Reconfiguring Affect and Emotion in HRI: an Ethnographic Approach

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Abstract— As a part of the broader scientific 'turn to affect', HRI scholars are turning their attention towards the concepts of affect and emotion. In line with the positivist paradigm, the methodological approach commonly adopted is quantitative psychological laboratory studies. These studies aim to develop 'emotionally intelligent' robots, capable of both apprehending human emotional expression as well as conveying appropriate emotional expressions themselves. As the application areas of robots are increasing, there is a need to extend the amount of qualitative work in HRI to understand the mutual shaping of robots and humans in a specific social and cultural context. While ethnography has, to a small extent, been applied within HRI, what is still lacking are ethnographic studies that focus specifically on the role of affect and emotion. This paper will discuss the potential of making use of an ethnographic approach in reconfiguring affect and emotion, by highlighting some key principles that can contribute to a deeper understanding of the human-robot relationship. We argue that in addition to reflexivity, participation and multi-sidedness that have already been identified as ethnographic concepts relevant to HRI, embodied engagement and theory-method interplay are particularly relevant for studies around affect and emotion.

Keywords— qualitative HRI, affect, emotion, ethnography

I. INTRODUCTION

As part of the broader scientific 'turn to affect', the number of HRI research focusing on the role of affect and emotion is growing. Based on the notion that emotions play a key role in human interaction and communication [14], [23], robotic designers and developers aim for robotic 'emotional intelligence'; that is, robots that are able to both apprehend human emotional expression correctly, as well as convey appropriate emotional expression corresponding to this [9], [15], [18].

Drawing on a positivist epistemology, current HRI methods are designed to measure the level of accuracy and efficiency, corresponding to how well these 'emotional' encounters function. There is a broad spectrum of research conducted within emotion expression in HRI [11]. In line with a positivist approach, they are mainly conducted in laboratory settings; a predefined context, with predefined interactions [2], [5]. Accordingly, emotions are approached as something physiologically measurable; either using technical devices such as ERG's, thermal cameras, or monitoring of brain responses or facial expressions [28]. Also different instruments, such as the Geneva Emotion Wheel are applied to measure perceived emotion of a social robot [8]. These studies often use pre-defined categories of emotional expressions, such as anger, disgust, fear, joy, sadness, surprise, relaxation [11], [25], [30].

As the application areas of robots are increasing, there has been a call for extending the amount of qualitative work within HRI. While ethnography has, to a small extent, been applied in HRI, what are still lacking are ethnographic studies that focus specifically on the role of affect and emotion in human-robot interaction. This paper will discuss the potential of making use of an ethnographic approach as a way of addressing emotional expression in interaction with robots, by highlighting some of the key principles that can contribute to a deeper understanding of how emotions are perceived, categorized and experienced in human-robot interaction. We argue that in addition to reflexivity, participation and multi-sitedness that have already been identified as ethnographic concepts relevant to HRI [2], [19], embodied engagement and theory-method interplay are particularly relevant for studies around affect and emotion.

II. BACKGROUND: QUALITATIVE HRI

Recent studies in HRI have aimed to expand philosophical and methodological questions in studying emotional relations between humans and

robots [36]. Related to the 'ongoing mutual shaping process between technology and its social environment' [6], the importance of broadening the methodological scope within HRI has been recognized [9], [19]. It is argued that long-term studies, which investigate the interaction between human and robots in a real social environment over time, and look into how the interaction functions as part of people's everyday lives, would benefit the HRI community as a whole [9], [19].

In their review paper of qualitative work within HRI, Veling and McGinn [34] conclude that 'there is a widespread use of qualitative methods within HRI, but very different approaches to reporting on it, and high variance in the rigor with which the approaches are applied'. The key qualitative methods identified by the authors are qualitative observations, semi-structured interviews, focus groups, generative activities, reflective and narrative accounts and textual analysis. According to their categorisation based on 'study type', qualitative work in HRI can be categorized into insight-driven studies, design studies and hypothesis-driven studies [34].

Ethnographic studies in HRI have previously focused on domestic service robots and their adoption and use in the home environment. Forlizzi and DiSalvo [12] conducted a study of the use of domestic robots to understand how robot design can influence human-robot interaction in the home. Sung et al. [31] investigated the long-term novelty effects associated with household's usage of domestic robots. Fink et al. [10] explored the usage, adoption and long-term effect of domestic service robots in people's homes, to understand how the robot was used and integrated into daily practices, whether it was adopted in a durable way, and how it impacted its environment. Sabelli et al. [27] reported an ethnographic study on the use of a conversational robot in an elderly care center, to clarify how older adults interacted with the robot, how the deployment process was designed, and how the personnel was involved in the deployment. Furthermore, Chang et al. [6] investigated social shaping of the Therapeutic Robot PARO in a nursing home, to understand how different social actors socially shape the interpretation and use of PARO.

Some participatory design studies also make use of ethnographic principles. For instance, Lee et al. [21] developed a methodology for the participatory design of social robots, which are meant to be incorporated into social contexts such as home and work. Their participatory design builds on participants' self-identified issues and concerns, and develops robot concepts according to participants' interpretation of the capabilities and potential applications of robotic technologies. Key concept in this participatory design approach is the mutual learning between researchers and participants, where users are included in the design as experts and their relations are considered to other actors and institutions, such as social networks and personal relationships

Qualitative work on affect and emotion within HRI
Research on the affect and emotion in HRI has tended to reflect discrete understandings of human emotion that propose a finite number of distinguishable basic emotions, such as anger, disgust, fear, joy, sadness, surprise, relaxation [11], [25], [30]. Most studies on affect and emotion in HRI focus on developing systems that can recognise, predict and detect emotions in human-robot interaction. These approaches often suffer from the inherent limitations of emotional labeling and their inability to capture the variability and context-sensitivity of emotion [17]. Qualitative work on affect and emotion could tackle these issues by focusing on participants' self-identified insights and concerns, and the mutual learning and shaping between human and robots in a social context.

However, under the current HRI studies of affect and emotion [11], [25], [30], only few studies have employed a qualitative approach. Recent qualitative studies on affect and emotion in HRI have investigated, for instance, how non-humanoid robots can communicate their affective state via bodily forms of communication, and the extent to which this influences how humans respond to them

[17]. Hickton *et al.* [17] employed a mixed method approach and conducted interviews with participants after they watched expressive and non-expressive robots performing different 'scenes'. Furthermore, Novikova and Watts [24] also explored whether a non-humanoid robot can express artificial emotions in a manner that is meaningful to a human participant. By combining a statistical analysis with a qualitative thematic analysis, the study demonstrated that even simple movements of a non-humanoid robot can convey emotional meaning, and attributing emotional states to a robot occurs in a certain event-based frame, through which people can make sense of the robotic expressions.

Against this background, this paper will discuss the potential of making use of an ethnographic approach in reconfiguring affect and emotion, by highlighting some of the key principles that can contribute to a deeper understanding of the human-robot relationship. Instead of focusing on emotion recognition, detection and prediction, our approach aims to show how the principles of ethnography could highlight users' self-identified emotions and affect, and the mutual learning and shaping between human and robots in a social context. We would, therefore, argue that if the aim for qualitative methods is to provide HRI with phenomenologically situated accounts - which captures the complexity of interactions between human and robots in a real social environment over time - HRI would benefit from incorporating a more holistic approach such as ethnography.

III. RECONFIGURING AFFECT AND EMOTION IN HRI WITH ETHNOGRAPHY

Ethnography has, to a certain extent, been applied within HRI; something which Hasse *et al.* [16] discuss in their introduction to the "Special Issue on Ethnography in Human-Robot Interaction Research". What has been identified as problematic is that the understanding of ethnography - how it is practiced and what principles it is based on - is interpreted differently by different researchers [13], [16], [19].

In their paper 'Becoming in Touch with Industrial Robots through Ethnography', Barker *et al.* [2] discuss what key principles they believe should be adhered to when conducting an ethnographic investigation of *affective touch* within HRI. The key principles identified - which the authors argue is currently lacking - are reflexivity, participation and multi-sitedness [2], [18]. While their focus is on investigations of affective touch in particular, we argue that the three key principles could be transferred into an ethnographic investigation of affect and emotion within HRI as well. However, we suggest adding two more principles: ethnographic embodied engagement, and an acknowledgement of the way that method and theory works in interplay throughout the whole ethnographic process.

A. Embodied engagement

As Chun [7] notes, current ethnography within HRI has relied exclusively on strict observation, rather than participant observation. Not only does this decrease the level of transparency in relation to reflexivity, but it also ignores the 'embodied know-how' that is part of engaging in ethnographic fieldwork. Within anthropology, the need for addressing the role that the anthropologist (ethnographer) plays within the field context is today widely recognized [33]. What is emphasized is how the researchers active participation renders it possible for her to understand the relation between the 'experiences, social practices and processes' taking place within the field [33]. In other words, the embodied engagement of the researcher is regarded as an important part of the ethnographic knowledge production.

In relation to research focused on affect and emotion, the embodied knowledge that ethnography can contribute with is highly relevant. By incorporating and presenting reflexive accounts of the researchers' embodied engagement, ethnography can provide intimate and phenomenologically situated knowledge about how affect and emotion takes shape as part of the interlocutor's lived experience [29]. Further, these types of empirical discussions can also serve to develop and refine

theories on affect and emotion - something that will be discussed in the next section.

B. Theory-method interplay

As opposed to an experimental, hypothesis-driven positivist approach, an ethnographic approach demands from the researcher to be flexible in terms of methodological and theoretical choices [4]. To practice ethnography is to let the empirical material lead the way: following what is going on in the field, and develop and refine methods and theories in harmony with the process of one's deepened understanding [4]. For ethnographic HRI studies on affect and emotion, this means that the theoretical framework (as well as the particular methods) of affect and emotion need to be continuously aligned and adapted as the empirical material develops. Once again connecting to reflexivity, the researcher has to ask herself: *in what way do affect and emotion figure in the empirical material? What theoretical concepts would be fruitful to juxtapose the material with in order to highlight the most prevalent aspects?*

What ethnography has to offer, then, is theoretical development and refinement around affect and emotion; theories that are grounded in the empirical material, which acknowledges how HRI unfolds 'in the wild' [19], [34]. Rather than issuing from the currently adopted theoretical understanding of affect and emotion, that propose a finite number of distinguishable basic emotions, ethnographic research can contribute with theoretical concepts that are more aligned with the complex unfolding of affect and emotion as part of peoples lived experience.

IV. CONCLUSIONS

While the relevance and contribution of ethnography as a method for investigating advanced human-technology networks have been recognised within the technology fields in general, particularly within HCI, there is a lack of ethnographic research within HRI [7], [16]. Further, most of technological ethnography has been positivist ethnography, which lacks reflexivity [26], as well as active participation [7]. One of the things that have been highlighted is the potential problem of the onto-epistemic divide:

that is, making qualitative findings transferable and understandable for HRI researchers departing from a positivist perspective [34].

Affect and emotion have been theorised in many ways, ranging from a social constructivist and discursive approach [35], to the non-representational, Deleuzian inspired, approach emphasising process, influence and force [1], [22], [32]. What theoretical framework and specific concepts that might be suitable to adhere to depend, as has been discussed, on the empirical material which researchers will collect [4]. On a speculative level, we believe that a relational approach [3] or a practice-based approach [35] could be suitable, as it recognises both the embodied, as well as the discursive aspects of affect and emotion. As HRI research concerns the interaction, and therefore the relationship, between humans and robots, increased attention to the concept of relationality could potentially provide findings that answer to the question of transferability to the HRI community [34].

To date, and to the best of our knowledge, there are no ethnographic HRI studies that attend particularly to affect and emotion. What this paper has discussed, and argued for, is the potential contributions that ethnography could provide in the strive towards expanding the knowledge around how affect and emotion in HRI takes shape 'in the wild'. While the question of how to bridge the epistemological and ontological gap between positivist and interpretative research within HRI remains open, this paper is intended to raise some concerns, as well as possibilities, to be further discussed.

REFERENCES

[1]   B. Anderson and P. Harrison, 'Questioning Affect and Emotion', *Area*, vol. 38, no. 3, pp. 333–335, 2006.
[2]   N. Barker, C. Jewitt, and S. Price, 'Becoming in Touch with Industrial Robots through Ethnography', in *Companion of the 2020 ACM/IEEE International Conference on Human-Robot Interaction*, Cambridge United Kingdom, Mar. 2020, pp. 128–130. doi: 10.1145/3371382.3378246.
[3]   I. Burkitt, *Emotions and social relations*. 2014. Accessed: Jan. 23, 2022. [Online]. Available: http://site.ebrary.com/id/10881280[
[4]   A. Cerwonka and L. H. Malkki, *Improvising theory: process and temporality in ethnographic fieldwork*. Chicago: University of Chicago Press, 2007.

[5] W.-L. Chang and S. Šabanović, 'Interaction Expands Function: Social Shaping of the Therapeutic Robot PARO in a Nursing Home', in *Proceedings of the Tenth Annual ACM/IEEE International Conference on Human-Robot Interaction*, Portland Oregon USA, Mar. 2015, pp. 343–350. doi: 10.1145/2696454.2696472.

[6] W.-L. Chang and S. Šabanović, 'Studying Socially Assistive Robots in Their Organizational Context: Studies with PARO in a Nursing Home', in *Proceedings of the Tenth Annual ACM/IEEE International Conference on Human-Robot Interaction Extended Abstracts*, Portland Oregon USA, Mar. 2015, pp. 227–228. doi: 10.1145/2701973.2702722.

[7] B. Chun, 'Doing autoethnography of social robots: Ethnographic reflexivity in HRI', *Paladyn, Journal of Behavioral Robotics*, vol. 10, no. 1, pp. 228–236, Jun. 2019, doi: 10.1515/pjbr-2019-0019.

[8] A. K. Coyne, A. Murtagh, and C. McGinn, 'Using the Geneva Emotion Wheel to Measure Perceived Affect in Human-Robot Interaction', in *Proceedings of the 2020 ACM/IEEE International Conference on Human-Robot Interaction*, Cambridge United Kingdom, Mar. 2020, pp. 491–498. doi: 10.1145/3319502.3374834.

[9] K. Dautenhahn, 'Some Brief Thoughts on the Past and Future of Human-Robot Interaction', *J. Hum.-Robot Interact.*, vol. 7, no. 1, pp. 1–3, May 2018, doi: 10.1145/3209769.

[10] [10]J. Fink, V. Bauwens, F. Kaplan, and P. Dillenbourg, 'Living with a Vacuum Cleaning Robot: A 6-month Ethnographic Study', *Int J of Soc Robotics*, vol. 5, no. 3, pp. 389–408, Aug. 2013, doi: 10.1007/s12369-013-0190-2.

[11] K. Fischer, M. Jung, L. C. Jensen, and M. V. aus der Wieschen, 'Emotion Expression in HRI – When and Why', in *2019 14th ACM/IEEE International Conference on Human-Robot Interaction (HRI)*, Daegu, Korea (South), Mar. 2019, pp. 29–38. doi: 10.1109/HRI.2019.8673078.

[12] J. Forlizzi and C. DiSalvo, 'Service robots in the domestic environment: a study of the roomba vacuum in the home', in *Proceeding of the 1st ACM SIGCHI/SIGART conference on Human-robot interaction - HRI '06*, Salt Lake City, Utah, USA, 2006, p. 258. doi: 10.1145/1121241.1121286.

[13] S. Frennert, H. Eftring, and B. Östlund, 'Case Report: Implications of Doing Research on Socially Assistive Robots in Real Homes', *Int J of Soc Robotics*, vol. 9, no. 3, pp. 401–415, Jun. 2017, doi: 10.1007/s12369-017-0396-9.

[14] A. J. Fridlund, *Human facial expression: An evolutionary view*. Academic Press, 1994.

[15] M. Ghafurian, G. Lakatos, Z. Tao, and K. Dautenhahn, 'Design and Evaluation of Affective Expressions of a Zoomorphic Robot', in *Social Robotics*, vol. 12483, A. R. Wagner, D. Feil-Seifer, K. S. Haring, S. Rossi, T. Williams, H. He, and S. Sam Ge, Eds. Cham: Springer International Publishing, 2020, pp. 1–12. doi: 10.1007/978-3-030-62056-1_1.

[16] C. Hasse, S. Trentemøller, and J. Sorenson, 'Special Issue on Ethnography in Human-Robot Interaction Research', *Paladyn, Journal of Behavioral Robotics*, vol. 10, no. 1, pp. 180–181, Apr. 2019, doi: 10.1515/pjbr-2019-0015.

[17] L. Hickton, M. Lewis, and L. Cañamero, 'Expression of Grounded Affect: How Much Emotion Can Arousal Convey?', in *Towards Autonomous Robotic Systems*, vol. 12228, A. Mohammad, X. Dong, and M. Russo, Eds. Cham: Springer International Publishing, 2020, pp. 234–248. doi: 10.1007/978-3-030-63486-5_26.

[18] R. Hortensius, F. Hekele, and E. S. Cross, 'The Perception of Emotion in Artificial Agents', *IEEE Trans. Cogn. Dev. Syst.*, vol. 10, no. 4, pp. 852–864, Dec. 2018, doi: 10.1109/TCDS.2018.2826921.

[19] A. Jacobs, S. A. Elprama, and C. I. C. Jewell, 'Evaluating Human-Robot Interaction with Ethnography', in *Human-Robot Interaction*, vol. 12, C. Jost, B. Le Pévédic, T. Belpaeme, C. Bethel, D. Chrysostomou, N. Crook, M. Grandgeorge, and N. Mirnig, Eds. Cham: Springer International Publishing, 2020, pp. 269–286. doi: 10.1007/978-3-030-42307-0_11.

[20] K. Leder Mackley and S. Pink, 'From Emplaced Knowing to Interdisciplinary Knowledge: Sensory Ethnography in Energy Research', *The Senses and Society*, vol. 8, no. 3, pp. 335–353, Nov. 2013, doi: 10.2752/174589313X13712175020596.

[21] H. R. Lee *et al.*, 'Steps Toward Participatory Design of Social Robots: Mutual Learning with Older Adults with Depression', in *Proceedings of the 2017 ACM/IEEE International Conference on Human-Robot Interaction*, Vienna Austria, Mar. 2017, pp. 244–253. doi: 10.1145/2909824.3020237.

[22] B. Massumi, 'The Autonomy of Affect', *Cultural Critique*, no. 31, p. 83, 1995, doi: 10.2307/1354446.

[23] P. M. Niedenthal and M. Brauer, 'Social Functionality of Human Emotion', *Annu. Rev. Psychol.*, vol. 63, no. 1, pp. 259–285, Jan. 2012, doi: 10.1146/annurev.psych.121208.131605.

[24] J. Novikova and L. Watts, 'Towards Artificial Emotions to Assist Social Coordination in HRI', *Int J of Soc Robotics*, vol. 7, no. 1, pp. 77–88, Feb. 2015, doi: 10.1007/s12369-014-0254-y.

[25] T. Ribeiro and A. Paiva, 'The illusion of robotic life: principles and practices of animation for robots', in *Proceedings of the seventh annual ACM/IEEE international conference on Human-Robot Interaction - HRI '12*, Boston, Massachusetts, USA, 2012, p. 383. doi: 10.1145/2157689.2157814.

[26] J. A. Rode, 'Reflexivity in digital anthropology', in *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*, Vancouver BC Canada, May 2011, pp. 123–132. doi: 10.1145/1978942.1978961.

[27] A. M. Sabelli, T. Kanda, and N. Hagita, 'A conversational robot in an elderly care center: an ethnographic study', in *Proceedings of the 6th international conference on Human-robot interaction - HRI '11*, Lausanne, Switzerland, 2011, p. 37. doi: 10.1145/1957656.1957669.

[28] A. Schirmer and R. Adolphs, 'Emotion Perception from Face, Voice, and Touch: Comparisons and Convergence', *Trends in Cognitive Sciences*, vol. 21, no. 3, pp. 216–228, Mar. 2017, doi: 10.1016/j.tics.2017.01.001.

[29] S. Serholt, S. Ljungblad, and N. Ní Bhroin, 'Introduction: special issue—critical robotics research', *AI & Soc*, pp. s00146-021-01224–x, Jun. 2021, doi: 10.1007/s00146-021-01224-x.

[30] S. Song and S. Yamada, 'Expressing Emotions through Color, Sound, and Vibration with an Appearance-Constrained Social Robot', in *Proceedings of the 2017 ACM/IEEE International Conference on Human-Robot Interaction*, Vienna Austria, Mar. 2017, pp. 2–11. doi: 10.1145/2909824.3020239.

[31] J. Sung, H. I. Christensen, and R. E. Grinter, 'Robots in the wild: understanding long-term use', in *Proceedings of the 4th ACM/IEEE international conference on Human robot interaction - HRI '09*, La Jolla, California, USA, 2009, p. 45. doi: 10.1145/1514095.1514106.

[32] N. J. Thrift, *Non-representational theory: space, politics, affect*. Milton Park, Abingdon, Oxon ; New York, NY: Routledge, 2008.

[33] A. Turner, 'Embodied ethnography. Doing culture', *Social Anthropology*, vol. 8, no. 1, pp. 51–60, Jan. 2007, doi: 10.1111/j.1469-8676.2000.tb00207.x.

[34] L. Veling and C. McGinn, 'Qualitative Research in HRI: A Review and Taxonomy', *Int J of Soc Robotics*, vol. 13, no. 7, pp. 1689–1709, Nov. 2021, doi: 10.1007/s12369-020-00723-z.

[35] M. Wetherell, *Affect and Emotion: A New Social Science Understanding*. 1 Oliver's Yard, 55 City Road, London EC1Y 1SP United Kingdom: SAGE Publications Ltd, 2012. doi: 10.4135/9781446250945.

[36] C. Y. Zheng, C. Lacey, and M. Paterson, 'Affect and Embodiment in HRI', in *Companion of the 2020 ACM/IEEE International Conference on Human-Robot Interaction*, Cambridge United Kingdom, Mar. 2020, pp. 667–668. doi: 10.1145/3371382.3374848.