Autonomy Design (Guobotics - Adella Guo, Rachel Nakamura, Alan Qiu)

I. Why We Chose the ShiverBot

Our team, Guobotics, boiled our many early research question concepts down into two very different potential research questions. The first of these, “ShiverBot,” explores how humans’ empathy varies in response to tangible expression of biological functions. We would chain a custom-built robot of about knee-height to the railing next to where the Pausch Bridge meets the entrance of Purnell. Directly on the ground next to the robot would be a box resembling a small generator with a hand crank attached to it. The robot, which will physically appear as if it is shivering, would call out to passersby, asking them to turn the crank in order to warm the robot up. The more the user would crank, the less the robot would shiver. We are interested in finding out how much time the user is willing to spend helping a robot solve a biological problem it cannot, technically, experience**.**

The second research question we posed plays with shaping a robot’s identity through the medium of social media. We would create a GoFundMe fundraiser for our robot explaining that, in order to support its family, our robot needs monetary donations. We would then create multiple social media accounts on a wide variety of social networks in order to construct a robust social media identity and backstory for our robot. The primary question at the forefront of this study is: Will having a social media presence influence people to donate money to a robot, which technically has no financial needs?

Ultimately, we decided to further pursue the ShiverBot study because we feel that its interaction exceeds that of the social media robot’s in terms of both depth and complexity. There is a complete lack of literature on the ability of robots to elicit empathy with regard to biological functions, let alone shivering. We hope that, by exploring this relatively novel area of human robot interaction, we will compel the field to question human perception of robots’ behavior with greater originality.

II. Implementing the ShiverBot

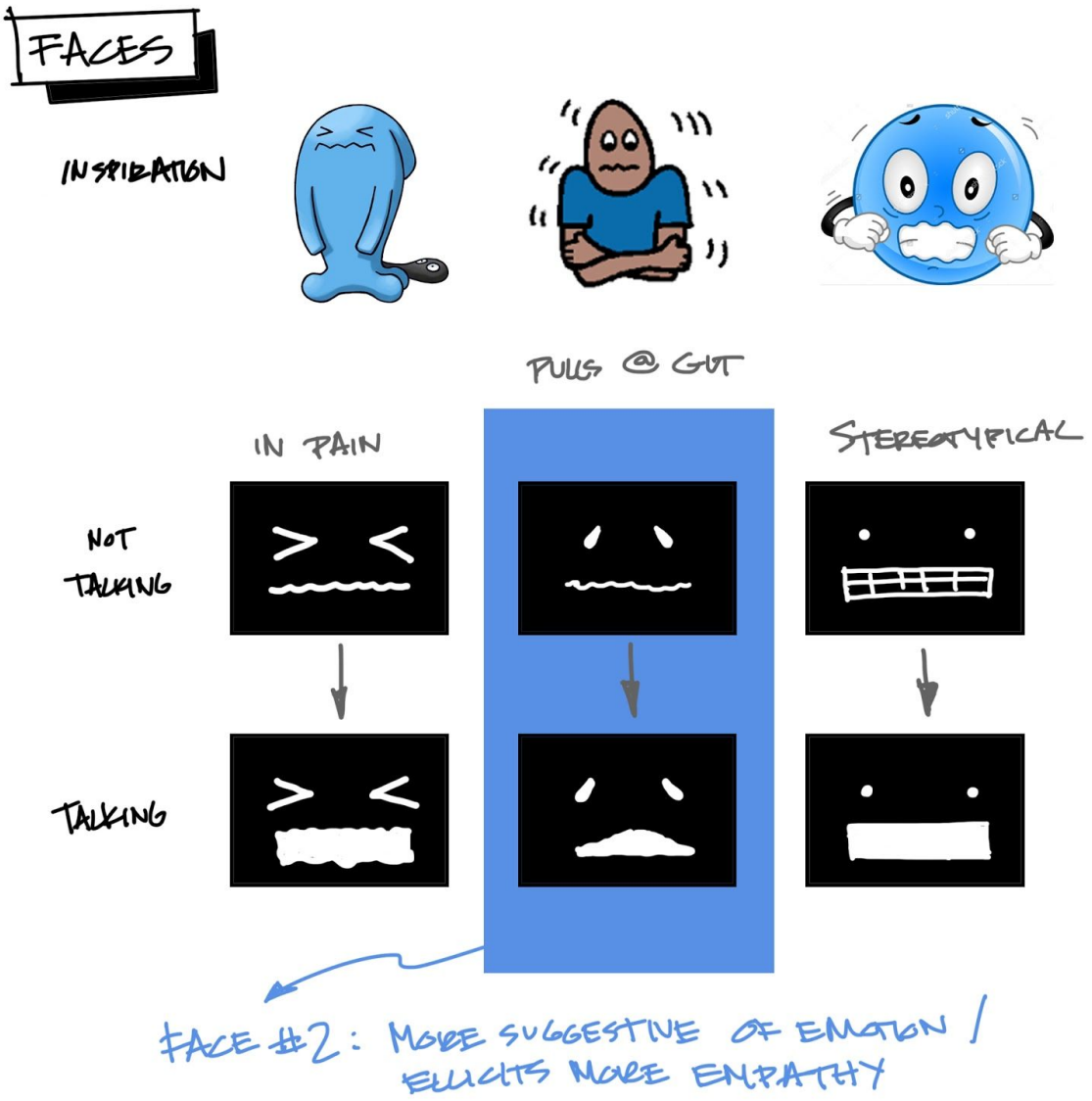
1) Appearance

Materials

Overall, Shiverbot will be structured out of acrylic sheets. Sheet metal will cover all external surfaces of the robot so that Shiverbot will be cold to the touch. Adorning the robot with small clothing accessories, such as a hat and a scarf, and giving the robot a pitiful facial expression will help convey to the user that the robot's slight and rapid shaking is actually "shivering" as a result of being too cold. Additionally, we intend to chain Shiverbot to the railing outside of Purnell, at the entrance of Pausch Bridge, to serve the dual purpose of not only making Shiverbot look even more helpless, but making sure that no one steals our robot. The clothing worn by Shiverbot will be made of materials similar to that of human clothing, like wool or cotton.

External Parts *(italicized items are still being debated/explored)*

1. Ipad
2. Smartphone
3. *2 Speakers* (bluetooth or wired)
4. Crank ($30)
5. Aluminum heat duct
6. Chain
7. Hook
8. Lock
9. Servo motors
10. Adhesives
11. *Heat Pack*



2) Build

We will laser cut acrylic sheets to create the frame of ShiverBot's body, afterwards cutting sheet metal to the size of all exterior surfaces of the body and covering said surfaces, so that the robot looks as if it is primarily composed of metal.

We decided to use an **iPad** for the face because the higher grade material contributes greater believability, fidelity, and reliability with regard to the robot's capability and intentions. We can also easily borrow an iPad from Hunt Library for the duration of our study.

The **smartphone** will serve the dual purpose of receiving audio from the user and outputting audio to the speakers. This is a good option because not only it is easily accessible for us, it will allow us to communicate and interact with the user wirelessly and effortlessly.

The 2 **speakers** will serve the 2 functions, the first will ShiverBot's means of communicating with the user and the second will create a crank sound when the heat generator is cranked. We are still debating whether or not we will be using the second speakers to amplify the crank sound because we are unsure if the mechanical crank has a loud enough sound to create the perception that heat is being generated.

One of the most important features of the ShiverBot is the **crank**. We decided to have the crank be connected to the robot through a heat duct tube to suggest that there is an internal generator in the secondary compartment which will help the robot "heat up". The person doing the cranking will receive auditory feedback (crank sound, generator noise etc.) as he cranks.

We looked at **heat ducts** of various materials and decided that aluminum would contribute most to the believability and fidelity. The heat duct could also be purchased online for less than $20 which will then be cut to the right size.

The metal **chain, hook, and lock** that binds the robot to the railing could also be purchased on Amazon, Creative Reuse, or Construction Junction.

As for the **servos**, we want to consult with Illah and our classmates for the best option before committing to any generic servos that can be purchased online (i.e. Amazon)

We are also currently exploring the idea of adding **heat** packs within the generator in order to make the generator seem more believable and that cranking is actually helping to warm the Shiverbot.

3) Operation

Shiverbot will have a tablet as its face. The tablet will display the same eye shape but have very simple mouth movements of opening and closing when it “talks”. We will wizard-of-oz this feature remotely where the animated images of the face will be controlled using a remote control such as a wireless mouse or computer. Shiverbot will also have a phone with bluetooth speakers placed in its head so that we can speak with the user and listen to his or her responses, making it seem that Shiverbot is actually talking. We will alter our voice using a voice changing software (Garageband for Mac). In addition, in order to generate believable male and female robot voices, we will use the text-to-speech feature on Mac computers.

Three types of voices to test as our independent variable:

- Robot (voiceover)
- Female (text-to-speech)
- Male (text-to-speech)

Dialogue

Contact Initiation
“Sorry! Excuse me?”
Get’s closer
“I wouldn’t ask unless I really needed the help, but can you please turn that crank?”

Backstory
“Really sorry, my owner has been gone for a while, he said he’d be back soon.”
“Is it chilly out here or is it just me?”

Possible User Responses:

- “Is that good?” -Sorry yes
- “What is this for?” - If you could just keep me warmer a little longer?
- “I’m sorry I have to go” - Really? [Contact Termination]
- “Do I just keep cranking?” -I’m sorry just a little bit longer please.

Elicit empathy

- **How has your day been?** Has anything exciting happened? Why why not?
- Are you looking forward to anything fun? If you can be anywhere right now where would you be?
- What do you like to do when you're not working?
- What type of music are you into?
- Have you read any good books recently?
- Are you a cat person or a dog person?
- Coffee or tea?
- Do you cook?

Contact Termination

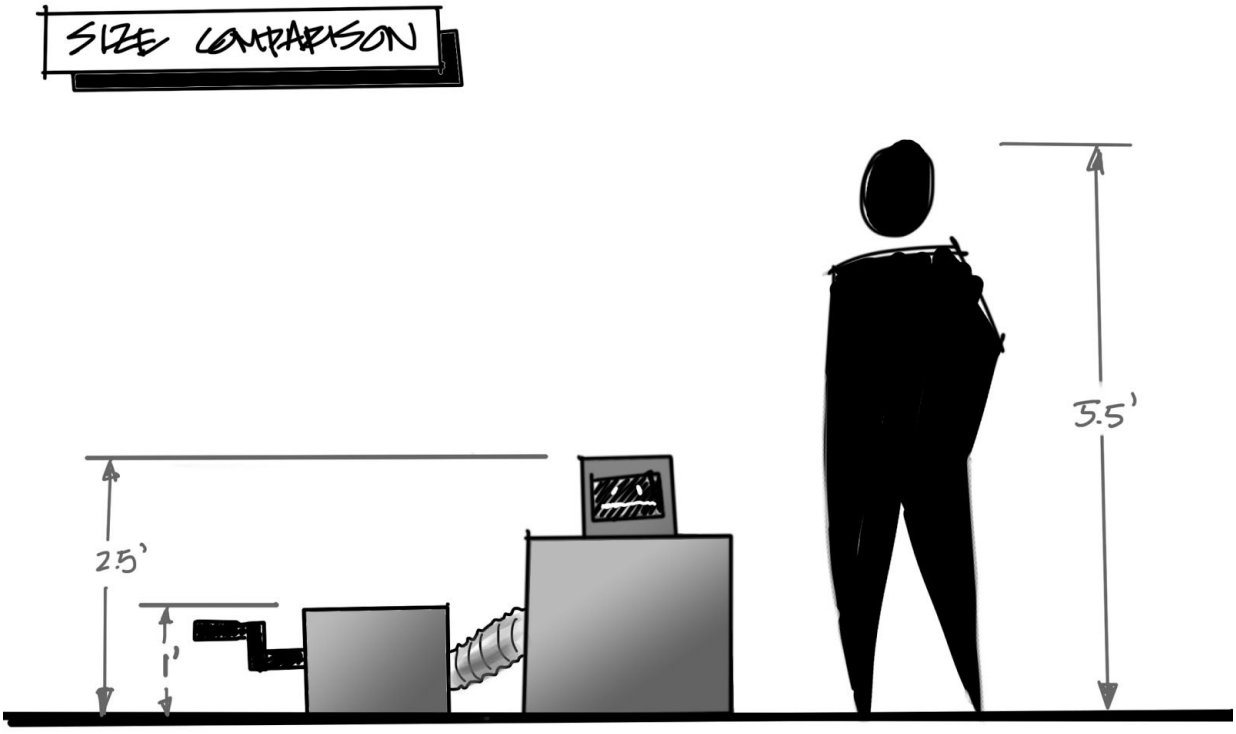
"Thank you so much! Sorry for troubling you! What's your name by the way?
User says name
"Well, it was really nice to meet you, [Name]. Take care of yourself, okay?"

4) Situating the Robot

Shiverbot will be located in front of the Purnell building at CMU. It will sit on the floor and be chained to the Pausch Bridge for the duration of the study. Shiverbot will stand about 2.5 feet tall, which means that users will have to squat or sit on the floor in order to be at eye level with the robot while cranking and conversing with it. The robot will not move during the study. In fact, the chain anchoring Shiverbot to the railing will serve to visually inform the user of Shiverbot's helplessness and inability to move itself.

We will be sitting in Purnell at one of the tables in the lobby from an angle where we can clearly see the robot without being seen by potential users. Outsiders typically do not look at the Purnell lobby as they pass by because the glare on the glass walls is usually quite strong and because the CMU Drama Department exists, culturally, in a world almost entirely isolated from the rest of the university.

The entrance to the bridge is an ideal location to conduct this study, as a steady number of people constantly pass by but never so many as to develop into an overwhelming, chaotic mob. This setting will hopefully give us more control in an environment that allows for little consistency. Additionally, choosing a spot located between Gates, the technological center of CMU, and Purnell, where artistry and emotion take precedence over machines, will allow us to interact with a greater variety of users than if we chose a building unique to one department.


SIZE COMPARISON
5.5'
2.5'
1'

III. Automation and Wizard of Oz-ing

Shiverbot

For our robot, we decided to Wizard of Oz speech, user recognition, user perception, cognition, robot facial features, heat generation, and timing.

Existing Technology

In areas of perception, Shiverbot could be automated by using a combination of sensors such as motion sensor, microphone, and heat sensor (thermometer). When placed correctly, the motion sensor could be used to detect passing individuals. Shiverbot could then make contact initiation or termination depending on the stage of interaction. Existing hardware prototyping microcomputers such as Arduino or Raspberry Pi could be used to execute given speech patterns as required by the researcher.

In terms of automating a dialogue with the user, exemplary software are Siri or Amazon Echo. Since one of the goals of the research is to see how long people are willing to interact with Shiverbot, we want to facilitate that as much as possible through the intermediary dialog. Having the human interact with an artificial intelligence which is capable of having an engaging conversation would be core to our research.

The current state of the technology, however, do not facilitate rapid prototyping of speech-related artificial intelligence such as Siri or Amazon Echo where a convincing and engaging conversation is held between the robot and the user. It is also worthy of noting how most current artificial intelligence chat systems do not hold the type of engaging conversations where the AI is leading the topic. We discussed how by programming specific auditory responses based on proximity and motion sensors would lead to a more autonomous robot. It is possible to create a chatbot which would fit the functional requirements of our research (The Rise of Chat Bots), however, given the time constraints and resources, it would not make a significant impact in terms of our research.

The robot could also be automated in terms of temperature and heat generation. By using a mix of temperature sensors and heater system, an automated Shiverbot would be able to accurately detect when and how much the user is cranking the generator. An

Arduino or Raspberry Pi would be able to autonomously and accurately record how much time has elapsed since the user has started cranking.

References

(n.d.). Retrieved March 22, 2016, from http://www.ichato.com/

The Rise of Chat Bots: Useful Links, Articles, Libraries and Platforms. (n.d.). Retrieved March 22, 2016, from https://stanfy.com/blog/the-rise-of-chat-bots-useful-links-articles-libraries-and-platforms/