How Would You Describe Assistive Robots to People Who are Blind or Low Vision?

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ABSTRACT

Assistive robots can enhance the safety, efficiency, and independence of people who are blind or low vision (B/LV) during urban travel. However, a clear understanding is still lacking in how best to introduce and describe an assistive robot to B/LV persons in a way that facilitates effective human-robot interaction. The goal of this study was to understand how different people would describe an assistive robot to a B/LV traveler. Our preliminary results showed that participants described the robot in a similar order (i.e. robot's appearance, function, and capability in order); however, they had different focuses on their descriptions. This pilot study will lead to better descriptions of assistive robots to B/LV users, supporting more effective interaction in our future real-world deployment works.

1. INTRODUCTION

Human-robot interaction generally begins with the human seeing a robot. The appearance (e.g., size and pose) of a robot greatly influences first impressions of sighted people and the subsequent human-robot interaction [1][2]. For people who are blind or low vision (B/LV), a first impression is likely to come from descriptions provided by others. Along with previously formed opinions about robots and technology in general, their first impressions are likely to be influenced by the introduction and description of the robot and its functionality.

Given the importance of first impressions on human-robot interaction, it is beneficial to examine how different people describe an assistive robot to a B/LV person. Having this base of knowledge will further understanding about how variation in descriptions influence subsequent interactions with the robot and derive an effective way to describe an assistive robot.

In this preliminary study, we explored how stakeholders, such as sighted experts who work closely with B/LV people and B/LV adults, would describe an assistive robot to a B/LV person who asks for assistance. This work is the first step towards our ultimate goal of a real-world deployment of assistive robots in public settings for travel assistance. Therefore, we utilized functionality concepts for a robot at a transit station help desk.

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Figure 1: Participants interacting with Baxter robot - a sighted expert (left), a B/LV adult (right).

2. METHOD

For this study, we used a human-safe, commercially available Baxter robot. This upper torso stationary humanoid robot was positioned behind a desk in a closed lab space. We conducted one-on-one interactive sessions and in-person/email interviews with six sighted experts (e.g., orientation and mobility instructors) and eight B/LV adults. Figure 1 shows participants interacting with the Baxter robot.

The study consisted mainly of four activities. The activities included meeting our Baxter research robot, learning about its functionality and capabilities with example scenarios in the context of the robot assisting B/LV travelers during urban travel, physically interacting with the robot, and answering interview questions about their experience.

Sighted experts were also interviewed via email one week later and asked, "How would you describe our assistive robot to a blind or visually impaired traveler?" As a reminder, we provided a picture of them with the robot taken during their session.

For B/LV adults, we adjusted the question as follows: "How would you describe our assistive robot to your friend who is blind or visually impaired?" We asked this question twice - the first time was during the in-person interview and the second time through a follow-up email one week later. We asked the question twice to capture how their memories and descriptions may have changed over time.

3. RESULTS

Five sighted experts responded to the email interview request, all eight B/LV adults responded during the the in-person session and seven responded to the email interview. However, one of the B/LV email responses was excluded

from this analysis since the participant only responded to a topic unrelated to this study.

We present here a brief summary of the themes identified. Participants often used descriptions of a human appearance as a comparison to describe the robot's appearance (e.g., human-like arms, man size). Interestingly, some B/LV participants explicitly stated that the robot looks more like a machine than a human (e.g., machine-like hands). Most of the participants described the robot in a similar manner. Their descriptions usually began with describing the robot's appearance. Then components of the robot, such as its arms and monitor, were mentioned along with functions/capabilities. Many participants referred to the size of the robot in their descriptions, stating the robot is bulky, large, or big. Several B/LV participants also voiced that the robot is unnecessarily big for the capabilities that it possesses. A few B/LV participants pointed out that they would describe Baxter as a robot similar to those seen in science fiction films (e.g., Lost in Space, Frankenstein).

Table 1 shows a frequency table for the results of the description study. "S-E" represents sighted experts responded in the email interview, "B-I" represents B/LV adults responding in the in-person interview and "B-E" represents B/LV adults responded in the email interview. Note that during the in-person session (B-I), we explicitly asked about the size of the robot. We prompted for this since we were curious about this issue. Table 2 shows a few examples of how participants descriptions relate to the themes.

Almost every participant addressed the robot's appearance and its function/capability. B/LV participants mentioned the appearance much more often than they did the other themes in their descriptions. Many B/LV participants mentioned small robot components such as hands (fingers and the suction cup), even in the subsequent post-activity description, while only one sighted expert mentioned such components. Likewise, more than half of B/LV participants described the robot's ability to pick up an object. Many B/LV participants also mentioned the robot's voice.

One sighted participant who is an orientation and mobility instructor specifically commented that clear and simple language should be used to describe the robot to a B/VI traveler. Also, if the person has any vision, she would first ask for that person to describe what he/she can see of the robot in terms of its size, basic shape, or color. Knowing this information on the level of visual impairment is very important because descriptions of depth, length or detail may need to be tailored to the individual.

There were some interesting and unexpected results. Surprisingly, none of the participants expressed anything about safety features of the Baxter robot. During the activities, we highlighted this feature because we felt that safety would be critical to B/LV travelers when interacting with a robot. However, no one included the safety of the robot in their description. Likewise, only one participant (B/LV) partially described the robot's pose. We initially surmised that providing B/LV travelers with details about pose would be essential for effective human-robot interaction. Pose clearly influences first impressions of robots for sighted humans.

Table 1: A frequency table that shows the number of participants who described themes

Themes	Sub Themes	S-E (5)	B-I (8)	B-E (6)
Appearance	Size	2	8	3
	Arms	4	7	6
	Hands	1	7	5
	Screen	2	7	6
Feature	Voice	2	2	5
	Button	0	2	1
Capability	Picking up objects	0	5	3
	Scanning documents	2	1	4
	Providing directions	2	1	3

*Numbers in parentheses indicate the total number of participants in the interview.

Table 2: Examples of Participants' descriptions

Themes	Verbatim Quotes
Appearance	"*Baxter is a large robot with two large arms that have buttons near them to perform tasks...*" (B4-E) "*Although Baxter is a metal robot, he has all the upper body parts of a human...*" (S5-E)
Feature	"*His speech is synthetic and easy to understand.*" (B7-E)
Capability	"*Baxter can scan and then read out loud printed information in an easy-to-understand voice...*" (S2-E)

4. DISCUSSION AND FUTURE WORKS

Overall our pilot study took a step towards a better understanding of how different people with blindness or low vision will interact with an assistive robot. There was variety in descriptions, which may have resulted from different levels of knowledge about robots and technology, previously formed opinions and expectations, and different levels of experience in working with B/LV individuals. To look into this further, we are currently using a web survey to gather input from robotics experts and members of the general public on how they might describe a robot to a B/LV person. Sampling a wide variety of people will allow us to explore how variances in describing an assistive robot influence interactions between B/LV persons and the robot. Additionally, such insights will lead to better descriptions of assistive robots to B/LV users, this supporting more effective interaction in our future real-world deployment works.

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