Assignment 2d: Design Research Review
CSE 440 Section AB | Distracted Drivers

Summary of Key Findings

We pursued four participants for our design research. When selecting our participants, we aimed to diversify levels of driving experience and reasons why they drive. We targeted two general demographics of drivers. The first demographic consists of *casual drivers*--people who drive for personal errands and common commutes (e.g. to work or school). The second demographic consists of *professional drivers*--people who make driving their career.

We primarily conducted interviews and fly-on-the-wall studies, since contextual inquiry posed a safety risk to our drivers. After synthesizing the results, we noticed an emergence of common themes, problems, and practices. This included general awareness of road safety, distracting behaviors, and privacy concerns. Informed by our design research, we were able to identify tasks essential to our design. Tracking common distractions and incorporating modern technology will be at the heart of our design.

Design Research Participants

Lynn, our first participant, is a soil scientist with the U.S. Forest Service. She owns a 2016 Subaru Impreza that she drives for word and leisure. She also checks out cars from a government-provided fleet, and she has driven a variety of vehicles. We first conducted a fly-on-the-wall study of Lynn's driving behavior on a short drive. While she was driving, she would glance at her phone every time she received a message. She also used Siri and Bluetooth controls to avoid physical interaction with her phone. Following this observation, we did an interview. She shared that her cell phone is the most distracting element of her daily commutes. We also discovered that Lynn is fully aware of potential distractions, and she seriously considers consequences of risky driving habits.

Stephanie, our second participant, is a casual driver with 36 years of driving experience. She primarily drives herself and her family in a 2016 Toyota Prius for her daily work commute, errands, and leisure. As a computer engineer at the Department of Defense, she is aware of privacy and security issues associated with data collection and the internet-of-things. With this expertise, she suggested that we store driving statistics locally rather than on the cloud. As we interviewed Stephanie in her car, we noticed that there seemed to be a generational difference with our previous casual driver, Lynn. The distractions that she faces on the road are further removed from interacting with her phone (e.g. checking messages or social media) and closer to external distractions (e.g. passengers and views). She shared that she rarely touches her phone when driving.

Jim, our third participant, is a retired law enforcement officer and a drive instructor from the *911 Driving School*. Jim has been driving since the 1970s, which amounts to 40+ years of driving experience, and has been an instructor for 8 months. He believes that anything that can take people's eyes off the road is distracting, such as views/accidents on the road, as well as the use of cell phones. When we asked him to identify common mistakes of new drivers, he pointed out

primarily mechanical behaviors; for example, new drivers often fail to signal, check their mirrors, or glance at blind spots. Although students don't check their phone during lessons due to the nature of the situation, Jim has noticed that students' attention span varies depending on the time of the day. Students in early morning lessons who are tired tend to make more mistakes than those who are more energetic and focused in later lessons.

A bus driver on Route 67, our fourth participant, was the subject of a fly-on-the-wall study. We got on bus 67 from UW and sat on the seats closest to and across from the driver (the disabled seating area). We did not tell him that we were observing him because we wanted to see how he genuinely drives. We observed that the driver was usually very attentive to everything around him. He would look into his rearview mirror to keep an eye on passengers, check his side mirrors when changing lanes and turning, and looked around often. There was an instant when a passenger was talking to the driver and he almost missed a stop. This was clearly dangerous behavior, but it was not the driver's fault. However, this shows that even professional drivers can become distracted even if it isn't from phone usage or exhaustion.

Design Research Themes

High-level themes and problems

Concerns surrounding privacy were common amongst the participants we interviewed. We first discovered this theme when asking our participants: "If we provide a device to track your driving behavior, what types of functionality do you expect it to have?" Most responded with a sort of eye or body movement tracker, and further questioning reveal minor concerns regarding security. Lynn shared, "I don't like the idea of having a camera watching me." On the other hand, Jim and Stephanie were extremely open to allowing data collection *only* in the case that their information was not being shared publicly (i.e. via the internet). Privacy is a legitimate concern, especially since adversaries can obtain and manipulate data for illegal use. Our design may potentially rely on the ability to see what the driver is doing, and therefore, we need assure people that data is only being processed locally.

We have discovered plenty of common distracting behaviors that people have while driving. The one mentioned the most was the use of cell phones, especially texting and calling while driving. Switching radio stations, looking at GPS navigation, tuning AC controls, and other interactions with car technology may also be a cause for concern. Some people also revealed that they drink, eat, and put on makeup while driving. Other than distractions from the car and themselves, drivers can also be distracted by having conversations with passengers, as well as accidents or scenery along the road. In other words, anything that takes one's eyes off the road is a distraction, which poses a serious threat to both the driver and everyone on the road. Finally, people tend to be more easily distracted when they are tired. We will focus on tracking these behaviors in our design.

Clearly, people are concerned with road safety. Nobody goes out to drive with the goal of getting distracted and possibly hurting someone. However people still do things like use the audio assistant (e.g. Apple's Siri) on their phone, talk on the phone through Bluetooth, change radio stations, listen to music, and use their phone to play music. These activities do not seem like distracting behavior

to our participants. One of our participants said that she listens to music while driving and that the only distracting part is if she has to switch songs or change channels. Another one uses her car audio and Bluetooth to chat on the phone. We asked participants to rate the level of distraction for a variety of activities, and there was a general consensus that most things affect their ability to drive safely.

We discovered that the presence of a passenger or a supervisor has a big influence on whether our participant will engage in distracting activities while driving. In both Stephanie's and Lynn's interview, when asked what stops them from doing distracting behaviors, they said that warnings from passengers reminds them to keep their eyes on the road. In our interview with Jim, we learned from his professional experiences that students rarely engage in distracting activities when they know they are being watched. The presence of a supervisor reminds drivers that they are being held accountable for their actions, thus preventing them from engaging in distracting actions.

Potential Design Tasks

After synthesizing the information gathered from our research, we were able to identify multiple tasks to design for. We also received several suggestions on ways we can confront common concerns. Tracking common distractions is key to discourage risky driving behavior; a reward system may also provide incentive for users to develop safe driving habits. A huge area of opportunity in this project lies in modern technology, such as voice recognition software, Bluetooth audio, and natural language processing. Finally, solving privacy issues is the greatest challenge to our design, so assuring our users that their data is safe remains a priority.

Task Analysis

1. *Who is going to use the design?*
   People who drive will use our design. In addition to benefiting individual drivers, our design will also work well when two or more parties are involved and data needs to be shared. For example, our design may benefit parents and their children, drive instructors and students, and taxi/Uber/truck companies and their contractor drivers.

2. *What tasks do they now perform?*
   People can purchase tracking devices to collect data about their car, braking frequency and turning speed. People can also purchase signal blocking devices which block phone signals when the car is moving. Also, many newer versions of cars come with preinstalled programs that discourage drivers from engaging in very distracting activities such as typing in addresses into the GPS and adding new Bluetooth devices. In addition, people avoid taking their eyes off the road and hands off the wheel by utilizing voice recognition installed on their phone and on cars to perform tasks.

3. *What tasks are desired?*
   People want to be reminded to stay safe on the road. They want good driving behaviors to be reinforced and rewarded. People want to cultivate good driving habits, which may require data collection on eye movements, head positions, and body positions, but they also want to ensure their privacy is maintained.

4. *How are the tasks learned?*
   Tasks can be learned through intuitive tutorials or instructional videos that will show our design's features. The user can be periodically reminded of the consequences of distracted driving through interesting statistics.

5. *Where are the tasks performed?*
   Tasks are primarily performed in the car. They can also be performed later on at home to review stats and to compare driving habits with friends. The tasks can also be done in a company setting, where employers or insurance companies track their employees and customers, respectively.

6. *What is the relationship between the person and data?*
   Data will be collected on driving behavior, which includes records of face, head, and body positions of the driver. It will be completely personalized to the user.

7. *What other tools does the person have?*
   Native phone apps can track the usage of phones directly. There is existing technology that can block the phone signals (e.g. airplane mode), which might keep drivers from interacting with their phones. There are also some devices that are currently used by insurance companies that tracks the states of cars.

8. *How do people communicate with each other?*
   A potential design can track and analyze people's driving behavior. Hence, parents and driving instructors can track the driving performance of their children and students, respectively. Users can also share safety scores graded by the system with families and friends. Passengers of ride-sharing services, such as Uber, can potentially learn about their driver's safety score before hopping on a car.

9. *How often are the tasks performed?*
   Tasks will start every time one drives. It will record and analyze in real time. The data will be stored and ready to be shown the user.

10. *What are the time constraints on the tasks?*
    One of the time constraints is providing drivers real time processing and feedback. It is important to give live updates and reminders when the driver is engaged in dangerous activities. We also want to provide cumulative data to drivers so they can track their driving habits over an extended period.

11. *What happens when things go wrong?*
    This design should discourage unsafe driving behaviors, so we do not want the tool itself to be a distraction. Since a device will give warnings when it detects a potential distraction, a possible error is to misjudge people's behaviors and warn them even if they are not distracted. We also intend to secure our users' information, but personal data can be leaked if there is a security loophole; if things go wrong, we need to make ensure that the data is not incriminating or personally identifiable information.