How Do Starship Robots Affect Everyday Campus Life? An Exploratory Posting Board Analysis and Interview-Based Study

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***Abstract*— The rapid emergence of food delivery robots in public spaces has raised important questions regarding public perceptions and policy creation. One method for addressing these questions is examining the relationship between delivery robots and the communities they already serve. We assessed our university community's experiences with, and perceptions of, the Starship Technologies robots (robots that currently operate on campus) using two efforts: analysis of online posting board content related to the robots and interviews of campus community members about the robots. Perspectives captured in the online post analysis tended to be negative, while views tended to be positive in the interview results. At the same time, both results showed differing opinions and complexity; one tension that emerged in both efforts, for example, is the potential of the robots to both benefit and impede disability communities on campus. Further, there were fundamental misunderstandings about what data the robots can and do record. This research can help to inform roboticists and policymakers whose work relates to autonomous robots in public spaces.**

Fig. 1: An example Starship robot, the food delivery platform around which we focused this work.

I. Introduction

Food delivery robots are an increasingly common sight on college campuses and city streets. Starship Technologies, for example, currently operates their robot delivery system on over 30 campuses across the United States (US). The introduction of these robots provides a valuable opportunity to analyze perceptions of robots in public spaces. Although food delivery robots offer significant potential benefits (e.g., easier food access, lower carbon emissions [1]), the rapid development and implementation of delivery robots has left important questions in its wake. Policymakers have struggled to keep up; as of May 2023, only 21 out of 50 US states had passed legislation related to delivery robots [2]. Due to their sensing needs and close-quarters interaction with the public, delivery robots have important implications on the privacy and safety of members of the general public. Thus, there is a need for more research on the full impacts of delivery robot implementation in a community. This work accordingly attempts to gain an initial understanding of community experiences of food delivery robots by analyzing perceptions of the Starship robots (Fig. 1) on the Oregon State University (OSU) campus.

Past work on autonomous delivery robots (ADRs) has illuminated potential benefits, drawbacks, and complexities of the implementation of robot delivery systems. ADRs have the potential to reduce delivery time and cost, as well as emissions, in certain scenarios [1], [3]. Other work has outlined some of the regulatory challenges with ADRs; for example, one short abstract used online posting boards to assess community perceptions of Starship robots on a college campus, finding both positive and negative depictions of the robots, as well as shaping of campus culture based on these systems [4]. Our team's recent pilot study on the OSU campus found generally positive perceptions of the Starship robots, but also areas of nuance in experiences of these systems [5]. A prominent example was participants' unthinking acceptance of robots driving somewhat intrusively in the middle of sidewalks on campus. This related work, taken together, motivated us to (1) assess the replicability of past online posting board results in a new campus context and (2) seek new insights with an updated interview guide and longer discussions with OSU community members.

The primary purpose of this research was to assess campus community member perceptions of the Starship robots, especially in the areas of robot expressivity (e.g., voice, personality) and key topics that might influence policy (e.g., onboard sensors, liability in the case of an accident). After reviewing past work related to our research interest (Section II), we conducted an analysis of Reddit online posting board content about the Starship robots (Section III) followed by a round of in-person semi-structured interviews (Section IV). We discuss the key findings, strengths, and limitations of this work in Section V. This work can help to characterize complex socials issues surrounding delivery robots and to inform policy related to these systems.

II. Related Work

Past work on ADRs, non-anthropomorphic robot expression, and existing ADR legislation informed our efforts.

Autonomous Delivery Robots: Related work on ADRs has illustrated a range of benefits and drawbacks of these systems.

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One study indicated that sidewalk-based ADRs have the potential to decrease delivery times, costs, and road traffic when paired with van-based delivery [3]. A different study pointed out that roadway-based ADRs may have lower energy consumption (compared to sidewalk-based ADRs) and avoid contributing to sidewalk congestion [1]. Limitations of ADRs include the incidence of bullying or abuse toward service robots, often by young people who are curious about the system [6], [7]. Additional ADR-related work suggests that robots that are perceived as autonomous are believed to be more threatening to humans [8]. ADRs can likewise provoke fears of robot labor replacing human jobs, which can significantly affect how consumers interact with robots [9].

Some work to date has aimed to establish guidelines and best practices for delivery robots and social interactions with service robots [10], [11]; for example, the latter work urges that in public spaces, human users of the space be prioritized over delivery robots. Singh et al. found that participants preferred delivery robots that moved slower than humans, avoided obstacles, and communicated multimodal cues when issues arose [12]. There may be cultural context-based needs to consider in policy formation as well; factors like age and gender have been found to affect perceptions of autonomous vehicles [13], as well as specifically ADRs [14]. Taken together, related work on ADRs indicates the merits of these types of systems, but also signals a need to understand interlocutor values and requirements, in addition to studying ADRs in varying contexts. Accordingly, this work aims to add to the body of knowledge on ADR users and passers-by by considering the effects and perceptions of these robots on our college campus.

Robot Communication and Expression: As vehicles intended to share public sidewalks, ADRs must take into account human behavior, needs, and expectations. People's perceptions of robot behaviors are often dictated by social norms [15], though those expectations may differ from what is expected of fellow humans [16]. Adjusting navigation systems to better adapt to how humans use sidewalks, for example, may be beneficial to ADR use cases [17]. The need for delivery robots to have explicit communication is debated; while in some work, features like graphics and speech have been helpful to pedestrians [12], [18], some research suggests that an autonomous vehicle's base movement alone is sufficient to communicate its intent [19]. Overall, there has been little research into social expectations for delivery robots. This paper seeks to add to current knowledge on, and requirements for, ADR expression.

ADR Legislation: The implementation of ADRs poses significant questions and challenges in legislation and regulation [2], [20]. For example, legislative bodies must decide how to regulate ADR traffic, and courts must decide how to rule in cases of collisions involving ADRs. There is also the matter of data privacy. Delivery robots require sensors to navigate, and the presence of these sensors in public spaces may raise concerns. Woo et al. state that the integration of ADRs into cities will challenge current expectations of privacy, as well as privacy-relevant laws [21]. Delivery robots are likely to further complicate the already complex field of privacy law, and public perceptions of this relatively new issue are not well understood. Our work aims to inform potential ADR policy in part by supplying rich information about people's perceptions of privacy- and liability-related ADR topics.

III. Posting Board Analysis

Analysis of online posts can provide valuable information about a community's attitudes toward robots [22]. In a past poster presentation, a thematic analysis conducted by Lee et al. on the Purdue University subreddit found that perceptions of the Starship robots extended past their usefulness as a delivery service and into complex personifications [4]. Our posting board analysis followed a similar process to the Purdue University effort, aiming to understand the perceptions of Starship robots on OSU's campus and assess whether and how these ideas might replicate from campus to campus. The OSU Institutional Review Board (IRB) approved this study.

A. Methods

Data Collection: Data was collected from the r/OregonStateUniv subreddit, an OSU campus-centered Reddit community. Our aim was to collect all posts related to the Starship robots, in addition to the comments written in response to these posts. We scanned the subreddit for relevant posts by searching for the following selected keywords: "Starship," "robot," "delivery," and "food robots." A secondary scan was performed by manually scrolling through the subreddit's most popular posts to find any important threads that were missed during the keyword search; more details on these additional posts appear in the paragraph below.

Corpus Characteristics: The initial keyword searches yielded 10 original posts with a combined total of 164 comment posts, for a total of 174 posts. The subsequent search through the subreddit's top posts found an additional three original posts with 54 comment posts, adding 57 posts for a sum total of 231 posts collected. An initial scan of the data found 17 comment posts to be irrelevant to our analysis; for example, many posts were complaints about OSU's dining services which did not mention the robot. These responses were excluded from analysis, leaving 214 posts in the final data corpus.

Analysis: We used thematic analysis to code and sort the collected posts. The following codes resulted from this inductive process, as further detailed in Section III-B. Note that a single post can be marked with multiple codes, and each percentage below is percent out of the full corpus size, so the sum total is over 100%.

- Robots Hazards (25.2%)
- Affection for Robots (18.7%)
- Robot Policy (17.3%)
- Robot Delivery Service Quality (13.1%)
- Dislike of Robots (12.2%)
- Internet Meme References (11.2%)
- Pop Culture References (7.5%)
- Other (8.9%; a catch-all category for remaining posts)

Further sub-codes are also explained in the following subsection. A trained human coder established this codebook and coded the full data corpus. A second trained coder reviewed and coded approximately 10% of the data corpus; the Cohen's kappa inter-rater reliability between the coders was 0.98, showing near-perfect agreement.

B. Results

Below, we provide a synopsis of the thematic coding results. Note that we group three of the categories (Internet Meme References, Pop Culture References, and Other) into the final subsection; these posts in particular appeared to have more to do with robots broadly or general internet culture than the Starship robots specifically. As in the previous section, percents can sum to over 100% since the same raw data can be marked with multiple codes.

Robot Hazards: 54 posts (25.2% of the corpus) were marked with the Robot Hazards code. Of those posts, 59.3% were complaints or observations about the Starship robots causing collisions, blockages, or other physical hazards. Complaints ranged from small inconveniences to more consequential stories of robots blocking street traffic, cutting in front of bikers, and even colliding with a blind pedestrian and damaging their mobility aid. However, 22.2% of the posts in this category were observations to the contrary; for example, one commenter mentioned "no problems avoiding [the robots]." 31.5% of the posts were involved in a debate about whether or not the robots are a harmful source of blue light. Within this argument, a single user (10 posts) argued that their headlights are "unpleasant, unhealthy and sometimes dangerous" while four other users (7 posts) disagreed.

Affection for Robots: 40 posts (18.7% of the corpus) fit the Affection for Robots code. This code included any posts that showed a positive affect toward the robots unrelated to their delivery service function. Related observations included posts that called the robots cute or adorable (8 posts), referred to the robots as friends or animals (11 posts), or even directly expressed love toward the robots (6 posts). The most common sentiment, with 16 posts, was the expression of some sort of compassion or protectiveness over the robots. Under one post containing a video of a Starship robot getting hit by a train, five users posted sympathetic comments such as "RIP little robot, we won't forget your sacrifice" and "Nooooooooooo, it should've been me!!!!" Others voiced their protectiveness over the robots with comments such as "we won't take kindly to people who do mess with them."

Robot Policy: The Robot Policy code included 37 posts (17.3% of the corpus) that were marked based on their potential relevance to robot regulation work. The posts included a broad range of opinions and observations which we used to inform the design of the interview-based study in Section IV. For example, a post about someone hitting a robot with their car and driving away prompted us to ask participants about how they would respond if they were to hit a robot with their car. This theme also included common points of conflict such as whether or not the robots should be able to use the sidewalk, shine bright headlights on campus walkways at night, and use onboard cameras to sense their surroundings. Further, this theme captured some of the complexity surrounding robotic delivery systems; for example, one post mentioned the benefit of the robotic food delivery in the case of PTSD flare-ups, while another reflected on congestion blocking curb cuts and privacy concerns.

Robot Delivery Service Quality: 13.1% of the corpus (27 posts) were related to the Starship robots' intended delivery role itself. Comments in this category were generally negative (64.3%) though some users did comment positively on the convenience (21.4%). Most comments in this theme were fairly straightforward, lauding or complaining about aspects of the robotic food deliveries.

Dislike of Robots: 26 posts (12.2% of the corpus) fit the Dislike of Robots code. This code functioned as the opposite of the Affection for Robots code, containing posts with negative sentiment toward the robots that were unrelated to the delivery service function. Some users (8 posts) celebrated the destruction of the robots by a vehicle, while others called the robots "annoying" or ugly (e.g., "an absolute eyesore") or expressed thoughts of violence toward the robots.

Other Codes: 24 posts (11.2% of the corpus) were Internet Meme References. Specifically, these comment posts were under two videos of a Starship robot getting hit by a train, and they all consisted solely of the letter 'F.' This is a reference to a popular meme originating from a Call of Duty scene in which the player is prompted to "press F to pay respects" at a funeral. It was not possible to discern additional intent from these posts beyond the meme reference, so we placed the posts in their own category.

16 posts (7.4% of the corpus) fell into the category of Pop Culture References, which mostly contained comments comparing the robots to pop culture characters such as Disney Pixar's WALL-E or the Star Wars droids of science fiction.

The remaining 19 posts (8.9% of the corpus; the 'Other' code) were either unclear in their sentiment or otherwise did not fit into any of the other codes. Although the posts did not fit into other themes, they were also not clearly excludable. For example, one comment asked "Who lost out on their lunch?" in response to the train video, and another quipped about needing to microchip a Roomba.

C. Summary of Key Findings

Our thematic analysis revealed varied and sometimes conflicting perspectives from OSU community members on the Starship robots. More posts included complaints about robot hazards or the robots themselves than positive comments on the robots. Affection for the robots still occurred, but was roughly half as common as in the related work by Lee et al. on Purdue's campus [4]. Results included conflicting opinions related to disability communities, since the robots can help with food access in the case of disability flare-ups while hindering access for those who rely on curb cuts. There was some evidence that opinions of the robots may worsen with habituation; for example, one commenter mentioned accessibility concerns related to the robots, but noted that they at first found the robots to be "adorable." The conflicts captured in the Robot Policy theme highlight the need for more work investigating the real-world benefits and drawbacks of last-mile delivery systems, to inform policy related to this topic.

IV. Interview-Based Study

Discourse on the internet captures some aspects of day-to-day life, but online culture can differ greatly in tone and content from end users' honest opinions. Accordingly, we paired the posting board analysis with in-person interviews with OSU campus community members to obtain a clearer picture of experiences with, and views on, the Starship robots. Our team previously conducted person-on-the-street interviews that informed this step [5] but left many open questions; the past interviews were only a few minutes long and yielded somewhat general results. In this follow-up study, we conducted longer interviews with participants, curated relevant media to help participants reason about real robot scenarios, and focused on two more specific topics: robot expressivity and robot policy formation.

A. Methods

The methods for this follow-up semi-structured interview-based study follow, as approved by the OSU IRB.

Procedure and Data Collection: After informed consent was obtained, the participant completed a pre-interview questionnaire using Qualtrics. The pre-interview questionnaire included four multiple-choice questions (requesting university role, living situation on or off of campus, primary transportation mode on campus, and extent of Starship robot use) for important background context.

The researcher then began an audio recording and led an approximately 30-minute semi-structured interview with the participant. During part of the interview, the participant received an on-paper schematic of the robot and was asked to indicate the location of any sensors that they believed the robot to have. An additional on-paper task required participants to indicate their assumptions about the shape and distance of the robot's field of view on a gridded map. At pre-determined points in the interview, participants heard a mock robot voice audio clip and watched a video of a car colliding with a Starship robot (pictured in Fig. 2). The interview covered the following topics:

Fig. 2: An example frame from a video shown to participants during later questions about robot-vehicle collisions. The robot is near the upper center of the image.

- General Opinions of the Robots
- Past Observations of the Robots
- Personality and Communication Abilities of the Robots
- Robot Sensing And Data Collection
- Policy Surrounding the Robots
- Liability in Cases of Robot Error
- Responses to Hypothetical Robot Incidents

When the interview ended, the participant completed the final section of the Qualtrics survey: a demographic questionnaire to record standard demographics such as age, gender, STEM experience, and robotics experience. Participants were compensated $7.50 US for their participation.

Participants: Participants were recruited from summer courses, summer on-campus programs, and local email lists. The participants consisted of 29 OSU community members between 18 and 69 years of age ($M = 31.7$, $SD = 14.6$), with 51.7% male, 41.4% female, 3.4% non-binary, and 3.4% genderfluid individuals. Most participants were undergraduate students (48.3%) or staff/faculty members (38.0%), with the remainder being graduate students (10.3%) or locals unaffiliated with the university (3.4%). 55.2% of participants reported an educational background in science, technology, engineering, or mathematics, but most ranked their general robotics experience as low ($M = 2.0$, $SD = 0.93$ on a 5-pt scale from "No Experience" [1] to "Expert-level Experience" [5]). 20 participants had never used a Starship robot for food delivery, two this utility in the past but would not do so again, six were occasional users, and one was a frequent user. All had regularly encountered the robots on campus.

Analysis: We transcribed the audio recordings and used thematic analysis to uncover the groupings of comments for each interview topic. The codes had more variation than in the Reddit analysis; accordingly, we report codes and sub-codes for each individual topic in the results below. A trained human coder inductively established the codebook and coded the full interview data. A second trained coder reviewed and coded approximately 10% of the data corpus; the Cohen's kappa inter-rater reliability between the two coders was 0.74, indicating substantial agreement.

B. Results

All interviews were successfully recorded and analyzed. The following subsections provide details on the thematic coding results for each interview topic, including visuals that may in particular help to shape future robot policy.

General Opinions of the Robots: High-level opinions of the Starship robots were largely positive. 78.1% of comment codes were positive, with descriptors from "cool" and "cute" to "good for accessibility." 6.3% of comments were neutral. The remaining 15.6% of comments were negative, spanning robot labels from "awkward" or "incompetent" to bad for individuals with disabilities within the campus community. One participant even described the robots as "detrimental to the fabric of college life."

Past Observations of the Robots: Our first sorting under this topic area was about unusual robot behavior. Four participants (representing 12.9% of codes) had observed a robot collision. Three members of this group witnessed a robot “tap” or “brush against” a pedestrian, while the other individual saw a robot collide with objects at a construction site. The remainder of codes indicated secondhand accounts of collisions (6.4%) or no knowledge of collisions (80.7%).

More than half of the codes about unusual robot behavior/circumstances (55.6%) involved the robots getting stuck. Beyond this, three participants (16.7% of codes) had seen people intentionally harassing or blocking a robot’s path. Two comments (11.1% of codes) involved a robot stopped in the middle of a crosswalk, blocking one side of traffic. Additional one-off observations (the remaining 16.7% of codes) in this area included stalemates on the sidewalk, overturned robots, and the robot’s lights flashing red.

Additional codes under this topic umbrella dealt with robot motion and planning. Among this grouping, 44.9% of codes noted that the robots are overly cautious and take a while to cross the street, or are often in the way (24.2%). An equal part of the comments (10.3% each) found the robots to either be jerky or responsive (perhaps based on different interpretations of the same behavior). The remaining 10.3% of observations (the remainder of this area grouping) included comments on residual tire tracks and apparent robot uncertainty and a final comment that described the robots as well paced.

Personality and Communication Abilities of the Robots: The first sorting under this topic dealt with robots’ methods of communication. Under this umbrella 32.5% of codes involved the communication being insufficient. Current communication methods articulated by the participants included the robot’s reaction to, or acknowledgement of, pedestrians (18.9% of codes), speech (16.2%), lights (13.5%), and nonverbal sound (10.8%), as well as communication between robots (8.1%).

We also elicited a set of responses coded as relevant to the mock robot voice clip. Responses to this stimulus were varied, with the most common responses calling it monotonous or boring (31.4% of codes) or electronic, robotic, or inhuman (17.1%). 14.3% of comments remarked that the voice was unexpected given the design and other behavior of the robot, noting for example that “[it] sounds like too masculine for such a cute robot” and that they “would think it would be happier and peppier and chirpier.” Another small group (8.6%) described the voice as kind. The remaining codes in this group (28.6% of the group, with one or two occurrences each) involved the robot being loud, male, bold, funny, pleasing, cute, ominous, and cold. Participants had varied opinions on the robot’s “personality.”

A final sorting under this topic umbrella dealt with high-level perceptions of the robots. 20.0% of the relevant codes reflected a lack of robot personality. Other perspectives ranged (with a low, roughly flat number of instances) from metaphors (e.g., “pet-like”) to descriptions of robot features (e.g., lights, flag, sound) and robot adjectives (e.g., interactive, polite, innocent, funny).

Robot Sensing and Data Collection: 32.8% of sensor-related codes overall demonstrated a belief that the Starship robots have cameras, but assumptions about other sensors varied greatly (as elicited using the robot schematic; results appear in Fig. 3). Interpretations that the robots used laser scanners, motion sensors, proximity sensors, audio sensors, infrared sensors, and radar made up the most common additional codes. The “other” category in the figure includes uncommon choices such as balance/tilt sensors, sensors in the robot’s compartment latch, thermal sensors, sonar, ultrasound, and vibration sensors.

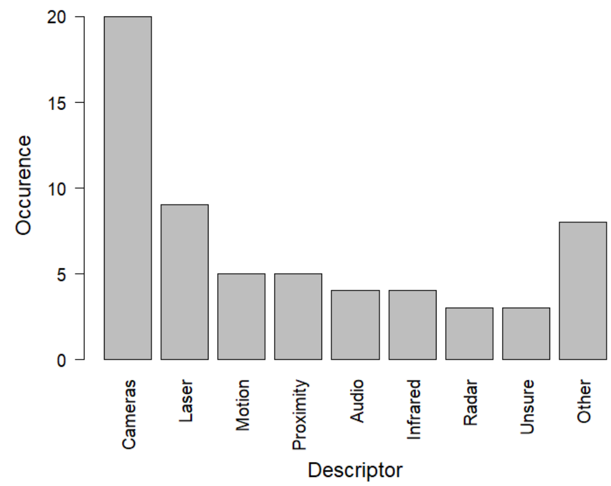

Fig. 3: Robot sensors mentioned by participants.

Under the coded topic of privacy, 12 participants (44.4% of related codes) felt that the robots were collecting and storing data from their sensors (including video, sometimes noting a belief that recording only happened “when there’s something wrong”), and four participants had privacy concerns. On the other hand, the remainder of the group was not worried about data use and privacy.

The final grouping of data under this umbrella dealt with robot responses to their environment. When asked how well the robot senses and responds to its environment, a large majority (87.1% of relevant codes) of the participants responded that the robots did well, while the remaining responses were neutral (9.7%) or negative (3.2%).

Policy Surrounding the Robots: The majority (56.8% of codes) of general policy thoughts reflected a lack of awareness of any policy related to the Starship robots. Smaller parts of the code corpus reflected beliefs about policy related to existing safety requirements (24.3%) and data collection (13.5%). The final two comments (2.7% each) concerned liability and the food contents of the robots.

Most participants (86.4% of related codes) were not concerned about the speed of the robots, and the remainder of the related comments (6.8% each) described the speed as slow or inconsistent, respectively.

Thinking about momentum of these robotic systems, we also asked participants to estimate the weight of the robots. Nearly half of the comments in the responses (45.2%) expressed no idea of the weight. Many (32.2%) of responses described the robots as “pretty heavy,” and the remainder

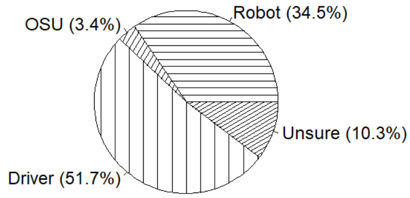

Fig. 4: Participant perceptions of the responsible party in a robot-vehicle collision.

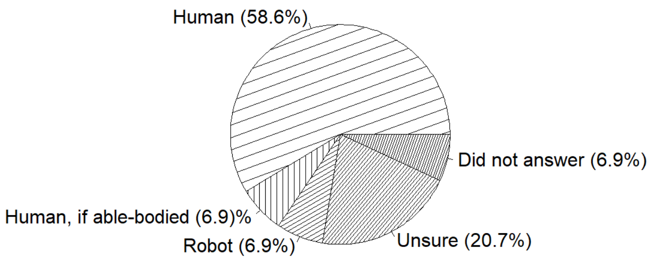

Fig. 5: Participant perceptions of the responsible party in a robot-human collision.

(22.6%) ventured guesses from 25 to 85 lbs.

Liability in Cases of Robot Error: Participants were shown a video of a car backing up out of a driveway and colliding with a Starship robot. Participant perceptions of liability or responsibility in this situation were varied. 51.7% of the group said that the driver was at fault, with many respondents using the rationale that the robot could have been a child or a cyclist that the driver did not see. 34.5%, however, thought the fault was on the robot (or the company that owns them). 10.3% were unsure or thought both parties were responsible, and one person (3.5%) thought OSU should be responsible for any damages. Figure 4 summarizes this input.

Participants were asked a similar question about liability in the hypothetical case of an inattentive pedestrian tripping over a Starship robot; a larger majority (58.6% of the group) thought that in that case, the human pedestrian would be responsible for the incident. Two further individuals (6.9%) mentioned a different view in the case of the pedestrian having a disability such as a visual impairment. 20.7% were unsure or thought both parties were responsible, and two participants (6.9%) put the liability solely on the robot. 6.9% of responses failed to specify a party. These results collectively appear in Fig. 5.

Participants also gave varied answers as to how they personally would respond in the case of observing a collision with a robot, as visualized in Fig. 6.

Responses to Hypothetical Robot Incidents: Participants were posed with a hypothetical situation in which they witnessed a group of people interfering with or damaging one of the Starship robots on campus. Almost half of participants (44.8%) said they would interfere directly with the instigators, while around a third (34.5%) said they would not interfere directly. Other responses included reporting the incident to OSU or Starship Industries (24.1%) or recording video of the incident (3.4%), with some participants (24.1%) saying

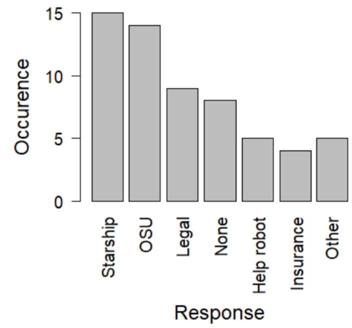

Fig. 6: Participant reports on who they would contact or what they would do in the hypothetical case that they observed a collision involving a robot.

that their response would vary based on the situation. (Some participants indicated multiple responses to this question, so the sum total of percents is over 100%.)

Participants were posed another situation in which they witnessed a Starship robot seeming to be stuck on a curb and unable to move. A majority (69.0%) said that they would attempt to help the robot by pushing it or picking it up, while a smaller group (20.7%) said they would not interfere with the robot. The remainder were unsure or gave mixed responses.

C. Summary of Key Findings

The general perception of the Starship robots was positive, although a few participants had observed a robot collision and many more had observed the robots getting stuck or behaving oddly. There is a lack of robot expression; the most common codes in each category under this topic showed that robots have insufficient communication and lack a clear personality. Responses to sensing, policy, and liability questions showed some fundamental differences in understandings of how the robots do and should operate, in addition to how to approach robot accidents. For example, less than half of the participant group believed that the robots stored sensor data, even though they are indeed able to. Opinions were split on prescribed fault in the case of collisions, especially in robot-car collisions, and respondents tended to blame the human more in all investigated cases.

V. Discussion

Investigations like the ones discussed in this paper are useful for illuminating the current relationship between food delivery robots and the communities in which they already exist. Efforts like our posting board analysis and interview-based study can help to uncover design improvement opportunities, potential policy underpinnings, and information communication needs related to these types of robotic systems. Both of our discussed efforts revealed a diverse range of opinions related to the Starship robots, including positive and negative perspectives.

Notably, the posting board comments were more negative than positive, and included a subset of users who had affection for the robot, but not as many as in past related work (i.e., [4]). Selected insights and tensions, such as the nuanced situation surrounding the robots' benefits and drawbacks for individuals with disabilities, are not fully resolved and might help to inform future design steps of food delivery robot systems. Results from this first effort also show that assessments during the first few months of a person's exposure to this type of robotic system would likely yield different results than an investigation later on; selected users articulated this type of change in their own perceptions over time, which aligns well with general knowledge of the novelty effect and habituation in human-robot interaction [23].

Interview feedback, on the other hand, was more positive than negative, despite the common tendency for participants to be unimpressed, or even worse disenchanted, with the Starship robots' design and day-to-day function. It was very common for participants to critique the robots' personality and expressive features. There also appeared to be important misunderstandings among participants about the recording and storing of data by robot sensors. For example, most participants did not think that the sensor data of the robots was stored, though Starship Technologies' privacy policy indicates that they may store video data for up to 60 days. Somewhat surprisingly, participants were quick to assign liability to humans, rather than robots or the companies that make them, in the case of collisions with robots.

Strengths of our efforts include gathering data from OSU community members who regularly interact with the Starship robots in day-to-day settings, some of whom have interacted with the robots for years. (The robots have been operating on campus for approximately three years at this point.) The collection of this type of ecologically valid data is unusual in human-robot interaction work, while at the same time playing a key role for robot success. *Limitations* of the work include inherent biases in each environment in which we collected data. The negative bent of the posting board data might be influenced by internet culture, while the positive slant of interview results may have been influenced by please-the-experimenter bias. Running studies on larger sample sizes and on multiple college campuses would also increase the relevance and potential of this type of work. Considering more robots and use contexts could help to extend the work.

This work can serve as a model for how to consider public perceptions and community contexts in the development and deployment of food delivery robots. We aim to help to illuminate ethical, legal, and societal implications of this type of technology as it becomes more common in day-to-day settings. Thus, this work can inform both policymakers and roboticists as they navigate the evolving landscape of autonomous robots in public spaces.

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