Course program and reading list

Semester 3 Year 2023

School: Sammy Ofer School of Communications M.A.

MA Seminar

Lecturer:

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Course No.:	Course Type :	Weekly Hours :	Credit:
3685	Seminar	2	0

Course Requirements :	Group Code :	Language:
Final Exam	233368500	English

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 anthropormpise 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; Bulling robots.

Course details: Course program

Meeting	Theme	Details
1	Course introduction	Course structure and brief (Hadas and Iddo)
	Theoretical overview	What are robots (Hadas) Tangible interfaces basic concepts to radical atoms (Iddo)
2	Tools introduction	Hands on Butter introduction (Iddo)
	Theoretical overview	Robot types (Hadas)
3	Tools introduction	Presentation of first prototype Hands on Blender introduction (Iddo)
	Theoretical overview	HRI & HHRI (Hadas)
4	Kick-of exploration stage	Presentation of animated prototypes Introduction to experimentation stage and quick user studies methodology (Hadas & Iddo)
	Core subjects	Shape changing interfaces (Iddo)
5	Concept forming	Present plan for first experiment

	and exploration	
	Core subjects	Non-humanoid robots (Hadas) New materials for interaction (Iddo)
6	Concept forming and exploration	Present first results and next experiment
	Core subjects	Robot's and Human nature (Hadas) 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 critiqueincluding 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.

Reading List

Detailed reading list:

1. Tangible interfaces basic concepts to radical atoms:

Mandatory

Ishii, H., Lakatos, D., Bonanni, L., & Labrune, J. B. (2012). Radical atoms: beyond tangible bits, toward transformable materials. *interactions*, *19*(1), 38–51.

Optional

Ishii, H., & Ullmer, B. (1997, March). Tangible bits: towards seamless interfaces between people, bits and atoms. In *Proceedings of the ACM SIGCHI Conference on Human factors in computing systems* (pp. 234-241). ACM.

Underkoffler, J., & Ishii, H. (1999, May). Urp: a luminous-tangible workbench for urban planning and design. In *Proceedings of the SIGCHI conference on Human Factors in Computing Systems* (pp. 386-393). ACM.

2. Shape changing interfaces

Mandatory

Alexander, J., Roudaut, A., Steimle, J., Hornbæk, K., Bruns Alonso, M., Follmer, S., & Merritt, T. (2018, April). Grand Challenges in Shape-Changing Interface Research. In *Proceedings of the 2018 CHI Conference on Human Factors in Computing Systems* (p. 299). ACM.

Kim, H., Coutrix, C., & Roudaut, A. (2018, April). Morphees+: Studying Everyday Reconfigurable Objects for the Design and Taxonomy of Reconfigurable UIs. In *Proceedings of the 2018 CHI Conference on Human Factors in Computing Systems* (p. 619). ACM.

Optional

Ishii, H., Leithinger, D., Follmer, S., Zoran, A., Schoessler, P., & Counts, J. (2015, April). Transform: Embodiment of radical atoms at milano design week. In *Proceedings of the 33rd Annual ACM Conference Extended Abstracts on Human Factors in Computing Systems* (pp. 687-694). ACM.

Hardy, J., Weichel, C., Taher, F., Vidler, J., & Alexander, J. (2015, April). ShapeClip: towards rapid prototyping with shape-changing displays for designers. In *Proceedings of the 33rd Annual ACM Conference on Human Factors in Computing Systems*(pp. 19-28). ACM.

Le Goc, M., Kim, L. H., Parsaei, A., Fekete, J. D., Dragicevic, P., & Follmer, S. (2016, October). Zooids: Building blocks for swarm user interfaces. In*Proceedings of the 29th Annual Symposium on User Interface Software and Technology* (pp. 97-109). ACM. Grönvall, E., Kinch, S., Petersen, M. G., & Rasmussen, M. K. (2014, April). Causing commotion with a shape-changing bench: experiencing shape-changing interfaces in use. In *Proceedings of the 32nd annual ACM conference on Human factors in computing systems* (pp. 2559-2568). ACM.

3. New materials for interaction:

Optional

Yao, L., Niiyama, R., Ou, J., Follmer, S., Della Silva, C., & Ishii, H. (2013, October). PneUI: pneumatically actuated soft composite materials for shape changing interfaces. In *Proceedings of the 26th annual ACM symposium on User interface software and technology* (pp. 13-22). ACM.

Yao, L., Ou, J., Cheng, C. Y., Steiner, H., Wang, W., Wang, G., & Ishii, H. (2015, April). BioLogic: natto cells as nanoactuators for shape changing interfaces. In*Proceedings of the 33rd Annual ACM Conference on Human Factors in Computing Systems*(pp. 1–10). ACM.

Dierk, C., Sterman, S., Nicholas, M. J. P., & Paulos, E. (2018, March). HäirIÖ: Human hair as interactive material. In *Proceedings of the Twelfth International Conference on Tangible, Embedded, and Embodied Interaction* (pp. 148-157). ACM.

Du, J., Markopoulos, P., Wang, Q., Toeters, M., & Gong, T. (2018, March). ShapeTex: Implementing shape-changing structures in fabric for wearable actuation. In*Proceedings of the Twelfth International Conference on Tangible, Embedded, and Embodied Interaction* (pp. 166–176). ACM.

Wald, I., Orlev, Y., Grishko, A., & Zuckerman, O. (2017, June). Animating Matter: Creating Organic-like Movement in Soft Materials. In*Proceedings of the 2017 ACM Conference Companion Publication on Designing Interactive Systems* (pp. 84–89). ACM.

4. Robot design methods - shape, movement and materiality

Mandatory

Anderson-Bashan, L., Megidish, B., Erel, H., Wald, I., Hoffman, G., Zuckerman, O., & Grishko, A. (2018, August). The Greeting Machine: An Abstract Robotic Object for Opening Encounters. In*2018 27th IEEE International Symposium on Robot and Human Interactive Communication (RO-MAN)* (pp. 595-602). IEEE.

Sirkin, D., Mok, B., Yang, S., & Ju, W. (2015, March). Mechanical ottoman: how robotic furniture offers and withdraws support. In *Proceedings of the Tenth Annual ACM/IEEE International Conference on Human-Robot Interaction* (pp. 11–18). ACM.

Jung, J., Bae, S. H., Lee, J. H., & Kim, M. S. (2013, April). Make it move: a movement design method of simple standing products based on systematic mapping of torso movements & product messages. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems* (pp. 1279–1288). ACM.

Optional

Nowacka, D., Wolf, K., Costanza, E., & Kirk, D. (2018, March). Working with an Autonomous Interface: Exploring the Output Space of an Interactive Desktop Lamp. In *Proceedings of the Twelfth International Conference on Tangible, Embedded, and Embodied Interaction* (pp. 1–10). ACM.

Hoffman, G., Zuckerman, O., Hirschberger, G., Luria, M., & Shani Sherman, T. (2015, March). Design and evaluation of a peripheral robotic conversation companion. In *Proceedings of the Tenth Annual ACM/IEEE International Conference on Human-Robot Interaction* (pp. 3–10). ACM.

Luria, M., Hoffman, G., Megidish, B., Zuckerman, O., & Park, S. (2016, August). Designing Vyo, a robotic Smart Home assistant: Bridging the gap between device and social agent. In

Robot and Human Interactive Communication (RO-MAN), 2016 25th IEEE International Symposium on (pp. 1019-1025). IEEE.

Norman, D. (2013). *The design of everyday things: Revised and expanded edition*. Constellation.

Behavioral principles:

1. **What is a robot:**

Mandatory

Kerstin Dautenhahn. 2007. Methodology & themes of human-robot interaction: A growing research field. *International Journal of Advanced Robotic Systems,* 4, 103-108.

Brian R Duffy. 2003. Anthropomorphism and the social robot. *Robotics and autonomous systems,* 42, 177–190.

Breazeal, C. (2003). Toward sociable robots. Robotics and autonomous systems, 42, 167-175.

5. Robot types:

Mandatory

Heerink, M., Kröse, B., Evers, V., & Wielinga, B. (2010). Assessing acceptance of assistive social agent technology by older adults: the almere model. International journal of social robotics, 2(4), 361-375.

Fumihide Tanaka and Madhumita Ghosh. 2011. The implementation of care-receiving robot at an English learning school for children. In Proceedings of the 6th international conference on Human-robot interaction.

ACM, 265–266.

Bartneck, C., & Forlizzi, J. (2004, September). A design-centred framework for social human-robot interaction. In Robot and Human Interactive Communication, 2004. ROMAN 2004. 13th IEEE International Workshop on (pp. 591-594). IEEE.

6. HRI & HHRI:

Mandatory

Sebanz et al., "Joint action: bodies and minds moving together" TICS, 2006.

Shah et al., "Improved human-robot team performance using Chaski, a human-inspired plan execution system" HRI 2011.

Birnbaum, G. E., Mizrahi, M., Hoffman, G., Reis, H. T., Finkel, E. J., & Sass, O. (2016). What robots can teach us about intimacy: The reassuring effects of robot responsiveness to human disclosure. Computers in Human Behavior, 63, 416-423.

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.

Scheutz, M., & Arnold, T. (2016, March). Are we ready for sex robots?. In The Eleventh ACM/IEEE International Conference on Human Robot Interaction (pp. 351–358). IEEE Press.

8. Non-humanoid robots:

Mandatory

Fritz Heider and Marianne Simmel. 1944. An experimental study of apparent behavior. *The American journal of psychology,* 57, 243–259.

Yang, S., Mok, B. K. J., Sirkin, D., Ive, H. P., Maheshwari, R., Fischer, K., & Ju, W. (2015, August). Experiences developing socially acceptable interactions for a robotic trash barrel. In Robot and Human Interactive Communication (RO-MAN), 2015 24th IEEE International Symposium on (pp. 277-284). IEEE.

Anderson-Bashan, L., Megidish, B., Erel, H., Wald, I., Hoffman, G., Zuckerman, O., & Grishko,

1. (2018, August). The Greeting Machine: An Abstract Robotic Object for Opening Encounters. In 2018 27th IEEE International Symposium on Robot and Human Interactive Communication (RO-MAN) (pp. 595-602). IEEE.

9. Robot's and Human nature:

Mandatory

Heider, F., & Simmel, M. (1944). An experimental study of apparent behavior. The American journal of psychology, 57, 243-259.

Gazzola, V., Rizzolatti, G., Wicker, B., & Keysers, C. (2007). The anthropomorphic brain: the mirror neuron system responds to human and robotic actions. Neuroimage, 35, 1674-1684.

Additional reading

Fong, T., Nourbakhsh, I., & Dautenhahn, K. (2003). A survey of socially interactive robots. Robotics and autonomous systems, 42(3-4), 143-166.Breazeal, C. (2009). Role of expressive behaviour for robots that learn from people. *Philosophical Transactions of the Royal Society of London B: Biological Sciences,* 364, 3527-3538.

Boden, M., Bryson, J., Caldwell, D., Dautenhahn, K., Edwards, L., Kember, S., ... & Sorrell, T. (2017). Principles of robotics: regulating robots in the real world. *Connection Science,* 29, 124-129.

Robins, B., Dautenhahn, K., & Dubowski, J. (2006). Does appearance matter in the interaction of children with autism with a humanoid robot?. *Interaction studies,* 7, 479-512.

Kidd, C. D., & Breazeal, C. (2008, September). Robots at home: Understanding long-term human-robot interaction. In Intelligent Robots and Systems, 2008. IROS 2008. IEEE/RSJ International Conference on (pp. 3230-3235). IEEE.

Gockley, R., Forlizzi, J., & Simmons, R. (2007, March). Natural person-following behavior for social robots. In Proceedings of the ACM/IEEE international conference on Human-robot interaction (pp. 17-24). ACM.

Young, J. E., Hawkins, R., Sharlin, E., & Igarashi, T. (2009). Toward acceptable domestic robots: Applying insights from social psychology. *International Journal of Social Robotics,*1, 95.

Shamay-Tsoory, S. G. (2011). The neural bases for empathy. The Neuroscientist, 17(1), 18-24. Mutlu, B., Shiwa, T., Kanda, T., Ishiguro, H., & Hagita, N. (2009, March). Footing in human-robot conversations: how robots might shape participant roles using gaze cues. In Proceedings of the 4th ACM/IEEE international conference on Human robot interaction (pp. 61-68). ACM.

Hoffman, G., Birnbaum, G. E., Vanunu, K., Sass, O., & Reis, H. T. (2014, March). Robot responsiveness to human disclosure affects social impression and appeal. In Proceedings of the 2014 ACM/IEEE international conference on Human-robot interaction (pp. 1-8). ACM. Gallese and Goldman, "Mirror Neurons and the Simulation Theory of Mind-reading", TICS 1998. Okamura, et al., "Medical and Health-care robotics: achievements and opportunities", IEEE Robotics and Automation Magazine, 2010.

Chidambaram, V., Chiang, Y. H., & Mutlu, B. (2012, March). Designing persuasive robots: how robots might persuade people using vocal and nonverbal cues. In Proceedings of the seventh annual ACM/IEEE international conference on Human-Robot Interaction (pp. 293-300). ACM. Harris, J., & Sharlin, E. (2011, July). Exploring the affect of abstract motion in social human-robot interaction. In *RO-MAN, 2011 IEEE* (pp. 441-448). I