SIGGRAPH ASIA 2019 BRISBANE

Extended Reality Practice in Art & Design Creative Education

sa2019.siggraph.org

Presented by:
June Kim, Gregory Bennett, Snow Fu and Jan Kruse

Course Abstract

As Jerald (2018) states, though virtual reality (VR) has existed for over 50 years, its use as a creative medium is relatively new. In the last four years, as part of the 'second wave of VR', new affordability and accessibility of hardware and software for experiencing and creating VR has incited a surge of interest for the technology from creative industries. Meanwhile, interest and attempts to create VR projects has expanded into other forms of Extended Reality (XR) technologies, like Augmented Reality (AR) and Mixed Reality (MR).

As a group of educators and practitioners from creative disciplines, our focus is to create a fundamentals of XR Education curriculum for undergraduates and/or postgraduates in schools of art and design who have no/less coding and software background.

We believe in guiding students to approach VR as a creative medium is increasingly important. Furthermore, we also introduce the XR-ED Group (sponsored by ACM SIGGRAPH Educators Forum). This group is a collective of educators and practitioners interested in creating an XR curriculum, and to share the work of students. The group was first run as part of a co-located event with VRCAI 2018 / SIGGRAPH Asia 2018 in Tokyo, and this year will be running in Brisbane as a co-located event with VRCAI 2019 / SIGGRAPH Asia 2019.

Executive Statement

This course proposes a learning & teaching curriculum emphasizing XR technologies within the art & design disciplines. It includes fundamental concepts of XR – exhibiting VR, AR and MR artwork and the history of art - Reflections from art practitioners on concepts and techniques from their own VR based art practice.

SA '19 Courses, November 17-20, 2019, Brisbane, QLD, Australia
ACM 978-1-4503-6941-1/19/11.
10.1145/3355047.3359407

Intended Audiences

Creatives (undergraduates, educators) who are interested in utilising XR technologies as a medium / tool for their own practices, as well as to teach future students.

Course Syllabus

Expanding on the course abstract, we propose a short introductory course which includes fundamentals of XR technologies and demonstrates:

- Fundamentals of VR, AR & MR from technical perspectives
- History of VR and AR in Art
- Examples of VR & AR artworks: 90s to the early 2000s
- Examples of VR and AR artworks in recent years (2014 onwards)
- Practical session (Demo):
  - How to create basic AR project with ar.js
  - How to create basic VR project with vr.js
- Collaborative VR – Gregory Bennett
- Concepts & intentions
  - What are the challenges in managing collaborative XR projects?
  - Managing collaboration between university schools and departments
  - Managing collaborations with non-academic organisations
  - Adding value to students experience
  - Project informed by University research and development
- Reflection on VR artwork – Snow Fu & her team
  - Concepts & Intentions
  - Why is this work meaningful and special?
  - Technical reflection: Working on Unreal as an art practitioner
- How do we design a curriculum that fosters XR projects?– Jan Kruse & students
- Closing with an introduction to ACM SIGGRAPH Educators Forum sponsored ED-XR Group opened by Miho Aoki and June Kim.

AR | VR as an Artistic medium

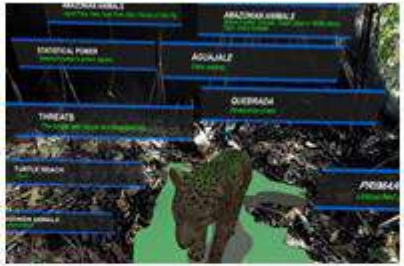
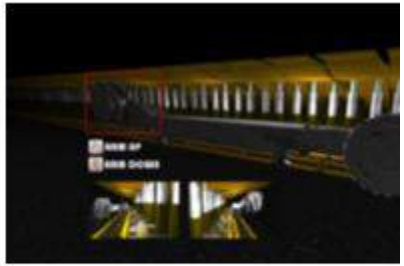
VR projects in the world of Art
1990s and early 2000

Milgram's Reality Virtuality Continuum

[Fig 1]

[Fig 2]



The area between the completely real and completely virtual, consists of both augmented reality, where the virtual augments the real, and augmented virtuality, where the real augmented the virtual.

Virtual Reality

1960s

"Wonderland constructed in computer memory" – Ivan Sutherland

Strictly military focused

1990s - 2000

"Collaborative Lucid Dream"-

Automotive, architecture and aerospace etc. Training application, research purpose

Definition of Virtual Reality

Medium focused

Krueger (1991) states that Virtual Reality typically refers to 3D realities implemented with *stereo viewing goggles and reality gloves*.

Experience focused

"Virtual reality is defined as a real or simulated environment in which a perceiver *experiences telepresence*" (Steuer, 1992)

4 characteristics of experiencing via the medium

- Virtual environment
- Immersion
- Sensory feedback
- Interactivity

(Sherman and Craig, 2003)

Pioneering Virtuality Reality Artworks

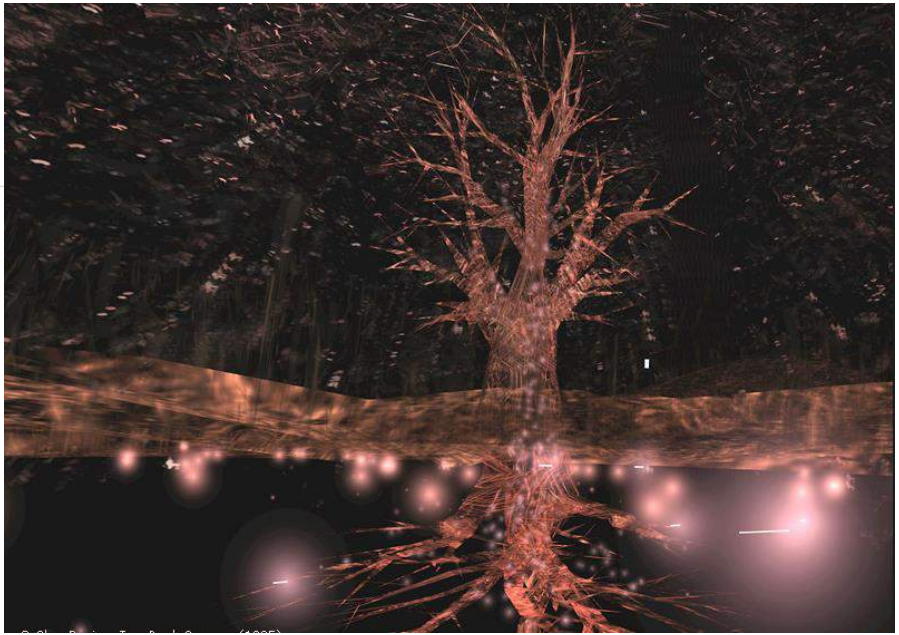
[Fig 3]

Legible City (1989) – Jeffery Shaw

A pioneering interactive art installation where the visitor rides a stationary bicycle through a simulated representation of a cities – Manhattan, Amsterdam and Karlsruhe.

Manovich (2001) states that “The Legible City functions not only as a unique navigable virtual space if its own, but also as a comment on all the other navigable spaces”.

Pioneering Virtuality Reality Artworks



[Fig 4]

Osmose (1995) – Char Davies

- Alternative aesthetic and Interactive sensibility.
- “Neither realistic nor abstract but somewhere in between” (Davies and Harrison, 1996).
- This was one and only example to push the expressive capabilities of existing 3D tools in 90s.

Pioneering Virtuality Reality Artworks

[Fig 5]

Placeholder (1992) – Brenda Laurel

New paradigm for interaction and narrative in virtual environments introduced:

Two participants with HMD transform

- “Neither realistic nor abstract but somewhere in between” (Davies and Harrison, 1996).
- This was one and only example to push the expressive capabilities of existing 3D tools in 90s.

Women-led Art

Gender imbalance in the art world in History

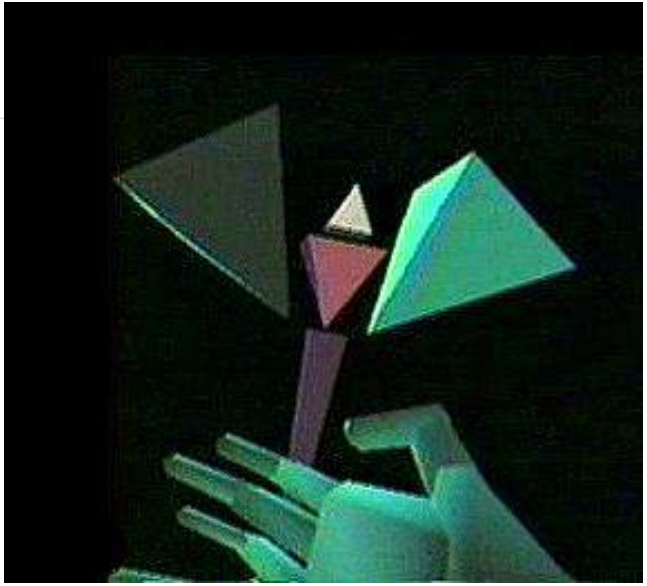
- In Louvre, 5,500 paintings by 1,400 male artists and 21 women artists.
- First women entrant was admitted to art school in 1861.-The Royal Academy Schools
- First women entrant to the science school graduated from 1873.-MIT

Women-led Art

According to Jacki Morie's research, approx. 70% of VR creators were women between 1985 and 2007. Thus,VR art can be considered the very first women led art field.

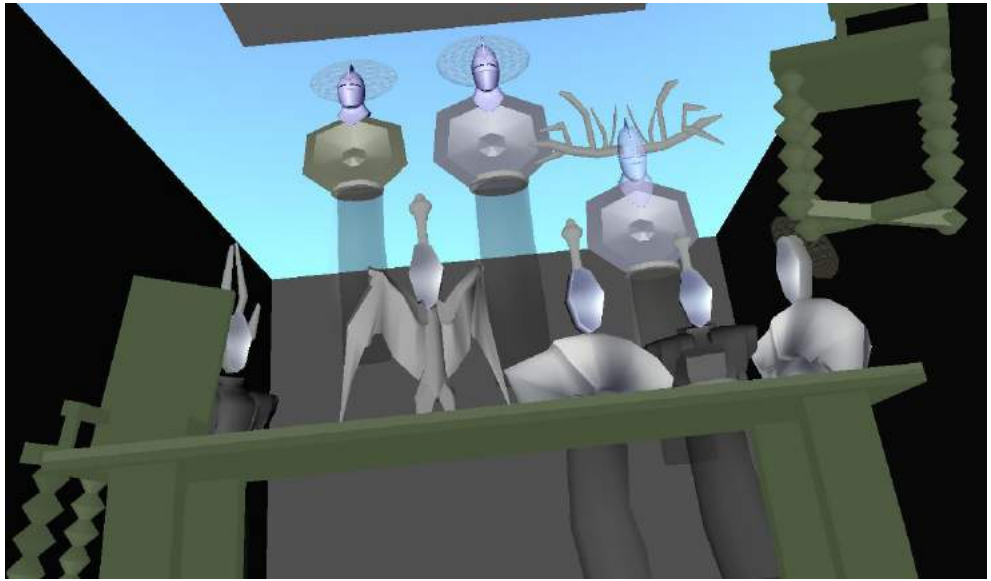
Nicole Stenger (1992, 2009), Monica Fleischman (1992), Carl Eugene Loeffler (1992, 1993), Ulrike Gabriel (1992, 1993), Diane Gromala (1993, 2001), Toni Dove (1993), Janine Cirincione (1994), Rita Addison (1994), Sheldon Brown (1994), Char Davies (1995, 1998), Maurice Benayoun (1994, 1997), Josephine Anstey (1997), Margaret Dolinsky (1997, 1998, 1999), and Rebecca Allen (1997, 1998, 1999).

Nicole Stenger



[Fig 6]

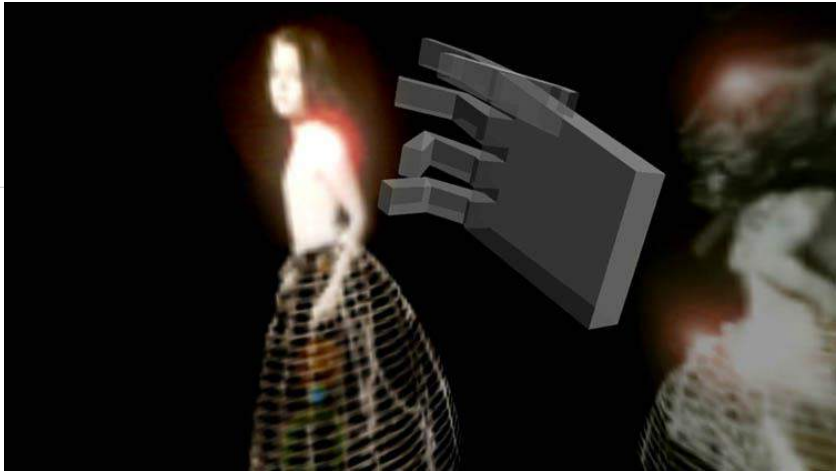
Angle (1992)



[Fig 7]

Dynasty (2009)

[Fig 8]



A dataglove helps locate the user "inside" the world of Toni Dove and Michael Mackenzie's dreamlike VR experience *Archaeology of the Mother Tongue* (1993).

The Coroner's Dream" sequence from Toni Dove and Michael Mackenzie's exquisitely designed *Archaeology of the Mother Tongue* (1993).

[Fig 9]

[Fig 10]

An "immersant" wearing stereoscopic head-mounted display and breathing/balance interface vest for a performance of Char Davies's Osmose (1995).

[Fig 11]

Installation view from 2003 of Osmose at the ACMI, Melbourne – showing the audience's dual view of the shadow of the "immersant" and the changing virtual environment.

[Fig 12]

Fleischmann, Monika; Strauss, Wolfgang «Home of the Brain (1992)

[Fig 14]

Diana Gromala

[Fig 14] Diana Gromala

The Banff Art & Virtual Environment Project

Lawrence Paul Yuxweluptun (Native ritual to virtual space)

Vision Rights (1992)

Brenda Laurel with Rachel Strickland, Rob Tow and Michael Naimark (theatrical paradigm)
Placeholder (1992)

Toni Dove and Michael McKenzie (Cinematic experience)
Archaeology of a Mother Tongue (1993)

Diane Gromala

Emotional and evocative

VR projects in the field of Art 2014 onwards

Renaissance of Virtual Reality

IMPACT ON Creative education

Hardware & software availability to consumer market with affordable price

Implement [developed] VFX techniques to achieve the desirable level of aesthetics

Implementing [serious] game concept onto art making

VR for Social Impact

Can be interpreted from the posthumanism perspective

Jacolby Satterwhite, Domestika, 2017. Courtesy of the artist and Mitchell-Innes & Nash, New York City

Marina Abramović as an avatar, in stills from ‘Rising’ © Acute Art (2017)

Creating Augmented Reality with AR.js and A-Frame

What is Augmented Reality (AR)

- Overlay digital content on a real world view
- Your augmented reality by adding information to be mean to enhance, not to replace
- AR is not Virtual Reality
- Marker-Based: Predetermined identifiers, Simpler, Less Intensive
- Markerless: Geolocation, Energy & power intensive

AR.js in PERFORMANCE & SIMPLICITY

- **Open Source**: An efficient Augmented Reality solution on the web developed by Jerome Ethienne with the idea of making AR available to everybody.
- **Very Fast**: AR.js made Augmented Reality went from running at 4 fps on high-end phone to 60 fps on three years old phone.
- **Web-based**: The beauty of AR.js is that it does not require any applications or specific [expensive] devices to run. It It runs 100% in your web browser. (no app and software to install!) Full javascript
- **Standards**: It works on any phone with webGL and webRTC.

Augmented reality in 10 Lines of HTML

- Codepen & hiro marker
- **Codepen**: An online code editor and open-source learning environment, where developers can create code snippets, creatively named “pens”, and test them. It is an online community for testing and showcasing user-created HTML, CSS and JavaScript code snippets.
- Link to AR.js – Augmented Reality in 10 lines of html - https://codepen.io/jeromeetienne/pen/mRqqzb
-

Augmented reality in 10 Lines of HTML

- Codepen & hiro marker
- **AR Marker**: is effectively two dimensional symbol, similar to QR code, that allows a camera to determine position and rotation relative to a surface. With this information, a camera can do many different things. Either Hiro marker and Kanji marker is commonly used.

https://raw.githubusercontent.com/jeromeetienne/AR.js/master/data/images/HIRO.jpg

Augmented reality in 10 Lines of HTML

```
<!-- Augmented Reality on the Web in 10 lines of html! https://github.com/jeromeetienne/ar.js -->
<script src="https://aframe.io/releases/0.5.0/aframe.min.js"></script>
<script src="https://rawgit.com/jeromeetienne/ar.js/master/aframe/build/aframe-ar.js"></script>
<script>THREEx.ArToolkitContext.baseURL = 'https://rawgit.com/jeromeetienne/ar.js/master/three.js/'</script>
<body style='margin : 0px; overflow: hidden;'>
        <a-scene embedded artoolkit='sourceType: webcam;'>
                <a-box position='0 0.5 0' material='opacity: 0.5;'></a-box>
                <a-marker-camera preset='hiro'></a-marker-camera>
        </a-scene>
</body>
```

Result of using the 10 Lines of HTML

3D Models

- Both Static and Animating Models
- A-Frame provides components for loading glTF, OBJ, COLLADA (.dae). glTF is most recommended as it gains adoption as the standard for transmitting 3D models over the Web.
- https://aframe.io/docs/0.5.0/introduction/models.html##sidebar
-

What is glTF?

- Jpg of 3D model
- glTF (GL Transmission Format) is a royalty-free specification for the efficient transmission and loading of 3D scenes and models by applications. glTF minimizes both the **size of 3D assets**, and the **runtime processing** needed to unpack and use those assets.
- https://aframe.io/docs/0.5.0/introduction/models.html##sidebar
-

How to create glTF?

- Via Blender: You can export or convert by using Blender.
- Cesium: http://52.4.31.236/convertmodel.html (Drag & Drop)
- (Max. 10MB)
- Many Free converters available online

Reference

[Fig 1] P. Milgram and A.F. Kishino, Taxonomy of Mixed Reality Visual Displays, IEICE Transactions on Information and Systems, E77-D(12), pp. 1321-1329, 1994.

[Fig 2] ©June Kim

[Fig 3] https://www.jeffreyshawcompendium.com/portfolio/legible-city/

[Fig 4] http://www.immersence.com/publications/char/1996-CD-Comp_Graphics.html

[Fig 5] https://proyectoidis.org/placeholder/

[Fig 6] & [Fig 7] http://www.nicolestenger.com/news2019.html

[Fig 8] & [Fig 9] https://www.digitalartarchive.at/database/general/work/archeology-of-a-mother-tongue.html

[Fig 10] http://www.immersence.com/publications/2007/2007-SDixon.html

[Fig 11] http://www.medienkunstnetz.de/works/home-of-the-brain/

[Fig 12] http://www.immersence.com/publications/2007/2007-SDixon.html

[Fig 13} & [Fig 14] http://www.siat.sfu.ca/faculty/Diane-Gromala/

[Fig 15] https://www.artsy.net/artwork/jacolby-satterwhite-domestika-1

[Fig 16] https://acuteart.com/artist/marina-abramovic/

AR.js & A-Frame materials: https://aframe.io/blog/arjs/

https://www.invaluable.com/blog/how-vr-is-changing-the-art-experience/

Guerrilla Girls: https://www.guerrillagirls.com/ was established by two founding Guerrilla Girls and other members to continue the use of provocative text, visuals and humor in the service of feminism and social change. They have written several books and create projects about the art world, film, politics and pop culture. They travel the world, talking about the issues and their experiences as feminist masked avengers, reinventing the “f” word into the 21st century.

Morie (2015). Why yes, Virginia, there have always been women in VR. Retrieved from https://vrscout.com/news/why-yes-virginia-there-have-always-been-women-in-vr/.

Collaborative VR projects

Collaborative VR projects

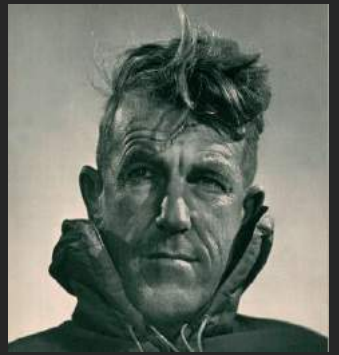
- What are the challenges in managing collaborative XR projects?
- Managing collaborations between university schools and departments.
- Managing collaborations with non-academic organisations.
- Adding value to students experience
- Projects informed by University research and development

CASE STUDY

Hillary's Antarctic Hut Virtual Reality experience

Collaboration between Design and Science staff and students at AUT

Collaboration between Auckland University of Technology and The Antarctic Heritage Trust



ANTARCTIC HERITAGE TRUST

AUT

Hillary's Hut (TAE Hut)
Virtual Reality Experience

sa2019.siggraph.org

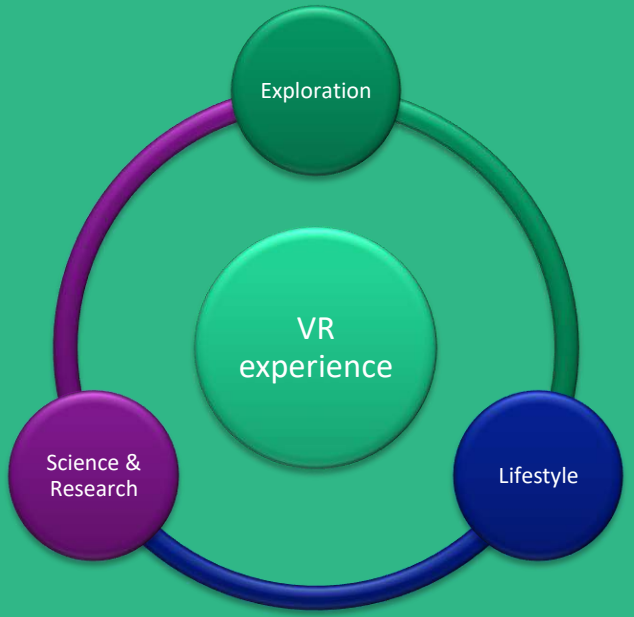
Hillary's Antarctic Hut Virtual Reality experience

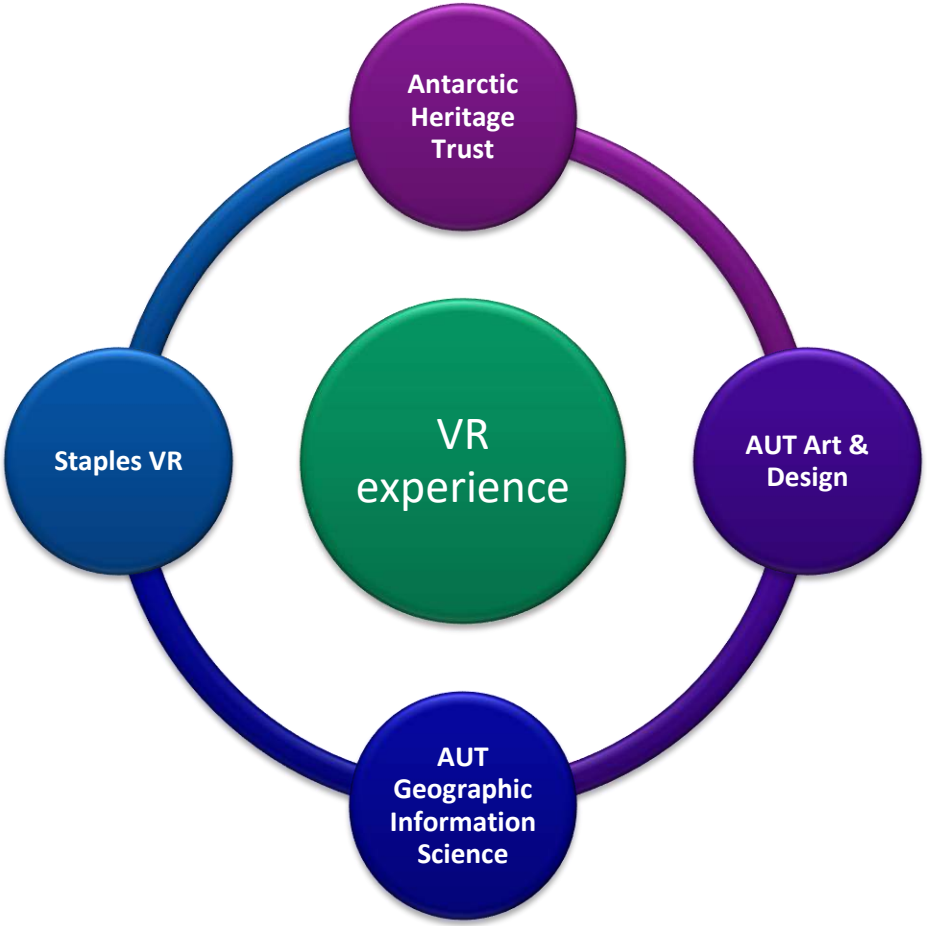
- Heritage site preservation in Virtual Reality
- Narrative development and design for VR museum experience based on historical site
- Technical pipeline from Lidar scan to game engine optimisation
- Interactivity/gamification challenges

A Virtual Reality Experience

- 3D Lidar scans from the restored Hillary's Hut at Scott Base are being used a as basis for a VR experience
- The general public will be able to take a tour of this important scientific and heritage site via a Virtual Reality application currently being developed by Auckland University of Technology and the Antarctic Heritage Trust


CHOCOLATE
12 2 oz. BARS
SPECIALLY PACKED FOR
TRANS-ANTARCTIC EXPEDITION 1956
ANDREW LUSK & Co LTD
LONDON


Exploration
VR experience
Science & Research
Lifestyle


Antarctic Heritage Trust
Staples VR
VR experience
AUT Art & Design
AUT Geographic Information Science

Dr Barbara Bollard, AUT Geographic Information Science

Identification, selection and management of Protected Areas, using geospatial sciences and novel remote sensing technology, such as drones, to map habitats and landscapes for conservation planning.

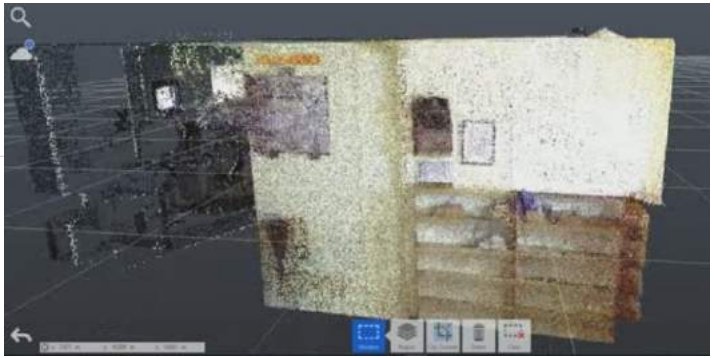
Faro Lidar Scanner

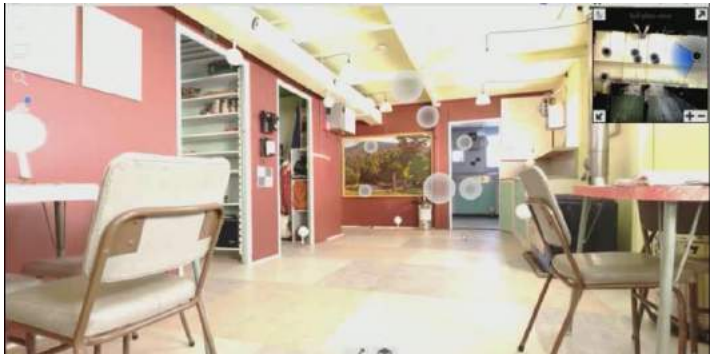
- registration spheres and grids set up around the rooms
- several laser scans made of each room to be combined later in data processing

Hutt interior

3D Lidar Scans of the newly restored Hutt interior are being converted to a VR environment replica which users will be able to navigate around

3D Lidar Scans



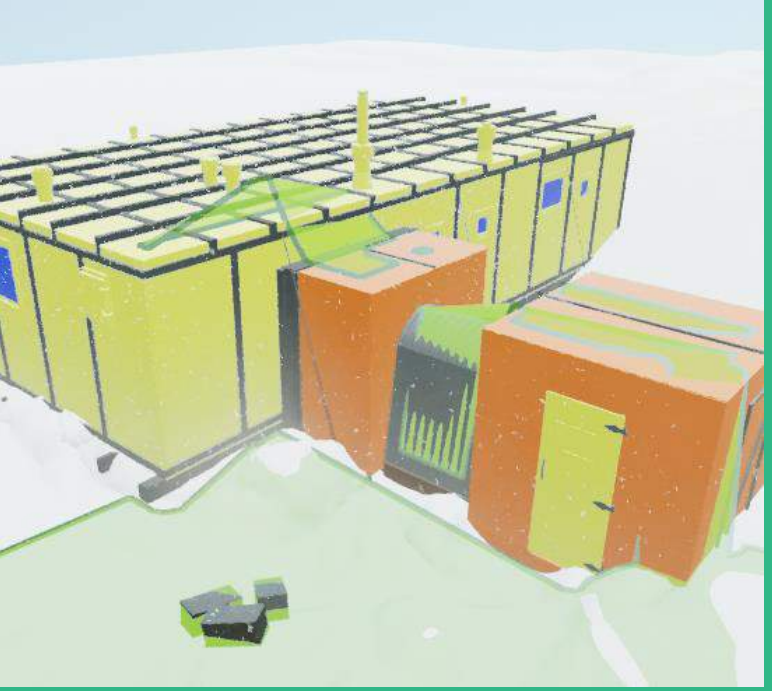


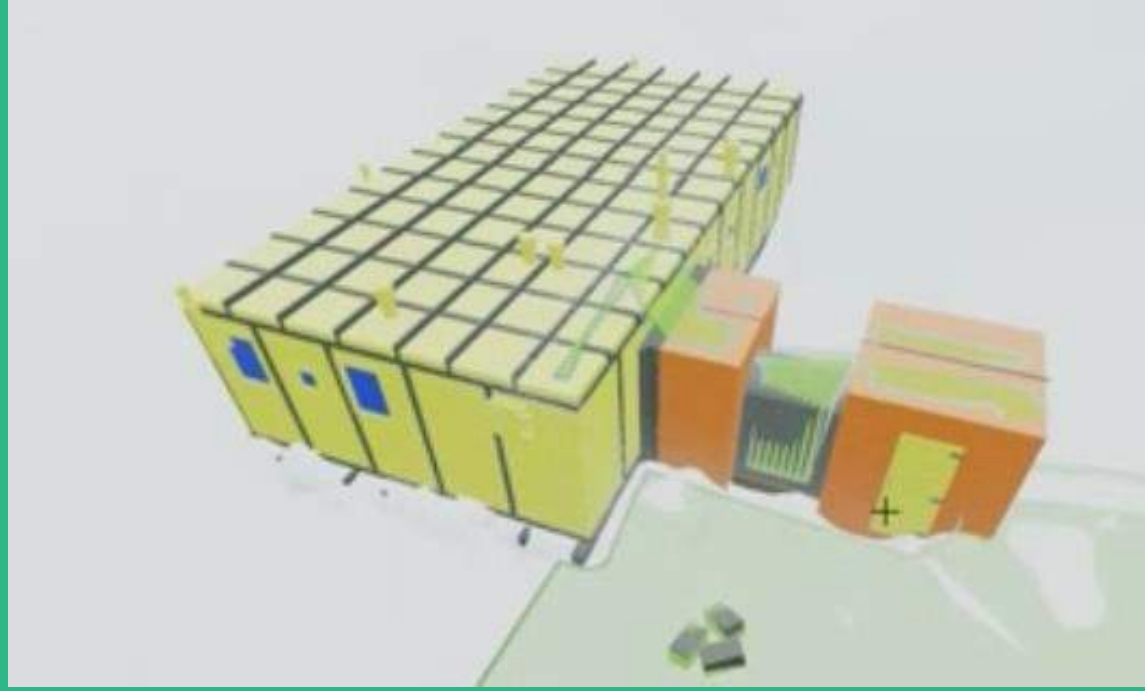
In addition interactive content is being planned so that users can pick up objects to trigger key narratives connected to the hut around exploration, scientific discovery and daily life in the 1950s for Hillary and his team

3D scans of historic artefacts

Hutt exterior

Location photos are used to create a 3D model of the Hutt exterior





Hutt exterior 3D model

Location photos are used to create a 3D model of the Hutt exterior

Screenshot of final VR scene

Geometry and textures clean-up and optimisation

Case study

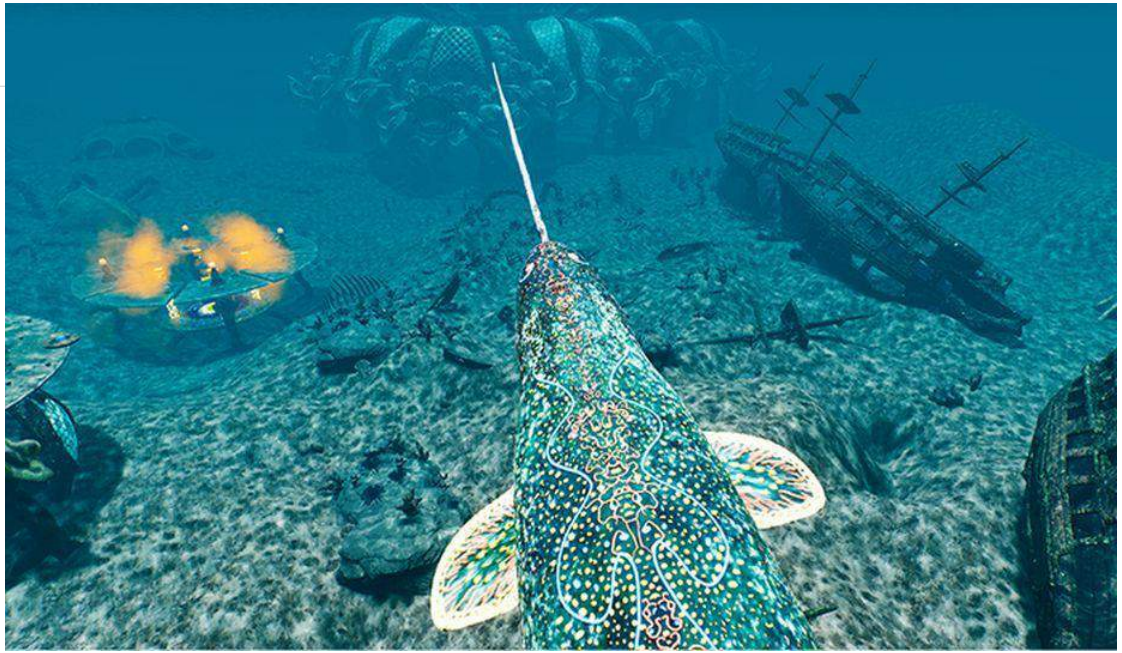
‘Lost City of Mer’ Virtual Reality game

- Collaboration between AUT and Astrea Media

‘Lost City of Mer’ Virtual Reality game

- ‘Lost City of Mer’ is a cross-platform interactive experience about the effects of climate change that combines a smartphone app with virtual reality.
- Using an expanded narrative which builds on universal mythic themes and worldbuilding methodology the experience both educates users about climate change and encourages them to have agency over their personal carbon footprint.
- Website: https://www.lostcityofmer.org/
- Trailer: https://vimeo.com/277547235

‘Lost City of Mer’



- Worldbuilding and asset design for VR
- VR navigation
- Sound design

‘Lost City of Mer’

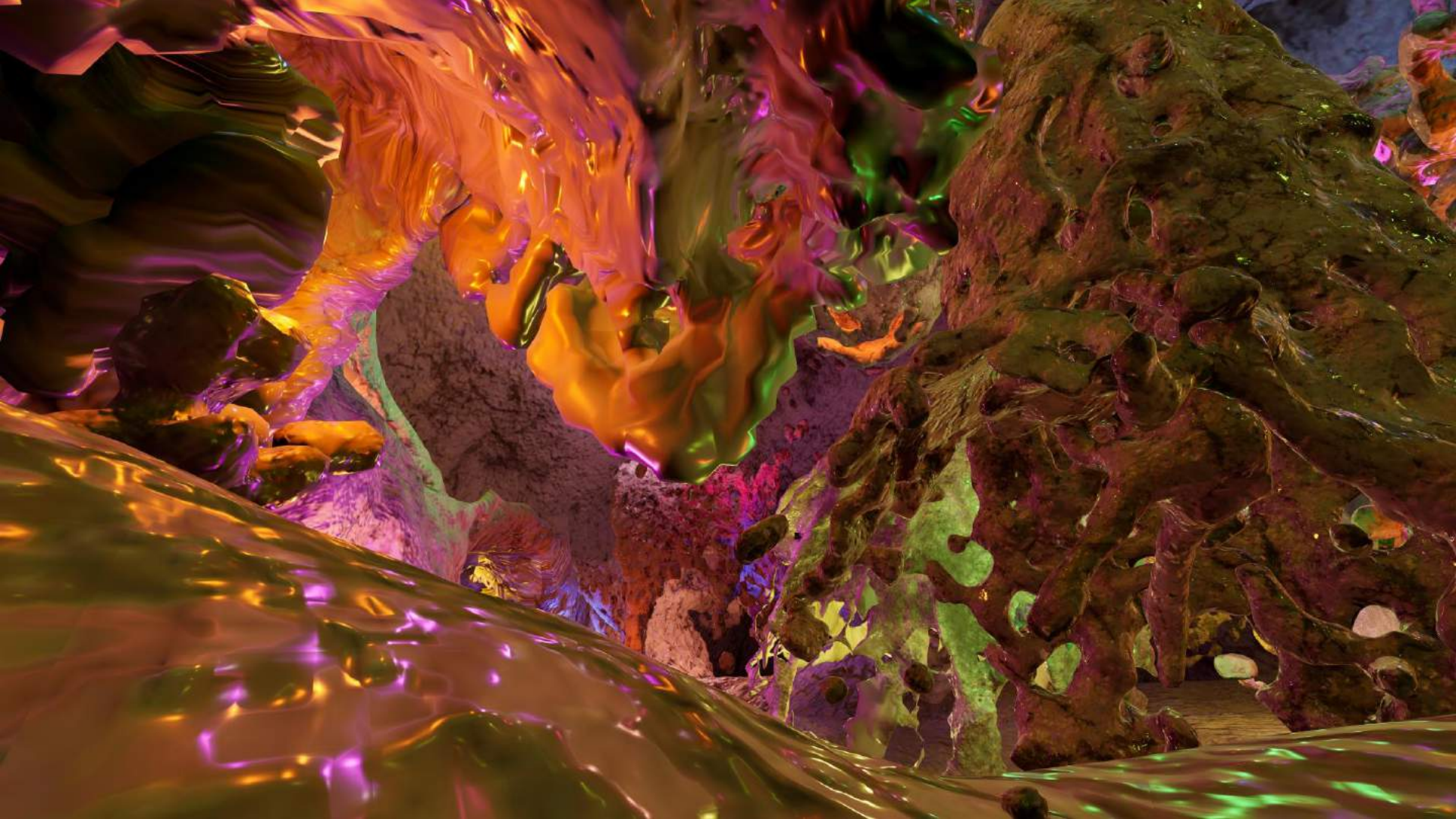
- Narrative development for VR
- Interactivity/gamification
- Science education

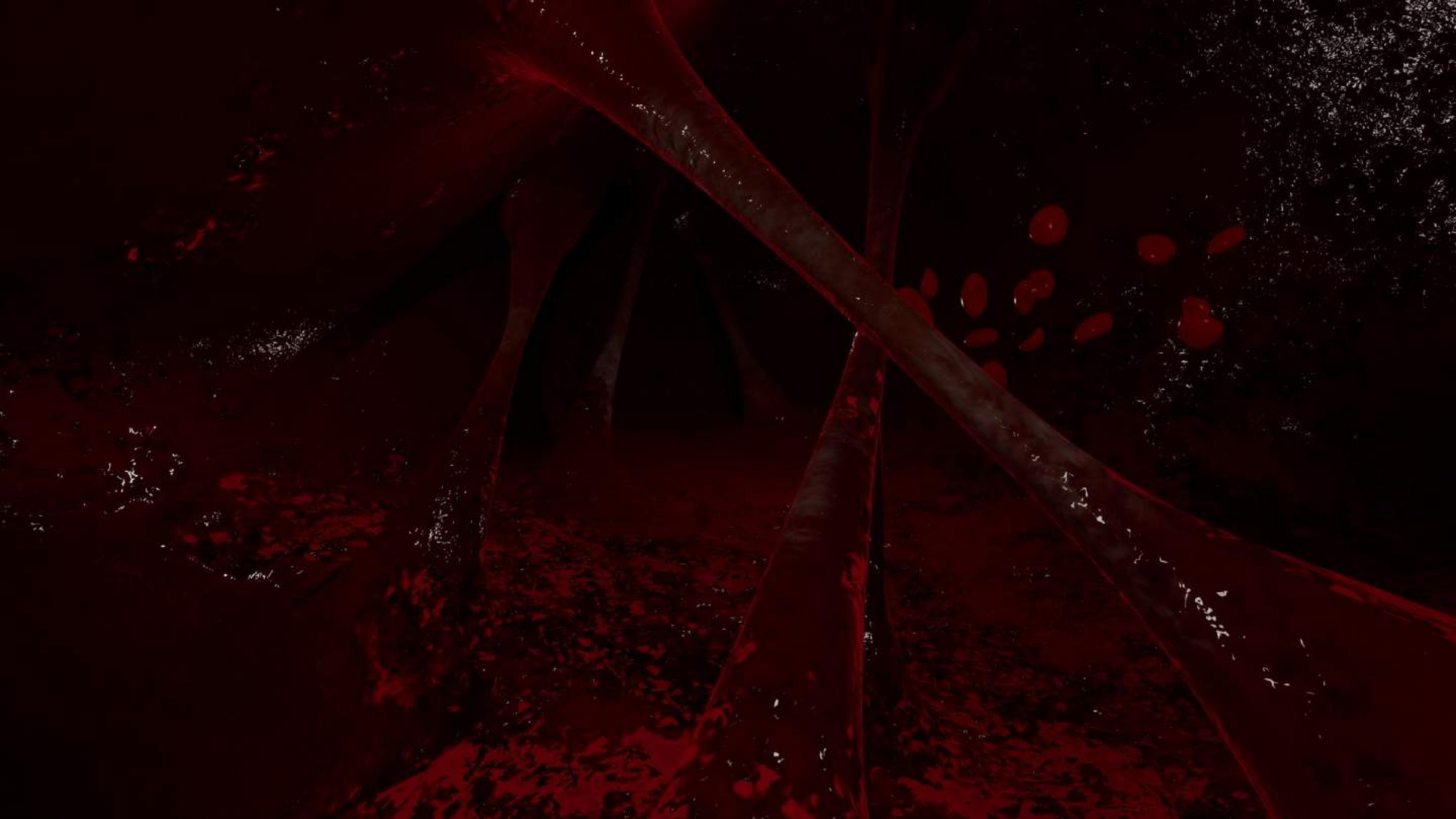
Alternate one column layout

- Alternate one column layout with black background
  - Text level two (20pt)
    - Text level three (20pt)
      - Text level four (20pt)
        - Text level five (18pt)

Karst

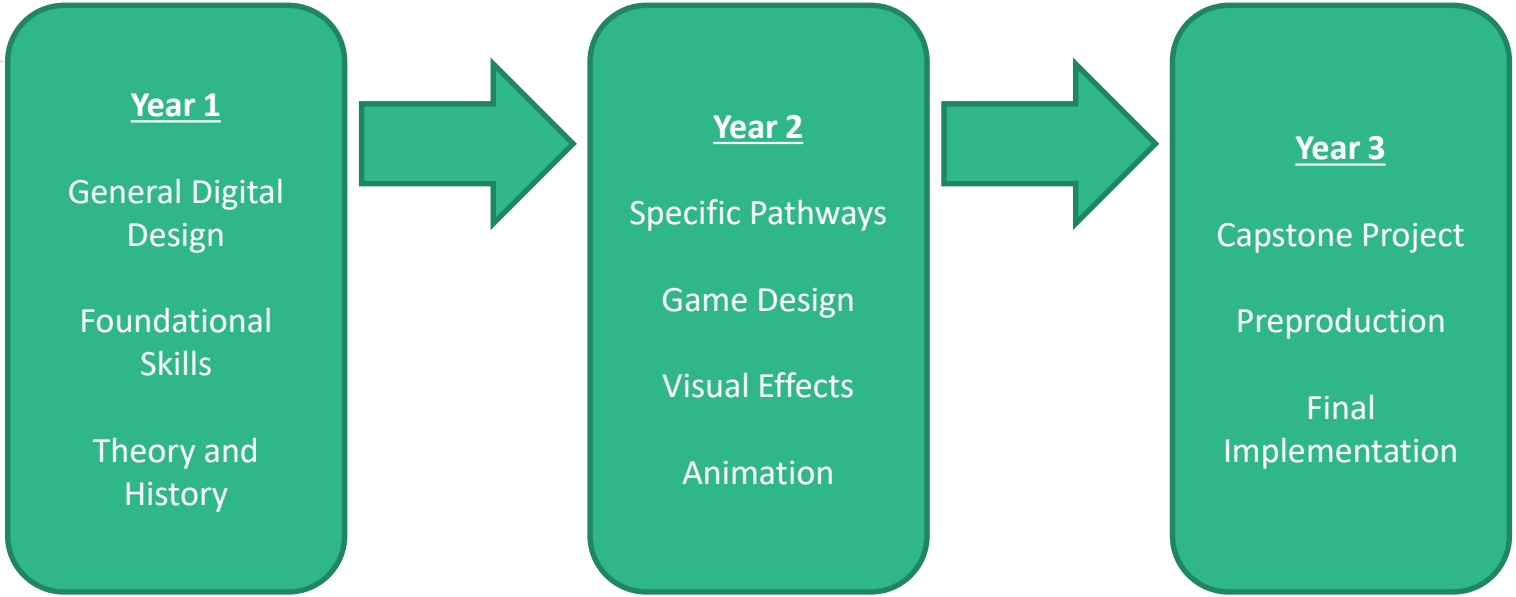

062 - Snow Yunxue Fu



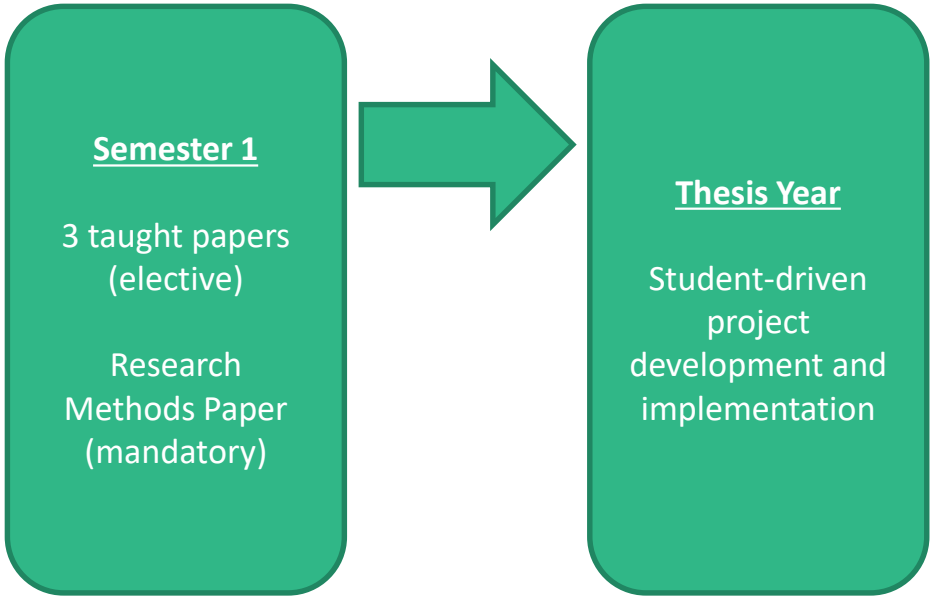


How do we design a curriculum that fosters XR projects

Structure of undergraduate curriculum

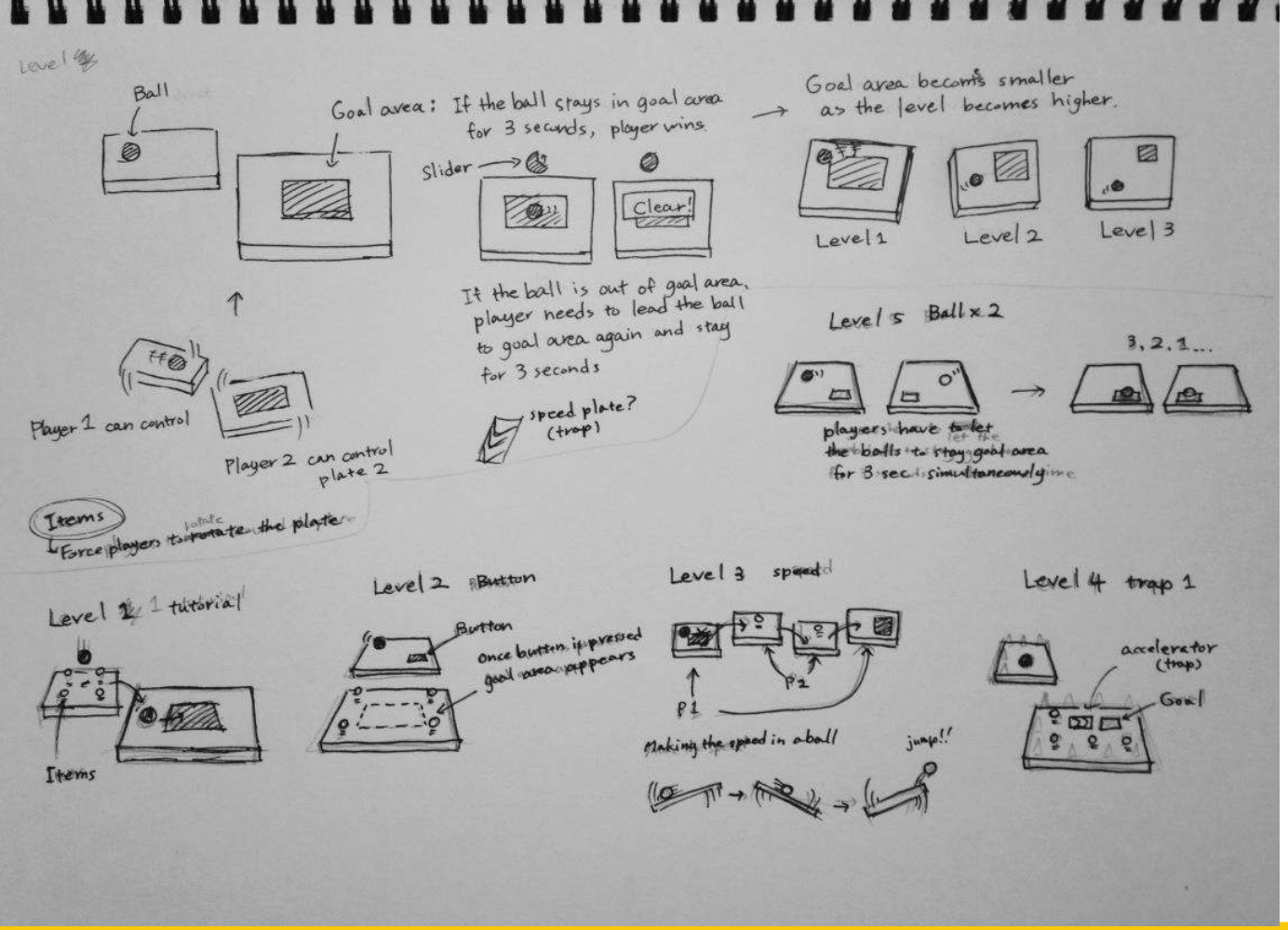


Postgraduate

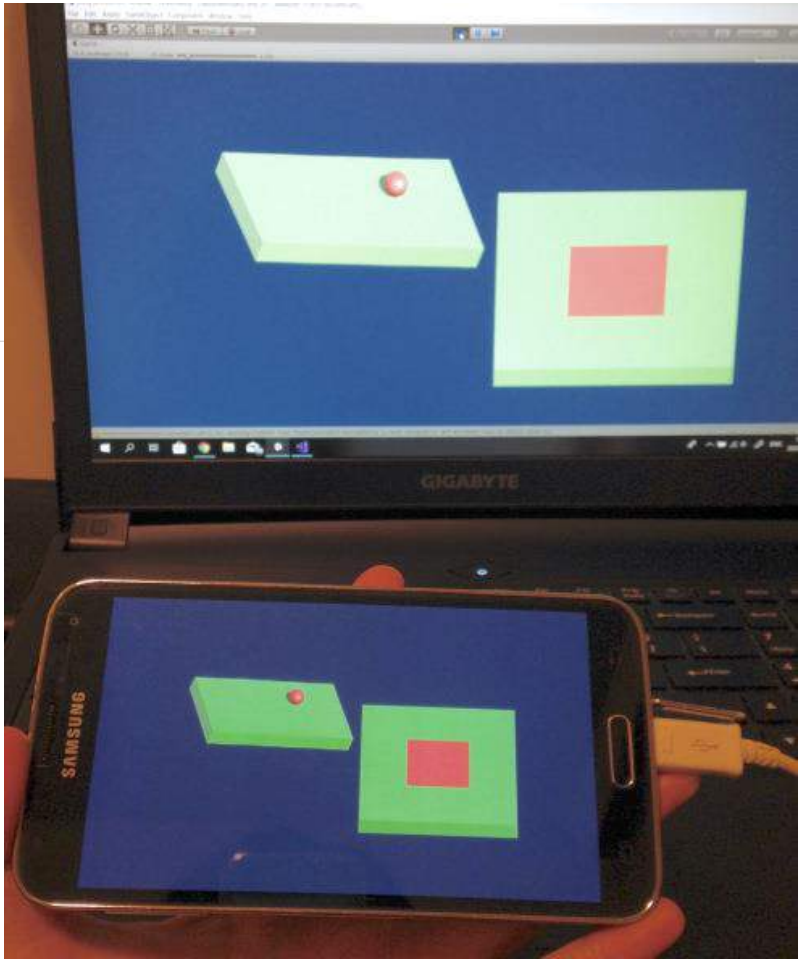


Ayaka Takayama

AR Case Study



Ayaka Takayama

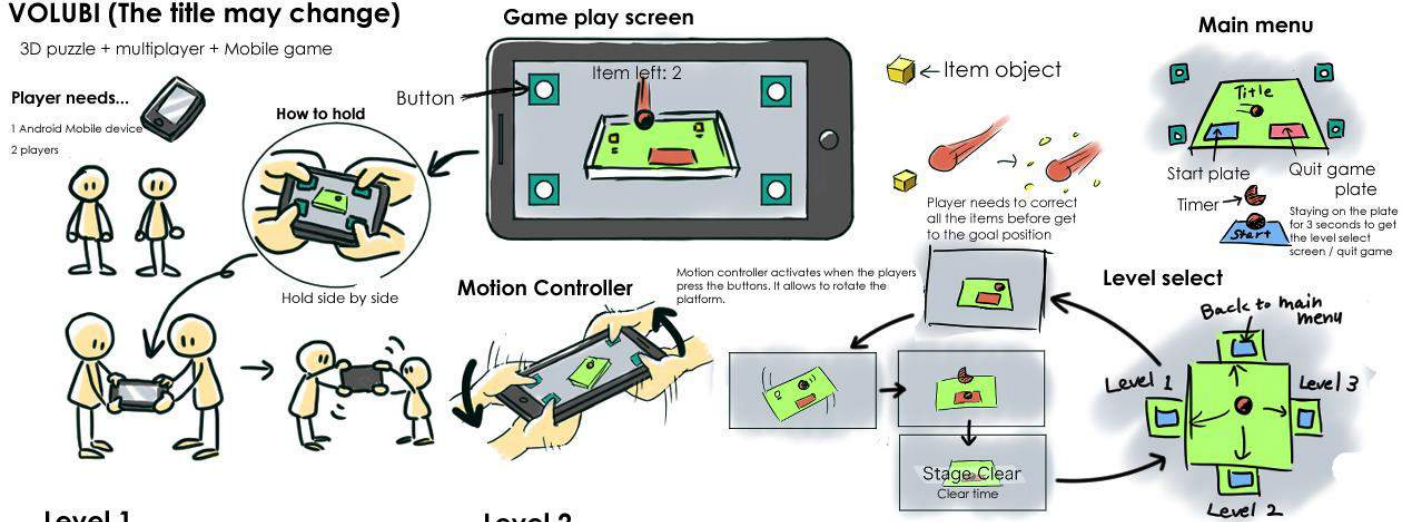


Ayaka Takayama

Ayaka Takayama

VOLUBI (The title may change)

3D puzzle + multiplayer + Mobile game

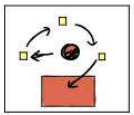


Level 1

Tutorial level

The most simple level

Plyer needs to collect all (three) items and stay in the goal plate for three seconds

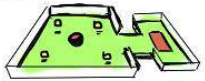


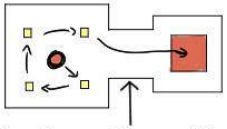
Practice level to see the basic mechanic of the game

Level 2

different platform shape

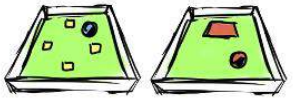
Four items





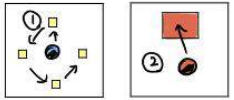
There is no walls around the bridge

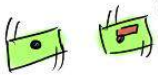
Level 3 double platform & double balls



Left platform for collecting items

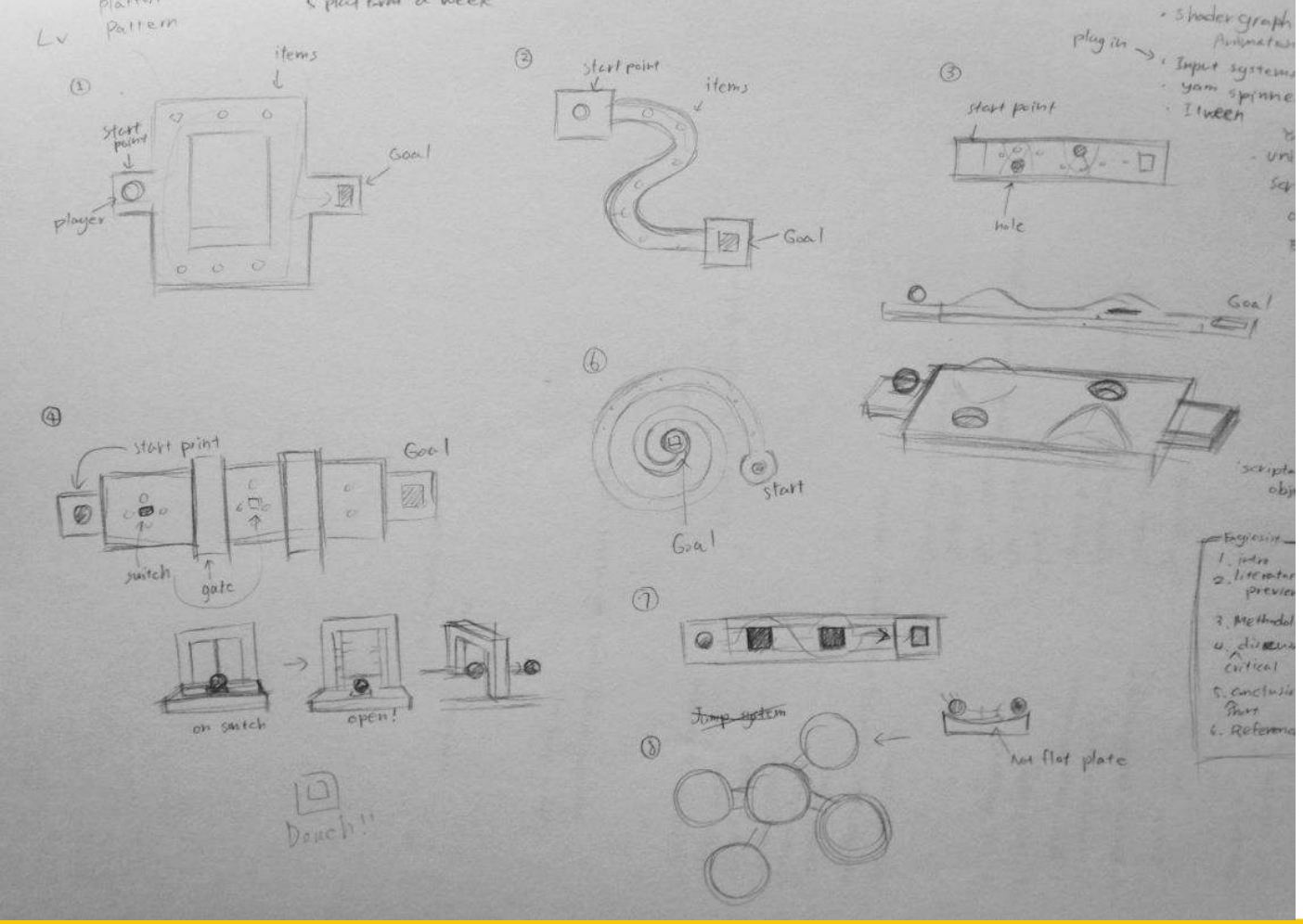
Right platform to reach the goal



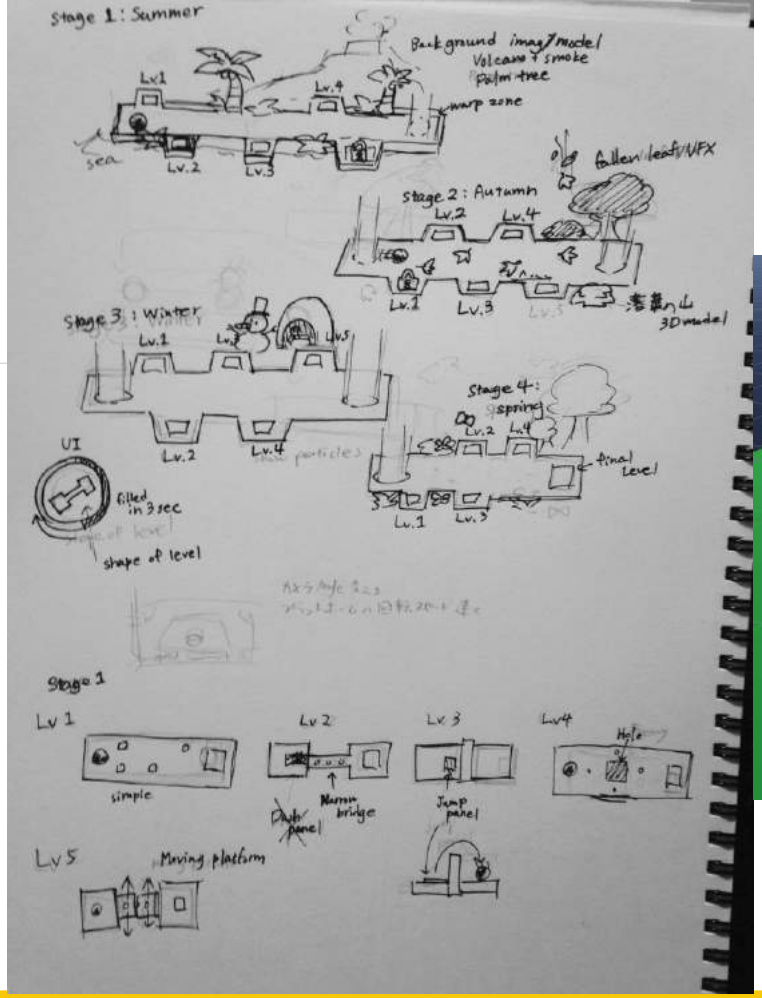


Platform rotates at the same time and same angle.

Ayaka Takayama



Ayaka Takayama

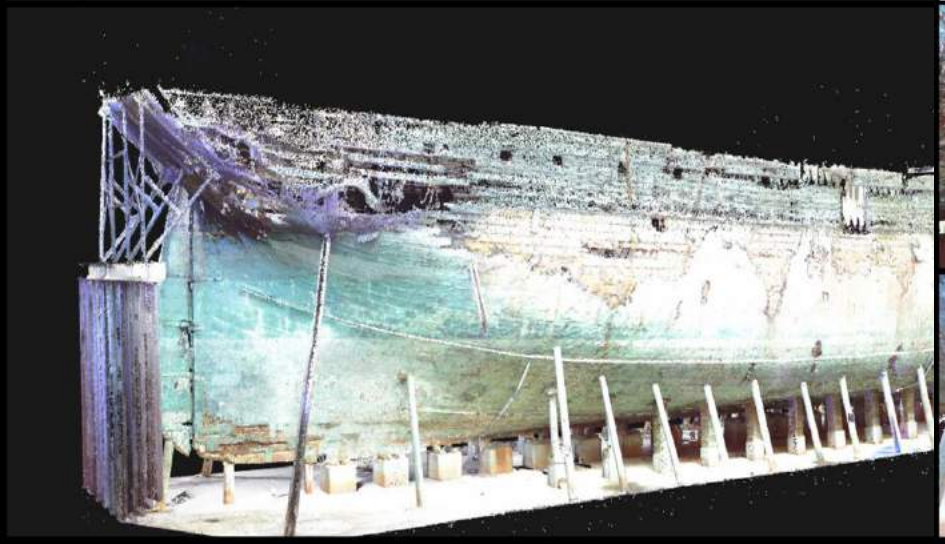


Ayaka Takayama

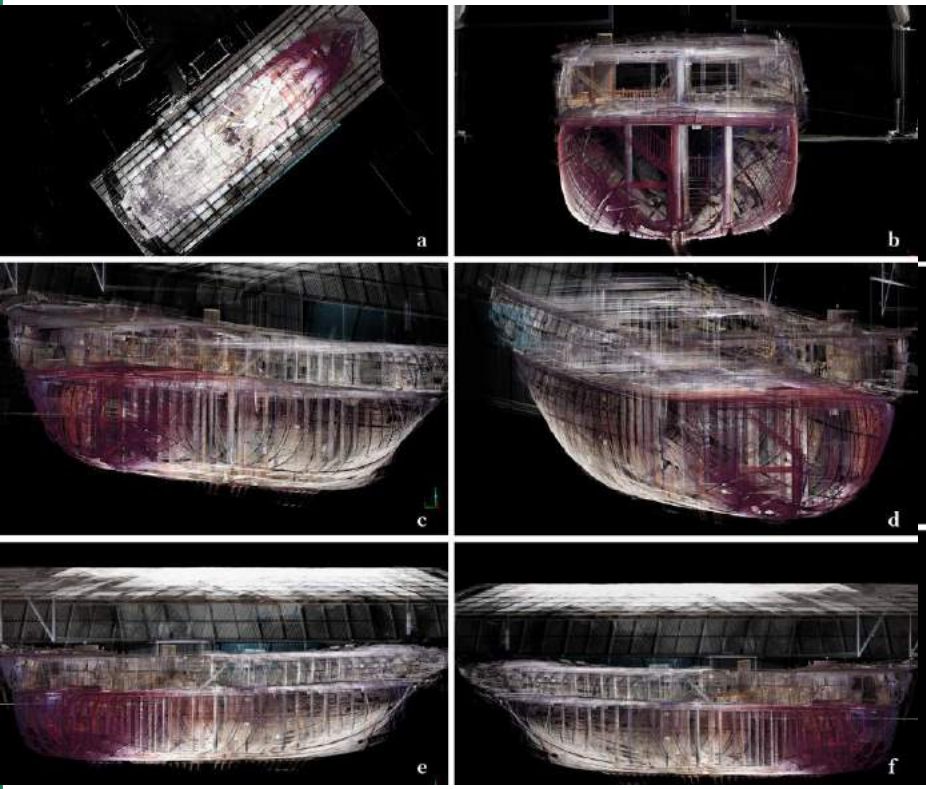
Katarina Markovic

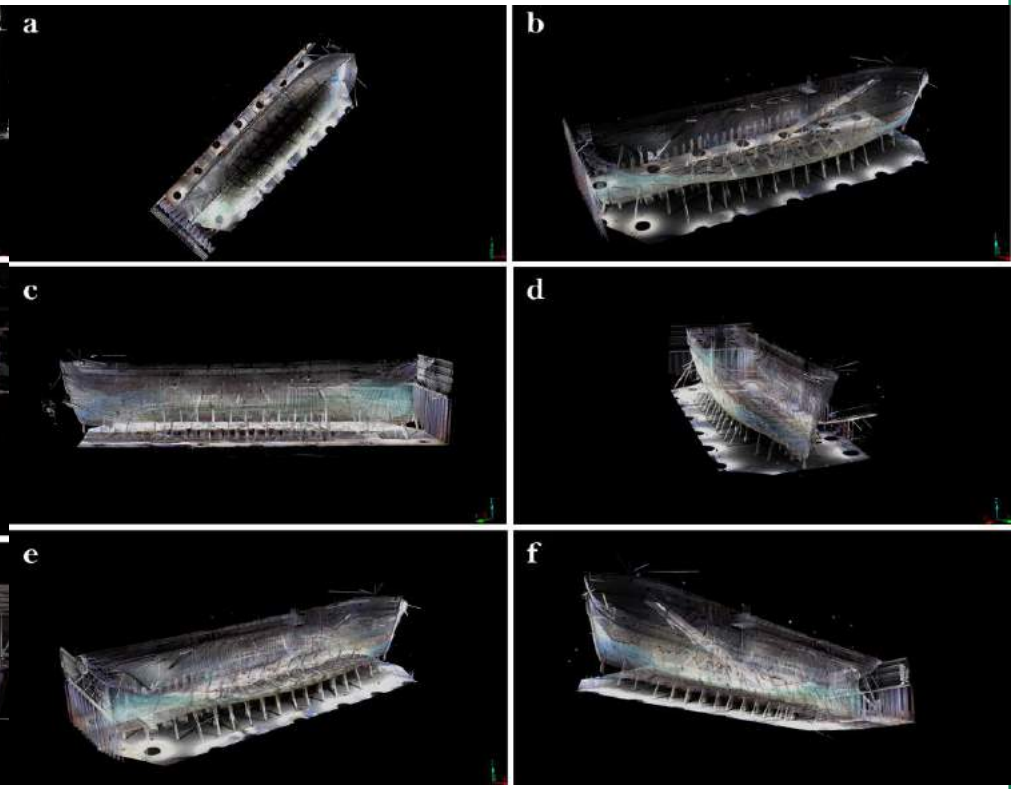
AR Case Study

VR Walkthrough Katarina Markovic



VR Katarina Markovic





VR Katarina Markovic


VR Katarina Markovic


VR Katarina Markovic

Summary

- Curriculum has to support and encourage students to go beyond simple Game Design and Visual Effects projects.

- Students need to understand that the learning curve for XR projects is steeper

- XR projects will offer a highly satisfying result, if well executed.

ED-XR group Workshop (ACM SIGGRAPH Educators' Forum sponsored)

Founded by Miho Aoki and June Kim and ran the 1st workshop in the VRCAI 2018, Tokyo.

2nd workshop was held in the VRCAI 2019, Brisbane (14 – 15 November 2019)

Core members of ED-XR workshop:
Miho Aoki, June Kim and Barbara Morne

Contact us if interests in working and sharing on VR curriculums:
June.kim@siggraph.org

SIGGRAPH ASIA 2019 BRISBANE

Thank you

June Kim: june.kim@unsw.edu.au

Gregory Bennett: Gregory.bennett@aut.ac.nz

Jan Kruse: jan.kruse@aut.ac.nz

Snow Fu: snowyunxuefu@gmail.com

sa2019.siggraph.org