

---

# Ethical Frameworks for Artificial Intelligence (AI) and Social Robots in Children's Healthcare Experiences

**Frauke Zeller**

Ryerson University  
Toronto, ON, M5B 2K3  
Canada  
fzeller@ryerson.ca

**David Harris Smith**

McMaster University  
Hamilton, ON, L8S 4L8  
Canada  
dhsmith@mcmaster.ca

**Mary Ellen Foster**

University of Glasgow  
Glasgow, G12 8QQ  
United Kingdom  
maryellen.foster@glasgow.ac.uk

**Ronald P. A. Petrick**

Heriot-Watt University  
Edinburgh, EH14 4AS  
United Kingdom  
r.petrick@hw.ac.uk

**Jennifer Stinson**

University of Toronto  
Toronto, ON, M5S 1A1  
Canada  
jennifer.stinson@sickkids.ca

**Samina Ali**

University of Alberta  
Edmonton, AB, T6G 2R3  
Canada  
sali@ualberta.ca

**Abstract**

This multi-disciplinary project aims to develop and evaluate an ethical, AI-enhanced, socially intelligent robot designed to alleviate children's distress and pain in a clinical setting. Spanning different disciplines such as HRI, communication sciences, and pediatric research, this workshop aims to explore the ethical implications of the child-robot relationship as it pertains to pain management and robot design, the potential for a pain-reducing social robot and the ethical implications of involving family, healthcare personnel, and children in the co-design of a socially assistive robot. The methodologies used to assess this child-robot interaction will be discussed in relation to both the clinical trial and co-design phases. This is a multidisciplinary project with 4 distinct phases: co-design and usability testing, development of an autonomous system, clinical trials, and an ethical and social implication review. Our method design integrates instruments from communication sciences, HRI design and pediatric research.

**Author Keywords**

Child-robot interaction; ethical design; socially assistive robotics; co-design methodology

**CCS Concepts**

•Human-centered computing → HCI theory, concepts and models;

---

Permission to make digital or hard copies of all or part of this work for personal or classroom use is granted without fee provided that copies are not made or distributed for profit or commercial advantage and that copies bear this notice and the full citation on the first page. Copyrights for components of this work owned by others than the author(s) must be honored. Abstracting with credit is permitted. To copy otherwise, or republish, to post on servers or to redistribute to lists, requires prior specific permission and/or a fee. Request permissions from [permissions@acm.org](mailto:permissions@acm.org).

Copyright held by the owner/author(s). Publication rights licensed to ACM.  
*HRI2021 Virtual Conference Measuring Child-Robot Relationships*, Interdisciplinary Research Methods for Child-Robot Relationship Formation Virtual Workshop  
ACM .

## Introduction

Children experience pain and distress in clinical settings every day, and the negative consequences of unaddressed pain can be both short-term (e.g. fear, distress, inability to perform procedures) and long-term (e.g. needle phobia, anxiety)[9] [10]. In this project, we aim to develop and evaluate a clinically relevant and responsive AI-enhanced social robot. We believe that interaction with a robust, adaptive, socially intelligent robot can effectively distract children during painful clinical procedures, thereby reducing pain and distress. This workshop will allow us to discuss the methods by which such a robot can be developed while taking into consideration the ethics of child-robot relationships.

## Ethical Considerations and Key Challenges

The impact of AI systems on society is determined by the social role that the robot plays [13], as well as determining an ethical and appropriate means of making its capabilities clear. Existing literature on ethical aspects of AI in the healthcare setting often focuses on AI diagnosis tools [11]. With the increased awareness of AI and other related topics, such as autonomous systems, robotics, or surveillance, the need and wish for more information on the end-user side has also increased.

Some ethical considerations and key challenges in developing the socially assistive robot include: language and cultural challenges in ensuring inclusivity and respect for all peoples and how to account for biases [8]; the moral framework embedded into the creation of the robot and how the relationship between the child and social robot develops and how parents and medical practitioners would like that relationship to develop [2] [3] [6] [7] [14]; account for parent and child's expectations of the robot for any misplaced anthropomorphism and its technical limitations [1] [12]; privacy considerations and ensuring transparency in consent

and data use, limitations, and destruction if necessary (Livingstone 2018; Li and Park 2020); and creating a collective vision with all stakeholders in the trajectory of human-robot relationships in the future [4] [14] [15].

## Research Methodologies

In a recent medical scoping review, potential benefits of using social robots to help children who require short- and long-term hospitalisation, as well as intensive care were found [5]. Most studies in this area used relatively small sample sizes, non-clinical trial designs, and had acceptability as the main outcome; larger sample sizes and more robust, patient-oriented healthcare outcomes are needed [5]. We will employ a wide range of interdisciplinary techniques: the robot behaviours will be developed and elaborated through a co-design approach including all stakeholders; the robot software will be developed using cutting-edge AI techniques, and will be evaluated using techniques from usability testing; the clinical trial will be carried out using standard tools and techniques for such a trial; while the investigation of ethical and social implications will rely on techniques from content analysis.

## Workshop Objectives

In this workshop our research will explore the ethical implications of the child-robot relationship as it pertains to pain management and robot design. We will explore the potentials for such a pain-reducing social robot beyond the boundaries of the technical limitations of the NAO robot that will be used in our clinical trial testing. This research further will contribute to the workshop by considering the ethical implications of involving family, healthcare personnel, and children in the co-design of a socially assistive robot. The methodologies used to assess this child-robot interaction will be discussed in relation to both the clinical trial and co-design phases.

## REFERENCES

- [1] BELPAEME, T., BAXTER, P., DE GREEFF, J., KENNEDY, J., READ, R., LOOIJE, R., NEERINCX, M., BARONI, I., AND ZELATI, M. C. Child-robot interaction: Perspectives and challenges. In *Social Robotics*, G. Herrmann, M. J. Pearson, A. Lenz, P. Bremner, A. Spiers, and U. Leonards, Eds., Lecture Notes in Computer Science, Springer International Publishing, pp. 452–459.
- [2] BORENSTEIN, J., AND ARKIN, R. Robotic nudges: The ethics of engineering a more socially just human being. 31–46.
- [3] CHRISTIAN, B. *The Alignment Problem: Machine Learning and Human Values*. W. W. Norton & Company. Google-Books-ID: Lh\_WDwAAQBAJ.
- [4] COECKELBERGH, M., POP, C., SIMUT, R., PECA, A., PINTEA, S., DAVID, D., AND VANDERBORGHT, B. A survey of expectations about the role of robots in robot-assisted therapy for children with ASD: Ethical acceptability, trust, sociability, appearance, and attachment. 47–65.
- [5] DAWE, J., SUTHERLAND, C., BARCO, A., AND BROADBENT, E. Can social robots help children in healthcare contexts? a scoping review. e000371. Publisher: BMJ Specialist Journals Section: General Paediatrics.
- [6] KORY-WESTLUND, J. M., AND BREAZEAL, C. Assessing children's perceptions and acceptance of a social robot. In *Proceedings of the 18th ACM International Conference on Interaction Design and Children*, IDC '19, Association for Computing Machinery, pp. 38–50.
- [7] MATTHIAS, A. Robot lies in health care: When is deception morally permissible? 169–162. Publisher: Johns Hopkins University Press.
- [8] MCLENNAN, S., LEE, M. M., FISKE, A., AND CELI, L. A. AI ethics is not a panacea. 20–22. Publisher: Taylor & Francis \_eprint: <https://doi.org/10.1080/15265161.2020.1819470>.
- [9] MCMURTRY, C. M. Needle and dread: Is it just a little poke? a call for implementation of evidence-based policies for the management of needle pain in clinical settings. 101–102.
- [10] MCMURTRY, C. M., PILLAI RIDDELL, R., TADDIO, A., RACINE, N., ASMUNDSON, G. J. G., NOEL, M., CHAMBERS, C. T., SHAH, V., AND HELPKIDS&ADULTS TEAM. Far from "just a poke": Common painful needle procedures and the development of needle fear. S3–11.
- [11] RIGBY, M. J. Ethical dimensions of using artificial intelligence in health care. 121–124. Publisher: American Medical Association.
- [12] RYAN, M. In AI we trust: Ethics, artificial intelligence, and reliability.
- [13] SMITH, D. H., AND ZELLER, F. The death and lives of hitchBOT: The design and implementation of a hitchhiking robot. 77–78.
- [14] VALLÈS-PERIS, N., ANGULO, C., AND DOMÈNECH, M. Children's imaginaries of human-robot interaction in healthcare.
- [15] WIEDERHOLD, A. Conducting fieldwork at and away from home: shifting researcher positionality with mobile interviewing methods. 600–615.