

# Individual and Collaborative Behaviors of Rideshare Drivers in Protecting their Safety

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The safety of passengers of rideshare apps has received attention from researchers, yet there is a lack of research on safety of rideshare drivers in the context of CSCW and HCI. As drivers are also an important user in the ecosystem of the ridesharing systems, we conducted interviews with drivers in the U.S. to understand how they, individually and collaboratively, address safety related issues they face conducting their job. We identified the factors that contributed to drivers' feelings of safety and the strategies they engaged in to protect themselves. We found that drivers relied on methods that were technical, social, and physical, to ensure their safety and engaged in informal collaborative and communicative activities with other drivers inside and outside of the ridesharing system. We discuss implications for future design for ridesharing apps and other location-based computer-supported collaborative systems that have potential safety hazards.

CCS Concepts: • **Human-centered computing** → **HCI design and evaluation methods** • **Human-centered computing** → **Mobile computing**

KEYWORDS: Rideshare; drivers; gig economy; safety; HCI; collaborative work; crowd work

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## 1 INTRODUCTION

The ridesharing industry is a major economy worth \$17,191 million in 2018 with an expected growth rate of 15% by 2022 [44]. Customer penetration rate in the United States is 17.8% out of the market segment of potential customers and is expected to reach 23.1% by 2022 [44]. Ridesharing is one of the most prominent examples of the gig economy.

There has been a lot of research on the ridesharing economy. Despite abundant research on the economic and labor aspects [26], passenger experiences [6, 11, 1, 19, 23], and cultural exchange [16], there has been a lack of research on security in general [8]. A 2017 meta-analysis examined the role of HCI in the gig economy and attempted to find possible areas that received less or no attention from researchers [8]. This study reviewed 112 research papers in the ACM digital library, and found a lack of safety related research regarding the gig economy in the context of CSCW.

Ridesharing is interesting to CSCW and its researchers to design collaborative tools in order to aid workers in conducting their job, while “lacking a traditional sense of “workplace” or “coworkers” [23].

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Since ridesharing entails connecting strangers through an app to meet in person, which may result in unsafe encounters, the safety of ridesharing (or rather, the lack thereof) has made headlines numerous times in the media. For example, the media has published incidents about unsafe situations for rideshare passengers [25, 40, 33].

Rideshare drivers' perspectives are particularly interesting because of their unique work circumstances. It is common for rideshare drivers to work as independent contractors with one or more rideshare companies [4]. Working for rideshare companies carries promises for independence and flexibility, however, that might not always be the case [29]. For example, prior work have questioned the advertised flexibility of crowdwork in Mechanical Turk [13,27] and in the ridesharing industry [1]. Researchers [1] also question the independence of being a peer-to-peer contractor because of the effect of the mediating algorithms of ridesharing apps. Furthermore, the occupation comes with other costs. Previous research on rideshare drivers revealed that drivers face uncertainty in their job conditions [17]. Rideshare companies often exercise unfair labor practices with their independent contractors [20]. Rideshare drivers receive low income [36], deal with payment uncertainty [26], and are expected to pay for their own expenses [26]. Rideshare drivers are also not offered adequate safety training required for this kind of job due to their classification as independent contractors [4, 21]. Furthermore, rideshare drivers are often the victim of abuse because of the nature of their job dealing with the public on regular basis [30, 21]. Thus, it is critical to understand this work environment in conducting this research.

In this study, we conducted qualitative research to understand the safety of rideshare drivers in the United States. By understanding factors that make drivers feel unsafe and identifying how they handle those situations, our results would shed some light on the safety of a key user that has been overlooked in the user experience of ridesharing and aid in the development of new technologies that would address safety issues.

## 2 RELATED WORK

In this section, we review the literature that explores the safety of rideshare drivers. We also examine rideshare companies' part in maintaining and enhancing the safety of their drivers.

### 2.1 Ridesharing and Drivers' Safety

We begin this section with safety related work in the general gig economy. Working in a gig job has been linked to a number of safety and health related hazards. For example, whether working as a gig construction worker or a rideshare driver, the lack of job security has an overall toll on the workers' personal wellbeing [41]. Being isolated from other co-workers denies them from simple benefits such as psychological and social support [41]. Other research [15] also looked at the safety of gig workers from income and job training perspectives. Gig workers do not benefit from employee training, health insurance and the general government safety net provided to employees [15]. Another troublesome consequence of gig work is the reluctance of independent contractors to report incidents due to fear of losing their jobs [51]. Other work has also looked at the road safety aspects and fatigue associated with working as a rideshare driver [5].

In this research, we focus on a different dimension of safety: drivers' personal safety in relation with driving passengers who are strangers. Although it was found that the literature generally lacks safety related research in the context of ridesharing [8], the studies that have focused on safety have mainly focused on passengers' safety. For example, a survey of 500 U.S. participants revealed the top fears of rideshare passengers, such as fear of driver creepiness, driver distraction

on the road, driver knowing passenger's location, among others [2]. Furthermore, research by Chaudhry et al. [3] was concerned with the safety of passengers in rideshare and provided recommendations for rideshare companies to increase the safety of passengers. However, Glöss et al. [12] looked at the differences in labor practices between taxis and rideshare and presented results related to the safety of both the driver and passenger. For the driver, the idea of the company tracking the ride and holding credit card information seemed to be positively perceived by drivers in terms of their safety. The work by Kumar et al. [22] found an "unequal measures of safety" where rideshare drivers had safety concerns regarding knowing minimal information about their passengers, contrasted with passengers who felt safer because the company knows more about the driver such as license number and government IDs. Though the work by Kumar et al. [22] minimally discussed safety for drivers, passengers' safety was more emphasized. Possible reasons for the previous research focus is that rideshare drivers get background checks that are sometimes questionable [14] and receive minimal preparation for this job [28].

There is little we know about rideshare drivers' safety and rideshare companies do not release statistics about the reports they receive from their drivers, thus, we turn to literature related to a similar job regulated by the government and that publishes their data, which is the taxi industry [28]. There are numerous studies that document the difficulties and dangers that come with driving strangers for taxi drivers. For example, Dalziel and Job found that taxi drivers' job is hazardous and drivers are abused on different levels of severity ranging from verbal to physical assaults such as being victims of homicides [6]. Another study found that a high level of stress is correlated with injuries, therefore, the authors recommended stress reduction strategies as an attempt to improve the safety of drivers [42]. Richardson and Windau found that taxi drivers' jobs had the highest number of homicides among occupations [35]. Furthermore, 40% of taxi drivers in a study stated that driver safety was poor and identified safety as the most important issue for them [6].

In terms of enhancing the safety for taxi drivers, drivers stated that video surveillance is important [6]. A female taxi driver reported that telling disturbing passengers that they are being recorded had deterred them from further wrongdoing [6]; which falls in line with modern research which states that cautioning passengers that they are being recorded was found to be the most effective way to deter crimes in taxis [30]. Moreover, video recording reduced the number of homicides for taxi drivers [30]. Video recording was also used by taxi companies to monitor the driver and also ensure their safety. It was found that installing a camera where the company gets footage feedback, has improved the actions of drivers [37]. Gambetta and Hamill [11] found that taxi drivers take different measures to maintain their safety; for example, they carry less cash or pose themselves as "machos", in other words, tough guys.

Literature on the safety of taxi drivers does not compensate for dedicated and specific research on the safety of rideshare drivers but it provides a starting point for understanding the safety of a profession that involves the constant encounter of strangers in closed spaces. Although there are similarities between taxis and rideshare services, there are differences between the two professions that make it necessary to conduct rideshare specific research. For example, rideshare trips usually do not include cash payments, which is one prominent reason for assaults against taxi drivers [8,9], so the burglary-related dangers for taxis may not apply so much to rideshare. However, taxis include safety measures such as shields, built-in cams, and panic buttons that are not easy to be installed in privately owned rideshare drivers' cars [9]. Furthermore, rideshare drivers don't receive safety training [9], while taxi drivers are required to receive multiple trainings including safety training to receive their government issued permit [45].

Because of the lack of research about rideshare drivers' safety, in this study we will investigate what makes rideshare drivers feel unsafe and how do they go about protecting themselves against perceived dangers. We were guided by the following research questions:

RQ1. What contributes to rideshare drivers' feelings of being unsafe?

RQ2. What are the strategies rideshare drivers apply to enhance their safety?

## 2.2 Ridesharing Companies' Role in their Drivers' Safety

Since the beginning of the phenomena of rideshare, many activists and cities have tried to regulate rideshare companies since it was easy to work for such companies without many rules to protect their hires [49]. There have been many legislations and lawsuits concerning the legality of rideshare and the responsibility of the company toward its contractors [18].

Rideshare drivers are considered independent contractors, hence, they do not receive health insurance and the company does not pay their expenses such as their car usage, their gas or maintenance [21,38]. With minimum wage payments and not having their work-related expenses covered by the company, rideshare drivers are insecure about their jobs which makes them more prone to abuse by their passengers [39].

According to the law of employment § 404.1007, employees do get training for their work such as safety training [46]. Therefore, since rideshare companies fought to keep drivers as independent contractors, they do not provide proper safety training for the fear of classifying drivers as employees [28].

Although rideshare drivers do not receive extensive safety training, most rideshare companies offer safety tips to their drivers that mainly consist of general advice and/or a safety quiz. Also, rideshare companies include features in their apps that are designed toward more safety for drivers. For example, one rideshare company recently piloted a panic button to increase the safety of its passengers and drivers [19], though this is only available for passengers at the moment, with promises from the company to provide the feature for drivers in the future.

Since rideshare companies' role in terms of their drivers' safety is not clear, we wanted to examine how rideshare drivers perceive the role of rideshare companies in regard to their safety: RQ3. From the drivers' perspective, what have the companies provided to ensure drivers' safety?

## 3 METHODS

We conducted semi-structured interviews with 20 rideshare drivers from the United States who were driving or had recently been a driver for one to 10 different rideshare companies such as Uber, Lyft, and Juno. Some of the main questions asked were: "Do you feel safe while driving for ridesharing companies? If yes, what makes you feel safe? If no, what makes you feel unsafe? Have you felt that your safety was jeopardized because of a passenger you were driving? If yes, can you tell us more about this?" We recruited drivers through two main methods; personal contacts and Twitter.

The recruitment message included concise information about the aim of the study, and the population for the study, which is any adult who has experience driving with one or more rideshare companies, full time or part time. Participants also needed to be 21 years or older and working in the United States. The criteria for contacting prospective participants was through mentioning or sending a private message to Twitter users in the U.S. who had one or more of the following words in their profiles: rideshare, ridesharing, driver, and any rideshare company name. On Twitter, some drivers who were advocates for their rights and who showed a lot of support for

the study, helped the researchers by retweeting the recruitment message and reaching out to their driver friends.

We contacted 201 Twitter users and were able to conduct 17 interviews (response rate: 8.46%). The other participants ( $n=3$ ) were recruited through personal contacts, which included a family friend, a classmate, and a colleague. Participants were offered \$10 compensation for their voluntary participation in the form of a gift certificate or cash. The initial recruitment message requested voluntary participation for a 30-minute interview, however, the length of the interview was extended due to the majority of participants' desire to share more content. About one third of the participants refused to take the compensation and wanted to participate because they believed the topic is important to them. Three of our participants were advocates for rideshare drivers' rights and had spoken to newspapers and to NPR. Also, one participant was writing a book about safety for rideshare drivers and has a blog where they post about incidents and general tips for drivers.

The average interview time was around 60 minutes. Participants provided demographic information such as age and race, which they all agreed to provide except one participant who, out of fear of being identified in social media, gave a range of 25-30 years old.

The interview protocol was piloted with a rideshare driver who was an acquaintance in an in-person interview. The interview protocol was slightly amended after the first three interviews, however, the main questions related to our research questions were not affected. Interviewing was done by two researchers and the second author reviewed the coding and themes found by the first author. Transcription was done using services called Happy Scribe and Temi. The authors spent 1.5 hours per 1 hour of recording to validate the accuracy of the generated transcripts. After transcription, the audio files were deleted to preserve the confidentiality of our participants.

We utilized an inductive approach for data analysis [40]. This method requires researchers to first clean the data and save it in a common format. Then, the researchers went through the transcriptions thoroughly and created a meta-analysis matrix in MS Excel. The process of data analysis was iterative and started after the third interview. Each week, the authors discussed the collected data and assigned temporary codes to later group them into categories. The researchers identified a large number of categories and with iteration, the number of categories was reduced to create general and inclusive categories. For example, to answer RQ1, we initially had nine codes such as violence, verbal argument, verbal threat and unexpected gender, and this was later grouped into the final four categories including: harassment, intoxication of passengers, drivers' own gender, and trust issues. Another example related to RQ2, the researchers identified different kinds of weapons used for protection as different codes, and later had one theme of "weapons" that included lethal and non-lethal weapons used by rideshare drivers as a mean for protection. The upper level categories and subcategories were revisited with every interview transcript introduced to the meta-analysis matrix. The results presented in this paper represent the final coding schema.

### 3.1 Participants

Participants in this study were 12 male and 8 female rideshare drivers. Participants' reported race was: White (50%), Black (20%), Hispanic (15%), Asian (5%), and of mixed race (10%). Participants' age ranged from 24 to 53 with an average of 37.5 years. Participants' experience working for rideshare companies ranged from 5 months to 7 years with an average of 2 years and a half; working with 1 to 10 different companies. Participants worked for rideshare companies either full-time ( $N=11$ ) or part-time ( $N=9$ ). Participants in this study reside in the following states: Washington D.C. ( $N=1$ ), Philadelphia ( $N=1$ ), Maine ( $N=1$ ), Florida ( $N=1$ ), Tennessee ( $N=1$ ), Arizona

( $N=1$ ), New York ( $N=1$ ), Texas ( $N=2$ ), New Jersey ( $N=2$ ), Colorado ( $N=2$ ), California ( $N=7$ ). More detailed participant demographics (including fictitious names) are listed in [Table 1](#).

**Table 1. Participant demographics.**

Alias	Age	Race	Gender	*Full time	**Companies	***Experience	State
John	34	White	Male	No	1	4 years	CA
Mona	32	Hispanic-White	Female	No	1	1 year	CA
Steve	25-30	White	Male	Yes	3	5 years	TX
Ebony	30	Black	Female	No	1	2 years	NJ
Mark	53	White	Male	Yes	2	3 years	CA
Juan	40	Hispanic	Male	Yes	3	4 years	CA
Noah	50	Black	Male	Yes	1	1 year	NY
Jack	53	Hispanic	Male	Yes	10	4 years	CA
Ryan	43	White	Male	No	1	3 years	FL
Nathan	28	White	Male	Yes	5	7 years	ME
Sarah	32	Hispanic-White	Female	Yes	2	6 months	CO
Adam	32	White	Male	No	1	5 months	TN
Mary	24	Black	Female	No	1	1 year	NJ
Allison	47	White	Female	Yes	3	14 months	AZ
Alan	27	White	Male	Yes	2	1 year	PA
Emily	50	White	Female	No	1	2 years	CA
Oscar	39	Asian	Male	No	2	6 years	CA
Sally	49	White	Female	Yes	2	1.5 years	TX
Grace	24	Hispanic	Female	No	1	8 months	CO
Victor	35	Black	Male	Yes	2	2 years	D.C.

\*Working full-time?; \*\*Number of rideshare companies worked with; \*\*\*Experience working with rideshare companies.

## 4 RESULTS

### 4.1 Reasons for Rideshare Drivers' Feelings of Lack of Safety

Analyzing the first research question, *what contributes to rideshare drivers' feelings of being unsafe?*, we found that broadly, the factors that contribute to their feeling of uneasiness either had to do with a specific behavior of the passenger or a personal attribute of the drivers themselves in relationship to the passenger.

**4.1.1 Harassment from Passengers.** Harassment came in different forms, whether it was threats, aggression or sexual harassment, our participants expressed their despair facing unpleasant, sometimes dreadful situations where they were victims of harassment. Under harassment, we identified three subcategories: sexual harassment, assault, and other harassments.

**Sexual Harassment.** Sexual harassment is defined as any verbal or physical action that is unwanted and of sexual intent [47]. One driver shared an experience of sexual harassment that made her uncomfortable, Mona said:

The second he got in the car he said, “Huh I didn’t know it was a girl,” and I was like, “Okay!” He kept questioning me, like “You’re really cute,” and obviously I was married and then he kept saying “You are just so cute,” and he would not be quiet about how cute I was... It was the most awkward situation. (Mona)

Mary said, “Sometimes, like, the guys are like making passes at you,” which made her uncomfortable. She said that harassment is a significant concern for her because her physical build is petite. “I’m very little. So I just think if anything were to happen, I don’t know if I could like, do anything for myself,” she said.

We found that sexual harassment was reported by both male and female participants. For example, Jack was harassed by an individual who thought he was homosexual and almost physically “threw himself” at Jack in an aggressive attempt to shake the driver’s hand. In another similar incident shared by Alan:

As a man you would think that a sexual assault would not be an issue. But it definitely is. I’ve been grabbed by numerous gay men, uh, and it’s so, it’s definitely like a Unisex-ish, like a lot of times sexual assaults really publicize a perspective that men [are] against women but it’s definitely just as big of a risk for men because I have picked up gay drunk men that were very aggressive, that made me very uncomfortable. (Alan)

*Assault.* The definition of assault varies according to different jurisdictions, however, we adopt a definition stating that assaults include physically and intentionally harming another person [48]. Assaults were one of the fears rideshare drivers expressed and often came in unforeseen situations.

Ryan was assaulted by a passenger because he asked the passenger to use seatbelts for his kids. Ryan said that he told the passenger, “As long as there’s kids in my car, my wheels don’t turn until they’re buckled.” The passenger refused and became aggressive. The passenger used a knife to attack the driver. He recalled: “Actually I came out of this, I had a cut that ran the full length of my right eyebrow. I had bruises [and] scratches down the side of my face.”

*Other.* Incidents that did not fit in the first two subcategories were included under ‘Other’ (general harassment). Jack, who is a spokesperson and an advocate for rideshare drivers, said: “It’s the attitude that is displayed and the harassment and the abuse that is unloaded on these poor drivers that are immigrants, low income, minorities, seniors, disabled, or students.”

Ryan explained an incident where he was not able to find a passenger because the passenger left the location where he requested a ride and thus, the passenger got angry. Ryan had to end the trip with the passenger and reported the issue to the rideshare company. Ryan said that the passenger was “threatening” him and saying he was going to beat him.

Drivers also experience threats from passengers when asked to follow a certain code of conduct in the vehicle, such as wearing seatbelts, or asked to refrain from certain behaviors, such as selling drugs out of the back seat. Sally said, “I also had a passenger threaten my life because I didn’t let him eat in my car.”

*4.1.2 Intoxication of Passengers.* Another source of insecurity was intoxication of passengers which could lead to any of the harassment scenarios identified in the earlier section, such as sexual harassment or assault. Rideshare drivers dealt with intoxicated passengers regularly mostly during the night after bars’ closing time. Mark expressed his fears of intoxicated passengers who had a lot of drinks or who were on drugs. He said, “That can be a scary situation.” Mary noted that when she drives drunk passengers she feels unsafe “because people just get different when they’re out of it.” Intoxication could lead to sometimes life-threatening situations. Nathan said, “The guy who threatened me and threatened to murder me he did it twice. Both

times he was beyond hammered, totally drunk.” Sally said she had to end the trip with a passenger who was drunk with a group of his friends. She described the passenger as “vulgar, obnoxious, rude, [and] belligerent”.

Aside from harassment, a major concern with intoxication was that it led to impaired passenger cognition, which would lead to risky situations for the drivers. Ebony said:

When I dropped her off, she acted as if I was kidnapping her. Like just trying to do something to her because she was that intoxicated. I was worried because she was white and I was black. I didn't want any trouble, I just wanted to do my job and drop her off. (Ebony)

Another common example of impaired judgment was when passengers were riding together and going to different destinations, but didn't enter all their addresses. When passengers were intoxicated, they sometimes had hard time doing that. John said:

I asked her to update the address because it didn't come through then she looked at me like a scared cat and said, “Who are you? Where is my girlfriend?” and I said, “We just dropped her off.” And I said, “Did you want to put in your address so I can take you home?” She [said] “How do I do that?” Then I walked her through this. When she was at the point where she should enter her address, she said, “I don't know how this works,” then hit the home button. This happened 3 times. (John)

*4.1.3 Driver's Own Gender.* Rideshare drivers sometimes feel unsafe for personal reasons that are often related to the passenger they are driving. Females expressed a fear for their safety when driving male passengers, especially at certain times of the day. Sarah said that because she is a woman, she fears strange men in her car. Also, Ebony shared an interesting perspective of her gender:

You know you're a woman, you know that you're not as strong, you know that there are a lot of odds against you when it comes to you just having just one passenger, and more than one passenger. (Ebony)

This idea of being small in stature may not be gender-specific, but this contrasted with what we found, which is men stating their physicality as being a reason for safety. For example, Ryan, who said he was only assaulted once on the job, said, “I do have a little bit of an advantage in there. I'm 6'4” 265 pounds. Most people think twice before bashing with me.”

Mona, Mark, and Juan said there should be ways for females to drive only females to maintain their safety especially during night time. Mona said: “I know a girl who made a deal with her boyfriend that she would cancel all guys because she doesn't feel safe with them.” Even when it came to drunk passengers, Mary said she felt safer with intoxicated females than with intoxicated males. She said: “When I had female riders and it was late at night and they were maybe a little tipsy like, it wasn't as frightening or scary as like driving a drunk guy or a group of drunk guys.”

*4.1.4 Trust Issues.* Driving strangers in one's car was sometimes a source of insecurity on its own. A number of drivers reported a feeling of unsafety of some level because of the nature of their job to encounter strangers on daily basis. This theme aligns with previous findings that drivers are put in an uncertain situation where they don't know enough about their passengers [22]. Mark told us:

We don't know anything about the person that we're picking up. And we have no idea where their destination is until they get in the car. So we're kind of in the dark until that passenger gets in your car and then, you could potentially be in a great situation with a

nice person or you could be in a situation where somebody that either is a dangerous person in themselves or is doing something like an activity like drugs where you don't necessarily know what they're doing. (Mark)

Ebony had a similar perspective that drivers are vetted to some level in order to get their jobs to ensure the safety of the passenger, however, drivers don't know much about their passengers, which was perceived as a source of threat. She said:

I think that rideshare drivers should have more information about the customer like the customer has information about you, like they have your license plate, they have your name but you don't have anything about them... for us, we get background checks, but the customers, we don't know anything about them [and] what they're capable of. (Ebony)

Oscar stated an almost identical claim that passengers know how the driver looks like but the driver only gets a "random name". Victor believed that providing only a name is not enough to identify the account holder to be held responsible for their actions:

So the person you're picking up may not be the account holder at all. You know what I mean, there's no I.D. check. The account holder could have said, "Oh I used my account to give a ride to my cousin." That's it. I mean, that's a simple explanation to get themselves out of liability. (Victor)

Emily didn't feel safe with passengers because she didn't know much about them. She said that one time she had "initials for the passenger's name" she didn't know if it was a male or a female:

I don't feel safe because I don't know who is getting in my car. I don't know if they have been drinking, under the influence. I don't know if they have a weapon, I don't know. That was the reason I ended up stop driving because I felt less and less safe over time. (Emily)

Furthermore, Steve and Sarah did not feel safe around people in general. Steve stated that he does not "feel safe around people at all" whether driving for rideshare or encountering strangers in life. Sarah had PTSD which increased her alertness of strangers in general, especially rideshare passengers in her car.

## 4.2 Rideshare Drivers' Strategies to Enhance their Safety

Rideshare drivers used different means to maintain their safety that may or may not be allowed by rideshare companies. Many drivers expressed that their safety is more important to them than following a rule that could jeopardize their wellbeing. We found that rideshare drivers were using three main methods to ensure their safety: video recording, carrying defensive weapons, and being selective of time and location.

*4.2.1 Video Recording.* Eight out of 20 of our participants reported using video recording through a "dash cam" when driving passengers, describing video recording as their "ultimate protection" or "for security reasons." One participant had video recording ready when he needed it but did not record on regular basis. Jack said, "I have like three devices that are there, you know, phones and I have it set up so I can record video and audio at, you know, at the touch of a button." Drivers who used dash cams mainly had two different motivations. The first is having the camera as a deterrent for passengers' misbehavior, if they know they are being recorded. For example, Steve said:

With the dash cam typically you are not [going to] get bullshit where passengers will try drugs or things they shouldn't have. They are not [going to] try to do drugs or anything because they see that I have evidence. (Steve)

Sally said, “I think it might be a deterrent, people see it and they are aware they are being recorded.”

The second motivation for having a dashcam was to have evidence in case of potential disputes. Adam said, “I would definitely feel safer and that is probably why I considered [video recording] because it’s really just your word against their word,” he said. This notion of wanting supportive evidence was echoed among others as well. Oscar said:

A dash cam that you need to have is one with GPS because without the GPS, you cannot prove speed and the location where you are driving. The GPS is your ally to helping build corroborated story to support your [argument]. (Oscar)

Allison believed that video recording is an important tool that should be encouraged by rideshare companies to protect their drivers. Allison said if a driver is accused of wrongdoing “There’s nothing [they] can do, unless [they] can prove that, if [they] had a dash cam.”

Not all drivers informed passengers of video recording because of fear of receiving a bad rating. Although sometimes the latter happens in a state where the law requires a two-consent party, where both the person recording and the person being recorded know about the recording. “Because if I tell them, they might not like it and rate me poorly in the app,” Juan explained. Drivers who did not have dash cams either were daunted by the technicalities and/or efforts of installation or did not want to mar passengers’ experience.

Mark and Noah did not use video recording at the moment, yet they expressed their intention of installing one. The main reason delaying their decision was the “hassle” element and because it is “labor intensive” to buy, install and store the videos. They both, however, stated the importance of video recording as a rideshare driver, not only for passenger surveillance, but it would also help with accidents on the road. John similarly explained:

I know [video recording] would protect me. The girl who said, “Are you going to rape me?” She could go and say that “oh yeah my [rideshare] driver tried to rape me,” and I don’t have a proof that I didn’t do anything. (John)

However, John was reluctant to install a dash cam because he believes it is “sort of a bump in the road for a good user experience”.

*4.2.2 Weapons.* Seven out of 20 of our participants reported carrying lethal and/or nonlethal weapons to ensure their safety. Rideshare companies are at odds of carrying nonlethal weapons such as mace and pepper spray. However, all rideshare companies, to the best of our knowledge, prohibit carrying lethal weapons such as firearms in the car while working for the rideshare companies, regardless of state law. One driver [Code removed] told us that it is common in their state that people carry guns and that they would only feel safe if they carried guns too. They said:

I carry firearms and knives in my car. I keep the guns in the trunk of my car. Actually, there are drivers who give other drivers weapons to protect themselves. It is not at all uncommon for rideshare drivers to carry something whether mace, knives or mounted, an actual firearm. I have actually seen drivers share basically a gun mounted an actual fire arm mounted and keep it at their feet while driving. I think this is pushing it too far. [Code removed]

Nathan said that some drivers carry a Glock, a type of firearm. However, Nathan and most other rideshare drivers interviewed resorted to less extreme options. “I actually do carry pepper spray [and a] pocket knife,” he said.

Drivers who carried weapons justified their behavior as being an inevitable choice because they thought they had to look out for their own safety. Mark said that as soon as he saw a video of a rideshare driver being assaulted, he bought pepper spray. Similarly, Mary said, “I always had my

pepper spray. I hope I never have to use it but I always had it really close to me in my cup holder, right next to me.”

Sally carries a taser for her “protection in case somebody gets extremely out of hand. It’s electronic, it zaps them with electricity”. Another participant stated that they carry some kind of a weapon but refused to state which type it is due to fear of losing their job. The driver stated:

I can’t say that specifically because [company name] have disclaimers and there are terms that prohibit drivers carrying weapons, self-protection, so I can’t say if I do, but I can say that some drivers choose to ignore that disclaimer, carry pepper spray or carry other things. [Code removed]

*4.2.3 Time/ Location Choice.* Rideshare drivers, being independent contractors, have the ability to work in the location they choose to, and at the time they prefer. This strategy was also documented by an earlier related work [25]. Thus, knowledge of hazardous locations helped rideshare drivers avoid them, should they choose to. Drivers reported different strategies when choosing where to work. They might be generally alert, paying attention to people and the area they descent to, while driving, “I am always aware of my surroundings as I am picking people up or dropping them”, Grace said. Drivers might also elect to completely avoid sketchy areas. Ryan said, “I’m not going to work in places that I knew I might be at risk.” Mona similarly noted, “If I drove in a bad area then I turn [the app] off until I get out. They don’t force you to drive in places you are not comfortable.”

Driving in unfamiliar neighborhoods, and the element of uncertainty, could be considered unsafe. Some drivers reported avoiding such places in an effort to reduce possible risks. Emily told us, “If I am not familiar with [the neighborhood] ... I turn [the app] off until I get out.”

Majority of drivers we interviewed did not have a professional safety training. However, Jack worked at a police department and has more training and knowledge about dealing with bad situations. He would still make the decision to avoid certain areas to improve his safety. “I’m a native San Franciscan and I know sketchy areas and I know sketchy situations,” he said.

The other perk of being an independent contractor, is choosing *when* to work. Drivers make a strategic decision of when to work to improve their safety. Alan told us, “I don’t drive during certain times, at least I try not to.”

According to our participants, rides that occur late at night are notorious for being risky because of intoxicated passengers leaving bars. Several of our female participants reported using this strategy. For example, Sally avoids driving after 12 a.m. Sarah similarly said: “I just feel safer getting up early in the mornings and riding people to work versus, you know, going out in the evening and dealing with some people.” Mark stated that his roommate is a female who drives for two major rideshare companies and that she stops driving at six o’clock at night because that is her way of ensuring her safety. Lastly, Allison works mostly at the airport because she is guaranteed not to get passengers who are drunk or carry weapons. Allison said, “So, I’d feel safe working airport at night. And so that’s kind of where I carved out my dish.”

*4.2.4 Collaborative Work and Communication with Colleagues.* While interviewing the participants, the questions were directed to the single driver we were interviewing, and we used a singular language such as: what do you think, how does this effect your safety... and the answers would mostly be in the plural form, using a lot of words such as: we, us, our, drivers, colleagues, and others that demonstrated how drivers perceived themselves as part of a community that is built upon support and collaboration to allow them to do their job. Communication is vital in daily activities; however, it is mostly valuable in the case of ridesharing, especially because drivers do

not receive an extensive training for their jobs and the sign-up process is fairly simple and quick. Thus, having a network of experienced workers preps the drivers to kick-start their careers in the ridesharing industry. A study [25] found that, when using online forums, drivers develop an “online social sensemaking” by socializing and learning about using the system. But, what about communications specific to their safety? After talking to the drivers, we found they interact indirectly through the app and mostly directly through other forms of online and offline communication mediums.

*4.2.4.1 In-App Communication.* Rideshare apps do not allow for communication between drivers—only communication between drivers and passengers. So, while there was no direct verbal communication between drivers, we found that drivers found a way of sending cues about passengers to other drivers through passenger ratings. After every ride, drivers have the ability to rate their passengers. Drivers used this feature to send an indirect message to the next driver about the behavior of the passenger. Many drivers also reported being hesitant to accept rides with passengers who have a very low rating. Jack shared how he uses this feature and said: “I document everything as soon as the rides are over and I give [the rider], you know, the lowest rating possible because it's sending a message out to other drivers ‘hey be on the lookout for this person’”.

*4.2.4.2 Off-App Communication.* To fulfil their needs, drivers resorted to ad-hoc ways of communication such as through online forums, blogs, Facebook groups, Twitter and other face-to-face relationships. The drivers we talked to reported communication with other drivers to learn about safety information and to either provide or seek support when faced with a safety-threatening situation.

*Safety Information Resource.* As discussed earlier, rideshare drivers are sent safety tips from their companies, and majority of the time these tips are short and not comprehensive, as claimed by our participants. Many drivers said they would skim through them, or not read them at all. However, drivers rely on a different, informal, resource for their safety training, that is other drivers. Although not a legitimate source, drivers heavily utilize those connections and online resources for this purpose, mainly because they trust them. Mona was one of the drivers who relied on those connections. She told us: “I don’t remember [the safety tips]. I don’t know if I read them, but I do remember the guy who helped me register; I asked him questions about safety questions and he was able to answer me.”

Steve also expressed a similar strategy and stated: “I haven’t gone through everything [safety tips] they have to offer. I tend to get on forums and other stuff, so I imagine there is nothing there that would be of any use to me.”

Drivers also give a lot of advice to other drivers. Many of our participants said they warned their friends not to drive without a dashcam, or not to leave an open bottle within the reach of a passenger because they might put something in it. Drivers diligently follow these advice and consider them a helpful resource when they are on the road, which adds to our understanding of how drivers collaborate using off-app methods. For example, drivers reported being in situations where it was their word against the passenger’s, where the passengers would accuse the drivers for things they did not do. Drivers decided to use dash cams and advised their colleagues to do the same. Steve said:

I have interacted with other rideshare drivers on occasion unfortunately a lot of them don’t have dash cams. I always always always recommend it to them like you know, you are kinda stupid if you get into this [ridesharing] and you don’t have a dash cam. (Steve)

*Provide/Receive Support.* Participants reported being “on their own” when it comes to driving for rideshare companies. When faced with safety related circumstances, they turn to their fellow drivers to receive support and guidance. Emotional support is important in cases that relate to one’s safety. Drivers provide emotional and psychological support by listening to each other’s experiences and provide advice accordingly. Advocacy for rideshare drivers is a huge thing in social media. Jack is an advocate for drivers and provides support to drivers through Facebook groups and other social media accounts. Jack reported having connections with drivers “nationally [and] internationally; like easily more than 300,000 drivers”. He claims that what they do is not for “profit”, but it is just to stand up with their fellow drivers and support them. Jack continued, “You know every man for himself mentality? Well, it's not like that. We have to watch out [for our] fellow man. If not, then we are going downhill. Downhill fast.”

### 4.3 Rideshare Companies’ Role in their Drivers’ Safety

Our third research question was: *From the drivers’ perspective, what have the companies provided to ensure drivers safety?* Participants’ opinions were split into either believing the company had a positive and/or a negative role in terms of the drivers’ safety.

*4.3.1 Positive: Location Tracking.* Rideshare companies track the vehicles of the drivers when they have the application turned on. Thus, when the driver has a passenger, the company knows exactly where they are which is a source of comfort for some drivers. Mona said:

I think [the company] tracks everything to make sure you are safe. They know obviously where you are. If I logged off they will still keep track on [me] for a while. They usually would take care of incidents. They are watching basically. (Mona)

*4.3.2 Positive: Passengers’ Identity is Known.* For a potential customer to use a rideshare app as a passenger, they need to register with their name and enter valid credit card information. This is a feature of rideshare companies that is not available for taxi drivers who usually pick up hitchhikers. It is also argued that it provides more safety for drivers compared to taxi rides [10]. Noah agrees with this argument and said:

You don’t pick up someone you don’t know. Whoever you pick, the company knows the person. Even if someone orders the [ride] for someone else the company knows. I believe I am safe, if anything happens to me, the company will know, unless the person is very stupid to act badly. But as long as I know the passenger’s name, I know something about them. (Noah)

Grace expressed a similar notion to Noah and said: “Everyone is documented, like the last person I got in my car, if something happens to me, I think it’s not easy to get away with if anything were to happen.” Mary reported perceived feelings of safety due to the company tracking the ride:

Most people are [well behaved] coz like, your details and everything is on the app. Like, it's not like regular cab ride that you can't track. Like [you are] just tracked on the app like if you misbehave, [it] can be traced back to you. (Mary)

For most rideshare apps, drivers can rate the passengers. Uber for example, just recently made this rating visible for the passengers and Mary thought that passengers’ rating along with their known identity work in the best interest of increasing the safety of the driver. Mary said: “When people became aware of the fact that they were getting rated too, I think people became more courteous and respectful and conscious of their actions.” Adam similarly noted that:

The passengers, their accounts are linked through the app which is linked to their phone and I think they realize that. They're not going to be able to threaten me, say stuff out of the ordinary because everything is linked to [their] phone, into [their] name. (Adam)

*4.3.3 Negative: Lack of Job Security.* The nature of working as a contracted driver for rideshare companies does not provide job security. For one, they are independent contractors who work on demand and do not receive the benefits of an employee [4]. They also deal with income uncertainty as mentioned earlier [26]. They also need to be overly pleasant, not to bother the passenger to avoid receiving a bad rating [34]. Thus, some drivers choose to sacrifice their safety for the “fear of losing their job”. For example, Nathan said:

The driver is put in a position of safety or security from a job security aspect, so many drivers are afraid to even do anything that may ensure their safety or protection due to fear of losing their job. (Nathan)

Nathan continued by saying that certain rideshare companies used to send emails with false information that dash cams are illegal and that having them could result in lower rating which could result in “termination”. John stated that he used to take all rides because he did not want to be terminated. Mona also expressed that sentiment, adding, “I wish that they would give you a buffer for, like, safety reasons to refuse a trip.” Alan expressed a similar need by stating a problem that he faced. Alan said:

You have someone that just called the ride and if [I] don't take the trip, [I am] going to be charged a fee and then they are [going to] be pissed off about that. Um, so there's no button [in the] app that said, ‘I don't want to take the ride because I feel unsafe’. (Alan)

Previously, rideshare drivers claimed that the rating system is a poor way to indicate their trustworthiness as drivers [34]. Emily shares the frustration of lack of job security because of the dependence on the rating system. She said: “It's almost as if you are walking on egg shells because of the rating system, you feel like you want to be overly pleasant.”

*4.3.4 Negative: Low Fares.* Another interesting perspective was the belief that with lower prices for rides, the passengers would be more likely to behave badly because they don't value the service provided due to it being very cheap. This was an interesting perspective that two drivers from California expressed. Emily said:

It's so cheap so you attract people who are jerks. There was this evolution I believe that matched this “race to the bottom”, to the dropping of fares, continual dropping of fares. They are taking these things for granted and again it's because of the dropping fares. (Emily)

Emily continued by saying that bad behaviors and attitudes stem from a lack of appreciation of the “personal service” that rideshare drivers provide for passengers, especially with the low price. Jack shares a similar opinion that lower fares attract bad behaviors and he uses an analogy to explain that:

It's now like Dollar Tree 99 cent store. And to put that in perspective if you go and buy something at Neiman Marcus or Macy's you're going to take care of it. Correct. If you buy something at Dollar Tree or 99 cents store. If you break, it who cares, right? (Jack)

*4.3.5 Negative: Lack of Support.* Drivers' perception of lack of support from the company's side was considered as a source of a lack of safety according to our participants. When an incident occurs between a driver and a passenger, the rideshare company would not match the driver with the same passenger again. However, this is not always the case. For example, Nathan told us:

The first time I reported him to [the company], I did brandish my pocket knife at him. In the first time, he did not have a weapon on him. I reported him immediately. If I go back, I could probably find an email where they blocked him and made it so that we won't be matched again. But unfortunately, I got matched with him again about 6 – 8 months later. In this time, he had a knife and a gun on him, first he started with a knife and then he pulled out a small pistol, I realized who he was and realized that [the company] did not do what they were supposed to do, and that they have failed. I went ahead and contacted the police. (Nathan)

Ryan shared an incident where he believed he did not get support from the rideshare company that he was working with when he was assaulted by a passenger. Ryan said, after he was assaulted with a knife, the perpetrator fled the scene. Ryan called the police who contacted the company and asked for the passenger's information but the company stalled and asked the police to contact them by email. Ryan said the passenger "got away" and "[company name] was completely 100 percent uncooperative".

Mary conveyed frustration over being in a dangerous situation with drunk college males and not receiving appropriate support from the company. She said: "[The company] just apologized. Oh, sorry you experienced that, we would take appropriate action. Whatever that action was, I don't know."

## 5. DISCUSSION

This section delves into the implications of the results presented above and how they support and complement the available wealth of knowledge. We began this paper with a literature review for taxi drivers, due to lack of research on the safety of rideshare drivers. We found that safety concerns for rideshare and taxi drivers overlap in many instances. We have identified four reasons why rideshare drivers feel unsafe, which was not any different from research on taxi drivers. One exception was the use of, and the consequences of the rating system. Although drivers used the rating system to send cues to other drivers about passengers' behaviors, the rating system also prevented them from engaging in behavior that could potentially protect them, such as installing a dash cam, because passengers might not be happy with that and poorly rate them.

This finding complements earlier research that the rating system in ridesharing apps is perceived by both drivers and passengers as vague and unclear [1,22]. Lampinen [23] argued, in order to improve the safety for workers in online marketplaces, workers should be able to "freely" make decisions concerning their job, which as discussed in the results, rideshare drivers are limited in that regard. Lampinen also recommended focusing on qualitative reviews, rather than the mere use of the stars system. For example, removing the easy to use stars system completely and allowing customers to enter at least one word to describe how they feel about their experience would yield more insight into the encounter. It would also help both drivers and passengers to learn from their behaviors in this specific context. The company can easily use algorithms to understand the sentiment of the overall comments, yielding a similar, but richer understanding of the nature of the short-term relationship between their drivers and passengers. We believe this might positively contribute to the safety of drivers, and would be an interesting future endeavor to tackle.

Contrasting taxis' safety measures with ridesharing, we see that taxis are built in a way that deter harassment and protect taxi drivers. For example, glass shields in taxis protect against robberies and serve as physical barriers to protect the driver from any attempt of physical harassment. Rideshares on the other hand, doesn't have such measures to protect the drivers. While it could be unrealistic to recommend physical barriers in privately owned cars, it raises the question of what rideshare drivers and/or rideshare companies should be doing to address these known problems.

The role of a rideshare company was perceived differently by drivers. Some drivers appreciated basic features such as tracking the location of a driver and storing valid customer credit card information, perceiving those features as safety enhancers. Yet, a number of participants complained about lack of support and not even knowing the gender of the customer they agreed to service. Although the results seem contrasting at a first glance, considering other personal factors such as experience help explain the results. Drivers who claimed the company had a positive role in their safety were relatively new in the profession, reporting experience of 1 year or less. It is possible that those drivers were either "lucky", as one of our drivers stated, or they were in the honeymoon phase of a job where they tend to have an overall positive overlook of their new job responsibilities and environment.

Regarding the collaborative and communication behaviors of rideshare drivers, we found that rideshare drivers visit online forums to vent about passengers and share information, which was consistent with prior research [25] on how drivers engage in "online social sensemaking" on online forums. Our research builds on that, revealing that extensive communication happens outside rideshare platforms and these activities can include exchange of tangible support and activism. Rideshare driver advocates are very active online and in social media to defend their cases and ask for more rights as independent contractors. Also, on the individual level, drivers reported using their experience as guidance to provide safety-related support for other drivers. Drivers not only seek information and ask questions in those forums, they also use them as valuable resources for their safety, which extends previous research findings [25]. This work complements the latter study in that drivers share safety resources, and coordinate offline meetings, and online activism; mimicking a form of collaborative informal union activities. It's an interesting avenue in the intersection of HCI and labor research, looking into how ad-hoc communication tools are used to create what looks like organized labor and/or worker rights activities.

On a similar note related to labor, there was recently a case about a package delivery that uses a similar employment model as rideshare companies. The court ruled in favor of a gig economy worker, ruling that he is an employee and not an independent contractor [52]. The court stated that it is the company's job to prove that a hire is a contractor. The court stated 3 main components that all must be met for a contractor designation, one of them is to do a job independent of the core business of the company [32]. While it is uncertain how this will affect other companies such as rideshare companies, this might change policies and labor structures in the future. Thus, it would be interesting to see how driver safety issues evolve with these possible changes in the horizon.

### 5.1 Design Implications and Future Work

A number of design suggestions are presented to enhance the safety of rideshare drivers based on the interviews conducted with our participants.

RS systems' users include: customers (riders) and providers (drivers). The safety considerations for usability have always been more passenger centric or at least these have been the ones highlighted. It is key to mention that there are almost as many drivers as passengers in each ride,

as system users. Consequently, to fully improve the system's potential, drivers' needs should be taken into consideration. A number of drivers reported that certain features provided by the app contributed to increasing their feeling of safety. Features such as choosing when to work, and relatively knowing where to work, were considered as positive features of rideshare apps. However, drivers are not allowed the flexibility of choosing certain features of their rides such as if the ride is long or short, and where their passengers are going. Hiding the drop-off locations might stem from the idea of reducing discrimination against certain locations. However, we suggest that allowing drivers to choose whether to drive a long or short ride would be a consideration for the preferences of the drivers. A driver might prefer to go on 2 hour long trips, however, some drivers might be reluctant to such long rides and might not feel comfortable driving that long. Allowing drivers to choose a range of the length of the ride will consequently affect their choice of where to work. If a driver prefers to work in relatively familiar areas, s/he will be more comfortable with shorter rides. Such a feature will contribute to the original feature of allowing drivers to turn the app on and off to choose where to work.

According to our female drivers, driving late at night with intoxicated males provided an unsafe environment for the driver. Previous research found that one reason females reject a trip at night was because the passenger is male [25]. There are some rideshare apps that allow female drivers to only drive female passengers which does solve some of the challenges raised by our female participants. However, we need to investigate the extent to which such platforms have affected/unaffected the number of reports received by rideshare companies from their drivers, claiming assaults or harassment. Furthermore, since our female participants expressed fear of male passengers late at night, we recommend looking into the idea of giving the option to female drivers to drive female passengers only at certain times of the day/night. It could be argued that such feature would also help female passengers feel safer while taking a ride in the middle of the night. This feature, however, would require companies to know the gender of the driver/passenger and it is uncertain whether people would want to provide this information for privacy reasons, or if it were implemented, what gender categories would be provided.

Rideshare platforms' reluctance to the safety of their drivers was evident through the narrative of our participants. The majority of safety enhancement efforts are directed toward the passenger, who is the direct source of income for the company, while neglecting the actual service provider. Perhaps this has to do with the large demand for being a rideshare driver, because of how easy it is to join the work force and start getting bread on the table. Even if it is, from a business perspective, feasible for those companies to participate in this negligence, it is unethical of large technology companies to undermine the importance of safety of their service providers.

To reduce the apparent platform reluctance, rideshare companies could reinforce the safety of their drivers through their app. The idea of a company advocating for the rights and safety of their employees could start in the form of small nudges that do not even require major resources and still be effective and efficient. Examples of businesses advocating for their employees include restaurants suggesting the calculated tip amount, online websites reminding customers to tip the driver, and taxi companies placing a large metal sign inside NYC cabs reminding passengers that assaulting a driver would result in up to 25 years in prison. Learning, and building on such successful initiatives, we suggest rideshare companies to research the idea of sending a screen with a notification to the passenger once the trip has been confirmed that includes friendly reminders for the passengers to respect the driver and to refrain from unsafe and illegal activities; because such actions would not be tolerated. Including a short sentence related to the possible legal consequences for undesired actions would fortify the expected results. The notification should be in a clear and easy to comprehend language, as well as concise to allow a quick glance

and understanding of the content. Adding an explanation that this would also help increase the safety of the passenger too, we assume would be an enough incentive for passengers to put on their best behavior.

The idea of video recording as a preventative measure presents opportunities and challenges. Video and/or audio recording passengers, while widely used, raises questions about privacy issues. Drivers stated fear of receiving bad ratings when they inform passengers of video recording. Thus, some drivers refrain from informing passengers of video and/or audio recording even if they are in a state that requires the consent of both parties being recorded. We recommend transferring the burden of recording and maintaining footage to the rideshare company. The dashcam does not have to be a separate camera, which entails more costs. Recording could be accomplished through the same app using the same mobile phone, or another one, if feasible. Rideshare platforms will have the responsibility of the ethical and moral handling of the recorded content, thus, relieving the driver from further liabilities. Moreover, rideshare apps should include in their agreement that requesting a ride entails consent to be recorded by the company, therefore, considering different state laws related to recording.

## 5.2 Limitation

One limitation in this study is that the majority of participants were recruited through Twitter and have used words like “rideshare” in their profile. This means they have a strong identity as a rideshare driver and might not reflect an average driver who might not be as enthusiastic about the profession. Another limitation is the sample size, although we have reached saturation in themes, we believe a larger sample of rideshare drivers would yield more insights about the prevalence of these concerns. Also, our research did not look at differences between different rideshare companies. Since companies have different policies as well as different features and customer bases, these are factors that could influence user experience. Finally, we only interviewed participants working in the U.S. and some rideshare companies are international, thus, the findings might not apply to international markets, especially in regards to weapons usage. Future research may want to see if there are cultural or geographically-influenced differences that influence safety issues associated with ridesharing.

## 5.3 Conclusion

The labor aspect of crowd work in rideshare and similar industries in the gig economy have been addressed in previous CSCW work, but the safety of the workers has been an understudied area. Rideshare drivers use their bodies to deliver services, so they are exposed to unsafe physical as well as emotional situations.

In this research, we identified safety concerns of rideshare drivers and the methods they use to deal with safety. Using qualitative, semi-structured interviews with rideshare drivers in the United States, we found a large overlap between rideshare drivers and taxis in terms of safety measures in both industries. Rideshare drivers reported four main factors, contributing to their lack of safety. They also stated using a variety of preventative methods to improve their safety, including the manifestation of informal communication with other drivers and the use of ad hoc tools to account for the lack of in-app communication methods. Our research shows that different technological features contribute to both safe and unsafe scenarios from the perspective of drivers.

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