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Editorial

Socially Acceptable Robot Behavior: Approaches for Learning, Adaptation and Evaluation

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Introduction

A key factor for the acceptance of robots as regular partners in human-centered environments is the appropriateness and predictability of their behavior. The behavior of human-human interactions is governed by social norms, which are customary rules that define how people should behave in different situations, thereby governing their expectations. Socially compliant behavior is usually rewarded by group acceptance, while non-compliant behavior can have consequences including isolation from a social group. Making robots able to understand human social norms allows for improving the naturalness and effectiveness of human-robot interaction and collaboration (Fong, Nourbakhsh, & Dautenhahn, 2003; Scheutz, Schermerhorn, Kramer, & Anderson, 2007; Walters, Dautenhahn, te Boekhorst, Koay, & Woods, 2007). Furthermore, it also increases their acceptance as partners' to human users because robots that follow social norms are seen as more caring, friendly, and trustworthy (Brave, Nass, & Hutchinson, 2005; Cramer, Goddijn, Wielinga, & Evers, 2010; Groom, Chen, Johnson, Kara, & Nass, 2010; Hamacher, Bianchi-Berthouze, Pipe, & Eder, 2016; Shiomi, Nakagawa, & Hagita, 2013). Since social norms can differ greatly between different cultures and social groups (Joosse, Poppe, Lohse, & Evers, 2014; Lee & Sabanovic, 2014; Li, Milani, Krishnamoorthy, Lewis, & Sycara, 2019), it is essential that robots are able to learn and adapt their behavior based on feedback and observations from the environment (Shiarlis, Messias, & Whiteson, September). Learning must be open-ended because social norms can change over time requiring continuous adaptation. Another challenge is that not all human social norms are applicable for human-robot interactions, while there might also be norms that only exist for human-robot interactions. What is considered socially acceptable behavior can greatly differ depending on the appearance and purpose of a particular

robot (Hwang, Park, & Hwang, 2013) as well as the specific scenario or environment the interaction takes place.

This special issue aims to discuss novel interdisciplinary approaches at the intersection of social and cognitive robotics, machine learning, and artificial intelligence that are aiming toward learning, creating, or evaluating socially acceptable robot behaviors. The following five papers were accepted after a rigorous and careful reviewing process.

Summary of the Special Issue

- The paper by Wullenkord, Bellon, Gransche, Nähr-Wagener, and Eyssel (2022) proposes the Five Factor Model of Social Appropriateness (FASA), which provides a multidisciplinary perspective on the notion of social appropriateness and its implementation into technical systems. The paper offers reflections on the applicability and ethics of the FASA Model, highlighting both strengths and limitations of the framework.
- The paper by Costantini, Formisano, and Pitoni (2022) addresses modeling of group dynamics of agents by proposing an epistemic logic, L-DINF-E, that allows to formalize the beliefs formed by a group of agents. L-DINF-E allows to model aspects of "Theory of Mind", understood as the set of social-cognitive skills involving the ability to attribute and reason about mental states, desires, beliefs, and knowledge of agents. The paper illustrates how L-DINF-E can be used to solve "false-belief tasks", i.e., tests in which an agent should understand that some other agent may develop, under some circumstances, false beliefs.
- The paper by Yildirim and Ugur (2022) presents a data-driven social navigation architecture that uses Conditional Neural Processes to learn global and local

controllers of a mobile robot from observations. Additionally, the proposed architecture uses a deep prediction mechanism to detect situations different from the trained ones, where reactive controllers step in to ensure safe navigation. The obtained results demonstrate that the proposed framework can successfully carry out social navigation tasks resulting in less personal-zone violations leading to less discomfort.

- The paper by Bassetti, Blanzieri, Borgo, and Marangon (2022) proposes a framework to make artificial agents socially-competent in varying multi-party social situations and beyond individual-based user personalization. The main idea is to provide artificial agents with the capability to handle different kinds of interactional disruptions, and associated recovery strategies, in microsociology. The result is obtained by classifying functional and social disruptions, and by investigating the requirements a robot's architecture should satisfy to exploit such knowledge.
- The paper by Roesler, Bagheri, and Aly (2022) presents an overview of how researchers in relevant research fields think the perception of robots and the corresponding interactions are influenced independently of a specific scenario if a robot's behavior conforms to social norms. Additionally, the presented study investigates what characteristics and metrics constitute a good general benchmark to objectively evaluate the behavior of social robots regarding its conformity to social norms according to researchers in relevant research communities. Finally, the paper summarizes how the obtained results can guide future research toward socially aware robot behavior.

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References

- Bassetti, C., Blanzieri, E., Borgo, S., & Marangon, S. (2022). Towards socially-competent and culturally-adaptive artificial agents Expressive order, interactional disruptions and recovery strategies. *Interaction Studies*.
- Brave, S., Nass, C., & Hutchinson, K. (2005, February). Computers that care: investigating the effects of orientation of emotion exhibited by an embodied computer agent. *International Journal of Human-Computer Studies*, 62(2), 161-178.
- Costantini, S., Formisano, A., & Pitoni, V. (2022). An Epistemic Logic for Formalizing Group Dynamics of Agents. *Interaction Studies*.
- Cramer, H., Goddijn, J., Wielinga, B., & Evers, V. (2010, March). Effects of (In)Accurate Empathy and Situational Valence on Attitudes towards Robots. In *Proceedings of the 5th International Conference on Human-Robot Interaction (HRI)*.
- Fong, T., Nourbakhsh, I., & Dautenhahn, K. (2003, December). A survey of socially interactive robots. *Robotics and Autonomous Systems*, 42(3-4), 143-166.
- Groom, V., Chen, J., Johnson, T., Kara, F. A., & Nass, C. (2010, March). Critic, compatriot, or chump?: Responses to robot blame attribution. In *Proceedings of the 5th International Conference on Human-Robot Interaction (HRI)*.
- Hamacher, A., Bianchi-Berthouze, N., Pipe, A. G., & Eder, K. (2016, August). Believing in BERT: Using expressive communication to enhance trust and counteract operational error in physical Human-robot interaction. In *Proceedings of the 25th IEEE International Symposium on Robot and Human Interactive Communication (RO-MAN)*.
- Hwang, J., Park, T., & Hwang, W. (2013, May). The effects of overall robot shape on the emotions invoked in users and the perceived personalities of robot. *Applied Ergonomics*, 44(3), 459-471.
- Joosse, M. P., Poppe, R. W., Lohse, M., & Evers, V. (2014, August). Cultural differences in how an engagement-seeking robot should approach a group of people. In *Proceedings of the 5th International Conference on Collaboration across Boundaries: Culture, Distance & Technology (CABS)* (p. 121-130).
- Lee, H. R., & Sabanovic, S. (2014, March). Culturally Variable Preferences for Robot Design and Use in South Korea, Turkey, and the United States. In *Proceedings of the 9th International Conference on Human-Robot Interaction (HRI)*.
- Li, H., Milani, S., Krishnamoorthy, V., Lewis, M., & Sycara, K. (2019, January). Perceptions of Domestic Robots' Normative Behavior Across Cultures. In *Proceedings of the 2019 Conference on AI, Ethics, and Society (AIES)* (p. 345-351).
- Roesler, O., Bagheri, E., & Aly, A. (2022). Toward Understanding the Effects of Socially Aware Robot Behavior. *Interaction Studies*.
- Scheutz, M., Schermerhorn, P., Kramer, J., & Anderson, D. (2007, May). First steps toward natural human-like HRI. *Autonomous Robots*, 22, 411-423.
- Shiarlis, K., Messias, J., & Whiteson, S. (September, 2017). Acquiring social interaction behaviours for telepresence robots via deep learning from demonstration. In *Proceedings of the International Conference on Intelligent Robots and Systems (IROS)*.
- Shiomi, M., Nakagawa, K., & Hagita, N. (2013, December). Design of a gaze behavior at a small mistake moment for a robot. *Interaction Studies*, 14(3), 317-328.
- Walters, M. L., Dautenhahn, K., te Boekhorst, R., Koay, K. L., & Woods, S. N. (2007, April). Exploring the Design Space of Robot Appearance and Behavior in an Attention-Seeking 'Living Room' Scenario for a Robot Companion. In *Proceedings of the 2007 IEEE Symposium on Artificial Life* (p. 341-347).
- Wullenkord, R., Bellon, J., Gransche, B., Nähr-Wagener, S., & Eyssel, F. (2022). Social appropriateness in HMI - the Five Factors of Social Appropriateness (FASA) Model. *Interaction Studies*.

tion Studies.

Yildirim, Y., & Ugur, E. (2022). Learning Social Navigation from

Demonstrations with Conditional Neural Processes. *Interaction Studies.*