**Interactive Hi-Fi Prototype**

StanX

Problem and Solution Overview

Students, faculty, administrators, and visitors often have shallow knowledge of Stanford's history because of gaps in Stanford's dominate narrative. These omissions cause members of our community to feel left out, and leave visitors unsatisfied. There is a need to help people on Stanford's campus dive deeper into the fascinating hidden and under-told stories of our university. StanX is a mobile augmented reality app that addresses this need by presenting users with curated photos and audio, placed throughout campus, that allow users to learn more wholistically and profoundly about Stanford.

Tasks and Final Interface

Simple: Exploring

Explore mode is StanX's default mode. While in explore mode, the user walks around campus and looks through their phone. As the user moves through campus, they see a landscape of photos within a 100 meter radius of their current location, scaled in size according to their proximity to the user, through their phone. Blue arrows help the user point their phone in the right direction to find photos near to them.
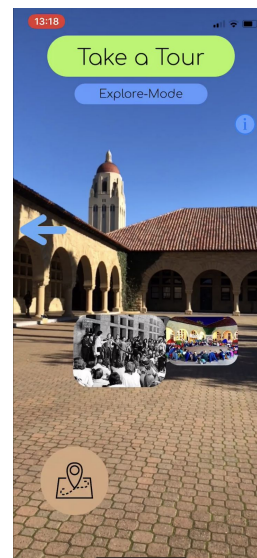
StanX in Explore mode, with the user's present status indicated at the top of the screen (Figure 1)

Moderate: Interacting

If a user does not wish to simply explore and find photos by walking around Stanford's campus, they can use the map as an alternative. By clicking the map icon, a user can see a map of Stanford's campus, marked with three different types of pins: red pins for the start of tours, blue pins for unseen photos, and green pins for seen photos. By clicking on a pin, the user can learn more about what awaits them at the pin they've clicked. For unseen pins, the user can only see the title of the story, to incentivize their actually visiting the site. Beyond looking at photos, users can interact with photos. Upon clicking a photo, a popover appears with a description of the photo and its importance. The user can scroll through this description, and that photo is marked as seen and now appears as a green pin on the map. Additionally, some photos have audio connected to them. Upon clicking the description, a user can hear this audio by clicking the play icon on the popover. To restart the audio, the user can click the replay icon.
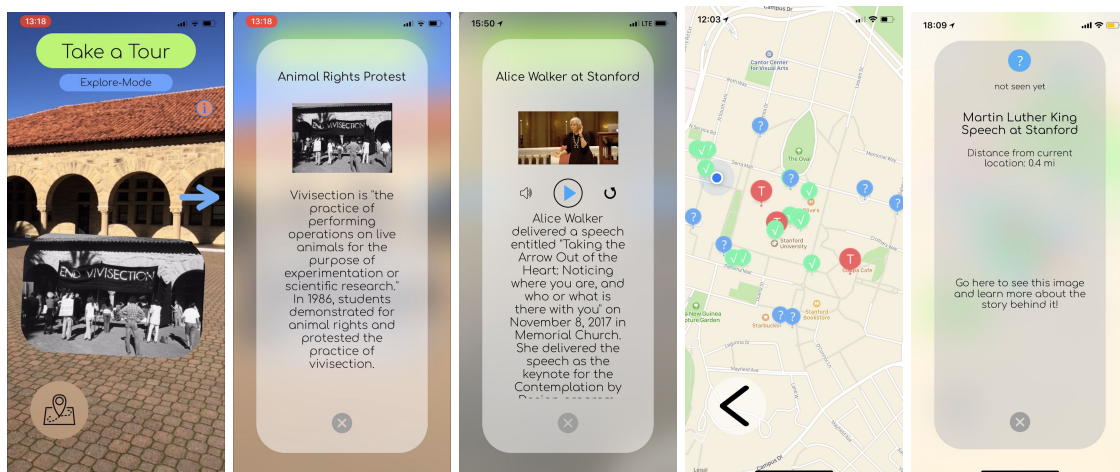

The different ways a user can interact with photos, audio, or the map (Figure 2)

Complex: Touring

Rather than creating their own paths through Stanford, users can click the 'Take a Tour' button at the top of their screen. Upon clicking this button, a user is presented with a list of tours, including each tour's title and duration. If the user is interested in a particular tour, they can click that tour, and a popup will appear with a description of the tour. If the user wants to take the tour, they click 'Start Tour' if they're already at the tour's start. Otherwise, they click 'Take me to starting point'. For each tour stop pink arrows appear guiding the user to it. Photos not related to the tour do not appear on the tour to avoid confusion. At the top right, a counter indicates the user's progress through the tour, and at the top left, the user sees how far they are from the end of the tour. After the user has viewed the last photo on the tour, they can click 'Done' to end the

tour; however, the user is always able to cancel the tour by clicking the 'Cancel' button at the top of the screen.
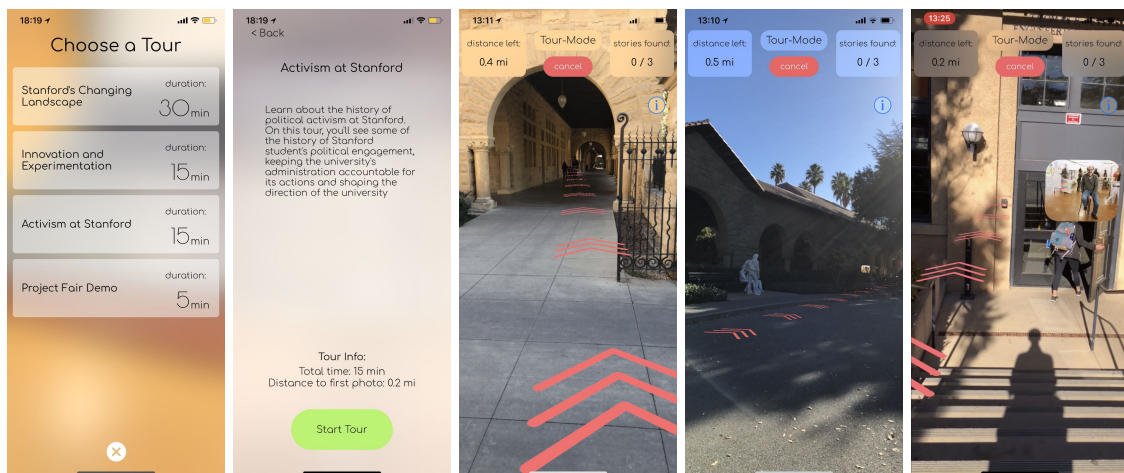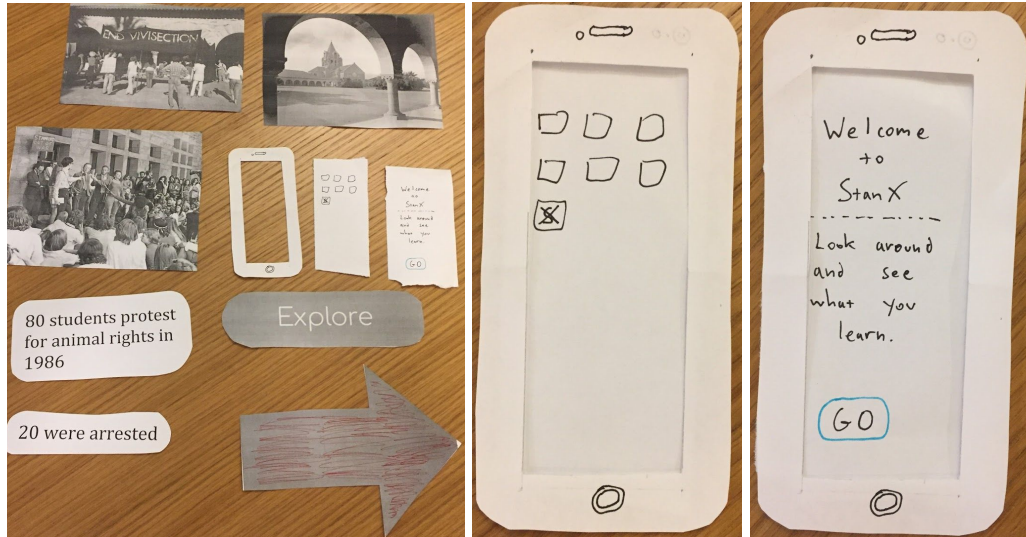

Touring through Stanford with StanX, a user picks a tour, chooses to start that tour, and follows that tour's directions (Figure 3)

Design Evolution

Our very first prototype of StanX (Figure 4)

Photos of our Low-Fi paper prototype, in which we faked a mobile augmented reality experience (Figure 5)

In our initial UI (Figure 4), in which we simply wanted to test how compelling seeing historical photos in space was for users, we only envisioned placing photos in space and allowing users to learn more about them by clicking a 'Learn More' button. From this initial UI, it was clear users wanted more ability to see related photos and discover photos, without having to walk around the entire campus hoping to find content.

Thus, in our Low-Fi prototype (Figure 5), we incorporated an 'Explore' mode, in which arrows appeared to guide users to new content. We found, however, that users felt uncomfortable hitting an ambiguously labelled 'Explore' button, and wanted to know what kind of content they were being taken to see and how long the journey would be. They also wanted to be able to plan their own journeys. The general theme of our feedback from our initial UI and Low-Fi

prototype was to provide users with more information and guidance. With this feedback in mind, we decided to make the following modifications to StanX:

1. Create tours

   We completely redesigned the 'Explore' mode, and decided to explicitly build tours into the app. We decided that by having tours, we could group similar content, provide users with descriptions of what they would see, and give users an idea of how much time their journey will take. Through tours, we allow users to see content of interest to them, and allow them to make an informed decision about allowing StanX to help them find new content, which addresses much of the feedback we received during user testing.

2. Add a map view

   To further allow users to see what content is available for them to explore, we added a map to the app, on which users can see pins at locations with content. By looking at the map, users can plan their own journey through campus, and therefore have an alternative way of discovering content if they do not have the time or desire to take a tour.

3. Prompt users to interact with photos

   For some users, it was not clear that they could click on photos, so in our Medium-Fi prototype we added small text under photos, letting users know that photos are clickable. We hoped this would make interacting with photos more intuitive.

We incorporated these changes into our Medium-Fi prototype (Figure 6).
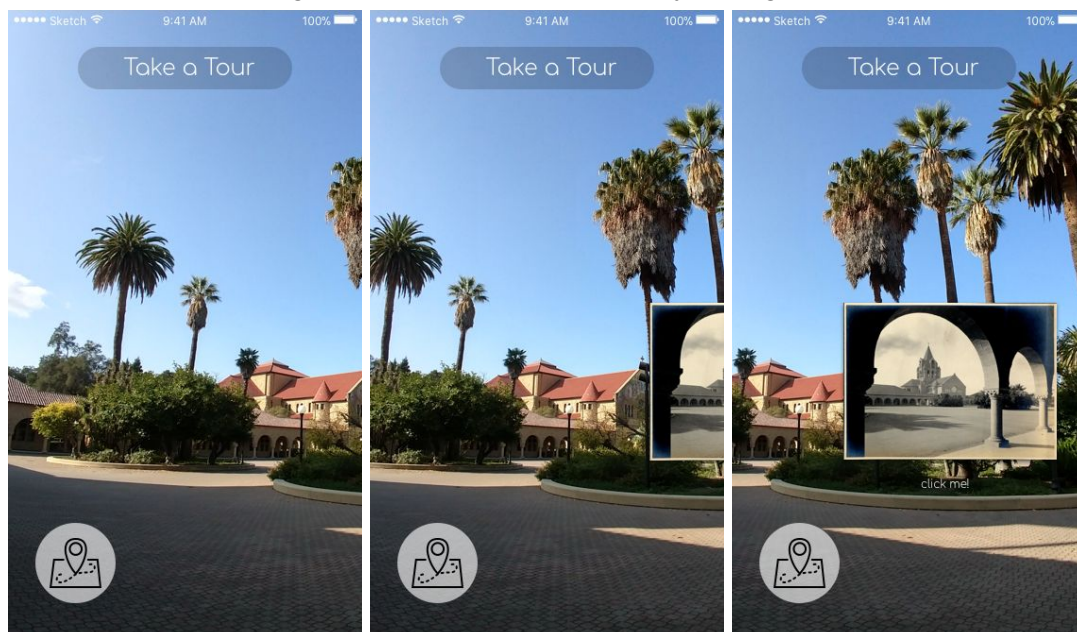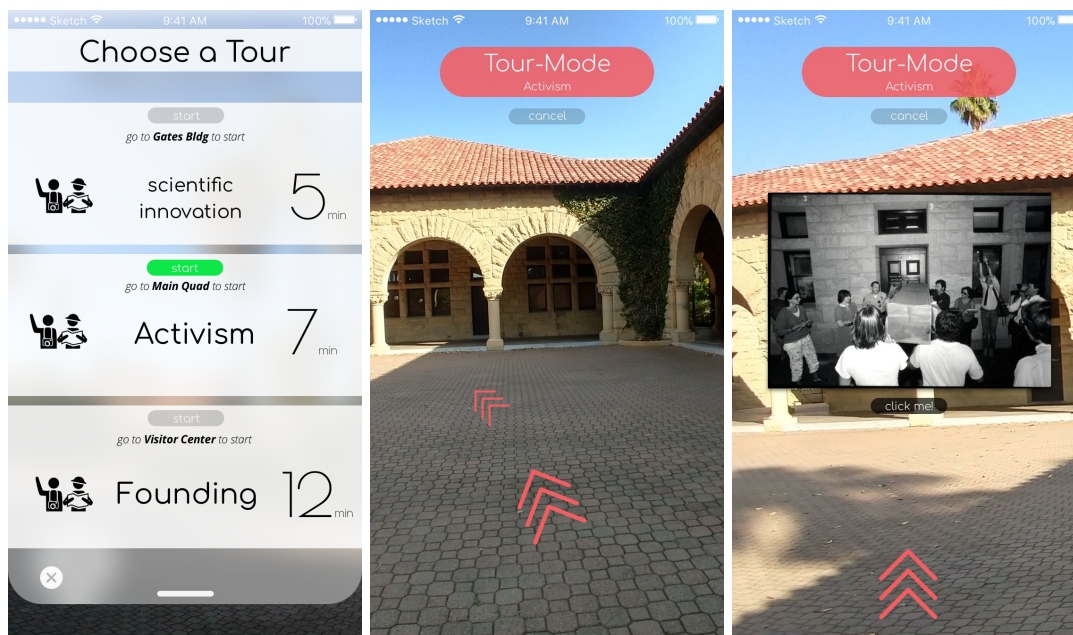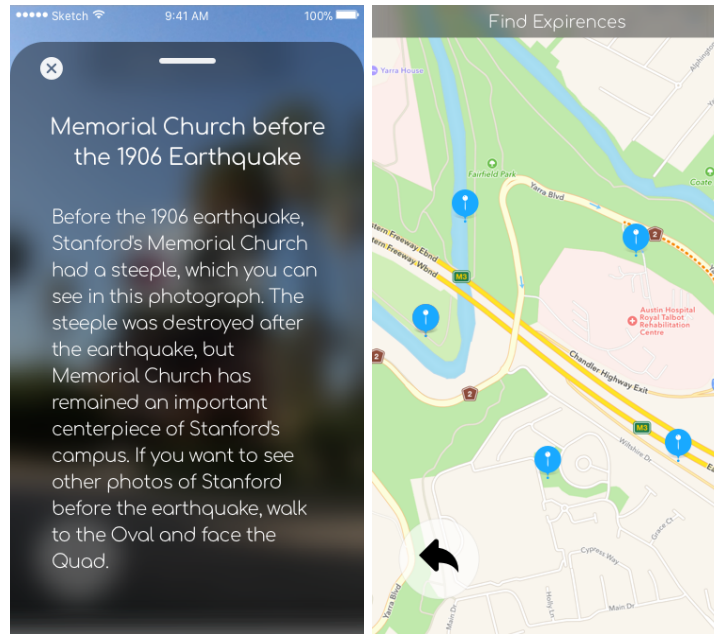
Our Medium-Fi Prototype, with our three tasks of exploring, interacting, and touring (Figure 6)

Major Usability Problems Addressed

From our Medium-Fi prototype, we received a heuristic evaluation which identified several problems. For each problem, we implemented the solutions listed below.

1. Explore mode unclear

   Problem: It was not clear for users that upon opening StanX they are free to walk around and find content.

Solution: We added a status at the top of the screen, stating that the user is in Explore mode. We added a small, standard information icon, describing Explore mode to users.

2. Instructions to click photos

Problem: The 'click me' under photos in the Medium-Fi prototype made it seem like the text rather than the photo might be clickable, and the 'click me' might be difficult to read depending on the background.
Solution: We placed instructions to click photos under the information section.

3. Map interface does not show where you are

Problem: The map interface in our Medium-Fi prototype had no indicator of a user's current location, making the map potentially disorienting for users who are less familiar with campus.
Solution: We added an icon showing a user's current location on the map.

4. Map interface unclear

Problem: In the Medium-Fi map, it was not clear what pins represented. Our evaluators thought all of the pins were the start of tours.
Solution: To make the map clearer, we created three different types of pins: seen, unseen, and tour starts. The tour pins are clearly marked with a 'T'. We distinguished between seen and unseen pins to appeal to expert users who may use the app frequently and don't want to revisit sites. Further, we made all pins clickable so that users could learn more about a location on the map.

5. Photos are occluded by their descriptions

Problem: In our Medium-Fi prototype, upon clicking a description of a photo, that photo would be completely covered by the description, not allowing users to move back and forth between reading text and viewing the photo.
Solution: We placed the photo corresponding to a description at the top of that description, so that the photo is always viewable.

6. Not enough information on tours

Problem: Though tours in our Medium-Fi prototype had a title, the tours were still ambiguous for users.
Solution: To provide users with more information, we wrote descriptions of tours, which appear when a tour is clicked. Users then decide from the description if they would like take the tour.

7. Not enough guidance within tour-mode

Problem: From our Medium-Fi prototype, it was not clear how a user would get to the start of a tour, or how a user was progressing through a tour.

Solution: Upon choosing to take a tour, we created two different screens--one that allows a user to immediately start a tour if they are the start location, and another on which the user can click a button to be taken to the tour's start. Within tours, we added a progress counter at the top right, and a distance to the end at the top left, to give users information as they progress through a tour.

Prototype Implementation

We implemented our Hi-Fi prototype using Apple's Xcode with Swift and the new augmented-reality package ARKit. We chose not to include any Wizard of Oz techniques, especially as our app maintains very little user state and we wanted to provide a real demonstration of what the AR experience would feel like.

We fully implemented every feature that we prepared in our Medium Fi prototype, which allowed us to have a complete understanding of StanX in real life. Our app can be divided into two main sections: the augmented reality screen and the 2D map screen:

1. The augmented reality screen contains 2D photos which float in AR space, and AR arrows which appear to stick to the ground (they're placed two meters below the camera). The photos are placed relative to the camera using GPS so that they are in their "correct" location (ie a photo taken in the quad can be found in the quad when using StanX). To increase the robustness of the AR system it is backed with GPS to check drift over long distances and correct for any error. Finally, the AR screen also contains the "Take a Tour" interface which pulls in walking directions from Apple maps so we can place arrows on the ground in AR for you to follow around.
2. The map screen contains custom implemented pins and info screens to allow you to know which photos you've seen and which you've missed, along with locations of where the tours start. Each pin item has its own info screen that will pop up if you click on it.

StanX contains many screens, all of which were created in Xcode's Storyboard and are filled in the moment by code in the app.

To populate the app with content, we curated photos and audio from Stanford's archives and other sources. We researched each piece of content to write informative descriptions of each, and placed each one at a related location on campus. We grouped related content into the tours that appear on StanX.

Summary

StanX is an augmented reality mobile app that allows users to discover stories about Stanford through photos and audio. Throughout the quarter, we have repeatedly iterated on our design of StanX, attempting to decrease ambiguities for our users and make our content more easily discoverable. We now have a working augmented reality app that we would eventually like to

share with our community. We hope that StanX fills some of the gaps in Stanford's narrative for community members, as well as for visitors.