

**Figure 1: Data collection**

# Robots on Campus: Understanding Public Perception of Robots using Social Media

**Ahreum Lee**

lahreum@purdue.edu

Purdue University

West Lafayette, Indiana

**Austin L. Toombs**

toombsa@purdue.edu

Purdue University

West Lafayette, Indiana

## ABSTRACT

As robots engage more in society in various forms, it is important to understand the public perception of robots. In this poster, we focus on a campus-centric subreddit to explore online discourse about delivery robots on university campus. We specifically identify how people share their experiences with robots and how people perceive robots in society by analyzing Reddit posts. In so doing, we raise existing concerns about the robots which give insights into acceptance and sociability in human-robot interaction.

## INTRODUCTION AND BACKGROUND

With advanced technologies, robots have been engaging in our daily lives in various forms. In a domestic setting, it is easy to find people using robot vacuum cleaners at home and kids playing with robot toys. Hazardous or non-ergonomic tasks which manufacturing workers would be reluctant to do are performed by industrial robots. Likewise, spaces where interaction with these robots typically occur

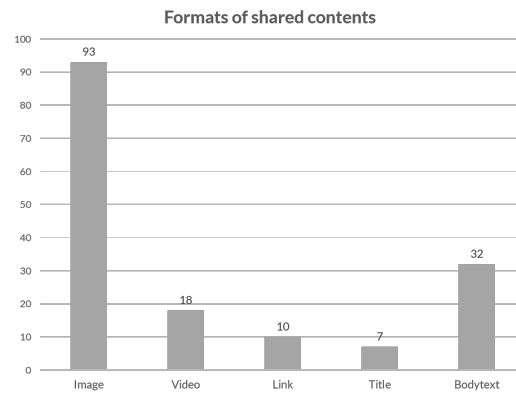
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**Figure 2: Formats of shared contents**

(Note: As some posts included more than two artifacts, multiple codes were assigned to each post.)

have been mostly confined to a specific environment which is occupied by people with intentions to interact with the robots and who would benefit from the interaction with the robots. However, robots are now leaving these boundaries and functioning in more complex public environments. For instance, patrol robots assist police by monitoring parks and public spaces. When a user orders food, robots deliver the food from a restaurant to the customer. In other words, the presence of robots is not limited to a specific space but is extended to all of society. Robots are exposed to unspecified individuals who do not directly interact with them but affect the acceptance of robots in society. Previously, society and the public have passively accepted and adapted to emerging technologies [6]. However, now, they have great influence on robot acceptance and trust as robotics technologies are applied in everyday environments. Comprehensive studies on public perception of robots are increasingly important [2, 4]. In this regard, we see social media as a beneficial source to investigate acceptance and sociability in HRI [9]. We specifically explore online conversations about delivery robots on a university campus. In this poster, we briefly present how people share their experiences with robots and how they perceive the robots in society. Our contribution through this study is two-fold. First, we conduct a qualitative study of online discussion posts on delivery robots to investigate public perception of robots through social media. Second, we investigate posts and shared artifacts which could provide insights into various concerns and opinions regarding the robots raised by the public who directly or indirectly interact with the robots as a part of their everyday lives.

### RESEARCH APPROACH

In order to explore how people discuss robots in society, we focused on the campus-centric subreddits, /r/purdue. Starship technologies<sup>TM</sup> launched a robot delivery service at Purdue University in August 2019. The starship is a six-wheeled ground robot which looks like a small cooler and announces “Here is your delivery” with a masculine voice when it completes a delivery. While working at the university, the authors noted that many people on campus were interested in the starship delivery robots and actively shared their experience with and thoughts on the robots on this subreddit. We collected posts including content related to the robots with selected keywords with the Reddit API (see Figure 1). Through review process, a final dataset was created with 161 posts contained 1373 comments (see Figure 1). In this study, we only considered the contents of posts to focus on types of contents being shared in this community. First, we performed a content analysis [5] to investigate how people described their perception of or experience with the delivery robot by classifying formats of shared contents. As there were several aspects of the starship robots which people particularly focused on and shared their opinions, we narrowed down our focus on posts including either images or textual information which were most frequently shared in the subreddit. Then, we additionally performed a thematic analysis [1] with the posts to investigate different aspects of the robots which people focused on. Two coders engaged in open coding and grouped the codes into six themes with multiple rounds of analysis.

<sup>1</sup>We referred to the text description of a post as a body text.

**Quote 1:**

*“Me trying to get through the semester versus Calculus.”*

**Quote 2:**

*“Please sign my petition to have a robot deliver the opening football at a home game.”*

**Quote 3:**

*“As we have adopted the robots as our goodest doggos, I would like to make a motion that you name them.”*

**Table 1: Perception of Starship robots**

Theme	Examples
Affection for robots	Interest in the robot itself
The number of robots	Single robot and a multi-robot
Vulnerability of robots	Robot bullies and technical limitations
Robots as service providers	Service quality
Robots as infrastructure	Regulation and accessibility
Others	

## FINDINGS

### Formats of shared contents

Posts from this subreddit were presented in five different ways: with images (58%), videos (11%), URLs (6%), body text (20%)<sup>1</sup> or only a title (without any other resources) (4%) (see Figure 2). Almost 60% of the shared images were original photos taken by redditors. We cannot confirm this with the collected data but only two posts directly mentioned that the redditors actually placed orders by sharing photos of the robot or food. Except for these posts, it seems that most post authors were not food-ordering customers but third parties who just found the robots on campus. On the other hand, 30% of images were photos edited for specific purposes. For example, people made fan art or illustrations of Starship robots, anthropomorphizing them by adding eyes or speech bubbles and expressing how much they liked them. Several redditors used the starship robot to present their situation, creating memes with the characteristics of the starship robot which is not very efficient. One post featured a meme with a photo in which two starship robots collided and reflected aspects of student life into the robots (see Quote 1). People used video to share their interest in the robots in the same way that they did with images. More than 80% of the videos were recorded by redditors to share their whole experience with the starship robots. Other than that, people edited original Starship promotion videos to make a fan art by adding music or animation to the video. People linked URLs to articles or social media where people officially shared their experience with and algorithms of the starship robots. They also shared specific websites (i.e., change.org) which hosted a petition to redesign starship robots to better fit into the campus culture (see Quote 2). There were many posts which did not include any media (e.g., images, videos, URLs) but emphasized their arguments only with the body text or post titles. While the formats of shared artifacts were different, there were common aspects of the starship robot on which people particularly focused and shared their opinions.

### How people perceived the starship robots

Our thematic analysis revealed six themes: affection for robots (35%), the number of robots (13%), vulnerability of robots (20%), robots as service providers (19%), robots as infrastructure (4%), and others (9%) (see Table 1). We coded posts as ‘others’ which were outside of the other five themes. These posts mostly used the starship robots as a tool or cue to reflect students’ lives or make stories with other objects (e.g., robots, trains, toys) and described folk theories[3] of the robotic system. First, as we found in the earlier analysis, people really liked the robots and expressed their affection for them. They wanted to give names to robots (see Quote 3) and make costumes for the robots for special events such as Halloween and football games. People even considered the robots as their university mascot and shared a 3D print file for making a starship toy. Second, we found that the number of robots was important to determine how people referred to the robot(s) and the impressions that people got from them. Some posts just referred to the robots as ‘starships’ while others characterized

**Quote 4:**

*“When the robots stop at a crosswalk for 20 seconds = it’s okay lil buddy you go when you feel like it.”*

**Quote 5:**

*“Please stop harassing starships for more than a couple minutes. ...Remember: they’re delivering food to people please don’t make them late :)”*

**Quote 6:**

*“I was driving on campus and reached the 4 way stop. A delivery robot was stopped just before the crosswalk. Obviously, I can’t wave it on (to let it know to cross) like I would a pedestrian. So I just waited for like 10 seconds to see if it would cross while I was stopped at the sign. It didn’t.”*

**Quote 7:**

*“They (Starship robots) also crowd an already stressed infrastructure (see any sidewalk from 11:30–2:00 or during exams), and their bulky form takes up more space than you would think. It reminds me of when bird (e-scooter) was filling up a street with their scooters so bad they got kicked out.”*

robots with gender stereotypes, referring to them as ‘he’ or ‘boy’. A single robot was called ‘a little boy’ or ‘a boy’ and referred to with affection. However, groups of starship robots were referred to collectively as ‘a gang’, with implied aggressive connotations. In these cases, the redditors shared their dystopian view of robotics and mentioned science fiction movies in which robots attack society. Third, redditors embraced the technical limitations of the starship robots and asked other people to care for them. One redditor posted a meme in which Spongebob is patting a starship robot affectionately (see Quote 4). Many posts captured a starship confronting a puddle or stranded in the middle of the street. Additionally, there were several posts reported instances of robot bullies on campus. One redditor claimed that people need to stop harassing the robots not only for the stake of the customer waiting for food but for the robot itself (see Quote 5). Of course, 19% of posts concerned service quality. There were skeptical and sarcastic posts about the inefficiency of the delivery service. Lastly, we found a non-trivial number of posts which pinpointed how the starship robots reshaped socio-cultural norms on campus. For instance, a redditor asked whether the delivery robots should be considered as pedestrians (see Quote 6). Another redditor argued that the starship robots created chaos on campus (see Quote 7). There were a variety of modes of transportation on campus such as bicycles, cars, electric scooters, and the starship robots but no one (even the company or university) took responsibility to build rules or provide guidance in place to ease the traffic issues. Indeed, the campus and the people on that campus were not ready to accept and adapt the new technology.

**CONCLUSIONS AND NEXT STEPS**

In this poster, we addressed how social media can give insights into acceptance and sociability in HRI. Although the main role of starship robots is to deliver food to customer, people considered the robots not only as service providers but as adorable mascots, vulnerable friends, aggressive gangs, or trouble makers. As the robots had become members of society in some shape or form, they reshaped the socio-cultural norms. We noted that most of the posts we analyzed were created by people who might not have directly interacted with the robots (i.e., order food from Starship) but were affected by the robots on campus. This implies the importance of understanding the public perception of robots who are not the main user directly interacting with the robot but have concerns about the robots on campus. We also found that people perceived the robots differently depending on their environments. While the starship robots do not have a conspicuous gender identity aside from its masculine delivery announcement, people identified the robot as male and felt insecure when they encountered a group of the robots. We cannot confirm that this is a result of its voice, but we can observe how the design variables affect people’s perception of and trust for the robots [7, 8]. While we only presented Reddit posts here, we found that redditors actively discussed a variety of perspectives on the robots on society. For the next phase of research, we will further explore the online discourse by analyzing posts with associated comments and investigate how the redditors made their arguments on various concern about the delivery robot with a constructive approach.

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