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Fearn, Warren ORCID logoORCID: https://orcid.org/0000-0002-2029-630X and Bloom, Katy ORCID logoORCID: https://orcid.org/0000-0002-4907-425X (2025) How can Augmented Reality be integrated into Primary Science Education through a Service Design Approach. In: Learning and Teaching Conference 2025, 23rd June 2025, York St John University. (Unpublished)

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SERVICE DESIGN APPROACH:

How Can Augmented Reality Support Primary Science Learning?

Talk about teaching. 2025.

23rd June 2025
Warren Fearn & Katy Bloom
York St John University

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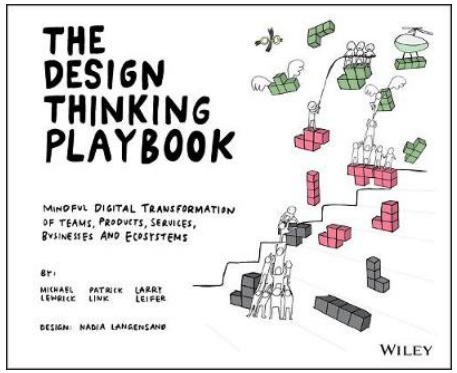
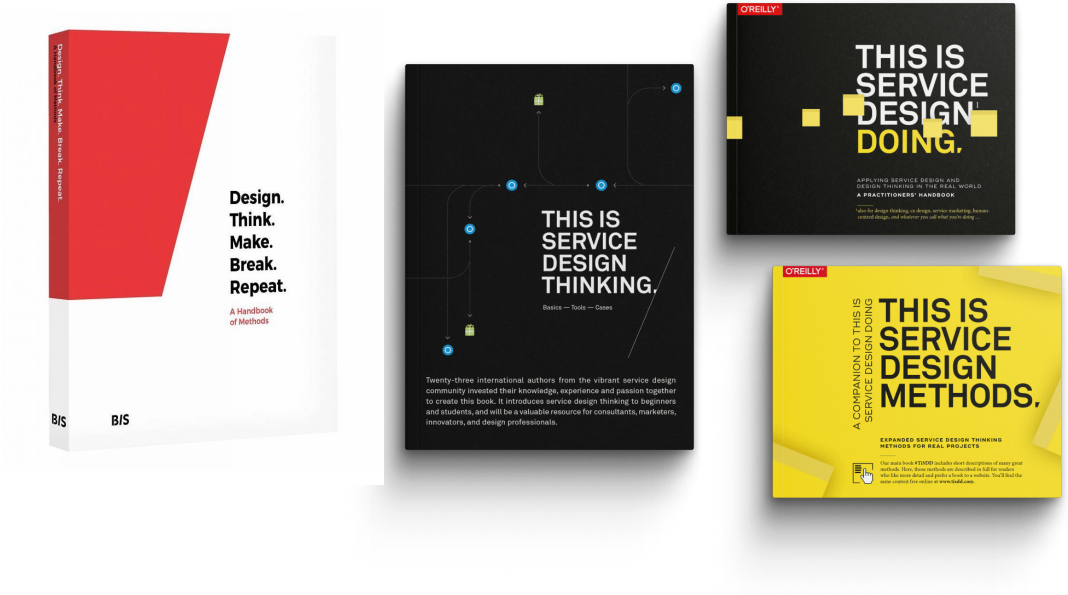
Why **Service Design**?





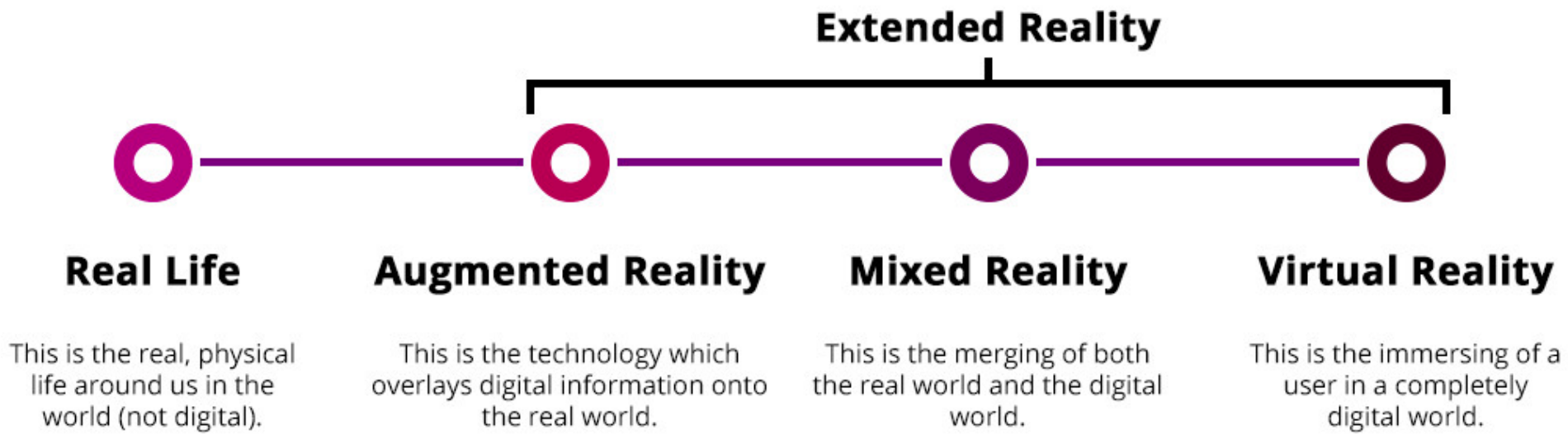
Brown (2009) acknowledges that an everyday device is already considered a service – a mobile phone connecting us to a telecommunications network – and the lines between product and service have blurred.

Brown, T. (2009). Change by Design: How Design Thinking Transforms Organizations and Inspires Innovation. P25.

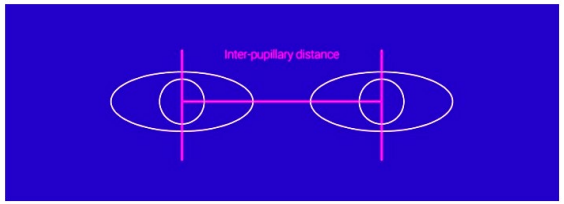
Organisations can use service design to improve the services they offer now and develop whole new value propositions, perhaps based on new technology or new market developments.

Stickdorn et al (2018). This is Service Design Doing. P14/15

What is **Augmented Reality**?



P11 Lenovo Tab (AR)
Android



Inter-pupillary distance
12 – 13 yrs (Wearable)

Image-Marker Based AR

(Akcayir, Akcayir, 2017; Wang, et al., 2017; Radu, 2014; Yuen, Yaoyuneyong, Johnson, 2011), Suggest educators and designers collaborate to **create sound pedagogy when developing AR applications** that maximise on learning outcomes.

Silva et al. (2019) found that although educators recognise the potential of AR, the **adoption of such technologies within mainstream schools is rare**.

(Kerawalla, Woolward, Luckin, 2006; Bistaman, Idrus, Rashid, 2018) Specifically, demonstrate that AR positively impacts **a teaching and learning experience** for primary science education.

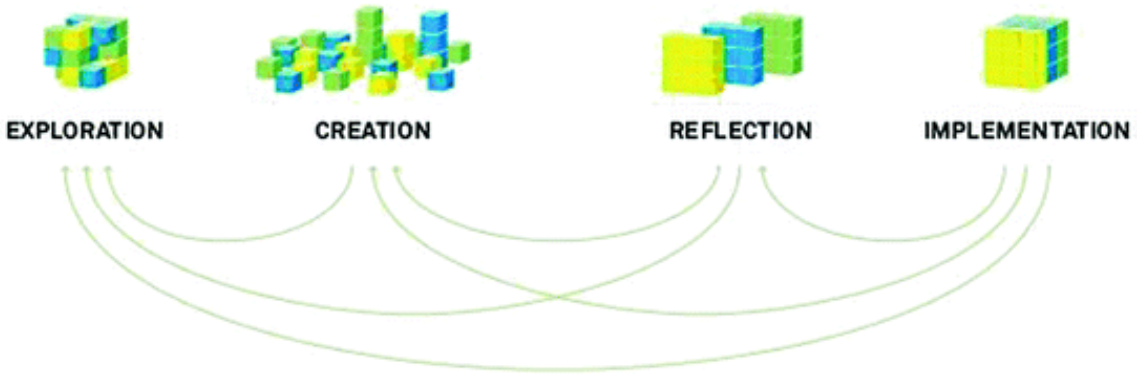
(Wellcome Trust, 2024) that primary teachers within the UK education system are now only managing to devote on average **1 hour and 24 minutes per week** in teaching science

1) How can AR create new remote experiences outside of the classroom?

2) What are the barrier and opportunities for using augmented reality within schools?

Methodology

Service Design Thinking



Stickdorn, Hormess, Lawrence and Schneider (2018)
This is Service Design Thinking

5 Principles of Service Design

1. User Centred
Experiences are customer focused.

2. Co Creative
All stakeholders are part of the process.

3. Sequencing
The service should be visualized as a sequence of interrelated actions.

4. Evidencing
The service should be visualized in terms of physical artefacts.

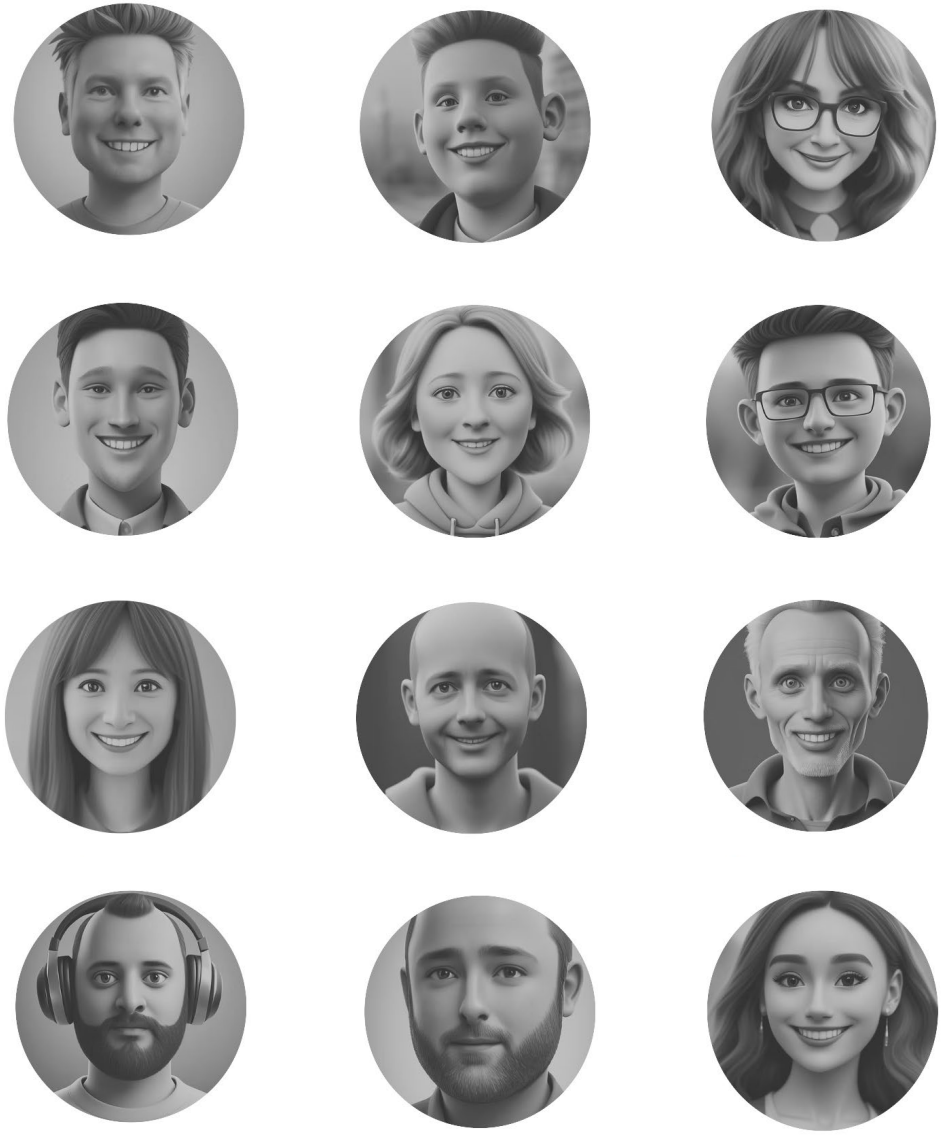
5. Holistic
The entire environment of a service should be considered.

Exploration:

Stakeholders / Co Creators

Warren Fearn (YSJ Design)
Dr Katy Bloom (YSJ Education)
Jonathan Bardwell (GDXR Learn)
Nicky Waller (Primary School Advisor, Centre for Industry Education and Collaboration)
Emma Davis (Science Lead, Ebor Academy Trust)
Jake Reeves Kemp (IT Lead, Ebor Academy Trust)
Tim Moat (Director, Ebor Academy Trust)
Professor Jon Hook (Interactive Media, University of York)
Lindsay West (Garthwest Packaging)
Dean Finnegan (Character Rigger, Ubisoft)
Andrew Byrom (YSJ Design, Brand)
Giselle Johnson (MA Graduate, Illustrator)
John Ricketts (MA Graduate, Sound Artist)
Keystage 2 Pupils (Ebor Academy Trust)

And other primary school teachers.



Exploration:

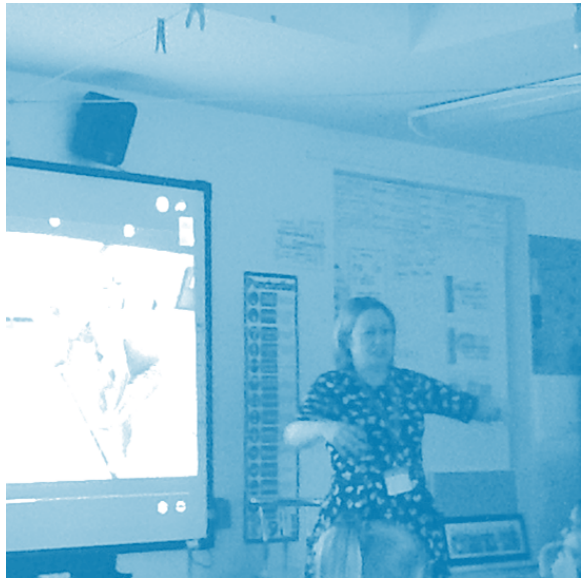
Observations / Focus Groups / Design Sprints

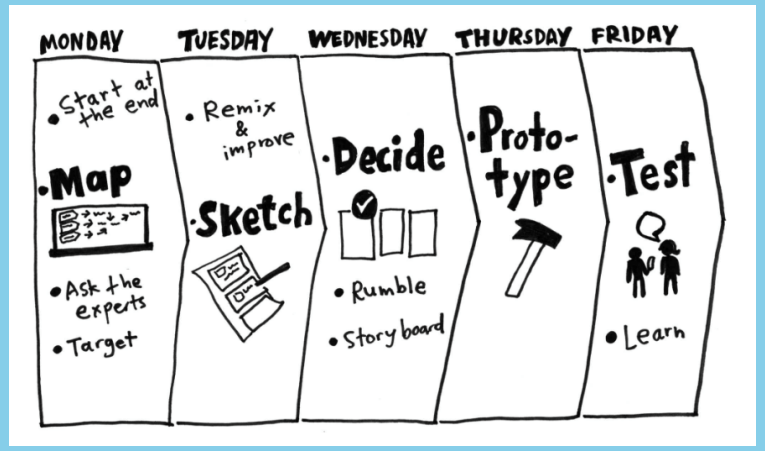
Design Sprint:

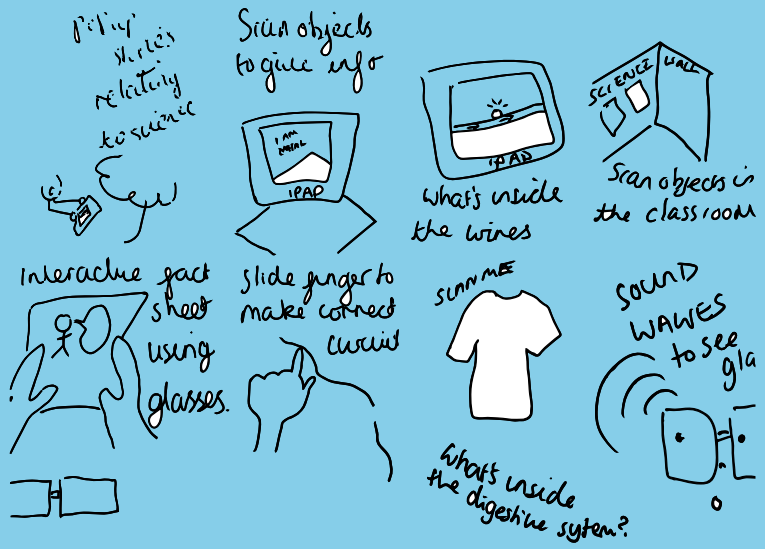
How to Solve Big Problems and Test New Ideas in Just Five Days.

Jake Knapp (2016).

Crazy 8's – 8 Designs in 8 minutes





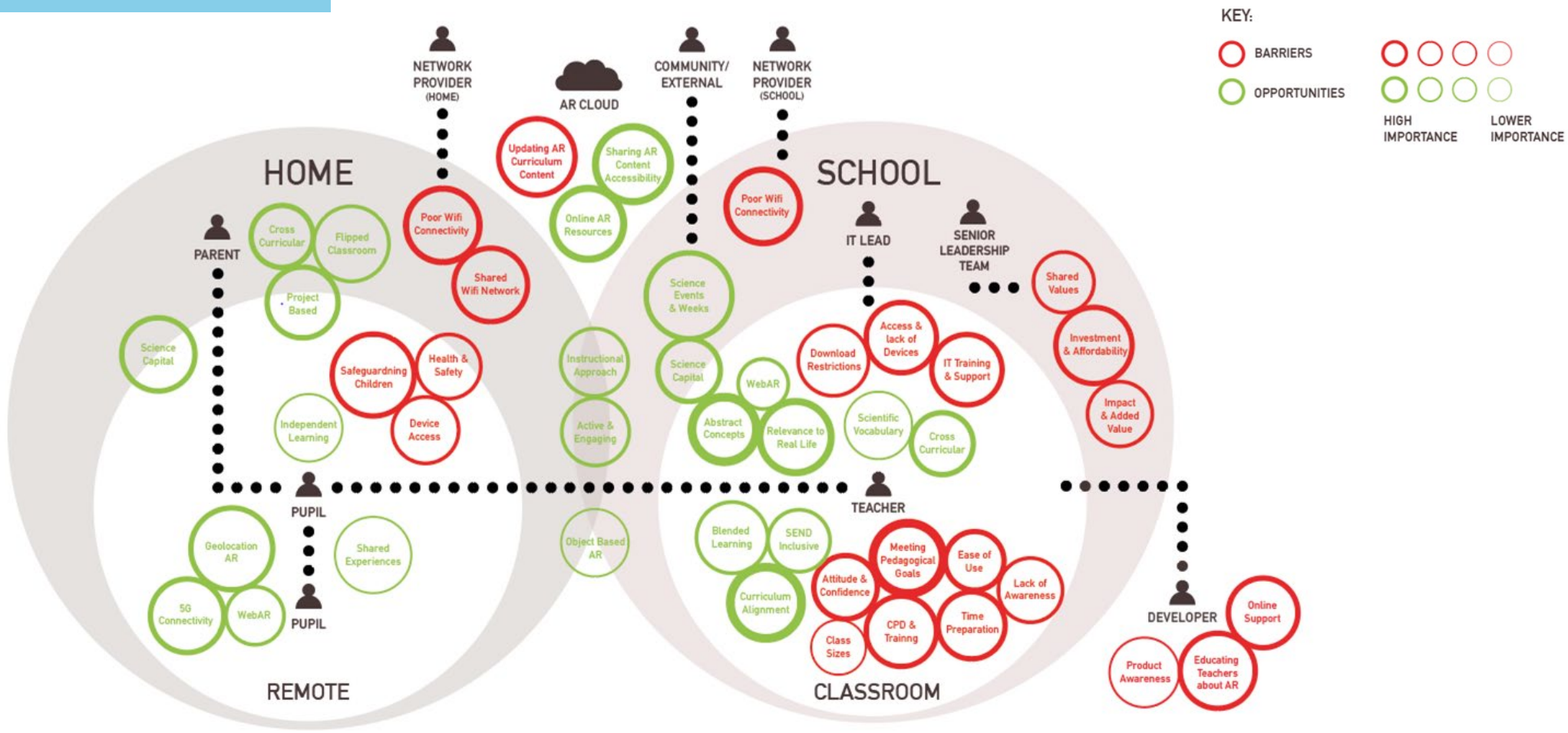


Exploration:

Empathy Canvas Maps

Exploration:

Findings



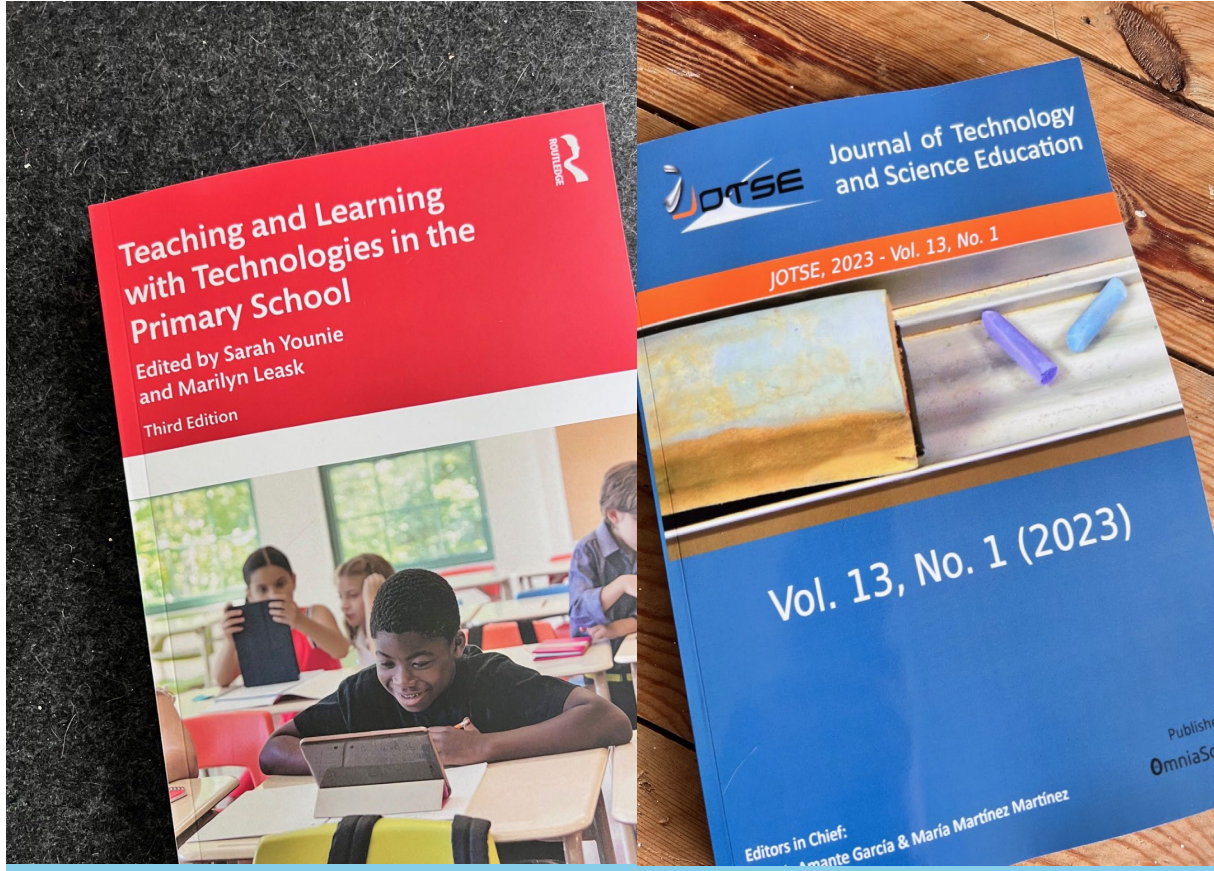
Fearn, Warren and Hook, Jonathan (2023) A Service Design Thinking Approach: What are the barriers and opportunities of using Augmented Reality for Primary Science Education? *Journal of Technology and Science Education*, 13 (1).

Exploration:
Findings

64 Primary School Teachers (England)

Affordability & Investment
Attitude & Confidence
IT Infrastructure (WIFI Connectivity)
Time Preparation
CPD & Training
Access to Devices (Digital Divide)
Inclusive
Not a level playing field
Safeguarding Pupils
Curriculum Alignment
Relevance to Real Life
Cross Curriculum (STEM)
Connecting Science to Real Life
Science Capital (Parental Engagement)

28% YES / **72%** NO – USING XR TECHNOLOGY



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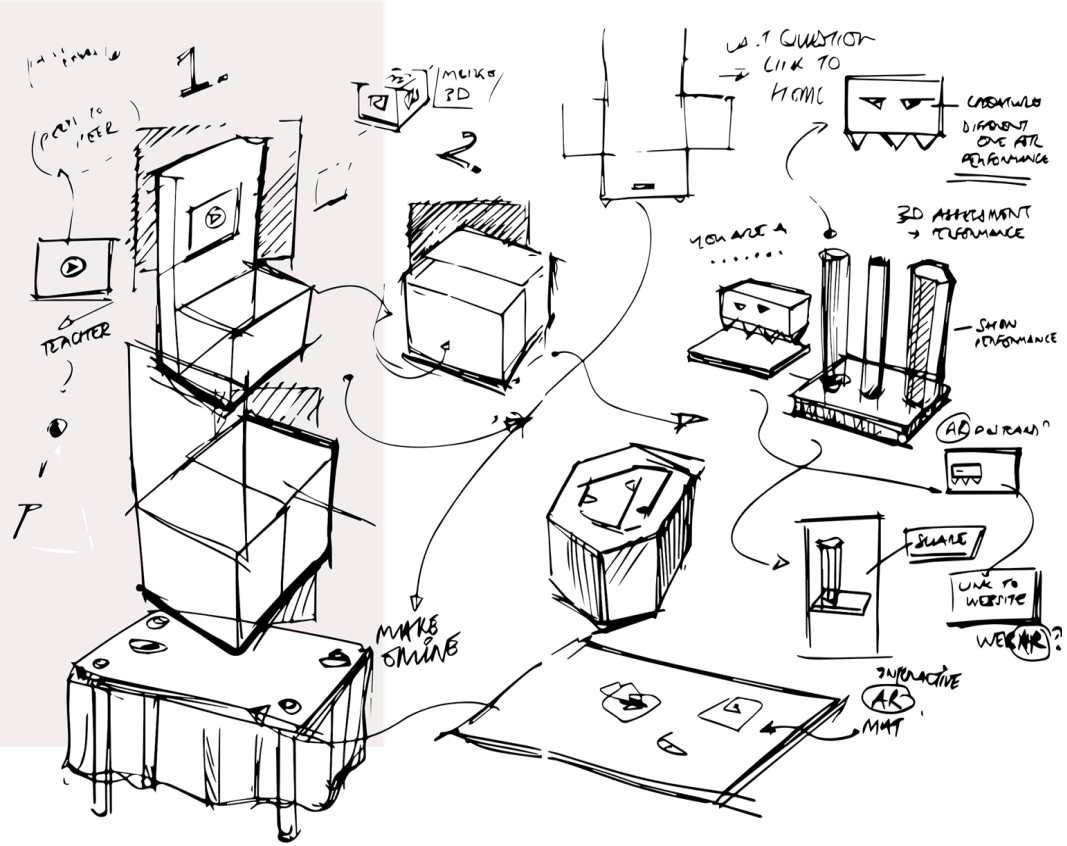
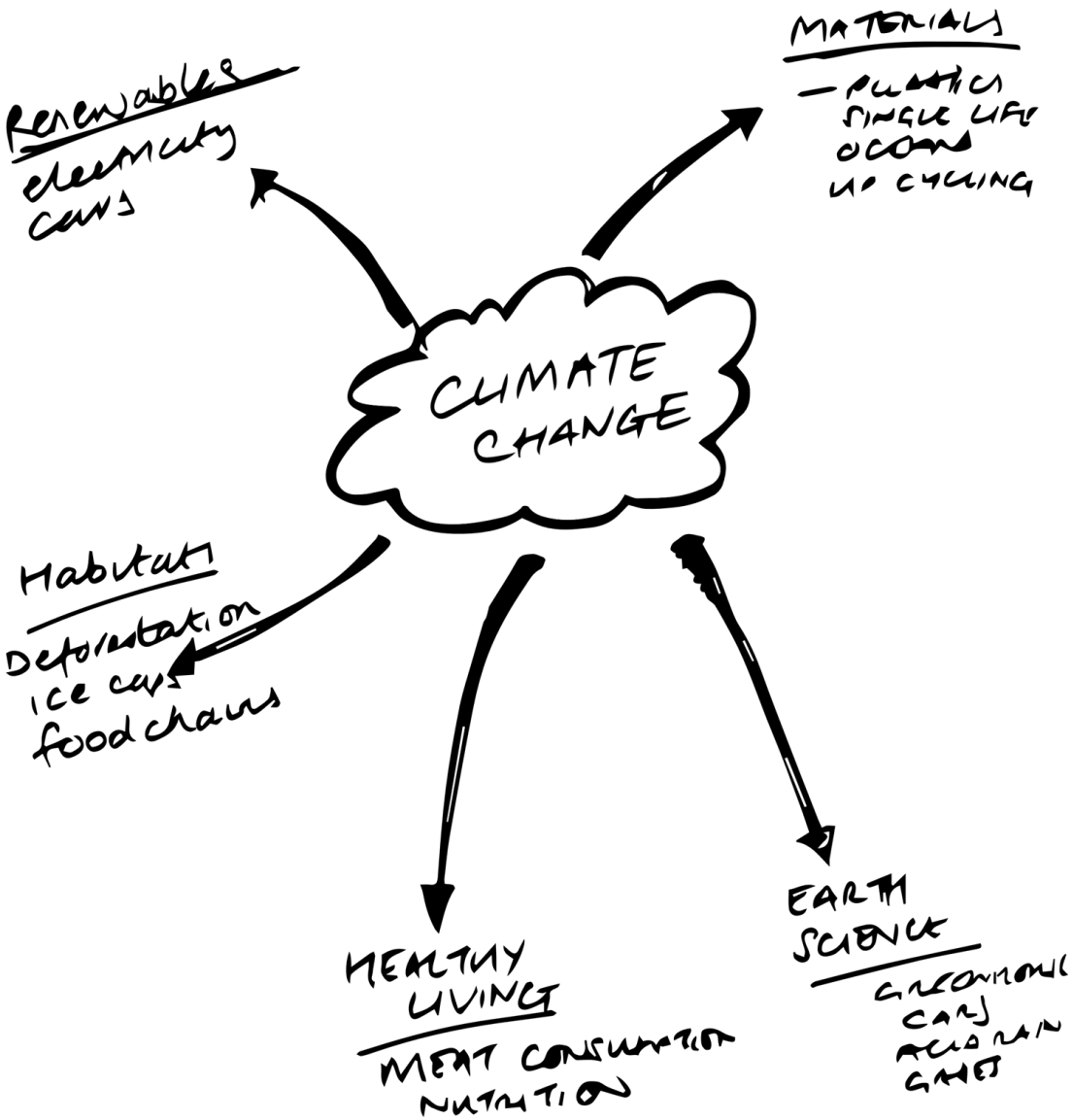
Fearn, Warren _and Hook, Jonathan (2024)
Augmented reality (AR) – innovative uses in primary education. In: Leask, Marilyn and Younie, Sarah, (eds.) *Teaching and Learning with Technologies in the Primary School.* 3rd ed. Routledge

Creation:

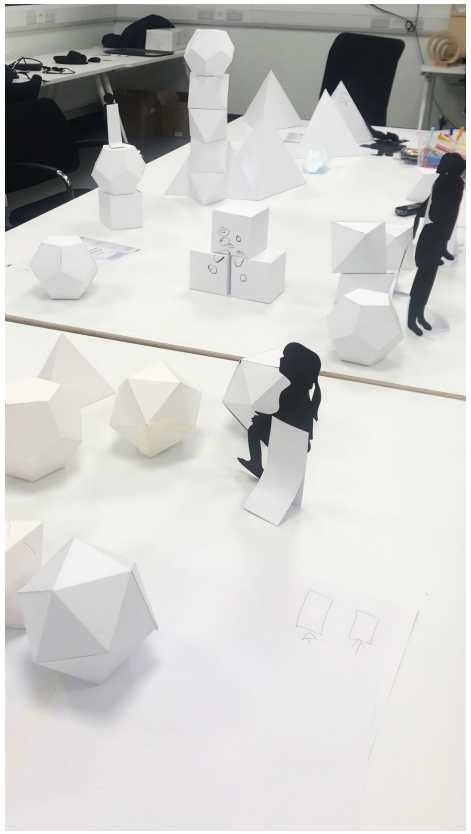
Concept Work

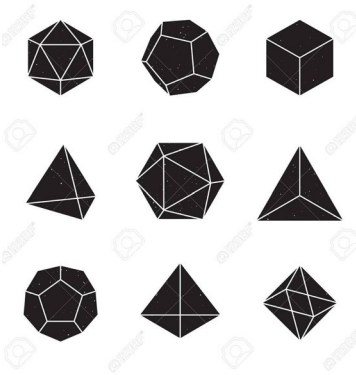




Creation:

Customer Journey Mapping / Role Playing





Implementation:

Pupil Reactions

8 Schools (Local) 111 Pupils

“Where does the AR come from?”
“My arms started to ache from holding it for too long.”
“Cool,” “Epic,” “Amazing,” “Mind Boggling!”
“If you use AR too many times, it could become boring.”
“How was it made?”
“Is there someone inside the shapes?”
“It would be a fun version of homework.”
“I want to go to University when I’m older.”
“Are we going to be the next scientists?”
“I already loved science, but this is amazing!”
“ I never expected to see the insides of a cow.”
“I’m shocked how 3D it is.”
“ It was 3D, fun and interactive, better than TikTok.”
“ I could buddy up with a younger pupil to show them around.”

Implementation:

Findings

Teacher Feedback:

Empowering through CPD
Safeguarding Children
Value and Data
Shared Ownership
Cross Curriculum
Accessible and Adaptable Platforms
Novelty and Wow Factor
Scaffold Learning
Reflection Structure Points
Feedback Loops
Supplementary Materials
Access and Equity
Engaging Champions
Special Educational Needs
and Disabilities

Intermittent Use

Launching or Landing
a Topic

Beyond the Classroom

Inspire Days

Embodied Learning

Ergonomics of Devices

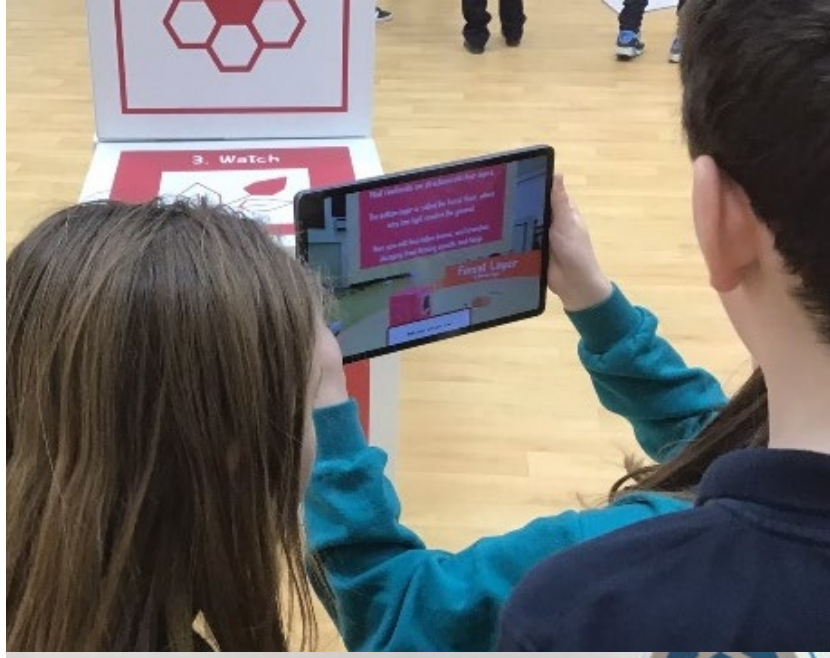
Cognitive Load

Constructivist Learning

Spatial Awareness

Social Collaboration

SEND



What's the future in **L&T**?

1. **Visualising abstract &/or invisible concepts and phenomena.**

- The ability to overlay digital information onto the real world can bridge the gap between theoretical knowledge and practical understanding in ways that traditional teaching methods often struggle to achieve.
- Students often feel disconnected from science. AR can make 2D drawings 3D, but students can also walk around it or interact physically. This spatial understanding often leads to deeper comprehension of processes.

2. **Contextualisation aspects:** Connection between the classroom and the outside world: 'how things work'

3. **Gamified learning:** Science concepts could be integrated into AR games, making learning more engaging and competitive. Students could earn points for correctly identifying elements, solving physics problems, or building virtual machines.

4. **Collaborative Learning:** Multiple students could interact with the same AR environment simultaneously, fostering teamwork and discussion as they explore scientific concepts.

5. **Adaptive learning, real-time feedback,** and **data collection**

Cost and Accessibility - AR hardware expense, potential digital divide.

Content development - high quality & accurate = time and expense

Integration with curriculum - requires careful planning and teacher training.

Technical glitches

Ergonomic Factors

Screen time/ eye strain

Educate North Awards Shortlisted Finalist
Digital Innovation and Education (2025)

What is Epic-Science?
BBC Sounds (2024)

The epic impact of Augmented Reality in Primary Education.
Teaching Times (2024)

Augmented Reality: The Future of Primary Education.
Twinkl Publishing (2024)

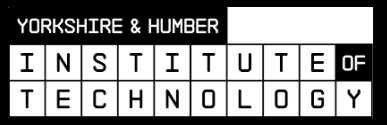
How Augmented Reality brought science alive for York kids by taking them inside a cow.
York Press (2024)

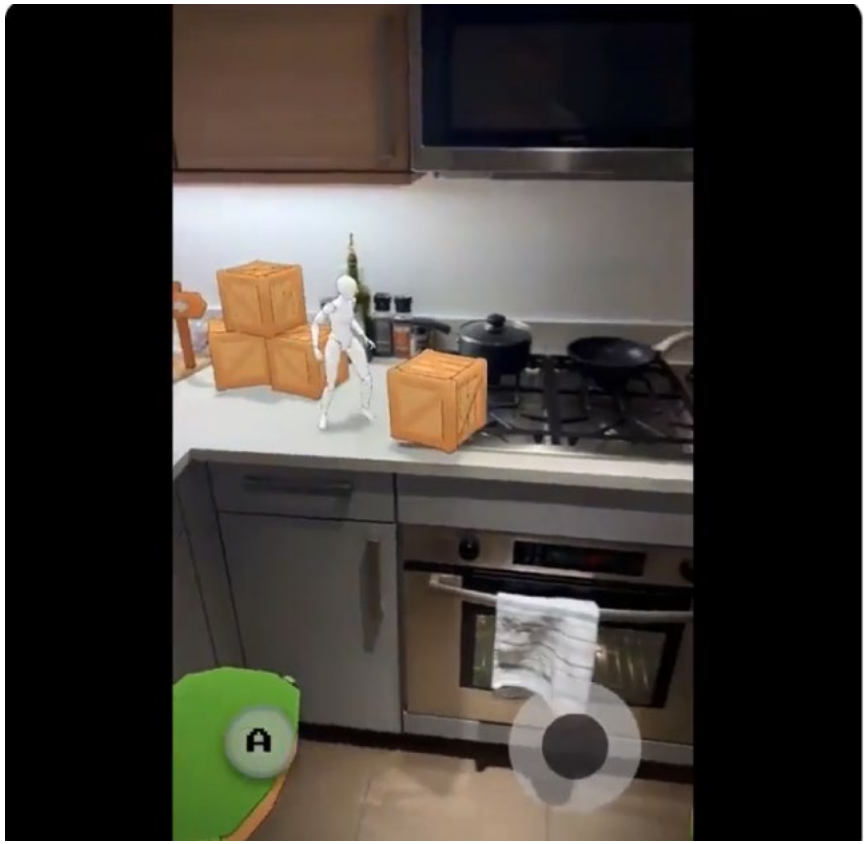
How can augmented reality bridge the gap between the classroom and remote learning?
Pint of Science (2024)

Jorvik Radio: Augmented reality sessions bring science alive for primary pupils in York. (2024)

TED X Doncaster: De Coding (2024)

Yorkshire and Humber Institute of Technology (2023)





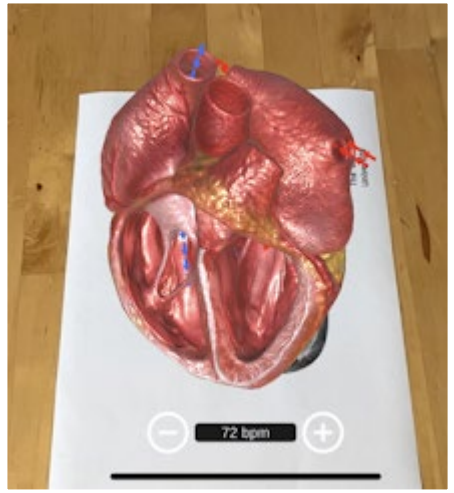
Dunleavy (2014) outlines one of his design principles for AR affordances: driving player interaction and learning through gamified stories or narratives.

Geo Location-Based AR

Google and Taito's Space Invaders AR Game

Merge Cube – Tangible AR

(Billinghurst 2002; Klopfer & Squire 2008, Wang. M et al 2017) believe that AR has vast potential implications and numerous benefits for the augmentation of teaching and learning environments through integrating digital learning resources to enable learners to experience scientific phenomena that are not possible in the real world.



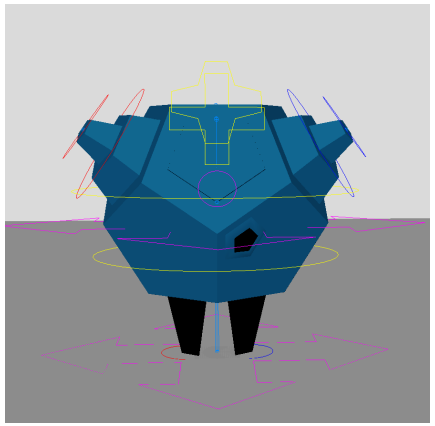
BEEQUEST (META) - PASSTHROUGH

Democratising AR:

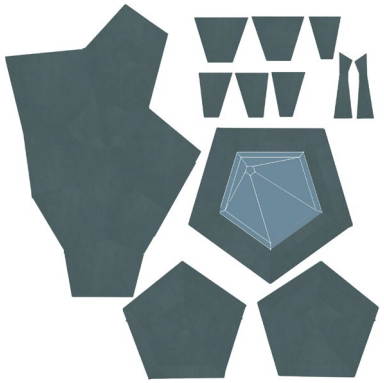
Use of AI: New Pipelines

Existing Pipelines

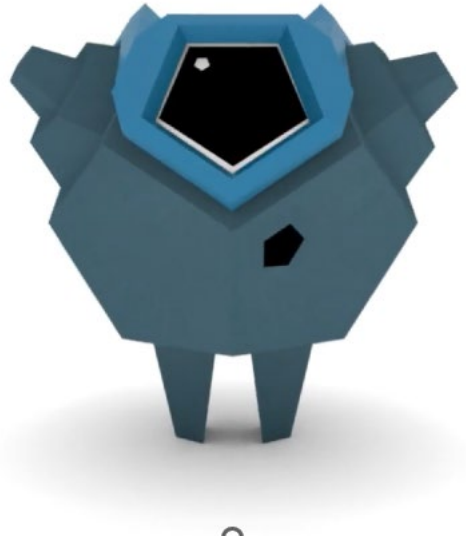
Sketch Ideas



3D Model



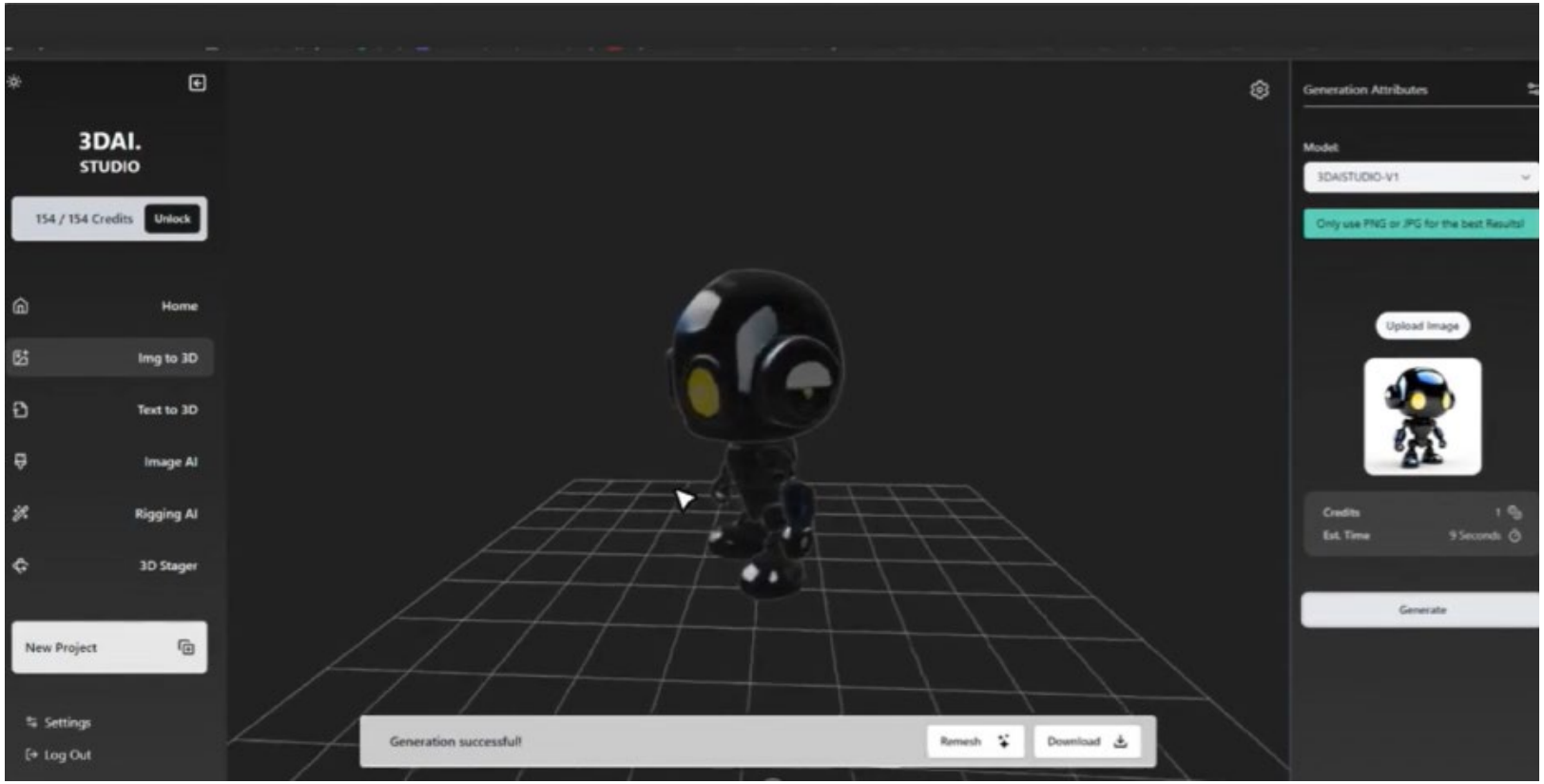
UV Texture Map



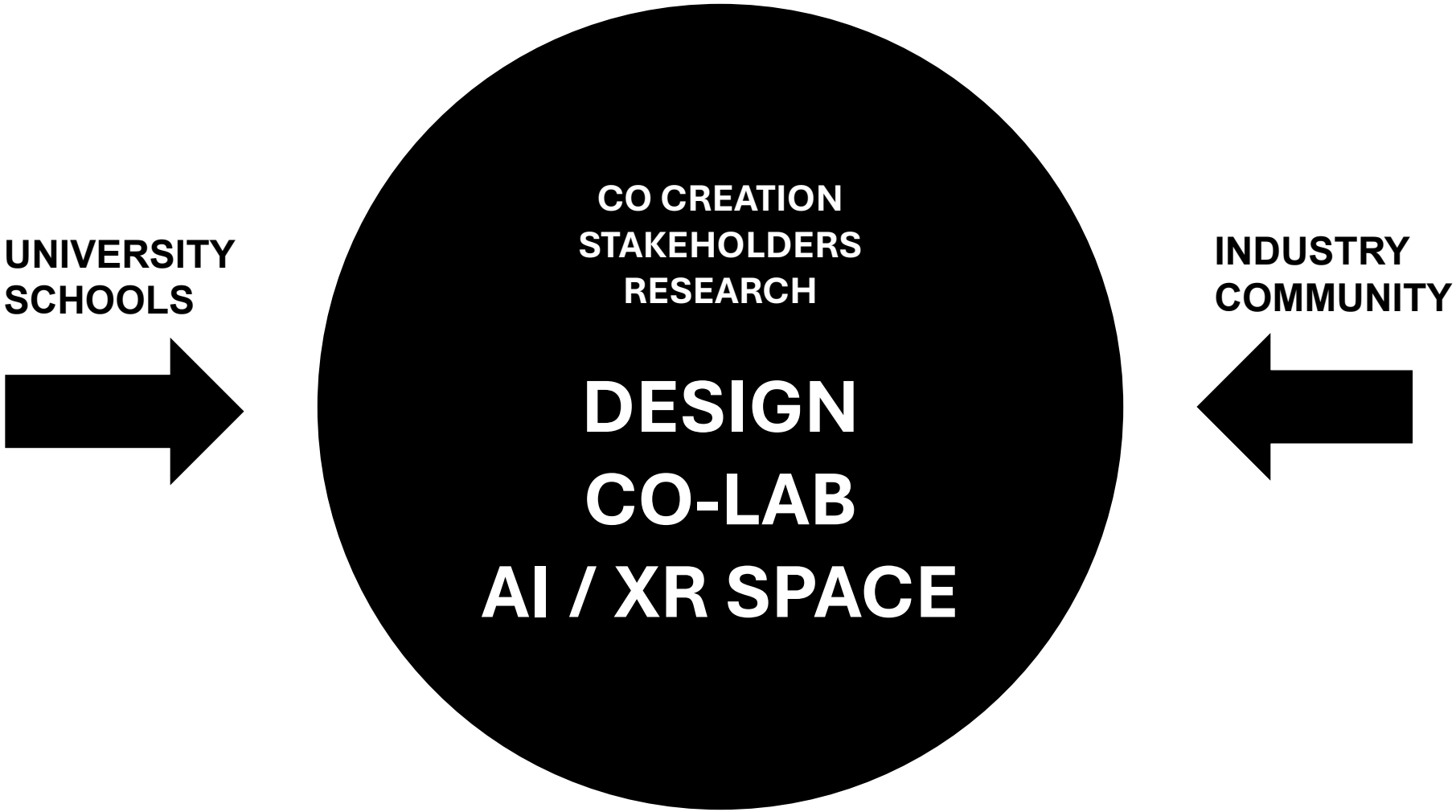
Rigging / Animate

Democratising AR:

Use of AI: New Pipelines



Prompt a concept ➡ Create Image ➡ Convert to 3D Model Texture Mapped ➡ Animate


UNIVERSITY
SCHOOLS
CO CREATION
STAKEHOLDERS
RESEARCH
DESIGN
CO-LAB
AI / XR SPACE
INDUSTRY
COMMUNITY

Thank you.

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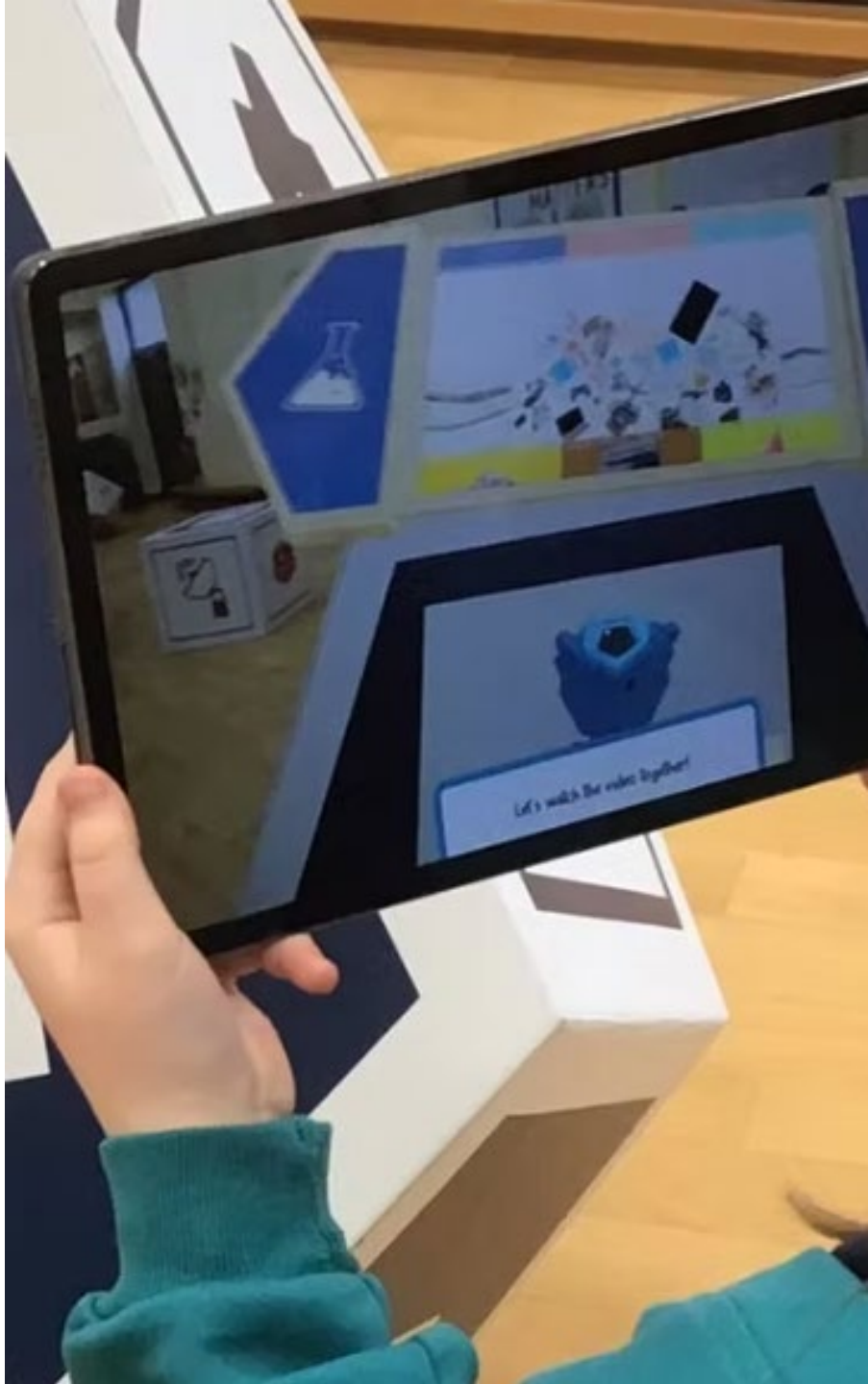
EPIC Science
Augmented Reality Project

www.epic-science.com

York Virtual / Augmented Reality Research Group

York Virtual and Augmented Research Group

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