Social Robots to Encourage Play for Children with Physical Disabilities: Learning from Family Units

Raquel Thiessen†
Department of Computer Science,
University of Manitoba,
Winnipeg, Manitoba, Canada
thiess83@myumanitoba.ca

ABSTRACT

Children with disabilities have fewer opportunities and lower motivation for play, impacting their cognitive and social development. Leveraging co-design and participatory design we plan to conduct a study with children with physical disabilities and their families to learn the requirements, concerns, barriers, and opinions about using social robots to facilitate play in children with physical disabilities. Combining the insights gathered from the families with knowledge from literature, we hope to outline the requirements needed to direct future research with a grounded understanding of the practical and social landscape these social robots would need to be designed within.

CCS CONCEPTS

• **Human-centered computing→Human Computer Interaction (HCI)**

KEYWORDS

child-robot interaction; human-robot interaction; participatory design;

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1 INTRODUCTION

For children, play is their primary occupation and a fundamental human right [1]. Through play, children develop their physical health, social skills, cognitive skills, creativity, and more [2], [3]. Learning new skills ultimately leads to increased confidence and will help them develop tools they will need to solve future problems or challenges [2]. Most importantly, play is a fun and joyful part of childhood that all children should have the opportunity to enjoy.

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Despite the vital role play has in children's development and the joy it can bring to them, time for play has decreased for children [4]. Children with physical disabilities often have even fewer play opportunities because they need to devote more time to their therapies and are impacted by their physical, social, and environmental barriers [5], [6]. We believe that social robots could effectively encourage and facilitate play for these children. Social robots have successfully engaged children in many applications, such as educational settings [7], [8] and therapies [9], [10]. They have also shown positive impacts on children's emotional well-being, such as mitigating anxiety and pain [11], [12]. Given the potential of social robots, we believe they could be influential in engaging, motivating, and supporting children with physical disabilities in their play.

We take a stakeholder-centered approach, conducting a study with children and their families using co-design [13], [14] and participatory design [15]. We are focusing on a social robot that would help facilitate play for play's sake [16], not necessarily just development-targeted play. As such, we imagine our social robot being present potentially at the children's homes, schools, or therapy centers. Therefore, it is important that the social robot be accepted and integrated into the family's life and routine. For this reason, we also prioritized learning valuable input from the family about safety, privacy, home environment, family dynamics, and more. Through this study, we hope to gain a clearer picture of the social and domestic environment and family dynamics that a social robot to encourage play for children with physical disabilities would need to fit in.

2 BACKGROUND

One way researchers have used social robots is to encourage collaborative play between children and their peers. In one example, researchers used the social robot KASPAR in a study of children with autism spectrum disorder. The results showed an improvement in the children's social behaviors when playing with each other [10]. Research such as this indicates the potential of social robots for facilitating collaborative play and helping social skills develop.

Past researchers have collaborated with therapists and other professionals (such as engineers and occupational therapists) to design and build robots tailored to support children. In the IROMEC project, researchers created a robot tailored for interactions with children with physical disabilities and those with autism spectrum disorder [17]–[20]. This research found that designing a robot to fit the requirements of both groups of children

was complex because of conflicting needs between the groups of children, but that overall, a social robot intervention showed potential for supporting play. In our research we want to build on this work by focusing on children with physical disabilities and learning from them through co-design techniques to outline for researchers the practical and social landscape the robot will need to be designed within.

Collaborative design methods such as participatory design or co-design approaches, aim to shift the power dynamic giving participants the control to influence the technologies used in their world. The purpose of collaborative design methods is to get direct ideas and feedback from the primary stakeholders about improvements, general needs, or innovations. One study worked with children and their parents to explore design requirements for a robot to help with pain management [21]. We follow a similar methodology, first having a phase to ground the stakeholders with what is technically feasible for a social robot before having them do a co-design robot activity.

3 PROPOSED METHODOLOGY

We designed a study to explore the opinions and concerns of children with disabilities and their families on a social robot for facilitating play. Currently, we are preparing to conduct our study at SSCY (Specialized Services for Children & Youth), aiming to work with 10-15 children and their families. Our approach to learning from them is through co-design and participatory design activities and follow up with semi-structured interviews. With their perspectives, we hope to extract their *primary concerns, desires, use cases, and more* to brainstorm and outline how we can leverage social robots to help facilitate play and the requirements of doing so.

Our study will be performed over a 1-1.5-hour session with children and their family units. To be eligible the primary child participating should be aged 4-14 with a physical disability. We will give the family the option to disclose the child's disability in our demographics form but will not require them to do so nor conduct any confirmation of their disability. For this session, we have two primary phases: *social robot exposure and elicitation*, where the elicitation phase consists of two subphases: *reflection and creation*. Throughout all phases of our study, we will ask the children and their families semi-structured interview questions to help us understand their thoughts, design choices, and opinions about a social robot.

Social Robot Exposure Phase. To help ground the stakeholder's ideas with what is technically feasible, we will start by briefly introducing them to social robots. With this information, the stakeholders will be primed to understand known possibilities and benefits, better positioning them to make judgments regarding a social robot intervention and provide more realistic desires, opportunities, and use cases.

Elicitation Phase. This phase engages the stakeholders to collect data that we can use to help understand our research questions. The elicitation will be through activities inspired by co-design and participatory design methods. The choice and sequence of the activities will be adapted per session to guide the participants through our research questions and potentially be modified based on the child's abilities. Throughout this phase, we will have semi-structured interviews, prompting the child and other family members to get additional information on their design decisions, general thoughts, and feedback. To moderate these interviews, we will have guiding questions to be asked for each phase, asking additional follow-up questions based on their answers. Questions will be asked to both children and family members where appropriate, allowing members to speak on behalf of one another if they choose.

Reflection. In the reflection subphase, we aim to get insight into what the family unit thinks about robots through a brief verbal reflection of the demo robots they saw. This phase also enables us to help them start the brainstorming process before we ask them to design their robot.

Creation. In the creation subphase, we aim to understand the kind of robot they believe would help encourage a child such as themselves to play. We will focus on understanding the participant's ideas for the general physical design, the functionalities, use cases, and the social dynamics of the robot. Using their described robot design, we will ask the guardians about any concerns they might have with the robot interacting with their children or of it being in their home and any perceived barriers to integrating such a robot. They can choose to build a physical robot prototype using the build set we created or draw their robot. If the child has trouble doing either, they will be encouraged to instruct the researcher how to build their robot. Following the creation, we will encourage the family to draw, act out, or verbally tell stories about their robot. If this does not work for them, we will instead describe stories of them with their robot and ask about their thoughts.

4 CONCLUSION

We want to build on previous work trying to leverage social robots for facilitating play by working with children with physical disabilities to ensure that we can meet families' real-life social and pragmatic needs and constraints. Our goal is to contribute to the HRI research field by providing insights we learned from our study to help guide future designs of social robots for children with physical disabilities to facilitate play for play's sake. Furthermore, we want to outline our process and the challenges we had with our method of co-designing with children with physical disabilities and their families.

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