

# Designing and Evaluating the Mobile Experience Through Iterative Field Studies

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## ABSTRACT

This experience report describes using iterative field studies to design and evaluate the mobile experience of soundtransit.org. One study aimed to evaluate the design of paper prototypes early in the design process and another study was conducted to test the implementation of an interactive prototype. In this report, we share our experience to provide readers with lessons that can be applied to conducting their own mobile field studies. Finally, we describe some of the broader impacts that have resulted from this work.

## Categories and Subject Descriptors

H.5.2 [INFORMATION INTERFACES AND PRESENTATION]: User Interfaces – *evaluation/methodology, mobile input devices and strategies, prototyping, user-centered design*

## General Terms

Design, Human Factors

## Keywords

User experience, mobile, field studies, paper prototyping, mobile user testing, user-centered design, usability testing, transit, government

## 1. INTRODUCTION

Creating a mobile experience has become crucial for most web sites. This was especially true for Sound Transit, a regional transit authority in the Puget Sound region that plans, builds, and provides transit services including commuter rail, light rail, and buses. Sound Transit's riders expect information resources that they can consult on the go.

This experience report details how Anthro-Tech designed and evaluated a mobile experience by conducting a series of field studies. Readers of this report will learn how field studies for mobile designs need to be adapted to acknowledge the context of the mobile experience. We provide details about conducting two field studies at different times in the user-centered design lifecycle. Finally, we share lessons learned from the experience that offer guidance to others planning their own field studies of

mobile products. The experience report concludes with broader impacts of the work.

## 2. BACKGROUND

### 2.1 Field Studies

Field studies are a collection of research methods adapted from anthropology and the social sciences. Field studies are useful because they help researchers collect more naturalistic data since they observe users in their context-of-use instead of in a lab.

Rosenbaum and Kantner describe field studies on a continuum with exploratory methods on one end, such as ethnography to more structured methods on the other, such as contextual inquiry and field usability studies [7]. The User Experience Professionals' Association's Body of Knowledge defines field studies as a method "for gathering user requirements" or "for studying currently executed tasks and processes" [3]. In these definitions, field studies are characterized typically as a tool for early ideation or understanding existing designs and practices, typically in a workplace setting.

### 2.2 Investigating Mobile in the Field

Mobile experiences add additional challenges and opportunities for field studies because the context-of-use is not a static location like a workplace, but instead is wherever a user happens to be with his or her phone. Researchers may consequently avoid studying the mobile context because it is often thought of as being logistically complex and resource intensive. However, as we demonstrate in this report, field studies can be well suited for investigating the mobile experience. They allow researchers to go to where the users are, understand how that context impacts their experience, gather design and technical feedback from realistic situations, and learn things that may not be apparent in a more controlled environment. Field studies are beneficial throughout the design lifecycle and not just during ideation, and, if well organized, are comparable to lab-based methods in terms of the resources needed to conduct them.

### 2.3 SoundTransit.org: The Need for a Mobile Experience

Sound Transit is a regional transit authority in the Puget Sound region of Washington State. As part of a larger effort to improve service for its riders, Sound Transit engaged Anthro-Tech to lead a user-centered redesign of their web site to make their site more rider-focused [10]. Usability studies provided evidence that users were more successful and satisfied with the redesigned site and the redesign was heralded as a success.

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SIGDOC '12, October 3–5, 2012, Seattle, Washington, USA.

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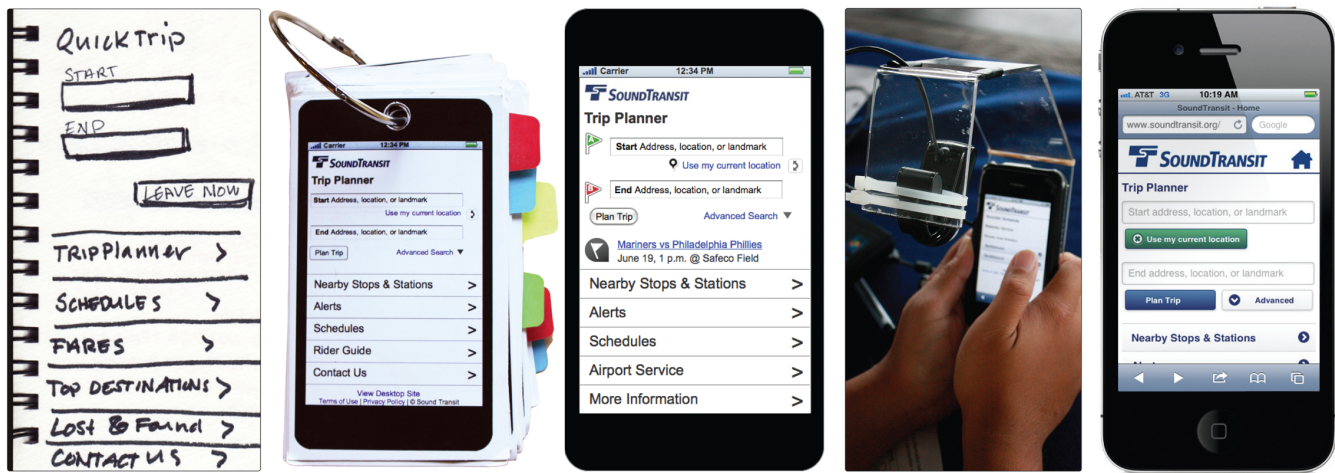


Figure 1 Iterative field studies of the paper prototypes and the interactive prototype shaped the final design of the soundtransit.org mobile site.

After redesigning the desktop site, it was clear there was a need for a mobile-specific experience, which is a natural extension for a transit site since users need to access information while on the go. Analytics of the site showed a 119% increase of mobile users accessing the site between March 2010 and March 2011. Interviews with riders and calls to the customer support line provided additional evidence that users required more information on their mobile devices.

Prior to the design of the mobile experience, smartphone users had to view the full desktop site on their mobile while feature phone users could not access the site at all.

Anthro-Tech helped Sound Transit research its users during the redesign of the desktop site, including gathering information about users' top tasks and personas. Given the ubiquity of internet-enabled mobile devices across many demographics [9], it was reasonable to repurpose that data and assume that those who were using the desktop site might also have access to a mobile phone. The mobile design needed to include the needs of *frequent riders*, such as daily commuters and those without personal vehicles (transit dependent), and *infrequent riders*, such as visitors and those who use transit to attend special events. Figure 2 shows the four personas that were the target of the design.



Figure 2 Sound Transit Rider Personas used for the desktop and mobile design of soundtransit.org

## 2.4 Following the User-Centered Design Process

Following the successful user-centered redesign of the existing desktop web site the Sound Transit mobile site was developed with the same approach by starting with understanding users and their needs.

Following the user-centered design process, we iteratively designed and evaluated a concept for the mobile design, starting with low fidelity sketches, creating a paper prototype, and finally creating an interactive prototype (see Figure 1). During each iteration, a team of Anthro-Tech researchers and Sound Transit staff gathered feedback from stakeholders and users. This experience report focuses on the two field studies the team conducted on the paper prototype and the interactive prototype.

## 3. STUDY 1: PAPER PROTOTYPE

The objective of the first field study, conducted early in the design process, was to evaluate paper prototypes with users. Anthro-Tech created digital prototypes in Axure RP [1], using the list of users' top tasks. These tasks guided the decision about which pages of the mobile prototype to develop. Using a digital tool like Axure RP to create the prototype had several advantages over using pen and paper. First, it allowed us to create templates that could be re-used across the different pages of the site. Second, it streamlined keeping track of different versions of the prototype to test with users. Third, it made it easier to make changes to the prototype. Finally, it allowed team members to collaborate on the design of the prototype without having to be co-located.

### 3.1 Prototype Design Considerations for the Field

Based on conducting similar studies in the past, the Anthro-Tech team of researchers knew the materials needed to be designed to be suitable for a field study. First, we wanted the prototype to be *portable* so that it would be easy for facilitators to carry. Second, the prototype needed to be *usable* so that participants could easily understand how to interact with it and the researchers could easily

facilitate it during the study. Third, it needed to be *durable* to withstand use by multiple people throughout a day of studies.

To meet these considerations, the prototypes were printed on cardstock – making them durable – and cut to the size of a medium-sized iPhone – making them portable. We also bound them together using a large binder ring and marked off the different sections of the prototype using binder tabs. These made it easy for the facilitator to change the order of the prototype and flip through to the correct page as participants “tapped” through the prototype. We also adapted our pre- and post-study questionnaires, the list of scenarios, consent forms, and honoraria receipt forms to be portable, durable, and usable as well. The research team stowed the materials in the pockets of the Sound Transit-branded aprons we wore in the field. The aprons not only turned our researchers into roving self-contained usability testing units, but also helped us appear “official” and trustworthy when we interacted with participants.



Figure 3 Study materials were developed and selected for being portable, durable, and usable in the field.

3.2 Creating Scenarios

The study scenarios selected represented users’ top tasks and focused on ones that were particularly relevant to the mobile setting. These included tasks such as planning a trip, finding out when a bus will arrive, and looking for transit alerts that could impact travel plans.

3.3 Study Planning and Preparation

To make the best use of our limited time in the field (approximately two hours), our research team consisted of five researchers total from Anthro-Tech and Sound Transit. Having multiple facilitators helped us evaluate the prototype with more participants. The lead researcher developed the study materials and the rest of the team piloted the materials to refine them. This also gave the team a chance to familiarize themselves with the prototype and customize the ordering of the pages if needed. Additionally, official clearance from Sound Transit was arranged in advance of the study date so that we could conduct the study at transit stations and on Sound Transit vehicles.

3.4 Field Site

The field study took place in the morning to include representation from daily commuters. Field sites included a transit station in downtown Seattle, and riding different modes of transit, including buses, light rail, and a commuter train. Conducting

studies while riding transit posed challenges, but it also ensured that we could recruit actual Sound Transit users.

3.5 Conducting the Study

Participants who consented to take part in the study were asked questions on demographics, transit use, usage of the Sound Transit website either on their desktop or mobile. We presented the prototype to participants and asked them to complete scenarios using think-aloud protocol [2]. Each researcher took detailed notes during the sessions. We found that taking notes while in transit was challenging. Findings that emerged across our participants were documented as we moved page-by-page through the prototype. Following the study, we asked participants questions about their experience with the prototype. Participants were offered coffee shop gift cards and transit passes as honoraria. For more information about who participated in the study, see Table 1.

Table 1 Breakdown of participants in the paper prototype field study (n = 33)  
# of Participants

|                             |    |
|-----------------------------|----|
| Male                        | 16 |
| Female                      | 17 |
| Phone Ownership             |    |
| Owns smart phone            | 17 |
| Owns feature phone          | 4  |
| Does not own a mobile phone | 2  |
| Transit Use Frequency       |    |
| More than 1 time a day      | 8  |
| Daily                       | 8  |
| Weekly                      | 4  |
| Less than once a month      | 2  |

3.6 Analyzing the Data

Immediately following the field research, the team met with the Sound Transit project sponsor to debrief on the study findings. Scheduling the debrief session immediately after being in the field enabled us to document findings while they were fresh. This was important due to the difficulty of taking detailed notes while on transit. The final deliverable from this research activity was a detailed list of findings and recommendations for improving the next versions of the prototype.

4. STUDY 2: INTERACTIVE PROTOTYPE

We iterated the digital prototype based on the feedback from the paper prototype field study. Based on this design, the development team from Sound Transit and OpenPlans.org then built a functional, interactive prototype that used live data. We conducted a second set of field studies to observe how riders would interact with a live site and understand how the site performed on riders’ own phones.

4.1 Creating the Mobile Sled

For the second field study we wanted to be able to record the study sessions with mobile users and allow them to use their own devices. To do so we decided to build a mobile test sled for the interactive prototype study. The set-up had several requirements.

First, the set-up needed to allow users to hold their phones as naturally as possible. Second, it needed to support a web cam that could be angled to observe and record the user's screen. Several options existed, ranging from do-it-yourself mobile testing sleds [5, 6, 8] to more fully-featured kits that included custom cameras [4]. Third, the testing set up needed to leverage the existing equipment we used for usability testing (including cameras and usability testing software). Finally, the testing solution needed to look professional. Since participants would be using their own phones we wanted to ensure the testing solution wouldn't damage their devices and would accommodate a variety of phone form factors (including flip phones). This requirement led us to conclude that DIY solutions would not work for our needs.

The solution we chose was a mobile testing sled design adapted from a design from the California Digital Library [6]. The modified design was then professionally fabricated at a local plastic shop. The design of the sled supported different kinds of web cameras and accommodated different mobile phone form factors. Because it was made from plastic, it was light enough for participants to hold in their hands.

## 4.2 Mobile Testing Configuration

To conduct the study, we set up two stations, each consisting of a mobile testing sled, a laptop, and a web camera. The cameras were secured to the sleds using zip ties. The web camera was connected via USB extension cords to a laptop running Morae Recorder to record the sessions. Extension cords were important to give participants more freedom to move their phones and interact with them more naturalistically. The facilitators secured the participants' phones to the sled using rubber bands, which could be easily adjusted and removed without risk of damaging a participant's phone. An example of this set-up can be seen in Figure 3.



**Figure 3 Interactive prototype field study included a mobile sled to record participants using their own mobile phones.**

In order to get clear video, it was important to be able to adjust the cameras' brightness settings and focus manually. At the beginning of each session, we adjusted the camera settings to optimize the recordings of the mobile phone.

## 4.3 Field Site

We conducted the field study of the interactive prototype at the Sound Transit Link Light Rail station at Sea-Tac International Airport. We chose this location because it allowed for recruitment of target users of Sound Transit. Specifically, it helped us to reach

visitors, who are traditionally harder to recruit since they are typically in the area only temporarily. This location also helped us recruit locals who were traveling or going to work at the airport. Similar to the paper prototype study, we received permission and support from Sound Transit prior to conducting this study.

The study station was in an area next to the light rail ticket vending machines, which made us highly visible, but out of the way of those who would not want to participate, see Figure 4.



**Figure 4 Choosing a site located next to transit ticket vending machines at the airport made it easy to recruit participants.**

## 4.4 Roles and Responsibilities

Like the paper prototype study, the research team for this study included both researchers from Anthro-Tech and Sound Transit. In order to maximize our time, conduct sessions with as many participants as possible, and capture data efficiently, we divided the responsibilities of recruiting, facilitating, and note taking between the four-member research team. Three of the four team members facilitated the studies with users, while the remaining team member acted as a dedicated note taker who would record notes relayed to them by the facilitators into a spreadsheet.

Having a dedicated note taker was beneficial because it maximized efficiencies. In between sessions, each facilitator could debrief and share their findings with the note taker, who would then record the information and start to analyze the data. Then that facilitator was free to prepare for the next participant. Meanwhile the other facilitators were recruiting users or conducting sessions.

## 4.5 Recruiting

We recruited participants by directly approaching people in the station and by asking those who came to us to ask for information (sometimes about the study, but more often about trip or fare information). We asked participants if they had a mobile phone with Internet access and screened out those who did not. For their participation, we offered all-day light rail passes as honoraria.

## 4.6 Conducting the Study

After consenting to participate and be recorded, participants completed a written pre-test questionnaire while the facilitators set-up the participant's phone on the testing sled and adjusted the cameras to record the session. During the study, the participant was asked to complete several scenarios similar to the ones used

in the paper prototype study. They were asked to complete the scenarios on their phones using think-aloud protocol. For more information about the participants, see Table 2 below.

**Table 2 Breakdown of participants in the interactive prototype field study ( $n = 13$ )**

|                              | # of Participants |
|------------------------------|-------------------|
| Male                         | 7                 |
| Female                       | 6                 |
| <b>Phone Ownership</b>       |                   |
| iPhone                       | 10                |
| Android                      | 1                 |
| Other smartphone             | 2                 |
| <b>Transit Use Frequency</b> |                   |
| More than 1 time a day       | 2                 |
| Daily                        | 2                 |
| Weekly                       | 3                 |
| Less than once a month       | 2                 |
| Less than once a year        | 4                 |

## 4.7 Analyzing Data

Between sessions, the note taker conducted preliminary analysis and grouped similar findings and themes. At the end of the day, the team debriefed to review the preliminary analysis, generated additional findings, and developed a prioritized list of changes that needed to be made to the site. This list was shared with the development team to review, prioritize, and implement.

## 5. LESSONS LEARNED

The two field studies were critical to the design and development of the new mobile site. Each study had different goals and designs, but together they provide several key takeaways that can be helpful for others conducting field studies.

### 5.1 Field Studies Can Make Recruiting Easier

Conducting research in the field made it easier to recruit participants. Being at stations and on transit ensured that we could find participants who were actual users of Sound Transit's services. Had we conducted only a lab study, our visitor user group would have been challenging to recruit, not because they're rare, but because they're only temporarily in the area. In the field we were easily able to find visitors to recruit for our studies.

Choosing an appropriate site to conduct field studies was key to the success of our studies. Since participants were recruited opportunistically and not scheduled in advance, we needed to design a study that would maximize our chances of finding willing participants. We chose sites where we could recruit a captive audience, i.e., an audience who had the ability and opportunity to participate in a study and did not have competing obligations. People at the airport and riding on buses had free time and were willing to take part in a study.

### 5.2 Combine Field Studies with Lab Studies to Leverage the Recruiting Strengths of Both

The recruiting criteria for the field studies included finding participation across the user groups, but also across types of phones. We anticipated that it would be difficult to find users with internet-enabled feature phones in the field. Therefore, we complemented the fieldwork with one day of lab usability testing to recruit and schedule these users in advance.

### 5.3 Careful Planning is Key to Success

Field studies can be logistically complex, which is why careful planning and preparation is key. The success of these studies hinged on careful logistical planning, preparing the research team, and developing tools that were suitable for the field.

We needed to plan time to get the appropriate clearances to conduct studies on Sound Transit property, have the client approve study materials, and obtain honoraria. Staying on top of these administrative details ahead made sure we could conduct the studies as planned.

Also, both of our studies needed to take place in half of a day, so the research team needed to be well prepared. Preparation included getting everyone on the research team familiar with the prototype, walking through a full study, and making changes to the materials based on feedback from the walkthroughs.

We spent time developing study materials and creating research tools for the field. Creating paper prototypes are beneficial for trying out a design and iterating it based on user feedback prior to moving forward with coding and development. However, creating a paper prototype that was field-friendly required additional assembly and preparation. For both studies, we developed alternative, shorter consent forms and questionnaires to allow more time to evaluate the prototype. For the interactive prototype study, we researched, designed, iterated, and fabricated the mobile testing sled. For this study, we also created a note taking spreadsheet that would make it easy for our dedicated note taker to catalog and analyze findings as the study progressed.

### 5.4 Provide Different Options to Participants

In our paper prototype study, we presented potential participants with two options to participate: a short five minute study with fewer questions and scenarios in exchange for a transit ticket, or a longer 15-minute study in exchange for a gift card. We provided two alternatives to acknowledge that while we may have a captive audience on transit, some people may only have a short amount of time to participate. Presenting two study options allowed us to reach more participants than we might have otherwise.

### 5.5 Involve Clients as Researchers

Anthro-Tech helps organizations embrace user-centered design and bring these techniques into their existing processes. Including clients in research is key. Sound Transit staff played a critical role on the research team. They provided subject matter expertise on the intricacies of transit, provided input and feedback on design concepts and helped design the scenarios and study materials. Being involved with the research, helped Sound Transit staff effectively communicate design decisions to the development team and advocate for user-centered design to project stakeholders. The staff were also key in helping to execute the

recommendations and make decisions about implementing the mobile experience of the site.

## 5.6 Collect Feedback on the Broader Rider Experience

Though the field studies focused on the design of the mobile web site, the research yielded many findings about the broader transit experience. Findings included users' impressions about the experience of riding the bus or train, what information they seek when they first arrive at the airport, and how they experience transit and transit tools in their hometowns. We may not have learned about these things if we only conducted lab studies. Ultimately, the field studies broadened the focus of inquiry to look at the end-to-end experience, not just the online experience. These findings are helping the organization look beyond the online experience and consider the impact of their stations, signage, vehicles, and beyond.

## 6. IMPACT BEYOND MOBILE

While the results of both field studies helped to validate and refine the mobile design concepts, the studies had additional impact beyond the mobile site.

First, the studies helped uncover design opportunities for the desktop site in addition to mobile. We learned that users of the mobile site use and value location-based and context-aware transit information, such as stop-specific information and trip planning. Users were also interested in having location and context aware features on the desktop site. As a result, Sound Transit is in the process of porting some of the features developed for the mobile experience back to the desktop site.

Second, the studies have helped the Sound Transit understand the broader transit experiences of their riders. Involving employees in the research and sharing rider experiences have encouraged Sound Transit to include user-centered design in additional areas such as signage and ticket vending machines.

Finally, the results of these studies have helped Sound Transit become recognized as a leader and model for other government organizations in the region in employing user-centered design methods to create better experiences for their customers.

## 7. CONCLUSION

Many organizations share Sound Transit's goal to create a compelling mobile experience that complements the experience of their desktop site. With the increasing ubiquity of mobile devices and applications, designers and researchers need methods that help them create products for mobile users, and in particular, methods for studying mobile use in the field. Our experience report shows how Anthro-Tech uses field studies to drive mobile product development and create lasting impacts.

## 8. ACKNOWLEDGMENTS

We are grateful for the opportunity to collaborate with the Sound Transit team on this research especially De Meyers and Jaime Vogt. Their involvement in these studies and commitment to making data-driven and customer-centric improvements led the way.

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