Designing a Mobile System for Public Safety Using Open Crime Data and Crowdsourcing

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Abstract
With more cities opening up crime data and the proliferation of participatory sensing, we explore ways to improve public safety of a local community by using open crime data and crowdsourcing. We first conducted an online survey to better understand the public safety needs of the Syracuse University (SU) community. Inspired by the survey results, we developed and deployed an Android mobile app in collaboration with the Department of Public Safety (DPS) at SU; the app integrates published safety incidents on a Google Map and SU campus alerts. We present our experience of co-designing this system with the DPS, challenges and experience of our initial app release. To design effective crowdsourcing of public safety information, we conducted a lab experiment to investigate what factors affect people's sharing decisions. The results suggest that both time of day and type of location significantly affect people's sharing decisions. These insights inform a re-design of our system to "nudge" people to report safety related information timely.

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Public Safety; Mobile App; Crowdsourcing

ACM Classification Keywords
H.4 [Information Systems]: Crowdsourcing, Mobile Applications..

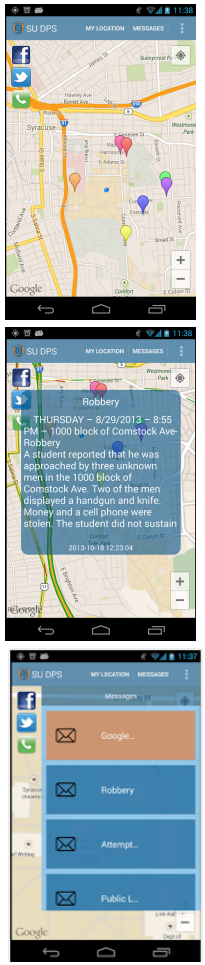

Figure 1: Top: color-coded notifications on a Google Map; Middle: details about a particular incident; Bottom: Orange Alerts and DPS notifications.

Introduction

There is an increasing trend of law enforcement agencies making crime data openly accessible to the public to increase government transparency and improve public safety. For instance, the UK government releases crime data on its website www.police.uk. In the US, different federal (Department of Justice), state (e.g., Minnesota), and municipal governments (e.g., Oakland, Baltimore, and Chicago) have launched similar projects. However, most of these projects provide historical rather than relatively recent or current crime data. For instance, Evans et al. noted that "Data often only arrives at Police.uk after a period of 4-7 weeks. The data indicates trends, but is not up-to-date or accurate enough to be able to help in tracking crimes as they occur - descriptive but not predictive of crime." [1]. In our work, we set out to design a platform for improving public safety by using both open crime data and crowdsourcing. Few such systems were designed and deployed for real-world use. Georgetown University recently released EmergenSee, a mobile app, for university residents to report safety issues [3]. However, we could not find any information about whether and how their target population uses the app.

User Safety Needs

To inform the design of our system, we conducted an online survey to better understand what kinds of safety needs people in the Syracuse University (SU) community currently have. The survey contained 24 questions. We recruited people using the public SU directory. We conducted the survey in October 2012 for two weeks and received full responses from 34 respondents. Among 16 male and 18 female, there are 10 students, 6 faculty, and 18 staff members. Their ages range from 19 to 67, and the average age is 39. 62% of them use smart phones. We asked questions about their opinions of campus safety, safety services, and their major safety needs. We also told them we are building a free smart phone application for campus safety and asked what features they want.

Respondents generally felt safe on-campus and were satisfied with DPS. However, their main concern regarding the campus safety is the safety of campus-neighboring areas. Many respondents spoke to their safety information needs. One respondent said "publish all incidents. I have heard of several incidents that were not reported to other students." Other respondents commented "More ways to notify students about safety on campus," "quicker crime briefs" and "Gather all information and put it in one easy space." Participants also recommended features to implement in our public safety mobile app such as "Maps of where incidents occur," "List of options based on my location with the schedule of the particular services" and "Feature allowing you to report a crime quickly."

SU DPS Mobile App

Based on these survey results, we collaborated with the SU DPS to design and deploy an Android mobile app for public safety. We incorporated all safety-related information published by the DPS into this app. As shown in the top of Figure 1, the app displays local safety incidents of the current and past year on a Google Map based on the user's current location and we color-coded these different types of notifications on the map. If a user clicks on a colored pin, more information about that incident will be shown in a pop-up window (shown in the middle of Figure 1). The app also allows users to instantly receive any urgent notifications from the university (SU's Orange ALERT) and campus safety notifications (shown in the bottom of Figure 1). In addition, the app also connects with DPS accounts on Facebook and Twitter so that users can view and post on the DPS social media

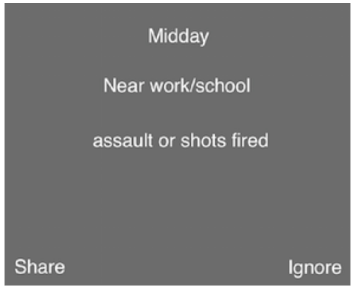

Figure 2: A sample screenshot of the behavioral experiment.

feeds. Users can also call the DPS directly by clicking the green "call" button.

The first version of the app was launched in the 2nd week of December 2013. However, participation was limited with only about 70 downloads in the following five months. We suspect the following main reasons for this low adoption: (1) there was only one news release by the DPS about this app during the finals week when everybody was busy, therefore the community may not know about this app; and (2) the app currently only delivers public announcements of major and confirmed crimes, such as thefts and robberies that have happened several days ago. This initial experience suggests that simply consolidating publicly available safety information in one place might not be enough for adoption. This further motivates us to explore crowdsourcing (i.e., allow users to report incidents) rather than simply relying on information from the DPS.

Design Challenges

Allowing people to report safety incidents using their mobile devices will help lower the bar of reporting but also enable the law enforcement to inspect and respond to the emergent safety issues. The community users can also be more aware of the safety of their current area and make informed decisions about their activities. However, the app will only be successful if it is widely adopted and utilized. There are several design challenges we face to support this vision of crowdsourcing public safety information, including but not limited to: how to motivate people to report sensitive public safety information, and how to protect user privacy while ensuring quality/accuracy of data, fast data collection and dissemination and system security. Citizens will only use the system if they trust that it is secure and they will face no public retaliation for making reports. Perhaps because of this concern, people are likely to under-share in such systems [2].

Additionally, because of some of the above concerns, the DPS is rightly cautious about launching the reporting features. In general, the DPS is quite cautious in introducing any risky research ideas into the app. We note that from a methodological perspective, while it will take more time and effort to test research ideas in the deployed app partly due to the meticulous testing needed to make the DPS comfortable, collaborating with the DPS allows us to deploy the app in the "wild," and potentially help improve the community's public safety. It also allows us to gain a good understanding of how the deployed app may affect the law enforcement's practices. Overall, these benefits over-weighs the extra collaboration effort.

It took us a long time to earn our police department's trust and convince them to collaborate with us. In the end, we worked closely with them including their public communication and IT staff as well as police officers in co-designing this app. This led to integrating the existing DPS notification systems into the app and designing the user interfaces for normal users and the DPS (i.e., an administrator interface). Another challenge is how to make this app secure enough so that people can trust it when retrieving information from it. We also worked together with the DPS to adopt the best practices to secure the app and mitigate concerns of trust and privacy.

Lab Experiment

Collaborating with DPS has high-risk but potentially high-payoff. In order to reduce the risk and successfully engage people in this crowdsourcing system, we first focus on the *under-sharing* challenge, i.e. how to encourage citizens to share potentially sensitive public safety

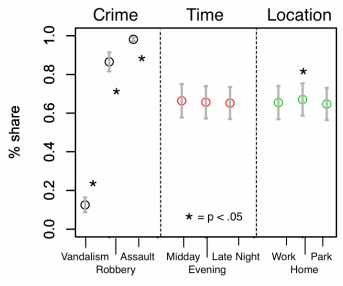

Figure 3: A comparison of the probability of sharing for each factor.

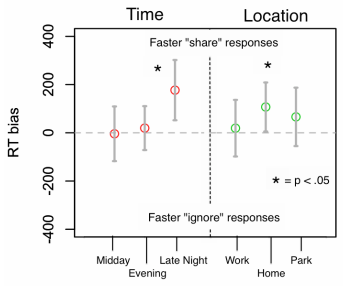

Figure 4: RTs are the response time for making one decision. Bias scores were calculated for each condition as the RTs for ignore responses minus the RTs for share responses.

information. Thaler and Sunstein popularized the idea of nudging which refers to "any aspect of the choice architecture that alters people's behavior in a predictable way without forbidding any options or significantly changing their economic incentives" [4].

In order to know how the system can "nudge" people towards sharing public safety related information in a timely manner, we conducted a controlled lab experiment to explore how different factors may affect people's sharing decisions of sharing crime information. We can then introduce those important factors in the system to nudge users. In particular, we employed computational modeling techniques from cognitive psychology to explore how the following three factors: time, location and crime severity influence people's sharing decision-making. In the experiment, each factor has three levels, leading to 27 different scenarios. Figure 2 shows one scenario of the screen. Each scenario was presented in random order 10 times for a total of 270 trials, and for each scenario the participant made a simple choice to share or ignore the incident through the mock app. The choice and response time were recorded for each decision. We ran this experiment in the Brain and Behavior lab that is equipped with Matlab and the Psychtoolbox package that allows accurate collection of response times from the task.

Our initial results in Figure 3 show that participants (5 male and 6 female) were much more likely to share for the more severe crimes. In addition, Figure 4 shows that participants were faster to respond and more willing to share if the incident occurred in late nights or near home.

Ongoing and Future Work

The experiment results will be used to guide the design of "nudge" features, such that people will be more willing to share sensitive reports. For example, when a user clicks the report page, the app can promote "late night" messages or "X meters from home", which may encourage people to report the incidents (based on the results of the lab study). We are conducting more experiment sessions and exploring various nudging mechanisms with more participants. A longitude field trial of the production system will be conducted to fully understand its usage and impact.

Acknowledgements

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