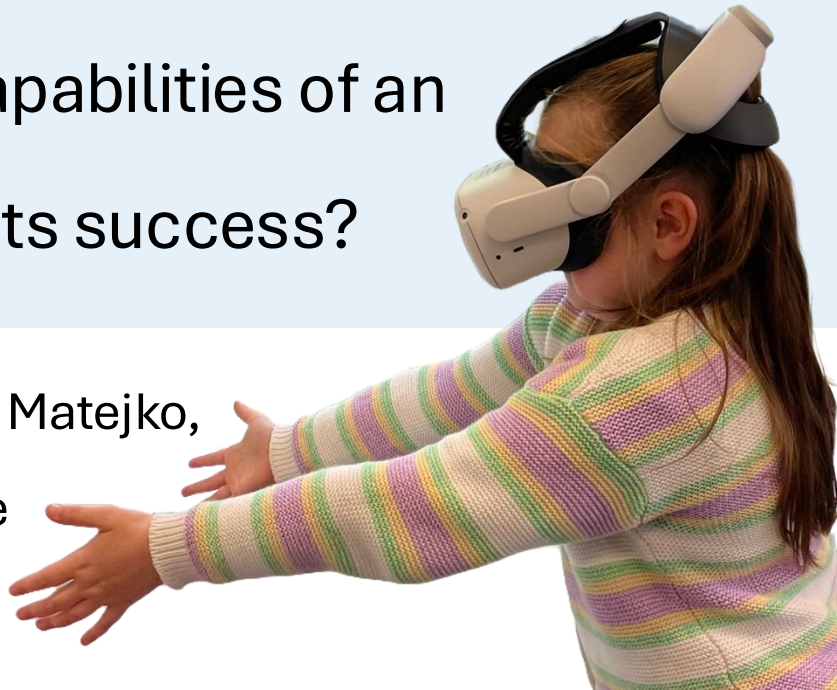
Durham University

Immersive Virtual Reality as an educational tool

How do the **multisensory** and **interactive** capabilities of an educational IVR experience contribute to its success?



Emerald Grimshaw, Simon Thurlbeck, Dr Anna Matejko,

Dr Bob Kentridge and Dr Dorothy Cowie

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What is so special about VR?

Fully immersive

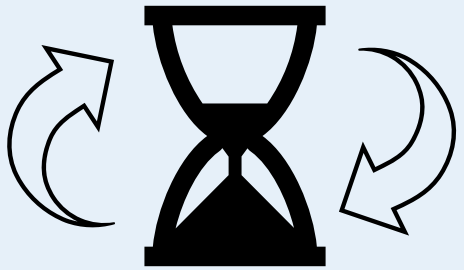
Multisensory

Interactive

Previous research

VR has been used as a learning tool, but predominantly for teaching Science subjects

Hamilton et al. (2021)



But VR also has the ability to transport users to a different time and place

The majority of research has explored educational VR use in older children and young adults

Di Natale et al (2020)

Household ownership of a VR device is on the rise in the UK

Ofcom (2024)

Children as young as 6 have been found to use VR at home

Allen & McIntosh (2023)

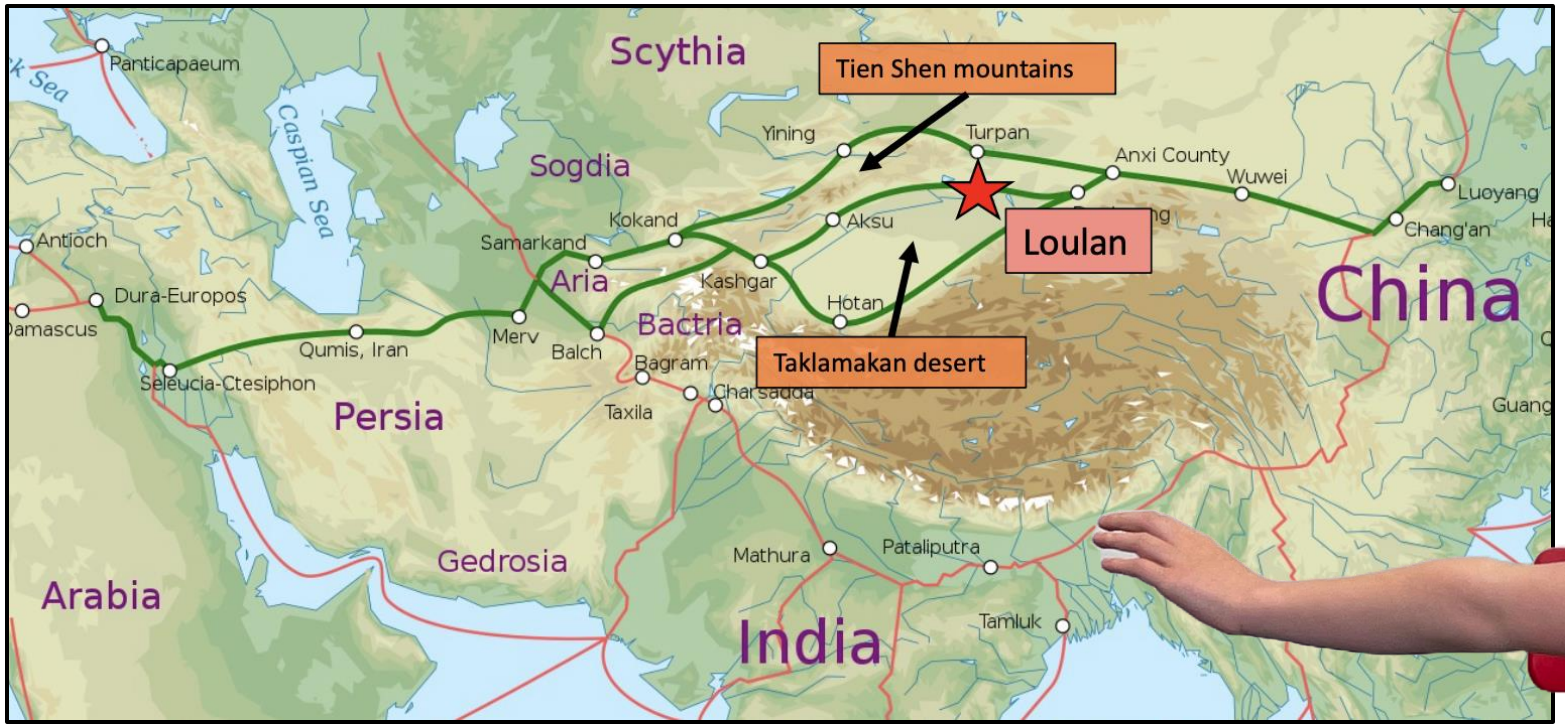
My aims

To understand the application of VR:

- In **History** education
- In **younger children** (aged between 7 to 13 years old)

And in particular, I aim to unpick how the **unique features** of VR contribute to its usefulness as a learning tool

Visiting the Ancient Silk Roads in VR



Visiting the Ancient Silk Roads in VR

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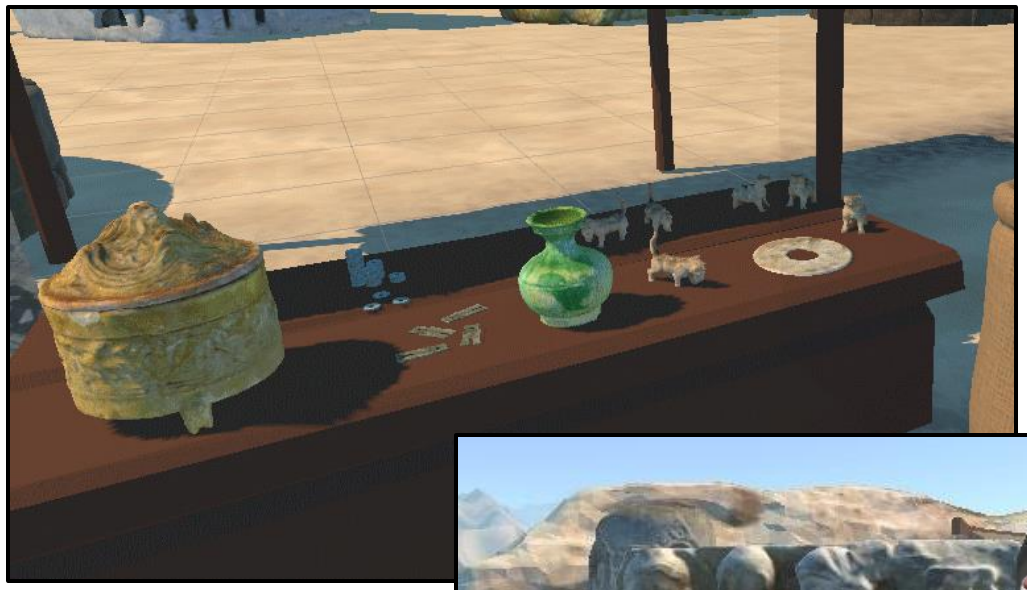
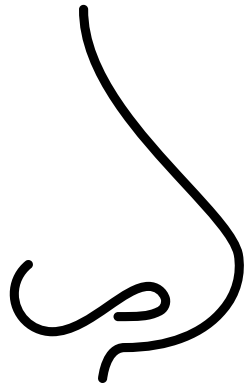


Visiting the Ancient Silk Roads in VR

Learning objectives:

1. To understand how merchants **travelled** along the Silk Road
2. To understand which **goods** were traded along the Silk Road and how they were made
3. To understand what **trade** is
4. To understand what **cultural exchange** is and how it happened along the Silk Road
5. To understand the **similarities/differences** between life on the Silk Road 2,000 years ago and life today



How do **sound**, **touch** and **interactivity** impact

learning, **engagement** and **presence**?

Our study

7 – 10 mins

How long can camels survive in the desert without water?

A: 3 days
B: 2 weeks
C: 2 months

What we measured

General knowledge

Pre- & post-VR

General questions about the Silk Road

“Which countries were on the Silk Road?”

Factual recall quiz

Post-VR

Multiple-choice question quiz about facts taught in VR

“How long can camels survive in the desert without water?”

What we measured

Engagement

Post-VR

Questionnaire asking about excitement and interest in the VR experience

“Did you enjoy your experience in the VR world?”

Presence

Post-VR

Definition: The feeling of ‘being there’ in a virtual world

Questionnaire to measure subjective presence in VR

“When you were in the virtual world, did you have a sense of ‘being there’ in the virtual world?”

What we measured

Embodiment	***Definition:*** The feeling of ownership and control over a virtual body
Post-VR	
Questionnaire to measure subjective embodiment in VR	
“When you were in the virtual world, did it feel as if the virtual hand was your own hand?”	

Exp 1

Tests the effect of adding sound

- **58** children aged **7 to 9** years old
- **55** children aged **11 to 13** years old

TOTAL: **113** children

Two conditions:

- **SoundOn –** includes a dynamic soundscape
- **SoundOff –** does not include a dynamic soundscape

Exp 1

SoundOn

- Narrator voiceover
- Background music
- Animal sounds
- User interface sounds
- Select items with Meta Quest 2 controllers

Exp 1

SoundOff

- Narrator voiceover
- Select items with Meta Quest 2 controllers

Exp 2

Low Interactivity

- No virtual hands
- Select items with gaze direction

Exp 2

High Interactivity

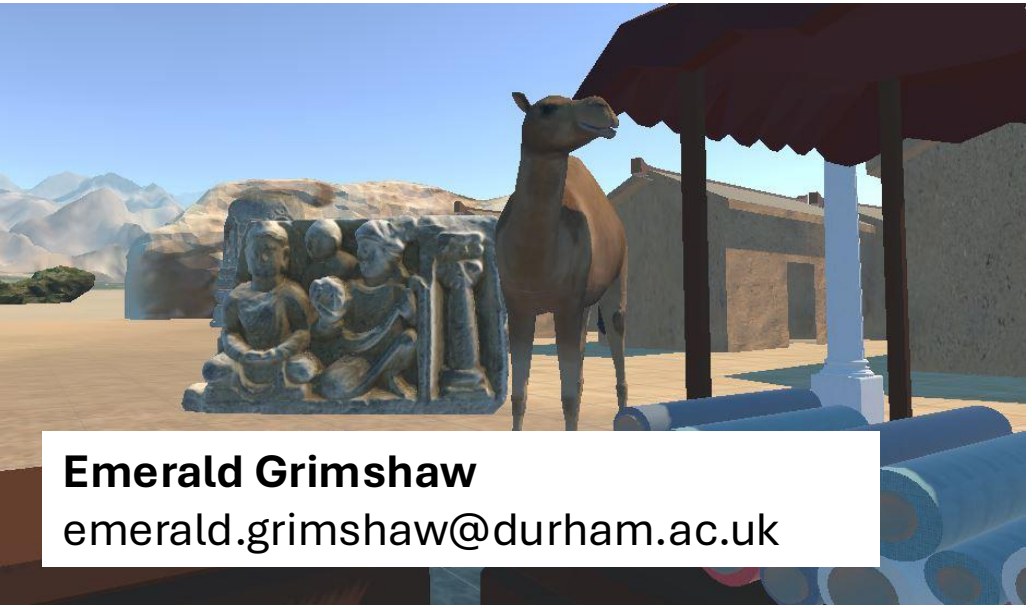
- Virtual hands, which are used to select items

Exp 2

High Interactivity + Touch

- Virtual hands, which are used to select items
- Passive haptics

Thank you!



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