

ExplorAR AR Urban Exploration App

Javier Guzman
Luyun Shao
Paola Favela
Omkar Dixit

College of Computing and Digital Media, DePaul University
HCI 594: Capstone (Group 1)
Professor Hank Streeter

November 14, 2021

HCI 594 Project Final Report	Team: Group 1
	Date: 11/15/2021

ExplorAR AR Urban Exploration App

1.0 Abstract

This project sought to develop an AR platform that was both entertaining and informational. Based on our competitive analysis and literature review, we identified a need for AR platforms that are substantive and informative as opposed to gimmicky. Therefore, we decided to develop the ExplorAR app which would allow users to use AR to learn about underexplored sites in their cities.

We started by trying to understand the goals and needs of our users on urban exploration and reward systems through interviews and surveys. We iterated our design from a low-fi to high-fi prototype, and ended by validating our design decisions with two rounds of usability testing. During our research, we found that AR has the ability to help users learn about the area around them if they are properly motivated and feel that the experience is cohesive. When compared to current travel websites such as Atlas Obscura, our prototype performed comparably well at delivering information to the user. By providing users with quick and digestible pieces of information, they are able to interact with sites in a new and unique way while also learning just as much, if not more about their city's hidden gems. Additionally, our reward system not only motivated users to continue using the app, but it also improved the overall user experience of the user flow.

One of the biggest hurdles of our project ended up being our prototyping tool limitations which did not allow us to properly flesh out our AR view. Another challenge we faced was improper balancing of group size during testing. While these were challenges, we were able to overcome them and create a product that would successfully engage and inform users of interesting sites around them.

2.0 Introduction

2.1 Motivations

Augmented Reality (AR) is an interactive experience where the real-world surroundings are blended with real-time, spatially-specific digital content. The increasing popularity and continuous development of AR technologies brought us new possibilities, and have constantly been shaping the way we interact with the world. By applying AR in an urban exploration app, we hope to help people detect those hidden gems in their living environment. To encourage a continuous usage of the app, we will be using reward-based incentives to keep this community of explorers dynamically engaged and alive.

2.2 Competitive Analysis

We took a look at 6 possible competitors to our application idea, Pokemon GO, Atlas Obscura, Google Maps, Road Trippers, World Around Me, and FlippAR Go. We specifically chose to look at apps that either provide information on places to visit or incorporate some AR features similar to our vision.

HCI 594 Project Final Report	Team: Group 1
	Date: 11/15/2021

Pokemon Go is a game that encourages users to catch Pokemon in urban settings using its powerful AR feature. It greatly integrates the AR feature with exploration and encourages an active user at the given site much like our app aims to do. However, the type of information given to users is drastically different from our application and it's AR features are mainly for entertainment purposes, used sparingly, as opposed to our stronger focus on AR as a tool for increased learning. Google Maps was another competitor we looked at, it offers in-app detailed information about specific places alongside it's powerful map features. Nevertheless, alongside another competitor we looked at, Road Trippers, doesn't suggest travel destinations while out-and-about. This results in users having to plan out their destinations ahead of time using these services unlike our app which can notify users of nearby sites, as well as allows them to explore their options ahead of time.

Atlas Obscura was probably the closest in terms of content type to the app we're proposing. However, Atlas Obscura is currently only available in book or online website formats, leaving mobile users with a clunky experience unlike our mobile-focused app.

Additionally, the most similar competitors we looked at in regards to the context AR is used were FlippAR GO and World Around Me. Both services focused on mobile devices and used AR to enhance some types of travel. The main benefits of our app, compared to these two, are the increased focus on the learning experience at the site while using the app, the ability to passively interact with our app which doesn't require users to keep their app open at all times, and an overlaying of the information we provide onto the AR view instead of having the information something to read alongside the AR experience. Overall, our app aims to provide a service not available on our competitors' services. We not only want users to actively interact with our app when they want to, but also intend to give them a passive experience to surprise them with new sites while they're on the go and not expecting them. We also want to more strongly intertwine the information we provide with the AR view, unlike our competitors, to allow for a stronger learning experience.

Summary of Key Findings from Competitive Review

- The most successful companies have a mobile version of their platform that allows users to be interactive.
- Users are able to search for points of interest, allowing for customization.
- A one-stop-shop containing all information users need for completing their task is highly preferred.
- Offload creation of new points of interest onto users, to make expansion easier.
- Appropriate multimedia information is needed based on different types of the site.
- Augmented reality is proven to enhance the user experience and make it more immersive.

2.3 Literature Review

To ensure that we were pursuing the right ideas and learning from other researchers and designers, we conducted a comprehensive literature review. We knew initially that we wanted to build an app that would encourage users to explore the space around them and learn about a location's historical context. Yoojung et. al (2015) 's research suggested that

HCI 594 Project Final Report	Team: Group 1
	Date: 11/15/2021

users often want information or mini-activities to do at sites, and not simply directions. Additionally, their research noted that users generally enjoyed viewing user generated information and suggestions. We took Yoojung et. al (2015) 's research into account in two ways, the first being that while we provide in app instructions to the historical sites, we primarily focus on the AR interactive component. Secondly, we have user reviews and indicate when a user's friend has visited a site so that users feel they have additional methods to validate sites.

Law (2018)'s research on a small English historical site showcased how an interactive AR experience has the potential to improve the popularity of a site while also enhancing site knowledge. Law was able to show that there was an increase in information retention with an AR app and we wanted to also test it with our app. Using methods similar to Law's, we were able to test knowledge retention through several rounds of A/B testing. We felt that there was a fine balance between providing users information and turning the app into a gimmicky, one-off app. Our hope was to provide users with enough information to feel satisfied learning something new while not overburdening them with information and multimedia content.

Despite this informational goal we had for the app, Zhang et al. (2020) 's research revealed that users generally do not see AR as anything more than a temporary entertainment tool despite some AR apps being very robust. So while an AR app might have a lot to offer, if it is not properly tailored for the whole user experience it has a high chance of becoming a gimmick and quickly forgotten. This was the main project challenge for us because we want no user turnover. In order to hopefully accomplish this, we built out a reward system and allowed users to view their friends' interactions. Our plan was to have users invest their time into the app and therefore increase the chances that they would use it more long term.

2.4 Project Guiding Principles

Taking into consideration both our team's personal experiences and our literature review, our team wanted to create an urban exploration experience that would be fun and informational while highlighting a city's underexplored areas. We wanted to show that people do not need to travel to other cities to experience something new, but can actually find interesting things in the area around them! In order to draw attention to locations around the user, we decided to package certain locations together in "quest packs". These packs would allow users to view similar locations and interact with them as they go.

In order to prevent users from passively absorbing information, we have decided to have the users interact with the sites through AR. Users would be able to overlay information bubbles over the site that they can click through to learn more about its history. In order to encourage users to continuously use the app we have created a rewards system that would provide enticing rewards after completing certain quest packs and tasks. Lastly we wanted to make sure that the app and its information was accessible to all, so there are accessible icons used in the app to highlight which quest packs are wheelchair accessible.

HCI 594 Project Final Report	Team: Group 1
	Date: 11/15/2021

3.0 Goals

Goal: Understand user's perceptions of AR as an alternative way of learning about sites

Measure: User interviews will be conducted with users, focusing on how users currently go about exploring sites and how AR might be used to help encourage further exploration.

Revisions or adjustments: We used the original measure designed and didn't have any revisions or adjustments

Explain changes: N/A

Goal: The AR view fosters learning about a travel destination more effectively than a traditional travel website

Measure: We will compare and evaluate the results from a round of A/B testing. Two groups of users will complete a pre-test consisting of 5 questions of a specific site. Each group will then be invited to use either the AR app, or a traditional travel website to explore that specific site with the given information within 10 minutes. After that, they will complete the post-test that consists of the exact same questions as the pre-test. A higher score in the post-test will indicate the app being more informative in terms of fostering learning.

Revisions or adjustments: We removed the pre-test step and only used post-test to measure the learning effect

Explain changes: When designing the A/B testing, we noticed that the process would last too long if we included a pre-test. Since learning itself requires a lot of cognitive effort, we didn't want our participants to lose interest due to extended testing time, which might further influence the validity of the results. Therefore, we selected a not well-known site with the assumption that participants were not familiar with it. In this way, instead of measuring the change of the pre-test score and post-test score, we will only analyze the post-test score as we assumed everyone would get a 0 for the pre-test.

Goal: Reward systems incentivize users to continue using the app

Measure: Users are invited to use a prototype of the AR app and given an explanation of the reward system. A usability test focused on the rewards will then be conducted to determine whether users would be incentivized to start, or continue using the app due to these rewards. Two groups were formed, one being a control group which are given tasks to complete which they can stop completing at any time they choose. The second group was given the same instructions, however, a reward was given every time they successfully completed a task. This would allow us to determine if the in-app rewards encouraged the rewarded participants to complete more tasks than the unrewarded group.

Revisions or adjustments: We ended up making some minor changes to the measure to work better with our prototype in the testing process. Participants in the experimental group, instead of being given a reward upon completion of the task, were instead shown a screen indicating that they have earned a new reward as well as informing them that they were close to another reward. This differs from our original version as there is no tangible reward being given, and participants are explicitly told they will get more rewards for continued task completions in the app.

Explain changes: When we were designing the prototype, we realized it takes longer than what we thought to build each AR tour, as we have to select base images that contain enough interesting aspects for us to create a tour, and collect information that actually

HCI 594 Project Final Report	Team: Group 1
	Date: 11/15/2021

matches the base image. Therefore, out of considerations of time limitations, we reduced the number of tasks given, replaced the tangible rewards to intangible ones, and asked users' reactions by letting them know explicitly the reward they are having.

4.0 Methods

Method: Competitive Review

Goal (contribution to project): Analyze the current market for AR, exploration and travel apps to determine how our app would be able to fill a market need. Also determine what works well with these current apps/websites and what can be improved upon.

Revisions or adjustments: We didn't have any revisions or adjustments

Explain changes: N/A

Detailed Method Description:

Using our existing knowledge as well as searching for mobile applications and websites with keywords of "AR", "urban", "navigation", "tour", "exploration", "guide", "gamification", "reward", we found a list of services that are relevant to our ideas. We then reviewed the introduction of each service, trimmed off services that appeared too similar, and narrowed the list down to 6 services. We interacted with each service, reviewed comments from other users in the App Store or third-party websites, and summarized the pros and cons of each service. A detailed competitive review can be found in [Appendix I](#).

Method: 'Live' User Research (Interviews)

Goal (contribution to project): Determine what users would like to see in a mobile app geared towards urban exploration.

Revisions or adjustments: We didn't have any revisions or adjustments

Explain changes: N/A

Detailed Method Description:

Based on the target demographic we listed in the project proposal, our team recruited four participants who are 18 years or older, and are interested in exploring hidden or under-explored historical parts of Chicago. Each team member recruited one participant in their personal network. Below is a table summarizing the demographics of our participants.

Table 4-1: Demographics Summary of Interview Participants

Participant #	Acronym	Pronoun	Age	Occupation	Location
P1	Steve	He/Him	29	Music Store Sales & Teacher	San Francisco, CA
P2	Lucy	She/Her	26	Project Manager	NYC, NY
P3	Annie	She/Her	22	Student	Boston, MA

We conducted semi-structured interviews with our participants remotely using Zoom, with each session taking between 20 and 30 minutes. After greeting the participant, we requested verbal consent on the Informed Consent Form (See [Appendix II](#)) we sent out before the interview, and notified them they had the right to stop the interview at any time. Upon getting the participant's consent, we recorded the audio of each session, and took

HCI 594 Project Final Report	Team: Group 1
	Date: 11/15/2021

notes from time to time. We also exported the transcripts provided by Zoom afterward.

We used the interview protocol (See [Appendix III](#)) we prepared in advance to conduct each interview. It includes three sections: 1) Introduction, 2) Questions, and 3) Closing. For the Questions section, we started by asking some warm-up questions about their recent travel and experience using AR apps, and dived deeper into their goals, motivations, and expectations of urban exploration experiences. We also asked them to brainstorm in the scenarios where they will use an AR app to go on these trips. Finally, we wrapped up the interview by inviting the participant to ask any questions they might have, and saved the demographic questions at last. We ended each session by thanking them.

When preparing these questions, the team adopted a two-step process. Each team member listed out a few questions worth asking, and then we walked through the questions one by one to trim off any unnecessary or redundant questions. We also adjusted the order of the question so that the script became logical during the discussion.

To synthesize the data, each team member presented the findings of the individual participants during our team meetings, and identified overlapping findings. We also used Affinity Diagram to synthesize the data, and the detailed process could be seen below.

Method: Affinity Diagram

Goal (contribution to project): Synthesize the qualitative data we gathered from the interview and help us narrow down our focus on solving the most critical problems.

Revisions or adjustments: This is a new method we used for our project.

Explain changes: When we were trying to synthesize the data, we noticed a simple debrief session was not enough for us to effectively synthesize insights from the interviews. Therefore, we used Affinity Diagram as a supplement.

Detailed Method Description:

We used Miro Board to create an Affinity Diagram. Combining the transcripts and our notes, we pasted key quotes from the interviews into the board, grouped quotes that shared the same themes, and identified similar patterns that would help us organize our findings. We used a unique color to represent each participant, which helps us identify themes that were frequently brought up.

Method: Survey

Goal (contribution to project): Understand participants' perception of the reward system, evaluate its feasibility, and identify areas of improvement based on survey results.

Revisions or adjustments: We didn't have any revisions or adjustments.

Explain changes: N/A

Detailed Method Description:

In contrast with our interviews that focused on urban exploration, the survey was designed to better understand how users generally perceive a reward system.

We used Google Forms to create the survey (See [Appendix IV](#)), and it was available from October 7, 2021 to October 14, 2021. The survey takes around 10 minutes to complete. In this survey, we primarily asked participants about their past experience using an application with a reward system, perceptions over different types of rewards, and thoughts on rewards that would incentivize them to continuously engage with an app.

To recruit participants, we posted the survey as a class activity in the Capstone D2L discussion board. We also recruited participants through the DePaul University Participant

HCI 594 Project Final Report	Team: Group 1
	Date: 11/15/2021

Pool. In order to be a part of this study, the participant must be 18-years of age or older and is interested in exploring hidden or under-explored historical parts of Chicago. In total, 27 participants completed the survey, with 16 participants identifying as female, 10 participants identifying as male, and 1 participant leaving this option blank. The age range of participants was between 20 and 55 years old, with 13 participants between 18 and 25 years old and 11 participants between 26 and 35 years old.

We referred to the “summary” section of Google Forms to analyze the data, and it was easy to synthesize insights from the visualization it created.

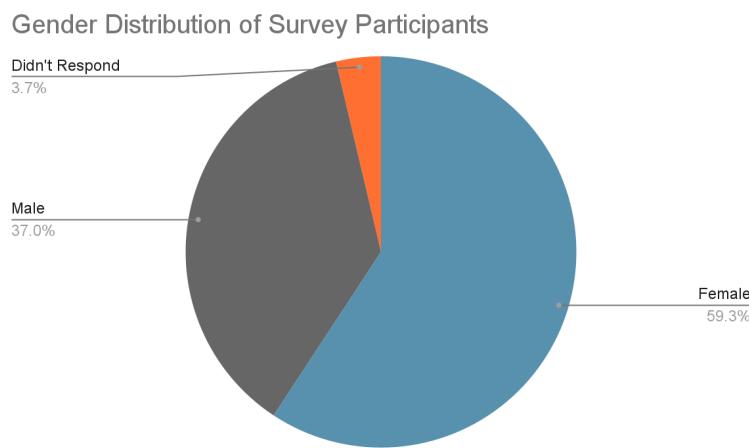


Figure 4-1: Gender Distribution of Survey Participants

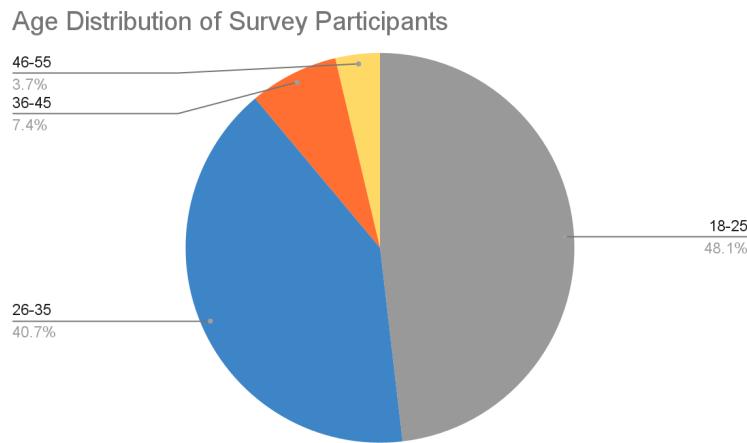


Figure 4-2: Age Distribution of Survey Participants

HCI 594 Project Final Report	Team: Group 1
	Date: 11/15/2021

Method: Personas

Goal (contribution to project): Represent the app's key user segments as well as their goals, needs, motivations, and frustrations. It will also help us focus on tackling the most important problems and address the major needs of the most important user groups.

Revisions or adjustments: We didn't have any revisions or adjustments.

Explain changes: N/A

Detailed Method Description:

Analyzing the interview and surveys for overarching themes and concerns, we distilled that information into goals and frustrations. It became clear from the interviews that there were two main types of users - the more curious, frequent explorer and the casual adventurer. And so, in order to represent both audience segments comprehensively, we created a primary persona and a secondary persona.

Method: Low-Fi Prototyping

Goal (contribution to project): Low-Fi Prototypes will be used for the first round of usability testing. They are easy to create, and enable us to validate or invalidate our ideas in a quick manner without throwing everything in the digitizing process. We will also address major design issues.

Revisions or adjustments: We didn't have any revisions or adjustments.

Explain changes: N/A

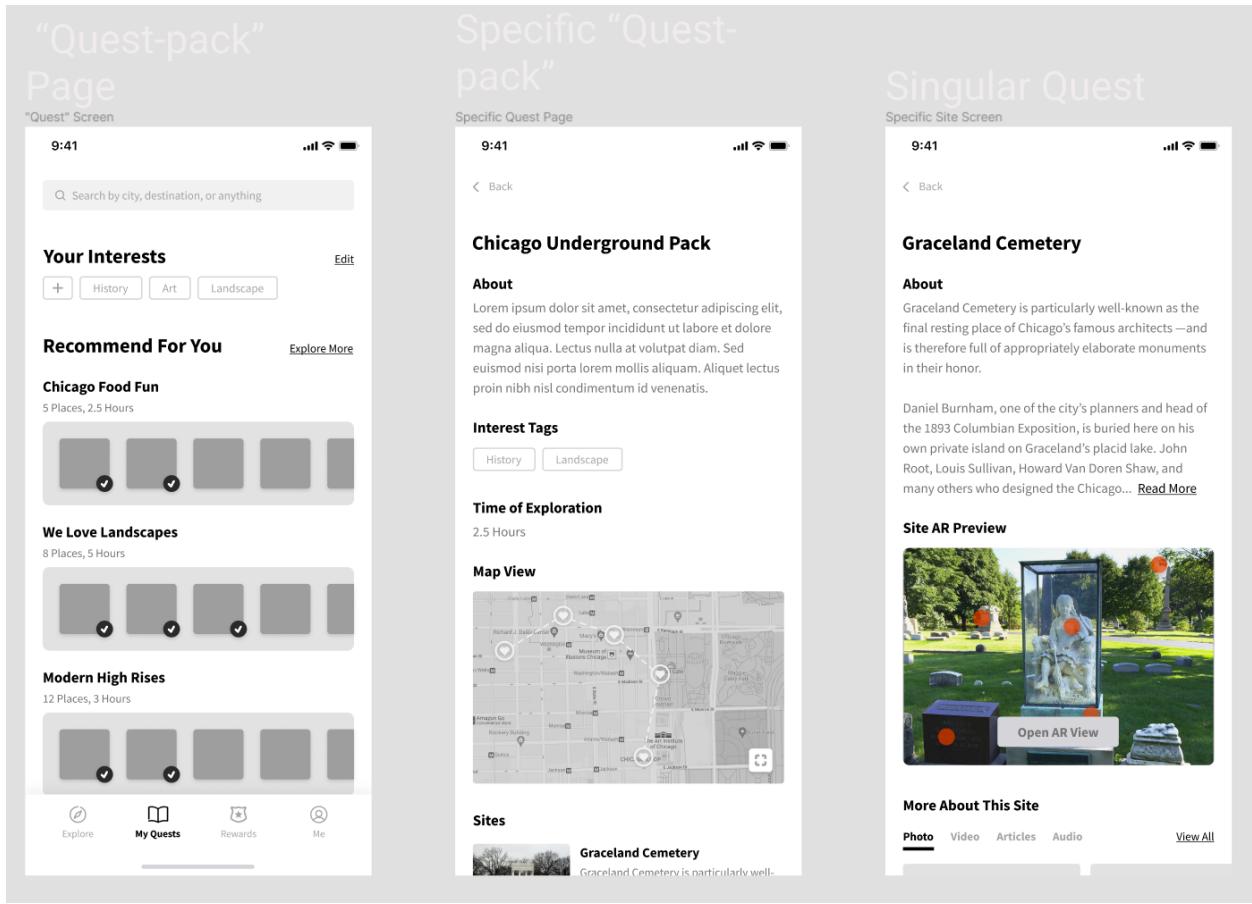
Detailed Method Description:

Taking the goals and frustrations of our personas into consideration, we designed low-fi wireframes with patterns that address these needs, and further created prototypes by linking appropriate wireframes. We used Figma to do the prototyping, as it is friendly for remote collaborations.

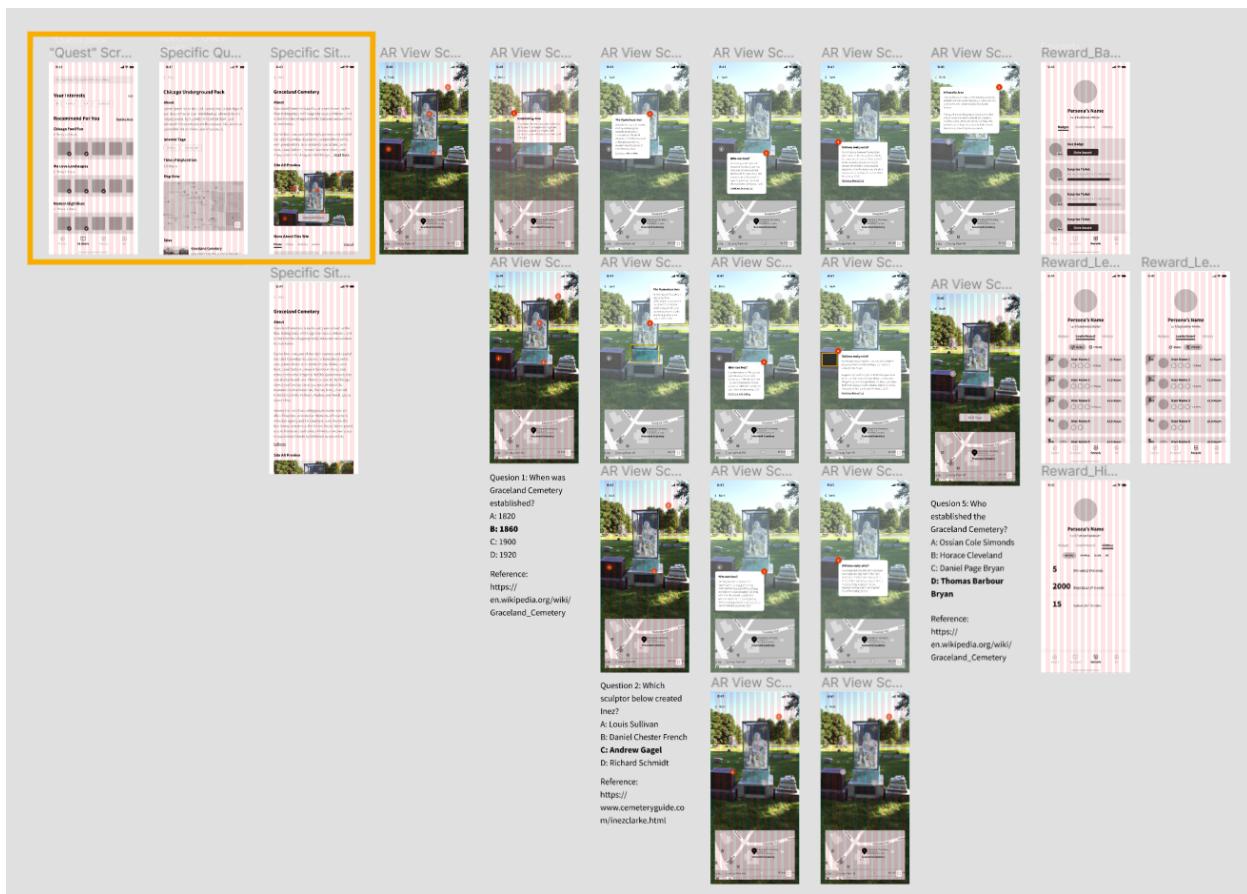
We started by discussing the user flow for completing an AR tour in our weekly group meeting, and identified screens we need to design for users to successfully complete this task. To gather more design ideas, each group member created their first version of low-fi wireframes, and presented the design in the next group meeting. We selected one version that appears to be the most complete as the base to move forward, and incorporated appropriate patterns from other designs as well. To ensure the overall visual consistency, one team member did a final check and adjusted any inconsistencies in the layout, UI components, colors, and typefaces.

We created our prototype in the same Figma file - having one centralized document will make it a lot easier for remote coordination and keeping every team member on the same page. We used Figma's "Fixed Position" feature to keep the iOS status bar and app navigation in a fixed position when the scrolling interaction is activated. Meanwhile, to save some time for the later mid-fi prototyping stage, we set up the hierarchy of the text and applied it to the heading and body text. It is extremely useful in keeping everything consistent and will save a lot of time when we want to adjust the style of a specific element.

HCI 594 Project Final Report	Team: Group 1
	Date: 11/15/2021



**Figure 4-3a: Selected screens of Low-Fi Prototype
(all screens we created can be found in Figure 4-3b)**



**Figure 4-3b: Draft screens of Low-Fi Prototype
(screens in the box can be found in Figure 4-3a)**

Method: A/B Testing for Low-Fi Prototype (Usability Evaluation Round 1)

Goal (contribution to project): Test whether our AR view will provide adequate information about the site compared to a traditional website view.

Rewards or adjustments: We removed the pre-test step and only used post-test to measure the learning effect.

Explain changes: When designing the A/B testing, we noticed that the process would last too long if we included a pre-test. Since digesting new information itself requires a lot of cognitive effort, we didn't want our participants to lose interest due to extended testing time, which might further influence the validity of the results. Therefore, we selected a not well-known site with the assumption that participants were not familiar with it. In this way, instead of measuring the change of the pre-test score and post-test score, we will only analyze the post-test score as we assumed everyone would get a 0 for the pre-test.

Detailed Method Description:

We started by deciding the competitor we would like to compare our app with for the A/B Testing. After reviewing our competitive analysis, we selected Atlas Obscura. It provides abundant information of a variety of historical sites in Chicago using lines of text without multimedia information, and became a good reference group for our app.

HCI 594 Project Final Report	Team: Group 1
	Date: 11/15/2021

Our A/B Testing would only be meaningful when the A version, Atlas Obscura, and B version, our app, are providing users with the same amount of information for the same site. Therefore, we chose a historical site that is not well known, Graceland Cemetery, from Atlas Obscura, and presented that information using multiple screens of our AR tour. When designing the tour, we arranged the narrative and storytelling to help the participants stay engaged and avoid overwhelming them with too much information at a time. Based on the information of Graceland Cemetery, we designed five multiple-choice questions for the post-test. Two forms can be found in [Appendix V](#).

A/B Testing normally requires more participants for its result to be valid. To save some time and recruit more participants, we decided to do unmoderated sessions by setting up Google Forms for each version. In these forms, participants were either asked to review the Graceland Cemetery pages on Atlas Obscura, or invited to finish the AR tour of Graceland Cemetery using our prototype link. After the interaction, they were asked to answer the post-test questions, and provide any additional comments on the prototype.

We primarily recruited participants from the CDM Participant Pool. In order to be a part of this study, the participant must be 18-years of age or older and is interested in exploring hidden or under-explored historical parts of Chicago. We set up two studies in the Participant Pool, one for Atlas Obscura and another for our low-fi prototype. To prevent participants from doing both studies, we adjusted the disqualifier to make both studies mutually exclusive; namely, participants who have completed, or have a pending sign-up for one study, couldn't not participate in the other.

In total, we recruited 10 participants for the A version testing, Atlas Obscura, and 29 participants for the B version testing, our app. We referred to the “summary” section of Google Forms to analyze the data, and it was easy to synthesize insights from the visualization it created.

Method: Mid-Fi Prototyping

Goal (contribution to project): We will address all the recommendations gathered in the first round of testing in Low-Fi prototypes, and use them for the second round of usability testing. They look like real app interfaces compared with Low-Fi prototypes, and participants tend to behave more naturally during testing sessions.

Revisions or adjustments: We didn't have any revisions or adjustments.

Explain changes: N/A

Detailed Method Description:

We had a debrief session to analyze the results from our round 1 usability testing. We discussed some highlighting comments from participants, proposed design solutions, and iterated them in the new version of design. We still used Figma for mid-fi prototyping.

The mid-fi prototype will be used to test whether the reward system can effectively incentivize users' continuous engagement with the app. Therefore, we had to create two sets of prototypes, one with reward and another without reward. Building from the low-fi prototype, we further discussed how the new user flow will be like when integrating the reward with the AR tour, and identified screens we need to add and flows that need to be adjusted. We also added several screens with new AR tours or travel packages to accommodate the situation where participants will continuously interact with the app. In this process, we compared multiple design patterns and components, discussed their pros and cons, and selected the ones that work best with our current design styles and layouts.

HCI 594 Project Final Report	Team: Group 1
	Date: 11/15/2021

At this step, we established the color system in Figma and applied them to components. Reflecting the theme of our app and the message it is intended to convey, it is clear that we were looking for colors that are natural and engaging. By looking at meanings of colors, we thought green, teal, and orange play well together. It also blends well with the color of maps that we have widely used in the app.

We linked the finished screens together to create the prototype. To ensure the overall visual consistency, one team member did a final check and adjusted any inconsistencies in the layout, UI components, colors, and typefaces.

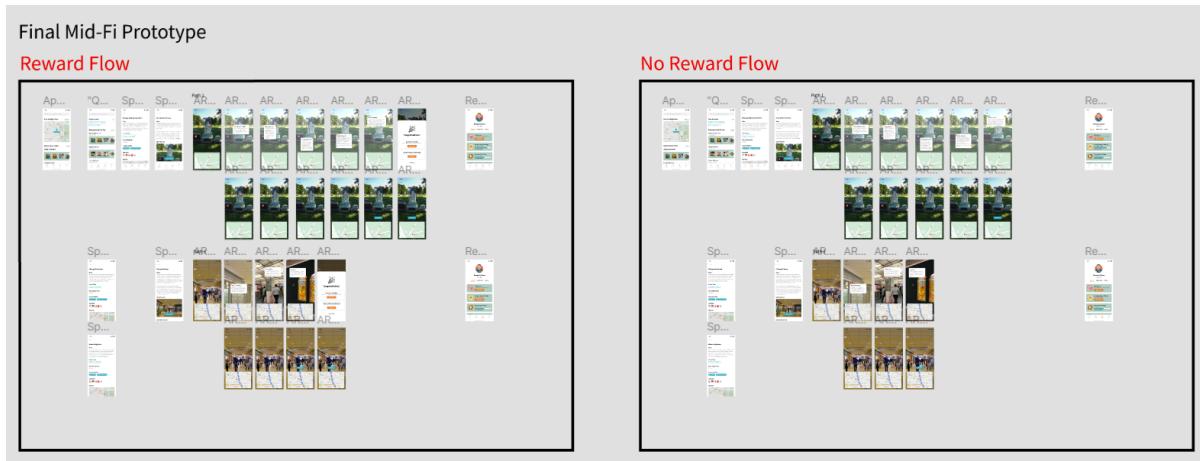


Figure 4-4: Draft screens of Mid-Fi Prototype

Method: Mid-Fi Evaluation (Usability Testing Round 2)

Goal (contribution to project): We will address all the recommendations gathered in the first round of testing in Mid-Fi prototypes, and use them for the second round of usability testing. They look like real app interfaces compared with Low-Fi prototypes, and participants tend to behave more naturally during testing sessions.

Rewards or adjustments: We ended up making some minor changes to the measure to work better with our prototype in the testing process. Participants in the experimental group, instead of being given a reward upon completion of the task, were instead shown a screen indicating that they have earned a new reward as well as informing them that they were close to another reward. This differs from our original version as there is no tangible reward being given, and participants are explicitly told they will get more rewards for continued task completions in the app.

Explain changes: The changes were made to allow us to complete this step within the time we had left.

Detailed Method Description:

We proceeded the evaluation using the mid-fi prototype we created. Considering the limited time reserved for this project would only allow us to recruit several participants, we decided to use a within-subjects design. In this within-subject study, each individual participant will work through all task paths.

Our team recruited seven participants from our personal network who fit with our personas. Two team members recruited two participants, and one team member recruited

HCI 594 Project Final Report	Team: Group 1
	Date: 11/15/2021

three participants. Among them, 4 participants interacted with the no-reward prototype, and 4 participants interacted with the reward prototype. Below is a table summarizing the demographics of our participants.

Table 4-2: Demographics Summary of Usability Testing (Round 2) Participants

Participant #	Acronym	Gender	Age	Ethnicity	Occupation	Location
P1	Jamie	Male	35	Hispanic	Engineer	Chicago, IL
P2	Joan	Female	26	White	Student Teacher	Chicago, IL
P3	Sam	Male	29	Filipino / Mexican	Data Entry	San Francisco, CA
P4	Tommy	Male	23	Caucasian	Construction	Pacifica, CA
P5	Yao	Female	24	Asian	HCI Student	Houston, TX
P6	David	Male	28	Asian	Actuary	Jersey City, NJ
P7	Judy	Female	22	Asian	Student	Long Island City, NY

We conducted testings with our participants either in person or remotely using Zoom, with each session taking between 10 and 15 minutes. For Zoom sessions, we recorded the video after getting consent from the participants. We observed their interaction with the prototype, encouraged or reminded them to adopt the think-aloud method, answered any questions they may have, and took notes from time to time.

In this testing, participants were asked to at least interact with the Graceland Cemetery AR Tour, and then they can choose to continue interacting with other tours or not. We used the testing script (See [Appendix VI](#)) we prepared in advance to moderate each session. It includes three sections: 1) Observation, 2) Questions, and 3) Closing. To help us effectively observe our participant, we had a checklist prepared and noted their actions and reactions accordingly. When they finished interacting, we asked them about their feelings about the reward section and any other suggestions of the app. We saved the demographic questions at last, and ended each session by thanking them.

To synthesize the data, each team member presented the findings of the individual participants during our team meetings. We identified overlapping findings, and proposed recommendations accordingly.

4.1 Diversity Documentation *(optional – include only if seeking subject diversity extra credit)*

We chose to tackle diversity in multiple ways both in testing and in-app usability features. For our testing, we recruited subjects both through the Depaul CDM participant pool and through personal connections to make sure we had a diverse set of participants in regards to age, location, and profession as we found that the CDM participant pool gave us a very narrow subset of individuals. For our live user testing, we each interviewed participants gathered through personal connections, which allowed us to collect

HCI 594 Project Final Report	Team: Group 1
	Date: 11/15/2021

information from a relatively even split of male and female participants with varying professions and ethnicities from various locations in the United States. Our survey as well as A/B testing for our Low-Fi prototype used the CDM Participant Pool, and was supplemented with participants recruited through personal connections. This allowed us to gather a wide variety of users for our testing as can be seen in our survey results (see [Figure 4-1](#) and [Figure 4-2](#), and also Figure 4-5 and Figure 4-6 below). Our Mid-Fi prototype testing, in contrast, was done only using participants who were personally recruited to ensure variety in ethnicity, age, gender, and profession in a short amount of time.

In regards to our app's usability features, we chose to focus on making the experience of searching for accessible locations easier for the user by allowing them to add filters when searching through travel locations. In our prototype, this is shown through both the "Wheel-Chair Accessible" and "Sign Language Staff" tags and icons. We also included flag icons to inform the user of language options for our AR view available at the chosen location. In the meantime, we kept the contrast of our color choices ideal to better aid users with vision problems, and added outlines to certain elements to make sure they could be distinguished from background elements, specifically in the AR view. Additionally, the colors chosen were specifically tested to make sure they were color-blind friendly.

Where are you located?

27 responses

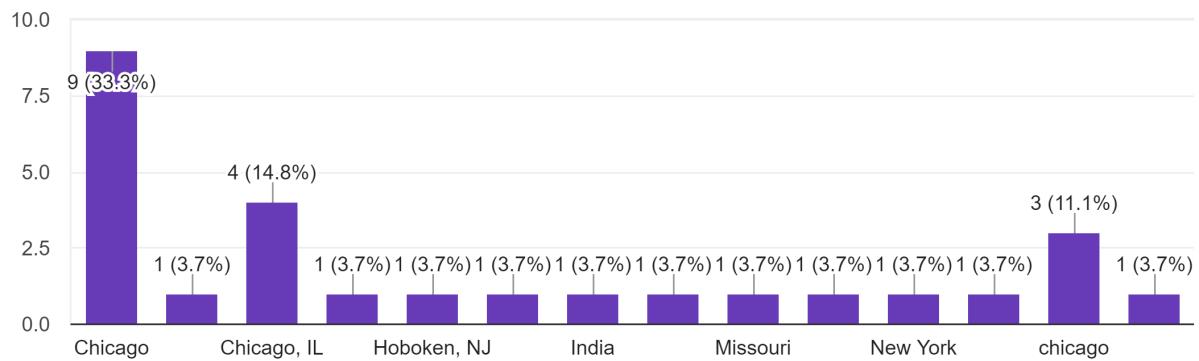


Figure 4-5: Locations of Survey Participants

HCI 594 Project Final Report	Team: Group 1
	Date: 11/15/2021

What is your occupation?

26 responses

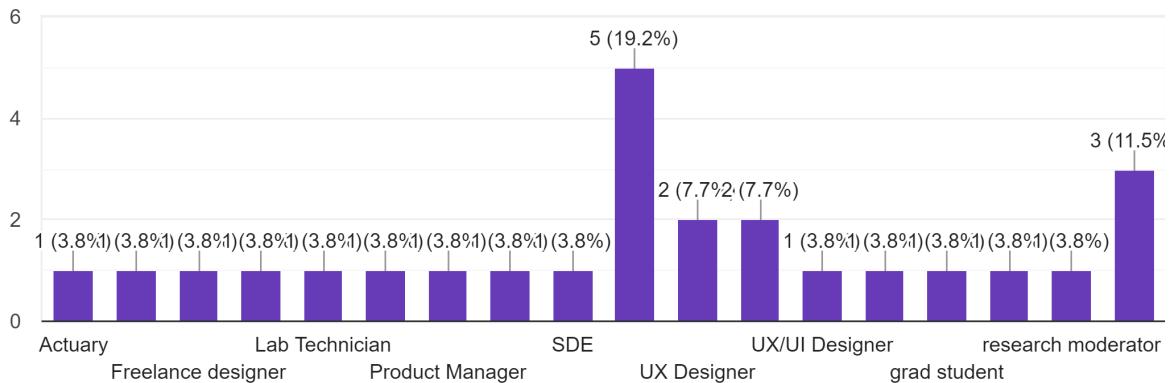


Figure 4-6: Locations of Survey Participants

5.0 Results

Method: Interviews & Affinity Diagram

Detailed Results Description for this Method:

We conducted four in-person initial exploratory interviews to start off our project. From these four interviews, and their accompanying recordings and transcripts, we worked as a group to create an affinity diagram to help us better understand the users wants, needs, frustrations, and more (see Figure 5-1). The affinity diagram helped us better understand the reasons for user motivated exploration and where our app's concept could be best used. We also discovered some frustrations with current travel experiences that our app could alleviate, such as a lack of reviews or unclear business hours. Users also had a wide variety of reasons for exploring, from relaxation, to obtaining new knowledge. In contrast, their reasons for not exploring were a lot more similar, usually having to do with a lack of time, or interest in areas around them. Additionally, we found that users, in general, positively responded to the idea of a gamified experience with collectible in-app rewards. Finally, we were able to discover that users most commonly find new places to explore through friend or acquaintance recommendations.

Method: Personas

Detailed Results Description for this Method:

The personas were created using the findings from the interviews and affinity diagram previously discussed (see Figure 5-1). These persona's helped us prioritize features and sections of the app by allowing us to better understand what users might expect to see during their experience and what pain points they encountered in competing services that we should keep an eye out for (see Figure 5-2 and 5-3). It also helped us form an understanding of the types of people that might use our app and for what reasons they might be using it. We noticed that while local users might make up the majority of the user

HCI 594 Project Final Report	Team: Group 1
	Date: 11/15/2021

base, travelers would also be a sizable portion which we would have to account for. Additionally, while the main goal of our original app idea might have been to replace webpage travel guides, we found that a portion of potential users would rather skip the tourist spots usually found on those guides and instead go to more under-visited, somewhat unknown spots. We made a point to internalize that feedback and added features to facilitate not only friend recommendations to alleviate part of this problem, but also conceptualized a user-generated content system to assist in finding those hidden gem travel locations. These systems formed from our persona findings, alongside more traditional content such as user reviews and images, make it easier, and quicker for users to find places they actually want to visit.



Figure 5-1: Affinity Diagram made from interview responses

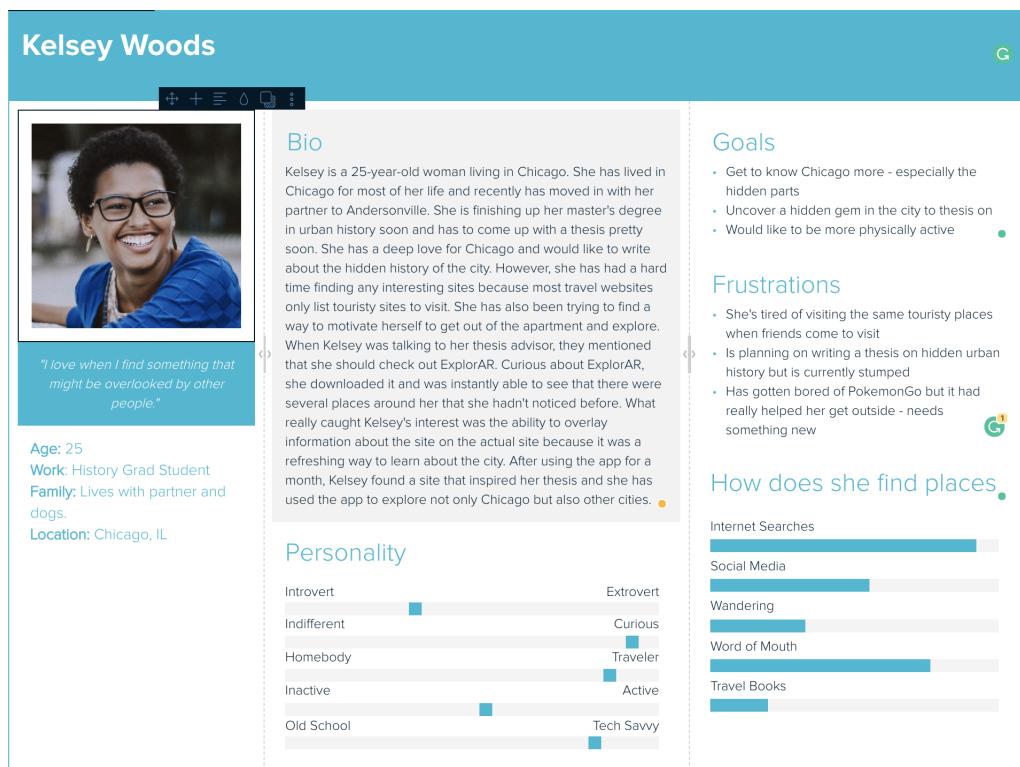


Figure 5-2: Primary Persona

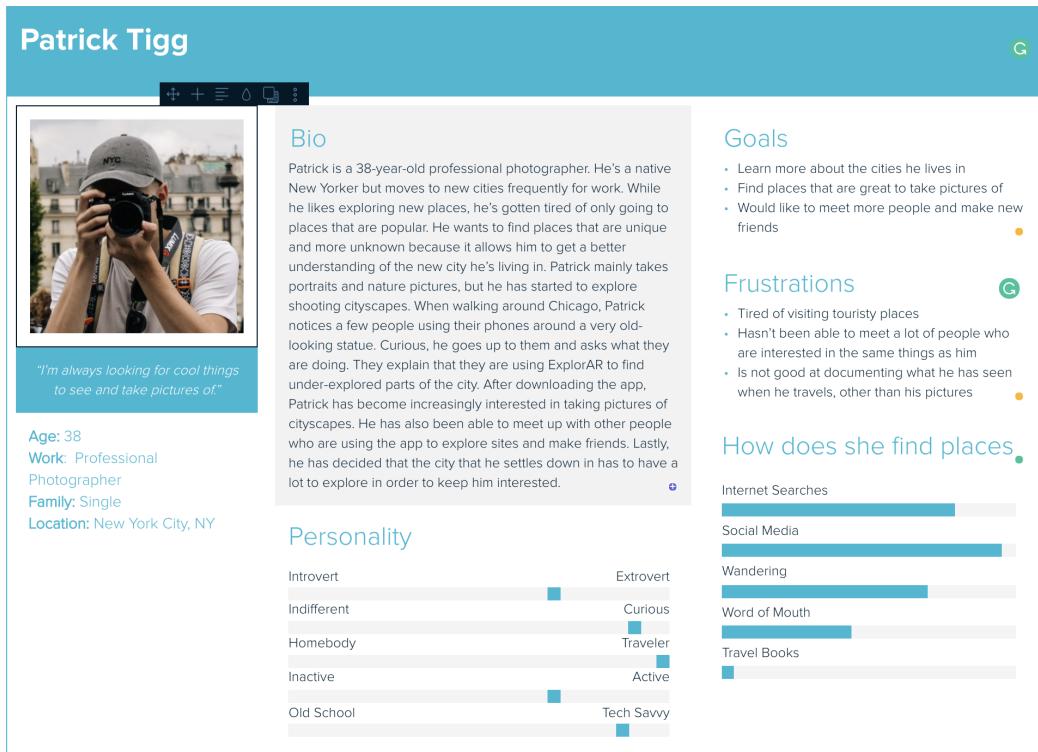


Figure 5-3: Secondary Persona

HCI 594 Project Final Report	Team: Group 1
	Date: 11/15/2021

Method: Survey

Detailed Results Description for this Method:

For our class activity we decided to go with a survey to gauge interest in a reward system for our prototype as well as the type of rewards users expect, and want given to them. Out of 27 respondents, 87.5% of users had prior experience with applications that deliver rewards for continued use, so we knew that this type of system is both common, and normal for users to interact with. Additionally, around 81.4% of respondents noted that they were more likely to use an app if it rewarded them for continued use (see Figure 5-4).

In regards to the types of rewards users wanted, 81% of the participants noted that some type of monetary reward would best motivate them to continue using a service. However, because of the difficulty and impractical nature of giving out monetary rewards we also gave survey participants a multiple-choice list of 5 common types of rewards that we could realistically implement into an exploration focused app like ours and asked which would incentivize continued use of a service. We also allowed for custom entries to be submitted (see Figure 5-5). From this, we concluded that Exclusive Content (66.7%), Ranking Systems (48.1%), and Badges (37%) were the best rewards to implement into our app with the limited time we had available.

How likely are you to use an app if it rewards you for continued use.

27 responses

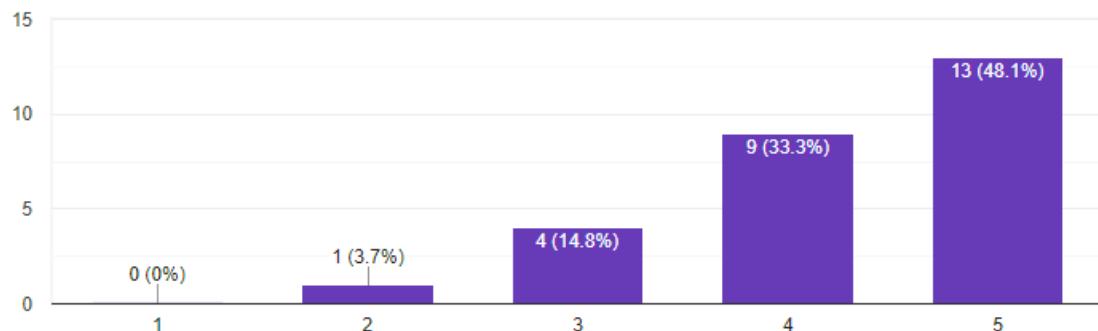


Figure 5-4: Likert scale for likeliness of continued app use based on if rewards are given

HCI 594 Project Final Report	Team: Group 1
	Date: 11/15/2021

Would any of the following types of rewards incentivize you to continue using a service?

27 responses

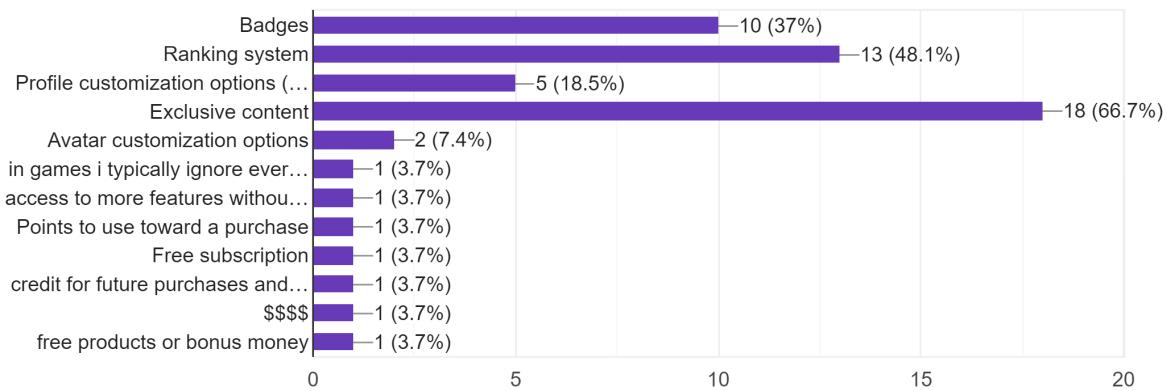


Figure 5-5: Rewards that would incentivize continuous app usage from survey participants

Method: Low-Fi Prototype, A/B Testing (Usability Testing Round 1)

Detailed Results Description for this Method:

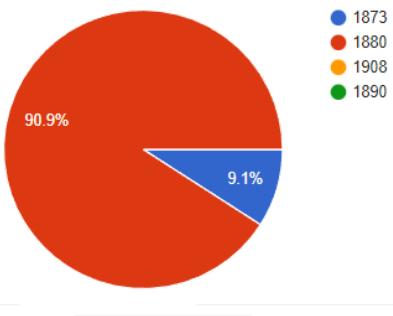
The goal of our A/B testing was to see if our prototype's AR view feature did a better job of conveying information than a traditional travel webpage. Group A was given an atlas obscura webpage while group B used our prototype. Both groups had access to the exact same information, the only difference was the way it was delivered. What we ended up finding was that our prototype's AR view resulted in a wider variety of answers, leading us to conclude that while it didn't perform badly, it might have caused more uncertainty than the webpage. For example, for one of our questions, only 79.3% of participants in group B picked the correct answer compared to 90.9% of those in group A (see Figure 5-6).

These types of results were present in all our questions and they seem to point at some potential confusion from the participants. However the vast majority of users chose the correct answer for every question given. In group A, the correct answer was chosen 96% of the time and in group B it was chosen 83% of the time. These results were not significant, and are potentially a result of the amount of participants we had in each group as Group B ended up with 18 more participants than group A. If the groups were balanced properly we potentially would have seen more similar results between the groups.

HCI 594 Project Final Report	Team: Group 1
	Date: 11/15/2021

What year did the girl the monument is named after die?

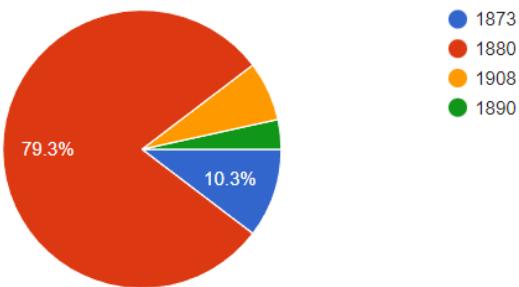
11 responses



Group A

What year did the girl the monument is named after die?

29 responses



Group B

Figure 5-6: Pie Chart for answers to a question where the correct answer is 1880 (red)

Method: High-Fi Prototype, Usability Testing Round 2

Detailed Results Description for this Method:

For our usability testing we observed 7 different participants, separated into two groups, go through our prototype and noted whether they kept exploring the prototype after the initial path was completed to see if potential rewards motivated continued interaction with the prototype. Four participants in one of the groups were shown a “congratulations” screen at the end of the first path which informed them of their reward as well as their progress towards a new reward while the 3 participants in the other group did not see this screen (see Figure 5-7).

Every participant who saw the congratulations screen went back and continued

HCI 594 Project Final Report	Team: Group 1
	Date: 11/15/2021

towards our second path while those who were not shown the screen either stopped after the first path or wandered around the app aimlessly awaiting further instructions. While our sample size is small, at 7 participants, we inferred that giving the participants a reward, and maybe more importantly, letting them know that they've gotten a reward and are close to obtaining another, does in fact play a part in the user's motivation to continue using our prototype app.

When participants were asked after the test if they felt inspired to look at other locations in the app, those in the experimental group which were given the congratulation screen reported that, yes, they felt more drive to continue interacting with the prototype. However some participants expressed that it was less inspiration and more a need for finishing the almost completed quest that pushed them to keep going. In contrast, the group that did not receive the congratulations screen were noted as being much less interested in continuing the activity and expressed that the experience felt abrupt and unfinished.

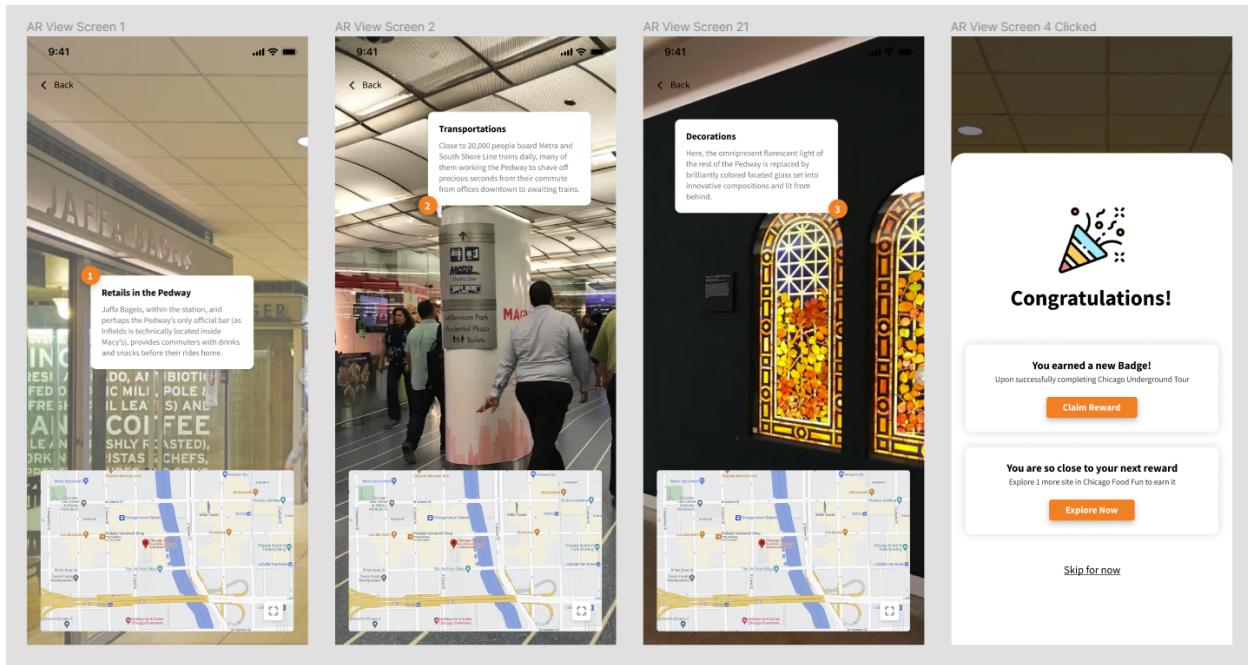


Figure 5-7: Congratulations Screen with rewards interface

6.0 Discussion

6.1 Analysis of Goals, Methods, and Results

For this project, our team wanted to create an AR exploration experience that would be fun and informational while also highlighting a city's underexplored areas. In order to do this we developed 3 main goals: understand how users view AR as a learning tool, demonstrate that AR fosters learning more effectively than a traditional travel website and illustrate how reward systems incentivize users to continue using an app. We chose these goals to measure the success of our app, ExplorAR, because we wanted to avoid it falling into the

HCI 594 Project Final Report	Team: Group 1
	Date: 11/15/2021

AR trope of being a gimmick or one-off use. Our goal was to create a platform that would allow users to have fun exploring the area around them, while also being motivated to continue using the app to learn about a site's history.

In order to measure the success of reaching each goal we used a variety of methods. For the first goal of understanding how people view AR as a learning tool we conducted user interviews with 4 participants. It was through these informative interviews that we learned that while users are interested in underexplored sites, it can be difficult to find places. All of the interviewees mentioned that they either use search engines or friends to find new places to visit. Additionally, all the interviewees were intrigued how they might be able to use AR as a way to learn more about a site. These findings from the first goal were the foundation for the second goal which was that AR fosters learning more effectively than a traditional travel website. While we knew that AR would provide a sense of novelty to the learning and exploring experience, we still wanted it to be substantive. In order to test this, we conducted A/B testing with two groups comparing site comprehension levels between a group that used the app and a group that used a traditional website. Both groups had access to the same site information, the only difference being its delivery. The results from the A/B testing revealed that while our prototype presented information well overall, there was a great range of user answers, suggesting that the app was not as clear at the webpage. While it is possible that the difference in answers was because of a lack of clarity, there is also the possibility that the participant imbalance between the two groups led to this difference. The group that interacted with the website had 18 more participants, which could have greatly skewed the results.

The last goal that we had was to develop a reward system that would incentivize users to continue using the app. As we saw in the user interviews, participants were very interested in a rewards system because it would keep them engaged in the app. In order to further understand user behavior around reward systems and determine what our reward system should look like, we conducted a survey with the class and several usability tests. The results from the in-class survey suggested that while users do see rewards systems as good motivators, the type of reward that is offered plays a large role in how motivating it is. Many users suggested that monetary rewards would be the best motivator, while others said that in-app badges or ranking would be just as good. Given that we would not be able to attach monetary rewards to the app at this time, we decided to focus on providing task completion badges. The reward system usability tests also supported our assumption that rewards motivate users to continue using the app. 3 out of 4 of the participants who were in the rewards group continued to explore after receiving the rewards pop-up, while none of the participants from the no-rewards group explored and felt awkward after reviewing a site. Therefore the incentive of receiving a reward was not only a motivator but also helped make the exploration experience more cohesive and less disjointed.

6.2 What might have done differently

While all of our goals were successfully met, there are a few places where we could have improved. The first is that we could have balanced the groups better for the low-fi A/B testing. Participants for this test were solicited from the CDM participant pool, where

HCI 594 Project Final Report	Team: Group 1
	Date: 11/15/2021

participants are able to select which studies they would like to participate in. In the attempt to gain the most participants, we had not set a cap for either group, but that led to a large imbalance between the groups. Despite this imbalance the results were similar enough to be compared.

In regards to the app, there are areas where we could have improved such as adding more flows to the hi-fi prototype in order to provide users with a more comprehensive app experience. Additionally, while we were limited by our prototyping tool, Figma, it would have been nice to add more interactive features in the hi-fi prototype, such as zoom in and zoom out for perspective adjustment. Users would have a more realistic experience with an actual working AR environment, which will help us collect more useful feedback from them. It is also always great to test often, so we would have liked to have been able to test the hi-fi prototype with more users if time had allowed for it.

6.3 Opportunities of future work

The final result of the ExplorAR app is something that we are very proud of but there are still areas to work on. The first is that we would like to build out the actual AR function for the app. In our current prototype the images are static and the app has limited interactivity. We would like to build an AR function to test how it might affect the way that people use the app and test our design choices. In particular we are curious to test if the clickable functions in the AR view would still be visible if overlaid on a real world object. Lastly a major future project would be thinking through how the sites available in the app would be curated. At the moment we were pulling sites from other websites, but in order to make our app stand out and have curated “quest packs” we would need to have our own site database. We have given this some thought and while having user generated lists appears to be a solution, more research would need to be done in order to know for sure.

7.0 Conclusion

This project sought to develop an AR platform that was both entertaining and informational. We were able to accomplish this by developing an app that would allow users to use AR to learn about underexplored sites in their cities. It is clear from our research that AR has the ability to help users learn about the area around them if they are properly motivated and feel that the experience is cohesive. By providing users with quick digestible pieces of information they are able to interact with sites in a new and unique way while also learning more about their city’s hidden gems. While our app was detailed and well developed, there are still a few areas that would need to be further developed to make it fully functional. If we were to continue working on this in the future, we would prioritize the development of the AR view because it is currently underdeveloped in the prototype. Further testing could then be done to further polish app features of our project that we chose to not prioritize in this iteration.

HCI 594 Project Final Report	Team: Group 1
	Date: 11/15/2021

8.0 References

1. Yoojung K., Changhoon O., Taeyoung L., Donghun L., Joongseek L., and Bongwon S. (2015). Travel Q: Questifying Micro Activities Using Travel Photos to Enhance Travel Experience. *CHI EA '15 Proceedings of the 33rd Annual ACM Conference Extended Abstracts on Human Factors in Computing Systems*, 1507–1512.
<https://doi-org.ezproxy.depaul.edu/10.1145/2702613.2732889>
2. Law, E. L.-C. (2018). Augmenting the Experience of a Museum Visit with a Geo-Located AR App for an Associated Archaeological Site. In Vermeeren, A., Calvi, L., and Sabiescu, A. (Eds.). *Museum Experience Design. Springer Series on Cultural Computing*. (pp. 205–224). Springer International Publishing.
https://doi.org/10.1007/978-3-319-58550-5_10
3. Carmine Elvezio, Frank Ling, Jen-Shuo Liu, Barbara Tversky, and Steven Feiner. (2018). Collaborative exploration of urban data in virtual and augmented reality. *ACM SIGGRAPH 2018 Virtual, Augmented, and Mixed Reality (SIGGRAPH '18)*.
<https://dl.acm-org.ezproxy.depaul.edu/doi/10.1145/3226552.3226570>
4. Zhang, H., Kim, M., Ye, C., & Costa, S. (2020). *Service Design for mediating technology and experience in Augmented Reality: A case study of a holistic AR travel service*. *ServDes 2020* (pp. 327-340) Linköping University Electronic Press.
<https://ep.liu.se/ecp/173/032/ecp20173032.pdf>

HCI 594 Project Final Report	Team: Group 1
	Date: 11/15/2021

Appendix I: Competitive Review

1. Pokemon Go (<https://pokemongolive.com/en>)

Availability: Mobile App

Introduction: Pokemon Go is an AR phone game that encourages users to go outside and catch Pokemon. Users are able to collect Pokemon, train them and battle with other users while using the app.

Strengths:

- Utilizes AR very well. The Pokemon appear to be fully integrated into the users surroundings which further increases engagement
- If a user is near a battling station or near a Pokemon site the app will alert the user to open the app.
- The rewards system that is built into the app encourages users to continuously use the app.

Weaknesses:

- It cannot run in the background. In order for a user to catch Pokemon or hatch an egg, the app has to be open.
- It drains phone batteries quickly, which limits the amount of time a user can be on the app.
- If there aren't different geographical features around the users, then the type of Pokemon available is repetitive and can make the app boring to use.

2. Atlas Obscura (<https://www.atlasobscura.com>)

Availability: Website and book

Introduction: Atlas Obscura provides website visitors and readers with unique places to visit all around the world. These locations are places that are often off the beaten track and places that most people would not notice. On the website, users are able to look up any location in the world and see anything from ruins and statues to alleyway book shops and cafes. Users also have the ability to travel with Atlas Obscura on themed trips or attend events/courses.

Strengths:

- Provides users a variety of locations, events, courses - there is truly something for everyone.
- Users can submit photos and comment on the locations.
- The events, courses and trips rotate frequently which encourages users to keep coming back.

Weaknesses:

- Only accessible if you are on the website or if you have the book.
- Provides the address and some information on the site, but there is not an interactive element to exploring the physical site.
- The book is massive and would not be something that you would want to carry with you.

HCI 594 Project Final Report	Team: Group 1
	Date: 11/15/2021

3. Google Maps (<https://www.google.com/maps>)

Availability: Web Tool and Mobile App

Introduction: Google Maps provides intuitive mapping services with powerful features that help users navigate, find places, and discover new experiences. It currently embeds satellite and aerial imagery, street maps, interactive panoramic street views, real-time traffic updates, travel route planning, and more. It also offers in-detail information about a specific place, including photos, reviews, opening hours, etc.

Strengths:

- The integration of navigation and place's information makes it easier for users to explore.
- It serves as a one-stop-shop for a lot of places where users can contact the owner, make a reservation, or even order directly.
- It enables AR features to help pedestrians navigate.

Weaknesses:

- It only offers general information for points of interest.
- Information is sometimes inaccurate or outdated due to a lack of updates.
- It might require a considerable portion of cell phone memory to operate.

4. Road Trippers (<https://roadtrippers.com>)

Availability: Web Tool and Mobile App

Introduction: Road Trippers is a mobile app and website that allows users to plan out road trips with friends, but with a focus on discovering roadside attractions and events. The app allows users to access the maps offline while also getting discounts for local areas.

Strengths:

- Road Trippers offers trip guides which are helpful for users who might not know where to start their trip.
- Allows users to customize their road trips with options for campsites, food, nightlife and outdoor attractions.
- Provides a wide variety of sites, many of them which are unique and often off the beaten path.

Weaknesses:

- Some features are only available on the Pro version.
- Only works in the United States.
- Users have to have an idea of what they are looking for or have a clear destination in mind when using the app.

5. World Around Me (<https://worldaroundmeapp.com/>)

Availability: Mobile App

HCI 594 Project Final Report	Team: Group 1
	Date: 11/15/2021

Introduction: World Around Me is a mobile app focused on finding useful places around you, such as restaurants, ATMs, shops, and more. The app uses the camera to overlay information onto your surrounding area using AR to enhance your view of the surroundings.

Strengths:

- Multiple ways to interact with the app, not limited to just AR.
- Gives users the ability to filter the “places” that pop up on screen by categories.
- Gives you information such as fares, prices, etc.

Weaknesses:

- Features are locked behind payment.
- Doesn't overlay detailed information on your screen, just location names and distance.
- Screen seems to get cluttered easily.

6. FlippAR Go (<https://flippargo.com>)

Availability: Mobile App

Introduction: FlippAR GO is the new-age travel app for the tech-savvy, modern traveller in India. It uses AR features to unveil interactive travel experiences while connecting history with the modern age. You can access stories and facts about heritage sites and explore things to do around you all on a single app.

Strengths:

- 10,000 + users, widely adopted in 80 locations, 35 cities, and 4 countries.
- Easy access to famous folktales and factual information about monuments.
- Interactive AR experiences which are customised and special to each site. Taking the form of video narratives, audio tour guides, and selfie filters among other experiences.
- Explore local specialities with FlippAR Go's list of recommendations of local arts, crafts, and culture.
- Public recommendations left behind by other app users.

Weaknesses:

- Bad UI.
- AR features don't work everywhere.
- Sometimes hosts inaccurate information.

HCI 594 Project Final Report	Team: Group 1
	Date: 11/15/2021

Appendix II: Interview Consent Form

ADULT CONSENT TO PARTICIPATE IN RESEARCH

ExplorAR AR Urban Exploration App

Researchers:

- Javier Guzman, Graduate student
- Paola Favela, Graduate student
- Luyun Shao, Graduate student
- Omkar Dixit, Graduate student

Institution:

DePaul University, Chicago, Illinois, USA

Department, School, College:

College of Computing and Digital Media

What is the purpose of this research?

The purpose of this study is to understand your past urban exploration experience and how AR technology can help people in such tours. Your actions and responses will only be used in connection with this class study.

This research is being conducted by Javier Guzman, Paola Favela, Luyun Shao, and Omkar Dixit as a requirement to obtain their Master's degree.

We hope to conduct four separate interviews for this study.

Why are you being asked to be in the research?

You are invited to participate in this study because you indicated in our screening procedure that you are 18 years old or older and follow the news on digital platforms. This study is not approved for the enrollment of people under the age of 18.

What is involved in being in the research study?

If you agree to be in this study, the research involves being asked a set of warm-up questions, interview questions and wrap-up questions.

We will document the session by taking notes using either a pen and paper and/or a laptop computer. The interview will be audio recorded and transcribed into written notes later in order to get an accurate record of what you said.

Transcripts, recordings, notes and any information that is collected will be used by our research team only and only in connection with this study. Any information collected will be associated

HCI 594 Project Final Report	Team: Group 1
	Date: 11/15/2021

with a pseudonym to protect your identity and will be stored in a safe location. Notes containing personal information will be destroyed after data is collected.

Are there any risks involved in participating in this study?

Being in this study does not involve any risks other than what you would encounter in daily life. You may feel uncomfortable or embarrassed (or sad or angry) about answering certain questions. You do not have to answer any question you do not want to.

Furthermore, you have the right to stop the session at any point. If you want to withdraw from the study, simply state that you would like the session to be over. There is no penalty for withdrawing. If you choose to withdraw, your recording will be destroyed.

Are there any benefits to participating in this study?

You will not personally benefit from being in this study. We hope that what we learn will help people have better travel experiences in the future.

How much time will this take?

The interview will take about 20 minutes to complete.

Are there any costs to me for being in the research?

There is no cost to you for being in the research.

Can I decide not to participate?

Your participation is voluntary, which means you can choose not to participate. There will be no negative consequences, penalties, or loss of benefits if you decide not to participate or change your mind later and withdraw from the research after you begin participating.

Who will see my study information and how will the confidentiality of the information collected for the research be protected?

The research records will be kept and stored securely. Your information will be combined with information from other people taking part in the study. When we write about the study or publish a paper to share the research with other researchers, we will write about the combined information we have gathered. We will not include your name or any information that will directly identify you. Some people might review or copy our records that may identify you in order to make sure we are following the required rules, laws, and regulations. For example, the DePaul University Institutional Review Board may review your information. If they look at our records, they will keep your information confidential.

The audio recordings will be kept until accurate written notes have been made, then they will be destroyed. The notes, recordings and transcripts will be kept for the duration of the spring quarter only and will be destroyed at the end of the quarter.

HCI 594 Project Final Report	Team: Group 1
	Date: 11/15/2021

To prevent others from accessing our records or identifying you should they gain access to our records, we have put some protections in place. These protections include using a pseudonym for you and other people in the study and keeping the records in a safe and secure place (using a password protected computer, encrypting our records, etc.).

What if new information is learned that might affect my decision to be in the study?

If we learn of new information or make changes to any portion of the study, and the new information or changes might affect your willingness to stay in this study, we will provide the new information to you. If this happens, you may be asked to provide ongoing consent (in writing or verbally).

Who should be contacted for more information about the research?

Before you decide whether to accept this invitation to take part in the study, please ask any questions that might come to mind now. Later, if you have questions, suggestions, concerns, or complaints about the study or you want to get additional information or provide input about this research, you can contact the researcher.

Before you decide whether to accept this invitation to take part in the study, please ask any questions that might come to mind now. Later, if you have questions, suggestions, concerns, or complaints about the study or you want to get additional information or provide input about this research, you can contact the research team or our faculty advisor. Their contact information is included below:

Researchers:

Javier Guzman, Graduate student

Email: javguzman20@gmail.com

Paola Favela, Graduate student

Email: pfavela1@depaul.edu

Luyun Shao, Graduate student

Email: lshao3@depaul.edu

Omkar Dixit, Graduate student

Email: odixit@depaul.edu

You may also contact DePaul's Office of Research Services if:

- Your questions, concerns, or complaints are not being answered by the research team.
- You cannot reach the research team.

HCI 594 Project Final Report	Team: Group 1
	Date: 11/15/2021

- You want to talk to someone besides the research team.

You will be given a copy of this information via email to keep for your records.

Personal Release for Filming

By completing this interview you authorize the ExploreAR team to take and use video and audio recordings in connection with the research study. The recordings will be destroyed after the research study is completed.

Statement of Consent from the Subject:

Verbal consent:

The consent has been provided to you. Have you had all your questions and concerns answered? If not, please ask me anything else you would like. If all your questions have been answered, do you provide your verbal consent to be in the research?

By completing the interview you are indicating your agreement to be in the research.

HCI 594 Project Final Report	Team: Group 1
	Date: 11/15/2021

Appendix III: Interview Protocol

Interview Introduction

Hello, my name is [____]. Thank you for meeting with me today. I am a graduate student at Depaul University and my group and I are interested in developing an app that encourages urban exploration using AR.

Just to confirm, your participation is 100% completely voluntary. Your name will be replaced with a pseudonym. Today's interview should take approximately 20 minutes, without interruption. Please refrain from using your cell phone or any devices that may serve as a distraction.

We are going to ask you some questions regarding a hypothetical urban exploration mobile application. Additionally, with your permission, I'd like to record this session. The recording will be completely confidential, not sold to third parties, and will only be used for internal research team purposes. If not, that is okay and I will continue forward recording your answers manually.

Warm up Questions:

- Have you ever used an AR based app (i.e. Pokemon-Go, World Around Me, etc)?
 - If so, please describe that experience.
- What's your most recent urban exploration experience?
 - Please describe

Main Questions:

- How do you decide what you want to explore in local or new areas?
 - Have you used services/platforms like Atlas Obscura, RoadTrippers etc.?
 - Please explain how you use them
- When you go exploring, what is it that you want to see/understand/learn?
 - What are things that catch your attention?
- Have you had any frustrating travel/exploration experiences recently?
 - What caused those frustrations?
 - Could any of those have been solved by an app?
- What type of features do you like to have in travel apps?
 - Why do you find those features valuable?
- If there was an app that would use AR to show you interesting facts about the places you are exploring, would you use it?
 - When would you use it?
 - How often would you use an app like this?
 - If there was a reward system within the app, would that be enticing to keep you engaged in the app?
 - What kinds of features do you expect this AR app to have?
 - How important would X be to you?

HCI 594 Project Final Report	Team: Group 1
	Date: 11/15/2021

Wrap-Up Questions:

- Is there anything I should know that I didn't cover in the previous questions?
- Do you have any questions for me?

Demographic Questions:

- What is your pseudonym?
- What gender do you identify yourself with?
- What city and state do you live in?
- Could you please tell me your occupation?
- Would you mind telling me your age (age group is also fine)?

Closing:

Thank you! That concludes the interview. Do you have any questions for me at this time? Remember that if you have any questions later on, you can email me after this session as well. Thank you for your time and for meeting with me.

HCI 594 Project Final Report	Team: Group 1
	Date: 11/15/2021

Appendix IV: Survey

Link to the Survey:

<https://forms.gle/hqbfBeASWdeqqvRp8>

Survey Transcript:

1. Have you ever used an application that gives you some type of reward for continued use? *
 - a. Yes
 - b. No

1.1 If yes, can you please describe that service and the rewards you were given?
2. How likely are you to use an app if it rewards you for continued use. *

Less Likely 1 2 3 4 5 More Likely
3. Please describe a type of reward which would incentivize you to continue using a service *
4. How much do you agree or disagree with the following statement: The type of reward given can determine my engagement with the service. *

Strongly Disagree 1 2 3 4 5 Strongly Agree
5. Would any of the following types of rewards incentivize you to continue using a service?*
 - a. Badges
 - b. Ranking System
 - c. Profile customization options (Profile icons, backgrounds, etc.)
 - d. Exclusive content
 - e. Avatar customization options
 - f. Other: _____
6. How much do you agree or disagree with the following statement: I like having access to exclusive features based on how hard I work for them. *

Strongly Disagree 1 2 3 4 5 Strongly Agree
7. How much do you agree or disagree with the following statement: I like to compare or share my scores with other people. *

Strongly Disagree 1 2 3 4 5 Strongly Agree
8. How much do you agree or disagree with the following statement: I like having multiple ways to customize a profile page. *

Strongly Disagree 1 2 3 4 5 Strongly Agree

HCI 594 Project Final Report	Team: Group 1
	Date: 11/15/2021

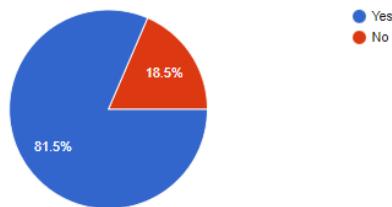
9. Please rank the top 5 features you would want to see in an exploration focused app. *
- a. Navigation
 - b. Rewards
 - c. Search Function
 - d. Favorites List
 - e. Previously Visited List
 - f. Useful information about sites
 - g. Filtering Content
 - h. Notifications when near sites
 - i. Recommendations
 - j. Reviews
10. Do you have any other comments or suggestions for an exploration focused app?

HCI 594 Project Final Report	Team: Group 1
	Date: 11/15/2021

Results:

Have you ever used an application that gives you some type of reward for continued use?

27 responses



If yes, can you please describe that service and the rewards you were given?

21 responses

Game app where they give you rewards for completing tasks

The Starbucks and McDonald's App. With every purchase you get points towards future purchases. As well as access on mobile only deals

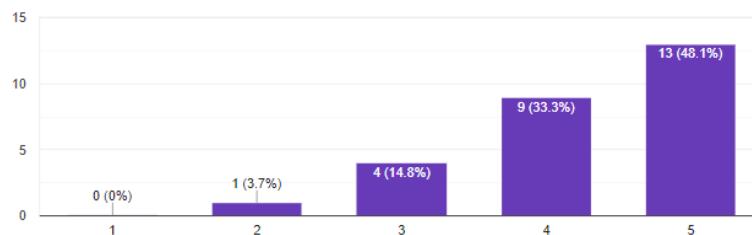
Honey, the google plug give the discount for shopping, will give reward point for next time use, save more money

it was a comic book service and you would enter in drawings with points you gained

I have some restaurant apps that I use that have loyalty programs. One that I use the most is Chipotle. Sometimes they give me free guac at random times, but mostly I get points from getting food from Chipotle and then I can use those points for "free" food. I also have used the Starbucks app for the same purpose. In terms of non-loyalty reward systems, I have used Duolingo for learning and practicing languages. I use the free app and it only allows you to do so much without upgrading. One piece to it is that you have to get points from doing well in a practice and you can use those points to unlock more practices. This is rewarding because then I can get access without having to pay. When I was younger, I played a game called Club Penguin. It was a virtual world with penguin avatars. You could gain coins from playing games well. You could use those coins to buy clothes for the avatar or furniture/decorations for

How likely are you to use an app if it rewards you for continued use.

27 responses



HCI 594 Project Final Report	Team: Group 1
	Date: 11/15/2021

Please describe a type of reward which would incentivize you to continue using a service?

27 responses

Gift card (Monetary benefit)

Money reward / ranking system

Points convertible to monetary currency.

It depends. Maybe streaming apps, and rewards to movie theaters, not sure. Grocery apps.

Daily deals, points towards free items

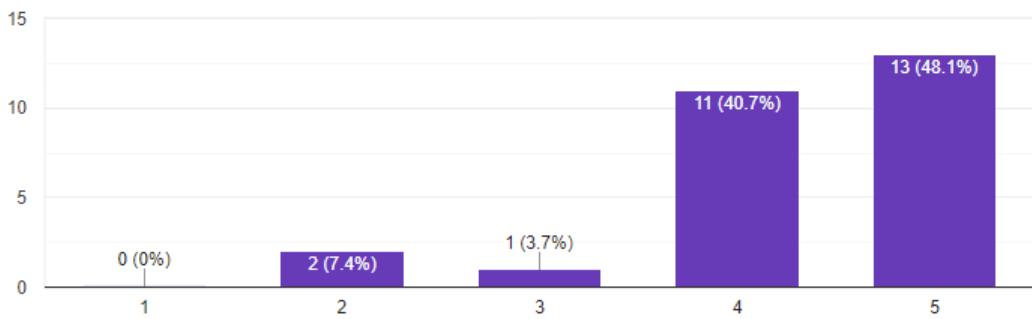
for save more monry or time

more of what the service provides

Coupons, "free" gifts/services, access to more features/content/customization, a reward that can be shown off to others (ex: work micro-credential or a "fun" badge/customization to show friends if there is a game/competitive element)

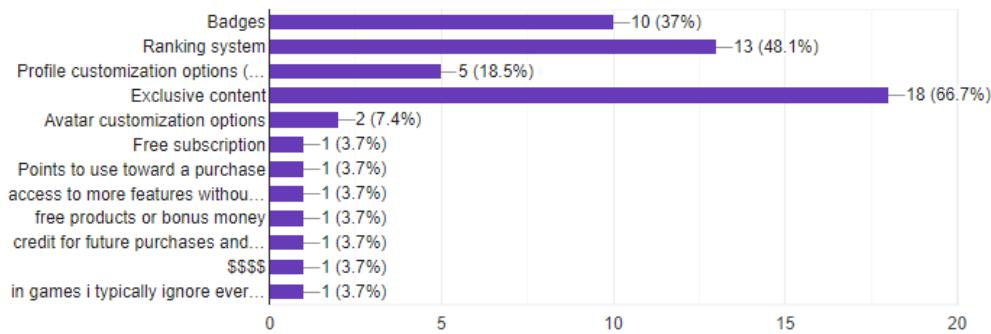
How much do you agree or disagree with the following statement: The type of reward given can determine my engagement with the service.

27 responses



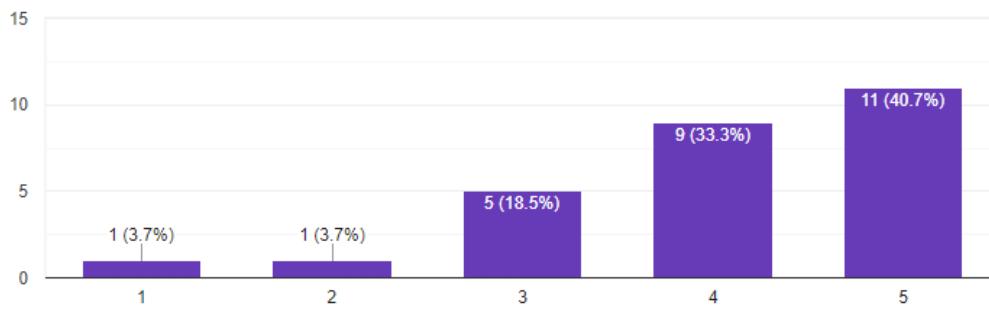
Would any of the following types of rewards incentivize you to continue using a service?

27 responses



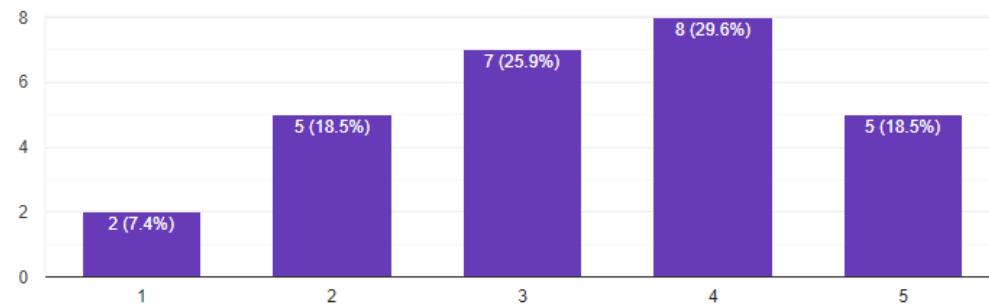
How much do you agree or disagree with the following statement: I like having access to exclusive features based on how hard I work for them.

27 responses



How much do you agree or disagree with the following statement: I like to compare or share my scores with other people.

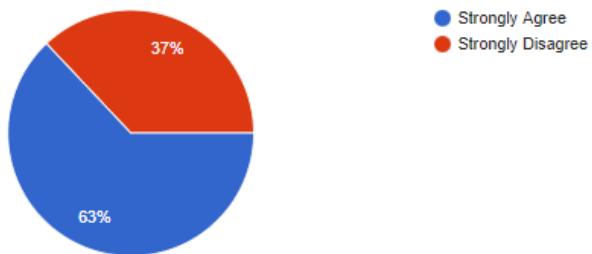
27 responses



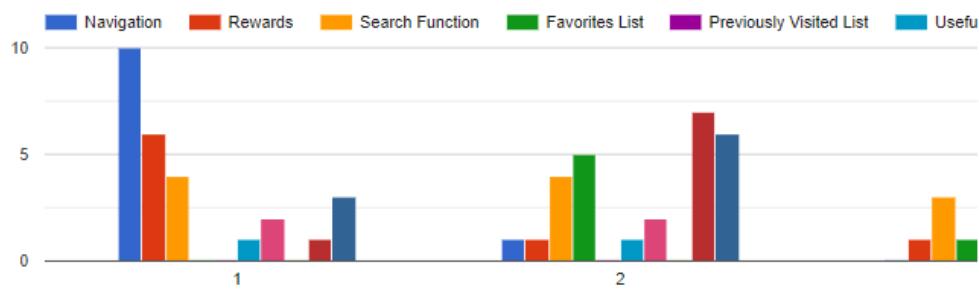
HCI 594 Project Final Report	Team: Group 1
	Date: 11/15/2021

How much do you agree or disagree with the following statement: I like having multiple ways to customize a profile page.

27 responses



Please rank the top 5 features you would want to see in an exploration focused app.



Do you have any other comments or suggestions for an exploration focused app?

14 responses

n/a

No

It would be preferable if the app will have a gamification theme.

N/A

I would say all features would be useful. I think having notifications tied in with navigation would be cool (i.e. indicating sound and audio directions).

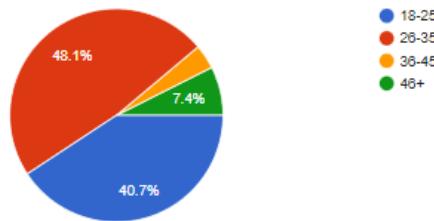
I'm not really sure what exploration focused app means to be honest. Also the ranking table in the previous question was really confusing for me

Community to make new friends with other explorers

I wish there was more context to this question. Such as a exploring to shop? Exploring a map? Maybe a function to explore new items or an efficient guidance system

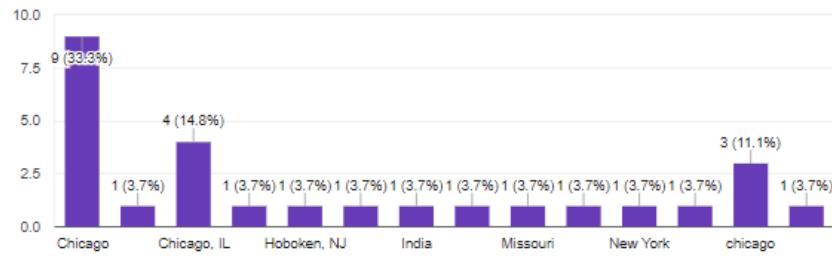
How old are you?

27 responses



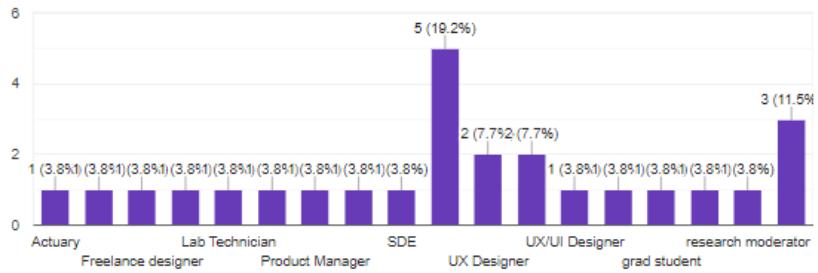
Where are you located?

27 responses



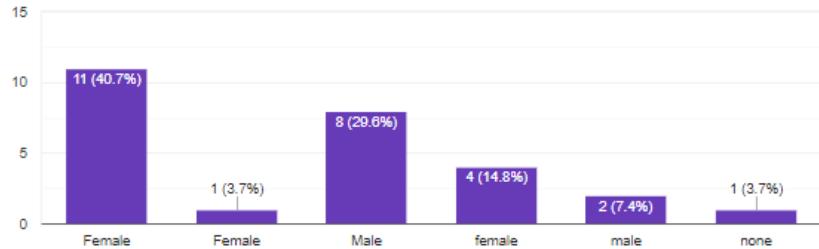
What is your occupation?

26 responses



What gender do you identify as?

27 responses



HCI 594 Project Final Report	Team: Group 1
	Date: 11/15/2021

Appendix V: A/B Testing Questions

Link to the Atlas Obscura Testing Questions: <https://forms.gle/YreXJjL1KBYHZM756>

Link to the Low-Fi Prototype Questions: <https://forms.gle/BQ6d6EpQY61VE9qi8>

Testing Questions:

Correct answers are **bolded**

(Instructions for Atlas Obscura Testing)

Please open, and only refer to the following link when answering the questions below:

<https://www.atlasobscura.com/places/graceland-cemetery>

(Instructions for Low-Fi Prototype Testing)

Please open, and only refer to the following link when answering the questions below:

<https://www.figma.com/proto/cBKnntQFLsGEWY1vA6q4fG/Low-Fi-Prototype?node-id=117%3A192&scaling=min-zoom&page-id=0%3A1&starting-point-node-id=96%3A1400>

1. When was Graceland Cemetery founded?
 - a. 1800
 - b. 1845
 - c. 1860**
 - d. 1893

2. What is Graceland Cemetery Famous for?
 - a. Many famous actors are buried there
 - b. Many famous architects are buried there**
 - c. There was a murder there
 - d. Elvis was buried there

3. What is the name of the little girl the monument is named after?
 - a. Jane Dillon
 - b. Sally Marshall
 - c. Charlotte Clarke
 - d. Inez Clarke**

4. What is the name of the sculptor who created the monument of the little girl?
 - a. Louis Sullivan
 - b. Daniel Chester French
 - c. Andrew Gagel**
 - d. Richard Schmidt

5. What year did the girl the monument is named after die?
 - a. 1873
 - b. 1880**

HCI 594 Project Final Report	Team: Group 1
	Date: 11/15/2021

- c. 1908
- d. 1890

Additional Questions

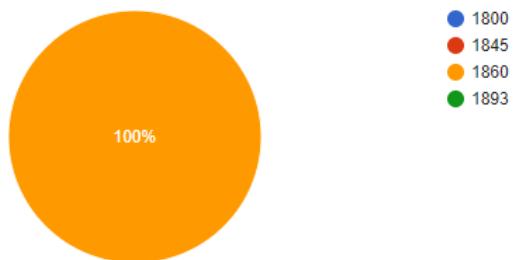
- Was there any task or portion of the test which you found confusing?
- Do you have any other questions or comments?

HCI 594 Project Final Report	Team: Group 1
	Date: 11/15/2021

A/B Testing Group A Results (Atlas Obscura Group):

When was Graceland Cemetery founded

11 responses



What is Graceland Cemetery famous for?

11 responses



On the page, locate and click the link to learn more about the child statue in the cemetery.

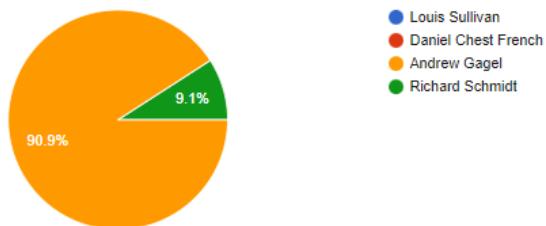
What is the name of the little girl the monument is named after?

11 responses



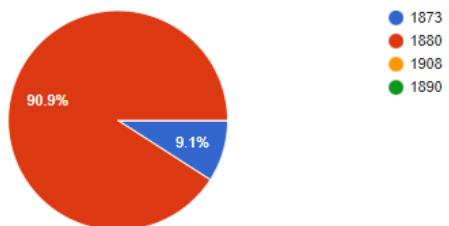
What is the name of the sculptor who created the monument of the little girl?

11 responses



What year did the girl the monument is named after die?

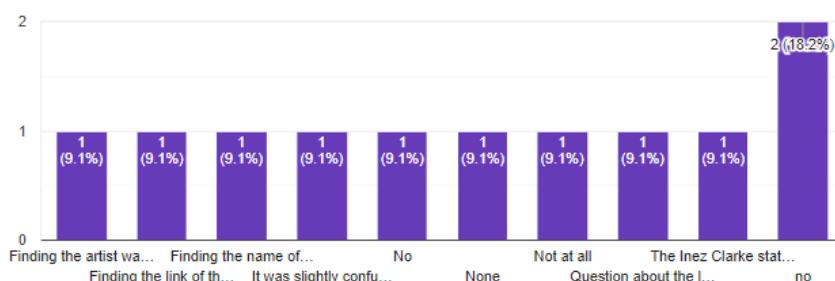
11 responses



Post Test Questions

Was there any task or portion of the test which you found confusing?

11 responses



Do you have any other questions or comments?

8 responses

No

Nope

Everything was all clear!

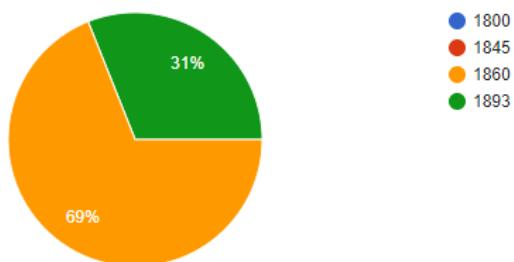
No, I think i mentioned everything above.

HCI 594 Project Final Report	Team: Group 1
	Date: 11/15/2021

A/B Testing Group B Results (Prototype Group):

When was Graceland Cemetery founded?

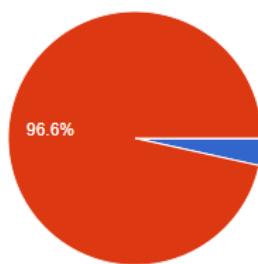
29 responses



What is Graceland Cemetery famous for?

29 responses

- Many famous actors are buried there
- Many famous architects are buried there
- There was a murder there
- Elvis was buried there

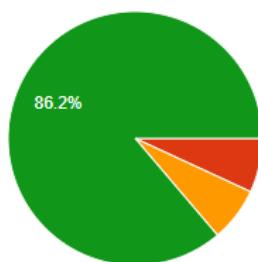


Find and click on a section to learn more about the child statue in the cemetery

What is the name of the little girl the monument is named after?

29 responses

- Jane Dillon
- Sally Marshall
- Charlotte Clarke
- Inez Clarke



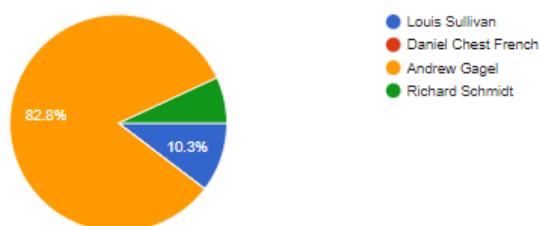
What is the name of the little girl the monument is named after?

29 responses



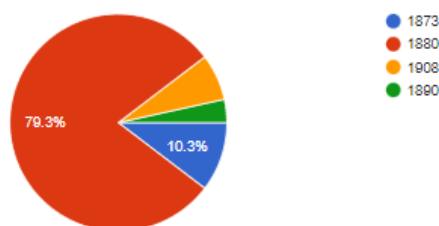
What is the name of the sculptor who created the monument of the little girl?

29 responses



What year did the girl the monument is named after die?

29 responses



Post Test Questions

Was there any task or portion of the test which you found confusing?

29 responses



HCI 594 Project Final Report	Team: Group 1
	Date: 11/15/2021

Appendix VI: Usability Testing (Round 2) Script

AR Quest Exploration and Reward System Usability Test

Introduction

Thank you very much for taking the time and helping me with the test! I will be moderating the usability study today. What I will invite you to do is to navigate through Figma and complete a few tasks.

Please note that the app is a mid-fidelity prototype with limited functions, and some features are not active if you click on them. In the process of completing this activity, I would like you to speak out loud to me about what you are thinking and how you are feeling. There are no right or wrong answers, no time limit, and you can stop at any time so please feel free to share anything in your mind. The test should take about 4-5 minutes to complete, however, there is no time limit. You can stop interacting with the app at any time.

Optional: I would like you to share your screen while you are completing your tasks. To make sure I don't miss any details, I would like to record the audio for the process.

For this activity, we'd like you to explore our app's AR feature available in the quest packs. You can start off by clicking the Chicago Underground pack on the homepage.

Observations:

1. Do they explore the Chicago Underground pack?
2. Are they able to find the Graceland Cemetery AR view?
3. After completing the quest on Graceland Cemetery, do they go back to the home page or the rewards page?
4. Do they go down one of the other paths?

Post Test Questions (Rewards Group):

1. After completing the quest on Graceland Cemetery, and getting that congratulations pop-up do you feel inspired to look at other locations?
 - a. After completing the quest on Graceland Cemetery, and getting that congratulations pop-up did you feel inspired to look at other locations to unlock more possible rewards?
2. Did you notice the rewards section on the navigation bar? **Yes**
 - a. Clicking on that, do you feel like you understand how to receive and claim rewards?
 - b. Can you tell us your progress towards receiving that reward?
 - c. Is this enticing enough to keep using the app?

HCI 594 Project Final Report	Team: Group 1
	Date: 11/15/2021

3. Is there anything that you would like to see more of?

Post Test Questions (No Rewards Group):

1. After completing the quest on Graceland Cemetery, did you feel inspired to look at other locations?
2. Did you notice the rewards section on the navigation bar?
 - a. Clicking on that, do you feel like you understand how to receive and claim rewards?
 - b. Can you tell us your progress towards receiving a reward?
 - c. Are the badges enticing enough to keep using the app?
 - d. Would these rewards for completing tasks have affected whether or not you looked at other locations on the app?
3. Is there anything that you would like to see more of?

Wrap Up:

If you don't mind, I would like to gather some demographic information.

1. Do you mind telling me your age?
2. Could you tell me your occupation?
3. What is your ethnicity?
4. Which gender do you identify yourself with?
5. What city and state do you currently reside in?

Closing:

Thank you for completing this usability test with me. That concludes the test. Do you have any remaining questions or comments for me?

HCI 594 Project Final Report	Team: Group 1
	Date: 11/15/2021

Appendix VII: Prototypes

Link to Low-Fi Prototype:

<https://www.figma.com/proto/cBKnntQFLsGEWY1vA6q4fG/Low-Fi-Prototype?node-id=117%3A192&scaling=min-zoom&page-id=0%3A1&starting-point-node-id=117%3A192&show-proto-sidebar=1>

Link to Mid-Fi Prototype (Reward):

<https://www.figma.com/proto/cBKnntQFLsGEWY1vA6q4fG/Low-Fi-Prototype?node-id=282%3A1523&scaling=min-zoom&page-id=0%3A1&starting-point-node-id=282%3A1523&show-proto-sidebar=1>

Link to Mid-Fi Prototype (No Reward):

<https://www.figma.com/proto/cBKnntQFLsGEWY1vA6q4fG/Low-Fi-Prototype?node-id=312%3A10397&scaling=min-zoom&page-id=0%3A1&starting-point-node-id=312%3A10397&show-proto-sidebar=1>