Guardian

COS 436: Human-Computer Interface Technology
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GP1- Project Proposal - October 12, 2017

Overview

Personal security for people in an outdoor environment is an issue that many have attempted to solve over time. There are infrastructures, such as the police department or "blue light" system, or products, such as alert mobile apps, that attempt to improve security for people, but these are not foolproof. Slow response times and product functionality barriers increment the danger people face the moment they leave their homes. One of our goals is to address the current shortcomings of physical barriers when sending a distress call and the slow response times in an emergency. But in order to develop an effective product, we need to understand behaviors in all outdoor environments ranging from running and hiking to buying coffee on the way back from work at night. We need to know the factors that influence the locations people visit, the precautions they already take to prevent incidents and the signs for perceived danger that they have learned to recognize over time. In addition, we also need to understand the perceptions of safety for pedestrians. Grasping these concepts will allow us to design a product that will make users feel safe and will protect them in an emergency scenario.

Methods

Our methods will include surveys, focus interviews, situational simulations accompanied by observations and post simulation interviews, and product testing. Surveys are a convenient way for us to collect a wide range of data from a wide range of users. Surveys allow us to better understand what problems and concerns exist for our users so that we design products that address those issues. Focus interviews will help us get more detailed feedback on what users want, what solutions work specifically well for a user, and how users

feel about a product. We will also conduct interviews after product testing to help us learn what was successful, what failed, and how to improve the product. Situation simulations allow us to observe how users act and react in troubling or potentially threatening situations, thus giving us a more accurate understanding of how to design products for these problem spaces. Through observation, we will be able to capture what users aren't always able to articulate and by conducting post simulation interviews, we will be able to learn what their thought processes and feelings were in those situations. These methods are ideal for us to design an optimal solution.

We intend to have 40-50 people participate in our surveys. Our survey will not take longer than 20 minutes to complete and will include questions about demographic information and general habits around daily activities, general feelings of safety throughout daily activities, logistics of daily activities, problems and threats during daily activities. For our focus interviews, we will interview 10 people individually for 15 minutes, asking them more detailed questions on what types of solutions would be useful to them to increase safety in their daily activities. After learning what is threatening or unsafe to users through surveys, we will run situation simulations with 10 people to learn how people act and react in simulated threatening situations, and conduct post simulation interviews, asking how they felt and what their instincts were, with the whole process taking about 30 minutes. We intend to have 10 people also participate in our product testing which will take about 20 minutes per user. Through product testing we will observe how users interact with the product and ask them what worked and what didn't.

We have several methods for data collection and data analysis. Surveys will be conducted using Google Forms or Survey Monkey. Survey results will be taken from Google Forms or Survey Monkey and put into open source software called Grace Analytics, designed by one of our team members, for text analytics using natural language processing. We intend to record our focus interviews and also have a physical note taker present. We will manually read through interview results and sort input into different groups based on the themes of the group. We will use this process for all interviews we conduct because our sample size of ten is small enough to do manual data analysis. We plan to video situation simulations and product testing. We will then make observations of themes from user actions and reactions in our videos and classify these observations accordingly to assess general themes from the data.

User Characteristics

We will be studying people that spend time outdoors in both urban and rural environments. These can be pedestrians, runners, hikers, campers, etc. These are individuals that perform their preferred activities alone or in groups of varying sizes. They vary greatly in age, occupation, sexual preference, educational background and socioeconomic status. Our large target market is united by the lack of safety, both real and imagined, they face every time they leave their homes for entertainment or professional purposes. This is particularly important for those users that are active at night, frequent low populated areas like national parks, and find themselves alone during the course of the day or night.

Because the group we have easiest access to here on campus is runners, the majority of our sample will belong to that subgroup. We will also reach out to students that travel alone off campus and who have night commitments, among others.

Tasks

In order to build a product that best fits user demands, we seek to understand the essential attributes of user behavior in our problem space. To this end, the user survey proposed as part of this report aims to collect details on potential users and further our understanding of tasks performed by users in the context of the problem we are trying to solve. One component of this data collection intends to comprehend the range of actions users will be able to perform while on the move, or even under duress. We assume that our users will be on the move, and therefore cannot immediately utilize other forms of electronic communication, with the exception of their mobile phones. Naturally, users in a position of distress will not be disposed to performing a complex series of actions. Similarly, users may not be ready to perform tasks that require acute concentration or a high degree of cognition, and we intend to take these factors into consideration during the design and execution of our product. Other characteristics of mobile users may include a limited range of motion, in the event that a user is encumbered by heavy baggage, or using both arms to carry possessions. Conversely, users may also not have the physical storage available, such as pockets or a bag, to carry additional items. Users may also have limited awareness of their surroundings, or have impaired audio-visual senses when on the move, by way of headphones, sunglasses, or items of clothing. This is particularly relevant for our users who are exercising outdoors, who may exhibit limited awareness of their surroundings while focused on their workout.

Another consideration, though not limited to athletes, is the potential for users to be tired or fatigued while on the move.

In addition to the tasks performed by users, we also consider the characteristics of the task environment in which users engage our product. Users may be potentially be in a rural location or an area disconnected from civilization that may limit means of contacting others for assistance. In the same manner, the task environment may have limited cellular reception, and coverage via other electronic means such as Wi-Fi may also be unavailable. The task setting may also impede the free movement of users, particularly in the outdoors, such as in a forest trail or other rugged terrain. The presence of natural or artificial barriers or hazards, such as cliffs, walls, or ravines, will also undoubtedly limit the movement of users. Apart from physical restrictions, the task environment may also impose other constraints that hamper the abilities of the user. For example, inclement weather may make use of certain devices difficult or even unsafe, such as in the event of a thunderstorm. Analogously, the time of day may disrupt users' range of vision, especially during nighttime. A loud or noisy atmosphere may also impair the abilities of users to communicate for help. Finally, the importance of users' relationship with the environment cannot be understated. Users' familiarity with the location and its characteristics, as well as their familiarity with other people in the task environment, are all significant factors that must be taken into consideration.

Existing Systems

There are several existing systems and structures that deal with people feeling unsafe on the move. These systems include physical security, phone security, and other personal products.

On campus, we have the "blue panic buttons" that appear on the main walkways. These are useful because a user may not always have access to a phone. However, this system is limited, and does not help users who are too far away from these buttons. Physical security also includes well lit roads. Studies have shown that the perceived safety at night is highly correlated with the number of street lights on the road. Unfortunately, if something were to occur, the number of street lamps would not keep the user safe.

If a user has a phone, they can call 911. However, during the call, they must be able to speak out loud and pinpoint their location. This limits their ability to record a video, take a photo or contact others at the same time. If the user cannot trust the response time of the

authorities, the last aspect is especially important. Finally, if the user owns a smartphone, it is very difficult to unlock the phone/dial a number while moving quickly. There are also few security apps that are built for smartphones that account for most corner cases. These apps are typically only built for certain kinds of users, and often require opening and unlocking the phone during a crisis situation.

The final systems available are personal alert products and personal defense products. Some products make loud alarm sounds when pressed. "Runner Personal Alarm" and "SABRE Personal Panic alarm" are two such products. Carrying pepper spray, mace, tasers, and other self defense items may be effective, but they are also cumbersome and difficult to carry. All such personal products require at least one hand for use.

Relevant Literature on Pedestrian Safety

The team has gone over several studies for dealing with safety. There have been several studies on the perception of safety for pedestrians at night, including "Perceptions of safety at night in different lighting conditions".[1] This study found that illumination of 30Ix was all that was needed to bring a feeling of safety to participants. We also found that it seems to be more of a phenomenon in the female population. When we looked for studies about "pedestrian safety", a larger proportion of the research dealt with traffic safety. However, when we looked for studies about "female pedestrian safety" versus "male pedestrian safety" we found that there were several studies on changes in behavior and higher rates of feeling unsafe in women than men.[2] A study from Fort Hayes University found that around a quarter of women interviewed felt afraid while running.[3] When asked if they ever had a negative experience while running, almost all women had at least one negative experience.

[1] Boyce, P R. "Perceptions of safety at night in different lighting conditions." *International Journal of Lighting Research and Technology*, Lighting Research and Technology, 1 June 2000, journals.sagepub.com/doi/abs/10.1177/096032710003200205.

[2] Amy Caiazza , "Don't Bowl at Night: Gender, Safety, and Civic Participation," *Signs: Journal of Women in Culture and Society* 30, no. 2 (Winter 2005): 1607-1631.

[3] Major, Wayne (2008) "Is Safety a Concern for Women Runners?," *Academic Leadership Journal*: Vol. 6 : Iss. 2 , Article 9.

Initial Evaluation Criteria

We have three main criteria to test our designs. The first is how long it takes people to use our product over the current standard of time while in a mock-crisis situation. For example, calling 911 on a cell phone while running. We want a faster time, because we assume that users will want something that takes the least amount of time. The second is the "feeling" of safety. We will measure this by a ranking score before and after the user trials the product. For example, we would ask "From 1-5, how safe do you feel running outside?" and then after the product is demonstrated, we would ask "From 1-5, how safe do you feel running outside while using this product?" The final criteria is how intuitive is the mapping of the product. This will vary depending on what kind of prototype we use and which direction we pivot after the first round of user feedback.

Appendix A: Consent Form: Page 1

ADULT CONSENT FORM
PRINCETON UNIVERSITY

TITLE OF RESEARCH: COS 436: Human-Computer Interface Technology Group Project - Guardian

PRINCIPAL INVESTIGATOR: Marshini Chetty

PRINCIPAL INVESTIGATOR'S DEPARTMENT: Department of Computer Science

You are being invited to take part in a research study. Before you decide to participate in this study, it is important that you understand why the research is being done and what it will involve. Please take the time to read the following information carefully. Please ask the researcher if there is anything that is not clear or if you need more information.

Purpose of the research:

Our goal is to understand the perceptions of safety for pedestrians in outdoor environments and design a product to increase feelings of safety. You are being asked to participate in order to help us better understand our users, the problem space, and the efficacy of particular solutions.

Study Procedures:

Study procedures may include surveys, interviews, threatening situation simulations, and product testing.

Your total expected time commitment for this study is: 30 minutes

Benefits and Risks:

Potential benefits of participating in this research include higher awareness of safety issues and increased proactiveness against potential threats.

Our research could potentially trigger a participant about any negative experience they might have had as a pedestrian in an outdoor environment. Our participants could also be uncomfortable with simulating a situation in which they would be asked to act as they would in an emergency or unsafe situation.

Alternatives

The alternative to participation in this study is choosing not to participate.

Confidentiality:

All records from this study will be kept confidential. Your responses will be kept private, and we will not include any information that will make it possible to identify you in any report we might publish. Research records will be stored securely in a locked cabinet and/or on password-protected computers. The research team will be the only party that will have access to your data.

Compensation:

Participants will not be compensated for their participation in this study.

This study has been approved by the Institutional Review Board for Human Subjects

Who to contact with questions:

1. PRINCIPAL INVESTIGATOR:
   Marshini Chetty (marshini@princeton.edu)

2. If you have questions regarding your rights as a research subject, or if problems arise which you do not feel you can discuss with the Investigator, please contact the Institutional Review Board at:

   Assistant Director, Research Integrity and Assurance
   Phone: (609) 258-8543
   Email: irb@princeton.edu

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3. I understand the information that was presented and that:

   A. My participation is voluntary, and I may withdraw my consent and discontinue participation in the project at any time. My refusal to participate will not result in any penalty.

   B. I do not waive any legal rights or release Princeton University, its agents, or you from liability for negligence.

4. I hereby give my consent to be the subject of your research.

_____ _____
Subject's Signature Date

_____ _____
Person Obtaining Consent's Signature Date

Audio/Video Recordings:

With your permission, we would also like to tape-record the interview. Please sign below if you agree to be photographed, and/or audio videotaped.

I hereby give my consent for audio/video recording: _____
Subject's Signature

This study has been approved by the Institutional Review Board for Human Subjects

Appendix B: Survey: Page 1

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Survey

1. Age: What is your age?
    a. 18-25
    b. 26-35
    c. 36-45
    d. 46-55
    e. 56-65
    f. Over 65
    g. I do not wish to disclose

2. Gender: What is your gender?
    a. Male
    b. Female
    c. Other

3. Education: What is the highest level of education that you have completed?
    a. 12th grade or less
    b. High school degree or equivalent
    c. Some college, no degree
    d. Bachelor's degree
    e. Master's degree
    f. Other graduate degree

4. Ethnicity origin (or Race): Please specify your ethnicity.
    a. White
    b. Hispanic or Latino
    c. Black or African American
    d. Native American or American Indian
    e. Asian / Pacific Islander
    f. Other

Appendix B: Survey: Page 2

5. a. Where do you currently live?
   b. What are your general daily activities for where you currently live?

6. a. Have you lived somewhere else within the past year?
   b. If so, where?
   c. If so, what were your general daily activities in that place?

7. During any of those daily activities, when do you feel safe?

8. During any of those daily activities, when do you feel unsafe?

9. When you feel unsafe, what measures or actions do you take to feel more safe?

Appendix C: Interview Guide

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Interview Guide

1. Where do you currently live?
2. What are your general daily activities for where you currently live?
3. Have you lived somewhere else within the past year?
    a. If so, where?
    b. If so, what were your general daily activities in that place?
4. During any of those daily activities, when do you feel safe?
5. During any of those daily activities, when do you feel unsafe?
6. Can you elaborate on situations where you felt unsafe?
    a. What was your environment?
    b. What tools or resources did you have at your disposal?
    c. What tools or resources did you wish you had?
    d. What was your emotional reaction?
    e. When did you eventually feel safe again?
    f. What made you feel safe?
7. When you feel unsafe, what measures or actions do you take to feel more safe?
    a. How effective are these measures?
    b. What other measures or actions would help you feel more safe?