Pre-school Children's First Encounter with a Robot

Elizabeth Cha, Anca Dragan, Siddhartha S. Srinivasa
The Robotics Institute, Carnegie Mellon University, Pittsburgh, PA
{lizcha,adragan,siddh}@cs.cmu.edu

1. INTRODUCTION

In this work, we investigate pre-school age children's attitudes and beliefs about robots, and how these are affected by interacting with a physical robot, as shown in Fig.1.

Although adults' attitudes towards robots is a common research topic [1, 3, 4], the attitudes of children remain relatively unexplored. Furthermore, research that studies children mainly focuses on children ages 7 and over [2, 5, 6].

In contrast, we focus on pre-school age children, who are still forming their ideas and opinions about robots, through both their peers and popular culture. Such children provide us with a valuable opportunity to observe and study *their first interaction with a real, physical robot*, and to explore *the effects of this interaction on their attitudes towards robots.*

Toward this goal, we conducted an exploratory study where we interviewed five children both before and after interacting with a bimanual mobile robot, HERB (Fig.1). We make two observations: (1) participants tended to be very open in their opinions of how a robot should look, and (2) meeting HERB broadened their views on the possible *functions* of a robot: participants who saw robots as assistants started to see a social role for them as well, and vice-versa.

2. METHOD

We performed an exploratory pilot study with five children (2 male and 3 female) that were all five years of age and enrolled in the same pre-school facility.

Outline: The study consisted of three phases: (1) pre-interview, (2) interaction with HERB, and (3) post-interview.

Questions: Since the children were pre-school age and might have difficulty answering surveys or questions using scales, we chose to utilize qualitative interviews.

Both before the pre- and post-interview, we asked each child to draw a picture of a robot — we used this both as a method for engaging the children into conversing about robots, as well as an additional method for identifying differences caused by meeting HERB.

After drawing the pictures, we interviewed each child about their drawings and ideas about robots. We first asked them to describe their drawing and asked any follow up questions that arose from their descriptions. Then, we asked about

1. what robots look like
2. what robots are made of
3. what robots do

Additionally, we asked the children whether they'd want to meet a robot during the pre-interview, and whether they enjoyed meeting HERB during the post-interview. We kept the interviews kept fairly flexible as to not frustrate the children or make them uncomfortable, giving them the option to skip over questions they had trouble answering.

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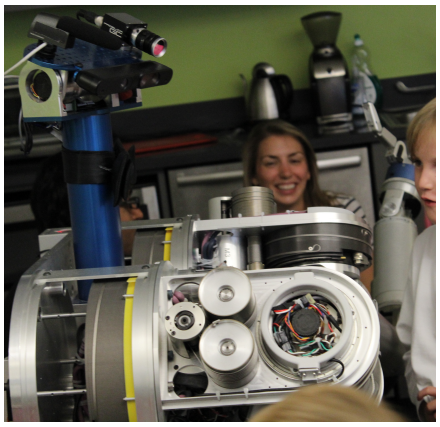


Figure 1: Interaction with HERB.

Interaction: The day after the pre-interview, we introduced the children to our robot, HERB. HERB is a two-armed robot that moves via a Segway RMP base, and is roughly human sized. We gave the children basic information about the robot, such as its purpose — to assist older adults and people with disabilities — and what the different components of the robot are. HERB did not move autonomously around the children for safety reasons. Instead, we teleoperated the head to look at the children, and the person introducing HERB moved the arms manually. The children were allowed to ask questions about the robot, as well as physically interact with it. This was the first interaction with HERB for every participant.

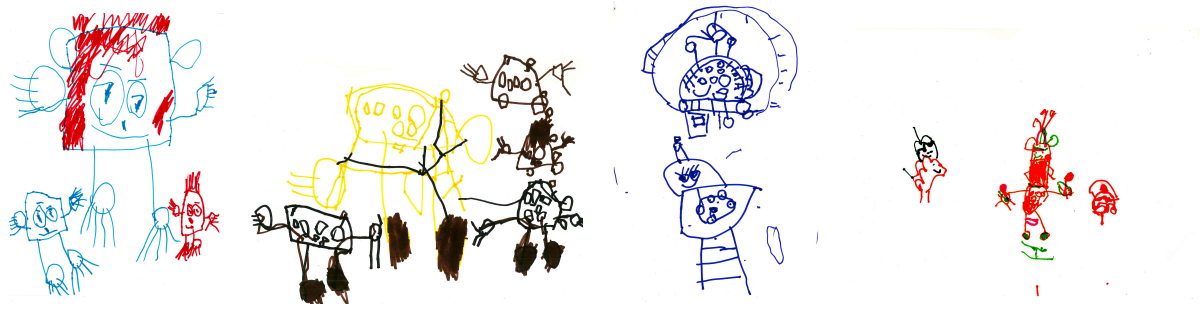
3. OBSERVATIONS

3.1 Tolerances and Biases

Overall, the children were surprisingly open in their ideas about robots – shape, size and personality. However, they did have certain biases, particularly about what robots were composed of.

Appearance: During our interviews, we found that participants were very open to what form a robot may take. Although each participant drew a robot with a particular form, all participants agreed with the idea that robots could come in other forms that resembled machines, animals, or humans. Participants also mentioned that robots can be either small or large. Some said that robots can come in many colors. Furthermore, many drawings included both female and male robots, with participants saying robots can be either boys or girls. Overall, participants accepted robots could be many different shapes, sizes, and genders.

However, participants also had certain biases about robots. Most participants drew faces on their robots and expressed the opinion that all robots should have one. Interestingly, participants also named some very specific features or components that robots must have to be considered a robot. For instance, all participants were quite insistent that a robot should be made of metal and can not be made of any other materials, e.g. plastic. They mentioned "metal



(a) Pre-Participant A (b) Post-Participant A (c) Pre-Participant B (d) Post-Participant B

Figure 2: Drawings made pre and post interaction by two participants. After meeting HERB, Participant A replaced the feet on his robot with wheels like HERB's, and Participant B replaced his two robots acting "silly" with a helpful robot mechanic.

brains", "metal bones", and "hearts of steel". Participants also mentioned buttons, antennas and screws as being critical to the robot's appearance.

Functionality: Participants were split on their view of what a robot's main function is. One participant viewed robots as potential friends or companions, while another viewed them as assistants that clean up. The other three participants drew robots without a clear purpose, and without involving humans. Instead, their drawings depicted robots interacting with robot friends and families.

Personification: All participants seemed to personify robots, giving them faces and genders. For some participants, robots had families or pets. Some also attributed personality traits to robots, such as badness, meanness or silliness. Participants who attributed such traits also mentioned that only some robots are bad, mean or silly, while others are good, nice or serious. One participant expressed a fear of robots (especially those with laser beams) and was the only one to respond during pre-interviews that he would not like to meet a robot.

3.2 Perception Shifts

We noticed different perception shifts for each participant in either appearance or function.

Appearance: After having been exposed to HERB, participants still expressed the view that robots should have some key features, such as being made of metal. However, some participants dropped other specific features, such as antennas, that were prominent in their earlier drawings.

Also, during post-interviews, several participants mentioned wires and electricity as important parts of a robot and some of their drawings featured robots with forms or features similar to HERB. For instance, one participant initially drew robots with legs and feet, but after seeing HERB, he drew wheels instead of legs: Fig.2, left.

Functionality: In post interviews, we found that many participants expanded their views of what functionalities robots may have. For instance, one participant was initially adamant that robots only clean. After seeing HERB, she also wanted a robot to play with her. Another participant who initially drew a robot doing karate with her, later said she wants a robot to clean and fetch items.

Others who initially drew robots as separate from humans shifted to a more functional view. For instance, one participant initially drew two robot friends acting silly. However, after interacting with HERB, the participant drew a workman robot that performs car repairs better than a human mechanic (Fig.2).

Personification: Initially, one participant expressed the belief that robots are scary, wanting to keep them on leashes, and keep their "metal teeth" away from him. He also responded that he did not want to meet a robot. After interacting with HERB, however, his attitude shifted to be more positive. He not only wanted a stuffed robot with which to sleep, but also a real robot to help him clean and do chores. Furthermore, his drawing now depicted a robot that helped people fix things.

4. DISCUSSION

We observed that compared to adults, these children were more open to the appearance a robot may take, and that they tended to personify robots more. After interacting with a real robot, participants shifted their initial views to see robots as more friendly and useful to humans. Participants that attributed social roles to robots now saw them as useful assistants as well, and vice-versa.

This work was a first step to understanding how children's perceptions shift after interacting with a physical robot. In the future, we are excited to explore how perception shifts might depend on embodiment (physical vs. virtual robots) and on the the duration and frequency of the interactions.

Overall, our observations suggest that exposing children to physical robots at a young age may positively affect their attitudes towards robots. This suggests that early exposure of such technologies may facilitate future acceptance. As robot designers, however, we must wonder what can be done during these early interactions to elicit greater and more purposeful shifts.

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