[T.-T.-Prof. Dr. Barbara Bruno // Socially Assistive Robotics with Artificial Intelligence (SARAI)]

Barbara Bruno joined the Karlsruhe Institute of Technology in May 2023 as a Tenure Track W1 Professor at the Institute for Anthropomatics and Robotics. Her research interests lie in Socially Assistive Robotics and Human-Robot Interaction. Barbara holds a M.Sc. degree and Ph.D. degree in Robotics from the University of Genoa, Italy. Upon completion of her PhD, thanks to a "Smart & Start" grant she received from the Italian Ministry of Economic Development, Barbara co-founded the start-up company Teseo, Italy, focusing on assistive technologies for older adults.

In 2017-2019 she was Technical Manager of the H2020 project CARESSES, which developed a culturally competent care robot for older adults. In 2019-2023, as a Postdoctoral Researcher and lab deputy head at the École Polytechnique Fédérale de Lausanne (EPFL), Switzerland, she contributed to various funded projects on social robotics, including the SNSF flagship initiative NCCR-Robotics, the MSCA ANIMATAS focusing on the development of socially assistive robots for education and the French-Swiss project iReCHeCk on the development of robotic technologies to assist children with handwriting difficulties. She is Associate Editor for the IEEE "Robotics & Automation Letters" journal and the Springer journal "Intelligent Service Robotics" and has contributed as organiser, invited speaker or panellist to several workshops and conferences on assistive robotics, personalised robotics and child-robot interaction.

// Overview and general information

The SARAI lab designs, develops, and evaluates robots that aid humans by establishing a social interaction with them. Typical applications for such Socially Assistive Robots include encouraging older adults to train their physical and cognitive abilities, helping people adhere to doctors' prescriptions and recommendations (e.g., concerning rehabilitation exercises, medicine intake, or diet), supporting children in acquiring curricular (such as reading, writing, second language learning or computational thinking) and extra-curricular skills (such as emotional awareness, collaboration or respect), and even promoting positive behaviours among the general population, such as correct waste disposal.

Developing robots for such applications requires tackling a number of fascinating open challenges, including:

- How can the robot assess effectively, autonomously and in real-time, all the user variables that are relevant for a given application scenario and task (e.g. whether a child is learning)?
- What actions can the robot take to help its user reach the goal and how can the robot assess their effectiveness in real-time?
- How can the robot adapt, possibly also on-the-fly, its actions and interaction to person-specific traits and contextual elements?
- How can expertise from end users, domain experts and practitioners (such as children, older adults, their families, teachers, doctors and nurses, learning scientists, psychologists) be incorporated in the robot design, to increase the robot's acceptability and efficacy?

To answer the above questions, our research leverages state-of-the-art solutions in AI and ML for robot perception, user modelling and planning and relies on participatory design approaches and user studies to identify and model the factors that affect a person's perception of, and interaction with, a robot, in the short and long-term.

// Projects and successes

The SARAI lab, together with other groups from the IAR and ITAS institutes of KIT, is a partner of the Reallabor "Robotics and Artificial Intelligence" project, aiming to bridge between AI and robotics research at KIT and public institutions. The project brings AI-powered humanoid robots into contexts such as kindergartens, hospitals, and museums, to promote awareness of AI technologies and experimentally gain new insights for the development of future robots.

// Selected publications

Maure, R., Bruno, B.: Participatory design of a social robot and robot-mediated storytelling activity to raise awareness of gender inequality among children. In 2023 32nd IEEE Int Conf on Robot and Human Interactive Communication (RO-MAN) (pp. 1-8). IEEE, 2023.

Bruno, B., Amirova, A., Sandygulova, A., Lugrin, B., & Johal, W.: Culture in Social Robots for Education. In Cultural Robotics: Social Robots and Their Emergent Cultural Ecologies (pp. 127-145). Springer Series on Cultural Computing. Springer, Cham,2023.

Rohlfing, K. J., Altvater-Mackensen, N., Caruana, N., van den Berghe, R., Bruno, B., Tolksdorf, N. F., & Hanulíková, A: Social/dialogical roles of social robots in supporting children's learning of language and literacy—A review and analysis of innovative roles. Frontiers in Robotics and AI, p. 251, 2022.

El-Hamamsy, L., Zapata-Cáceres, M., Barroso, E. M., Mondada, F., Zufferey, J. D., Bruno, B.: The competent computational thinking test: Development and validation of an unplugged computational thinking test for upper primary school. Journal of Educational Computing Research, 60(7),p. 1818-1866, 2022.

Wright, L. L., Kothiyal, A., Arras, K. O., & Bruno, B.: How a Social Robot's Vocalization Affects Children's Speech, Learning, and Interaction. In 2022 31st IEEE Int Conf on Robot and Human Interactive Communication (RO-MAN) (pp. 279-286). IEEE, 2022.

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