



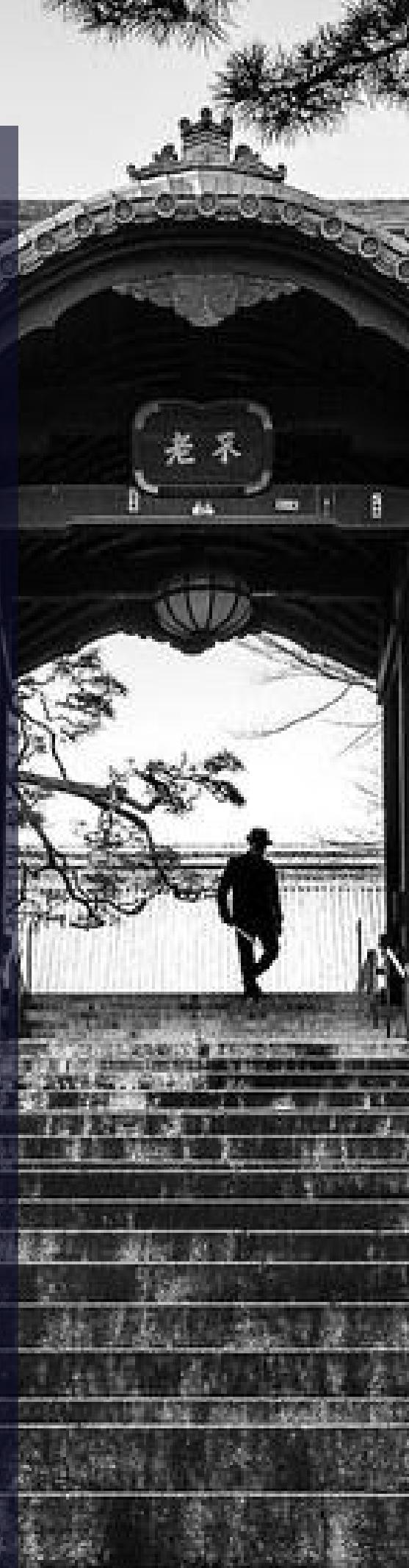
Sarah Deak

Spring 2022 Capstone // UX Design

Purdue University

# Contextual Learning:

*Location Based History*



# Table of Contents

<b>Project Overview: Learning in Context</b>	<b>2</b>
Defining Local History & Why it is So Important	
What are my goals?	
Who am I designing for?	
What are my outcomes?	
<b>What do my users need?</b>	<b>5</b>
Defining the Opportunity	
User Characteristics	
Characteristics Translated into Needs	
<b>How might I address these needs?</b>	<b>9</b>
Inspiration + Ideation	
Journey Maps + User Feedback	
LoFis + User Feedback	
<b>Have I met the needs of my users?</b>	<b>15</b>
Design Proposal	
Further Considerations	
Reflection	
<b>Appendix</b>	<b>19-27</b>
<b>Bibliography</b>	<b>28</b>

# Project Overview: Learning in Context

*I was given the opportunity to conduct my own project over the course of one semester. I wanted to choose a project that would enable me to **practice a wide variety of UX skills**, while also being something I was **passionate** about learning.*

*I eventually landed on exploring opportunities within digital technologies to better facilitate learning about location-based history. This section will describe why this is such an important space for work to be done in, as well as what I wanted to get out of my exploration of this space at the end of the semester.*

## Defining Local History & Why it is So Important

What are my goals?

Who am I designing for?

What are my outcomes?

## What is Local History?

Local history, as described by Buckingham (n.d.) "attempts to reconstruct the history of a place to understand how the way people lived connects to the community's present and future". In essence, **local history is the study of the ways our lives have been shaped by the people and places that have come before us in the small geographical areas that we live in.**

*But why is local history so important to learn about?* As students, we learn so much about national and international events, but the history of the places that directly surround us are often disregarded. When we study the history of our individual interactions, it allows us to connect the past with the present, as well as enables clearer understanding of communities and the relations of the people in those communities (Buckingham, n.d.).

---

"Local history reflects the reality that our lives are shaped by particular places and that our physical place in the world is a major determinant to how our lives are lived"

(Buckingham, n.d.)

---

## What are my goals?



Uncover opportunities to leverage different types of technologies to prompt the best on-the-go learning environment

My passion for this project lies deeply within **designing for an on-the-go lifestyle**, particularly one of discovery. I wanted to *learn* about the different technologies that are currently available that **encourage curiosity** and best **promote contextual learning**.



Design a digital tool that fosters a connection between people and places

The second goal for this project was to *design* a digital tool, using my findings from throughout the semester, that fosters some kind of **meaningful connection between people and places**. This interaction was to be designed as I learned more about the space and the needs of the people within it.

## Who are my users?

During my research, I looked into possible existing technologies that already have this function. However, I ended up realizing that because nothing like this already exists ([My Competitor Analysis](#)) the best place to start would be with the people that would actually want to use it. I found this group of people to be best described as **passionate informal learners**.

## Deliverables



### Research Report

Firstly, I will be conducting **research into this opportunity space and consolidating my findings into a single report**. These findings may include but not be limited to existing technologies, implementation strategies & limitations, and the psychology of mobile learning.



### Digital Tool

My second deliverable is **mockups of my proposed digital tool**. These mockups will likely have some forms of interaction, but still emphasize those most important aspects of the design. These will have been evaluated for desirability and function in previous iterations.



### Presentation & Documentation of Outcomes

Lastly, I will be creating a design document that includes an overview of my design process as well as explores **future considerations** for if work on this project were to continue.

---

# What do my users need?

*The first thing I needed to do for my project was define who I was designing for and what those individuals need. This was accomplished mainly through a literature review covering the psychology of mobile learners, but I also talked to a few people who were interested in my initial idea pitch.*

*I found three main characteristics to be most relevant to my user group and opportunity space. I then translated these characteristics into actionable needs using, well, more research. These two things in conjunction helped to define what I wanted to provide for these individuals by the end of the semester, at which point I moved into ideating within actually addressing these needs.*

Defining the Opportunity

User Characteristics

Characteristics Translated into Needs

## Defining the Opportunity Space

My focus this semester was on designing an experience that:

---

enables users to learn the history of the places around them.

---

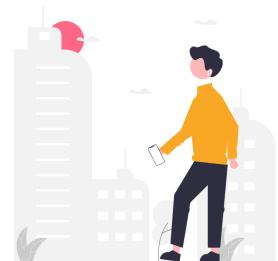
The way this goal is written is extremely important. I use the word enable because my focus is on **completely informal, user-led learning**. No requirements, no competition, just pure enjoyment and desire- my users learn because they want to learn. So essentially I'm creating something that encourages users to utilize it purely for their own fulfillment.

*Why did I do this?* The reason for my focus on this group of people is twofold. One is that this is the user group that is easiest to design for- they will use it for its intended purpose- *to learn*. Designing for this group means not having to worry about encouraging extrinsic motivation or how to “trick” people into using the tool. The second reason is even more important: Because this space is a **completely new opportunity**. I’m not fixing an existing problem for a specific group of people- I am creating a new experience for people to enjoy. Focusing first on those people who will *actually want to use it* just makes sense in this context.

## Relevant User Characteristics



So, to give a face to these characteristics, this is Marley. Marley has three relevant main characteristics which are that they are:



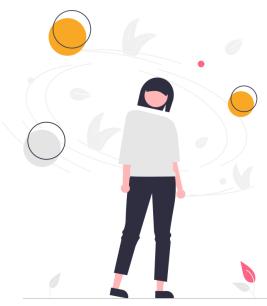
### A Frequent mobile user

This characteristic is important because this is how my users tend to receive information. They commonly use their mobile device and are familiar with how the technology works for the most part. This is also important because it means they **regularly have their mobile phone on them** while traveling.



### A Passionate explorer

They have an **intrinsic curiosity about the world around them and enjoy seeking it out**. This is important because it means all I must do is give them the opportunity to partake in their learning instead of forcing it upon them.



## & An Informal learner

Informal learning is defined as learning that “takes place outside the formal educational contexts; it is self-regulated, intentional and interest-based.” This is important both because they need the intrinsic motivation to learn *and* because **informal learners have unique sets of requirements for their learning environments** (Viberg & Wiklund, 2021).

Marley isn't perfect, though, and neither is the world. While she has the desire to learn more, there is a **barrier to entry that is hard to ignore**. Especially in local history, where do you start to learn about these things? We are often recommended to start at local museums or talking to local curators, but this takes away **the context and exploration that is crucial to the informal learner's interest**. Museums also can't answer the **contextual questions**- where did these things take place? What has happened in that area since this time? How has the area changed because of the past?

---

There exists an *opportunity* to provide Marley with a way to answer these and other types of questions about places they explore while on the go.

---

## Translated into User Needs

So the next question I asked myself was: what does Marley need? It's great that we know who they are- but this doesn't tell us what to design. Through secondary research and interviews with users, I translated these characteristics into actionable needs.

Informal Learner → Complete control over the environment and pace



“Informal learning should be so free and so subconscious that we cannot say when and how this kind of learning takes place” (Viberg & Wiklund, 2021)

First of all, as an informal learner Marley needs **complete control over their learning environment**. Informal learning occurs because an individual wants it to occur- **they** set the boundaries of their learning (Viberg & Wiklund, 2021). I must simply provide them with the opportunity to act upon their desire to learn, and the ability to add it seamlessly into their lives.

## Mobile User → Contextual, on the go learning



"A key facet of mobile learning is that it enables situated learning whereby learning materials can be linked to real locations" (Jarvis et al., 2016)

Next, as a mobile user, Marley desires **contextual, on-the-go learning**. In my research, I found that situated learning- or learning linked to real locations- is an important part of mobile learning adoption (Jarvis et al., 2016). However, *maintaining* interest in mobile learning requires a few additional things. Which brings me to the last key need which is

## Passionate Explorer → Maintained curiosity &amp; immersion



"Learners use mobile platforms when the environment gains their focused attention and offers curiosity and enjoyment" (Karimi, 2016)

Informal learning is influenced by intrinsic motivation and the actual process of performing an activity (Karimi, 2016). This means that as a passionate explorer, my users want a way to learn in context to the world- take away their exploration, and they are left with no motivation to learn.

---

# How might I address these needs?

*With my users' needs in mind, I set about trying to address them through a digital tool. I took a lot of inspiration from different existing technologies. I focused intently on creating the best experience for the needs of my users, and less on the nitty gritty details.*

*My process was **iterative**, but I definitely ran out of time to get the full amount of iterations that should be done to have a completed final design. I tested once with my initial sketches for proof of concept, and once with my low fidelity mockups for usability.*

Inspiration & Ideation

Journey Maps + User Feedback

LoFis + User Feedback

## Inspiration

In order to ideate on possible ways to address the needs of my users, I took inspiration from a few different successful technologies that could be utilized in a different way.

### Assassin's Creed Franchise

In a casual conversation with a potential user, they brought up Assassin's Creed and the similarities it holds to my project. Assassin's Creed is a series of video games known for historical depictions based on real events. According to Porter (2018), the developers "decided to release a teaching aid that enabled students to learn through **immersion**. The idea is the same as the game, except it removes violence in favor of a **walking simulation that highlights local history**."

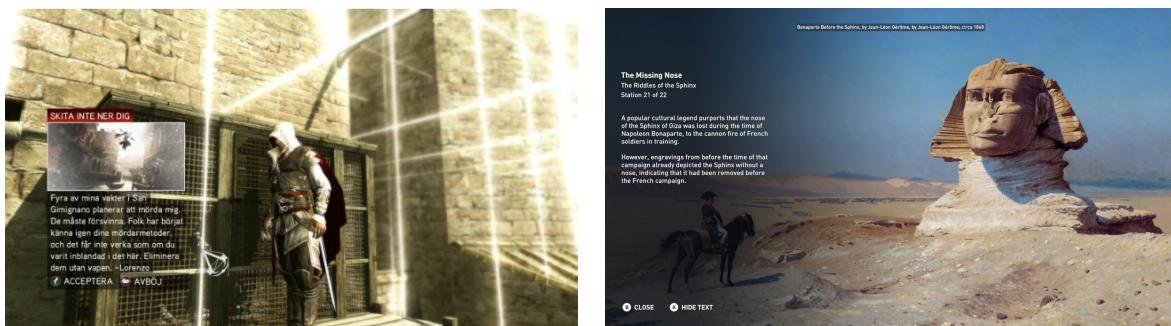


Figure 1 Cage with pigeons

This sparked an interest in me, so I conducted some reddit research into why these games are popular and their success at encouraging informal learning. Some quotes from reddit users about **how the game helped them learn about history**:

"ACIII gave me a comprehensive understanding of the time period, and made me actively interested in doing my own research and comparing it to the game's portrayal. It brought history to life for me." (darkspine10)

"The learning is an indirect result of the games because it sparks people's interest and curiosity. So I don't think it's a direct tool." (AlphaDavidMahmitt)

My research into this game helped solidify how important encouraging **curiosity** in my users was. This also indicated that the resources I provided to my users needed to *encourage additional informal learning*, instead of limiting it to only the information provided.

### Geocaching

A second inspiration point came from the geocaching community. I did some light research into the geocaching community and how immersive it is and how successful it is at encouraging exploration.



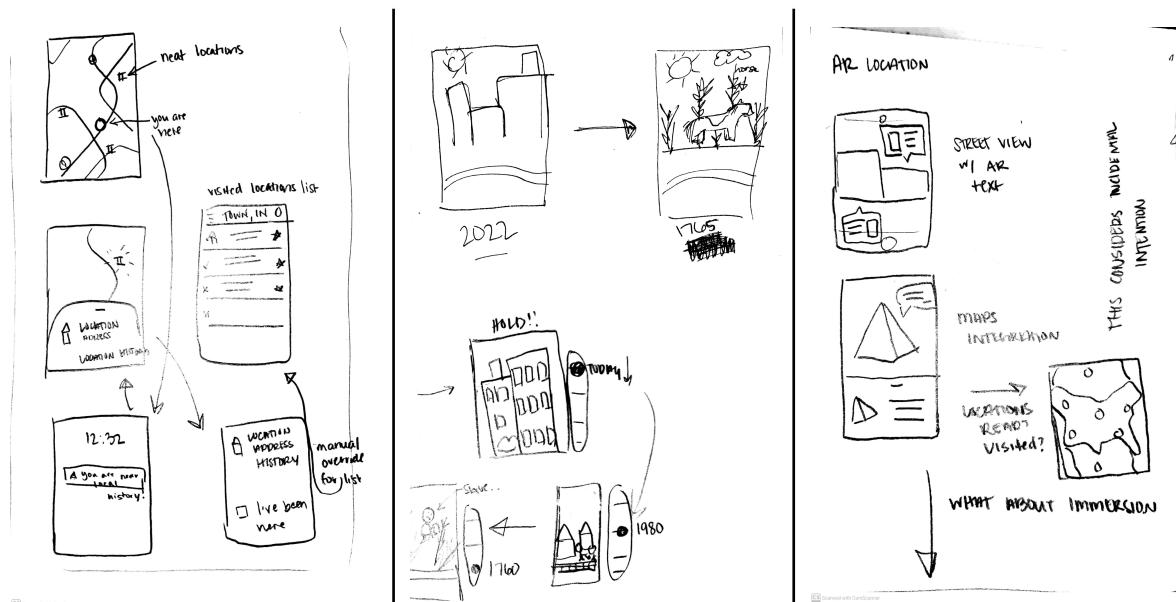
Geocaching is kind of like a global treasure hunt. Geocaching is a community of people looking for, adding, and maintaining caches across the world (*Geocaching*, 2012). According to the community, geocaching helps to blur the lines between physical locations and digital technologies, which is an important need of my users.

"This community use mobile and social technologies to blur the boundaries between the virtual spaces of the Internet and the physical spaces that surround them, thus creating persistent digital narratives of location that provide a temporal record of place that acts as a resource for others" (Clough, 2010)

"I like geocaching because it takes me places; it takes me places I might not otherwise go, shows me things I might not otherwise see, teaches me things I might not otherwise learn. The cache itself is a waypoint." (User on forums.geocaching.com)

## Journey Maps + User Feedback

After a few rounds of sketching, which can be found in the [appendix](#), I felt I had three solid paths I could take to address the needs of my users. These ideas were:



### Maps Integration

Adding local historical data to widely used travel apps

### AR Layers

Allowing users to actually see what the world looked like

### Geocaching & ACreed

A treasure hunt for historical data at a visited location

For each of these paths, I made a sketch that describes the journey the user would go through for each idea. These journey maps gave me something physical to use to help me pitch my ideas to people. My journey maps can be viewed in depth here > [Journey Maps.pdf](#)

My goals for creating these maps were to recognize where user emotions might come into play within current ideas as well as to show them to potential users to collect feedback.

The [feedback](#) I got from my journey maps helped me solidify the route I would take in my design. I had three potential ideas that I showed to users, and on a very high level the main insights I gained were:

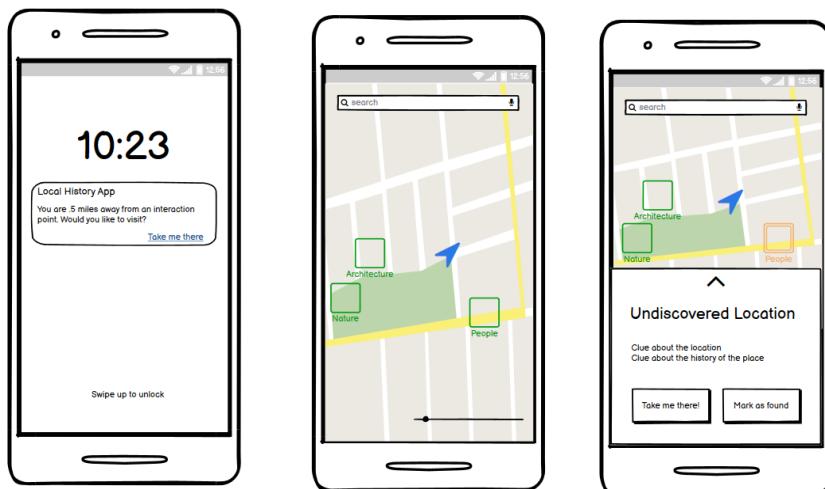
- X Users don't really care about what the place used to look like physically
- X Google could easily add a feature like this
- ✓ Users find the treasure hunt style is kind of cool, but don't want to have to search too hard
- ✓ AR is good for quickly attaching surroundings to history

I ended up taking all of the ideas and kind of mashing them together for my next iteration. They each had some good things that I took and other things I left behind. At the end of my first rounds of ideation and journey map testing I was left with this design, which is reflected in my low fidelity mockups.

→ A new application that would help users to navigate to an area to hunt for a specific point of interest within the area. Once they located the point of interest with their camera, they would then see floating AR information which would teach them about the location.

## Lofis + User Feedback

I created my lo-fis using balsamiq wireframing software. This is the first time I've ever used this software, so it was fun to learn another wireframing method.

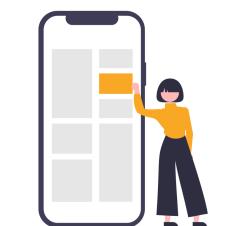




My goals going into testing my designs were as follows:

- Test workflow understanding
- Receive suggestions for additional/removed features
- Consider app-use *in-context*

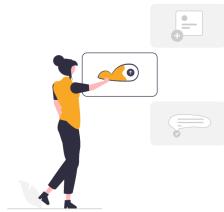
I tested my design with three users. Some of the most valuable actionable insights I gained are broken down into sections below, while all insights can be found in the [appendix](#).



### Workflow understanding

- “Interaction points” are confusing
- What if they can’t find the location?
- Users are more likely to miss historical significance and beauty when looking through the camera for so long

*This feedback caused me to pivot to a more in-the-moment workflow. In my next iteration, users can simply pick up their camera whenever they see a location they want to learn more about.*



### Feature suggestions

- Why doesn't the app just take me straight to the location?
- Search function is confusing if the places are unknown until found
- Filtering where they've already been

*They should be able to have complete control over their learning, which means locations should not be unknown. In the next iteration, locations will be suggested to them to go explore and learn more about, for increased transparency about the actions they are taking.*



### Contextual app use

- Wouldn't this make more sense as an addition to the apps people already use to navigate?
- Likes the option to be able to listen to the history
- Not sure they would necessarily start by using it for their own town, but would in tourist-y places.

*This feedback caused me to pivot entirely to creating an **addition to existing maps apps**, rather than an entirely separate app. This allows users to implement it more seamlessly into their lives with less mental effort. In my next iteration, I illustrate my design as a google maps integration.*

---

# Have I met the needs of my users?

*With my testing insights in mind, I created my final design proposal using Figma. The changes I've made still needed to be evaluated, but due to time constraints I was not able to test with users. So instead, I evaluated based on what I know my users need.*

*Of course, there could be changes made if I had even more time to work on this project. I want to acknowledge where my design falls short of expectations and what would still need to be researched and tested if this project were to continue.*

## Design Proposal

Google Maps Implementation

AR History

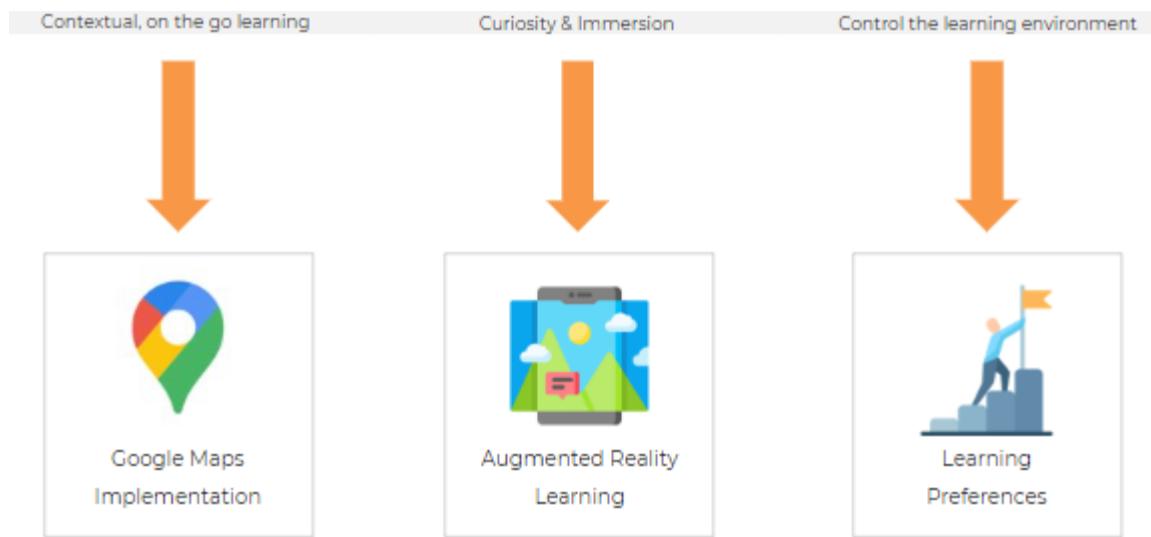
Learning Preferences

## Further Considerations & Reflection

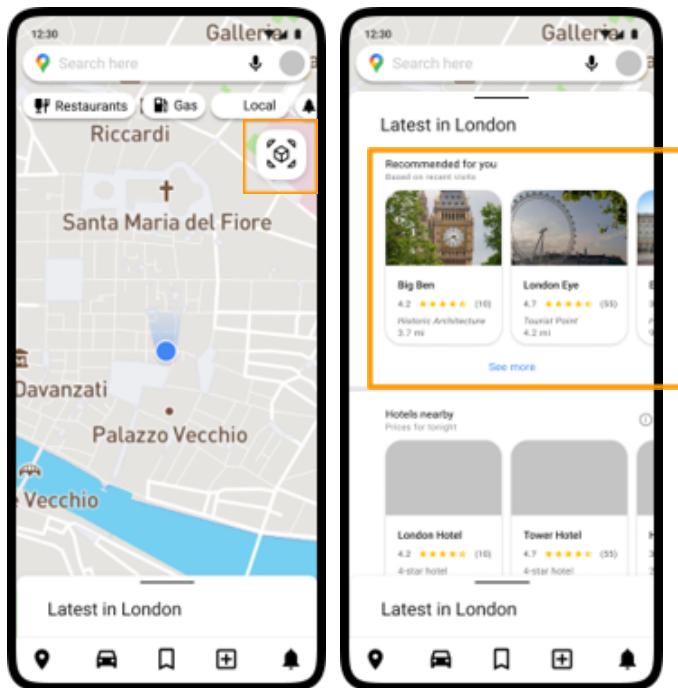
## Final Design Proposal

Full Figma Designs -> [AR History Maps Integration](#)

My final design is broken into sections in order to evaluate whether the needs of my users have been met. Each section of my design addresses at least one of my users' needs, as shown in the diagram.



### Google Maps Implementation



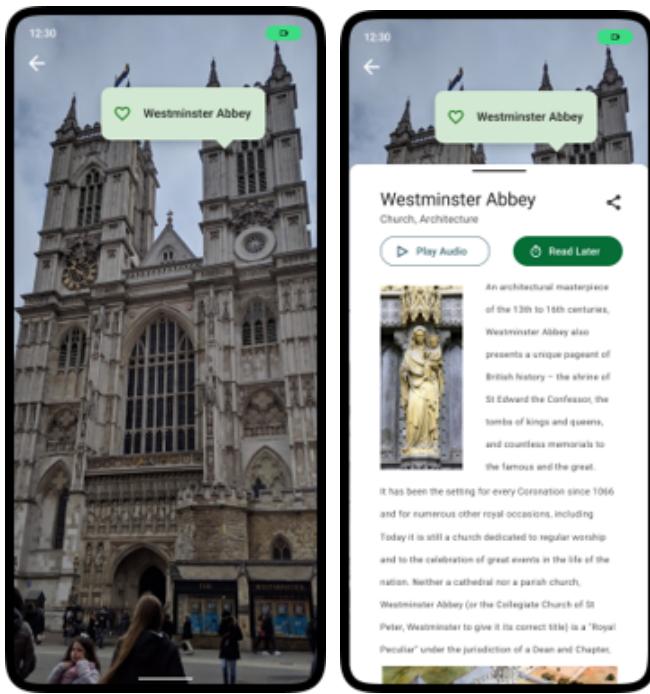
**My proposal is an addition to the existing google maps app.**

As you can see in the frames, **AR searching** would be a new choice on the main screen, and new **recommended areas** would be provided based on user preferences.

Not shown here, there would additionally be **contextual notifications** given to the user. When near a marked location, maps would prompt the user to take a look at their surroundings to learn more. These locations would be based on user preferences to keep them relevant to the user's interests.

Considering that we cannot predict when informal learning will happen, I simply want users to have the opportunity to partake **whenever the desire arises**. This provides the contextual, on the go learning that a frequent mobile user needs. It also helps informal learners have control over their learning environment.

## AR Learning



*This is the feature that the passionate explorer needs - it **encourages curiosity while still allowing immersion with the environment.***

As a reminder, my app is meant to be supplementary- it is meant to spark their interest and curiosity. The information provided will not be substantial enough to learn everything, and will instead mostly provide additional resources. How do we best spark that curiosity and interest? By ensuring that the information they are shown is relevant to their interests, which is the final section of my design.

## Learning Preferences



**The most important addition to maps would be AR Learning.**

Users would be able to use their **phone's camera to identify points of interest**, which then prompts them to learn more about it.

Movement encourages learning as well. With my AR implementation, there is motivation to **physically visit each location** because that is how you will get the resources to learn more about the area.

While I have not created prototypes for this, the last critical aspect of my design is that **users would have complete control over what is recommended to them.**

Most importantly, they would be able to specify which **types of history** they are most interested in.

On top of that, I also want to encourage people to learn **on their own time**. Once a location is visited, they are able to save the resources to read later, as well as listen to the **audio version** of it at any time.

People learn best when they have some control over their learning. Choice motivates people to engage with the materials. *It is crucial that the informal learner has complete control over their learning environment. This allows them to engage with the material in their own way, and actually connect with it.*

## Further Considerations

What else would need to be done if I or someone else were to continue this project?

### Smaller scale adaptation



My current designs are meant to be able to be adapted to be used at a local scale- just like Westminster Abbey can be scanned, so can the diner down the street from your house. But to capture this type of complexity, it is necessary to **immerse ourselves in the area and its stories**. So how is this data compiled?



### Database considerations

In order to be able to provide this as a resource for people to use and view, the **data would most likely have to be open sourced, collected from local historians and knowledgeable citizens in their respective towns**. This causes a few different issues, one being uneven distribution in minority inhabited areas.



### Community Focus

Lastly, in my research I found that a community aspect would be especially valuable to my designs, I simply didn't get to that point within my project. **It would be highly beneficial to see how a sense of community could be better facilitated within the app.**

## Reflection

This project definitely tested my abilities- more than anything it helped me recognize my strengths and weaknesses as a designer. I enjoy secondary research and compiling results, I enjoy creating & testing wireframes and analyzing insights- I do *not* enjoy hi fidelity prototyping or conducting user interviews. I have a very good grasp on how a UX process should be run- but I do think I'd have a lot more fun working on a UX team that can complement my strengths and weaknesses. I also know now where I will need to work a little harder in order to stay on track, if I'm ever asked to do these things in the future.

Overall, I did have a lot of fun with this project. It was a really fun space to work in, and I think that this is a space I could definitely see myself staying interested in as I advance through my career.

# Appendix

## Lit Review

### Goals:

I started off my project with a literature review. I wanted to learn *terminologies* in the space of local history as well as learn about *existing technologies* that can be utilized for on-the-go learning. I also wanted to use this time to learn about the *psychology* of different types of learning.

### Method:

I searched for relevant publications through the PurdueLibraries Database. The following search strings were used: *mobile learning*, *informal learning*, *local history*, *human geography*, *location based applications*, and *mobile technologies*. I was guided by the following inclusion criteria:

- papers published during 2016 – 2021;
- papers published in English,
- papers relevant to the search criteria.

I read about 12 articles, seven of which are included in the following review.

### Overall Takeaways:

I split my takeaways into 4 main categories. Below some of the takeaways within each category are listed, but the full lit review (with all references) can be viewed here > [Research Report](#)

### Technologies



- Lots of good information about AR tech in mapping software, mobile learning considerations, and gamifying learning.
  - LBAs provide a digital 2D representation of real world geography, so AR is able to place “fictional” or additional things in this interface (Laato et al., 2020)
- Some current technologies that exist include:
  - Niantic database (Laato et al., 2020)
  - Mscape from Hewlett Packard (Jarvis et al., 2016)
  - GIS/GPS (Jarvis et al., 2016)

### Psychology of Learning (with a focus on mobile learning)



- Mobile learning capabilities help increase motivation to learn
  - Exercise, Hands-on-practice, context
  - “Developing systems which increase focused attention, curiosity, and enjoyment will therefore result in higher playfulness and greater adoption of m-learning” (Karimi, 2016)

## Design Considerations



- Important to ensure virtual points of interest in historical locations are high fidelity, reliable, and placed correctly (Laato et al., 2020)
- Four Design considerations from (Laato et al., 2020):
  - Ensuring the quality and fidelity of the virtual PoIs
  - Support for Visualizing Multiple Layers of PoIs
  - Information on Lost Objects and Structures
  - Design of Crowdsourcing to Expand the Solution into Global Scale
- “Without a careful learning design, students must feel confused and frustrated when facing both the real-world targets and the digital world resources provided via mobile devices” (Viberg & Wiklund, 2021)

## Design Constraints



- “We found that many of the concepts used to describe informal learning are challenging to design for. We found that the definitions of informal learning revolve around the idea that informal learning should be so free and so subconscious that we basically cannot say when and how this kind of learning takes place” (Viberg & Wiklund, 2021)
- LBA lacks databases, the ones that exist lack historically accurate information, Crowdsourcing limits information to more densely populated areas (Laato et al., 2020)

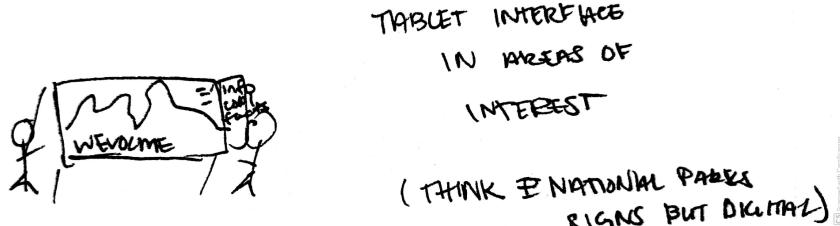
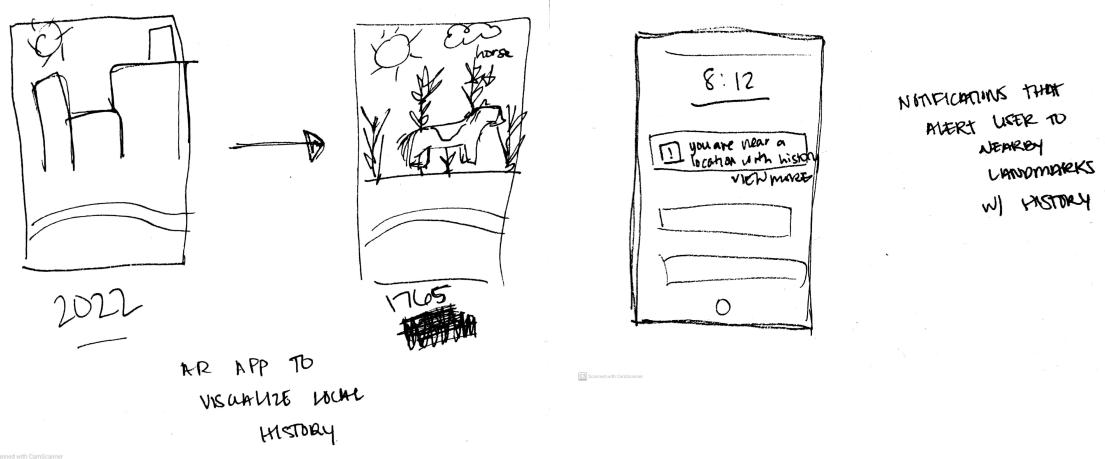
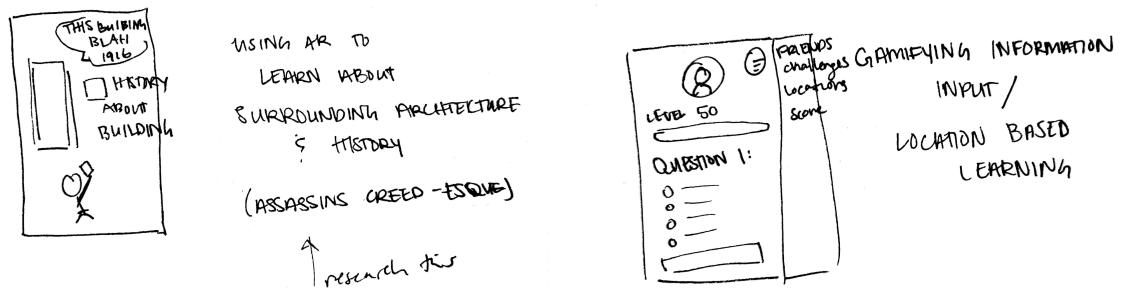
## Ideation (sketches)

### Goals:

The goals for each individual sketching session throughout the semester varied, but the overarching goal was to generate ideas within my opportunity space.

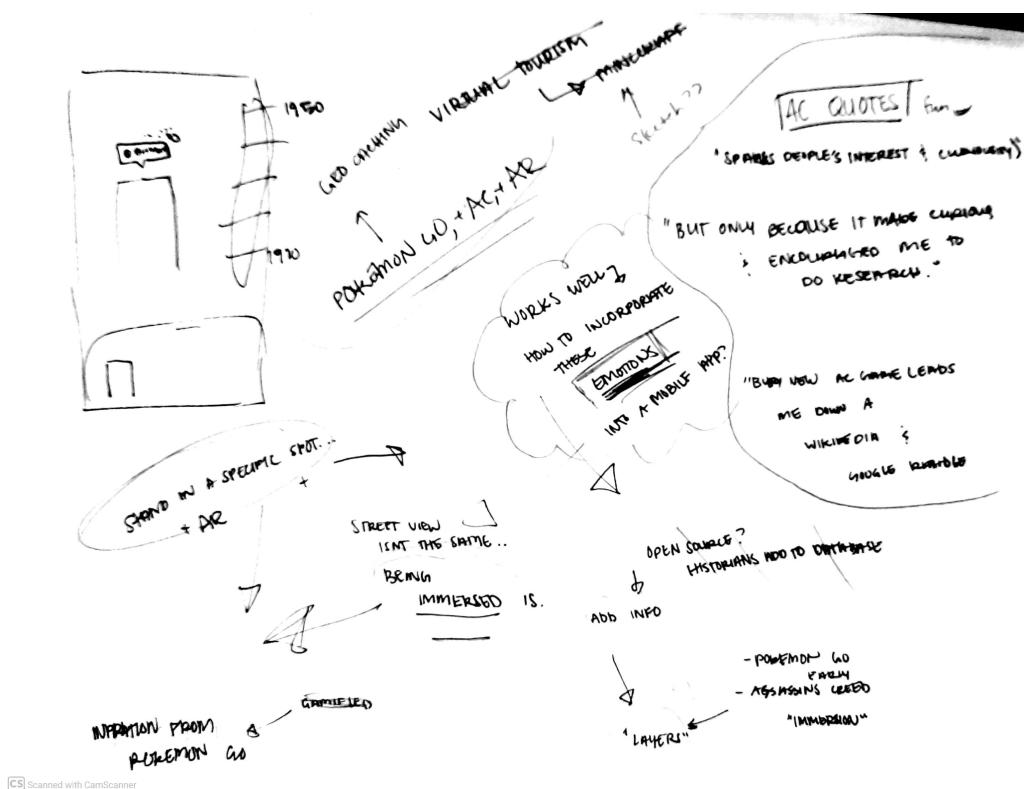
### Round 1:

After reading the aforementioned articles and learning more about my problem space, I decided to let my imagination wander for a bit in order to demonstrate some of the initial ideas running through my head. These are found below.

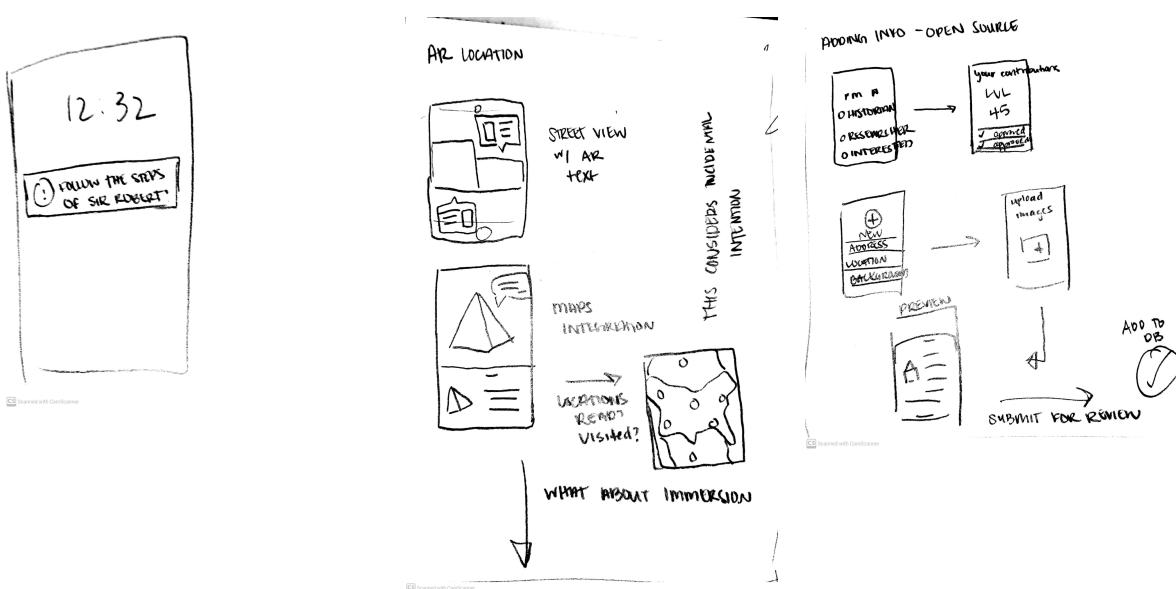


### Round 2:

Get my very messy thoughts on paper- idea generating and thought gathering. Tried to do lots more idea generating this time around.

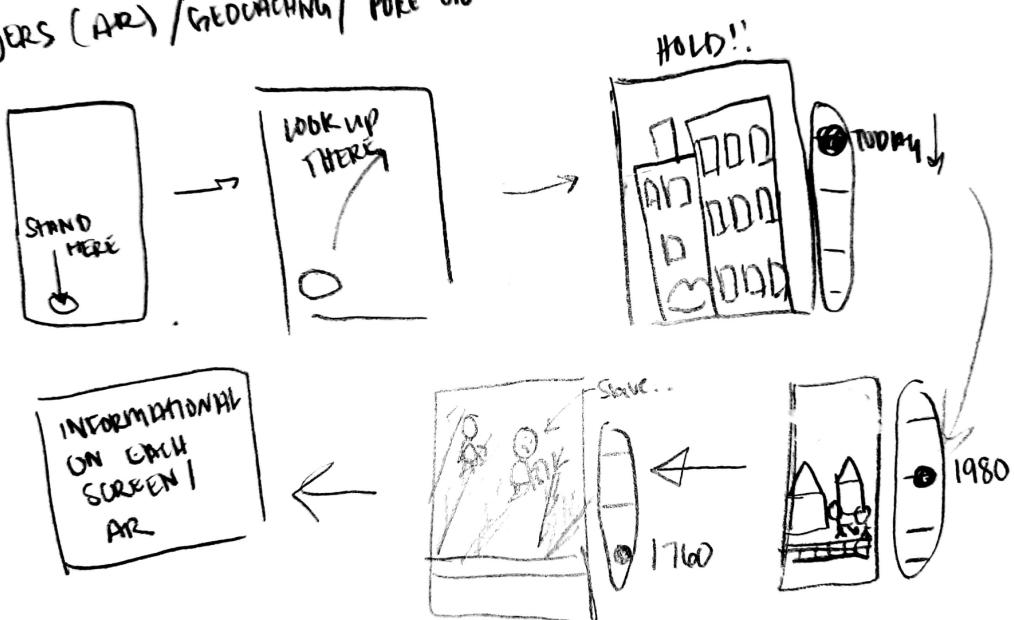


Scanned with CamScanner



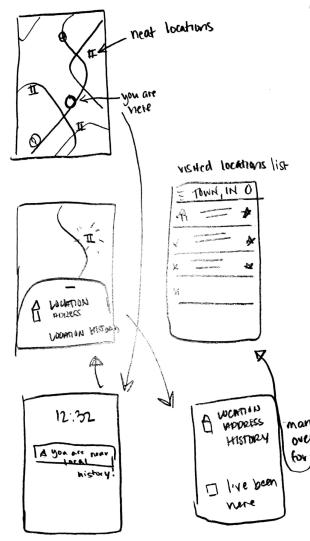
Scanned with CamScanner

PLAYERS (AR) / GEOLOCATION / POKÉ GO



Scanned with CamScanner

MAPS - INFORMATION FOCUS

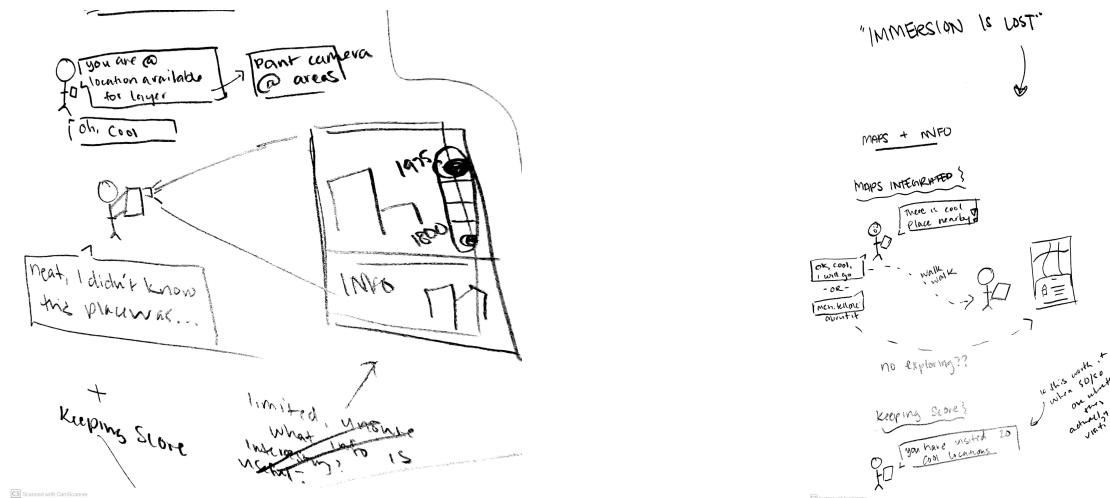


Scanned with CamScanner

IMMERSION:



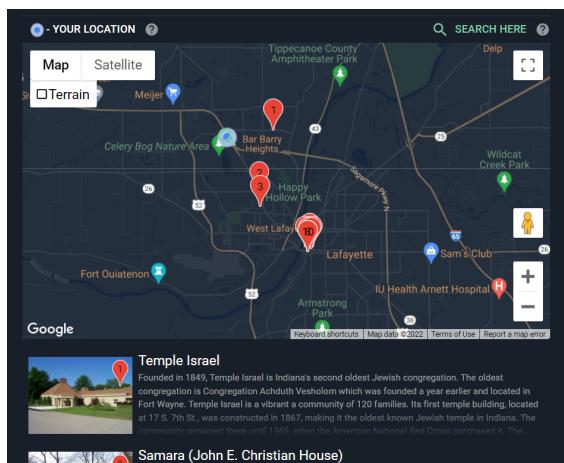
Scanned with CamScanner



# Competitor Analysis

*Some existing “solutions”:*

<https://www.theclio.com/>



Clio is a **website** and **mobile app** that enables people to learn about the history of specific places in the United States. They have **39143** historical entries from all across the country, and appears to be mostly **open-sourced**. “Each entry includes a concise summary and useful information about a historical site, museum, monument, landmark, or other site of cultural or historical significance. In addition, “**time capsule**” entries allow users to learn about historical events that occurred around them.”

- Clio claims to “*guide the public to thousands of historical and cultural sites*”
  - “We believe that there is something powerful that occurs when our sense of the past connects with our sense of place. We hope that you will use Clio to connect with the history and culture that surrounds you.” Clio
  - Clio- doesn’t leverage mobile capabilities- it focuses solely on information gathering

<https://cuseum.com/>

Provides **mobile engagement** to venues and tours through miscellaneous **companion material**.

- “Whether indoors or outdoors, help your visitors navigate your venue with ease. Help guide your visitors with interactive maps and step-by-step directions to make their experience as satisfactory as possible.” Cusuuem

- Cuseum provides mobile notifications based on proximity to an object or specified location, as well as image recognition for museums and AR visual layers and dynamics.

Additionally:

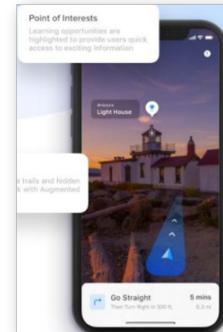
Wemap- focuses more on navigation, no information gathering

<https://getwemap.com/augmented-reality/>



DiscovAR- focused solely on one park and does not consider how this could be implemented into the real world.

<https://www.hcde.washington.edu/capstone/2019/discovar>



## Journey Map Testing Insights

### *Some insights from user conversations*

#### Maps integration vs. Layers vs. Geocaching

- Doesn't really care about what the place used to look like physically, although could see it being a feature in certain areas
- Google could easily add a feature like this considering they already provide AR directions
- Treasure hunt style is kind of cool, but doesn't want to have to search too hard
- AR is good for quickly attaching surroundings to the history

#### History bits

- Under-taught history- labor unions, factory pasts, etc.
- The first park built in the neighborhood, the hotel in which somebody famous stayed when passing through, and the oldest tree in the neighborhood
- Land preservation history, unique plants, local resources
- Neighborhood contributions to history
- Education, initiatives, food pantries
- Streets, states, neighborhoods, building name changes
- Battlegrounds, fort locations, battles, what happened to these people, how they shaped local history

#### Other comments

- Local resources are local libraries, long-time residents, and local educators
- Consider collaboration, is this meant to connect people?
  - Also consider puzzles- some of the best parts of geocaching is figuring out where to go
    - Hints or categories for what you are going to find at each location, also just in case they're not interested in that type of history

## LoFi Testing Insights

### **Workflow comments:**

- What is an interaction point?
- Will there be additional clues in case they can't find the location?
- Why does it need to be a hunt once in range? More likely to miss historical significance and beauty when looking through the camera. Possibly making these physical checkpoints would make people enjoy the hunt more.
  - Along the same lines, the AR feature really doesn't add a whole lot to the discovery of places. They'll be standing in front of it, why does it need to be viewed through a camera?
- Unsure how this will prompt additional learning- what kinds of things would the learn more link go to? (participant couldn't think of anything themselves)

### **Add/remove/edit features:**

- What do the types of places mean?
- I thought the icons were indicating where the location was, but once you get there it turns into an area? They would just use the map in order to know the exact location, rather than have to hunt for it.
- Unsure what the search function would be used for if the places are unknown until found. It seems like a way to see previously discovered locations would be more helpful. Or a filter based on type.

- 
- Having a picture *and* the AR is a bit dumb.

**In-context issues:**

- Will it give a notification for every place within walking distance? That would likely get annoying depending on where they are.
- Wouldn't this make more sense as an addition to the apps people already use to navigate?
- Learn more encourages further exploration but only if those links are useful.
- If in a hurry, would probably just use "mark as found" if the clues were uninteresting.

**Other:**

- Would be really useful in *other* areas. Not sure they would necessarily start by using it for their own town, but would in tourist-y places.
- Likes the option to be able to listen to the history
- Wishes there was a way to find other people who also enjoy this type of activity to talk to about findings
  - How can I emphasize community more?
- Don't emphasize competition, but do include stats to encourage them to continue to use it
- It was hard for all participants to come up with anything that they felt should be included on the actual history pages. The things they did come up with were extremely specific, which means I will likely need to think largely about how implementation should work, even if it's just guidelines.
- Overall, simplicity is good but missing just a few things. The AR workflow needs to be reconsidered.

# Bibliography

- Buckingham, K. (n.d.). *What is local history?* Ohio Local History Alliance. Retrieved April 18, 2022, from <https://ohiolha.org/best-practices/what-is-local-history/>
- Clough, G. (2009, September 22). *Geolearners: Location-based informal learning with mobile and Social Technologies*. IEEE Xplore. Retrieved April 18, 2022, from <https://ieeexplore.ieee.org/abstract/document/5255222>
- Geocaching*. National Geographic Society. (2012, October 9). Retrieved April 18, 2022, from <https://www.nationalgeographic.org/encyclopedia/geocaching/>
- Jarvis, C., Tate, N., Dickie, J., & Brown, G. (2016). Mobile learning in a human geography field course. *Journal of Geography*, 115(2), 61-71.  
Study using data collected from students doing field work, focused on considering the use of mobile technology in order to bolster students' skills in observation as well as to be better emerged in the urban history.
- Karimi, S. (2016). Do learners' characteristics matter? an exploration of mobile-learning adoption in self-directed learning. *Computers in Human Behavior*, 63, 769–776.  
<https://doi.org/10.1016/j.chb.2016.06.014>  
Considers which personal, individual characteristics motivate learners to use mobile-learning
- Laato, S., Rauti, S., Laato, A., Laine, T. H., Sutinen, E., & Lehtinen, E. (2020). Learning History with Location-Based Applications: An Architecture for Points of Interest in Multiple Layers. *Sensors (Basel, Switzerland)*, 21(1), 129. <https://doi.org/10.3390/s21010129>  
Considers local history layers to best represent geography throughout history.
- Porter, J. (2018, May 16). *Assassin's Creed has a new mission: Working in the classroom*. The New York Times. Retrieved April 18, 2022, from <https://www.nytimes.com/2018/05/16/arts/assassins-creed-origins-education.html>
- Rosier, J. (n.d.). *Exploring the effects of geocaching on understanding ...* Retrieved April 18, 2022, from <https://scholarworks.umass.edu/cgi/viewcontent.cgi?article=1013&context=nerr>
- Viberg, Andersson, A., & Wiklund, M. (2021). Designing for sustainable mobile learning - re-evaluating the concepts "formal" and "informal." *Interactive Learning Environments*, 29(1), 130–141. <https://doi.org/10.1080/10494820.2018.1548488>  
Considers how to design for sustainability in formal and informal mobile learning.