Affect and Embodiment in HRI

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ABSTRACT

Both affect and embodiment have enormous importance for the field of HRI, which is increasingly interested in how the manifestation of the forms of robot embodiment influences the emotional state of the user. Designing and evaluating the affectivity of the robot body has become a frontier topic in HRI. To date, this is one of the few HRI workshops dedicated to affective robotics, and we propose three objectives: to identify relevant questions for the design of robotic bodies with high affective qualities; to consider cross-currents in ethical, philosophical, and methodological questions in studying emotional relations between humans and robots; and to foster synergies among designers, engineers, and social scientists in affective robotics.

CCS CONCEPTS

• **Hardware → Sensors and actuators; Tactile and hand-based interfaces; Haptic devices** • **Computer systems organization → External interfaces for robotics**.

KEYWORDS

Affect, Embodiment, Emotion, Design, Touch, Relationships.

1 INTRODUCTION

As HRI becomes interested in how the manifestation of the forms of robot embodiment influences the emotional state of the user, affect and embodiment have become prominent areas of inquiry. The physicality of robotic systems is therefore a crucial factor for user interactions in shared spaces.

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This recognition of machinic corporeality shares theoretical affinities with recent interests in the humanities and social sciences, of the centrality of embodiment. In the cognitive sciences and philosophy, the body has long been regarded with suspicion, but recent theories of embodied, extended, enactive, or ecological (4E) cognition, for example, have meant a renewed significance for the body as the locus of perception and action, inseparable from memory, learning, and reasoning activity.

Meanwhile, embodiment is a factor in the formation of social and emotional relationships, with the 'Affective Turn' in the social sciences recognizing the role of embodiment in the production of intersubjective experiences. As such, it problematizes traditional boundaries between sensations and affects, or cognitive and visceral experiences.

Designing and evaluating the affectivity of the robot body has become a frontier topic in HRI, with previous studies [1,2] emphasizing the importance of robot embodiment for human-robot communication. In particular, there is growing interest in how the tactile, haptic materiality of the robot mediates users' affective and emotional states.

2 BACKGROUND

Several previous HRI workshops and papers have focused on topics relevant to this workshop. The inaugural HRI conference in 2006 featured a keynote from Clifford Nass titled, 'Every body is somebody: The psychology and design of embodiment' [3], which questioned how robot embodiment affected users' conception of, and response to, robots. At HRI'19, Yuhan Hu and Guy Hoffman's paper, 'Using Skin Texture Change to Design Emotion Expression in Robots' [4], evaluated the capacity of skin texture change in a robot to affect users' emotions. Rather than rely on a robot's gestures or facial movements to express internal states, the researchers developed an emotionally expressive robot that communicates using dynamically changing skin textures (e.g. goosebumps and spikes). The study revealed that touch is a promising design channel for human-robot communication. Also at HRI'19, Samantha Reig et al.'s 'Leveraging Robot Embodiment to Facilitate Trust and Smoothness' [5], sought to understand the role of robot embodiment in social interactions, in particular how robot embodiment influences users' trust and comfort. Laura Hoffman and Nikolai Bock's 2018 paper, 'The Peculiarities of Robot Embodiment (EmCorp-Scale)' [6], emphasized that users'

perceptions of an artificial entity's physical capabilities were thoroughly influenced by robot embodiment.

To date, there have been two prior HRI workshops relevant to this topic: (1) 'Applications for Emotional Robots' (HRI'14) [7]; and (2) 'Advances in Tactile Sensing and Touch HRI' (HRI'12) [8]. Ours is the first HRI workshop to explicitly focus on the relationship between affect and embodiment in HRI, and to fully integrate knowledge of embodiment and affect from both design and the social sciences and humanities in HRI.

3 OBJECTIVES AND TOPICS OF INTEREST

We propose three objectives: to identify relevant questions for the design of robotic bodies with high affective qualities; to consider cross-currents in ethical, philosophical, and methodological questions in studying emotional relations between humans and robots; to foster synergies among designers, engineers, and social scientists in affective robotics. Topics of interest include, but are not limited to:

- Current challenges in designing affective physical embodiment in robots—materials, kinesthetics, sensory experience, and behaviors enabled by affective computing

- Determining a user's emotional needs within an interaction and how those needs are met by the machine

- Novel affective experiences afforded by interaction with robots or smart material embodiment

- Developing theoretical frameworks and social science methodologies for evaluating affect and embodiment in human-robot interactions

4 WORKSHOP ORGANIZATION

4.1 Organizers

Caroline Yan Zheng is a PhD candidate and visiting lecturer with Information Experience Design, Royal College of Art, London. She founded Affective Futures, an initiative for interdisciplinary participants to propose, probe and prototype the futures of our emotional life with technologies and robots. In collaboration with the Institute of Cancer Research UK and Imperial College London, her current design research focuses on creating simulated affective touch using soft robotic interfaces and exploring its applications in improving patient experience.

Dr Cherie Lacey is a lecturer in Media Studies at Victoria University of Wellington. Her research explores the ways in which the design of smart technologies mediates relationships, emotions, and affects. Cherie has published in the areas of data privacy and ethics, robot design, digital wellbeing, and user subjectivity, and is a member of *Mataora: Encounters between Medicine and the Arts*—a research group that explores health and wellbeing from creative and clinical perspectives.

Dr Mark Paterson is Assistant Professor in Sociology at the University of Pittsburgh and is contracted with Routledge to write *Animal Automata and Lifelike Machines: Robots, Replicants and Companion Species.* He is author of several books *including The Senses of Touch: Haptics, Affects and Technologies* (2007) and *Movement, Measurement, Sensation: How We Became Sensory-Motor* (Forthcoming, University of Minnesota Press). He is Vice-President of International Sociology Assoc. Thematic Group 'Senses and Society' and serves on the Editorial Boards of *The Senses and Society* and *Emotion, Space and Society.*

4.2 Workshop Preparation

The workshop includes three types of contributions: full papers, ignite talks, and participatory activities. Our CFP is published on our workshop website https://sites.google.com/view/affect-and-embodiment-hri/ and is circulated among our networks. Full papers are 4000-4500 words and allotted 15 minutes for presentation, and six ignite talks are 1800-2000 words for 5-10 minute presentations. Papers should be submitted in MS Word to affectandembodimenthri@gmail.com.

The workshop also includes two interactive, participatory activities. The first is a 'Mapping and Clustering' exercise based on co-design methods. The second is a round-table discussion with themed questions. Developed papers from the workshop will be collected and published in a journal special issue such as *Body & Society, International Journal of Social Robotcs,* or *The Senses and Society.*

REFERENCES

[1] Andreasson, R., Alenljung, B., Billing, E. et al. 2018. Affective Touch in Human–Robot Interaction: Conveying Emotion to the Nao Robot. Int J of Soc Robotics 10(4): 473-491. DOI: https://doi.org/10.1007/s12369-017-0446-3.

[2] Ventre-Dominey, J., Gibert, G., Bosse-Platiere, M. *et al.* (2019) Embodiment into a robot increases its acceptability. *Nature Sci Rep* **9,** 10083: 1-10. doi:10.1038/s41598-019-46528-7

[3] Clifford Nass. 2006. Every body is somebody: The psychology and design of embodiment. In Proceedings of the 1st ACM SIGCHI/SIGART conference on Human-robot interaction (HRI '06). ACM, New York, NY, USA, 2-2. DOI: https://doi.org/10.1145/1121241.1121243

[4] Y. Hu and G. Hoffman Using Skin Texture Change to Design Emotion Expression in Social Robots. *2019 14th ACM/IEEE International Conference on Human-Robot Interaction (HRI)*, Daegu, Korea (South), 2019, pp. 2-10. doi: 10.1109/HRI.2019.8673012

[5] S. Reig, J. Forlizzi and A. Steinfeld. Leveraging Robot Embodiment to Facilitate Trust and Smoothness. *2019 14th ACM/IEEE International Conference on Human-Robot Interaction (HRI)*, Daegu, Korea (South), 2019, pp. 742-744. DOI: 10.1109/HRI.2019.8673226

[6] Hoffmann, Laura & Bock, Nikolai & Rosenthal-von der Pütten, Astrid Marieke. (2018). The Peculiarities of Robot Embodiment (EmCorp-Scale): Development, Validation and Initial Test of the Embodiment and Corporeality of Artificial Agents Scale. 370-378. 10.1145/3171221.3171242.

[7] Oliver Damm, Frank Hegel, Karoline Malchus, Britta Wrede, and Manja Lohse. 2013. Applications for emotional robots. In Proceedings of the 8th ACM/IEEE international conference on Human-robot interaction (HRI '13). IEEE Press, Piscataway, NJ, USA, 441-442.

[8] Giorgio Cannata, Fulvio Mastrogiovanni, Giorgio Metta, and Lorenzo Natale. 2012. Advances in tactile sensing and touch based human-robot interaction. In Proceedings of the seventh annual ACM/IEEE international conference on Human-Robot Interaction (HRI '12). ACM, New York, NY, USA, 489-490. DOI: https://doi.org/10.1145/2157689.2157844