonverbal cues for social interaction; Other emotional nonverbal cues; Expressive objects and non-humanoid robots, examples for variety of functions (Shimon, Travis, Vio, Kip, The Greeting machine)

6. **Robot’s and Human nature**: Humans tendency to anthropomrize the world around them;

Mirror neurons, robots, and empathy; Automatic social interpretation of abstract object’s gestures; Robots and attachment related effects; Robots and stereotypes; Bullying robots.

**Course details: Course program**

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and exploration

Core subjects
Non-humanoid robots (Hadas) New materials for interaction (Iddo)

6 Concept forming and exploration
Present first results and next experiment

Robot’s and Human nature (Hadas)

Core subjects
Robot design methods - shape, movement and materiality (Iddo)

7 Concept forming and exploration
Present results and three possible directions with next experiment

Core subjects
Robot Ethics (Hadas)

8 Concept development
Present concepts with initial related work and work plan

Robot design methods - shape, movement and materiality (Iddo)

9 Concept development
Present development and demos

Small group tutorials (Hadas & Iddo)

10 Concept development
Present development and study plan

Small group tutorials (Hadas & Iddo)

11 Final Crit
Present final prototype with initial trial results.
Course Goals

Course goals:

The students will gain knowledge of expressive objects. They will be presented with significant and cutting-edge work on designing expressive objects and evaluating the interaction with them. Students will develop their own expressive objects, test them in user studies, allowing them to acquire knowledge on the process and challenges of designing interaction with expressive objects. The course will provide students with tools for developing and assessing expressive objects in the future. Students’ final assignment would be in the format of a shot paper, prototype and video, which could be used as a ground for a short conference paper submission, media releases or exhibition.

Course structure:

The course will guide the students through the process of building and evaluating an expressive robotic object designed for studying a predefined research question. The process would be of rigorous iterations of prototyping, evaluating, and presenting progress on a weekly basis, including work in class and group tutorials. Frontal lectures will accompany this process, presenting concepts and cutting-edge work in the field, along with methods for developing and evaluating experiences with robotic objects.

Projects will be carried out in groups of three (predefined by the staff to assure skills diversity). In order to lower the barrier for creating expressive artifacts and experiences, the students will be presented with Butter – a robotic object prototyping tool used in the lab. Students will not be limited, but advised to use the platform.

The course will be constructed of three major parts: 1. Introduction – introducing the course outline and project brief, the tools that will be used, and familiarise the students with the main themes of the course (three meetings). 2. Concept forming and exploration – while gaining knowledge through lectures, students will develop a series of demos and rapid experiments which they will present and discuss in the class along with relevant related work (five meetings). 3. Concept development – Students will develop a final artifact or experience, along with an experiment for evaluation (four meetings).

The final meeting will be a critique including a presentation of the complete prototypes and an initial evaluation. After the last meeting, students will carry out the full evaluation and submit the final assignment and video.

Grading

Course requirements and grade components:

Course requirements:
1. Class attendance and participation
2. Reading the mandatory bibliographical material in preparation for class
3. Weekly presentations
4. Submission of a final paper
5. Submission of project video

**Grade composition:**

1. Class presentations (weekly basis) - 75% Criterias:
   - Understanding of the taught material and creating work within the context
   - Technical and design quality
   - Experimentation design
   - Enginuity
   - Rigure

2. Final paper - 20% Criterias:
   - Evaluation will be conducted based on the presentation of the motivation, the background, the design process and the evaluation.

3. Final video - 5% Criterias:
   - Concept enginuity
   - Engineering Design
   - Delivery in video

4. Weekly presentation: The students will be asked to present their progress, challenges and possible The weekly presentations will be in accordance with the stage of the project including relevant literature, technical progress, study design, evaluation, analysis and adjustments according to each evaluation.

**Final paper:** The students will submit a report elaborating the motivation for their idea, relevant background, design process and iterations based on user studies and the final expressive object and its evaluation.

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**Reading List**

**Detailed reading list:**

1. **Tangible interfaces basic concepts to radical atoms:**
   - Mandatory
   - Optional


2. Shape changing interfaces

Mandatory


Optional


3. New materials for interaction:

Optional


4. Robot design methods - shape, movement and materiality

Mandatory


Optional


Behavioral principles:

1. **What is a robot:**

Mandatory


5. **Robot types:**

Mandatory


6. **HRI & HHRI:**

Mandatory


7. Robot Ethics:
Mandatory

Bryson, J. J. (2010). Robots should be slaves. Close Engagements with Artificial Companions: Key social, psychological, ethical and design issues, 63-74.


8. Non-humanoid robots:
Mandatory


9. Robot’s and Human nature:
Mandatory


Additional reading


