Personal Safety App Effectiveness

Mike Just
Heriot-Watt University, UK
m.just@hw.ac.uk

Hasmeet Chandok, Raghav Sampangi, Kirstie Hawkey
Dalhousie University, Canada
singh@dal.ca,{raghav,hawkey}@cs.dal.ca

Alette Willis
University of Edinburgh, UK
a.willis@ed.ac.uk

JeyaBalaji Samuthiravelu, Dilpreet Gill, Michael Altair
Dalhousie University, Canada
{jeyabalaji.s,dilpreet.gill}@dal.ca,m.altair@live.com

ABSTRACT

We present the results of our study of people's responses to unsafe scenarios with personal safety apps. Several such apps have been developed, offering features such as a location-sharing panic button. However, there is little research into how people might respond in different personal safety situations, and how such apps might contribute to their response. We performed a lab study with 30 participants and used semi-structured interviews to gather responses to a set of three increasingly risky scenarios, both before and after the installation of a personal safety app. From our results, participants stated that they would use mobile phones and personal safety apps most often to support "collective" responses, with calls to others for assistance. Further, while collective responses were often combined with "avoidance" or "protective" responses, when using a personal safety app, collective responses were less often combined with other reaction types. Overall, our results suggest some potential benefit from personal safety apps, though more study is required.

CHI'19 Extended Abstracts, May 4–9, 2019, Glasgow, Scotland UK

ACM ISBN 978-1-4503-5971-9/19/05.
https://doi.org/10.1145/3290607.3312781

KEYWORDS
App effectiveness; crime; personal safety app; unsafe situation

INTRODUCTION

Personal safety is the ability to protect oneself in situations perceived as involving a threat to well-being ("unsafe situations"). Studies show that people with mobile phones feel more secure, and that security can be a primary reason for owning a mobile phone [13]. Smartphones offer enhanced features in this regard, such as enabling calls for help to include location details. As a result of such technological innovations, there have been high-profile calls for personal safety apps [19, 20], and the Indian government mandated a mobile phone "panic button" [8].

Previous research on personal safety apps has primarily focussed on building solutions instead of developing an understanding of personal safety from a user perspective. While Karusala and Kumar [9] and McCarthy et al. [12] have begun to investigate whether such apps might be used, the situations in which people might use these apps, and how they might use them, remains unclear.

Our study represents the first steps to understanding how personal safety apps might be used in public spaces as part of a person's response to situations perceived to be unsafe. To do this, we designed a lab study that used scenarios as a stimulus for gathering participant reactions. In particular, three risk-varying personal safety scenarios were shown to 30 participants (15 female, 15 male), and their reactions before (preApp) and after (postApp) the installation of a personal safety app were recorded and analysed.

Table 1: Three stages of study

Stage	*Stage Activities*
1-Setup	Recruitment, screening & consent
	Demographic questionnaire completed by participants
2-Unsafe scenarios	Present scenarios to participants
	preApp scenario responses
3-App use	App introduction, preference selection, and training
	postApp scenario responses

RELATED WORK

Published research has been undertaken in relation to designing specialized tools to aid personal safety in unsafe situations and several downloadable personal safety apps (e.g., bSafe, CircleOf6, Life360) and wearable devices (e.g., a wearable button [16]) have been developed. Of the published papers we reviewed, three focused on the technical issue of obtaining help quickly and from trusted parties. Thakur et al. [17] designed a proximity-based trusted alert system, which uses a database of trusted encounters (e.g., past Bluetooth connections) to avoid reliance on raising an alarm to a central system (e.g., a central university campus system). Ovelgönne et al. [14] proposed an emergency alert service that shares a person's phone location with social network contacts, giving priority to more recent, and even physically proximate contacts. Ananda et al. [1] built a personal safety app (Cheeka) that posts a person's location to Facebook, or periodically sends out texts of their location when a person feels unsafe. They also performed a small app evaluation, but focused only on location accuracy. A further four papers discussed trigger devices and resulting communications. KishorBabu et al. [10] proposed an alert and tracking system that, in addition to communicating location information, also sends a voice recording made just after triggering a panic button. Toney et al. [18] proposed an armband triggering system that sends trusted contacts

a video recording, and location details. Chang et al. [4] and Chand et al. [3] provide a sensor-based solution based on shaking the phone, in addition to an app-based panic button.

However, we found only two examples of academic research into the use of such apps. Through a survey (n=469), McCarthy et al. [12] found that there was some willingness amongst Irish public transport users to download and use a personal safety app. However, they gave no consideration to the context in which these apps might be used, nor to how personal safety apps might be used with other, non-technical safety measures (e.g., physically calling for help) as part of an overall response. Karusala and Kumar [9] used semi-structured interviews (n=17) and a survey (n=30) to investigate the experiences of women in public spaces in India, and their feelings on the Indian government's panic button mandate. Their approach rightly focuses on the problem, with a panic button being one of several solutions explored, though they do not use particular scenarios, or investigate other potential safety app features. Our study goes a step further by investigating how people's reactions vary to a set of three personal safety scenarios, and how apps are used for those reactions.

METHODOLOGY

For obvious, ethical reasons, we could not expose participants to actual unsafe situations. For this exploratory study, we also decided not to ask participants to describe their own, personal safety situations and opted to use generic scenarios as the core of our semi-structured interviewing approach to determine participant reactions to the scenarios. As with some other personal safety studies [6] we recruited participants who were currently studying, or had recently completed their studies at university or college (a group for whom personal safety is a very relevant concern).

Our project involved three stages (see Table 1). In Stage 1, participants were recruited through an advertisement distributed via email, social media, and posters on campus. People who were over 18 years of age, and who confirmed at least one previous experience of feeling unsafe in a public situation (details of the situation were not gathered) were invited to an interview for between 2 to 2.5 hours in a campus office. Participants were provided an information sheet describing the study and the expectations placed on them. Once they signed a consent form, they completed a demographic questionnaire. They were compensated for their time with the equivalent of 30 US dollars.

In Stage 2, participants were engaged in a semi-structured interview which was attended by two researchers: one led the interview while the other took notes. The interviews were recorded (audio), which was used to confirm the accuracy of the note taking. A small number of pilot interviews were held to confirm the suitability of our data collection approach. During the interview, participants were given written descriptions of three 'unsafe' scenarios (Table 2), and for each, participants were asked to provide an action they might take in response (preApp responses). Participants were not restricted in the types of reactions that they could specify, e.g., physical reactions, or using their

Table 2: Three safety scenarios.

#	*Scenario*
1	You have arrived at a community gathering with friends, but there are also many people there whom you do not know. While talking to a stranger, something this person says makes you feel uncomfortable. You look around but cannot see any of your friends, making you feel unsafe.
2	You have arranged to meet with a stranger in a parking lot in a distant neighbourhood during daylight hours to finalize a purchase from a classified website. While talking with this person, something that they do makes you feel very uncomfortable and unsafe.
3	You are walking home alone late at night and you notice that someone is walking behind you. You attempt to ignore them but something in their actions makes you believe that they might harm you.

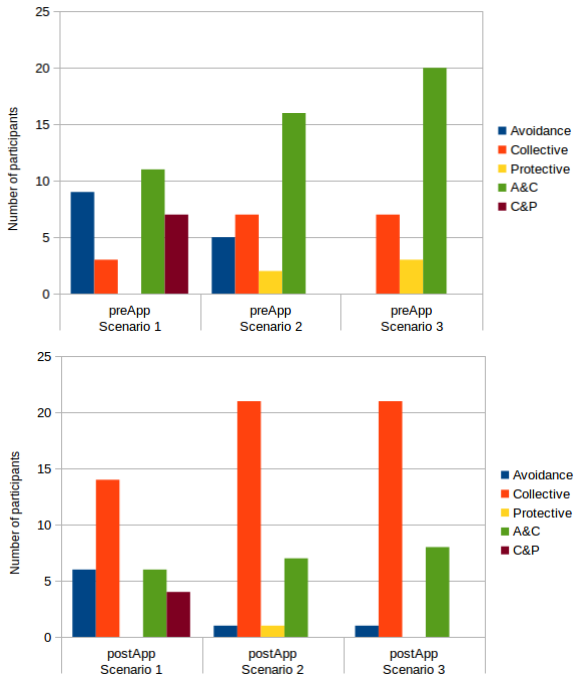

Figure 1: preApp & postApp responses by scenario, coded to 5 reactions: Avoidance, Collective, Protective, including two combined: Avoidance-Collective (A&C), and Collective-Protective (C&P).

mobile phones. The scenarios were designed to progressively increase the level of isolation, drawing on studies that used "being alone" as a key factor for safety perception [13]. In particular, the level of social isolation respectively increases from "friends are nearby", to "an arranged meeting with a stranger", to "being alone".

In Stage 3, participants were introduced to three personal safety apps: bSafe [2], CircleOf6 [5], Life360 [11]. These apps offer a representative set of safety features (e.g., panic button for sending location via SMS, fake call, "follow me" location-sharing feature) and are available for download for both Android and iPhone. Our aim was not to evaluate these apps, but rather to understand whether and how people might use an app to respond to an unsafe situation. In addition to viewing a short text and video summary of the apps and their features, which we produced, participants were asked to investigate the apps as they would normally through their phones' app store. Participants were then asked to choose and install their preferred app. We asked participants to install the app on their own phones, however, we also offered the option of using one of our lab phones if preferred. Once they were familiar with their chosen app, participants were again asked for their reactions to each of the three scenarios (postApp responses). In this case, participants were asked to consider using the app for their reaction, although they were not required to do so, and thus could use reactions similar to their preApp response.

RESULTS

We recruited 30 participants (15 males, 15 females), with 17 participants from 18-24 years of age, and 13 participants from 25-34. We had 24 current students and 6 recently graduated. Nearly all participants (n=28) spent at least two hours per day on their smartphone, and most (n=20) downloaded at least one new app each month.

We classified participant responses using the categories of behavioural reactions to a fear of crime established by Gates and Rohe [7]: Avoidance, Collective, and Protective responses, which respectively involve attempts to end/avoid the situation, ask others for assistance, or confront the threat. In our analysis, we also found two combined responses, Avoid-Collective, and Collective-Protective. Since this classification is from 1987, and thus pre-dates mobile phones, we augmented the response definitions to include technology-based responses. Two coders individually coded the reactions, creating the modified codes that reference mobile phones and apps. Of the 180 codings (30 participants x 3 scenarios x pre/postApp reactions), 13 codings were inconsistent between coders (reliability: 93%). The coders discussed these inconsistencies, which both resulted from aspects of the reaction being missed by coders; thus code reconciliation was straightforward. An overview of reactions for each scenario is shown in Figure 1, for both the preApp and postApp responses, with details in Table 3. Below we summarise the results across the scenarios, and between the preApp (Stage 2) and postApp (Stage 3) responses. Participant quotation examples are shown in Table 5.

Table 3: preApp & postApp resp. for Avoidance, Collective, and Protective, and two combined reactions, Avoidance-Collective (A&C), and Collective-Protective (C&P). Final four columns sum previous: All Avoidance (Avoidance + A&C); All Collective (Collective + A&C + C&P); All Protective (Protective + C&P); All Combined (A&C + C&P).

		Avoidance	Collective	Protective	A&C	C&P	All Avoidance	All Collective	All Protective	All Combined
preApp	Scen. 1	9	3	0	11	7	20	21	7	18
	Scen. 2	5	7	2	16	0	21	23	2	16
	Scen. 3	0	7	3	20	0	20	27	3	20
postApp	Scen. 1	6	14	0	6	4	12	24	4	10
	Scen. 2	1	21	1	7	0	8	28	1	7
	Scen. 3	1	21	0	8	0	9	29	0	8

Table 4: Number of reactions with mobile phone (in preApp stage) and app (in postApp stage) from 30 participants.

	preApp Mobile phone used	postApp App used
Scenario 1	9	12
Scenario 2	22	20
Scenario 3	20	21

For Stage 2 (preApp) responses, when friends were potentially nearby in Scenario 1, participants relied more on avoidance-only reactions (n=9), which did not involve using their phone (e.g., walking away), compared to Scenario 2 (n=5) and Scenario 3 (n=0). In Scenario 3, while no participants used *only* an avoidance reaction, avoidance reactions were provided, but only when combined with a collective reaction (n=20). There were likewise more combined avoidance and collective (A&C) reactions in Scenario 1 (n=11) and Scenario 2 (n=16). Collective reactions were the most frequent reaction overall in the preApp stage (either alone, or in combination), with the highest for Scenario 3 (n=27), compared to Scenario 1 (n=21) and Scenario 2 (n=23). In scenarios, collective responses were most often used in combination with avoidance (see Table 3). Protective responses were rarely used, and only then in combination with a collective response in Scenario 1. Across all scenarios, more than half of the participants indicated that they would use a combined response, either avoidance with collective, or collective with a protective response. In Stage 3 (postApp), in Scenarios 2 and 3, 70% of participants (n=21) used a collective-only response, with almost half (n=14) in Scenario 1. Overall in the postApp, there were fewer combined reactions across all scenarios, also corresponding to fewer avoidance reactions. Thus, the two key differences between the preApp (Stage 2) and postApp (Stage 3) reactions were as follows: (i) postApp reactions involved more collective-only reactions and (ii) postApp reactions involved fewer avoidance and fewer combined reactions.

We also coded the reactions based on whether participants chose to react with their mobile phone, or app (see Table 4). In preApp (Stage 2), participants used their mobile phones across all scenarios, with only about 1/3 of participants using them in Scenario 1 (possibly due to the physical proximity of friends), and about 2/3 in Scenarios 2 and 3. In Scenario 1, phones would only be used to communicate with friends; they were used to contact emergency services in some cases in Scenarios 2 and 3. In postApp (Stage 3), the proportions of participants who indicated that they would use a personal safety app were similar. Yet this did not necessarily mean that mobile phones and apps were consistently used between preApp and postApp reactions by each participant. For example, in Scenario 1, of the 21 participants who did not use a mobile phone in the preApp stage, 6 used an app in the postApp stage. These reactions suggest that for some participants, the basic features of a mobile phone might be insufficient, compared to a specialised personal safety app.

CONCLUSION

The results of our lab study reveal some differences in how people might react to personal safety situations. In particular, our participants stated a preference for collective reactions, especially in cases where they were more isolated. Further, access to a personal safety app changed the nature of the stated reactions to fewer combined reactions when there was access to such an app. It is not clear whether this change is due to the suitability of the app features, or whether using an app distracts a person from making other reactions, potentially putting them more at risk.

Table 5: Sample participant quotations. "Mx" and "Fx" respectively identify male and female participant number "x".

Reaction	*Quotation*
Avoid. (preApp)	"Will ask if we can do the deal in any public area, moving from the parking basement." (F3)
Avoid. (postApp)	"Would choose fake alarm as it helps me to be independent in the way I am seeking help." (M2)
Collect. (preApp)	"I will share my location with my friend by calling them as it makes me comfortable that someone knows where I am." (M13)
Collect. (postApp)	"I will use follow me feature as it will help them locate me if when I am changing location at the time of any emergency." (M4)
Prot. (preApp)	"Will turn and give them a reaction. Confront them." (M9)
A&C (preApp)	"I would just call 911 and run from there." (F15)
A&C (postApp)	"Run off to the nearest exit, not sure about making calls. If there are people around, just get attention somehow." (F15)

Given that our investigation only gathered participant intentions from a lab study, our next steps will involve a couple of approaches for more realistic investigations, namely by trying to simulate a stressful situation for assessing response choices, as well as a longer-term study with use of personal safety apps by people in their day-to-day lives.

REFERENCES

[1] S Ananda Kanagaraj, G Arjun, and A Shahina. 2013. Cheeka: A mobile application for personal safety. In *CollaborateCom*. IEEE, 289–294.

[2] bSafe. 2017. *Never Walk Alone* Personal Safety App. http://getbsafe.com/.

[3] D Chand, S Nayak, K Bhat, S Parikh, Y Singh, and A Kamath. 2015. A mobile application for Women's Safety: WoSApp. In *TENCON*. IEEE, 1–5.

[4] J-C Chang, P Wang, K-H Fan, S-R Yang, D-Y Su, M-Sh Lin, M-T Sun, and Y-C Tseng. 2011. iMace: protecting females from sexual and violent offenders in a community via smartphones. In *ICPPW*. IEEE, 71–74.

[5] CircleOf6. 2017. Personal Safety App. https://www.circleof6app.com/.

[6] K Cumiskey and K Brewster. 2012. Mobile phones or pepper spray? Imagined mobile intimacy as a weapon of self-defense for women. *Feminist Media Studies* 12, 4 (2012), 590–599.

[7] Lauren B Gates and William M Rohe. 1987. Fear and reactions to crime: A revised model. *Urban Affairs Quarterly* 22, 3 (1987), 425–453.

[8] W Huizhong. 2016. India says every phone must have a panic button by 2017. http://money.cnn.com/2016/04/27/technology/india-smartphone-panic-button-rape/index.html.

[9] N Karusala and N Kumar. 2017. Women's Safety in Public Spaces: Examining the Efficacy of Panic Buttons in New Delhi. In *CHI*. ACM, 3340–3351.

[10] S KishorBabu, V Sagar, B Nikhitha, and P Priyanka. 2015. Exigency alert and tracking system. In *ICACEA*. IEEE, 700–705.

[11] Life360. 2017. "The New Family Circle" Communication App. https://www.life360.com/.

[12] O McCarthy, B Caulfield, and M OMahony. 2016. How transport users perceive personal safety apps. *Transportation research part F: traffic psychology and behaviour* 43 (2016), 166–182.

[13] J Nasar, P Hecht, and R Wener. 2007. 'Call if you have trouble': Mobile phones and safety among college students. *International Journal of Urban and Regional Research* 31, 4 (2007), 863–873.

[14] M Ovelgönne, A Sonnenbichler, and A Geyer-Schulz. 2010. Social emergency alert service-a location-based privacy-aware personal safety service. In *NGMAST*. IEEE, 84–89.

[15] M Phillips, F Mostofian, R Jetly, N Puthukudy, K Madden, and M Bhandari. 2015. Media coverage of violence against women in India: a systematic study of a high profile rape case. *BMC women's health* 15, 1 (2015), 3.

[16] ReactMobile. 2017. Enterprise Safety Platform. https://reactmobile.com/.

[17] G Thakur, M Sharma, and A Helmy. 2010. Shield: Social sensing and help in emergency using mobile devices. In *GLOBECOM 2010*. IEEE, 1–5.

[18] G Toney, F Jabeen, and S Puneeth. 2015. Design and implementation of safety armband for women and children using ARM7. In *ICPACE*. IEEE, 300–303.

[19] Whitehouse. 2011. Apps Against Abuse. https://obamawhitehouse.archives.gov/1is2many/apps-against-abuse.

[20] XPrize. 2017. Anu & Naveen Jain Women's Safety XPrize. http://safety.xprize.org/.