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Session 1 · Immersive XR Interaction

Spatial Hyperlinking for Novices

Portal-Based Navigation of Multi-Room Volumetric Captures



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MOTIVATION

Virtual tours today are linked 360° panoramas

Museums, real estate and Street View connect panoramas with clickable hotspots.

Cheap to capture and easy to publish, which is why they are everywhere.



one fixed viewpoint per node

MOTIVATION

Gaussian splats provide more immersion, but are harder to make

	360° panoramas	3D Gaussian Splatting
Perception & UX in museums	Lower	Higher (Kwon & Yu 2025)
Viewpoint	Fixed per node	Free movement in 3D
Multi-space creation	Easy: link with hotspots	Expert hardware, expert knowledge or several people

THE GAP

No open-source pipeline lets novices link rooms

	SINGLE OBJECT / SPACE	MULTIPLE LINKED SPACES
Expert setups	Can do multi-space, but needs specialised hardware, expert knowledge or several people e.g. XGRIDS PortalCam, Lixel K1, Volinga, krpano	
Novice apps	Low budget, easy, but one object or one room at a time e.g. Polycam, Luma AI, vid2scene	**Ours: "Room Explorer"** videos in, manually linked walkable splats out

RESEARCH QUESTION

To what extent can novice users create and explore linked multi-room Gaussian splat environments using an automated video-to-VR pipeline?

SYSTEM

Room Explorer: record, process, explore



1 · Record

Walk a loop with an iPad, filming video



2 · Process

Upload, wait for the splat, place portals



3 · Explore

Walk through linked rooms in WebXR

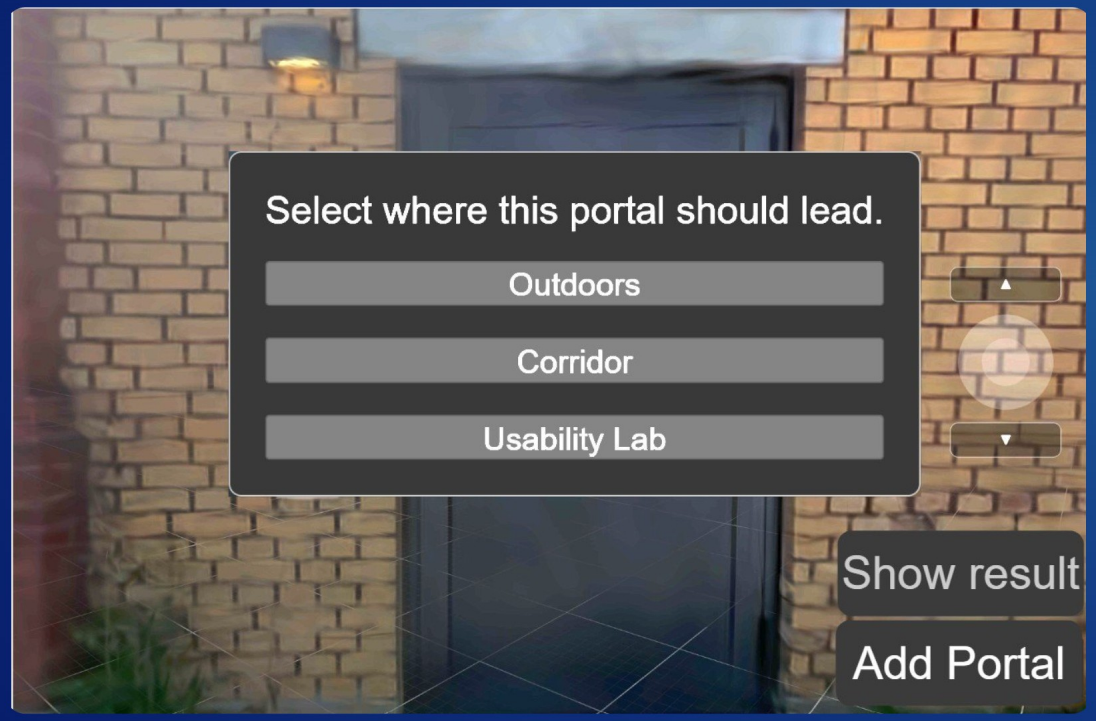
SYSTEM · THE TASK

Link three recordings with four portals

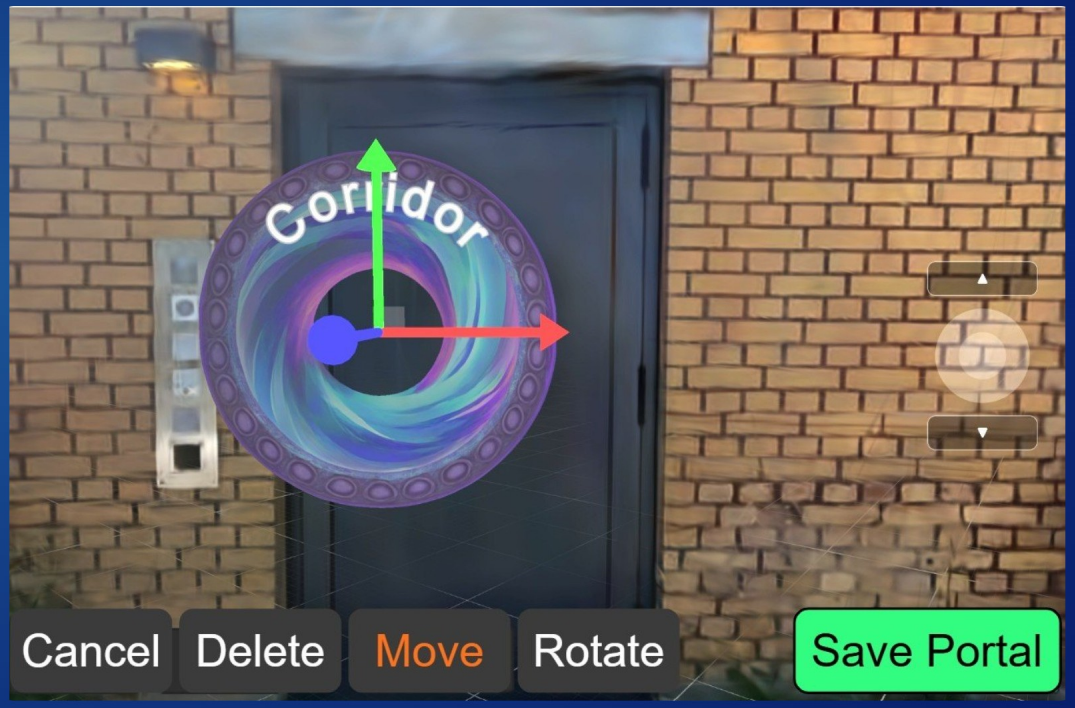


4 portals per participant: every link needs a portal on both sides.

Portals are placed on a tablet with 5-DoF controls



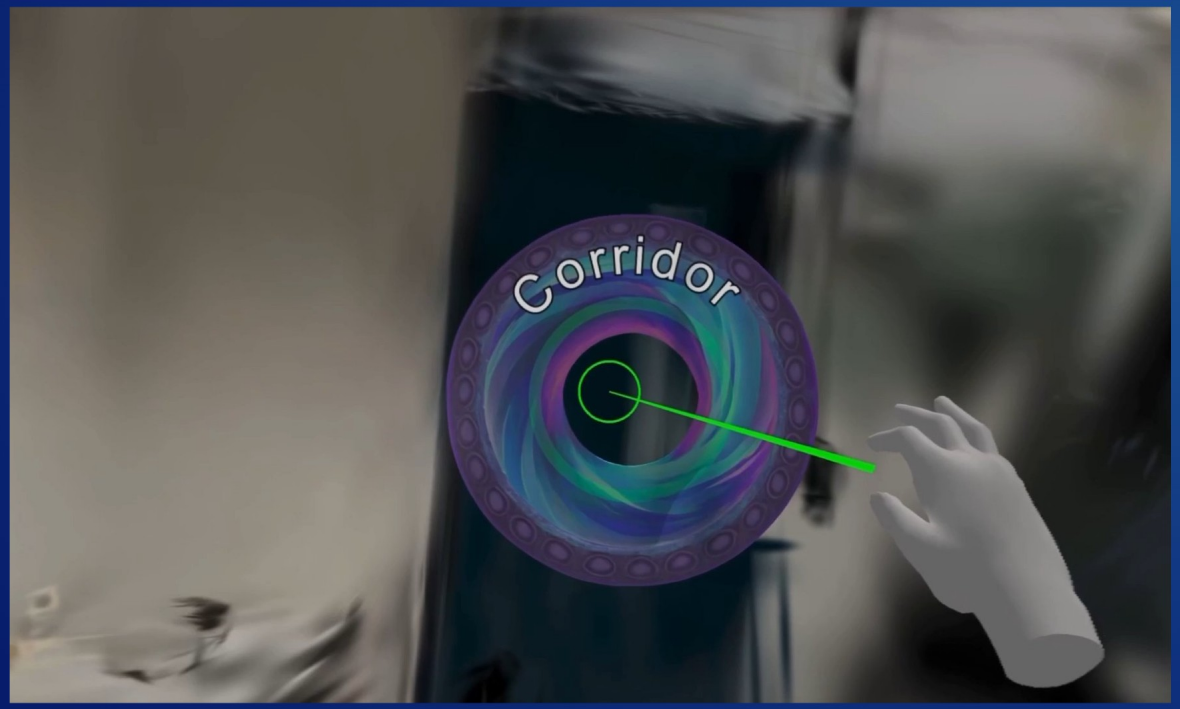
Add Portal, then pick the target room



Move / Rotate it into the doorway, then save

SYSTEM · PORTAL METAPHOR

Portals act as spatial hyperlinks between splats




```
{
  "url": "…/corridor",
  "title": "Corridor",
  "position": [x, y, z],
  "rotation": [0, ry, 0],
  "scale": [s, s, s]
}
```

Maps onto X3D <Anchor> nodes or glTF camera tags

Long-pinch dwell swaps the scene in place: no page reload, VR session stays open, last position restored.

METHODS · PARTICIPANT MEASURES

One session, four ways to capture the user's view

Intro	Record	Process (Upload & Author)	Explore (in VR)
8 min	10 min	15 min → SUS	10 min → TAM

Time on task

Minutes per phase

All phases

Think-aloud

Audio transcribed, then thematic analysis (n = 13)

All phases

SUS

Perceived usability of creating the tour; 10 items, score 0–100

After processing phase

TAM

13 items, 5-point: usefulness, ease of use, output quality, intention to use

After explore phase

RESULTS · SANITY CHECK

The pipeline delivered usable, linked rooms

36/42
captures gave a usable, floor-aligned splat

< 4°
residual floor tilt vs. world Y, all models

0.60 m
median portal offset from the doorway centre

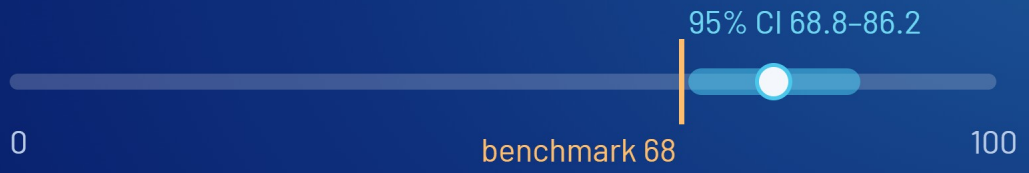
169 s
first upload to first splat

RESULTS · USABILITY & TIME

System Usability Scale, Time on Task

77.5

mean SUS score (SD 15.0) · adjective rating "good"



25 min

mean time on task, recording to VR



No significant correlation with prior experience or demographics (Pearson, $p > .05$).

RESULTS · TECHNOLOGY ACCEPTANCE

Usability, Output Quality



TAM means on 5-point scales, n = 14

> *"You had to get the hang of it a bit, how to set up a portal, how to rotate it, and so on. But then it went quickly."*
>
> Process phase · authoring

> *"It looked, like, melted, [...] it was a bit weird."*
>
> Explore phase

TAKEAWAYS

Three things to take home

1

Novices can author linked splats

SUS 77.5, ease of use 4.32, recording to VR in about 25 minutes.

2

Portals work as spatial hyperlinks

0.6 m median placement error, participants intuitively used portals in VR

3

Reconstruction quality is the bottleneck

Output quality clearly brings down intention to use.

LIMITATIONS

What this study cannot tell us yet

Gaussian splat output quality

short training time led to quality insufficient for most participants use cases.

Small, mixed sample

N = 14; five participants from outside the target domains because of recruiting constraints.

Holistic design

Interface usability and reconstruction artifacts are measured together; per-phase studies would separate them.

Scale

Rooms and outdoor scenes came out about 2× real size.

OUTLOOK

Where Room Explorer goes next

Longer training

Two-session studies so scenes can train to full quality

Automatic rescaling

Reference-object scale calibration (Cho & Woo 2026)

Collision bodies

Stop users walking through virtualised objects

Image-based capture

A few (panoramic) photos instead of video

Thank you!

Questions?



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Paper: doi.org/10.1145/3822516.3834874

Code & demo video: https://osf.io/ewcf3/overview?view_only=7c8dd92c5512440f9e88d1013af18a12

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