Human factors and requirements for a successful mobile platform dynamic taxi-share system in the USA

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ABSTRACT
Taxi sharing services are increasingly becoming important to meet rising accessibility needs and maintain stable income-earning societies with rising social capital [1]. Mobile platforms for taxi sharing are currently in development both commercially and within academic institutions. The success of these platforms relies not only on robust algorithms but also on appropriate consideration of human factors relating to system users. What safety, gender, monetary and time factors will affect both taxi drivers and passengers in a taxi share system? Specifically, safety factors are highly important to the success of taxi share systems. This paper presents results from a survey of one user population about potential ride share risk areas. Results from this survey both support and complicate previous findings regarding common group membership and optimal passenger count. Additionally, it was concluded that high gender diversity is desirable to taxi share participants.

General Terms
Design, Human Factors.

Keywords
Ride share, Taxishare, Safety, Selfishness costs.

1. INTRODUCTION
A taxi sharing system typically involves multiple users with the same or geographically similar (i.e. within a small distance from each other) destinations [1]. These users coordinate through some platform to share the same taxi. This platform could be a physical or online message board, taxi stand at an airport, mobile SMS based service, or shared electronic screen in a central location [2]. Rides can be shared to or from *in-personal* (e.g. hotel, airport, place of business, restaurant) destinations or *personal* destinations (e.g. private home). A dynamic taxi share system accommodates each individual user's trip and adjusts currently scheduled trips at any time by matching between individual user trips [2]. Dynamic systems use real-time information to match and schedule trips of any length at any time [2].

In addition to personal transportation use to and from airports, conferences and other centralized locations, taxi sharing has also been used in rural communities and communities with low supply of public transportation as a substitute for a bus system [3].

The financial considerations of taxi sharing include decreased direct and indirect costs. Direct costs are those "to the users and operators"; indirect costs are those to the society and include things like "pollution costs" [4]. Other advantages include safety (e.g. as compared to busses that do not have seatbelts) and efficiency (e.g. minimal number of stops, no transfers) and driven by individual need.

The taxi sharing system discussed in this paper, QuickHit.ch, is a web-based dynamic taxi share system for rides with in-personal or personal destinations. QuickHit.ch will first be released in the University of Maryland, College Park (UMCP) community.

In order to create an effective ride share application we wanted to survey our user base before creating the application. From previous research, we found that the most critical issues in taxi sharing are:

- Taxi driver compensation
- Participant cost minimization
- Participant and taxi driver safety maximization
- Publicity

Thus, in our survey we wished to ask our user community questions in the following areas:

- Safety
- Usage: times and locations

We felt that safety questions would inform our design in the area of participant and taxi driver safety maximization. Usage questions served to enlighten our marketing strategy.

The goal of the analysis presented in this paper is to analyze survey results, specifically in the area of safety. This analysis leads to conclusions regarding design recommendations and relates to previous conclusions presented in the literature review. The conclusions from the literature review were drawn from papers analyzing failed taxi and ride share systems. Thus, this paper provides a new perspective presenting pre-design data rather than a post-failure analysis.

2. LITERATURE REVIEW
The purpose of this review is to discover what requirements seem necessary for successful operation of a taxi sharing service, in the context of a dynamic mobile system and the culture of the United States of America.

Through this literature review, eight journal articles and two book chapters were collected for review. Of the articles included in the review, 50% were published in the past three years. Table 1 shows the frequency of publication years for studies in this review by year.

Table 1.
Publication Year.

Year	#
2000	1
2006	2
2007	1
2009	1
2010	2
2011	1
2012	2
Total	10

Table 2 shows the type of publication, publication source, and number of publications from that source.

Table 2.
Publication source.

Publication	Type	#
Journal of Advanced Transportation	Journal	1
Washington, D.C.: Transportation Research Board	Conference	1
Research in Transportation Economics	Journal	1
Transportation Research Part E	Journal	1
Thesis	Thesis	1
Contemporary Ergonomics and Human Factors	Book	1
The World Bank	Report	1
ComputationWorld'09	Conference	1
International Conference on Wireless Communication, Networking and Mobile Computing	Conference	1
Systems	Book	1

Finally, Table 3 shows what research questions were answered by which papers. The research questions are:

- Q1: What factors effect whether users chose to participate in taxi sharing service?
- Q2: What are the benefits and costs of taxi sharing?
- Q3: What are taxi driver considerations necessary for a successful taxi sharing service?

Table 3.
Research Questions.

Title	Author	Publication	Research Question(s)
Analogy of fixed route shared taxi (taxi khattee) and bus services under various demand density and economical conditions	Gholami, A. & Mohaymany, A. S.	J. Adv. Transport.	Q2
Promoting social inclusion in a deregulated environment: Extending accessibility using collective taxi-based services	Mulley, C.	Research in Transport. Economics	Q3
Airport ground access mode choice behavior after the introduction of a new mode: A case study of Taoyuan International Airport in Taiwan.	Jou, R. C., Hensher, D. A., Hsu, T. L.,	Conference	Q1
Analysis of selfish behaviors on door-to-door transport system.	Mukai, N., Watanabe, T., & Feng, J.	Conference	Q2
Why do demand responsive transport systems fail?	Enoch, M.; Potter, S.; Parkhurst, G. & Smith, M.	Conference	Q1, Q3
Performance and Design of Taxi Services at Airport Passenger Terminals.	Costa, D.	Thesis	Q1
Dynamic Taxi-sharing Service Using Intelligent Transportation System Technologies	Tao, C.	Conference	Q1, Q2, Q3
User requirements and constraints for on-demand taxi sharing technology	Sun, X.; Golightly, D.; Sharples, S.; & Bedwell, B.	Book	Q1
Study on Urban Transport Development	N/A	Report, World Bank	Q2
A Framework for Dynamic Car and Taxi Pools with the Use of Positioning Systems	Korres, A.; Datsikas, C.K.; Tombras, G.S.; & Peppas, K.	Conference	Q1, Q3

Below is a detailed compilation of each study with its context and relevant results.

2.1 What factors effect whether users chose to participate in a taxi sharing service?

2.1.1 Airport ground access mode choice behavior after the introduction of a new mode: A case study of Taoyuan International Airport in Taiwan [5].

The context of this paper is the implementation of a new transportation system in the Taipei airport. Amongst travelers across the globe, travel time and cost are the most important factors influencing choice of airport access mode. This study concludes in more detail that important factors (more than 50% survey response rate) influencing choice in transport are: time-savings/efficiency, punctuality, user-friendly (door-to-door), safety, and convenience of storing and retrieving luggage (48.7% response rate). These surveys were conducted among travelers at the Taipei airport.

2.1.2 Why do demand responsive transport systems fail? [3]

This paper is a review of various demand responsive transport systems in the United Kingdom. The paper notes that many taxi share program failures occurred due to "a lack of understanding about the scheme amongst the public; there was resistance to the psychological barrier of requesting shared rides and by the perceived low probability of finding other passengers with whom to share," others failed due to unclear rules of use and payment. Another "crucial issue is effective marketing."

2.1.3 Performance and Design of Taxi Services at Airport Passenger Terminals. [6]

This paper is an analysis of taxi transport system at Portela Airport in Lisbon, Portugal. The paper notes that the introduction of a taxi share system in an environment where taxi drivers are very competitive and there is an intense demand for taxis (e.g. an airport) can pose risk of "lack of customer interest due to social habits" and "lack of operations interest from transportation operators or strikes/boycotts from taxi drivers."

2.1.4 Dynamic Taxi-sharing Service Using Intelligent Transportation System Technologies. [2]

This paper discusses a trial of Intelligent Transportation System (ITS) technologies, a dynamic taxi sharing system conducted through the World Wide Web and mobile technology. This trial was conducted in the city of Taipei, Taiwan. The study found that "over 70% passengers are willing to pay taxi-sharing fees comparing with their original travel budgets when the maximal waiting time is guaranteed within 10 minutes and number of acceptable taxi-sharing passengers is three." Additionally, the best type of taxi sharing platform will support passengers who come from many destinations and are going to multiple destinations, as opposed to passengers originating at one destination and going to multiple destinations or visa versa. Maximizing flexibility and minimizing increase in travel time is preferable. Finally, the trial found that passengers prefer to ride share when they are looking to transfer to public transportation.

2.1.5 User requirements and constraints for on-demand taxi sharing technology. [7]

The paper analyzes taxi share usage at a UK conference in 2012 where a mobile dynamic taxi share system was implemented. The paper concludes that implementation of a mobile taxi share

system at a conference showed that individual benefits are amplified in situations with limited transport. Taxi share systems that allow real time decisions to share. That is, systems that do not anticipate that taxi share participants will have made their decision to share in advance, are most effective. Systems that use shared display (e.g. at conferences) not just mobile devices to coordinate sharing are also more effective. A shared screen shows taxis available to share and also serves as a method of publicity. Results found that 86% of conference attendees surveyed were happy to share a taxi. Additionally, users of the service saw the taxi driver as a sort of security guard between themselves and other passengers, and their comfort with sharing a taxi was largely contingent on the fellow passenger's membership in a common group (e.g. conference attendees or fellow university students/faculty/staff). Finally, users preferred to share a taxi to and from an impersonal location rather than to or from their private home.

2.1.6 A Framework for Dynamic Car and Taxi Pools with the Use of Positioning Systems. [8]

This theoretical paper explores how to set up a successful taxi or ride share system based on results from previous studies and new surveys. The paper notes that taxi share users deem security extremely important. Thus it is recommended that a taxi share system "secure the car or taxi pool by validating the personal data of participants and provide a safety mechanism for each participant in case there is a problem."

2.2 What are the benefits and costs of taxi sharing?

2.2.1 Analogy of fixed route shared taxi(taxi khattee) and bus services under various demand density and economical conditions. [4]

This paper provides an analysis of a fixed route shared taxi called a taxi khattee in Iran.The paper introduces the concept of direct and indirect costs as noted in the introduction. For the context of this paper, there is government subsidy provided for taxi khattees and this is included as an indirect cost. The study shows that "taxi khattees should be used in areas where population density is low, work force is inexpensive, social costs are not considered in fare calculation, and users' value of time is high…[this] contradicts the common belief that since taxi khattees provide a high frequency compared to buses, they are economically plausible to use in a transit fleet." Since our evaluation does not focus on the concept of using shared taxis to replace or add to current public transport this is not of concern. However, we might consider a university or conference a case in which "social costs" are not considered and population density is relatively low (compared to that of a metropolitan city) and value of time is high. Thus taxi sharing might be reasonably effective according to this study. It is important to note however, that this study was focused solely in Iran, a country with a reasonably different transportation system (in terms of regulations and costs) from the USA.

2.2.2 Analysis of selfish behaviors on door-to-door transport system. [9]

This study is a theoretical analysis and conceptualization of the effects of behavioral selfishness on door-to-door shared transport such as taxi sharing. Customer selfishness can often degrade the efficiency of door-to-door shared transport systems such as taxi sharing, for example "selfishness of customers may cause the delay of arrivals and the decrease of benefits" (e.g. increase in costs due to waiting fees). The paper notes that that "…the degradation caused by selfishness of customers can be avoided by adjusting the number of transport vehicles or the relative size of area to visit requested points. If the parameters of the door-to-door system cannot be changed, customers should take altruistic behaviors to achieve the optimal efficiency of door-to-door system." Since it seems unlikely that passengers will take "altruistic behaviors" it is reasonable to consider the selfishness equations presented in this paper in design of future taxi share systems. The paper calculates that the optimal number of passengers in a shared taxi is three.

2.2.3 Dynamic Taxi-sharing Service Using Intelligent Transportation System Technologies. [2]

This paper discusses a trial of Intelligent Transportation System (ITS) technologies, a dynamic taxi sharing system conducted through the World Wide Web and mobile technology. This trial was conducted in the city of Taipei, Taiwan. For passengers in this study, "average saving travel time after using taxi-sharing system [was] 26.48 minutes, while the average travel cost [increased to]…about 1 US$." Thus we see that there is a large time-savings to passengers (this is in comparison to public transport, not private car or private taxi) with minimal increase in direct cost.

2.2.4 Study on Urban Transport Development. [1]

This World Bank report on the status of developing urban transport analyzes many facets of urban transport including Jeepneys, shared 16 person jeeps that operate similarly to taxis. Jeepneys are very popular in Manila, Philippines. They "cost 16% less per seat km more than do operation of standard buses, while jeepneys generally provide a higher level of service (e.g., greater reliability, shorter wait times) at lower fares than do buses. In particular, jeepneys take less time to load and unload, they stop less frequently, and run on shorter headways than do buses, which are larger. … multi-destination trips are made, the very trips that are most costly for public transit to serve." Thus we see an example of the cost effectiveness of shared taxis in an urban environment, although the cultural context and economic makeup of Manila is different than that of urban United States cities.

2.3 What are the taxi driver considerations necessary for a successful taxi sharing service?

2.3.1 Promoting social inclusion in a deregulated environment: Extending accessibility using collective taxi-based services. [10]

This paper involves a study of taxi sharing in the United Kingdom, particularly focused on bringing accessibility to rural areas. This study notes that in order to have taxi drivers participate in the taxi share program, taxi share taxi's charged a premium fare.

2.3.2 Why do demand responsive transport systems fail? [3]

This paper is a review of various demand responsive transport systems in the United Kingdom. The Paddington Station ride share system was highly successful. This system used a ticketing system in addition to the standard metered taxi charge system.

Tickets ($7.50) were sold such that the cost of ticket combined with the group-metered fare was less than an individual cab fare (for passenger cost benefit). The ticketing system was used to benefit the taxi driver such that they got an additional payment per passenger, the tickets also paid for the cost of the system (in this case a person) putting together the ride shares. This system was implemented to counteract the backlash to taxi sharing exhibited in another system where other operators attacked taxi drivers who participated in taxi share programs.

2.3.3 Dynamic Taxi-sharing Service Using Intelligent Transportation System Technologies. [2]

This paper is a trial of Intelligent Transportation System (ITS) technologies a dynamic taxi sharing system conducted through the World Wide Web and mobile technology. This trial was conducted in the city of Taipei, Taiwan. This matching service was well received by Taipei taxi drivers since, "the average daily working time per taxi driver is 10 hours, but the vacancy time is 3 hours." Thus drivers are eager to participate in programs, which lead to more rides and fewer vacancies.

2.3.4 A Framework for Dynamic Car and Taxi Pools with the Use of Positioning Systems. [8]

This theoretical paper explores how to set up a successful taxi or ride share system based on results from previous studies and new surveys. The paper concludes that a successful taxi share system should "keep track of all the [requests] a participant put's into the program and charge a partial taxi fare based on the actual distance travelled by each pool participant." This is suggested to maintain fairness, and is a new idea, however feasibility might be difficult.

2.4 Literature review conclusions

From the studies analyzed in this literature review, we find that taxi share users most frequently value minimization of both travel time and cost. Users also place high importance on security. A sense of safety can be achieved by only arranging taxi shares between members of the same group (e.g. university, conference, company) and by placing a safety device within the taxi.

In some cultures there may be resistance to sharing rides (particularly in non collectivist cultures), or there may be resistance to sharing rides to and from a personal home. Thus, users may have concerns regarding finding rides, especially when there is a lack of sufficient marketing for a taxi share system such that not enough users know of its existence.

Typical users of a taxi share system originate at many destinations and are traveling to many destinations; thus it is an important feature of the taxi share system to organize passengers such that their destinations are as time efficient as possible and with a reasonable number of passengers per taxi (no more than three [9]). This can serve not only to produce time efficiency but also to mitigate selfishness costs. A taxi share system has been found to be a good and often used alternative to the public transport system, however users are not always as eager to choose a shared taxi over traveling by private car.

In order to ensure taxi driver participation in a ride share system, ensuring appropriate driver compensation through higher taxi sharing fares or a ticketing system (where passengers buy tickets as well as paying the metered rate) is crucial. In all the situations presented in this paper, additional fees for taxi sharing (e.g. ride premiums or a ticketing system) have not been found to deter users from utilizing a taxi share system. Thus these fees present only benefits to the drivers and no cost to the happiness of users in a taxi share system. Finally, it is also important to ensure taxi driver safety in similar ways as passenger safety is ensured.

Overall, mobile, dynamic taxi sharing can have many time and cost benefits over traditional taxi transport or public transport such as a bus. Important factors for the success of a future mobile dynamic taxi sharing system include:

- Taxi driver compensation: premium fares or a ticketing system, which gives the taxi driver compensation for participating in a shared taxi program beyond the standard metered rate.
- Participant cost minimization: organization of shared taxi such that travel time is minimized and a maximum of three people are in each taxi to minimize selfishness costs.
- Participant and taxi driver safety maximization: verify personal information of passengers and drivers, include a safety device (such as a technology that allows for real time 911 communication) in the taxi, only conduct taxi share passenger matching between passengers who are members of a common group.
- Publicity: through advertisements, governmental assistance or shared screens. Shared screens would be larger platforms in a conference, business or university setting where potential users could see taxi trips currently available and sign up at the shared screen or using their personal device.

With suitable matching algorithms and a culturally receptive passenger and driver base, these four factors should create a viable taxi share system.

3. METHODS

We conducted this survey online. The survey was created and distributed through SurveyMonkey. This survey contained thirteen questions. All survey participants were over 18 years of age. Surveys were distributed to faculty and staff members using departmental mailing lists. For students, surveys were distributed through social media, mailing lists (UMCP honors, UMCP CMNS, UMCP department of computer science), class extra credit (PSYC361), and class webpages (CMSC420, CMSC411, CMSC131, CMSC122, CMSC434). The UMCP Institutional Review Board approved the survey and survey distribution methods on October 16, 2012.

The data in this report is based off survey responses from 270 participants. Our population was 1.48% faculty, 86.30% undergraduate students, 10.37% graduate students, and 1.85% staff; 52.96% of the participants were male and 47.04% were female.

3.1 Hypotheses

In the area of safety, we asked the following questions with the indicated hypotheses.

Q4: Would you consider sharing a taxi with any person (not necessarily UMCP affiliated)?

Hypothesis: no prediction was made for the percentage of respondents willing to share a taxi with anyone. This question was asked to create a baseline for comparison of answers on Q5 and Q6.

Q5: Would you consider sharing a taxi with a UMCP affiliate (faculty, staff, or student)?

Hypothesis: a higher (statistically significant but not overly large, approximately 15% higher) percentage of respondents were expected to be willing to share a taxi with a UMCP affiliate than with anyone (e.g. Q4). This prediction was made because it was expected that riders would feel safer if they knew that fellow riders were members of the UMCP community.

Q6: Would you consider sharing a taxi with a UMCP affiliate of your same type (e.g. if you are a student only sharing with other students NOT with staff or faculty members)?

Hypothesis: a higher (statistically significant so approximately 7-10% higher[1]) percentage of respondents were expected to be willing to share a taxi with a UMCP affiliate of their type than with anyone (e.g. Q5). This prediction was made since it was suspected that riders would experience less anxiety interacting with members of their same type.

Q7: If you were to share a taxi with others, with how many people would you be comfortable sharing the taxi?

Hypothesis: respondents were expected to primarily (>75%) to want to take a taxi with two other passengers. This prediction was made because previous research states that selfishness costs minimization occurs with three passengers [9].

Q8: Would you feel comfortable sharing a taxi with one of the following: persons of your same gender, persons of the opposite gender, or both?

Hypothesis: it was suspected that female respondents would primarily (>75%) want to ride share with persons of their gender. It was suspected that male students would be most likely (>75%) to want to ride share with persons of both genders. Both of these predictions were made based of safety maximization considerations. For females, it seemed that they would consider riding with females most safe. For males, it seemed that they would consider riding with only males potentially unsafe (males tend to be stronger and more violent) and that riding with only females could be anxiety provoking [11].

Q9: Would you feel comfortable sharing a taxi to and from your residence?

Hypothesis: it was suspected that respondents would feel uncomfortable (less than 25% comfortable) sharing a taxi to and from their private homes. This was predicted due to safety maximization and desire for anonymity.

[1] Statistical significance for a sample of 200 is 6.93% at 95% confidence level

4. RESULTS

4.1 Q4 vs. Q5

Our first analysis was the comparison of responses to items Q4 and Q5 (Figure 1, Figure 2). We found that 51.48% of respondents were willing to share a taxi with any person. As hypothesized, respondents were more willing (88.52% of respondents) to share with a UMCP affiliate. There was no statistically significant difference in the response to this question between male and female respondents. This result shows that respondents are 37.04% more willing to share a taxi if the fellow riders are UMCP affiliates; this greatly exceeded our predicted difference. Thus we draw the following conclusions:

- Membership in a particular group leads to a highly increased sense of safety
  - This increase in sense of safety is far greater than hypothesized
- QuickHit.ch and other ridesharing applications should build in a way of screening rides so that only members of certain groups can join certain rides

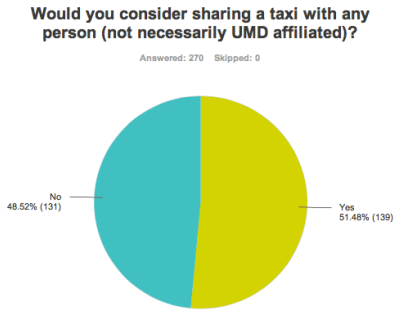


Figure 1

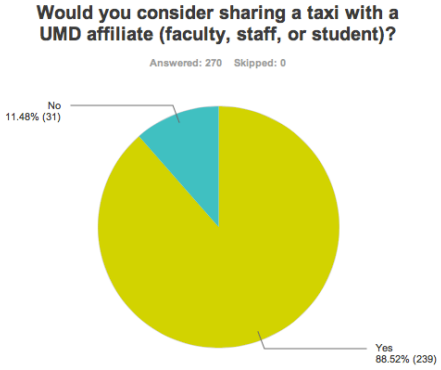


Figure 2

4.2 Q5 vs. Q6

On Q6, 85.56% of respondents said they would consider sharing a taxi only with a UMCP affiliate of their same type (Figure 3). We predicted that respondents would be statistically significantly more likely to share a taxi with respondents of their same type. However, we find that respondents are equally or less likely (the current difference is not statistically significant) to share a taxi with respondents of their same type. This result could indicate that: respondents are not concerned with or do not experience significant social anxiety associated with sharing a ride with a UMCP affiliate of another type. Thus these findings do not lead

to a design consideration for QuickHit.ch since the type of the member of a particular group is not a consideration when setting up QuickHit.ch and does not affect respondents desire to share.

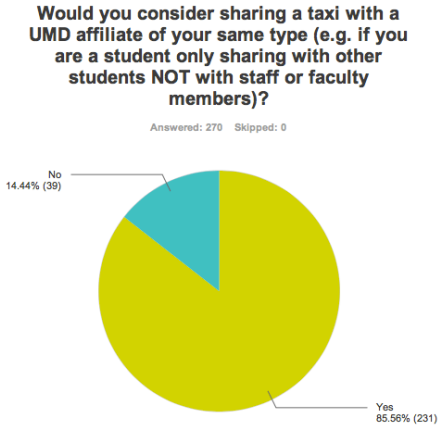


Figure 3

4.3 Q7

On Q7, 50.37% of respondents wanted to share the taxi with the maximum number of passengers, 27.78% wanted to share the taxi with only two passengers, and 21.85% wanted to share the taxi only with one passenger (Figure 4). Each of these results was statistically significant and there was not a statistically significant response difference between male and female respondents. The percentage of respondents wishing to share a taxi with the maximum number of passengers was significantly higher than predicted; the percentage of respondents wishing to share a taxi with two other passengers was significantly lower than predicted.

Possible explanations include:

- Feeling of safety from more passengers in the taxi.
- Perceived lower cost with more passengers.
- Lack of consideration of selfishness costs such as wait times and space for bags.

Implications for QuickHit.ch design include:

- Need to limit the number of passengers or provide an option for limiting the number of passengers allowed in a given ride share.
- Educational and marketing materials showing implications of different numbers of ride share passengers.

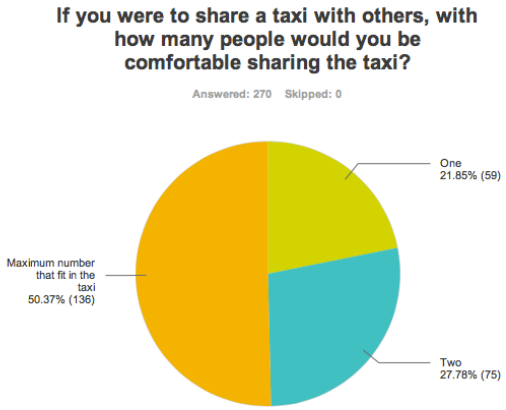


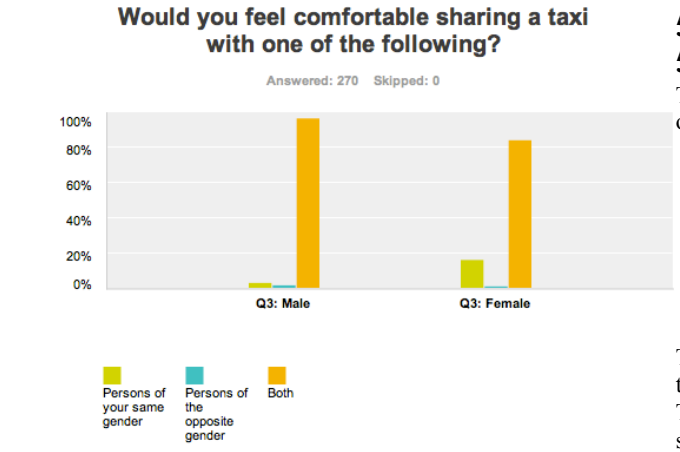
Figure 4

4.4 Q8

For Q8, we found that 15.75% of females wanted to share a taxi with persons of their same gender while 83.46% of females wished to share a taxi with persons of both genders (Figure 5). This contradicts our conclusion that women would want to share a taxi primarily (>75%) with persons of their same gender.

As predicted, male respondents also want to share primarily with both genders: 95.80% of male respondents wanted to share with both genders. Although the percentage of women wanting to share with both genders was statistically significantly less than the percentage of men, it was smaller than expected. Finally, as predicted both men and women were unlikely to desire ride sharing with persons of the opposite gender (1.40% men, 0.79% women). These results imply that QuickHit.ch should attempt to:

- Create gender diversity in its membership group
- Allow users to ask for gender proportions in a ride share group
- Provide data on a ride share group's current gender makeup to potential ride share members



	Persons of your same gender	Persons of the opposite gender	Both	Total
Q3: Male	2.80% 4	1.40% 2	95.80% 137	143
Q3: Female	15.75% 20	0.79% 1	83.46% 106	127
Total Respondents	24	3	243	270

Figure 5

4.5 Q9

On Q9, 76.30% of respondents were comfortable sharing a taxi to and from their residence; this is the exact opposite of our prediction (Figure 6). One possible reason for this response is due to the lack of safety in College Park, MD the city in which UMCP is located [12]. Respondents may feel that it is more comfortable to allow other ride share passengers the knowledge of their residence than to walk or bike from a public location to their residence. Additionally, since respondents felt very safe (see findings for Q4 and Q5) with UMCP affiliates, this could affect their comfort with those affiliates knowing the location of their residence. These results do not significantly affect QuickHit.ch design.

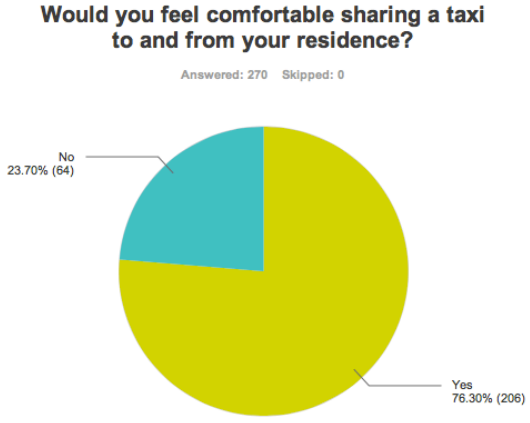


Figure 6

5. DISCUSSION

5.1 Relation to previous work

The two main safety considerations found from previous analysis of taxi share systems are:

- Participant cost minimization: a maximum of three people are in each taxi to minimize selfishness costs.
- Participant and taxi driver safety maximization: only conduct taxi share passenger matching between passengers who are members of a common group [9].

The data presented in this study shows that users prefer to share a taxi with the maximum number of people who can fit in that taxi. This does not support the first conclusion regarding the best scenario having three people in a taxi. It is possible that survey respondents did not consider selfishness costs (e.g. wait times), respondents may have been primarily concerned with monetary costs.

The data presented in this study supports the concept that users are more comfortable sharing taxis with members of a common group, in which they have membership. As presented in the Results section, users in the UMCP indicate that they would be 37% more likely to share a taxi with another member of the UMCP community than with a person not guaranteed to be a member of this community.

5.2 Design considerations

- QuickHit.ch should create a method for screening rides so that only members of certain groups can join certain rides.
- QuickHit.ch should provide an option for limiting the number of passengers allowed in a given ride share.
- QuickHit.ch should distribute educational and marketing materials showing implications of different numbers of ride share passengers.
- QuickHit.ch should aim for high gender diversity in the membership group.
- QuickHit.ch should provide data on a ride share group's current gender makeup to potential ride share members.

6. CONCLUSIONS

The data presented here supports previous research showing that membership in a common group makes potential users more likely to use a taxi share system. The data shows that users want to share taxis with the maximum number of potential riders. Previous research states that this will lead to high selfishness costs and low user satisfaction. Additionally, the data led to the new conclusion that high gender diversity is desireable in a ride share group. Thus, the two main safety related design considerations from our survey are common group membership and high gender diversity. In order to validate conclusions in practice data should be collected regarding usage of QuichHit.ch. That is, data regarding user frequency in selecting rides with and user satisfaction after: riding in taxis with different numbers of share passengers and sharing with groups of high and low gender diversity. Collection of this data will allow further verification of research conclusions.

7. APPENDICES

7.1 Survey Questions

1. Are you a faculty member, staff member or a student?

Faculty

Undergraduate Student

Graduate Student

Staff

2. With what gender do you identify?

Male

Female

Other

3. Would you consider sharing a taxi with any person (not necessarily UMCP affiliated)?

Yes

No

4. Would you consider sharing a taxi with a UMCP affiliate (faculty, staff, or student)?

Yes

No

5. Would you consider sharing a taxi with a UMCP affiliate of your same type (e.g. if you are a student only sharing with other students NOT with staff or faculty members)?

Yes

No

6. If you were to share a taxi with others, with how many people would you be comfortable sharing the taxi?

One

Two

Maximum number that fit in the taxi

7. Would you feel comfortable sharing a taxi with one of the following?

Persons of your same gender

Persons of the opposite gender

Both

8. Would you feel comfortable sharing a taxi to and from your residence?

Yes

No

9. When would you use this taxi-share service the most?

Before/After breaks such as Thanksgiving, Winter Break,

Summer Break, Spring Break

During the semester

During breaks

10.Where would you want to go using the taxi-share service?

Airport

Near-by city

Train station

Other (please specify)

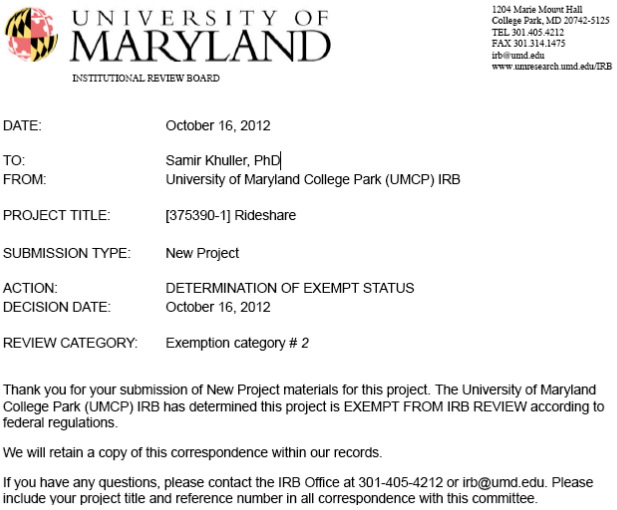
11. Would you feel more comfortable using only one taxi service (e.g. Washington Flyer)?

Yes

No

12. Further comments about what would or would not cause you to use the taxi-share service, questions, other notes.

7.2 IRB approval



UNIVERSITY OF MARYLAND
INSTITUTIONAL REVIEW BOARD

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DATE: October 16, 2012

TO: Samir Khuller, PhD
FROM: University of Maryland College Park (UMCP) IRB

PROJECT TITLE: [375390-1] Rideshare

SUBMISSION TYPE: New Project

ACTION: DETERMINATION OF EXEMPT STATUS
DECISION DATE: October 16, 2012

REVIEW CATEGORY: Exemption category # 2

Thank you for your submission of New Project materials for this project. The University of Maryland College Park (UMCP) IRB has determined this project is EXEMPT FROM IRB REVIEW according to federal regulations.

We will retain a copy of this correspondence within our records.

If you have any questions, please contact the IRB Office at 301-405-4212 or irb@umd.edu. Please include your project title and reference number in all correspondence with this committee.

8. ACKNOWLEDGMENTS

Thank you to CREU, CRA-W, CDC, NSF and the University of Maryland, College Park for their funding of the ride share research project. Thank you also to Dr. Samir Khuller, research advisor and Dr. Jan Plane and Dr. Michelle Hugue for their assistance in the literature review and revision process.

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