EXTENDED-ABSTRACT

6th Workshop on Adapted intEraction with SociAl Robots (cAESAR)

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Abstract

Human Robot Interaction (HRI) is a field of study dedicated to understanding, designing, and evaluating robotic systems for use by, or with, humans. In HRI there is a consensus about the design and implementation of robotic systems that should be able to adapt their behavior based on user actions and behavior. The robot should adapt to emotions, personalities, and it should also have a memory of past interactions with the user to become believable. This is of particular importance in the field of social robotics and social HRI. The aim of this Workshop is to bring together researchers and practitioners who are working on various aspects of social robotics and adaptive interaction. The expected result of the workshop is a multidisciplinary research agenda that will inform future research directions and hopefully, forge some research collaborations.

CCS Concepts

• **Human-centered computing**; • **Computing methodologies**; • **Artificial intelligence**; • **Knowledge representation and reasoning**; • **Cognitive robotics**;

Keywords

Social Robots, HRI, Adaptivity, Human Behavior Understanding, Human Centered AI

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1 Workshop Description and Motivations

Human-Robot Interaction: A Shift in Perspective

Human-Robot Interaction (HRI) is a field dedicated to understanding, designing, and evaluating robotic systems intended for use by or with humans [22]. An important issue in the adoption of new technologies such as robots concerns with the capability of robots to adapt to their human counterparts, understanding their needs, fostering seamless collaboration, and being perceived as considerate and reliable partners in shared environments. It is, in fact, fundamental for a successful introduction of robots in everyday life use, that they are as little disruptive as possible and do no require the users to have to acquire new knowledge and competencies to engage in a comfortable interaction and co-existence. This approach emphasizes the need for mutual understanding between humans and machines, advocating for novel design paradigms. Collaborative robots should not only anticipate the goals of their human partners but also enable humans to anticipate their intentions [42]. In the HRI field, it is clear how robotic systems should be designed to adapt their behavior based on users' actions and reactions. This adaptation extends to recognizing emotions, understanding personality traits, and maintaining a memory of past interactions to enhance credibility. This principle is equally central in humanoid robotics, which strives to replicate human traits such as physical abilities, cognitive processes, responsiveness to environmental stimuli, and contextual adaptability.

Social Robots: The Quest for Credibility

Social robots are a type of autonomous robots that are designed to interact with humans through social-affective behaviors, skills

and rules tailored to their collaborative roles. These robots can go beyond basic interaction by recognizing and engaging with individuals, tapping into previously acquired knowledge and perceived context, and even communicating and learning from each other. Their ability to promote meaningful interactions depends on the credibility of their behavior. To achieve this goal, robots need to take into account a wide range of user dimensions, including age, gender, emotional states, personality traits, cognitive biases, inclinations, and the context of past interactions, all of which play a crucial role in decision formation. Moreover, it is as important for robots to also take into account social context and norms to correctly interact with humans. Creating such systems requires robots to develop and apply sophisticated, context-aware models of human behavior as part of their reasoning processes. This is particularly complex in fields such as assistive robotics, where robots are often tasked with assisting vulnerable individuals. In these scenarios, the stakes are higher, as robots must navigate nuanced social and emotional landscapes, ensure safety and promote trust by adapting to the unique needs of each individual. Achieving this level of sophistication requires continued advances in machine learning, human-robot interaction frameworks, and ethical design considerations to ensure that robots can serve as effective and empathetic partners in diverse real-world contexts.

2 Workshop goals and topics

The aim of this Workshop is to bring together researchers and practitioners who are working on various aspects of social robotics and adaptive interaction. The expected result of the workshop is a multidisciplinary research agenda that will inform future research directions and hopefully, forge some research collaborations. Topics of interest reflect the main research trends in the field, as also demonstrated in the literature, and include (but are not limited to):

- Personalized HRI, e.g. [37, 40]
- User modeling, user profiling and adaptation strategies in HRI, e.g. [1, 38]
- Affective interaction with robots, e.g. [6, 12, 19, 24, 43]
- Machine learning for social robots, e.g. [23, 45]
- Natural Language Interaction with social robots, e.g. [17, 32]
- Social Assistive Robots and Robotics for Autism, e.g. [11, 20, 31]
- Social Robots in Education, Industry, and Elderly care, e.g. [7, 21, 29, 33, 36]
- HRI and Cognitive Impairments, e.g. [35, 39]
- Cognitive architecture for HRI, e.g. [27, 41, 44, 46]
- Social Robots as Conversational Recommender Systems, e.g. [13]
- Persuasion and Social Robots, e.g. [5]
- Social Robots in the real world and in the wild, e.g. [18, 34]
- Empirical Evaluation of Social Robots, e.g. [25]
- Human-centered Design and co-design in social HRI, e.g. [8, 12, 26]
- Behavior Transparency for Social Robot, e.g. [16]

The current workshop follows four previous editions held in conjunction with IUI in 2020 [9], with UMAP in 2021[1] 2022 [14] and 2025 [15], CHItaly 2023 [10], and a special session on Adaptation and Personalization in Human-Robot Interaction at the 2019 IEEE conference on Systems, Man, and Cybernetics[2].

3 Contributions

Five have been accepted for presentation at the workshop, which will be detailed in the following. Topics covered range from assistive robotics to multimodal interaction with robots, from transparent HRI to emotional robot's body language and kinetic anthropomorphism.

Donini et al.[30] present a novel approach to the use of the humanoid robot Pepper in educational contexts, focusing on dialogic and multimodal interaction for teaching abstract concepts in mathematics and physics. Unlike traditional lecture-based models, our system supports learner-centered lessons where students engage in spontaneous dialogue with the robot while interacting with visual content displayed on its tablet. The robot responds to user questions through the coordination of speech, synchronized textual output, and dynamic visual cues, such as real-time modifications to vectorial images that highlight relevant elements. To promote accessibility and engagement, the system includes customizable visual features such as color schemes and adjustable font settings for visual-impaired users. This approach aims to foster a more inclusive, personalized, and interactive learning experience by adapting the lesson content to the learner's interests and inquiries.

Lillo et al.[2] present the development of a simulated assistive system based on the NAO humanoid robot, designed to support cognitive engagement and well-being in elderly users. Leveraging the Webots simulation environment, we integrated advanced functionalities including voice interaction through Google Speech Recognition, contextual dialogue using the LLaMA language model, and speech synthesis via pyttsx3. The system enables the virtual NAO (vNAO) to conduct conversational interactions, administer cognitive exercises, issue reminders, and guide users through physical activities, all within a personalized, elderly-friendly virtual environment. Our implementation demonstrates that a simulation-based approach can provide a scalable, accessible framework for testing and deploying socially assistive robotics.

Paloka et al.[4] present a first AI-based prototype designed to enable a humanoid robot to recognize emotional and postural states in dogs and adapt its behavior accordingly. Using a deep learning-based pipeline for real-time detection and classification, the robot could adapt its movements to better accommodate canine responses. We propose that such an adaptive approach paves the way for more natural coexistence between robots and animals in domestic settings, raising new challenges in perception, behavior design, and ethics within ARI.

Ferrato et al.[3] present a novel approach to enhancing children's experiences in museums through the use of social robots equipped with multimodal large language models (MLLMs). By leveraging the capabilities of models such as LLaVA, we enable robots to generate interactive and engaging questions about artworks, fostering deeper involvement among young visitors. Through a comparative evaluation of visual and contextual question generation using a subset of the AQUA dataset, we assess both quantitative performance

[1] https://caesar2021.di.unito.it/

[2] http://smc2019.org/approved_special_sessions.html

and the qualitative richness of the generated prompts. Particular attention is given to the models' capacity to craft questions tailored to children, aiming to stimulate curiosity, promote active observation, and support cognitive and emotional engagement. We propose that this integration of MLLMs into robotic systems can contribute to more inclusive, enjoyable, and meaningful educational experiences in museum environments.

Raggioli et al.[28] present a survey of current approaches aimed at endowing robots with Theory of Mind (ToM) capabilities, a foundational element for enabling natural and effective human social interaction. As robots increasingly operate within human environments, equipping them with the ability to infer mental and emotional states becomes critical for fostering collaboration, adaptability, and emotionally attuned behavior. We focus on two principal dimensions: Cognitive ToM (C-ToM), centered on reasoning about others' beliefs and intentions, and Affective ToM (A-ToM), which involves recognizing and responding to emotional states. While both perspectives have contributed to more adaptive and engaging robotic systems, they are often pursued separately. We propose that future research should explore integrated models that unify cognitive and affective reasoning, advancing the development of robots capable of richer, more socially intelligent interactions.

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References

[1] Muneeb Ahmad, Omar Mubin, and Joanne Orlando. 2017. A Systematic Review of Adaptivity in Human-Robot Interaction. *Multimodal Technologies and Interaction* 1, 3 (2017). doi:10.3390/mti1030014

[2] Claudio Mattutino Alberto Lillo and Cristina Gena. 2025. vNAO: Virtual NAO as a Cognitive Companion for the Elderly. *cAESAR workshop, UMAP 2025* (2025).

[3] Carla Limongelli Alessio Ferrato, Cristina Gena and Giuseppe Sansonetti. 2025. Multimodal LLM Question Generation for Children's Art Engagement via Museum Social Robots. *cAESAR workshop, UMAP 2025* (2025).

[4] Fabiana Vernero Filipa Correia Valentina Nisi Laura Lossi Angelo Paloka, Alberto Lillo and Cristina Gena. 2025. Robots adapting to dogs: a new frontier? *cAESAR workshop, UMAP 2025* (2025).

[5] Agnese Augello, Giuseppe Città, Manuel Gentile, and Antonio Lieto. 2021. A storytelling robot managing persuasive and ethical stances via act-r: an exploratory study. *International Journal of Social Robotics* (2021), 1–17.

[6] Lorenzo Battisti, Sabrina Fagioli, Alessio Ferrato, Carla Limongelli, Stefano Mastandrea, Mauro Mezzini, Davide Nardo, and Giuseppe Sansonetti. 2024. Towards Empathetic Social Robots: Investigating the Interplay between Facial Expressions and Brain Activity (short paper). In *Joint Proceedings of the ACM IUI 2024 Workshops co-located with the 29th Annual ACM Conference on Intelligent User Interfaces (IUI 2024), Greenville, South Carolina, USA, March 18, 2024 (CEUR Workshop Proceedings, Vol. 3660)*, Axel Soto and Eva Zangerle (Eds.). CEUR-WS.org. https://ceur-ws.org/Vol-3660/paper22.pdf

[7] Tony Belpaeme, James Kennedy, Aditi Ramachandran, Brian Scassellati, and Fumihide Tanaka. 2018. Social robots for education: A review. *Science Robotics* 3 (08 2018), eaat5954. doi:10.1126/scirobotics.aat5954

[8] Elin A. Björling and Emma Rose. 2019. Participatory Research Principles in Human-Centered Design: Engaging Teens in the Co-Design of a Social Robot. *Multimodal Technologies and Interaction* 3, 1 (2019). doi:10.3390/mti3010008

[9] Berardina De Carolis, Cristina Gena, Antonio Lieto, Silvia Rossi, and Alessandra Sciutti. 2020. Workshop on Adapted intEraction with SociAl Robots (cAESAR). In *IUI '20: 25th International Conference on Intelligent User Interfaces, Cagliari, Italy, March 17-20, 2020, Companion*. ACM, 3–4. doi:10.1145/3379336.3379360

[10] Berardina Nadja De Carolis, Cristina Gena, Antonio Lieto, Silvia Rossi, and Alessandra Sciutti. 2023. CaESAR: The Fourth Workshop on Adapted intEraction with SociAl Robots. In *Proceedings of the 15th Biannual Conference of the Italian SIGCHI Chapter, CHItaly 2023, Torino, Italy, September 20-22, 2023*, Cristina Gena, Luigi De Russis, Lucio Davide Spano, Rosa Lanzilotti, Tania Di Mascio, Catia Prandi, and Salvatore Andolina (Eds.). ACM, 33:1–33:4. doi:10.1145/3605390.3610809

[11] Giovanna Castellano, Berardina De Carolis, Nicola Macchiarulo, and Olimpia Pino. 2021. Detecting Emotions During Cognitive Stimulation Training with the Pepper Robot. In *Human-Friendly Robotics 2021 - HFR: 14th International Workshop on Human-Friendly Robotics, Bologna, Italy, October 28-29, 2021 (Springer Proceedings in Advanced Robotics, Vol. 23)*, Gianluca Palli, Claudio Melchiorri, and Roberto Meattini (Eds.). Springer, 61–75. doi:10.1007/978-3-030-96359-0_5

[12] Valerio Cietto, Cristina Gena, Ilaria Lombardi, Claudio Mattutino, and Chiara Vaudano. 2018. Co-designing with kids an educational robot. In *2018 IEEE Workshop on Advanced Robotics and its Social Impacts (ARSO)*. IEEE, 139–140.

[13] Berardina De Carolis, Marco de Gemmis, Pasquale Lops, and Giuseppe Palestra. 2017. Recognizing users feedback from non-verbal communicative acts in conversational recommender systems. *Pattern Recognition Letters* 99 (2017), 87–95.

[14] Berardina Nadja De Carolis, Cristina Gena, Antonio Lieto, Silvia Rossi, and Alessandra Sciutti. 2022. 3rd Workshop on Adapted IntEraction with SociAl Robots. In *Adjunct Proceedings of the 30th ACM Conference on User Modeling, Adaptation and Personalization* (Barcelona, Spain) *(UMAP '22 Adjunct)*. Association for Computing Machinery, New York, NY, USA, 120–122. doi:10.1145/3511047.3536345

[15] Berardina Nadja De Carolis, Cristina Gena, Antonio Lieto, Silvia Rossi, and Alessandra Sciutti. 2024. 5th Workshop on Adapted intEraction with SociAl Robots (cAESAR). In *Adjunct Proceedings of the 32nd ACM Conference on User Modeling, Adaptation and Personalization*. 201–204.

[16] Heike Felzmann, Eduard Fosch-Villaronga, Christoph Lutz, and Aurelia Tamo-Larrieux. 2019. Robots and transparency: The multiple dimensions of transparency in the context of robot technologies. *IEEE Robotics & Automation Magazine* 26, 2 (2019), 71–78.

[17] Mary Ellen Foster. 2019. Natural language generation for social robotics: opportunities and challenges. *Philosophical Transactions of the Royal Society B* 374, 1771 (2019), 20180027.

[18] Cristina Gena, Federica Cena, Fabiana Vernero, and Pierluigi Grillo. 2013. The evaluation of a social adaptive website for cultural events. *User Model. User Adapt. Interact.* 23, 2-3 (2013), 89–137. doi:10.1007/S11257-012-9129-9

[19] Cristina Gena, Francesca Manini, Antonio Lieto, Alberto Lillo, and Fabiana Vernero. 2023. Can empathy affect the attribution of mental states to robots?. In *Proceedings of the 25th International Conference on Multimodal Interaction, ICMI 2023, Paris, France, October 9-13, 2023*, Elisabeth André, Mohamed Chetouani, Dominique Vaufreydaz, Gale M. Lucas, Tanja Schultz, Louis-Philippe Morency, and Alessandro Vinciarelli (Eds.). ACM, 94–103. doi:10.1145/3577190.3614167

[20] Cristina Gena, Claudio Mattutino, Andrea Maieli, Elisabetta Miraglio, Giulia Ricciardiello, Rossana Damiano, and Alessandro Mazzei. 2021. Autistic Children's Mental Model of an Humanoid Robot. In *Adjunct Proceedings of the 29th ACM Conference on User Modeling, Adaptation and Personalization* (Utrecht, Netherlands) *(UMAP '21)*. Association for Computing Machinery, New York, NY, USA, 128–129. doi:10.1145/3450614.3463422

[21] Cristina Gena, Claudio Mattutino, Gianluca Perosino, Massimo Trainito, Chiara Vaudano, and Davide Cellie. 2020. Design and development of a social, educational and affective robot. In *2020 IEEE Conference on Evolving and Adaptive Intelligent Systems (EAIS)*. IEEE, 1–8.

[22] Michael A Goodrich, Alan C Schultz, et al. 2008. Human–robot interaction: a survey. *Foundations and Trends® in Human–Computer Interaction* 1, 3 (2008), 203–275.

[23] Minsu Jang, Ho Ahn, and Jong-Suk Choi. 2023. Editorial Introduction to Special Issue on Machine Learning for Social Human-Robot Interaction. *International Journal of Social Robotics* 15 (03 2023). doi:10.1007/s12369-023-00992-4

[24] Myounghoon Jeon, Chung Hyuk Park, Yunkyung Kim, Andreas Riener, and Martina Mara. 2021. Editorial: Contextualized Affective Interactions With Robots. *Frontiers in Psychology* 12 (2021). doi:10.3389/fpsyg.2021.780685

[25] Minjoo Jung, May Jorella S. Lazaro, and Myung Hwan Yun. 2021. Evaluation of Methodologies and Measures on the Usability of Social Robots: A Systematic Review. *Applied Sciences* 11, 4 (2021). doi:10.3390/app11041388

[26] M. Kim, K. Oh, J. Choi, J. Jung, and Y. Kim. 2011. *User-Centered HRI: HRI Research Methodology for Designers*. Springer Netherlands, Dordrecht, 13–33. doi:10.1007/978-94-007-0582-1_2

[27] Antonio Lieto. 2021. *Cognitive design for artificial minds*. Routledge.

[28] Alessandra Rossi Luca Raggioli and Silvia Rossi. 2025. Computational Models of Cognitive and Affective Theory of Mind. *cAESAR workshop, UMAP 2025* (2025).

[29] Daniel Macis, Sara Perilli, and Cristina Gena. 2023. Employing Socially Assistive Robots in Elderly Care (longer version). *CoRR* abs/2304.14944 (2023). doi:10.48550/ARXIV.2304.14944 arXiv:2304.14944

[30] Pier Felice Balestrucci Luca Anselma Cristina Gena Alessandro Mazzei Matteo Nazzario Massimo Donini, Michael Oliverio and Irene Borgini. 2025. Towards a Structured Multimodal Speech-Image Coordination. *cAESAR workshop, UMAP 2025* (2025).

[31] Maja J. Matarić and Brian Scassellati. 2016. *Socially Assistive Robotics.* Springer International Publishing, Cham, 1973–1994. doi:10.1007/978-3-319-32552-1_73

[32] Daniele Mazzei, Filippo Chiarello, and Gualtiero Fantoni. 2021. Analyzing social robotics research with natural language processing techniques. *Cognitive Computation* 13 (2021), 308–321.

[33] Claudia Di Napoli, Giovanni Ercolano, and Silvia Rossi. 2023. Personalized home-care support for the elderly: a field experience with a social robot at home. *User Model. User Adapt. Interact.* 33, 2 (2023), 405–440. doi:10.1007/S11257-022-09333-Y

[34] Chung Hyuk Park, Raquel Ros, Sonya S. Kwak, Chien-Ming Huang, and Séverin Lemaignan. 2020. Editorial: Towards Real World Impacts: Design, Development, and Deployment of Social Robots in the Wild. *Frontiers in Robotics and AI* 7 (2020). doi:10.3389/frobt.2020.600830

[35] Olimpia Pino, Giuseppe Palestra, Berardina De Carolis, Valeria Carofiglio, and Nicola Macchiarulo. 2020. Social Robots in Cognitive Interventions. Advances, Problems and Perspectives. In *Proceedings of the Italian Workshop on Artificial Intelligence for an Ageing Society 2020 co-located with 19th International Conference of the Italian Association for Artificial Intelligence (AIxIA 2020), Anywhere, November 25th-27th, 2020 (CEUR Workshop Proceedings, Vol. 2804)*, Filippo Palumbo, Francesca Gasparini, and Francesca Fracasso (Eds.). CEUR-WS.org, 113–120. https://ceur-ws.org/Vol-2804/paper8.pdf

[36] Olimpia Pino, Giuseppe Palestra, Rosalinda Trevino, and Berardina De Carolis. 2020. The Humanoid Robot NAO as Trainer in a Memory Program for Elderly People with Mild Cognitive Impairment. *Int. J. Soc. Robotics* 12, 1 (2020), 21–33. doi:10.1007/S12369-019-00533-Y

[37] Kathrin Pollmann, Wulf Loh, Nora Fronemann, and Daniel Ziegler. 2023. Entertainment vs. manipulation: Personalized human-robot interaction between user experience and ethical design. *Technological Forecasting and Social Change* 189 (2023), 122376. doi:10.1016/j.techfore.2023.122376

[38] Silvia Rossi, François Ferland, and Adriana Tapus. 2017. User profiling and behavioral adaptation for HRI: A survey. *Pattern Recognit. Lett.* 99 (2017), 3–12. doi:10.1016/j.patrec.2017.06.002

[39] Silvia Rossi, Claudia Di Napoli, Federica Garramone, Elena Salvatore, and Gabriella Santangelo. 2024. Personality-Based Adaptation of Robot Behaviour: Acceptability Results on Individuals with Cognitive Impairments. *Int. J. Soc. Robotics* 16, 1 (2024), 211–226. doi:10.1007/S12369-023-01074-1

[40] Silvia Rossi, Mariacarla Staffa, Maartje M. A. de Graaf, and Cristina Gena. 2023. Preface to the special issue on personalization and adaptation in human-robot interactive communication. *User Model. User Adapt. Interact.* 33, 2 (2023), 189–194. doi:10.1007/s11257-023-09365-y

[41] Alessandra Sciutti, Michael Beetz, Tetsunari Inamura, Ayorkor Korsah, Jean Oh, Giulio Sandini, Shingo Shimoda, and David Vernon. 2023. The Present and the Future of Cognitive Robotics [TC Spotlight]. *IEEE Robotics Autom. Mag.* 30, 3 (2023), 160–163. doi:10.1109/MRA.2023.3293303

[42] Alessandra Sciutti, Martina Mara, Vincenzo Tagliasco, and Giulio Sandini. 2018. Humanizing human-robot interaction: On the importance of mutual understanding. *IEEE Technology and Society Magazine* 37, 1 (2018), 22–29.

[43] Matteo Spezialetti, Giuseppe Placidi, and Silvia Rossi. 2020. Emotion Recognition for Human-Robot Interaction: Recent Advances and Future Perspectives. *Frontiers in Robotics and AI* 7 (2020). doi:10.3389/frobt.2020.532279

[44] Ana Tanevska, Francesco Rea, Giulio Sandini, Lola Cañamero, and Alessandra Sciutti. 2019. A Cognitive Architecture for Socially Adaptable Robots. In *2019 Joint IEEE 9th International Conference on Development and Learning and Epigenetic Robotics (ICDL-EpiRob).* 195–200. doi:10.1109/DEVLRN.2019.8850688

[45] Lorenzo Vaccaro, Giuseppe Sansonetti, and Alessandro Micarelli. 2021. An Empirical Review of Automated Machine Learning. *Comput.* 10, 1 (2021), 11. doi:10.3390/computers10010011

[46] David Vernon, Claes Von Hofsten, and Luciano Fadiga. 2011. *A roadmap for cognitive development in humanoid robots.* Vol. 11. Springer Science & Business Media.