

T3^{ATX}

*Exploring Local History
through Virtual Reality*

OVERVIEW

OVERVIEW OF PROJECT

T3 is an exploration into using Virtual reality environments to study the local history of a place through a first person driven experience. For this specific project, we chose the Scholzgarten in Austin, TX as an anchor point to explore the city's local history and changes over a time period of almost 150 years. The experience's impact on learning was measured through immersion, presence, recall and change in behavior of the users.

TEAM

Sashank Macharla / Hesam Andalib / Kaitlyn Salazar

TIMELINE

October - December 2019

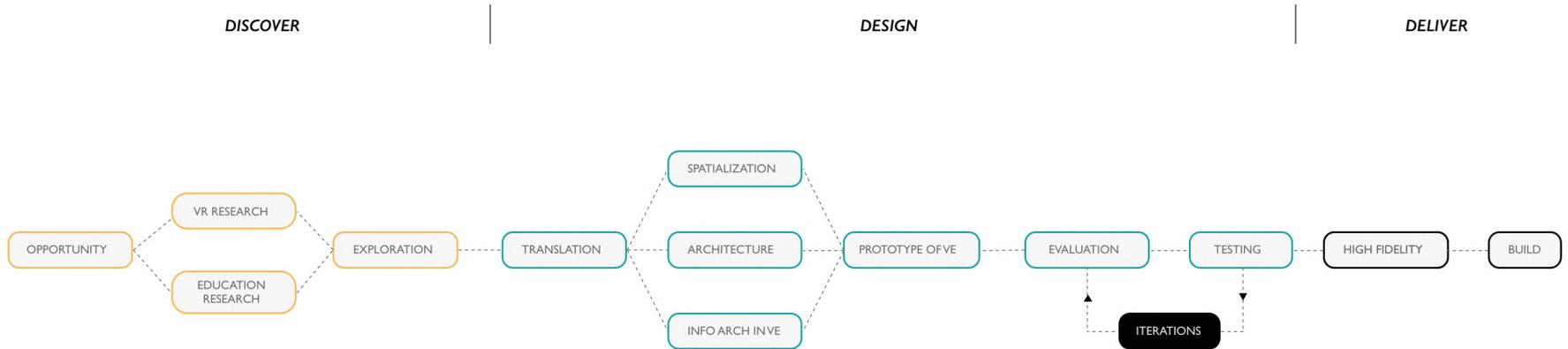
ROLE

Designer, HCI Researcher, VE Developer

TOOLS

Unity 3D, SketchUp, Blender, AfterEffects, C#

OVERVIEW OF PROCESS



PROBLEM STATEMENT

History education as mere instruction of objective information is limited in its engagement of students and providing lasting experience or measurable real world change in user perception/behavior.

OVERVIEW OF PROCESS IN NUMBERS

Virtual Environments and using the VR medium has its own set of complications and might result in cybersickness, causing disorientation, nausea and even memory loss in some cases for the user. For this reason, testing with large numbers of people was essential to find a common solution for the users.

In the limited time between post development of the VE and the actual delivery of the submission, we managed to test it with multiple users and evaluated their experiences through multiple measurement methods

50+

*Users Reached in
Research/Testing*

20+

*Testing
Walkthroughs*

10+

*User Driven
Environment Iterations*

6

*Evaluative and
Measuring Methods*

Virtual Reality is a relatively newer medium and not much exploration has been done in its application to many fields. We wanted to understand if an experiential mode of learning history would have a more positive impact on the users than traditional reading, or audio-visual media. We looked at many factors that passively indicate deep learning such as familiarity or recognition/recall of information in users' present day experience of the city.

To tailor the past experience, we studied the present day experiences of the users, and synthesized them into the VR. The measurements were primarily of presence and how it influenced user experience and learning, and how the entire experience affected their perception and behavior of their city.

RESEARCH & SYNTHESIS METHODS



Contextual Enquiry



Concept Testing



Journey Mapping

MEASUREMENT METHODS



Usability Testing



Focus Groups



*Behavioral Analysis
& Observations*



Physiological Measures



*BACKGROUND
& CONTEXT*

The Scholzgarten in Austin is the oldest operating business in Austin, TX with a history of over 150 years. It was established in 1866 and stood witness to the city's rise, fall, struggles and glory. We used the familiarity of the local people with the bar to anchor their exploration of Austin's local history and culture through time. It is still frequented by the locals, and enjoys a place that is known and preferred for its food, ambience, history and culture. This proved like an ideal point to let the locals explore their city's history and educate and entertain themselves in the process. Some of the factors because of which we chose this as an anchor point for our VR exploration are -

FAMILIARITY

Using a local landmark to pivot through history of a city can give the users a reference point to orient themselves,

EXPLORATION

Allowing history education to be an exploration rather than instruction or information could increase user engagement and reduce cybersickness and skepticism of VR as an education tool.

COMMUNITY BUILDING

Understanding the city the users live in, as greater than themselves has resulted in more social responsibility by the citizens, and greater sense of belonging as well.

Virtual Reality in a classroom environment can offer an exploratory learning experience that goes beyond space, time and laws of physics. For this project, we wanted to create an application about the study of local history as an immersive learning experience. Moreover, we wanted to explore what it means to control spatial and temporal constraints as part of a user experience.

For our project we decided to focus on the educational aspect of a VR experience, and to tailor it towards an exploratory, first person driven experience of Austin's local history.

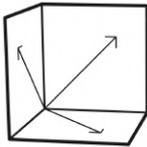
We wanted to build a **VE of an existing place - a familiar local landmark and use it as an anchor point to explore the city's history for the 150 years** that the landmark has existed in the location. The user would embody a character inside the environment and learn through passive experiences such as conversations, visual cues, cultural contexts and more.



Virtual Reality is an immersive, spatial medium that translates information into experiences almost indistinguishable from perception of reality. It is a low cost alternative to spatially experience and explore environments that are not physical as almost being real. We used optical tracking systems and HMDs for tracking and rendering the users' movements in the VE and used custom triggers inside of the VE that the user could use to navigate through time periods of the space. This was built in Unity 3D and the 3D models were built in Blender, SketchUp and Unity.

Since VR is a spatial medium, it was essential for us to think spatially and design the architecture of the space and place the triggers as an affordance of the character in the context of the bar. We used drinks labelled by their years as triggers that would transport the user to the time period written on the bottle when touched.

SPATIAL



IMMERSIVE



INTERACTIVE

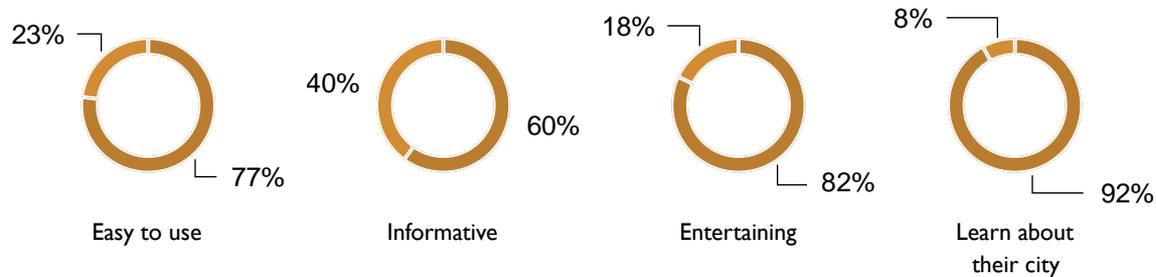




RESEARCH

Our immediate users were the people of Austin who also frequented the Scholzgarten bar and were interested in learning about /experiencing their local history. This could include both formal ways of learning - inside of an educational setting or a group with specific purpose of learning local history and also informal ways, which might include tourists, or locals wanting to know more about their city or get entertained through a trip through history.

For our contextual analysis, we started with the Scholzgarten, and knowing how much the context of history drive the visitors to this place. (for informal users). We also met with the Austin History Association for the more formally inclined user base. We conducted user interviews, surveys and also observational enquires about the habits, attributes, and inclination of the user base to use the product we were designing.



Our research and preliminary testing identified two primary sets of users for the VR experience driven by their purpose and approach - Formal set, and the informal set. The formal set had a narrower focus group as compared to the informal set and consisted mostly of users from academic backgrounds, while the informal ones consisted of users seeking entertainment, and novelty and also tourists exploring the city and its landmarks in the present day.

To better identify and empathize with the focus groups, we mapped out their pain points and priorities as they went through the low fidelity prototype experience of VE.



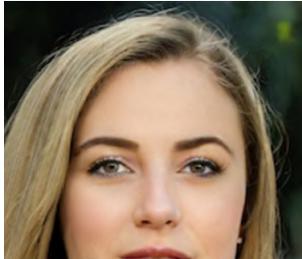
INFORMAL SET



FORMAL SET

TESTING - FOCUS GROUP PERSONAS

INFORMAL SET



Emily Expert Level: 24
 Function: Cashier
 Location: San Antonio, TX

Emily loves traveling and has loved the Parties and live music in Austin. She is interested in exploring more of the city as a Hobby and as a traveller.

Needs | Goals

- Deliver a memorable and a fun VR experience
- Being able to experience something new

Challenges | Frustrations

- Bored of usual tourism
- Looking for experiences
- History is for nerds

Expectations

- Interactive tours would be great
- Activity I can enjoy

Priorities in a VR experience




Rich Expert Level: 24
 Function: Sales Executive
 Location: Austin, TX

Rich has lived in Austin for the last 25 years And frequents the Scholzgarten for drinks And socializing with friends. He finds the Place amusing because of how old it is and Wants to know more about it for social talk.

Needs | Goals

- Want to know more about Scholzgarten
- Want to be entertained on a night out

Challenges | Frustrations

- Not too inclined towards technology in a social setting
- Thinks Virtual Reality is not good for us
- Want to know Austin, but documentaries are boring

Expectations

- Make me see my city in a new light
- Give me a fun story to tell my friends about this place

Priorities in a VR experience



FORMAL SET



Chris Expert Level: 24
 Function: Asst Manager
 Location: Austin, TX

Li Europan lingues es membres del sam familie. Lor separat existentie es un myth. Por scientie, musica, sport etc, litot Europa usa li sam vocabular. Li lingues differe solmen in li grammatica, li pronunciation e li plu commun vocabules.

Needs | Goals

- Document the history and historical places in the city of Austin
- Experience history as something engaging

Challenges | Frustrations

- Reading history is always through someone's perspective
- People are not patient enough to appreciate and experience history
- History is becoming too crowded because of the internet

Expectations

- Document places like how they exist now
- (Re)live experiences that we capture or create

Priorities in a VR experience




Adam Expert Level: 24
 Function: Student
 Location: Austin, TX

Li Europan lingues es membres del sam familie. Lor separat existentie es un myth. Por scientie, musica, sport etc, litot Europa usa li sam vocabular. Li lingues differe solmen in li grammatica, li pronunciation e li plu commun vocabules.

Needs | Goals

- Make history more accessible
- Put history in context of the present day

Challenges | Frustrations

- No way to put history in present day context
- History needs imagination, most people hesitate to put the effort
- Accurate history is too academic

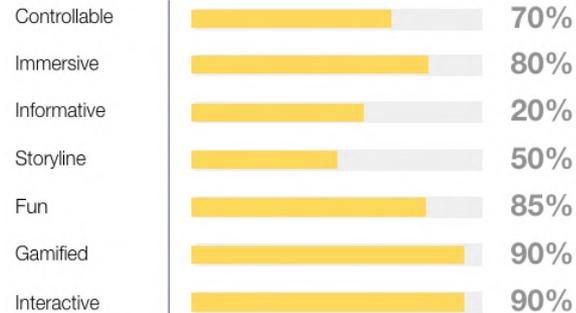
Expectations

- Make everyone actually experience history
- Explore history as themselves, not as an objective, impersonal view

Priorities in a VR experience

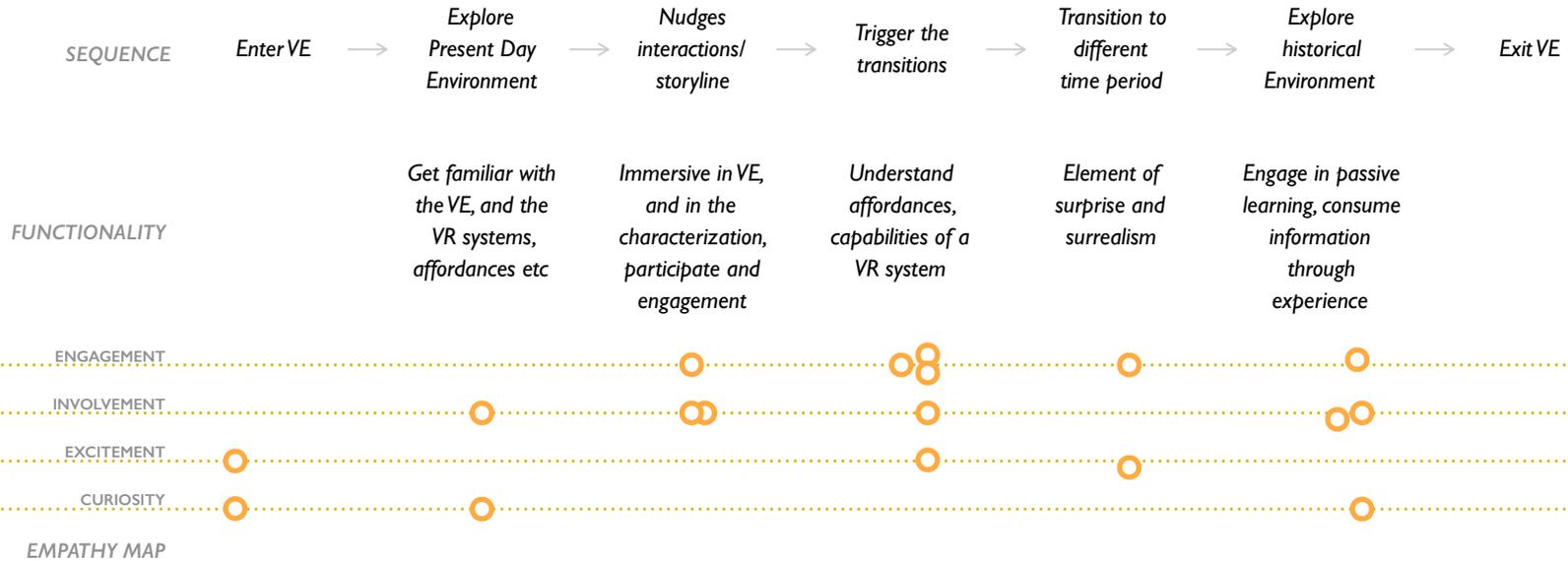


Since exploring local history thorough immersive first person experience was a new concept to most users, we relied on two existing methods to help them understand the concept, while also aiming to test it with user interest, engagement and usefulness. Before we could build the VE itself, we used the concept of exploration through first person inside a game environment, and immersion through a 360 video on YouTube. We gathered and quantified the results through questionnaire, and also interviews and observations.



RESEARCH - USER JOURNEY MAP

The VR experience would consist of a storyline to hold the information, experience and also the affordances in place when a user would be interacting through it. Converting information into this experience was at the core of the design, and the research to aid and provide a framework for this was done through user journey maps.



Presence is a vital factor when experiencing a virtual reality experience. It is defined psychological state in which virtual (para-authentic or artificial) objects are experienced as actual in either sensory or non-sensory ways. A greater sense of presence results in a greater sense of engagement, immersion, retainment of learning and reduces cybersickness - which is why designing for greater presence is a best practice in VR.



**SELF
PRESENCE**

- Sense of Bodily Connectivity
- Sense of Bodily Extension
- Emotional Connectivity
- Sense of self being in the virtual environment



**SOCIAL
PRESENCE**

- Sense of coexistence
- Human realism
- Not being aware of social mediation
- Not being aware of the artificiality of social interaction



**PHYSICAL
PRESENCE**

- Physical realism
- Not being aware of physical mediation
- Sense of control in virtual environment
- Sense of being in the virtual environment

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SPATIAL DESIGN

The design has to be thought as not screens or interactions, but spatial, like a building or an actual restaurant.

AFFORDANCES

Being able to be themselves is important for the users to get comfortable and interact naturally, thus absorbing the VE better.

PASSIVE LEARNING

Learning happens through overhearing a conversation, noticing a fleeting image, or in other subtle and passive ways.

2 | DESIGN

We then began rapidly ideating a number of concepts before narrowing in on a select few and creating flows, user stories and storyboards to define user requirements and safety inside of a Virtual Environment.

We felt that the chosen concepts had enough breadth for us to experiment with a variety of user interactions and experiences to help later inform our design choices for our final chosen concept. These concepts were:

1

GAMIFICATION

An experience that gives the user freedom of choice, movement and presence inside of the VE.

2

SOCIAL SPACES

For allowing exploratory learning, we wanted to place the user inside of a social space where their engagement with embodied agents and events can occur as a direct result of their presence.

3

TIME TRAVEL

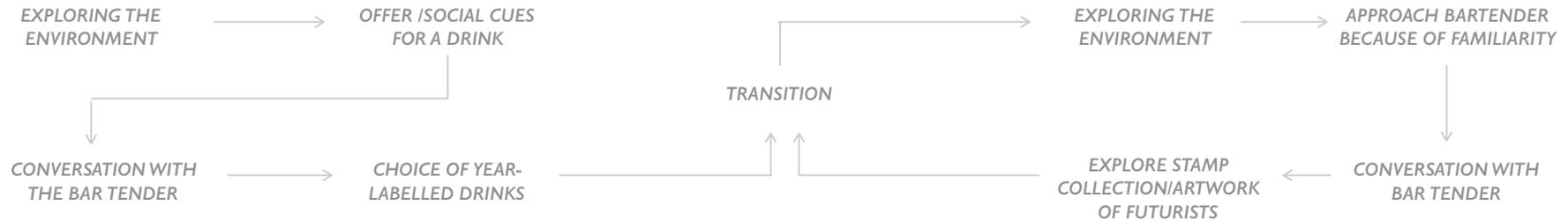
VR is a spatial medium but we wanted to explore the connection of time travel through this medium.

4

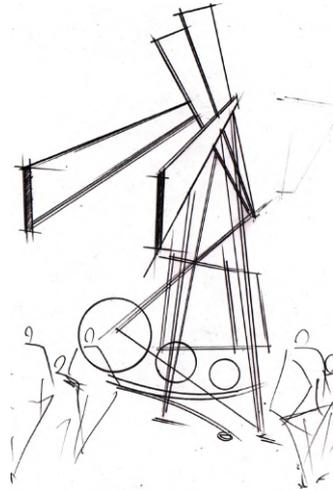
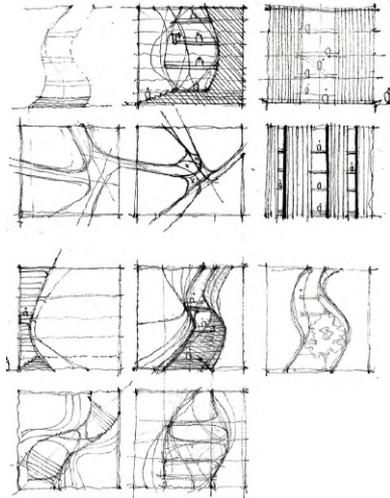
STORYLINES

While a VR experience allows the user to make their own choices and affords freedom of movement and interactions, presence of a storyline passively directs the experience towards a goal and a purpose.

The users journey inside of the VE had to be balanced between an exploratory experience while remaining true to the storyline to keep them engaged. The storyboarding process was vital to mapping out the events, affordances and triggers to translate into the Unity Editor.

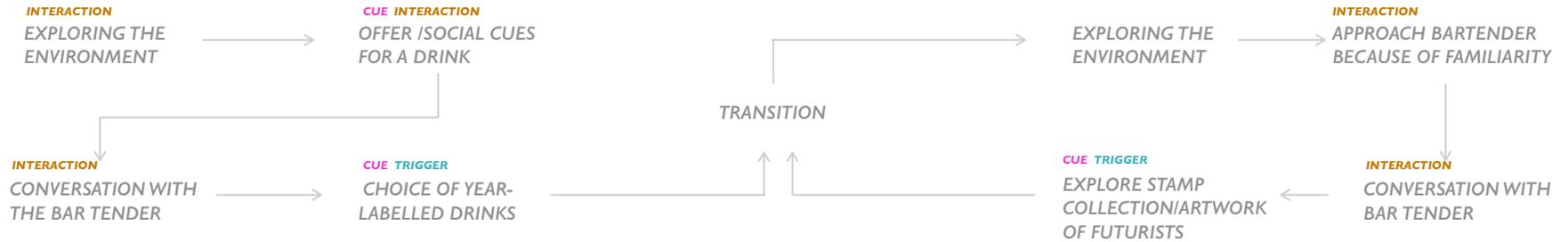


Since VR is a spatial medium, it was essential for us to think spatially and design the architecture of the space and place the triggers as an affordance of the character in the context of the bar. I used my architectural design skillsets and experience to design a restaurant that drove the user to explore a limited space inside of it by moving, and the rest by visuals. The circulation space between the tables turned increasingly narrow as one went further from the starting point to achieve this. Passive artifacts such as photographs on the wall, and sound design further reinforced the social presence of actually belonging in a different time period.



DESIGN - CUES, TRIGGERS & INTERACTIONS

The flow the entire experience was vital for the engagement levels and presence, towards this end, we decided to embed the triggers for the transitions between the time periods into interactions of the user with the objects, conversations and auditory cues from the other agents inside of the VE.



We made a low fidelity VE with two different models inside Unity but without a transition that we were happy with. The VE enabled the user to explore the environment, use their hands to interact, and had a time triggered transition into the different time period.

The environment was also not populated with sufficient human presence, and ambience suiting a bar, thereby reducing both self presence and social presence inside the VE.



3 | TESTING

We did the usability testing with 8 participants and collected their think aloud usability feedback verbatim and also measured their experience of the VE through a series of simple tasks that were given to them as a survey. The results are published on the next page.

'This is incredible, it is almost like I time travelled to the past, while still being present in this bar. I cannot use the changes this place has underwent. Seems reverential to be here now.' - User #5

'I felt dizzy after I came back from the 1920s to 2020s. It sounds a little weird- the way it sounds, but it was surely fun' - User #1



We converted the usability testing into a table with tasks, and how the users were able to complete these tasks by themselves and got out of the VE with learnings about the present day Scholzgarten

Task	User #1	User #2	User #3	User #4	User #5	User #6	User#7	User#8
Go to the 2019 Interiors and travel to 1920	PASS	PASS	PASS	PASS	PASS	PASS	confused	PASS
Identify a trigger in 1920	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS
Go back to 2019 from 1920	PASS	PASS	PASS	PASS	confused	PASS	confused	PASS
Identify 3 familiarities from 1920 to present	PASS	PASS	PASS	confused	PASS	confused	PASS	PASS

Cybersickness happens when a disparity occurs between the sensory inputs and the rendering of the VR system, or between the rendering and the mental model of the user. This usually happens either by the design of the VE, or by a lag between the tracking and rendering of the VR.

We addressed these three presences in the following ways through design choices in the first iteration -

1. Provide interactive hands to give orientation and sense of direction for the user inside the VE
2. Reducing the Field of View to the default setting by Oculus plug in for Unity.
3. Keeping only a small percentage of the FoV animated/ moving during the exploratory phase
4. Continuing social interactions with agents inside the VE



4 | FINAL SOLUTION

ATX
T3



FINAL SOLUTION - ENVIRONMENT

The final solution consisted of a single large environment which had two different models inside of it which were inaccessible and also invisible from inside each other. These were separated by a 'transition space'. The transition involved the user passing through a space for 10 seconds which created the effect of morphing, transportation which is inspired from the movie 'The Matrix'



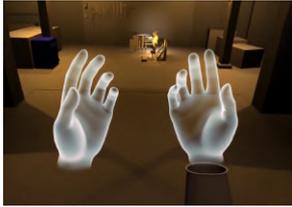
FINAL SOLUTION - EXPLORATION

While we intended the user to explore the environments, we used multi sensory ways to allow for it - conversations, physical movement, interaction with artifacts and objects, and interaction with other agents inside the VE. The architecture of the environments are designed to discourage physical movement through social cues, and ample props and artifacts such as newspapers and photographs were provided inside fo the VE to explore instead.



We provided the user with a basic set of affordances - motion, interaction with hands, audio and a set of predetermined gestures of the other agents inside the VE such as gaze and excusing themselves as they were in the middle of a conversation.

The avatar of the user had a set of hands that they could use to interact with and orient themselves in terms of direction.



*Virtual hands for interaction with objects
and for enhancing self presence*

FREEDOM TO
MOVE/EXPLORE



CONVERSATION
WITH AGENTS



INTERACTIVE
VIRTUAL HANDS



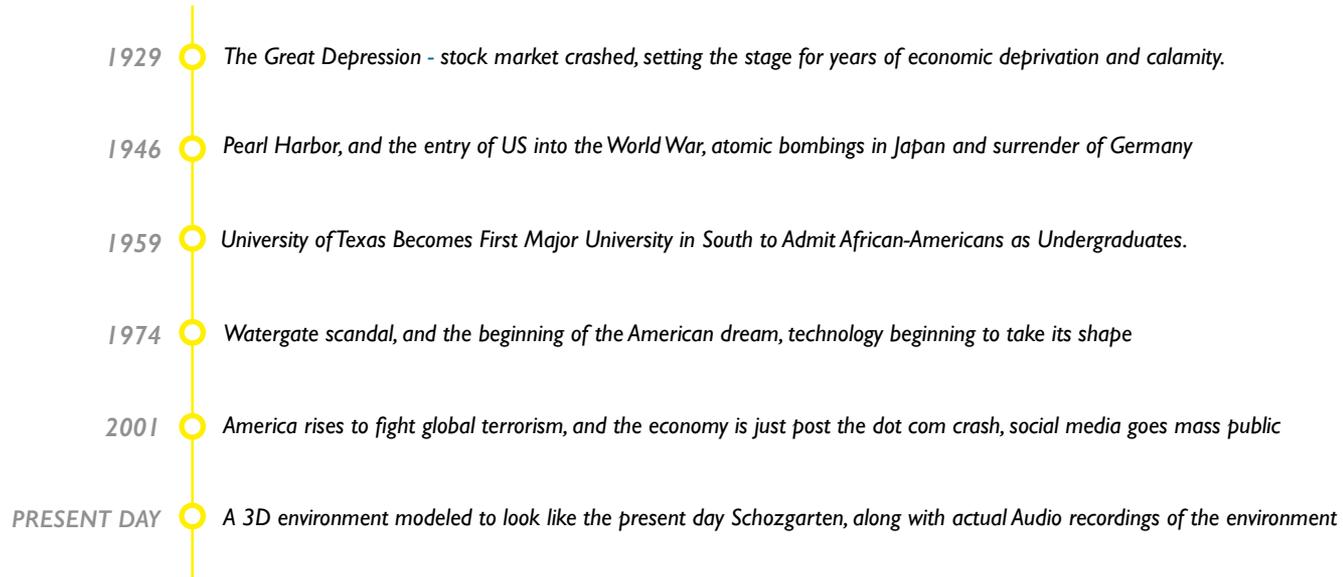
EMBODY A
CHARACTER



FINAL SOLUTION - TIMELINE

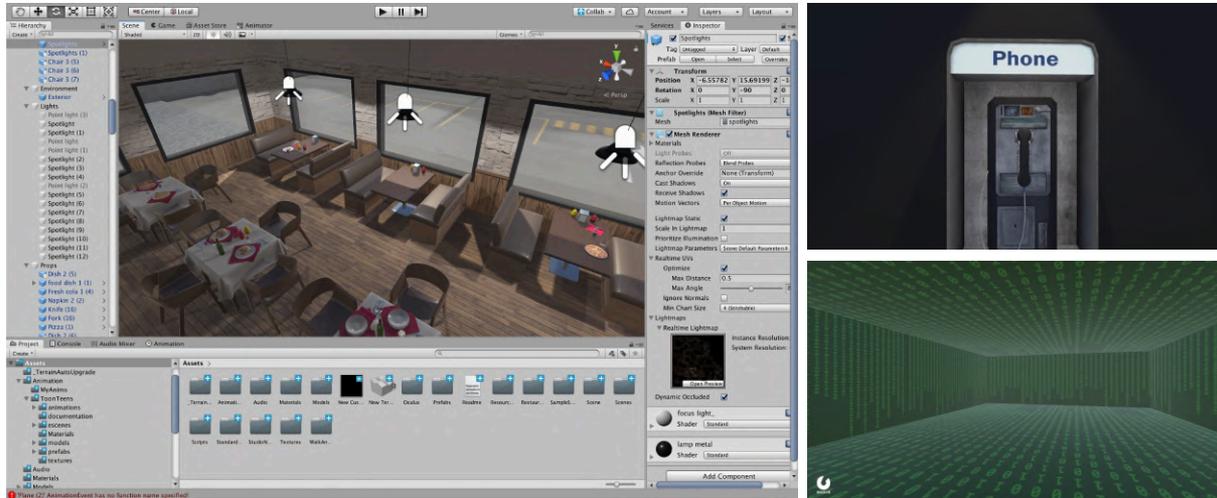
We used timelines to provide specific experiences in significant points in Austin's and the United State's history. These were accessible through triggers and were distinct environments inside of the Unity model.

The years chosen for the experience were -



FINAL SOLUTION - TRIGGERS & TRANSITION

Diversifying from our original idea of using the drinks as the triggers, we decided to use props such as a payphone, a stamp collection and photographs on the wall that were from a specific time period that the user could travel to. This was to gamify the experience through exploration of the VE. The transition between all the environments is kept consistent and becomes shorter as time passes to reduce the element of boredom and familiarity for the user. The final effect was taken from the movie 'The Matrix' and evolved an immersive animation with digits and 8-bit sounds.



Since VR requires realtime tracking of the whole body, there is extensive scope for data collection and measurement of the experience through it. For this project, we decided to use data on body movement, physiological functions, verbal and other behavioral factors as well. Pairing body language with psychological responses can give insights into behavior of users, and physiological data combined with experience timeline can provide developers data about which aspect of the VR experience to focus, change, and improve.

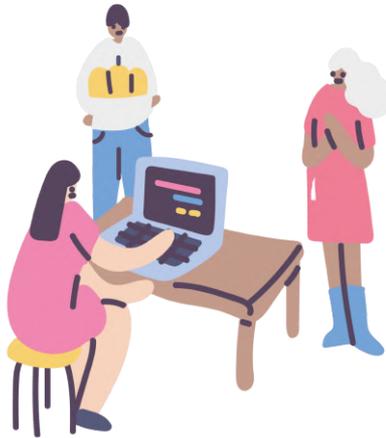
<i>PHYSIOLOGICAL</i>	Heart Rate Skin Conductance EEG
<i>BEHAVIORAL</i>	Observations Questionnaires Body & Facial Expressions Tracking
<i>PSYCHOLOGICAL</i>	Questionnaires Survey



Measure engagement of the user in the VE, measure presence, cybersickness, heat maps of areas of focus, data about reactions to interactions, triggers and events inside the VE.

5 | *NEXT STEPS*

The users seemed very engaged and immersed in their interaction with the VR system and the environment. Many were involved enough to use reflexes to the cues and events inside of the VE, and reacted entirely as if present inside the simulated environment. We measured and collected feedback from the users through a survey and some interviews immediately post their experience.



The biggest challenge besides introducing and exploring a new concept with a user base that was unfamiliar with it was the time we had to execute the project. We could not design all the environments to our taste, but exploring the medium of VR was rewarding, as were the reactions of the users.

CHALLENGES

- Familiarizing the medium as well as the content for the users.
- Designing for cybersickness, presence and gamification.
- Building a VR environment in a limited timeframe.
- Brainstorming a wide amount of ideas with limited time for implementation.

GOING FURTHER

- Design the VE in greater detail for more immersion and presence.
- Design the VE with a real world place to leverage users' familiarity and comparison with a real physical space.
- Do another round of usability testing to refine triggers for the transitions, and include more affordances
- Further brainstorm and explore with the interface visual identity and layout

Our main focus for the T3 VR experience was to show users the functionalities of a full fledged VR environment and the level of detail, control and exploration that was possible in it.

We wanted to explore the different ways that VR's affordances of immersion and simultaneous multi sensory stimulation could be used for education, and better learning. We found that to control a human being's experience is a hugely rewarding task, but also one that had to be done responsibly, especially considering cybersickness and other motion related issues.



THANK YOU