SafePath

Don’t Go There!

Lo-to-Mid Fidelity Prototype Testing and Refinement

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Overview
As part of the greater DC area, the pervasiveness of crime has long been a stigma of College Park. Although crime rates have been decreasing in recent years, many in the UMCP community still feel unsafe when walking both on and off campus, especially at night. Our proposed solution is SafePath, a personal safety application for Internet-enabled mobile devices. SafePath’s primary use will be to generate a safety heat map that shows how the likelihood of a crime occurring varies with your location on and around campus, and to use this data, along with other safety information, to create a safe route that the user can follow to walk to their chosen destination. The application primarily uses the location of safety infrastructure (such as lighting, cameras, and PERT phone locations) and to a lesser extent the locations of past crimes when determining the safety of an area. Bus routes and NITE ride usage are integrated into the direction generation algorithm to further minimize walking time. SafePath will also contain contact information for existing safety programs and a panic button that alerts police if an emergency happens.

Prototype Description
Our low fidelity prototype is a paper-based depiction of a smartphone. It consists of a paper smartphone frame mounted on a cardboard backing, an assortment of tabs and dialog boxes, and three maps which are colored to resemble heatmaps [Fig 1,2]. The maps are of the area off the southeast side of UMD’s campus, and each has either a route or a location highlighted in blue.
Fig 1: Phone frame and background maps

Fig 2: Tab and dialog box screens
The “viewable area” of the phone is cut out so that the cardboard piece can be placed over a map and only that part of the map is revealed. The “info,” “directions,” and “panic” tabs are taped to the appropriate sides so that the prototype matches our design [Fig 3].

Fig 3: How the prototype looks at the start of testing

The main functionality of the prototype is in the tabs and dialog boxes that show up. In response to the user touching tabs or dialog box options, the appropriate screen is placed on top of the viewing area. Small post-its are affixed to text boxes for the user to fill in [Fig 4]. If the user action causes the map display to change, then one of the other heatmaps is swapped in to show what the new background should be.

Fig 4: Text boxes

As it is designed to resemble a smartphone, touch is the main method used to interact with the
prototype. Touching or dragging on a tab activates that tab, and touching dialog options selects those options. For instances in which a keyboard would appear on screen, the participant is handed a pencil to write in what they would type. While the participant can physically push the viewing area around the map, it does not respond in the same way a phone would and there is no zoom, so manually moving the map around to view areas is only partially supported by the prototype.

Representations of the main features of our application are supported by the prototype. Use of the info tab, panic button, showing an address, and getting directions from one address to another are included.

Testing Method
In order to find participants, members of our team stood near the food court in the Stamp Student Union with a paper sign stating that we wanted non-engineering majors to talk to us. We also approached students walking or sitting nearby to ask if they would participate. We moved around to different areas of the food court as needed to find more participants. In this way, we found four UMD students for our study, whose majors were classics, philosophy, physics, and sociology.

Each participant was interviewed at one of the tables near the food court in the Stamp Student Union. The area was lightly trafficked and had a moderate amount of background noise, but otherwise few distractions. One experimenter acted as the interviewer, who gave directions to the participant, a second experimenter manipulated the prototype in response to the participants’ actions, and a third filmed.

The three tasks for our study were as follows: place a call to NITE-Ride, obtain safety information about an area, and use the application to get walking directions between two locations. Placing a call to NITE-Ride was what we considered our “easy” task, as it only required hitting the “info” tab and finding NITE-Ride on the drop down menu. We considered obtaining safety information our “moderate” task, and for this the participant had to bring up the “show” tab, input the address, and correctly interpret the heat map which appeared. The third task was finding walking directions, which we rated as “hard.” In order to complete this the user needed to directly input or use other interface functions to get their current location and destination into the navigate tab, and then press “go.”

The first action we took in our testing procedure was to give the participant 2 copies of the video consent form, one for them to sign and give back to us, and another to take with them. After this, the interviewer read them a statement explaining the goals and format of the study. The participants then performed a ‘cold run’ of the program where they were told to interact with the interface and get used to using the paper prototype with no prior direction in its use. After they felt that they had adequately explored the interface the interviewer then demonstrated some
basic functionality of the application by pulling out the panic pane and using the panic button. For
the next step, the interviewer gave the participant a sheet of paper with a task written on it, and
they were told to attempt to complete the task and announce when they were done. Once they
were finished with the task, they were given the next one, until all 3 were attempted or
completed. The tasks were given out in a random order. We concluded each interview by asking
the participant for any general comments or observations that they had about the interface, and
then provided them with compensation in the form of a package of Nerds candy.

As far as measuring the effectiveness of our interface, we were mainly looking at the more
qualitative data from the interviews. We looked at how the participants perceived its usability,
which screens caused them to express confusion or stop progressing, and their comments
while using the interface. Although we noted some objective measures, such as task completion
rate and number of mistakes made, due to the low number of participants and the nature of our
testing environment there was no way to fairly test each task, and so our focus was more on
why mistakes were made and at which points the participants got stuck.

Testing Results
When asked all users found that the interface was easy to use and understand. All users were
able to complete all of the tasks, though each at a different pace. On average users who spent
longer exploring the interface during the cold runs completed the tasks much faster. This
indicates that after only a short amount of time users were able to learn and understand many of
the functions of the application without guidance outside of the interface.

While users believed the application to be intuitive we noticed that there were numerous areas
open for improvement. None of the problems we noticed caused users to be unable to complete
the tasks, but they did cause users to pause and consider what to do next or to backtrack and
see what they did wrong.

One such confusing aspect of our design was the fact that entering an address into the ‘show’
pane brings up and populates the ‘navigation’ pane with the entered address in the destination
box. As users were unaware this would occur, they were initially put off by the new pane’s
sudden appearance and spent a large amount of time trying to determine what exactly
happened. Also an unforeseen consequence of the auto-population became apparent. Since the
text boxes were populated and therefore the placeholder text indicating start and end addresses
was gone, users did not know which box held the destination address and which the current
address. This led to more than one user mistakenly entering the address of the current location
into the destination textbox and generating a backwards path.

A small amount of confusion occurred when users first opened the info pane. When presented
with the initially blank pane some users went to the dropdown, however others were concerned
that they had done something wrong and were confused about what should happen next. One
user in particular thought that the info tab would display dynamic information about the current area and was confused when it did not.

Finally, and possibly most importantly, users were not able to determine what the colors on the heat map meant. Most participants did not even question the colors until it was brought up and explained by the interviewer. However, once explained, users correctly understood the idea and were able to correctly judge the safety of the area for the moderate task.

We also found that many features of our program were essentially hidden from users simply because they were not even aware that they existed. For instance, some users during their initial cold run through the program were not aware that the various tabs were interactable objects, and only one realized that they were draggable. Similarly, none of the users discovered that you could reach the navigation tab by pulling further on the directions tab. It is possible that because of this, the hard task was more difficult than necessary as the participants had to go through the show tab to reach the navigation tab.

Interface Revisions

We attempted to address many of the issues encountered by users by making some key revisions to our design.

For instance the tabs have been revised to include “grip bars” indicating that they can be pulled. This is in line with both Android and iOS design guidelines ensuring that most typical smartphone users would recognize this indicator [Fig 5]. The directions tab has been further changed to become a double tab when pulled out allowing easy and highly visible access to both the show and navigation panes instead of hiding navigation behind the long pull gesture [Fig 6,7,8].
Fig 5: Tabs with grip

Fig 6: Initial state of directions tab
We have also endeavored to more clearly explain the functionality of our interface. For instance on first run of the application a small tutorial will be displayed that explains the general idea of the safety heatmap [Fig 9]. This is because we determined that after an initial explanation most users clearly understood the concept and therefore did not need a constant visual reminder of how it worked. Later, this along with more detailed information will be available through the info
pane. Also the info tab no longer displays an initial blank page but instead shows simple directions to select an item from the dropdown for information about it [Fig 10].

Finally the navigation pane has been altered such that in addition to having placeholder text in the address text boxes indicating which was the start and which the destination, the destination box will also be labeled with a checkered flag pattern [Fig 8]. The checkered flag pattern will also be present in the marker indicating the destination on the map visually linking the two interface
components [Fig 11]. The checkered flag quickly and easily visually indicates to the user that this is the end address, based on the cultural dependency that the checkered flag indicates the end of a race.

![Fig 11: Matching checkered pattern linking endpoint and its text box](image)

**Discussion and Lessons Learned**

We found that the usability study was effective because some issues became readily apparent after only a little testing. Once problems were mentioned or experienced by participants, the need to make changes became clear, even though we had only tested on a few people.

The influence of the study can be directly seen in the latest iteration of our interface. We have redone the look and functionality of the “show/navigate” tab because of misunderstandings about its use. The addition of grip bars to tabs was in response to participants either getting stuck or expressing confusion when they wished to manipulate a tab. Changes were made to the “info” tab so that it is clear that the top part is a drop down menu because a participant noted that it looked like a blank screen and was unsure how to proceed. In addition, we have made the call feature on a service’s info page more obvious.

Although much was learned from the experiment, there are things about how the study was performed that could have been improved. During the interviews, there were a few errors made on the part of the experimenters, such as putting up an incorrect screen or showing the wrong information, that could have influenced the results. There were some smaller features of the application that were not included in the paper prototype and thus not tested as they were not relevant to our tasks, such as camouflage navigation. In addition, since we chose to show each participant the panic button feature as an example, we did not test its usability. It may have been a good idea to have had two easy tasks instead of one, so that the experimenters could choose...
one to demonstrate as an example and test the other on the participant, then for the next participant switch which task was shown and which task was tested.

There were also limitations to our study stemming from our paper prototype and our method for acquiring subjects. While the paper simulation works well for touching and typing, the dragging actions allowed by the tabs and the map could not be simulated very well. Only once did a participants attempt to drag one of the tabs, but we are unsure if that is because it did not make sense on paper, since they could see that the tab was attached, or if they would not have done so in any case. In addition, time was a major concern for potential participants and our test had to be short enough to not discourage people from agreeing.

Ideally if done again we would devise a working prototype for mobile phones similar to projects done in balsamic. This way not only would interactions be more natural, as users would be using the prototype on the phone itself, but also testing could be done completely in the wild and features such as turn by turn navigation could be tested since users could be outside moving with the prototype.

Video Report

For our team, videotaping the interviews was easily accomplished, and yielded moderate benefits. To keep things simple we used phone cameras, with one person filming to the side so as not to hinder the testing. None of the participants were concerned about having to sign the video consent form, and the small amount of background noise does not have any effect on understanding what is happening. While we did not have any problems with videotaping the tests, we did not gain much new information, as re-watching the interviews only confirmed what we had remembered and written down while conducting them. The main benefits are that team members can review interviews they did not attend, and we can reference the videos later if we decide there is more information to be gleaned. Videotaping studies is definitely a good idea because the recordings can be viewed later if the test needs to be re-examined, and there is no real drawback.

We began the video by introducing the participants and then showed a quick shot of us standing around trying to attract people. This was followed by each of the tasks being performed by a participant. We chose interactions that were interesting and had a notable effect on our design.
Appendix A: Consent Form

Consent Form (videotaping included)
Human-Computer Interaction Course Projects (CMSC434)

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Project Purpose and Procedures

The purpose of this course project is to gain information about how best to design a personal safety mobile phone application. You will be asked to use a paper simulation of a mobile phone to perform a number of tasks. We will observe you performing those tasks and analyze how the technology is used. You will be asked to participate in 1 session consisting of a learning period and 3 tasks. The sessions will be videotaped. Videotapes will be used for analysis and may also be used for class project presentations. You may elect to be videotaped from over your shoulder so that your face cannot be seen.

Confidentiality
The identities of all people who participate will remain anonymous. The one exception is that excerpts from the videotape may be presented as described above, and your identity may be revealed through those video excerpts. No personal information will be collected, and all data from individual participants will be coded when it is used in any reports and presentations that result from this work.

Remuneration/Compensation
We are very grateful for your participation. However, you will not receive compensation of any kind for participating in this project, except Nerds.

Contact Information About the Project
If you have any questions or require further information about the project you may contact any of the team members listed above.
Contact for information about the rights of research subjects

If you have any concerns about your treatment or rights as a research subject, you may contact the UMDCP Institutional Review Board Office at 301-405-0678.

Consent

We intend for your participation in this project to be pleasant and stress-free. Your participation is entirely voluntary and you may refuse to participate or withdraw from the study at any time. Your signature below indicates that you have received a copy of this consent form for your own records.

Your signature indicates that you consent to participate in this project. You do not waive any legal rights by signing this consent form.

I, ___________________________, agree to participate in the project as outlined above. My participation in this project is voluntary and I understand that I may withdraw at any time.

____________________________________________________
Participant’s Signature Date
Appendix B: Directions to Participants

Thank you for participating in our study. We're in the early phases of designing a mobile phone application to be used by the students, staff, and faculty of UMD. The application is designed to provide safety information about campus and the surrounding area. As part of the design process we're going to have you take a look at it and perform some tasks with the app and give us your feedback. The purpose of doing this is to get your input on how to improve the usability of our mobile app. You're going to be working with a mobile app that happens to be on paper. This is James he’s going to helping us today, he’s going to playing the mobile phone, and handing you the screens as you work on your task. How this works is this is your mobile phone area. You'll be using your finger to interact with the simulated touchscreen as you would a normal phone touchscreen. If there’s an area that you would normally type in with your keyboard you'll use this pen to write in what you would type at the keyboard. We will be giving you some time to get acquainted with the app, and then we will give you 3 tasks to perform. When you think you are done with a task, say “I’m done.”

Appendix C: The Three Tasks

Easy task:
It is late at night and you are trying to get home. You have heard of a service called NITE-ride, which will pick you up and take you there. Use the application to call NITE-Ride.

Moderate task:
You intend to travel to 7410 Yale Ave, and wish to know if the area is safe. Use the application to find safety information about 7410 Yale Ave.

Hard task:
It is late at night and you are trying to get home. Use the application to find a route to get to your home at 4316 Knox Rd from your current location at 7500 Princeton Ave.