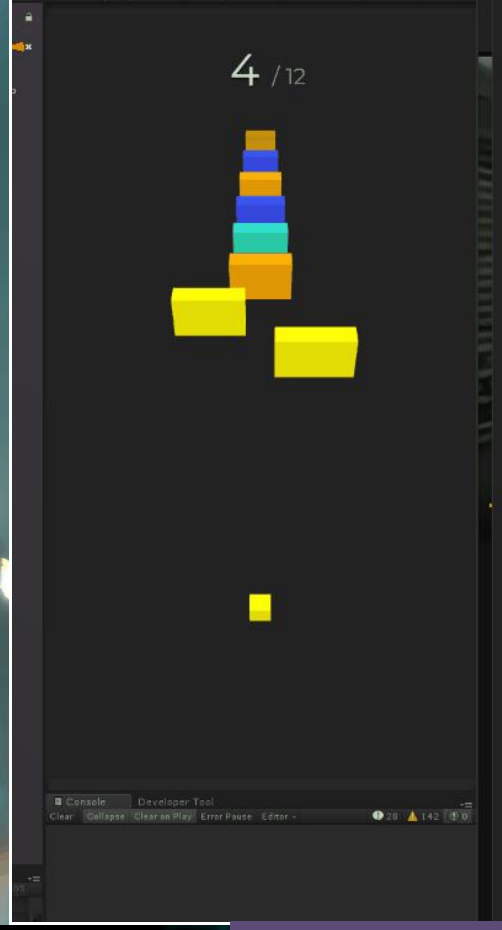
A framework for interacting with multidimensional data in XR

1) Research Objectives

2) Study Design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PIXEL
ARCADE
VR


AMMO 13
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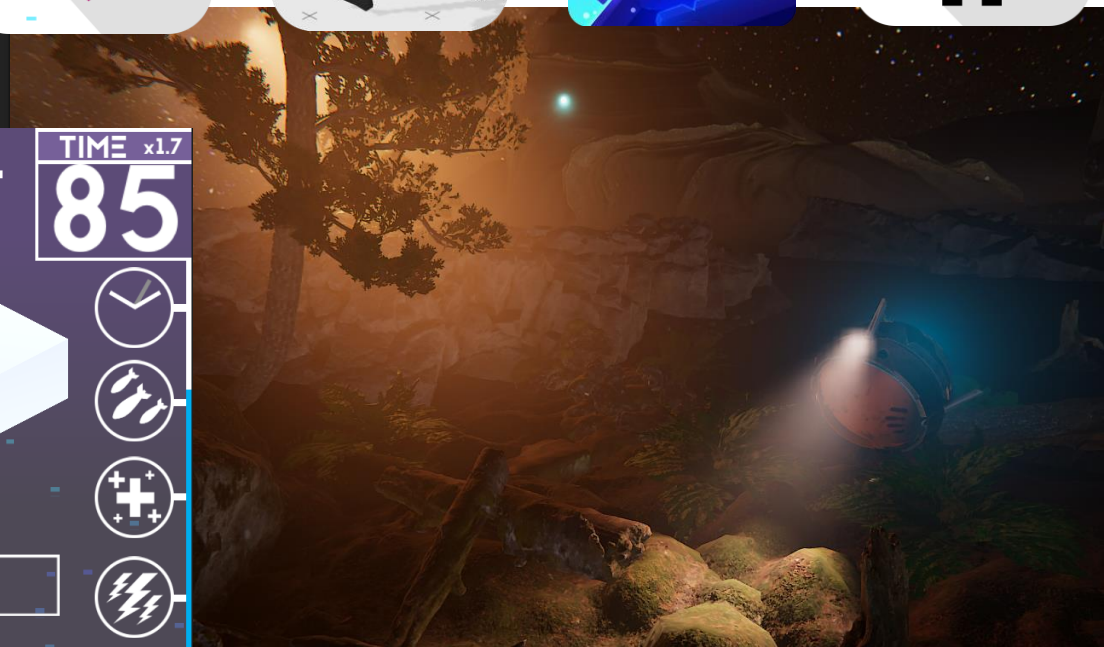
85
TAP
JUMP



C#

Game Dev Technologies

Real-time preferred

Initial Studentship proposal

Design and develop a multidisciplinary framework to aid communication, public engagement and informed decision making in tourism through the novel application of Computer Graphics and HCI technologies.

.. narrowed it down to

Framework for visualising volumetric data in XR to improve user insight & Engagement

….. now its (currently)

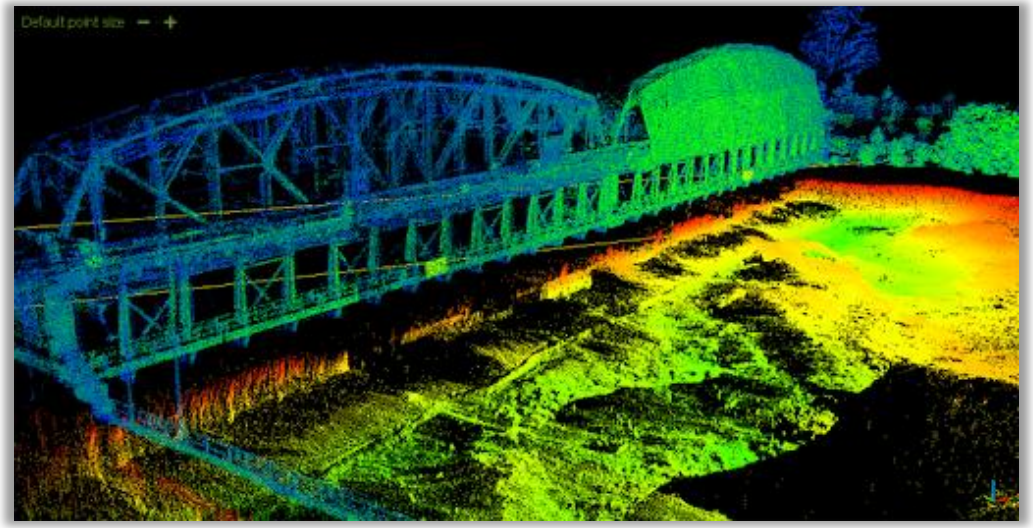
A framework for interacting with multidimensional data in XR.

….. Probably change to something again

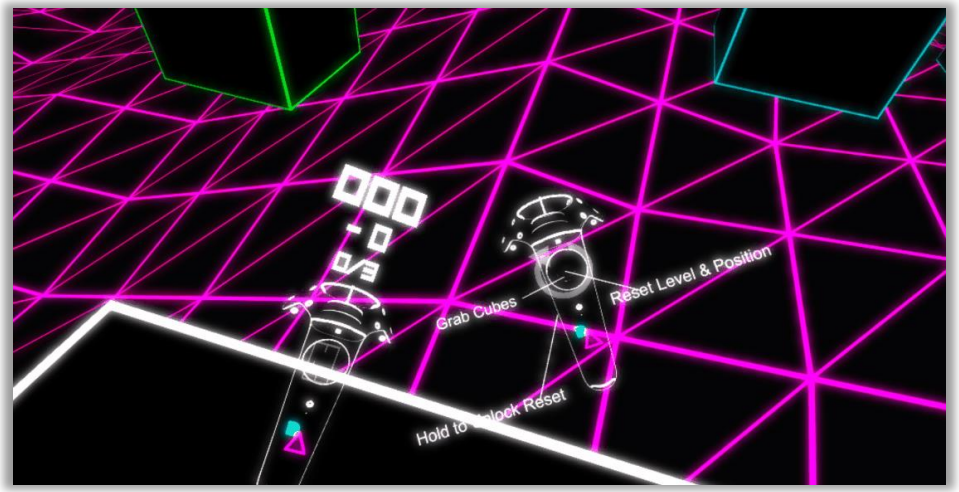
A framework for visualising multidimensional data in XR

3D Graphic Processing

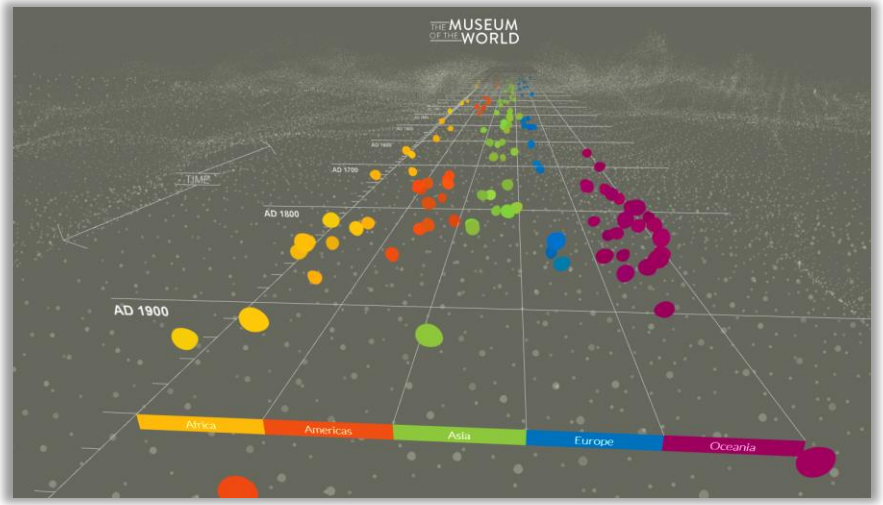
Optimization of Data for Representation



Interaction Framework VR / AR?



Information Visualisation Techniques



Objectives

Design and develop a multidisciplinary framework to aid in the communication of data and decision making.

1. What data representation techniques could immersive technologies support in enhancing decision making?
   - Macro cognitive perspective
   - Will also touch on data management models that can be used for 3D datasets
2. Optimization approaches for 3D data representation
   - Reduce model complexity without losing fidelity
   - Improve fidelity, removing artifacts produced by photogrammetry scanning
3. Interaction with the data using immersive technologies
   - Interoperability
   - Need for new intuitive interaction with data

The Broader Picture – Literature Review

"2013 to 2020 worldwide data will increase from 4.4 to 44 zettabytes" *[1]*

"Challenges related to human ability to extract information, and create a basis for meaningful conclusions" *[1]*

"Cultural Heritage Sites have "rich and often heterogeneous metadata" *[2]*

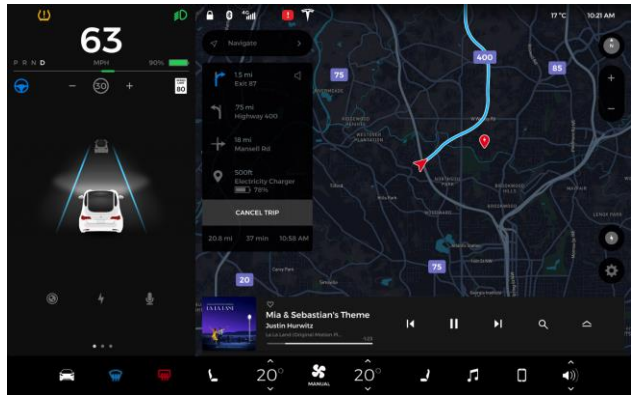
[1] Visualizing Big Data with augmented and virtual reality, Ekaterina Olshannikova 2015

[2] Visualisation of cultural heritage sites, Florian Windhager 2019

Key Papers

IEEE VR Journal

- Visualising big data with AR/VR challenges
  - Provided a list of interaction techniques a VR software should have for interacting with data *GREAT!*
- Olsens Framework for Innovative UI design
  - A checklist of requirements, interim studies not essential



Photos of various platform HCI

Key Words

Digital Libraries

Real Time Processing

Optimization

Information Visualization

Immersive Technologies

Photogrammetry

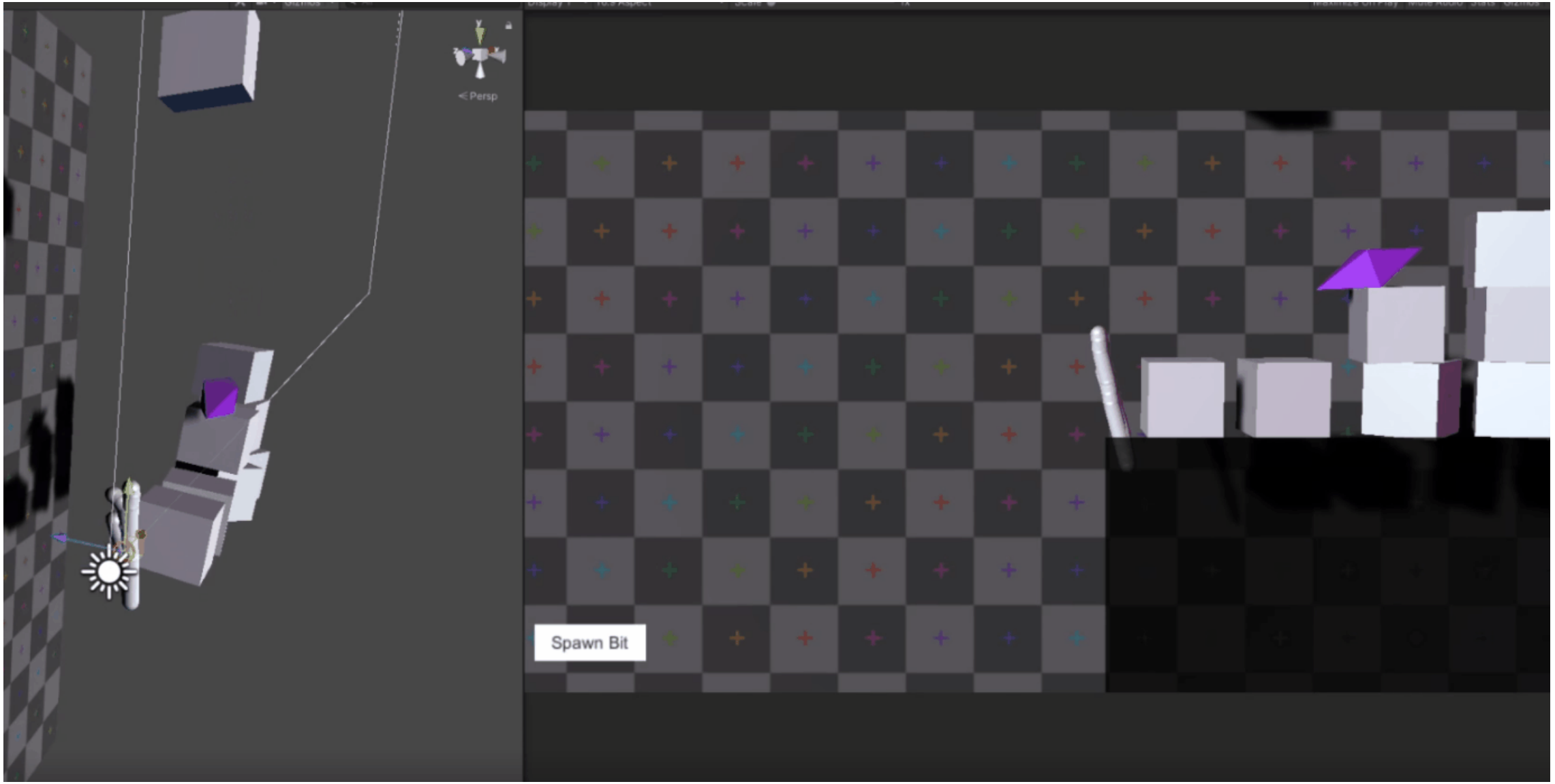
Interaction

Big Data

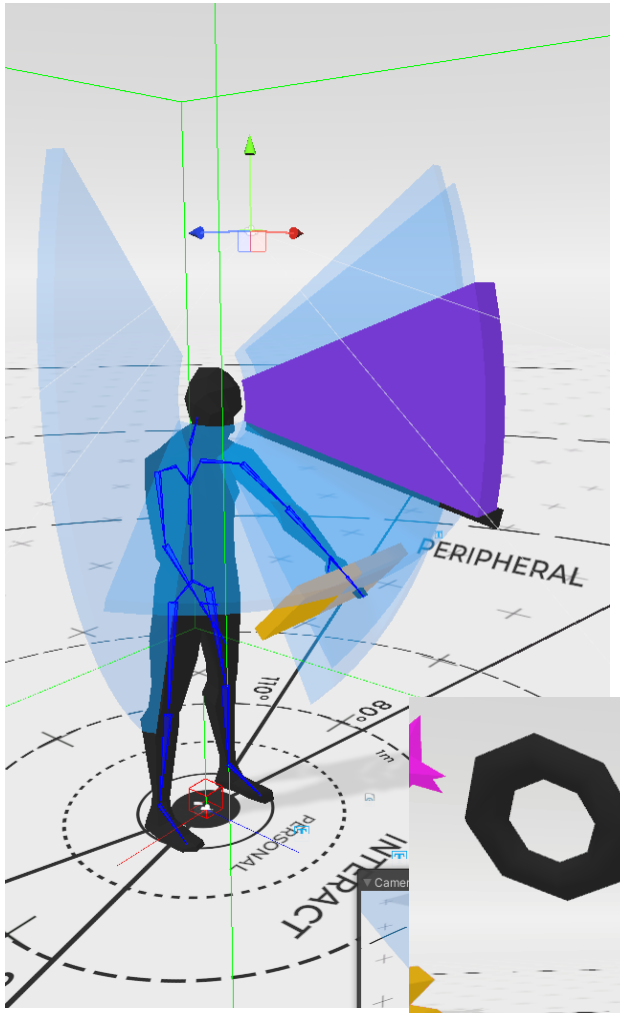
Point Cloud

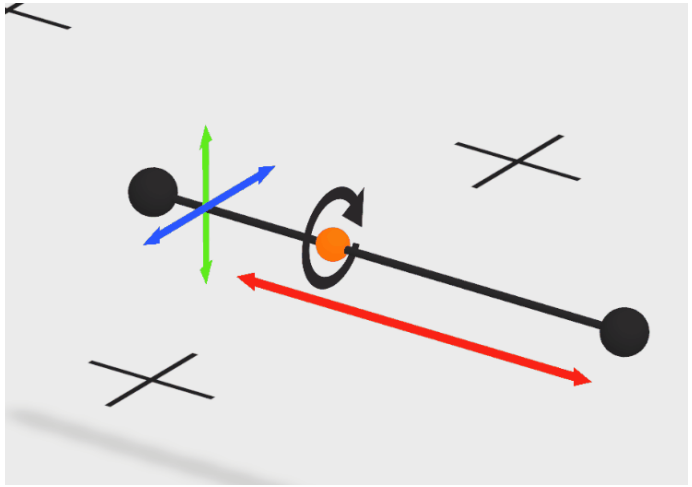
No clear path to how to achieve that goal

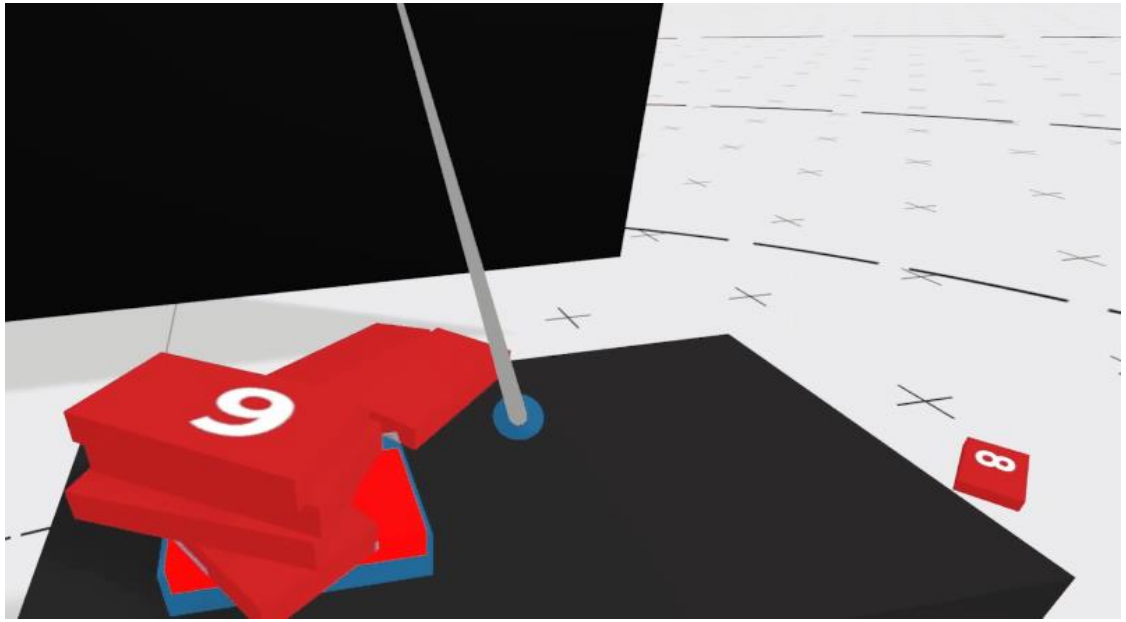
1. Literature review
2. Accessibility paper
3. IEEE Poster
4. Prototypes & Experimentation
5. Grounded concepts
6. Study Design ← I am here
7. Review Papers
8. Finish Implementation
9. Complete Study
10. Write Up



Camera hand gesture model with ONXX Sterilization in Unity Barracuda. Rigid body support


PERIPHERAL
110°
80°
1m
INTERACT
PERSONAL

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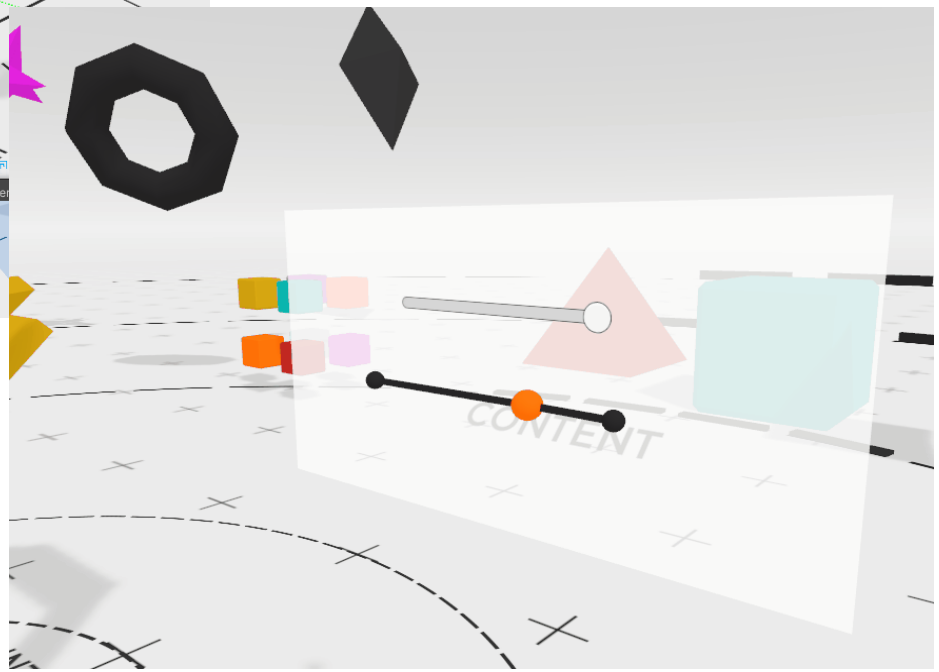
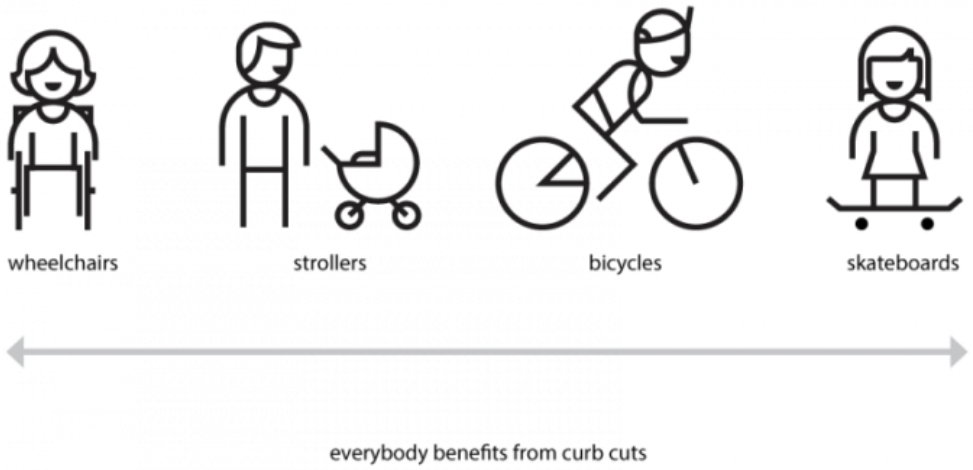
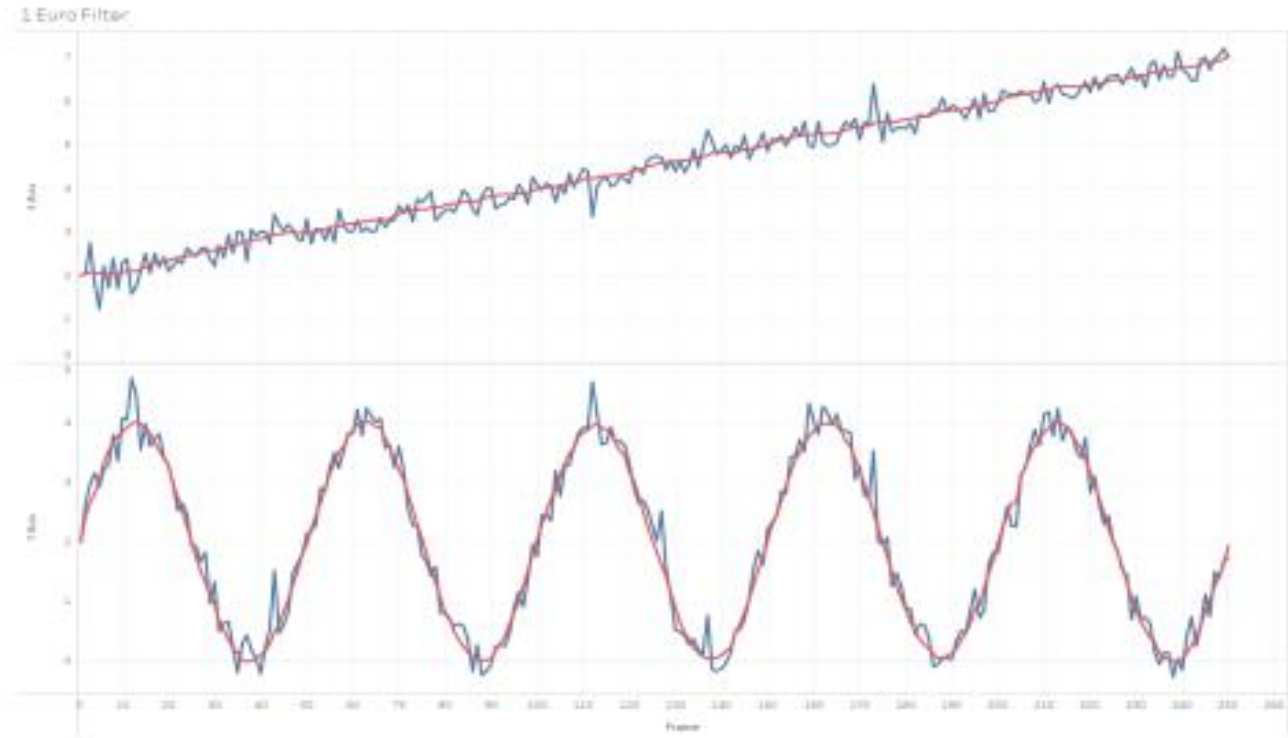

CONTENT

The curb cut effect

The **phenomenon of disability-friendly features being used** and appreciated by a larger group than the people they were designed for





Supporting Accessible Multisensory Interactions in XR

Corrie, J. Green

Robert Gordon University, c.green1@rgu.ac.uk

Dr Yang, Jiang

Senior Lecturer in Digital Media, Robert Gordon University, y.jiang2@rgu.ac.uk

Dr Michael, Heron

Senior Lecturer, Chalmers University of Technology, heronm@chalmers.se

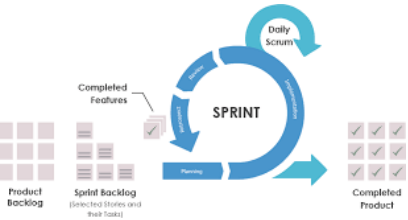
The advancements in virtual reality (VR) technologies has resulted in unique approaches for interface and interaction design comparative to conventional 2D methods. This poses a challenge when developing an application for extended reality (XR) devices, as current accessible interaction standards and techniques made available are limited. Many 2D interaction techniques have been directly translated to a virtual environment with no change to the interface interaction technique. By implementing assistive systems such as filtering user input noise, currently adopted interaction approaches can be made more accessible without re-design. By reducing fine motor requirements in interface selection, users have the opportunity for more accurate and consequently less frustrating environment interactions. A development study was conducted to understand the feasibility of implementing a tremor removal algorithm into a VR environment, while also discussing current XR interaction design philosophies. Analysis on evidence supporting multisensory feedback has been studied with further discussion on psychological models, accessibility guidelines and interface usability considerations.

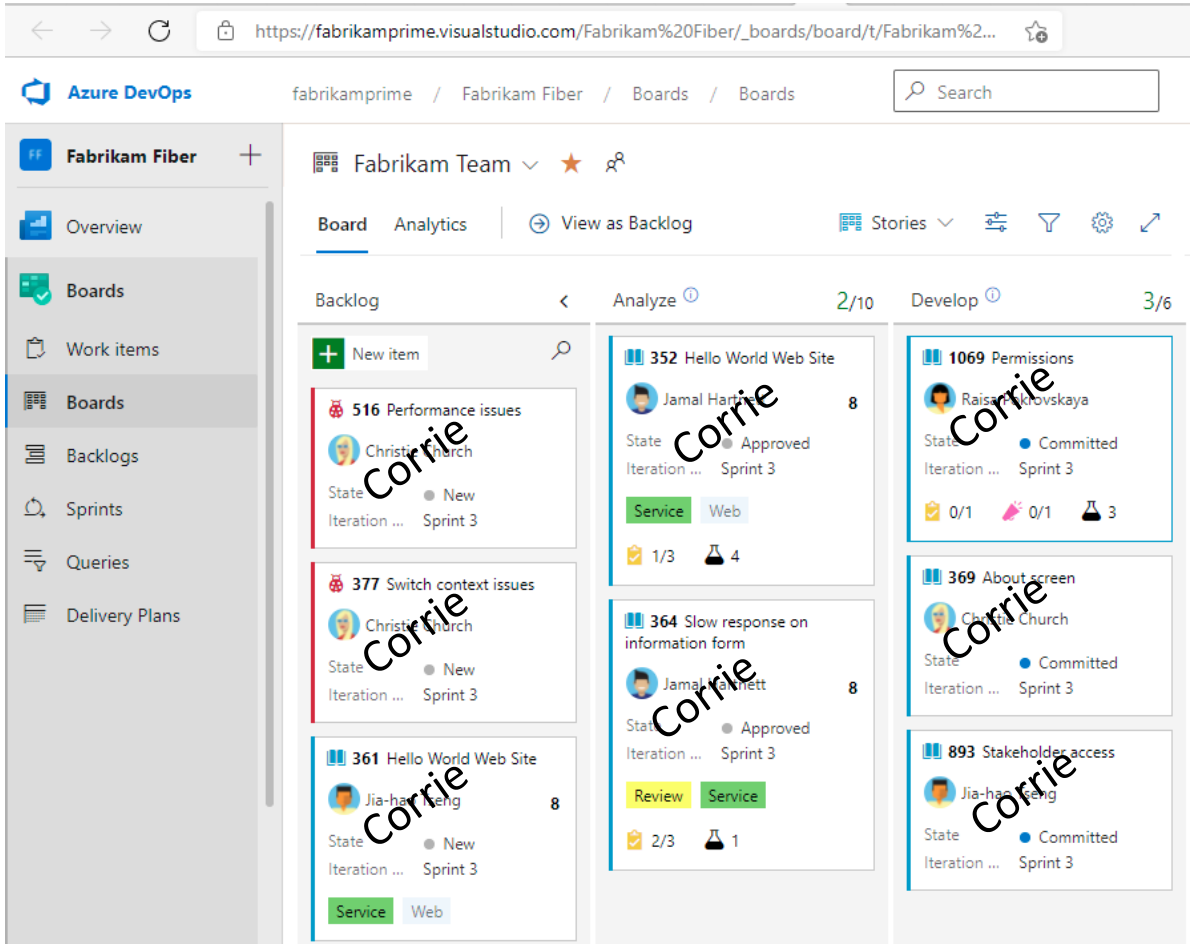
CCS CONCEPTS • Human Centered Computing • Accessibility • Accessibility systems and tools

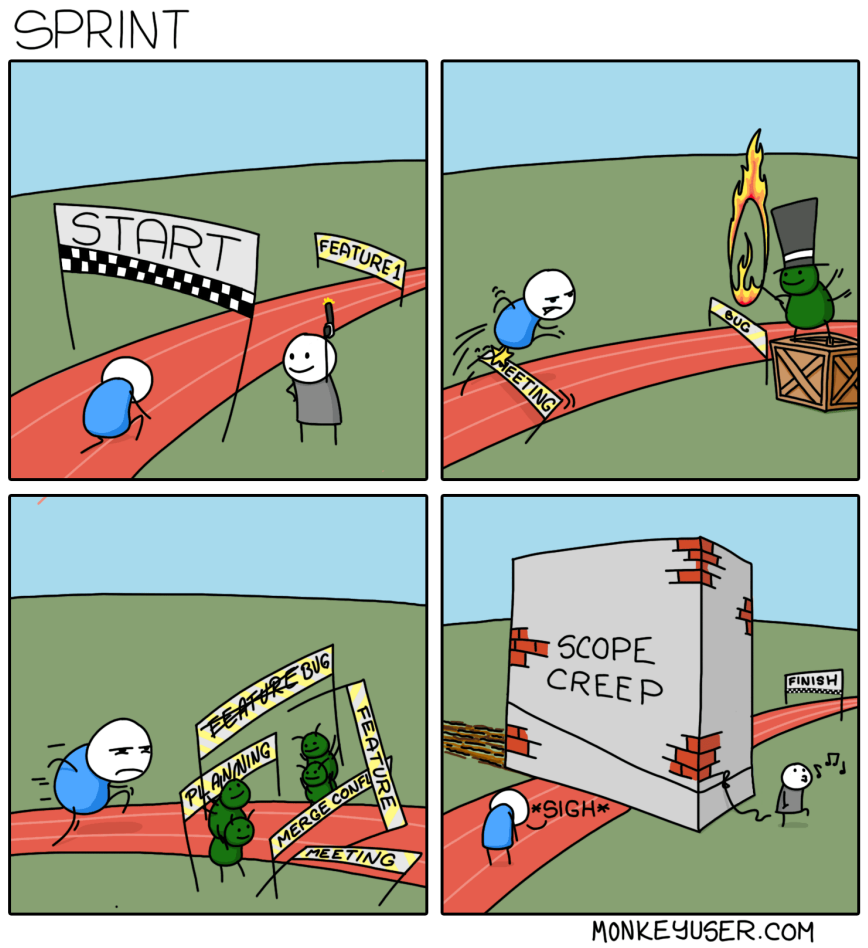
Additional Keywords and Phrases: Virtual Reality, Ergonomics, Physical Accessibility, UI

Tremor Removal in VR

Project Management



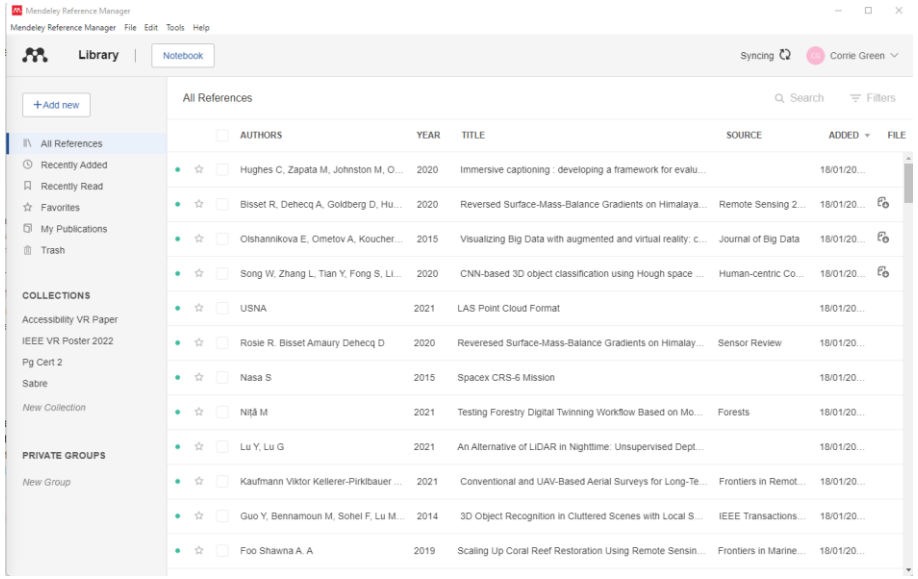




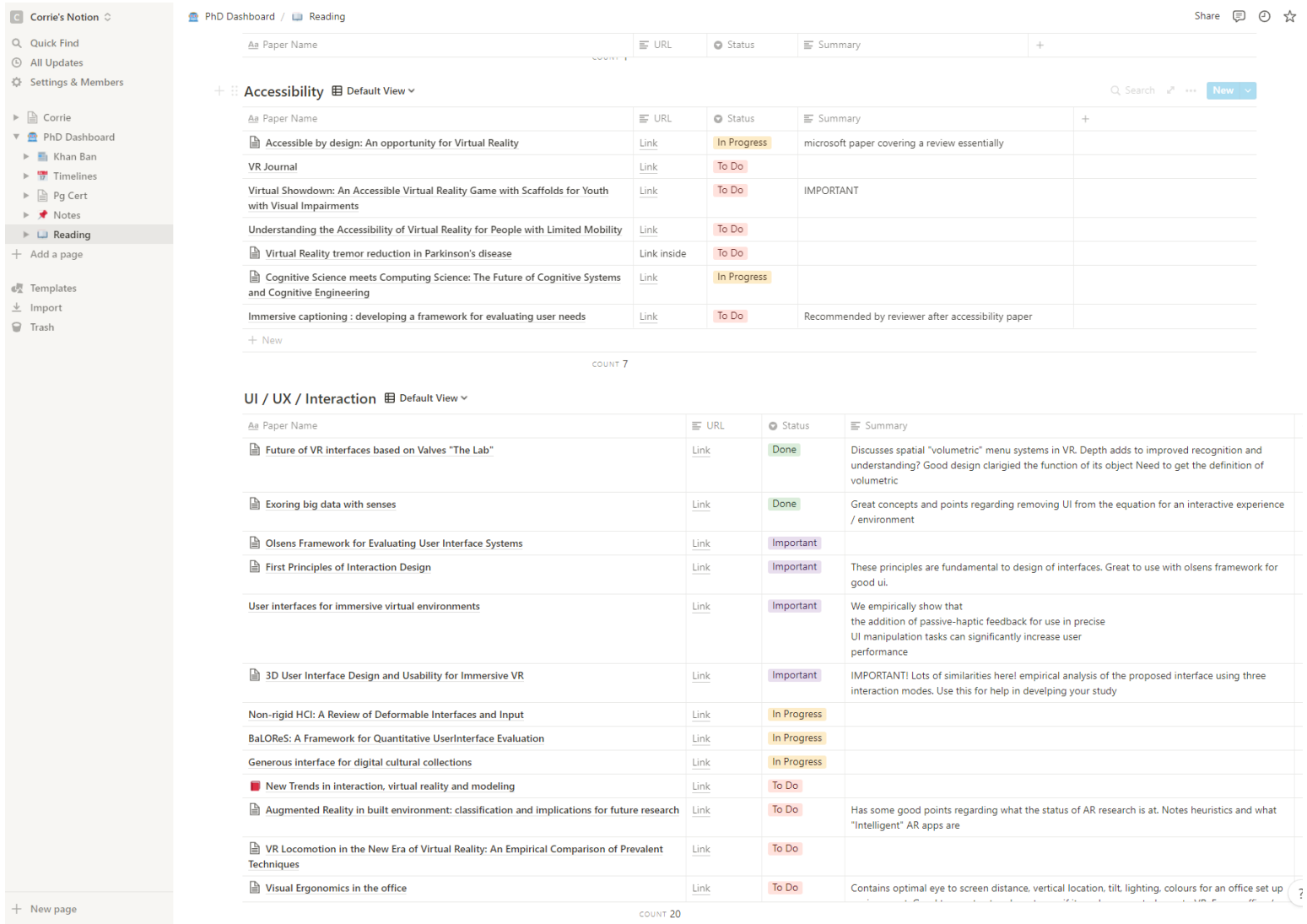
Khan Ban Board for task allocation – Jira, Dev Ops, Trello, Notion.so

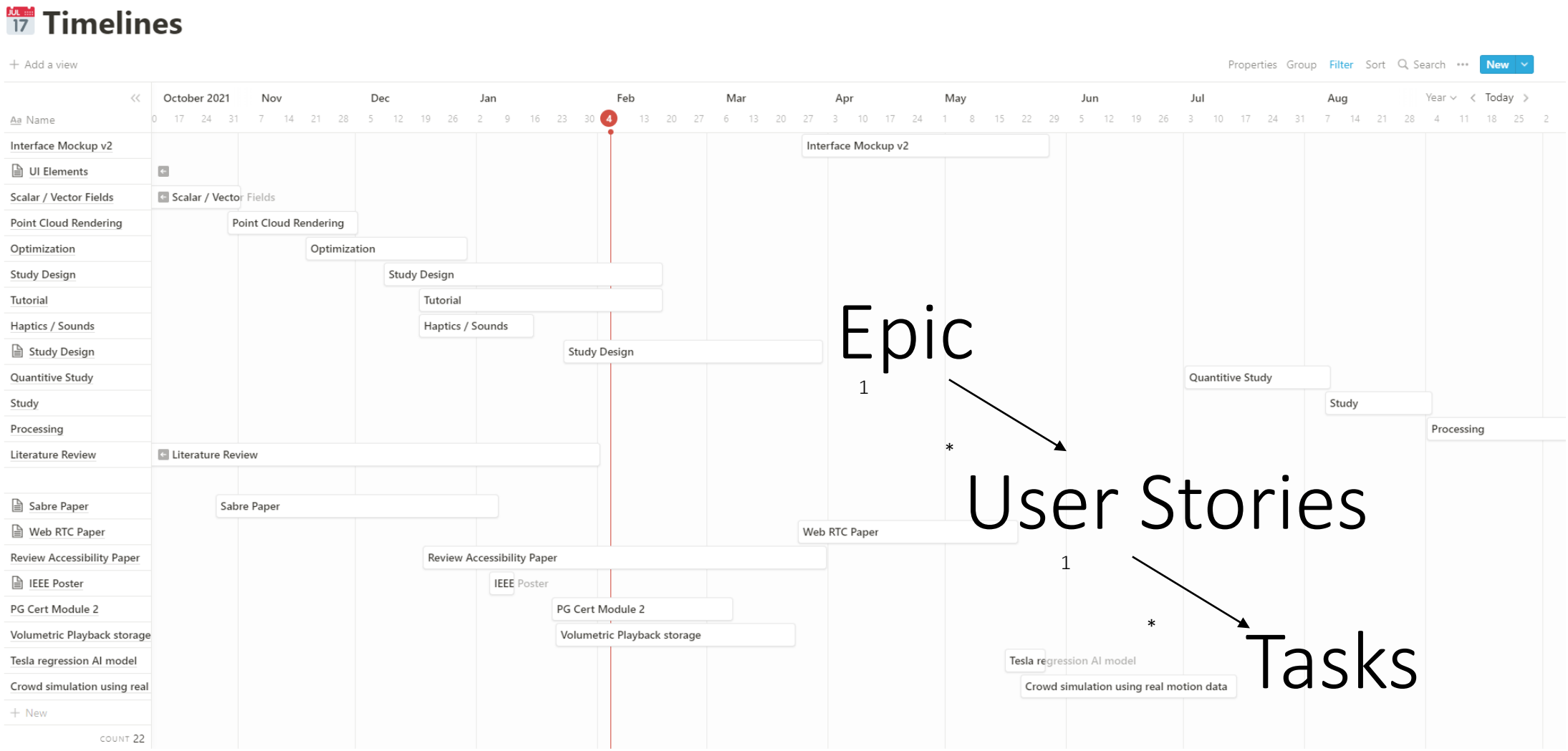
Agile Development exists - prepare to change course

Organisation of literature



Private digital library containing your research interests




Timelines
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Nov
Dec
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Year
Today
Name
Interface Mockup v2
UI Elements
Scalar / Vector Fields
Point Cloud Rendering
Optimization
Study Design
Tutorial
Haptics / Sounds
Study Design
Quantitive Study
Study
Processing
Literature Review
Sabre Paper
Web RTC Paper
Review Accessibility Paper
IEEE Poster
PG Cert Module 2
Volumetric Playback storage
Tesla regression AI model
Crowd simulation using real
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Interface Mockup v2
Scalar / Vector Fields
Point Cloud Rendering
Optimization
Study Design
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Haptics / Sounds
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Quantitive Study
Study
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PG Cert Module 2
Volumetric Playback storage
Tesla regression AI model
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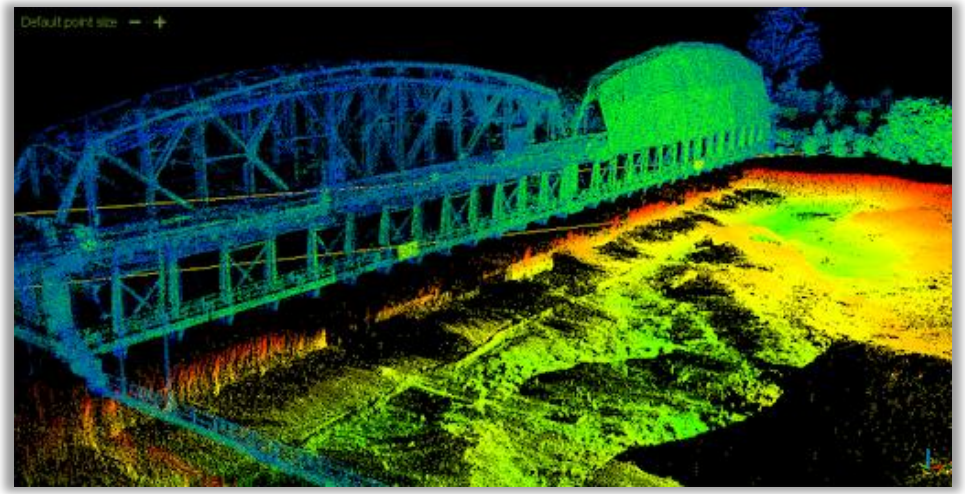
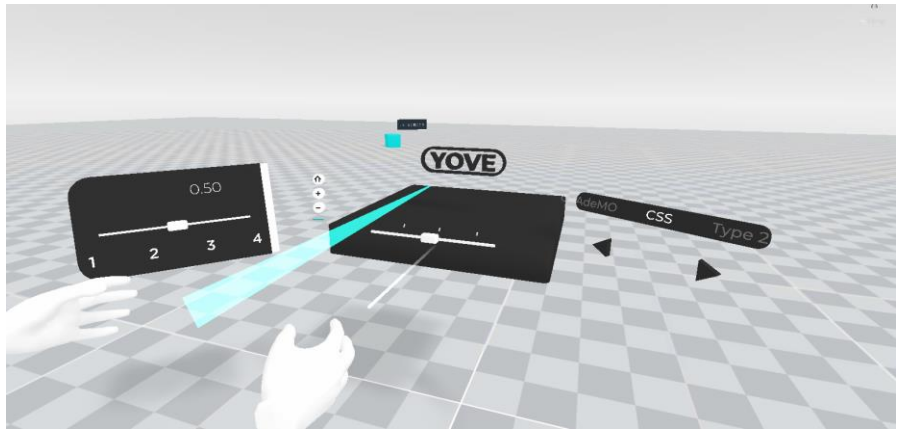
Tasks

- Geographical Location
- Its in the physical world, now we have a digital twin

3D DATA



2D DATA & REPRESENTATION



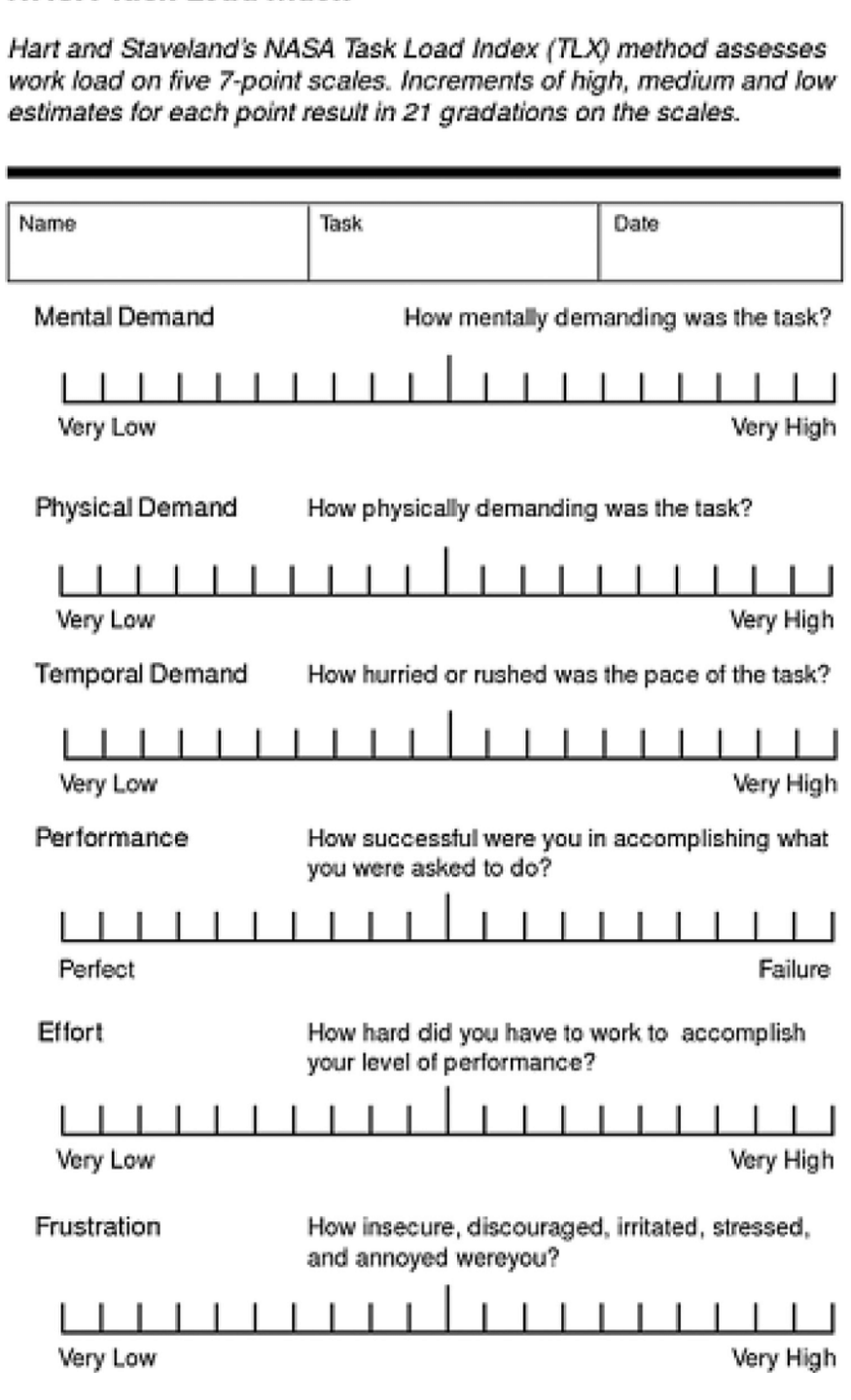
3D DATA

Study Methodology

- Read papers see what their methodology is, how can you learn from their study design?

Analyse UX

NASA TLX which is a workload assessment tool subjective workload



Hart and Staveland's NASA Task Load Index (TLX) method assesses work load on five 7-point scales. Increments of high, medium and low estimates for each point result in 21 gradations on the scales.

Name	Task	Date

Mental Demand — How mentally demanding was the task?

Very Low — Very High

Physical Demand — How physically demanding was the task?

Very Low — Very High

Temporal Demand — How hurried or rushed was the pace of the task?

Very Low — Very High

Performance — How successful were you in accomplishing what you were asked to do?

Perfect — Failure

Effort — How hard did you have to work to accomplish your level of performance?

Very Low — Very High

Frustration — How insecure, discouraged, irritated, stressed, and annoyed wereyou?

Very Low — Very High

Now scraping real-time EV charge data in Scotland to visualise on a 3D topographical map in VR