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Conference Paper · June 2019

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Participatory design with teens: A social robot design challenge

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ABSTRACT

Design requirements can be gathered through a variety of ways; however, engaging teen audiences in design process can be challenging. We present a novel method for engaging teens in design through a social robot design challenge. Groups of teens participated in the challenge to prototype a social robot that would live in their high school and help address stress, a persistent and pervasive problem for this age group. In this paper, we present our methods and share preliminary findings.

KEYWORDS

social robots; teens; design requirements

ACM Reference Format:
Emma J. Rose, Elin Björling, and Maya Cakmak. 2019. Participatory design with teens: A social robot design challenge. In *Interaction Design and Children (IDC '19), June 12–15, 2019, Boise, ID, USA.* ACM, New York, NY, USA, 6 pages. https://doi.org/10.1145/3311927.3325304

IDC '19, June 12–15, 2019, Boise, ID, USA

ACM ISBN 978-1-4503-6690-8/19/06…$15.00
https://doi.org/10.1145/3311927.3325304

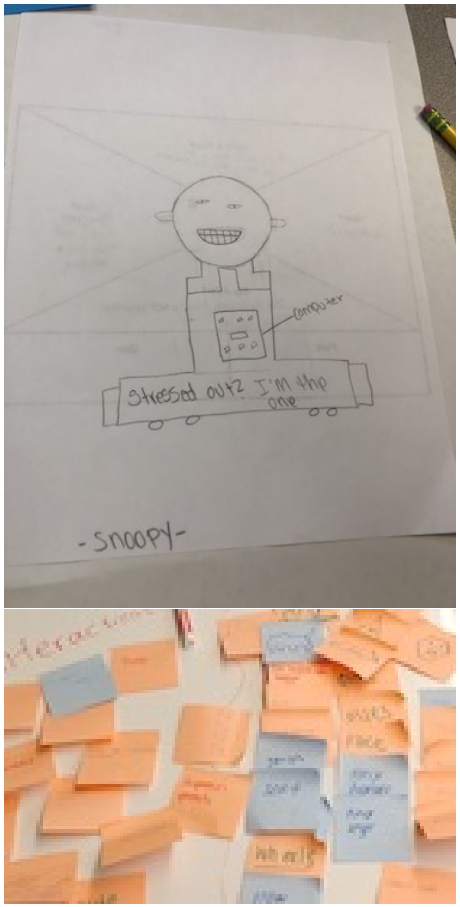

Figure 1: Examples from research and ideation sessions.

INTRODUCTION

Teens are a unique population and especially vulnerable to mental health issues [7] [17]. The use of social robots shows promise to assist with mental health assessment and therapy and address the unmet needs of a variety of populations [4] including vulnerable populations[9]. We present a novel method for gathering requirements to inform the design of a social robot to help teens with stress. In 2018, we conducted a social robot design challenge for the purpose of informing the design of EMAR (Ecological Momentary Assessment Robot), a social robot being developed to help measure and address teen stress. The purpose of the challenge was to engage teens as co-designers and gather data specific to their lives, contexts, and schools. We begin by discussing teens, mental health, and social robots, then describe the methods used and report preliminary findings.

Teens, mental health and social robots

A mental health robot that gathers data from teens is a beneficial and timely expansion of current technology. Social robots have been developed to support emotional wellness in children and adults, such as Therabot [5], Paro [14], Pleo [6, 10]. Since teens are not quite children and not quite adults, they require different approaches in design [2, 11] but tend to be under explored [11, 16].

To identify design requirements for a mental health social robot, we wanted to engage teens in a meaningful way as co-designers. Further, since every school setting is unique, we wanted to gain a better understanding of the needs of several communities to understand commonalities and differences. To gain a deeper understanding of the context, we developed a participatory, in the wild, approach in the form of a social robot design challenge to better understand specific needs and requirements that came directly from users. Design challenges are a common form of learning in mechanical robotics in the United States at university [1] and high school [8] levels. Participation in robotics design challenges increases robotics learning and positive attitudes toward robotics and engineering [13] and science in general [15]. We created a similar design challenge, focused on social robots to help teens with stress to inform the design requirements for our larger project [3, 12].

METHODS

The design challenge ran from January - March 2018 and the protocol was reviewed and approved by our University's Institutional Review Board as well as each school district's research review board. We recruited seven high schools to gain a range of representation based on demographics, location, and interest. To support participating high schools, we introduced key concepts of human-centered design to the teens through teen appropriate curriculum either in the classroom or as part of an extra curricular club [12]. Teens were given the following requirements for designing their low fidelity prototypes: (1) use the five stages of human-centered design, (2) involve students from your school to

Figure 2: Teens prototyping robots

Figure 3: Boom Boom

gather data, and (3) document your process. Teens were given the following areas to explore their design requirements: (1) What does the robot look like? (2) How does the robot sound? (3) How does it help students with stress? and (4) How is it unique?

During each visit, we taught human-centered design via activities and workshops (Fig 1).

- User Research: methods included interviewing and discussing with peers, expert interviews experts like counselors, surveying peers, idea boards (questions in public spaces), online research, reflection, and discussion with peers.
- Ideation: teens discussed research, turned ideas into features, used affinity diagramming, sketching, scenarios, and storyboards.
- Prototyping: teens built low fidelity prototypes with a variety of available materials (Fig 2)
- Testing: teens conducted external prototype testing and gathered feedback from peers.
- Iteration: teens utilized testing feedback to make necessary improvements to their designs.

The social robot design challenge culminated with a public showcase on March 24, 2018 where 6 of 7 high school teams presented their designs to the public. We collected a variety of data including team presentations, design rationales, photos and descriptions of the prototypes, question and answer sessions. We did a thematic analysis to identify key features and characteristics. We describe each robot prototype and highlight key functions and features. These prototypes were intentionally designed to low fidelity with limited functionality. Designers demonstrated functionality through description, Wizard of Oz methods, and by connecting their prototypes to other devices, like mobile phones to simulate features.

Boom Boom. (Fig 3) is a small boxy robot covered with a black and white floral pattern and designed to engage with stressed teens. The team designed Boom Boom to have a friendly face, play music, and provide multilingual support. Boom Boom is equipped with a mood sensor to read people's emotions and designed to communicate and reflect back how a teen was feeling and also calibrate itself to help interact with that teen.

CARL bot. The name CARLbot (Comfort And Relaxation Laugh bot) approaches teens at school to offer stress relief and provides a variety of options and provides customized interventions. The robot (Fig 4) is equipped with four buttons that let teens choose a stress relieving activity: jokes, inspiration, relaxation, meditation. A teen likened it to the similar roaming features of a Roomba. CARLbot also has a display screen that changes depending on the option to show animated famous people's faces that will talk with you.

Comfort Zone. Comfort Zone (Fig 5) is a social robot designed to create a calming atmosphere. It's unique feature is that its embodiment is a room, rather than a physically present robot. The impetus for the design was to give teens a way to escape from school. The team built the prototype and did

Figure 4: Carlbot

Figure 5: Comfort Zone

field testing by having other teens go inside the room to report what they did and didn't like. The room is voice activated and teens can control the ambiance in the room by changing the colors of light on display, the kind of music is playing, and the relaxing video that is showing.

Joaquin Bartholomew III. (Fig 6) is a two foot tall robot designed to give support to stressed teens like tangible gifts and supportive interactions. Joaquin dispenses a products on demand to soothe teens, such as tea, chocolate, and provide aromatherapy. Joaquin is covered with a soft coat of fur to encourage hugging. Joaquin is also designed with lights that provide ambiance but also communicate with teens. Joaquin has a voice with a customizable accent. Finally, the team talked about designing for durability to sustain abuse, since some teens might want to destress by kicking or punching the robot.

Lucy. (Fig 7) is a robot that looks and acts like a dog and was created to help relieve stress. The designers envisioned that Lucy could be pet by teens and taken for walks, activities that mentioned have calming effects and relax people. Lucy can also wag it's tail and bark to show it is happy or to get attention. Lucy would also include voice recognition. When addressed, Lucy would perk up its ears, and respond with a human voice, saying "I'm Lucy from [High School], I'm here to help you to reduce your stress." In terms of interactions, the designers imagined Lucy would listen to concerns and issues of teens. Lucy would emphasize and show sympathy and then offer resources or support, such as instructing a yoga lesson, providing advice, or providing phone numbers or other resources such as counseling.

Petunia. (Fig 8) was designed to provide personalized support by focusing on help with academics. Petunia's provides individual students with personalized attention and focuses on school work and tutoring and displays grades. Petunia provides personalized music playlists to help users concentrate and snacks and drinks. She can be summoned from a companion mobile app to where you are in school. The designer also mentioned that you can just be with the robot when you are stressed "You can just sit and have alone time with it."

Key features and requirements

The social robot prototypes, the design rationales, and the team presentations were analyzed to identify common themes.

Voice and Interaction. Many of the robots emulated a variety of interaction mechanisms such as voice recognition, natural language processing, or touch screens. Teams spent considerable attention on the type of voice the robot should have, indicating its importance. Other robots had voices that were intentionally meant to soothe or calm you and have a familiar voice.

Figure 7: Lucy

Figure 8: Petunia

Size and embodiment. Out of the six robots, 5 were designed to be at human height when on a table top or smaller. The designers of Joaquin mentioned the importance of having a robot at eye level. Several designers specifically mentioned designing the robot to be cute, friendly, and approachable. The exception was Comfort Zone, a room, and although it has a drastically different embodiment, it offers similar features to the other robots.

Face and Gender. All of the robots had some sort of face. Whether it was designed to smile and be friendly like Boom Boom, Petunia, and Joaquin, or was realistic like the Lucy's, as a dog. Others had faces that weren't permanently displayed like CARLbot and only appeared during certain interactions. And even Comfort Zone, which did not have a typical robot embodiment had a plant inside the room that contained eyes. The teams chose a variety of pronouns when referencing their robots, including he, she, and it. When asked about gender, some of the teams talked about gender fluidity.

Offerings. A cross-cutting theme that unified the robot designs was the idea of offerings including

- Material: Robots were designed to give something tangible or material during an interaction. Many of the robots were designed to provide food or drink.
- Active: Each robot offered active interventions for stress in the form of jokes, homework help, guided meditation, or hugs.
- Ephemeral: Robots provided ways to create a refuge or cocoon of calm for stressed out teens: music, lighting, visualizations.

CONCLUSION

As the emerging evidence suggests, stress is a universal experience, but the causes of stress varies greatly. Teens designed appropriate and contextual robots to alleviate their stressful environments. From these data, we infer that designing a single, social robot with a limited scope will fail to address the myriad of teen stressors or the diversity of school settings. Therefore, creating a customized and flexible robot platform has become a key design requirement for our larger project.

SELECTION AND PARTICIPATION OF CHILDREN

This project was reviewed and approved by University of Washington's IRB, school districts' research committees. If teens elected to participate in the design showcase, they gave their assent and parental consent (form). We explained to teens that data collection included photos, descriptions of prototypes, and rationales of design process.

ACKNOWLEDGEMENTS

Thank you to all the teens who participated in this research. This work is supported in part by the National Science Foundation under grant no. NRI-1734100.

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