Support for Social and Cultural Capital Development in Real-time Ridesharing Services

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ABSTRACT

Today's transportation systems and technologies have the potential to transform the ways individuals acquire resources from their social networks and environments. However, it is unclear what types of resources can be acquired and how technology could support these efforts. We address this gap by investigating these questions in the domain of real-time ridesharing systems. We present insights from two qualitative studies: (1) a set of semi-structured interviews with 13 Uber drivers and (2) a set of semi-structured interviews with 13 Uber riders. Our results show that both drivers and riders acquired and benefited from informational, emotional and instrumental resources, as well as cultural exchanges via interactions with each other and with online platforms. We argue that these interactions could support the development of social and cultural capital. We discuss our findings in the context of labor and contribute design implications for in-car social and cultural experiences and for the ways technologies such as GPS and location-based services can support the additional emotional, social, and cultural labor that drivers provide to their riders.

ACM Classification Keywords

H.5.m. Information Interfaces and Presentation: Misc.

Author Keywords

Social Capital; Cultural Capital; Real-time ridesharing; Labor

INTRODUCTION

Breakthroughs such as the integration of smartphones, global positioning systems (GPS), and electronic payments in autonomous and non-autonomous vehicles contribute to a larger smarter cities vision [46], and these breakthroughs enable real-time ridesharing services like Uber and Lyft to exist. Real-time ridesharing services help to reduce road traffic [8] and emissions [7] by making use of underused private cars. Despite these benefits, there has been limited input from stakeholders [34]. Several past works in the transportation domain aim to

fill this gap. For example, past work has explored ways to improve stakeholders' transportation experiences [12, 47] and methods to create more equitable workspaces for drivers to exercise control over ridesharing platforms [1, 16, 27]. Studies that contribute insights from stakeholders such as drivers and passengers find that driver benefits include flexible work schedules and the opportunity "to be their own boss" [38], and that passengers benefit from the immediate access to reliable transportation and accurate estimates of arrival times [12]. These studies report on conversations between drivers and riders but stop short of discussing the potential value of these interactions [12].

Social capital, which refers to the benefits people can draw from their social network [35] (for instance, financial help or useful information) has been previously studied in the context of transportation. Putnam argues that one of the main reasons for the reduction of social capital in the United States is the increasing commute times, over two-thirds of which involve people commuting to locations alone [35]. On the other hand, cultural capital, which refers to assets like knowledge and skills [3], is less well understood in the context of transportation. In this paper, we draw from an in-depth examination of two studies exploring the experiences of drivers *and* riders using the real-time ridesharing system Uber to examine how the ridesharing ecosystem affords opportunities to support the development of both social and cultural capital. Further, we contribute ways in which technology can leverage and consequently enhance interactions between riders and drivers. We asked the following research questions:

- RQ1: Do interactions between drivers and riders lend themselves to the development of social capital? If so, how? What is the nature of the benefits that result from these interactions?
- RQ2: Do the same interactions lend themselves to the development of cultural capital? If so, how?
- RQ3: How can HCI-related technologies enhance interactions between riders and drivers in the context of real-time ridesharing systems?

To answer these research questions, specifically RQ1 and RQ2, we conducted 13 semi-structured interviews of Uber drivers who drove in the metro-Detroit area. We complemented these data with data from 13 semi-structured interviews and a diary study of individuals living in transportation-scarce areas of Detroit. We analyzed the data using Ferlander's classification of

social resources [14] to understand the opportunities that exist for the growth of social capital. This was a relevant theoretical frame because Ferlander argues that the extent of availability of social resources is a reliable representation of one's social capital. In addition, we analyzed cultural exchanges to determine the potential of ridesharing as a venue for the acquisition of cultural capital. Indeed, we found that ridesharing affords opportunities to riders and drivers to grow both forms of capital, although in different ways. We found that drivers networked with other drivers via Facebook groups to seek information about their job and to receive and provide social support. Further, they interacted with multiple riders who were often information leads. Drivers learned about new places as a result of driving to multiple locations. On the other hand, riders benefited from their interactions with the drivers, which resulted in riders acquiring information about local spots like restaurants and receiving emotional help. We argue that the acquisition of information and emotional support, two types of social resources, makes ridesharing a venue for the potential development of social capital. Finally, we also found that both drivers and riders found value in cultural exchanges (for instance, about the history of the city and changing neighborhoods), which we argue could contribute to the development of cultural capital.

We contribute the following:

- An analysis of interactions between drivers and riders and an explanation of how the resulting benefits from these interactions could support the development of social and cultural capital for both parties.
- Ways in which HCI and Ubicomp technologies can enhance interactions between drivers and riders and contribute to the growth of their social and cultural capital. We contribute design implications for future user-facing technologies (RQ3), specifically for real-time ridesharing systems to take advantage of the social space created within these rides.
- Additional labor that drivers inherently provide, and suggestions for how such service platforms can acknowledge this work so that it transforms to offline contexts.
- An extension of research examining the benefits of public transportation which includes the opportunities it affords to develop social capital—we confirm this research in the space of real-time ridesharing systems.

FORMS OF CAPITAL AND THEIR ACQUISITION

In addition to gaining economic capital, prior work suggests that the benefits individuals draw from their social network (social capital) and their awareness and skill of culturally prescribed social rules (cultural capital) factor into upward mobility [3, 32]. Further, social and cultural capital are associated with other tangible and intangible benefits [3, 11, 35]. We describe each form of capital in detail in the next two sections.

Social Capital

Putnam defines social capital as the "specific benefits that flow from the trust, reciprocity, and cooperation associated with social networks" [35]. While tangible benefits such as access to information channels [9] and social support [37] can lead to economic capital, intangible benefits under certain conditions can be converted to economic capital, as well. For instance, research has shown that people obtain information about job opportunities from their social networks [17]. Traditional sources of social capital include but are not limited to membership in friend groups, family, work, and churches.

Ferlander argues that the benefits of social capital can be viewed as resources that can be classified as informational, instrumental, emotional, and companionship. *Informational resources* refers to the provision of useful information or suggestions [45], often to the effect of problem-solving [26]. For example, having access to a mechanic as a friend or resource would enable an individual to receive details and advice about car care. Having a mechanic as a friend could also provide *instrumental resources*. Instrumental resources are tangible, direct ways in which people assist others [26], which includes people giving others a helping hand, providing financial assistance, and exchanging material goods or services [19]. If a driver's car malfunctions, his or her friend who is a mechanic could help to fix the car, which is instrumental support. *Emotional resources* involve offering concern, empathy, love, care, or encouragement [26]. Family members and friends often offer words of hope, support, and encouragement. Finally, *companionship* involves social time spent with other people that gives them a sense of belonging. This extends to people engaging in shared social activities. For instance, a group of mechanics involves people with similar interests coming together to discuss cars and express their opinions [26]. For our study, we use Ferlander's classification of social resources as a frame to view the benefits of the interactions between drivers and riders. Specifically, we attempt to understand how riders *and* drivers acquire informational, instrumental, and emotional resources, as well as companionship, in the case of ridesharing, which we argue could result in the growth of social capital. Further, we suggest ways in which technology can leverage and enhance these interactions to create additional opportunities to further support its growth.

Cultural Capital

Cultural capital refers to inherent qualities and skills of an individual, academic qualifications, and knowledge that result in an understanding of cultural meaning and references [3]. Cultural capital takes three forms: embodied, institutionalized and objectified. Cultural capital in its embodied form refers to properties of oneself that are acquired over time [3]. In this form, capital can be acquired both consciously and passively. The acquisition of this form of capital is determined by one's social environment, i.e. it is often the product of socialization with one's family and immediate social circles. For instance, one acquires fluency in a dialect, a form of embodied cultural capital through a process of socialization with family members over time. Although we do not expect to uncover the two final forms of cultural capital in our study, these include objectified, which refers to the capital derived from an understanding of the cultural meaning and significance of possessions like artwork [3], and institutionalized, which refers to academic credentials and qualifications [3]. Like social capital, all forms of cultural capital can also be transformed into economic capital under certain conditions.

RELATED WORK

We capture work at the intersection of transportation and social capital that analyzes the relationship between different modes of transportation and social capital. In addition, we examine evidence of existing technologies fostering social and cultural capital and how certain features allow for the development of both forms of capital. Finally, we summarize the current state of research at the intersections of HCI, Ubicomp, and ridesharing to determine gaps and explore opportunities to improve ridesharing experiences for both riders and drivers.

Transportation as a source of social capital

Putnam argues that the increasing frequency and duration of commutes, over two-thirds of which involve people driving alone, leave little time for community engagement [35]. These solitary drives also contribute to the reduction of social capital. On the other hand, studies point to the value of public transportation in promoting engagement, enhancing social capital and subsequently contributing to longer-term benefits like social inclusion. For instance, Currie et al. argue that the social space within public transportation could benefit socially excluded populations by affording interactions with passengers and drivers [10]. Cass et al. examined the notion of access and emphasized the importance of public transportation in helping people grow their networks by allowing access to informal networks of work and leisure [6]. While these studies primarily focused on public transportation, we attempt to understand whether these benefits extend to ridesharing services. Moreover, while social capital is discussed in transportation literature, the relationship between transportation as a mechanism for creating opportunities for growing cultural capital remains unexplored, a gap we aim to fill.

Technology that fosters social and cultural capital

Research has examined how shared physical spaces mediated by some form of technology can have positive benefits and help foster social capital. For instance, Dillahunt and Mankoff in the context of a social-energy monitoring application found that shared spaces are a necessity to increase social interactions among community members [11]. This study investigated whether services such as Foursquare could be used to facilitate meetings in physical spaces among people in different socioeconomic groups [11]. The ridesharing technology that connects riders to drivers inherently creates a shared space (the car), affording interactions between riders and drivers during a trip. In our current work, we investigated what benefits are already present in the shared space of ridesharing, and what role technologies could play in supporting and enhancing these benefits.

Additional studies suggest that technologies such as People-Nearby Applications (PNAs) and Massive Open Online Courses (MOOCs) and MOOC camps play an explicit role in fostering social and cultural capital. Hsiao and Dillahunt [21] found that people use chat features in PNAs to develop trust before engaging in offline interactions. These offline interactions often involve conversations between strangers. Strangers discuss cultural elements (social norms, music, and food) and exchange relevant information that they argue contributes to the growth of both forms of capital. MOOCs and MOOC camps are sources for learners to acquire cultural capital including language (participants were found to pick up English skills because it was the primary mode of instruction) [28]. These learners acquired social capital online with learners on social media websites and forums and through face-to-face interactions. Similarly, here we explored opportunities for riders and drivers, another set of strangers, to develop social and cultural capital at the intersection of both offline and online mediums, and in the context of real-time ridesharing systems.

Ridesharing in the context of HCI and Ubicomp

To contribute to the design of better real-time ridesharing services, HCI studies focusing on rider perspectives have elucidated the need to accommodate personal preferences [33], maintain privacy and safety [4], foster trust [12], and consider social networks among the elderly [30]. On the other hand, studies of drivers have indicated the need for designs to facilitate the creation of equitable workplaces [1, 16, 27]. For example, designs should enable drivers to exercise control [1] by empowering them with relevant information (like rider preferences and needs) to help them make better decisions [16, 27]. Ahmed et al. suggested making rider locations accessible to drivers so that drivers can determine whether the commute time to pick up the rider is worth it [1]. Both Ahmed et al. [1] and Glöss et al. [16] suggested ways in which technologies can enhance driver-rider interactions, including ways in which riders can make their needs visible to the drivers. Our study extends this work by taking into consideration both riders and drivers and investigating the role for technology to enhance rider experiences. Moreover, we studied how HCI and Ubicomp-related technologies can support drivers' efforts to be better at their jobs.

Ubicomp-related transportation technologies have been used primarily to detect transportation modes [20, 42] and to improve environmental sustainability [15, 24, 44]. Although there has been work to understand how Ubicomp technologies can improve ridesharing by making it more reliable [39] and contribute to traffic reduction [8], their potential in the context of improving driver and rider experiences is less clear. Therefore, we explored opportunities for Ubicomp technologies to improve driver and rider social experiences.

DRIVER PERSPECTIVES

Method

We recruited drivers (Table 1) through a combination of offline and online sources. The majority of participants (N=9) were recruited offline during rides by the second author while the remaining (N=4) were recruited via Facebook groups. Individuals who expressed interest in participating in the study and were driving for Uber on a regular basis (more than 4 hours/month[1]) were contacted for phone interviews. In total, we interviewed 13 drivers with a range of driving experience from 2 weeks to over 2 years. Of the 13 drivers who were interviewed, five worked part-time, using Uber to support their main source of income, and eight worked full time. The semi-structured interviews lasted 45-80 minutes and participants

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[1]minimum number of hours required by Uber to be considered an active driver partner

Table 1. Driver Information
List of Drivers

Nickname	Gender	Age	Driving For	Full/ Part Time
Rogelio	Male	45-49	18 months	PT
Marlon	Male	21-24	24 months	FT
Bradford	Male	35-39	18 months	FT
Krista	Female	59	18 months	FT
Nathaniel	Male	44-45	3 months	PT
Harvey	Male	64	3 years	PT
Taylor	Male	44-45	9 months	FT
Sharon	Female	49	15 months	FT
Anita	Female	40	4 months	PT
Ryan	Male	44-45	> 2 years	FT
Gerald	Male	45-49	1.25 years	FT
Rex	Male	43	< 1 year	FT
Benni	Male	54-55	2.5 years	PT

were compensated $35. During the interview, participants were asked about their general work experience at Uber including their motivations, daily routines, and the benefits and challenges of their work. All drivers lived and worked in the metro-Detroit area. In this case, we attempted to answer RQ1 and RQ2 via interviews, where questions about interactions with riders (most memorable and difficult interactions), aspects about the job they liked and problem-solving methods helped us understand the opportunities that existed for drivers to grow their social and cultural capital.

Analysis

All interviews were audio recorded and transcribed. We developed a codebook using a hybrid process of provisional coding [40] and open coding [40]. We developed provisional codes to represent four kinds of social resources: informational, instrumental, emotional, and companionship. We also included the three forms of cultural capital in our provisional codes: embodied, objectified, and institutionalized. The interview scripts and journal entries were coded by two coders over multiple phases. The coders met at the end of each phase to resolve coding conflicts and to discuss new codes, which on agreement were added to the codebook. In total, there were 10 codes: seven provisional codes and three new codes that were added to the codebook as a result of the open-coding process. An inter-rater reliability analysis using the Kappa statistic was performed to determine consistency among raters and was found to be Kappa = 0.751 (p<0.001; 95% confidence interval [CI] = 0.572, 0.93), which represents substantial agreement.

Aspects of Social Resources

Drivers reported liking certain aspects of their job including meeting new people, conversing with them, and traveling to new locations as part of their job. To further understand the nature of these interactions, we categorized these benefits into the four social resources: informational, instrumental, emotional, and companionship. Overall, drivers described receiving informational resources via Facebook groups and instrumental resources from riders. Drivers largely provided emotional resources to their riders and also benefited from cultural exchanges with riders and their drives to new locations.

Informational resources

The four Uber drivers recruited via Facebook groups reported sharing and receiving information about surge pricing (Sharon), safe times to travel (Rogelio), locations prone to ticketing (Krista), and Uber rules and regulations (Ryan) on these groups. In an interview, Rogelio shared the latest posts in his Facebook group:

> Well, I opened up the page so that I could see what groups I'm in. Let's see, a woman is asking, 'Just wondering **do anyone drive in the inner city of Detroit?** If so, what time of day? I'm trying to figure out all most safe times. Thanks in advance...' Here's a **warning from a couple of hours ago**. 'Anybody in the 696 and Mound area, there's a rollover accident eastbound side 696. Avoid the area.' - Rogelio (Interview)

The importance of online groups for drivers has been studied previously by Lee et al., who reported on its use for "sensemaking" of Uber algorithms [27]. While the Facebook groups were central to driver-driver interactions, we noted three instances of drivers communicating with others through other channels and subsequently obtaining relevant information from them. Rogelio, for example, got the contact information of a car cleaner from another Uber driver.

> *Rogelio:* I **got a number for a guy** at the [workplace removed for anonymity], that's what he does at the [workplace]. He stole a bunch of cleaning supplies. If you get $150 for somebody throwing up in your back seat from Uber, he wants 100 of that. If you get 60, he wants 40. It's basically a 2/3. Yeah, he's got the gloves and the mask and all that stuff. You call him, you get your car cleaned up real fast.
> *Interviewer:* How did you find out about him?
> *Rogelio:* I **got him from another Uber driver**.

Further, Bradford created a small network of Uber drivers through the referral program and used the network regularly to swap information (locations prone to tickets, surging locations) and engage in collective problem-solving.

Instrumental resources

Rogelio was involved in a transaction where he sold his dash camera (installed as a safety device) to a passenger who paid him $215 in cash, which was $95 more than what he had paid for it. There were two other instances of drivers giving riders their contact information to create more permanent relationships that were no longer mediated by the Uber application. In these cases, drivers were paid cash, which provided opportunities for passengers to tip drivers, a function not afforded by the Uber application at the time.

> *Harvey:* Yeah. But **each of my customers call me directly, I give them a ride too**. Sometimes my customers call me, say, "Hey, can you give me a ride to Up North? It's four, five hours from here."...
> *Interviewer:* Okay. Do they pay you through the Uber app? Or do they give you cash?

Harvey: No...once they know me and I know them, they do not go through Uber, they give me a call direct.

Like Harvey, Rex also explained how he gave out contact information to riders who called him directly with ride requests.

Emotional Resources

Emotional resources for the *drivers* often took the form of motivation, which they acquired from other *drivers* via offline and online channels. Bradford, who created a small network of Uber drivers through the referral program, spoke on the need to keep others encouraged, while Rogelio and Sharon indicated that Facebook groups provide moral support.

I pretty much just try to **keep drivers encouraged**. Like I got my brother driving and he quit his job because he thought it was a great thing but now he's kind of fallen off. Because, like, once you don't drive one day, and then, oh, you get up late the next day, and then you didn't make that much money, and now you're starting to, and you're starting to say this ain't what you want to do...I'm trying to just **keep them encouraged and keep the carrot in front of them, you know?** And to help them get to a certain point where they muscles are built up and they're used to it. - Bradford (Interview)

However, it was evident from the interviews that *riders* often received emotional support from *drivers*. Riders often benefited from words of care and encouragement the drivers had to offer. Rogelio spoke about consoling a passenger "who came out of the closet for the first time."

One of the things that's always stood out to me was I had a young lady who got in the back of the car. She started crying. I thought maybe somebody had hurt her. I stopped. I pulled out a flashlight. I'm checking to make sure she's not physically injured. She was crying because she was a lesbian and had never told anybody and was afraid that if her sorority sisters found out, they'd kick her out. Her parents didn't know. Her friends didn't know... She came out to me. I don't have any experience with that. **I'm like, Uh. There, there. It will be okay.** I don't know what to do. I pulled over on Trull, and I sat there with her for like 15 minutes so she could get kind of calmed down. - Rogelio (Interview)

Rex recalled how he spent time in a coffee shop with a rider after he learned that she had been domestically abused. This is a clear example of a driver going beyond his role as a driver and providing emotional support for his passenger. Along the same line, Nathaniel and Sharon reported being "psychologists" and offering "Dr. Phil cures" during their rides. These two drivers highlighted the emotional state of riders during their rides and the subsequent support they provided.

Companionship

Like the riders, the drivers received companionship as a result of spending time with the riders during the ride. However, there were also instances of the riders and drivers keeping in touch after an Uber ride and spending time with each other. Both Marlon and Rex reported developing friendships – Mar-

lon with a rider who he helped with his luggage and Rex with two police officers he had driven around.

I've also had like a good ride in terms of like I met an energy consultant and like we're still—And I dropped him off, so we **became pretty good friends, and I hang out with him or whatever**, and you know, he's helping me like grow like personally...— So you know, that was like a really good ride. - Marlon (Interview)

Cultural Exchanges

Drivers benefited from the cultural exchanges through interactions with multiple riders and traveling to new locations. For example, Marlon had a conversation where a rider spoke to him about how the refugee crisis was affecting Germany and Turkey. Ryan had a conversation with a rider from Germany who told him about areas he should tour if he visited the country. Bradford spoke in general about the benefits of conversing with people from other regions and cultures.

However, it was more apparent that the drivers enjoyed driving to new locations to pick up and drop off passengers, clearly indicating that this was an aspect that they liked about their jobs. For instance:

Seeing new places in the city that I haven't seen. Let's say, metro Detroit all together, or going to places that I haven't been in a long time and **seeing the changes**. It's kind of fun. It's relaxing, even between rides, it's just relaxing just to be on the road. - Krista (Interview)

Bradford tried new restaurants in new locations; Taylor enjoyed taking riders to fancy neighborhoods in the city, and both Ryan and Rex learned and became more familiar with parts of the city as a result of driving with Uber.

Drivers reported using riders' location and names, and their inherent knowledge of certain cultures, to decide which passengers to pick up and who to avoid. Two drivers, Rogelio and Rex, were wary about certain neighborhoods in the metro-Detroit area given their propensity for drunken riders. The two subsequently relied on this knowledge to avoid these areas.

There are three things that I take into account by **screening out problem passengers**. One is the location that you're picking from, alright. Because there are some areas that are – Yeah, you know, different socioeconomic status. Two, the name. You know, and unfortunately people with – And it's not necessarily – Yeah, people with more Anglicized names – and no, it's not necessarily Anglicized names. How do I put this? You can tell someone from a lower socioeconomic background by the name, because they tend to name their children things that are spelled uniquely, and those people tend to be more problematic on average, and then too, **you can also tell a lot by their name, like where they're from**, or you know, sometimes you can tell the ethnicity by the name and stuff like that. You know, like some – (sighs) Some Indian people are extremely, extremely difficult to deal with, alright? I've lived with Indian people before and stuff like that, and like a lot of them are nice, **but some of them are extremely difficult to deal with be-**

cause of the culture. There's a cultural aspect of it. So if I see like an Indian name... - Marlon (Interview)

Here, Marlon profiled riders by locality. He also formed his own stereotypes based on his prior experiences working with this demographic.

RIDER PERSPECTIVES

Method

We recruited riders, many of whom had not used ridesharing services previously (n=10; Table 2), through a combination of offline and online sources, and via snowball sampling. Offline sources included putting up flyers in public locations like barber shops, churches, and bus stops while online sources included popular social media sites such as Facebook. People who expressed interest were screened for three criteria: they had to be 18 years or older, own a smartphone to use the Uber application, and have limited or no access to transportation. We evaluated transportation access using walk scores based on our riders' ZIP codes and based on whether individuals had access to their own vehicles. After screening ineligible participants (for instance, people who owned a car that they used regularly or those who lived in neighborhoods with relatively high walk scores), we onboarded 13 riders onto Uber. We used Uber for Business, which allowed us the flexibility to onboard riders as employees and subsequently track and handle costs for trips. We gave riders $75 in Uber credits. To answer RQ1 and RQ2 we used a combination of interviews and a diary study. Riders were instructed to maintain the diary for the duration of the study in which they were asked to capture details pertaining to the driver, conversations they had with drivers and anything else they found interesting. They were asked to capture these details at the end of each ride and send them to the research team (via a text message or a photo if they wrote down the details). Once riders depleted their monetary allocation, they participated in an interview for which they were compensated with $25 in cash. The interviews were semi-structured and lasted 45-60 minutes. During the interview, we asked the riders about their experience using Uber and used the diary entries as probes to understand in detail the nature of their interactions with the drivers.

Analysis

All interviews were audio-recorded and transcribed. We used the same provisional codes that were developed to analyze the driver interviews. Two coders then coded the interviews in multiple phases. After each phase, the coders met to discuss conflicts and new codes, which on agreement were added to the codebook. In total, nine codes, seven provisional codes and two new codes were added to the codebook as a result of the open-coding process. Again, an inter-rater reliability analysis using the Kappa statistic was performed to determine consistency among coders and was found to be Kappa = 0.763 (p<0.001; 95% CI = 0.611, 0.915).

Aspects of Social Resources

The interviews and diary entries indicated that riders engaged in rich interactions with the drivers. These conversations often resulted in the acquisition of new information. As with drivers,

Table 2. Rider Information

Nickname	Gender	Age	Profession	Used Uber Previously?
P1	M	20	Office Assistant	N
P2	F	22	Student	Y
P3	F	20-25	NA	N
P4	F	52	Self-employed	Y
P5	M	30-40	Unemployed	N
P6	F	50	Unemployed	Y
P7	F	53	Unemployed	N
*P8	M	25-30	NA	N
P9	M	26	Dry Cleaning	N
P10	M	30	Medical Assistant	N
P11	M	37	Automotive	N
P12	M	39	Unemployed	N
P13	M	21	Unemployed	N

Note: Names redacted for anonymous review.
*Unable to participate due to personal reasons

to understand the nature of these interactions, we categorized these benefits into informational, instrumental, emotional, and companionship.

Informational resources

Informational resources were the most commonly acquired resources by riders during the Uber rides, with 10 riders involved in at least one interaction that resulted in them learning something new. Most common were instances of drivers giving riders information about local spots and details about being (and becoming) an Uber driver.

Local knowledge: There were instances of drivers who were well-versed about the target site location, sharing details of neighborhoods and popular spots with the riders. For example:

Upon entry, I informed Ahjai [the driver] that I would be going to Marcus Market in Midtown. She smelled good so I commented on what I thought was lavender oil. She let me know that it was patchouli and gave me the **name of the shop** that she purchased it from. Ironically, **the shop was a place that I had intended to visit earlier in the day**, so I asked that we take a detour to that space prior to going to Midtown. - P3 (Diary Entry)

Local knowledge also extended to suggestions about popular hangout spots like restaurants, local stores, and theatres.

On the route, we approached Louisiana Creole, a southern soul food joint that Ahjai told me had some of the best greens, catfish, and mac and cheese in town. I told her that I was slightly picky about **Northern soul food joints** being that I am from Mississippi. She then told me that she is from Mississippi as well... During the ride she also **mentioned a few other places** in the area (stores, clubs, etc...) so that I could be aware of some cool spots if I had not yet heard of them. - P3 (Diary Entry)

From P3's diary entry, it is evident that her interaction with her driver resulted in her acquiring information about a restaurant

that was previously unknown to her. She also learned about other places in the area. Four other riders (P1, P11, P2, P6) described such interactions, which resulted in them learning more about the city and popular locations there. The city of Detroit was a common theme in rider-driver interactions, where they discussed the city's: history, decline, transformation, and future. P6's brief diary entry describes one such interaction with her driver:

> We kind of talked about **the area and how it has declined**. He [the driver] lives in Oakland County. He said he was a retired engineer but now builds guitars. Thought that was funny but interesting. - P6 (Diary Entry)

Employment with Uber: Riders and drivers also engaged in conversations about Uber, specifically about the requirements to be an Uber driver and what the job entailed. Drivers were reported as being satisfied with their jobs and with the flexible schedule. Good financial returns were also cited as reasons why drivers were satisfied with their jobs. P2 described a conversation with Archie, an Uber driver who taught her about car financing options, handling license plates, and insurance details, which helped her get a better sense of what she needed to do to get started as an Uber driver:

> I learned that there are different companies that's willing to help you get a car in order to do Uber. I didn't know that. I thought you had to come in with a car. But **there are places that work with you**, and then you can make that like your job is to do Uber. ...the only reason why I couldn't do it [become an Uber driver] is because it's my dad's insurance that's on the car. However, even though I pay for everything and I'm on his policy, he's the main person. So that was one thing that I learned is if I can get my own insurance, then I can kind of get started with Uber. - P2 (Interview)

P2 was able to understand several aspects of being an Uber driver from a single conversation with Archie. Others received details about car financing (P11), the effectiveness of cashless transactions for the drivers (P6), and other intangible benefits like "meeting new people" (P1). Two riders (P6, P7) indicated that at least one of the drivers encouraged them to be an Uber driver by telling them about these intangible benefits. These informational resources about "being employed with Uber" could have longer-term benefits for riders looking for employment opportunities and secondary sources of income.

Instrumental resources
As mentioned, instrumental resources extend to people giving others a helping hand. In our study, two riders, P4 and P6, had physical disabilities and needed help with tasks like folding up their walkers and moving groceries. P6 recalled an interaction with a former police officer and described how the officer made the interaction memorable by helping her with her groceries:

> **Helped us with our groceries**. He was a retired police officer from our area. We talked about the area he patrolled...I loved that he **helped with our packages**. - P6 (Diary Entry)

Both P6 and P7 were appreciative of drivers who provided tangible assistance while being critical of unhelpful drivers. Both of them compared their Uber experience to cabs that were made available to them as part of Medicaid (medical insurance) benefits, whose drivers they described as unhelpful. Instrumental resources also extended to riders acquiring information that could directly translate to potential long-term economic benefits. For instance, P12, an active job seeker, found value in job leads he received from one of his drivers, who he subsequently named as the one driver who stood out the most.

Emotional Resources
There were instances of drivers showing care and concern for the riders, which resulted in riders' positive perceptions about the customer service that Uber provided. P11 described an emotional experience when he took a ride on his birthday with his cousins.

> They [Uber drivers] gave me a birthday gift. They let me get around in style. Not only did they **make me feel comfortable**, they made **my people feel comfortable**, and I appreciate that...I appreciate that guy for **making me feel real important on my birthday**. That meant a lot to me. - P11 (Interview)

P11 mentioned the Uber driver wishing him happy birthday at multiple junctures during the interview. It made him feel that the driver cared for him as a person, which meant a lot to him. In another instance, P1 recalled telling his driver Kurt about his business idea of opening a food truck and Kurt encouraging him in this endeavor. Evidence of emotional support for riders was a consistent theme in the interviews with Uber drivers as well. Drivers described the often vulnerable state in which they found riders and the value riders found in the support they received. We discuss this in detail in the section pertaining to driver findings.

Companionship
As mentioned, companionship involves social time spent with other people [26]. All riders reported interacting with at least one of their drivers and at some point, all received social companionship via these social interactions.

Cultural Exchanges
Like the drivers, riders too reported on exchanges concerning race and cultural elements like food and music. For instance, P9 spoke about an interaction he had with his driver concerning the Black Lives Matter movement.

> Now, you have a lot of people that's a part of the Black Lives Matter movement, but then you have black people that feel like the movement itself is kind of like contradictive [sic] or more like one-sided. Not just black lives matter, all lives matter. He was more of the not like the black people that stick with the movement, he was more like let's forget the Black Lives Matter, how about everybody matters. That's the kind of conversation me and him was having and...I actually got into the car with a different outlook on what I believed in and he kind of helped me look at things different. He [the driver] just

gets deep off into it, so **when I got out his car, I had a whole different outlook on what I knew before I got into the car**. It's not really necessarily I learned something. **I looked at stuff different[ly] by talking to this guy**. - P9 (Interview)

This exchange about the Black Lives Matter movement resulted in P9 adopting a different viewpoint by the end of the Uber ride.

Similarly, P1's conversation with his standout driver Gregory concerned the African-American youth in the city They discussed how the youth had changed over the years and how today's youth seem to be arrogant and have less direction in life. P7 reported on a conversation where she and her driver discussed the changes in music over the years and the music of Prince and Michael Jackson, who had died recently, and how their music still touched people's lives. P11 spoke about an instance where he and his driver conversed about the cultures of different countries, knowledge they acquired as a result of their travel experiences. While driver interactions were the major source of cultural exchanges, riders also reported learning about cultural elements from their surroundings. For instance, P1 enjoyed and learned about a genre of music he had not listened to previously.

Well it was different, **like different kind of music**. I didn't know what it was at first, and I was just sitting there. That's why I happened to just peek around, look at the radio station, it said classical. It relaxed me in the morning because you know, I'm not used to listening to that kind of music. Because I thought that classical was somewhat like jazz, and jazz puts me straight to sleep. But this music actually just put me in a good mood, so I liked it. - P1 (Interview)

These findings show that the Uber rides offer opportunities for exchanges between the riders and drivers, which the riders reported benefiting from and enjoying. Further, these conversations often impacted how riders rated and reviewed drivers at the end of the ride. Drivers who engaged with the riders were described as "polite" (P9, P5), "good people" (P13), "outgoing" (P2), and "conversational" (P7) while drivers who engaged in little or no conversation were described as "dismissive" (P2) and "not very pleasant" (Renee).

DISCUSSION
First, we discuss our main findings and address our research questions. Given the value of the interactions between drivers and riders, we discuss design implications and opportunities for HCI and Ubicomp-related technologies to support drivers and riders to enhance these interactions and create further opportunities for the development of both forms of capital via real-time ridesharing services.

Opportunities to grow social capital
To summarize, we found that drivers gained informational resources (route changes, surge localities) and emotional support (moral support) primarily from other Uber drivers through social media. Riders, on the other hand, acquired informational resources (details about becoming an Uber driver, insights about the city of Detroit), emotional support (comfort, encouragement) and on occasion instrumental support (job leads, helping hand with groceries) from drivers. This is not to say that drivers did not benefit from their interactions with riders. There were instances of drivers acquiring vital resources (informational and instrumental) from riders, as well. Both parties benefited from each other's company during the rides, and drivers formed friendships with riders, that resulted in shared social activities. Given these benefits, i.e. the nature of the exchange of information, emotional, and instrumental resources between drivers and riders (and other drivers through online means), our results indicate that real-time ridesharing services present opportunities to grow social capital.

Opportunities to grow cultural capital
There were also multiple instances of cultural exchanges between drivers and riders, which we argue could contribute to the growth of embodied cultural capital. Our interview results show cultural exchanges about race, music, and food that resulted in riders understanding cultural aspects that they were not aware of previously. In the case of the drivers, this is the nature of their job, which involves traveling to new locations and interacting with multiple riders. However, as anticipated, there were no indications of objectified or institutionalized forms of cultural capital. As mentioned, objectified cultural capital is the result of the acquisition of an object and its associated cultural meaning. While we noted the sell and exchange of material objects such as a dashboard camera and business cards, it is evident that these objects (unlike art) have no inherent cultural meaning and do not result in the acquisition of cultural capital. Also, while there were instances of drivers and passengers disclosing academic and professional qualifications and certain knowledge resulting from these qualifications to each other (sharing rides with a retired police officer and principal), there was no evidence suggesting the acquisition of an institutionalized form of cultural capital. Again, we stop short of suggesting that riders or drivers gained cultural capital as a result of using ridesharing services. However, there is enough evidence to suggest that riders and drivers valued the shared space and the mutual cultural exchanges. This socialization, an important requisite for the growth of embodied cultural capital, provides some evidence that opportunities exist for the growth of cultural capital in ridesharing.

Our study provides detailed insights into the nature of interactions between drivers and riders and thus extends past research on ridesharing, emphasizing the need to understand and enhance rider-driver relationships [1, 16]. While these findings are similar to past findings of public transportation [6, 10], real-time ridesharing is a new context. In addition, we found that ridesharing affords opportunities for the potential growth of cultural capital, which to our knowledge has not been discussed in transportation, HCI, or Ubicomp literature.

We believe that HCI and Ubicomp technologies can increase these interactions, which involve drivers and riders providing each other with different social resources (e.g., informational, instrumental, emotional support, and companionship). We provide design implications in the following section. We also suggest opportunities for pervasive technologies to better

support drivers, to strengthen knowledge of localities (cultural capital) and to provide additional social support (informational, instrumental, and emotional).

Design Implications

In this section, we discuss opportunities for HCI and Ubicomp technologies—specifically location-based services — to foster informational, instrumental, and emotional support (three forms of social capital) and cultural capital among drivers and passengers in real-time ridesharing environments. We also discuss our findings in the context of work and contribute opportunities for digital platforms and passengers to support the additional emotional, social and cultural benefits they acquired from the drivers.

Location-based services

Developers of location-aware applications could collect and reason about route options to support drivers. Incorporating knowledge of past routes to influence future routes could enhance passengers' (and drivers') access to informational resources. In fact, the opportunity to develop systems to enhance these conversations about locations has been discussed by [29], who reported the design of an in-car system to capture conversations along with GPS locations for the purpose of sharing with other nearby cars. In our case, both drivers and passengers acquired informational resources and insights about the city. To better support the acquisition of informational resources, location-aware applications could suggest routes to elicit this type of information based on prior routes. For example, an out-of-town passenger being picked up from an airport might appreciate taking a more scenic route to get to know and learn about a new city, which could enhance a person's access to cultural capital. Building on suggestions from Jung et al. [23], future systems could incorporate location-based inferences to infer that a passenger who is being picked up from an employment or job-training facility could benefit from learning about job opportunities, and could suggest ways in which the drivers can provide instrumental support to their passenger(s). Our findings suggest that riders appreciated ridesharing services and drivers who provided them with instrumental resources (e.g., helping with groceries and packages). Location-based services could also be used to infer context and make suggestions for when drivers may wish to prepare for picking up their passengers. For example, pickups from grocery stores and malls might be an indication that riders may need assistance.

Our findings also suggest that drivers used their online activity from Facebook groups to aid in their offline work. Drivers acquired informational resources such as surge pricing [27], safe times to travel, locations prone to ticketing, and Uber rules and regulations. Ubicomp technologies, another source for this information, could help drivers connect with other drivers based on their current location and by using other contextual factors such as local traffic patterns, accidents, and weather. These factors, along with others, could influence supply and demand, which could factor into surge pricing. Some of this context could be used to provide drivers with an indication of safe times to travel, and the integration and analysis of crowd-based platform data (e.g., Google Waze) could be used to suggest locations prone to ticketing. While

real-time ridesharing companies may not wish for drivers to connect with other drivers in this way, having this level of support could improve driver work conditions [1, 16].

Design of in-car social and cultural experiences

Past research on in-car interfaces for drivers primarily focuses on enhancing support for driving tasks such as helping drivers make better navigational decisions [5, 31] and improving their safety by reducing distractions [22]. In the case of ridesharing, while driving people safely to destinations constitutes the most important part of drivers' job, our research suggests that drivers often seek and acquire resources from other drivers to help complete their job successfully. For instance, drivers reported getting information about which locations to avoid and which neighborhoods were surging and receiving encouragement from one another to reach their milestones.

Given that many people who drive for ridesharing services do so full-time, opportunities exist for designers to understand how these spaces can be used to improve drivers' and riders' social and cultural experiences. Gridling et al. found that drivers and riders often engage in collaborative activities that help both of them get through the journey [18]. For instance, while the driver might occasionally seek navigational help from the rider, riders ask for assistance with groceries [18]. In our study, we found that both drivers and riders found support that extended beyond the ride. For instance, one rider received job leads from the driver during a ride. Providing opportunities to disclose these needs to each other could result in enhanced interactions and increased social capital.

We argue that the future design of automotive interfaces, specifically for ridesharing, should take into account these additional interactions to support drivers. Can in-car interfaces allow drivers to connect with one another and seek information on a need-to-know basis and seek support when necessary? Apart from immediate benefits, this would create opportunities to enhance one's social capital. Moreover, it has been argued that as autonomous vehicles become more ubiquitous, drivers will have more time, and in this case, cars can be viewed as places of productivity [25].

Informational, Instrumental, Emotional, and Cultural Support and Additional Labor

According to Currie and Stanley, the duration of a cab ride might be too little for a meaningful relationship to develop between the rider and driver [10]; however, our results suggest that drivers and riders engage in rich social interactions, which we argue are opportunities for the development of social and cultural capital. In fact, it was evident that drivers often went beyond the scope of their job of driving passengers to specified locations to provide informational, emotional, and cultural resources to the riders. Similar to previous researchers, we argue that this counts as additional labor for which drivers should be recognized. Although real-time ridesharing systems inherently support a rating system that allows riders to recognize driver efforts (and vice-versa), there are problems with the rating system. As Raval and Dourish pointed out, the most significant challenge is that the riders more often than not do not understand the implications of the ratings [36].

We then ask the questions: Are there ways to support the drivers for this additional labor? How can such platforms be re-designed to acknowledge and accommodate the extra work provided? The answers to these questions suggest additional policy implications for HCI as indicated by Dillahunt et al. [13]. Many drivers in this study worked part-time via the platform while others worked full time. Perhaps the part-time drivers would value acknowledgments that could be transferred in an offline context (e.g., a badge or certificate to be printed or that could be shared with a potential employer). Those who work as full-time drivers may appreciate additional incentives or rewards via the platform. We believe that recognition and rewards to drivers for these resources would be a small step toward creating more equitable workspaces.

It is unclear whether the drivers in this study provided this type of support for higher ratings; this was not supported by our findings. However, this type of work supports past literature that identifies the work as emotional labor [36], which was highly valued by passengers from our study. These drivers clearly exceeded expectations to drive passengers to their locations and these drivers should be rewarded and acknowledged for this additional work. While our findings do not reveal whether passengers understood the way ratings impact their drivers' ability to work for the platform, platforms should be designed to identify whether and how passengers benefited.

Along the same lines, drivers receiving support from passengers should also be able to acknowledge them as well. For example, did passengers/drivers learn anything new from the ride? Did passengers/drivers receive any additional support from their drivers/passengers?

LIMITATIONS
Our study was highly localized in that it was limited to a single U.S. city and our results are based on interviews with a small sample of drivers and riders. Specifically, Detroit is steeped in issues of inequality [2, 43] and the shared experience of riders and drivers in this setting is a possible explanation for some of the conversations that we observed (for instance, the conversation on racial inequality and the Black Lives movement). Moreover, the riders were demographically similar because they were from low-income, transportation-scarce localities and many of them were unemployed. Further, most of the riders were first time Uber users. Although we use data describing drivers' experiences to help counter this limitation, we also acknowledge that the driver sample is constrained by geographical context and the nature of this context and other factors (e.g., racial inequality) might have influenced driver-rider interactions. Surveying a larger and wider demographic of riders and drivers across multiple real-time ridesharing services and geographical regions is a viable next step. To confirm our findings, we could explore ways to implement and evaluate the effectiveness of tools that help to infer context to better support the social and cultural capital exchange between drivers and riders and to evaluate whether this enhances their overall experiences.

FUTURE RESEARCH DIRECTIONS AND CONCLUSION
We took a user-centered approach to identify opportunities for technology to incorporate support for and enhance driver-rider interaction. We contribute results from two qualitative studies of drivers and riders to understand opportunities for technology to foster the development of social and cultural capital in the context of real-time ridesharing systems. Our findings show that both drivers and riders gained informational, emotional, and instrumental resources, and companionship by being part of the real-time ridesharing ecosystem. Our contributions suggest future research opportunities to explore. For example, there are open opportunities to facilitate drivers' support of other drivers. Moreover, both riders and drivers valued and mutually benefited from the cultural exchanges, suggesting that there are opportunities to grow cultural capital within the ridesharing ecosystem.

While we conclude based on the interactions that there are opportunities for the growth of social and cultural capital in the case of ridesharing, the acquisition of social and cultural capital is itself contingent on several individual and community characteristics. Ethnicity, socio-economic backgrounds, and educational attainment [41] are some factors that determine whether individuals can take advantage of and benefit from these opportunities. Examining how these factors played into the opportunities created and whether and how they were turned into something beneficial by drivers and riders is a potential next step for our research. Our results also suggest opportunities for future research to explore ways to acknowledge drivers' additional labor. Are there ways in which systems could acknowledge drivers' additional labor to extend in offline contexts? Could on-demand platforms be integrated with OpenBadges[2] to show the skills drivers demonstrated?

While facilitating support for drivers is crucial to enhancing real-time ridesharing systems, it is important to consider the future of the ecosystem. For example, autonomous vehicles equipped with driver assistance will change the nature of driver roles and their function within ridesharing services. The potential loss of this stakeholder in the ecosystem must also be taken into consideration. Drivers are central to the opportunities that exist for riders' acquisition of social and cultural capital. How might this loss affect the modified driver roles?

ACKNOWLEDGMENTS

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