

From Realistic Re-Creation to Artistic Interpretation:
Authenticity and Engagement in Virtual Cultural Heritage

Benjamin Seide. School of Art, Design and Media, Singapore
Elke Reinhuber. School of Creative Media, Hong Kong

CityU School of Creative Media 香港城市大學 City University of Hong Kong
NANYANG TECHNOLOGICAL UNIVERSITY SINGAPORE
School of Art, Design and Media
College of Humanities, Arts, and Social Sciences



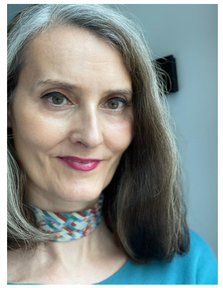


School of Art, Design and Media (ADM)
Nanyang Technological University, Singapore

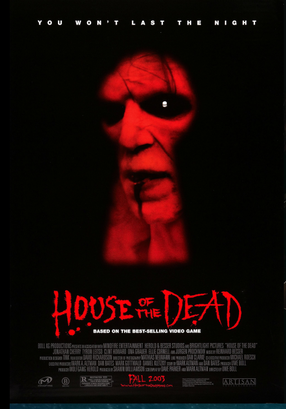
School of Creative Media (SCM)
City University of Hong Kong

Benjamin Seide
Associate Prof



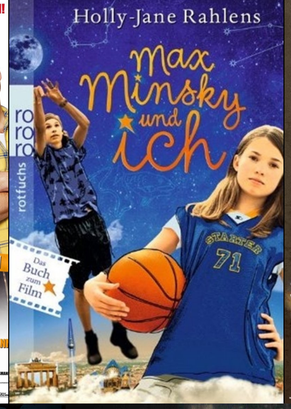


Elke Reinhuber
Associate Prof

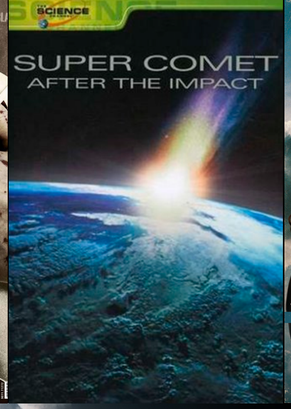

YOU WON'T LAST THE NIGHT
HOUSE OF THE DEAD
BASED ON THE BEST-SELLING VIDEO GAME


BLOODRAYNE


ZWEI FREUNDE, EINE FRAU – UND DIE IST DAS PROBLEM!
MARIO BARTH
DIETER TAPPERT
DER FILM
MÄNNERSACHE


Holly-Jane Rahlens
Max Minsky und ich
rotfuchs
Das Buch zum Film


WAZ
WELCHE QUALEN ERTRÄGST DU?


SUPER COMET
AFTER THE IMPACT


EIN TRAUM VON LIEBE
06.+ 07.02. | 20:15
DAS EVENTMOVIE IN ZWEI TEILEN
HINDENBURG


THE CRIMSON OCEAN


ONE OF THE MOST LEGENDARY DIRECTORS OF OUR TIME
TAKES YOU ON AN EXTRAORDINARY ADVENTURE
HUGO
3D
NOVEMBER 23
IN real 3D, DIGITAL 3D & SELECT 2D THEATRES


SNOW WHITE & THE HUNTSMAN
SUMMER


GAME OF THRONES
YOU WIN OR YOU DIE
AN EPIC NEW SERIES
ONLY ON HBO
SUNDAY, APRIL 17, 9PM


STAR TREK
INTO DARKNESS
MAY 17
IN THEATRES, real 3D AND IMAX 3D

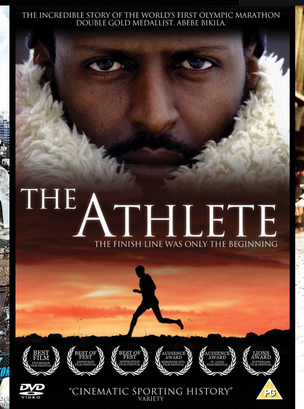

EARTH IS A MEMORY WORTH FIGHTING FOR
TOM CRUISE
OBLIVION
FROM THE DIRECTOR OF TRON: LEGACY
AND PRODUCERS OF RISE OF THE PLANET OF THE APES
IN THEATERS AND IMAX
APRIL


CUBA GOODING JR.
TERRENCE HOWARD
RED TAILS
JANUARY 20
IN 3D

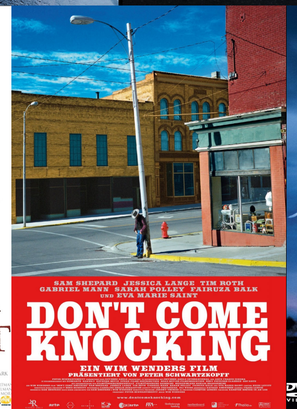

BELIEVE THE IMPOSSIBLE. DISCOVER THE INCREDIBLE.
JOURNEY 2
THE MYSTERIOUS ISLAND
FEBRUARY 10TH IN 3D
EXPERIENCE IT IN IMAX 3D

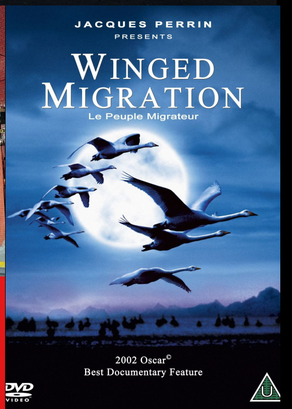

RUSSIAN LESSONS


PARKOUR
BEAT YOUR FEAR


THE INCREDIBLE STORY OF THE WORLD'S FIRST OLYMPIC MARATHON DOUBLE GOLD MEDALLIST, ABEBE BIKILA.
THE ATHLETE
THE FINISH LINE WAS ONLY THE BEGINNING
"CINEMATIC SPORTING HISTORY"
VARIETY


UN FILM DE
ROMAN POLANSKI
OLIVER TWIST


DON'T COME KNOCKING
EIN WIM WENDERS FILM


JACQUES PERRIN
PRESENTS
WINGED MIGRATION
Le Peuple Migrateur
2002 Oscar®
Best Documentary Feature

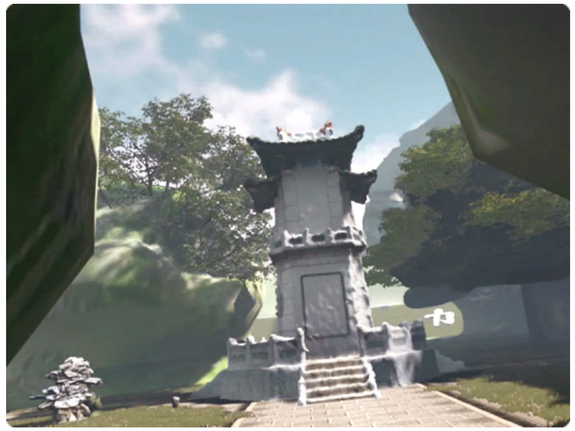
OUR IMMERSIVE MEDIA PROJECTS



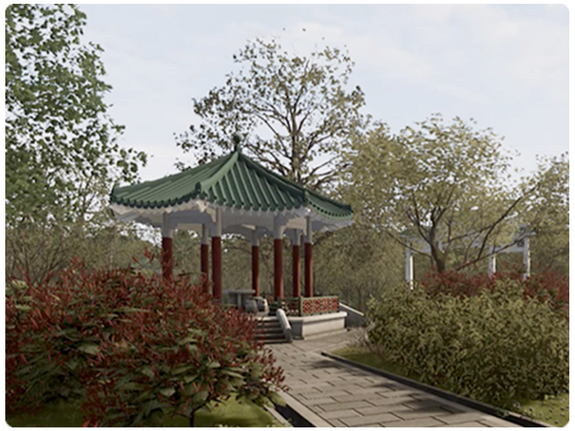
2015 **Fellini**
Cinematic VR
Dome Projection



2017 **Secret Detours**
Cinematic VR
Dome Projection



2018 **Gone Garden**
Room-scale VR



2020 **Garden of Changes**
Room-scale VR



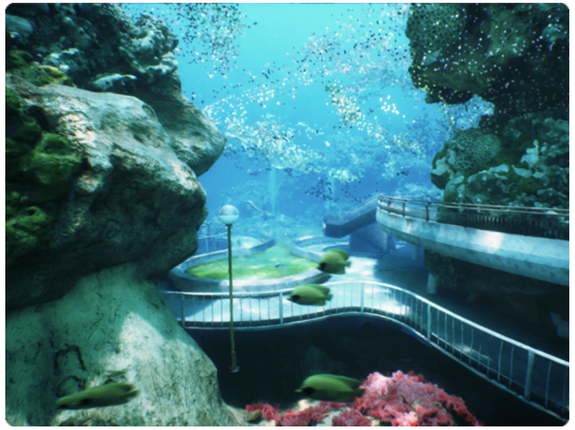
2021 **Flux Garden**
Room-scale VR



2022 **Seven Step Verse**
Cinematic VR



2024 **Deer Button**
Cinematic VR



2025 **Water Spirits**
Room-scale VR

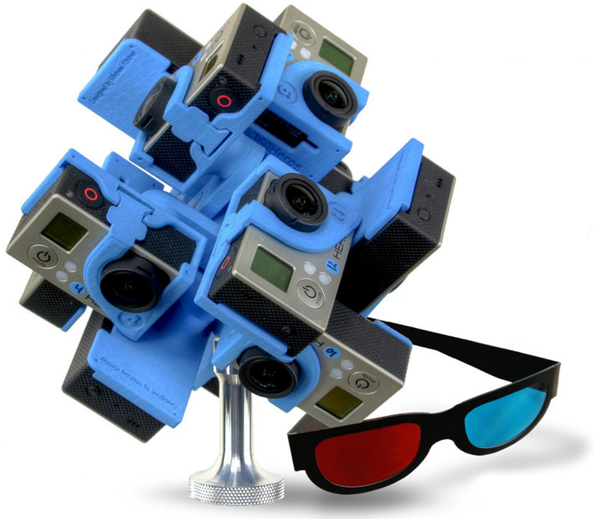
2010- S3D 360 CAMERAS

Cinematic Virtual Reality

Stereoscopic 360 cameras over the years



Custom stereo rig
Walters and Barlowski (2010 - 2014)



3DH3Pro12 (2014)
5k USD



Odyssey (2015)
15k USD



Insta360pro (2017)
3.5k USD

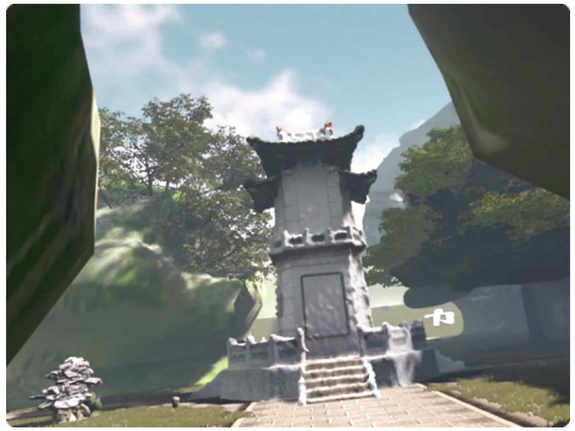
OUR IMMERSIVE MEDIA PROJECTS



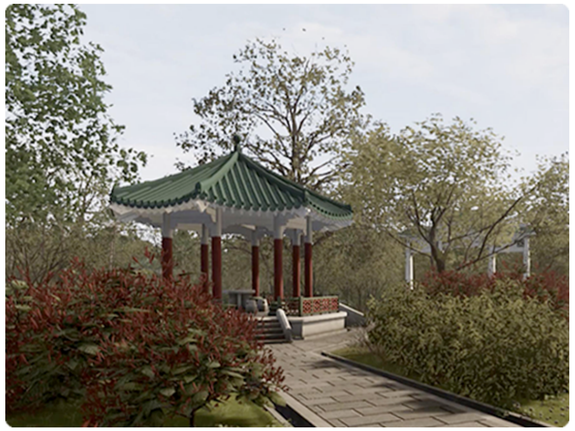
2015 **Fellini**
Cinematic VR
Dome Projection



2017 **Secret Detours**
Cinematic VR
Dome Projection



2018 **Gone Garden**
Room-scale VR



2020 **Garden of Changes**
Room-scale VR



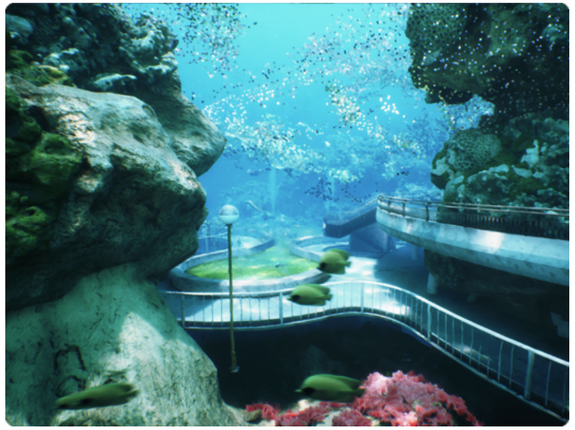
2021 **Flux Garden**
Room-scale VR



2022 **Seven Step Verse**
Cinematic VR



2024 **Deer Button**
Cinematic VR



2025 **Water Spirits**
Room-scale VR



From Realistic Re-Creation to Artistic Interpretation: Authenticity and Engagement in Virtual Cultural Heritage

From **Realistic Re-Creation** to Artistic Interpretation:
Authenticity and Engagement in **Virtual Cultural Heritage**

Virtual Cultural Heritage
Realistic Re-Creation



- Primary goal is preservation, creating accurate digital replicas
- Impressive developments in achieving visual “realism” and “believability”

Beit Ghazaleh 3D Scan (2017)
https://www.youtube.com/watch?v=mvddYCRP6js



Content

- Brief History of Early VCH
- Major Technological Developments
- Brief Overview of Current VCH Developments
- Back to the Thesis…



Content

- Examples: Artistic and Experimental VR
- Examples: Artistic and Experimental VR in VCH
- Discussion: Preservation vs. Interpretation



Virtual Cultural Heritage:
Early Developments

1993 Virtual Egyptian Temple (Jacobson et al.), Carnegie Mellon University

Presented 1994 at the Guggenheim

World Toolkit on an IBM 486 with one of the first graphics accelerator cards ever made

Later versions in VRML



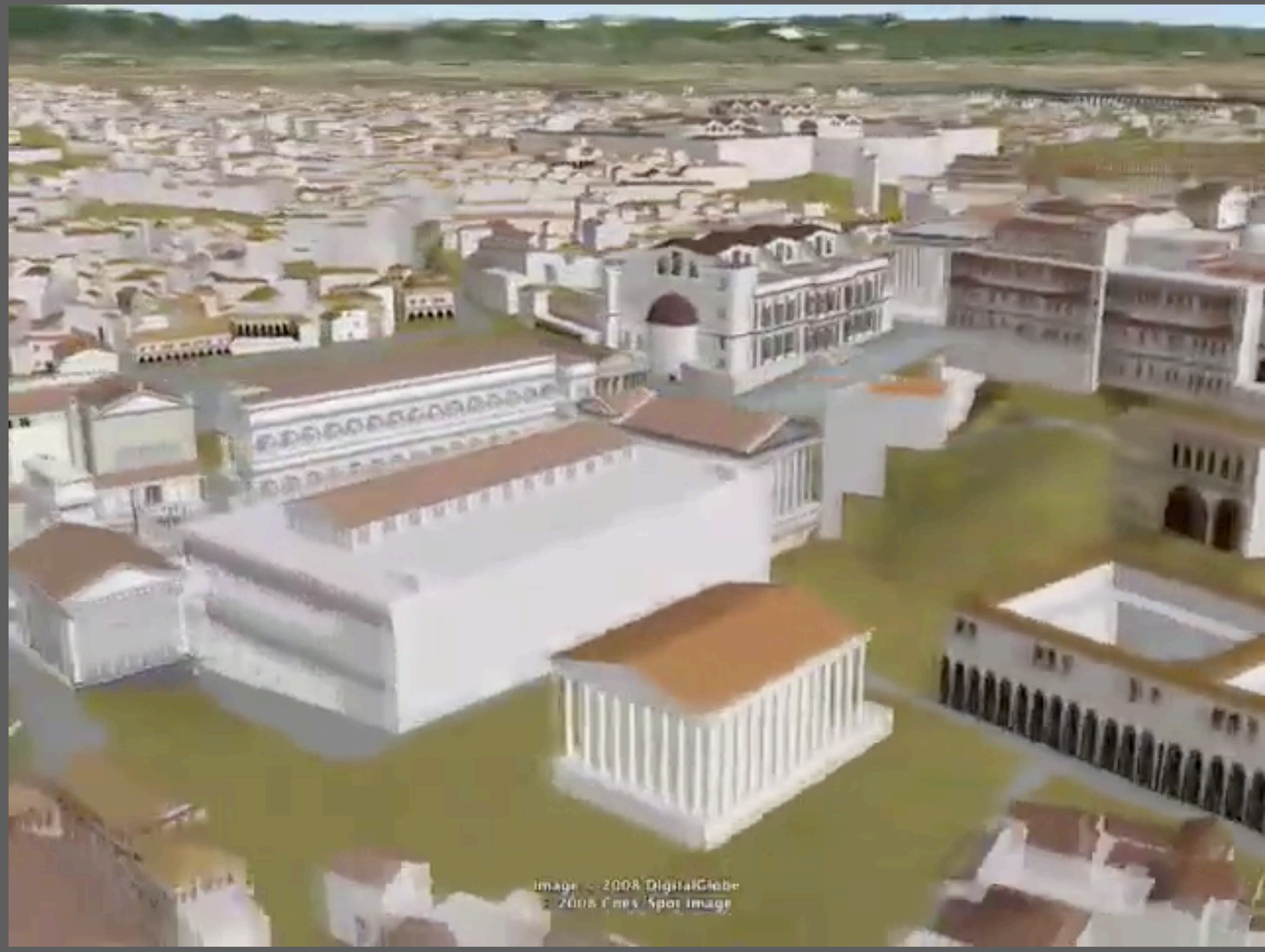
https://www.youtube.com/watch?v=maSkFwTjCoA&t=88s

2007 v1 Rome Reborn (Frischer et al.)

2008 v2 Google Earth Rome

2018 v3

2023 v4



https://www.youtube.com/watch?v=MqMXIRwQniA



Virtual Cultural Heritage:
Major Technological Developments

Major Technological Developments

2000 LiDAR available but still expensive



Slam100 Handheld Lidar Laser Scanner
https://www.youtube.com/shorts/mY_csmByFJI

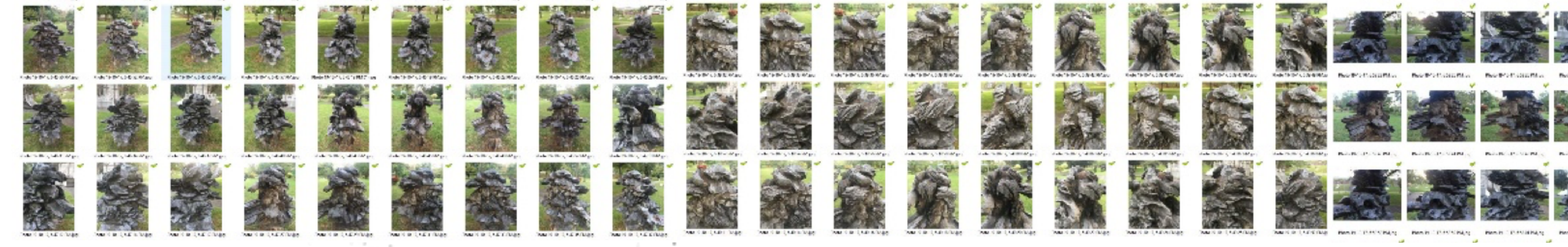
Major Technological Developments

2000 LiDAR available but still expensive

2010 Structure-from-Motion
-> Photogrammetry



Seide, Reinhuber (2017)











DETECTED CAMERAS

POINT CLOUD

DENSE CLOUD

MESH

Early 2010s: PHOTOGRAMMETRY

Structure-from-Motion (SfM) algorithms in the early 2010s (Westoby et al., 2012)

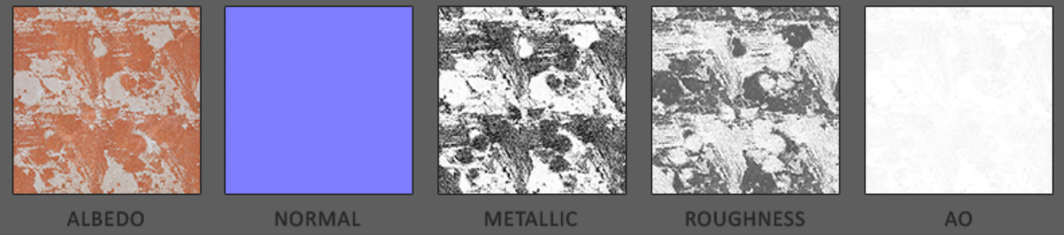


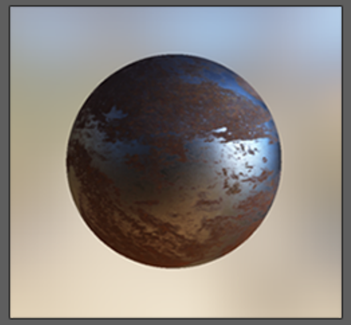
Major Technological Developments

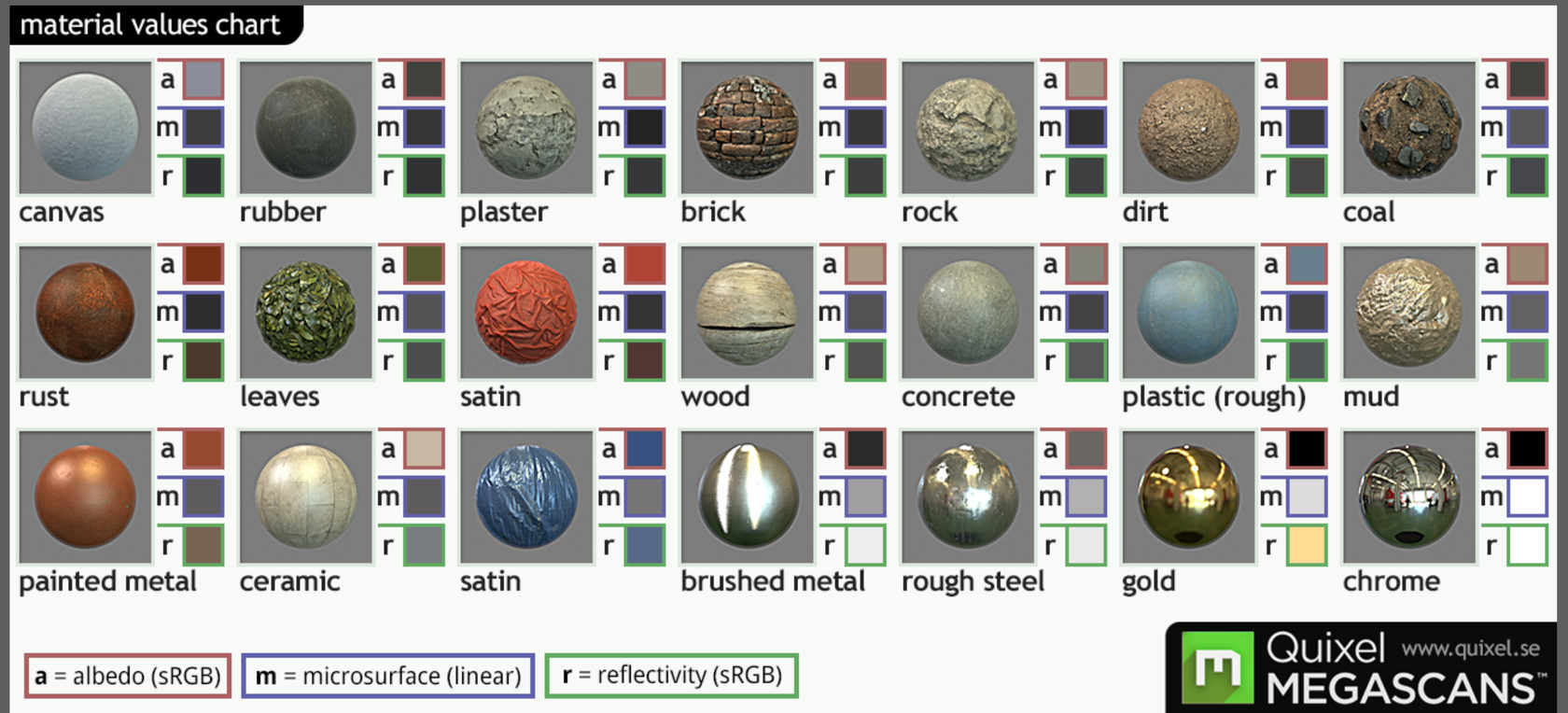
2000 LiDAR available but still expensive

2010 SfM -> Photogrammetry

2014 Physically based rendering (PBR) in Unreal Engine







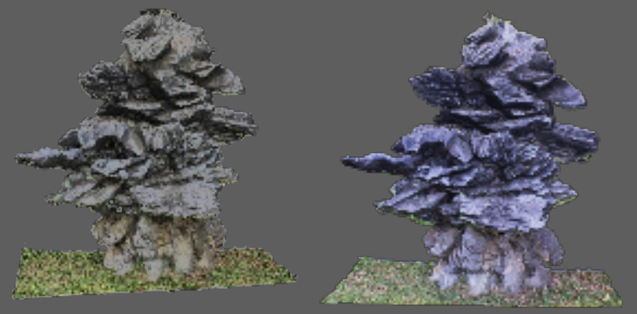
Major Technological Developments

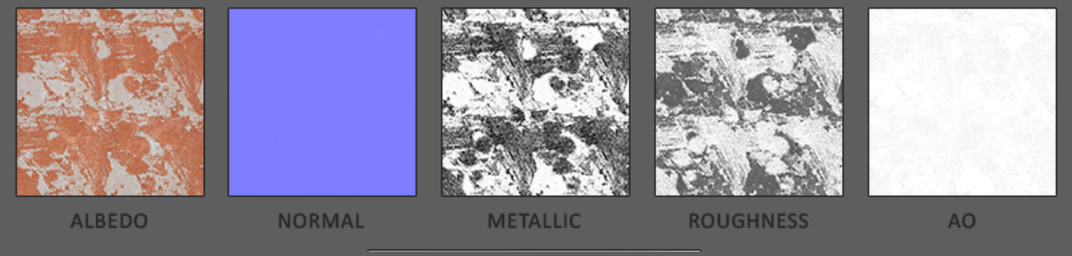
2000 LiDAR available but still expensive

2010 SfM -> Photogrammetry

2014 PBR in Unreal Engine

2014 Google Cardboard



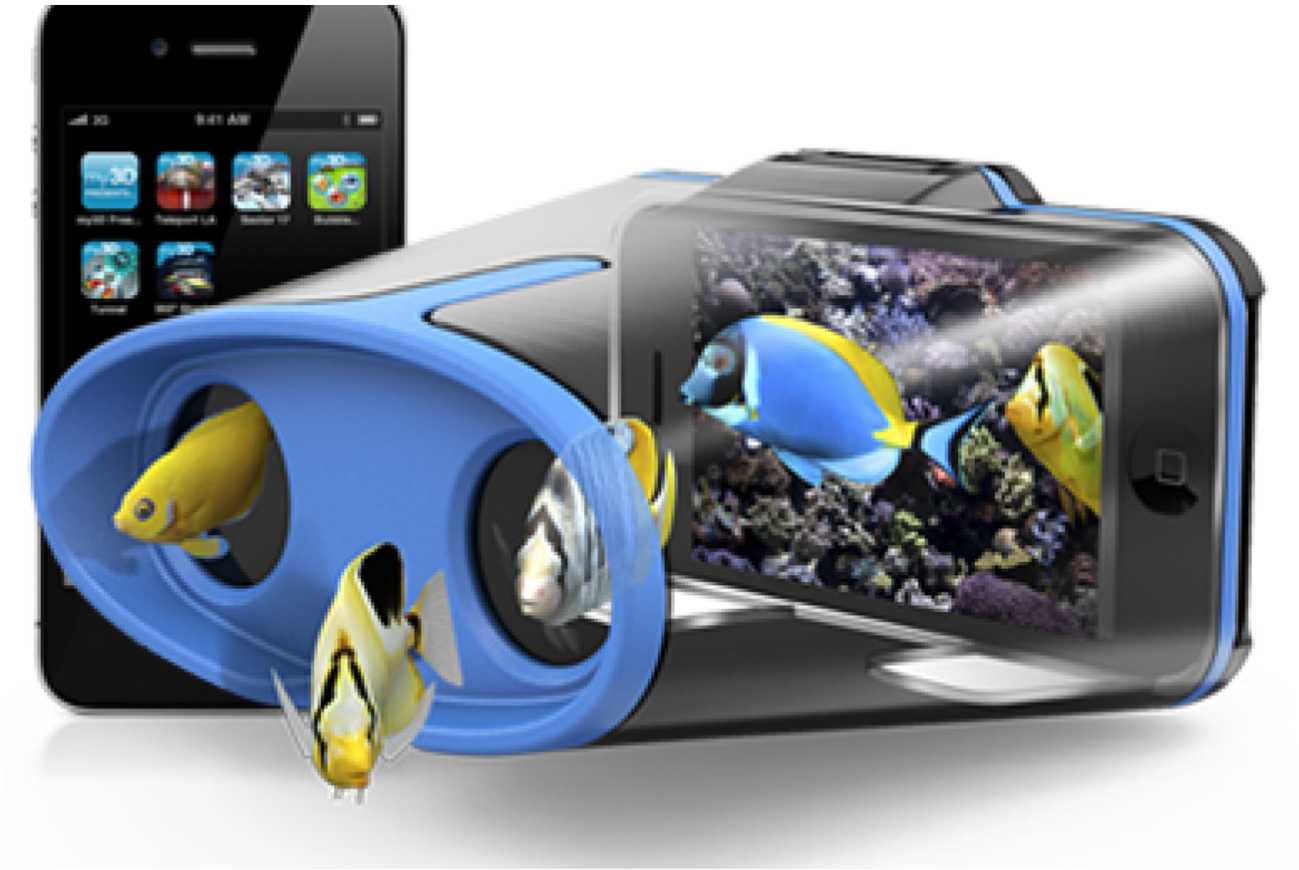




2011 VR SECOND WAVE

HASBO MY3D

2011- Hasbro Launches MY3D 360-Degree Handheld Viewer for iPhone



1861



2014 CARDBOARD

GOOGLE CARDBOARD

2014 - 2017: Over 10 million shipped, 160 million Cardboard app downloads

Many cheap plastic versions followed to enjoy **Cinematic VR**

2015 - YouTube supports 360° videos





Major Technological Developments

2000 LiDAR available but still expensive

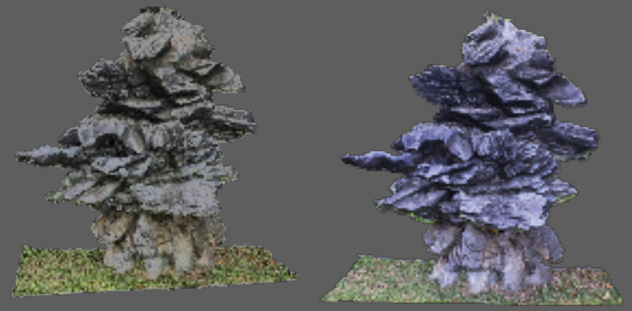
2010 SfM -> Photogrammetry

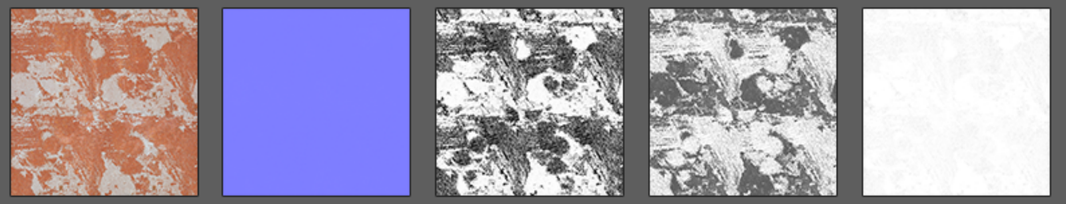
2014 PBR in Unreal Engine

2014 Google Cardboard

2015 Affordable camera drones

2016 Oculus Rift and HTC Vive





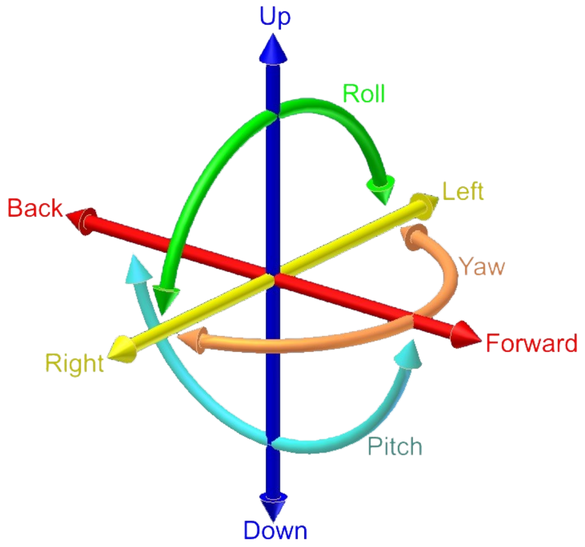


2016 THE YEAR OF ROOM-SCALE VR

Room-scale tracking
And **Gesture input devices**

HTC Vive
2 lighthouses (shooting laser beams) to track position of headset and controllers

6DOF











youtu.be/TckqNdrdbgk

Tilt Brush by Google (2016)

Major Technological Developments

2000 LiDAR available but still expensive

2010 SfM -> Photogrammetry

2014 PBR in Unreal Engine

2014 Google Cardboard

2015 Affordable camera drones

2016 Oculus Rift and HTC Vive

2018 NVIDIA RTX



Real-time Ray Tracing. Epic, ILMxLAB, and NVIDIA (2018)
https://www.youtube.com/watch?v=IMSuGoYcT3s

Major Technological Developments

2000 LiDAR available but still expensive

2010 SfM -> Photogrammetry

2014 PBR in Unreal Engine

2014 Google Cardboard

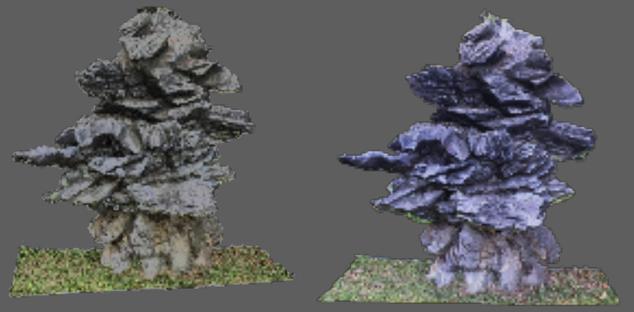
2015 Affordable camera drones

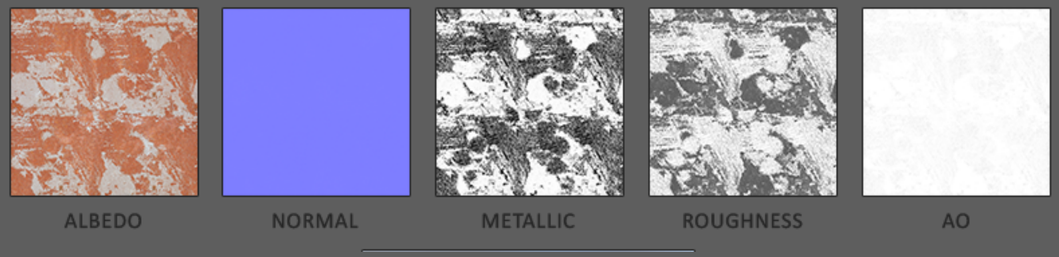
2016 Oculus Rift and HTC Vive

2018 NVIDIA RTX

2020s LiDAR in iPhone, prices down 90% in 10 yrs

2020/3 NeRF and Gaussian Splatting

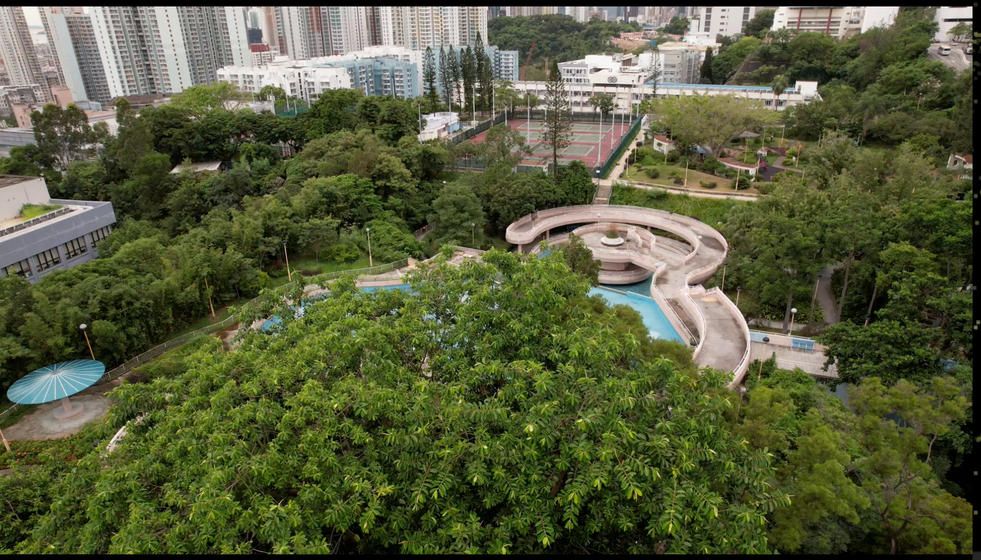




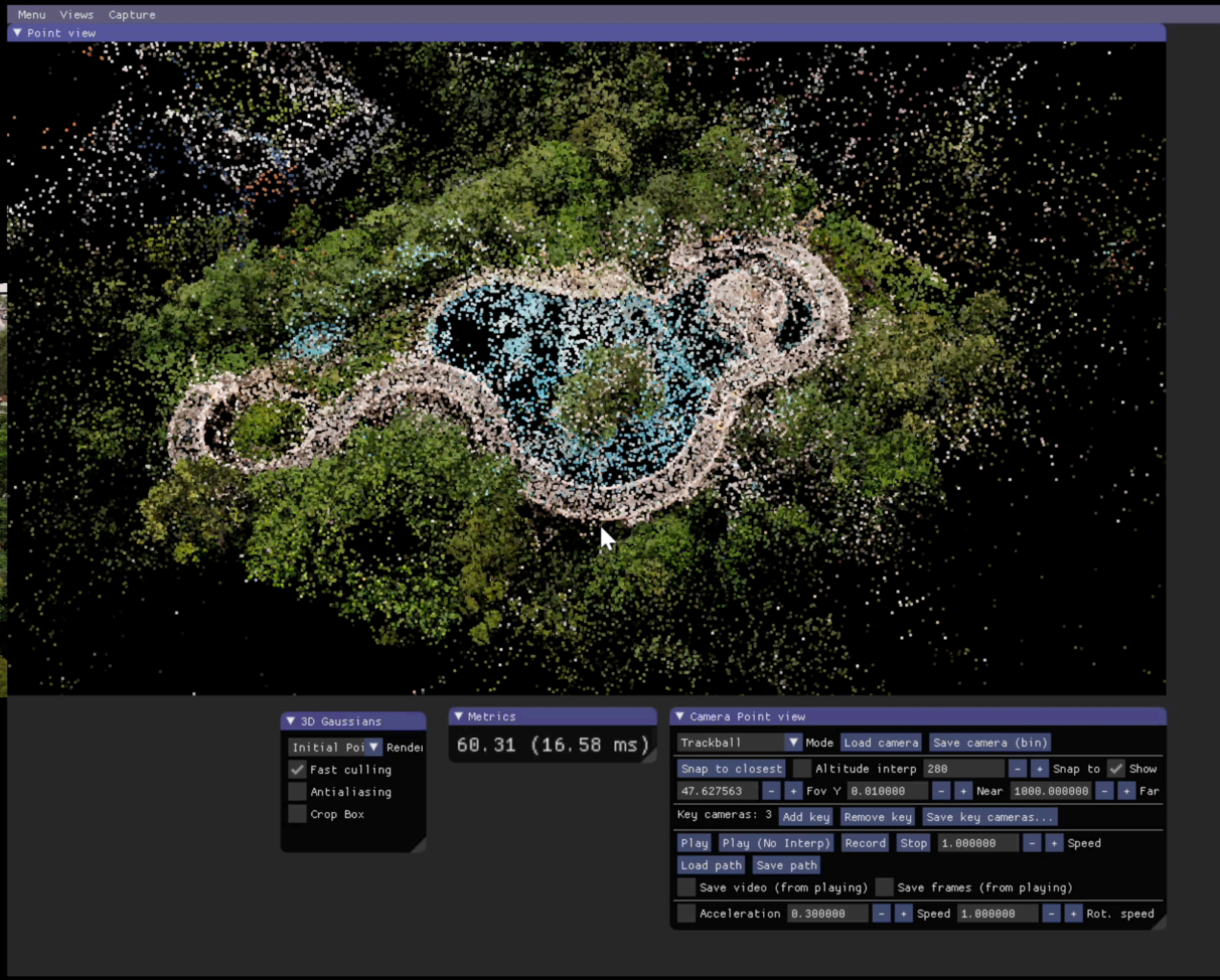




3D Gaussian Splatting for
Real-Time Radiance Field Rendering
(Kerbel et al., 2023)



Hong Kong Shek Kip Mei Park
Seide, Reinhuber (2024)



Major Technological Developments

2000 LiDAR available but still expensive

2010 SfM -> Photogrammetry

2014 PBR in Unreal Engine

2014 Google Cardboard

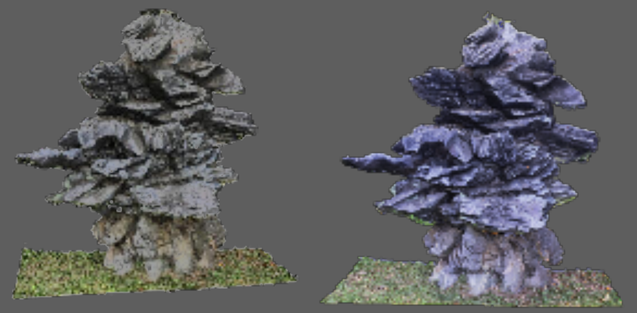
2015 Affordable camera drones

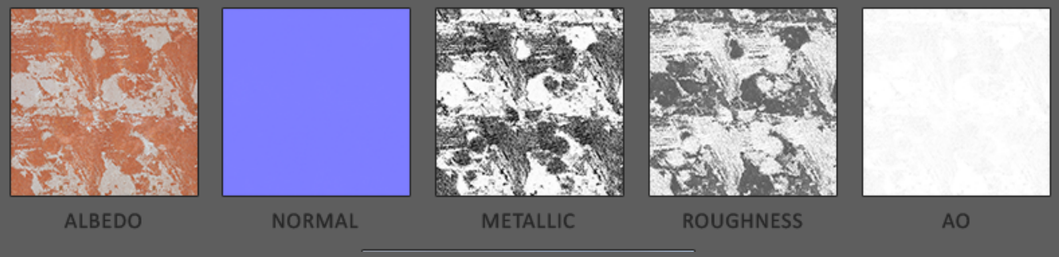
2016 Oculus Rift and HTC Vive

2018 NVIDIA RTX

2020s LiDAR in iPhone, prices down 90% in 10 yrs

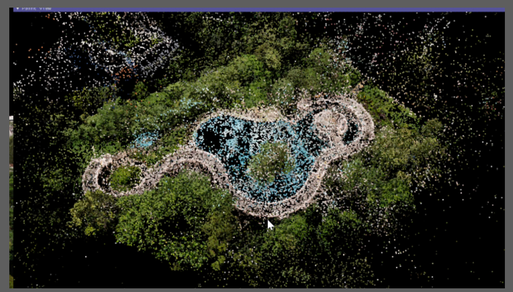
2020/3 NeRF and Gaussian Splatting













Meta Human by Epic (2021)

https://www.youtube.com/watch?v=S3F1vZYpH8c



Virtual Cultural Heritage:
Brief Overview of Current Developments

Sketchfab

heritage

CANCEL



Pirene Fountain, Corinth ... 1.6k 15 75



Arch of Triumph in Palmy... 4.6k 8 88



Earthquake Kathmandu ... 11.9k 2 58



The Morning Roo... 5.4k 9 166



Mont Saint Michel - France



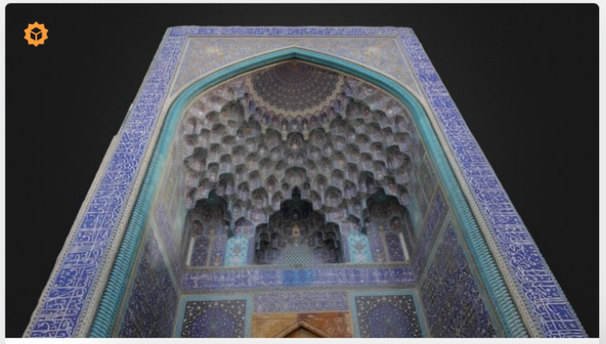
Dolmen Monte Areo ... 4k 27 78



Armenian Khachkar Stone... 1.3k 8 42



Madona Sculptu... 756 2 25











Al Khazneh (2018) Detailed 3D reconstruction by Raiz New Media

Interactive on sketchfab.com



Church of St Mary at Mount Naranco (2017) Detailed 3D reconstruction by Raiz New Media
Interactive on sketchfab.com

Raiz New Media







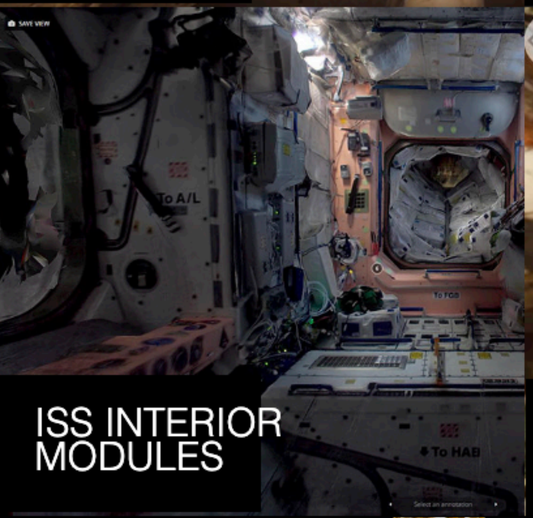


















Explore the stories and 3D models



ONLINE EXHIBIT

Bagan

Myanmar



3D MODEL

3D Model of Bagan

Click to explore



ONLINE EXHIBIT

Brandenburg Gate

Germany



3D MODEL

Brandenburg Gate 3D model

Click to explore



ONLINE EXHIBIT

Ancient Corinth

Greece



3D MODEL

Ancient Corinth 3D model

Click to explore



ONLINE EXHIBIT

Chichén Itzá

Mexico



3D MODEL

Chichén Itzá 3D model

Click to explore



ONLINE EXHIBIT

Ayutthaya

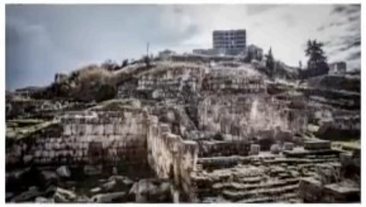
Thailand



3D MODEL

Ayutthaya 3D model

Click to explore



ONLINE EXHIBIT

Temple of Echmoun

Lebanon



3D MODEL

Temple of Echmoun 3D model

Click to explore











Google Arts & Culture by CyArk

https://www.youtube.com/watch?v=2r1YcOIm-UU

2007 v1 Rome Reborn
(Frischer et al.)

2008 v2 Google Earth

2018 v3

2023 v4

Rome Reborn 4.0 Demo Reel Nov. 16, 2023
https://www.youtube.com/watch?v=s50hT6SOdI4&t=110s





The *Yunnan Garden* VR Experience.

Virtual Heritage Re-Creation (≠ Reconstruction)

Benjamin Seide, Elke Reinhuber, Ross Williams (2020)

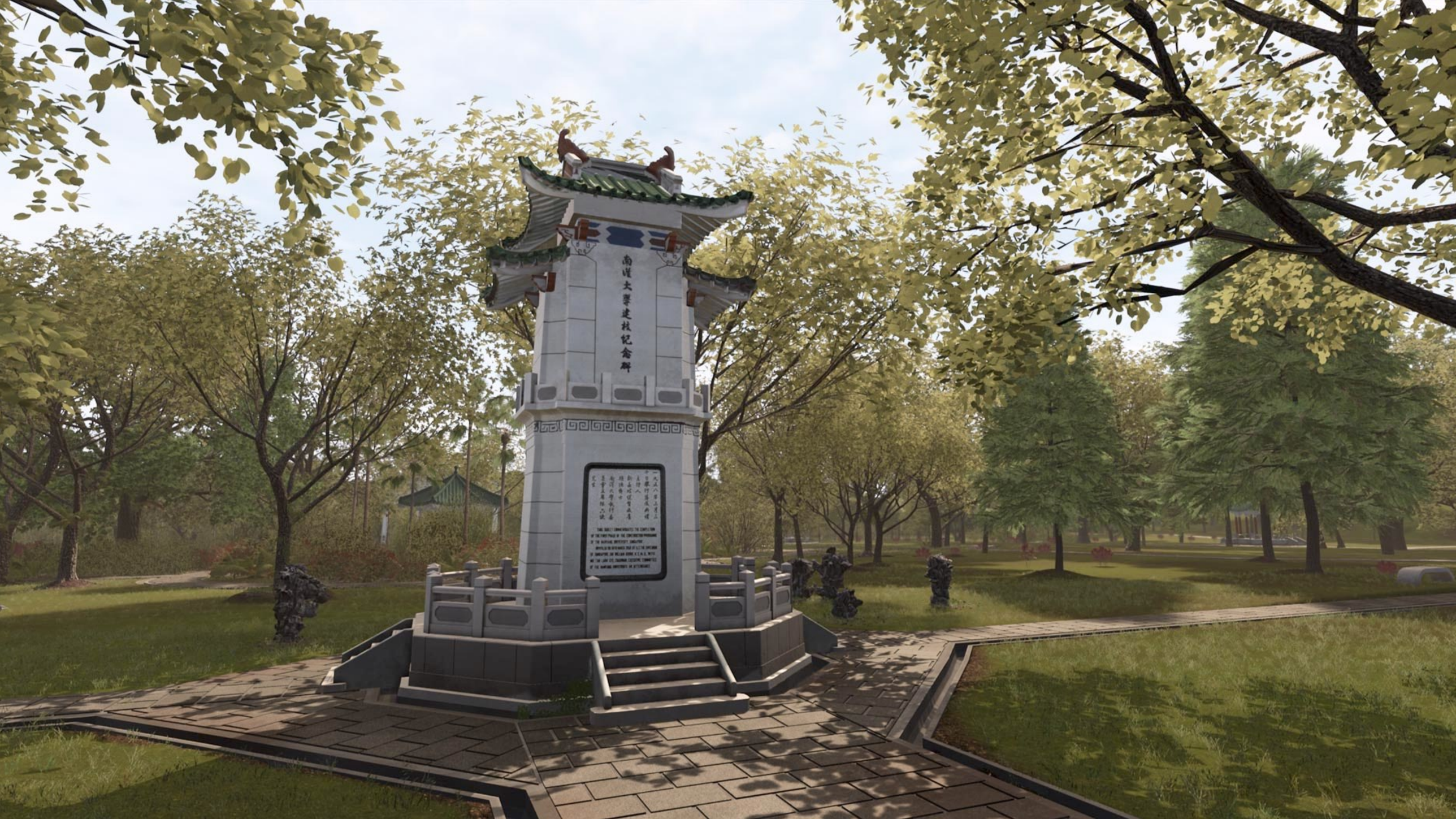








Yunnan Garden VR (2020) - Reinhuber, Seide, Williams


南洋大學建校紀念碑

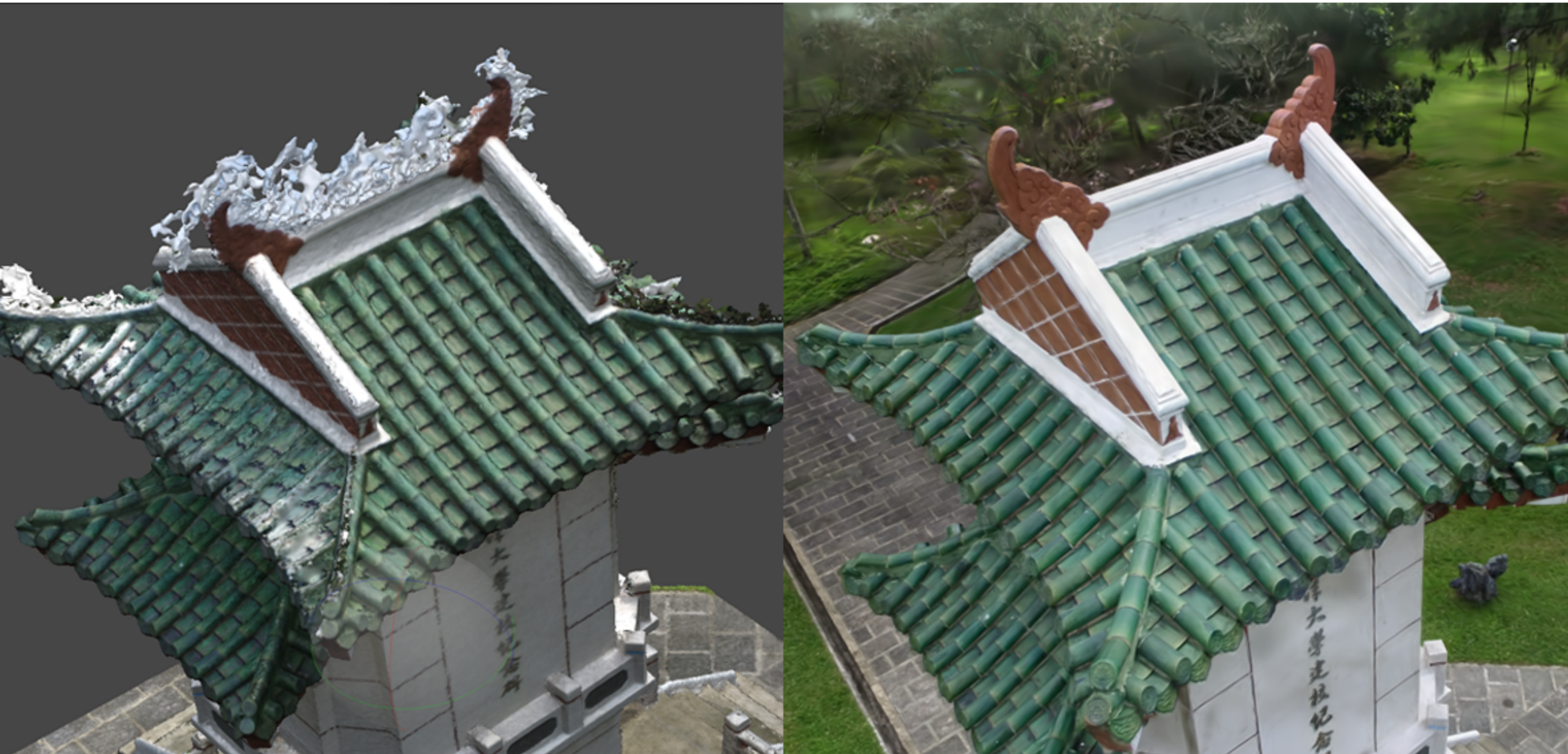



1955





Photogrammetry (2017) vs 3DGS Gaussian Splatting (2023)





From Realistic Re-Creation to Artistic Interpretation:
Authenticity and Engagement in Virtual Cultural Heritage

Background: Theoretical Foundations
And a Thesis

1/

VCH work often assumes that

v**isual realism equals historical truth.**

… but often overlooks that heritage is not only
about physical structures or objects.

It also involves memories, emotions,
and the way people relate to a place…

2/

Theories of VR immersion, especially Slater’s (2009) concepts of *place illusion*, t**he feeling of really “being there”**, and *plausibility illusion*, **the sense that what happens in VR is believable**, help to explain why also non-photorealistic environments can feel very real.





Walkabout Mini Golf VR

3/

Increased Believability through Visual Realism

Photorealistic reconstructions are often perceived as more “authentic”

Increased Believability through VR Immersion

Place illusion - the sensation of “being there”, and *plausibility illusion*, the sense that what happens in VR is believable, (Slater, 2007)

Believability ≠ Engagement

While realism and immersion contribute to believability, they do not automatically create emotional or intellectual engagement

4/

Higher Engagement Through Narrative and Artistic Interpretation

Narratives provide context, while artistic techniques (such as abstraction or stylisation) can evoke emotional responses that pure realism cannot.

Meaning Through Artistic Interpretation

Inspired by Merleau-Ponty's interpretation of Rodin's perspective, **that an artist captures deeper truths** than a photograph ever could.

Merleau-Ponty argues that the artist does not just copy what is seen. Instead, they interpret the world, showing its hidden layers. (Merleau-Ponty, 1968).

… artistic interpretations in VCH could create more emotional and subjective experiences of history…



Artistic and Experimental VR:
Expanding the Boundaries of Immersive Experience



Artistic and Experimental VR: Photogrammetry Experiments

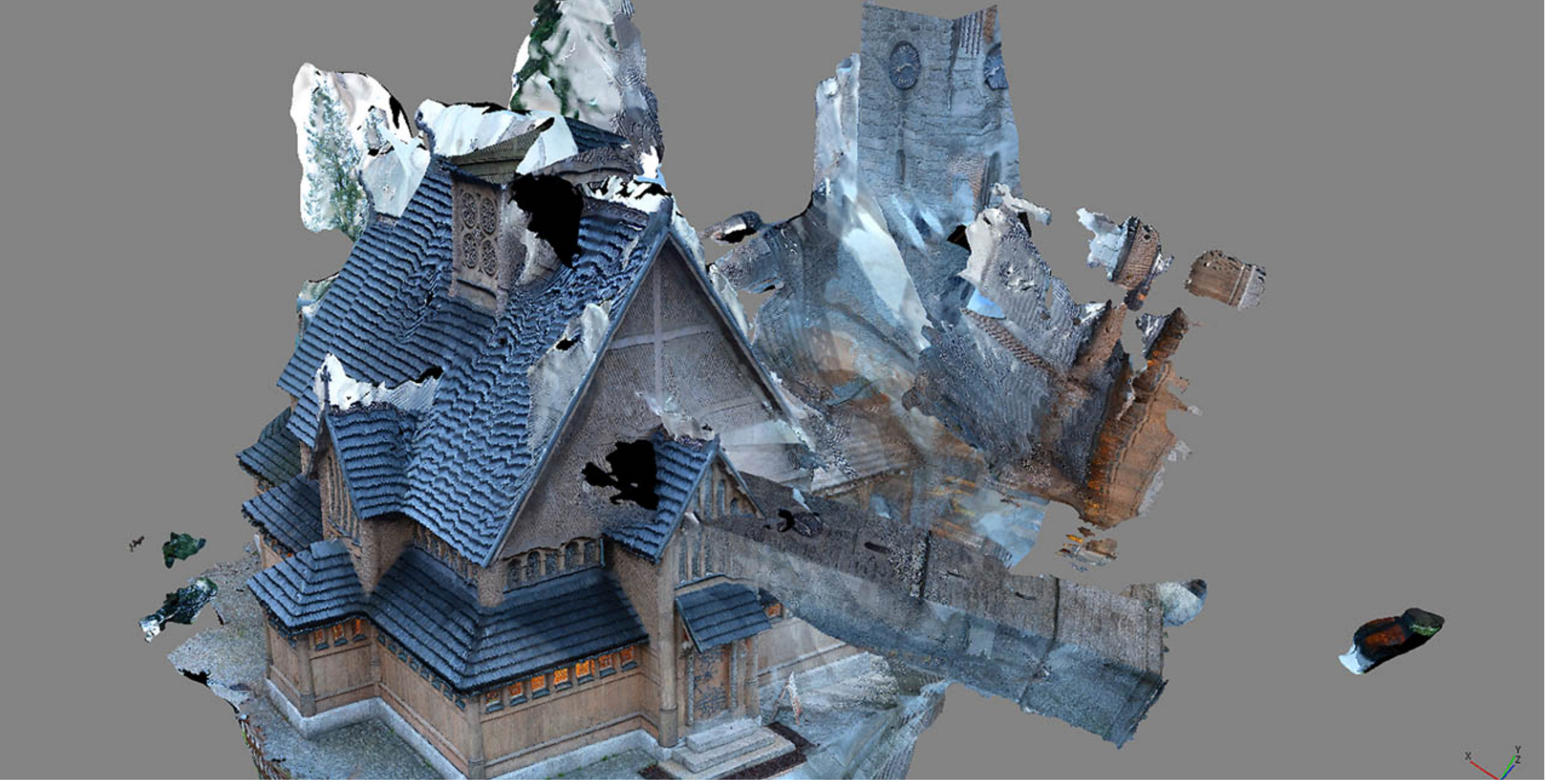
2010s marked a major change, making photogrammetry and VR tools accessible not just to academic researchers but also to independent artists and hobby creators. By 2016, early experiments started appearing on platforms like SteamVR



Abandoned Room Photoscanned (2019) by Imbace, on SteamVR workshop



Small House Interior
Nagano, Japan (2017)
Z-UP RESEARCH
On SteamVR workshop
https://skfb.ly/6tI9I



Photogrammetry gone wrong (2015) by lookbothwaysvr.blogspot.com



Mum's 3D Living Room, 2015. University of Crete, Department of Information Technology and Cultural Heritage



Important Things, Approximately Right (2017) by Steffen Kloster Poulsen, on SteamVR workshop



37 Clinton (2017), by Gibbs FKA Leroy, on SteamVR workshop

Merging fragmented photogrammetry and 3D models



Artistic and Experimental VR: Photogrammetry Experiments

The glitchy, fragmented look of low-quality photogrammetry, with distorted shapes and ghostly textures, became a key feature of early VR art, this questioned ideas of digital perfection but also changed how audiences interacted with virtual versions of real places, valuing emotional impact over perfect accuracy.

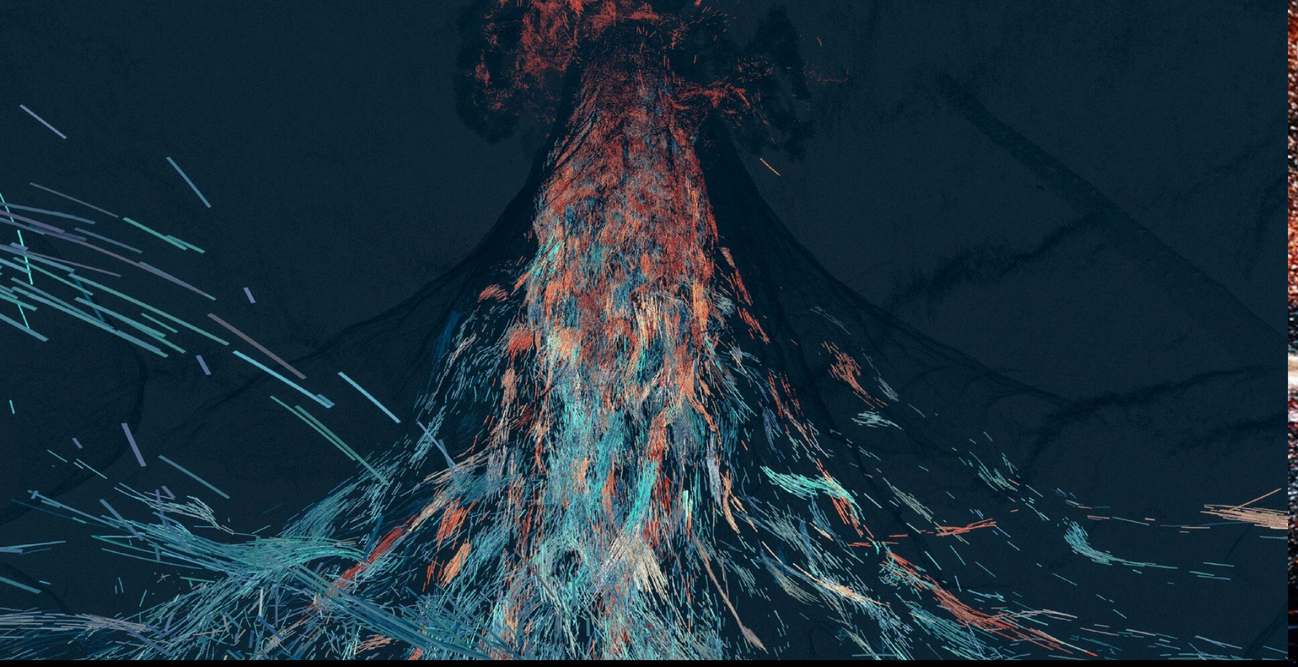


Artistic and Experimental VR:
Point Cloud

Another unique aesthetic coming from 3D reconstruction is point cloud visualization. By avoiding photorealistic accuracy, artists highlight the broken, **dream-like quality** of unprocessed point clouds to explore themes like memory, temporality, and digital abstraction.

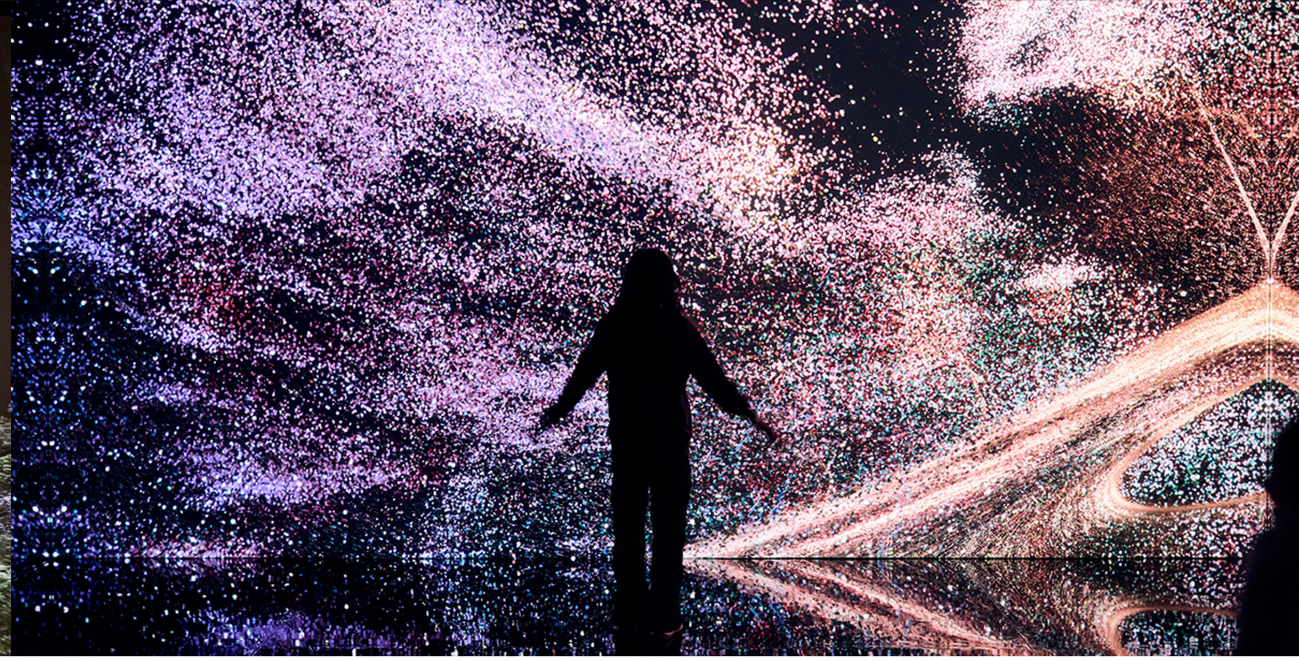


Post-Industrial Landscapes 5.0: Urban Scan by Kyle Chung and Tobias Klein









Projects from *Marshmallow Laser Feast* www.marshmallowlaserfeast.com



IN THE EYES OF THE ANIMAL by Marshmallow Laser Feast
https://www.youtube.com/watch?v=XJMA0Nj_zsA



Artistic VR Projects in Virtual Cultural Heritage: Beyond Realism



Home after War (Parameswaran et al., 2017)



Parragirls Past, Present

Unlocking Memories of Institutional ‘Care'

Lily Hibberd, Volker Kuchelmeister (2018)



Parragirls Past, Present



Parragirls Past, Present



Parragirls Past, Present



The *Gone Garden* VR Experience.

An Impressionistic Representation as Virtual Heritage Reconstruction (2018). Seide, Reinhuber



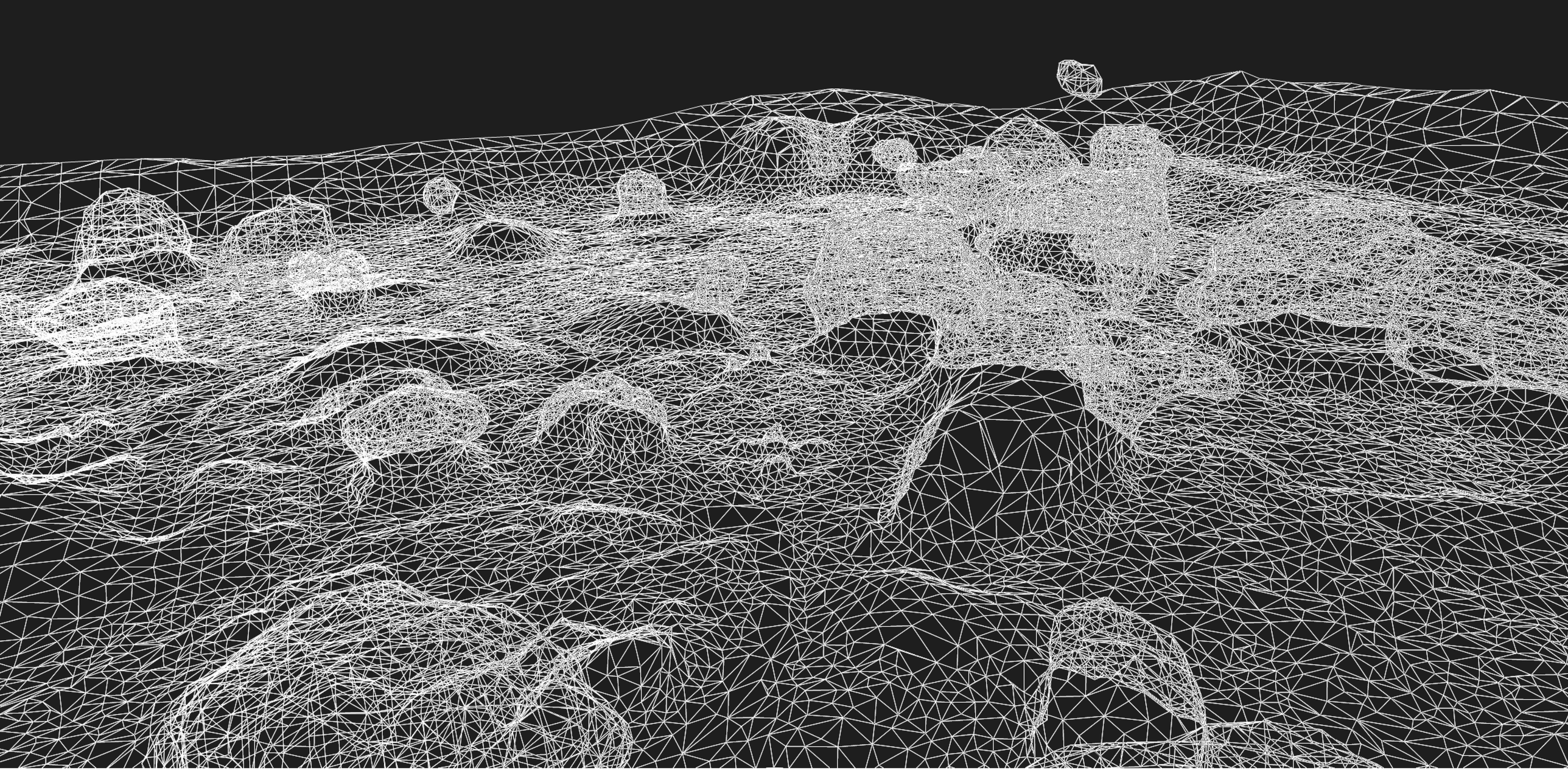
Yunnan Garden, Singapore, 2017



3D re-creation



3D reconstruction from insufficient data



3D reconstruction



Gone Garden (2018) VR experience



The *Flux Garden* VR Experience

a Poetic Memory of a Lost Garden in VR (2021). Seide, Reinhuber

Performance Capture



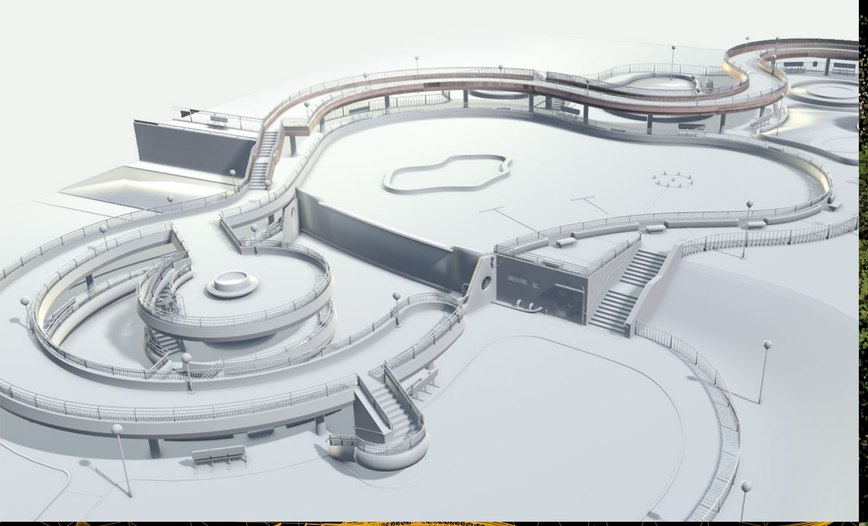


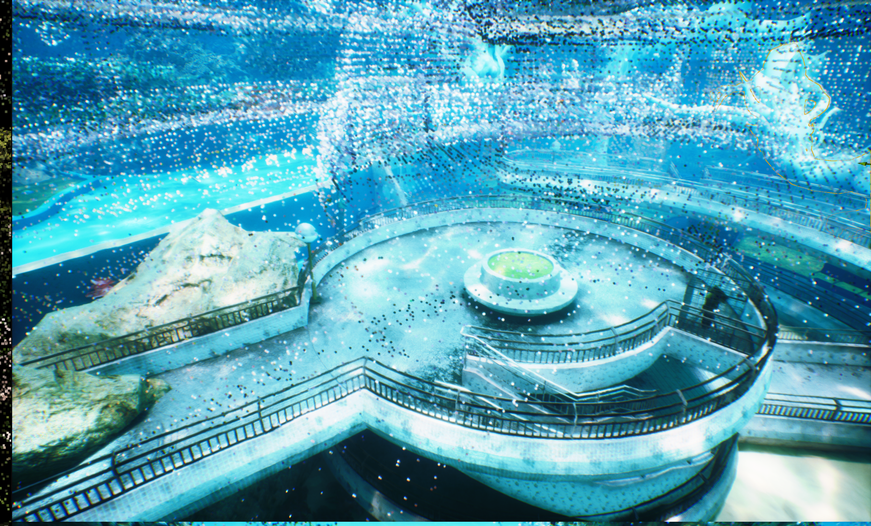
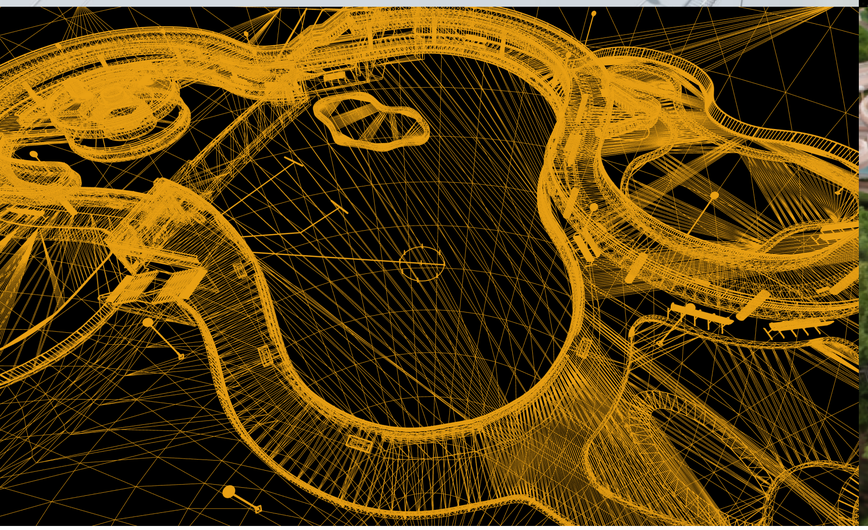


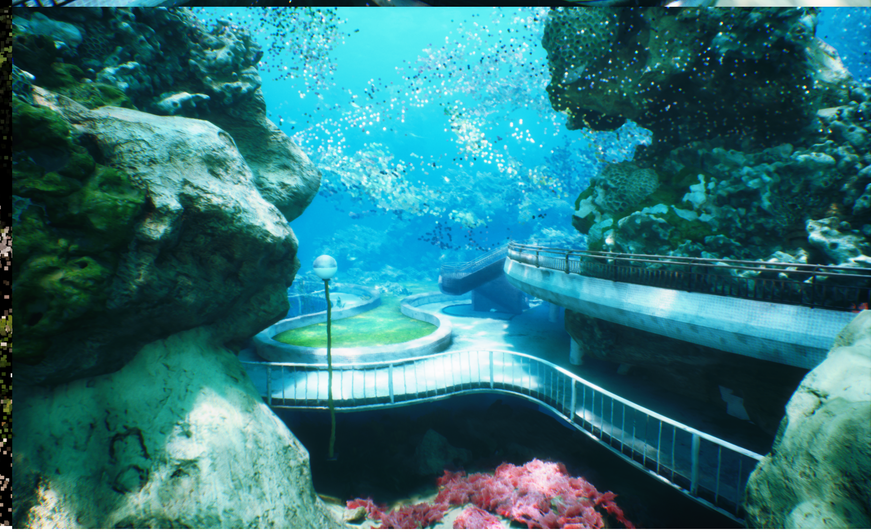
Garden of Changes VR Experience

VR Experience as Meditative Divination Device (2020)







Awakening the Water Spirits

VR Experience based on HK’s Shek Kip Mei Park (2025)

Blending partial realism with an impressionistic, dreamlike quality, this underwater world and its dragon inhabitant serve as a poetic tribute to the lost park, evoking both its memory and the pressing environmental challenges of our time.



Virtual *Cinematic* Heritage
Homage to a lost film from 1957 as immersive VR experience

Benjamin Seide, Benjamin Slater



The lost film Pontianak (1957)



Virtual *Cinematic* Heritage



Performance Capture

Project goals

Reimagine scenes of the lost film as “walk-in” VR movie experience



Advertisement for Mandarin dialogue version of *Pontianak* (1957) - Front









VR Kampong screenshots



VR Kampong screenshots



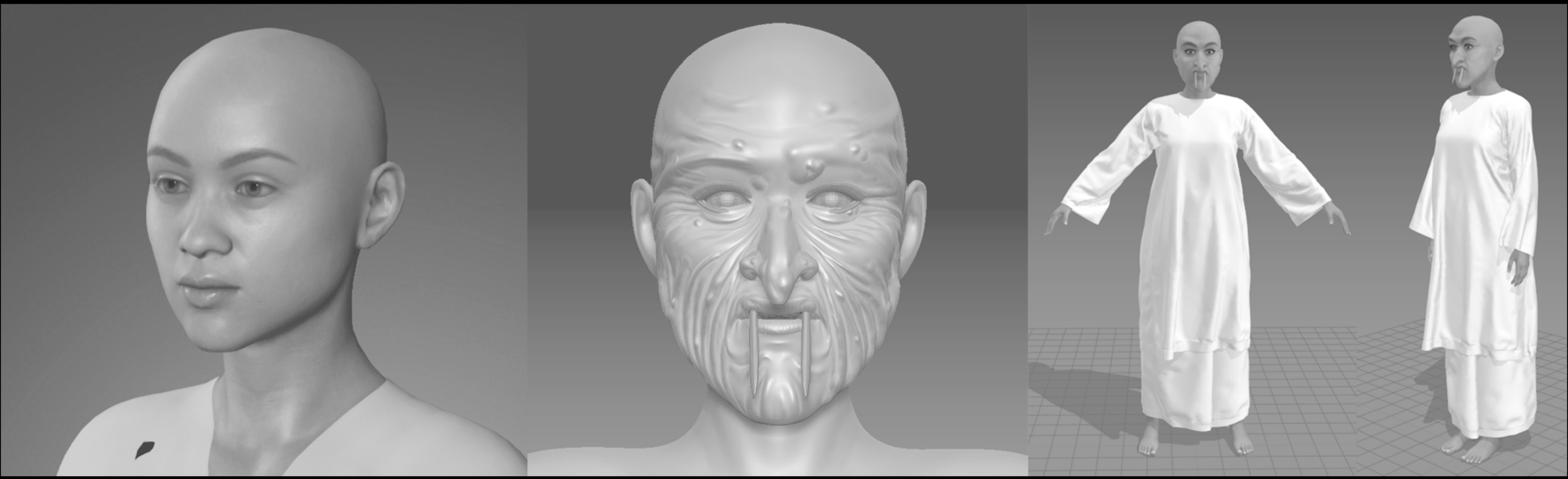
VR Kampong screenshots











Character sculpting, Chomel and Pontianak



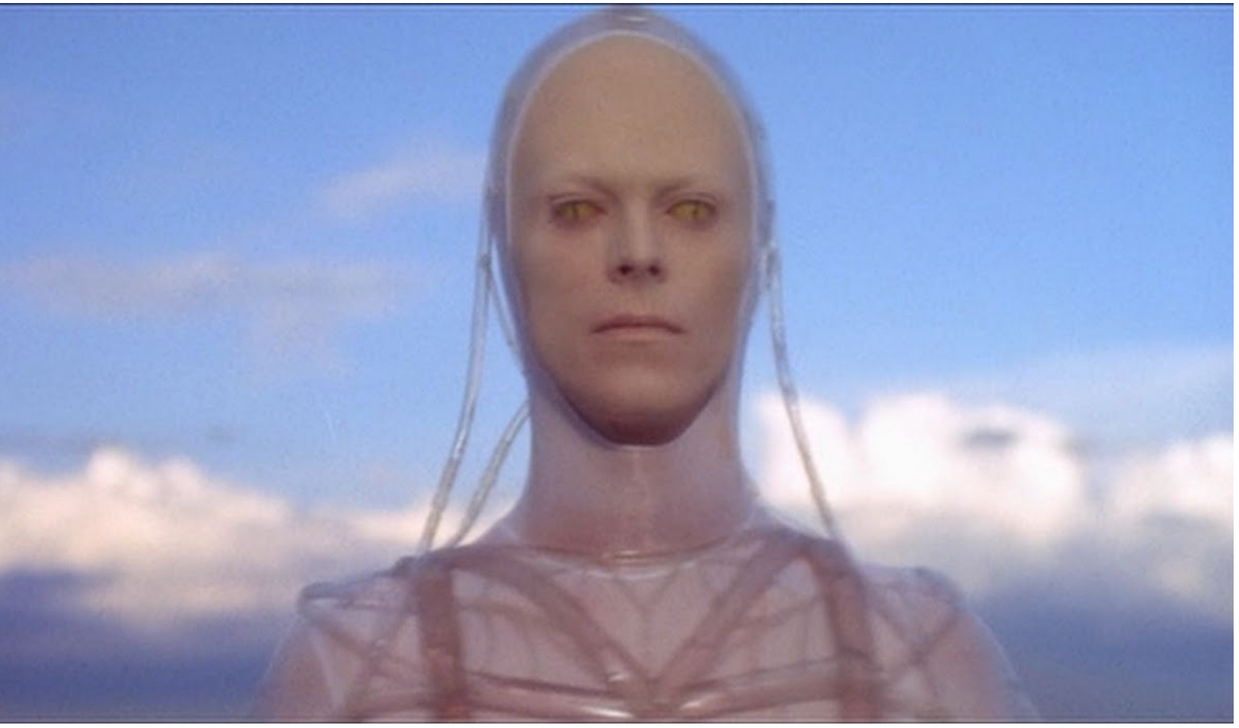


Sumpah Pontianak (left), VR Pontianak (right)



Exploring B-Movie Themes in Virtual Reality:
The Woman Who Fell to Earth and Met the Pontianak

Benjamin Seide, Benjamin Slater



The Man Who Fell To Earth (1976)



Lifeforce (1985)



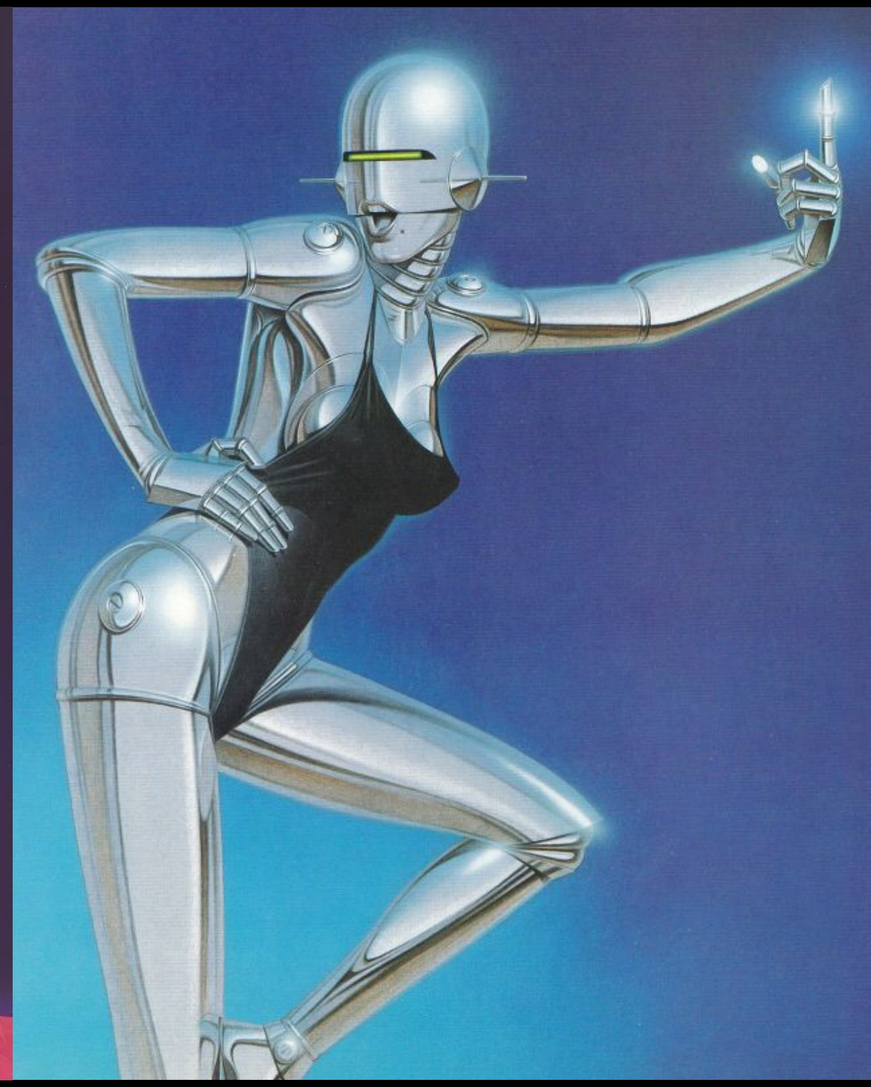
Under The Skin (2012)



H.R Giger concept art for *Species* (1985)







Hajime Sorayama, female robot art late 70s, early 80s



B-Movie VR Experience

The Story

















Conclusion: Preservation vs. Interpretation

Should digital heritage serve mainly as an archive, or should it also be a tool for storytelling?

Digital twins have an established place / fit well with guidelines from UNESCO

Concerns regarding “Difficult Heritage”, a clean replica might be a misrepresentation

Parragirls Past, Present - glitches and breaking parts, reflects how memory works, especially traumatic memory



Conclusion: Preservation vs. Interpretation

We expect more storytelling elements to attract a broader audience / edutainment

It is not just about the architecture, but the feeling of the place

VCH should not be seen as something frozen in time, but as something living, evolving, and open to interpretation.



Conclusion: Preservation vs. Interpretation

John Dewey argued in his 1934 book "Art as Experience," that art is not merely about aesthetics but about the transformative power of experience.

Rodin knew well, that the most powerful truths are sometimes those that cannot be exactly copied.



From Realistic Re-Creation to Artistic Interpretation:
Authenticity and Engagement in Virtual Cultural Heritage

Benjamin Seide - bseide@ntu.edu.sg - ataribaby.de
Elke Reinhuber - elke.r@cityu.edu.hk - eer.de

CityU School of Creative Media 香港城市大學 City University of Hong Kong
NANYANG TECHNOLOGICAL UNIVERSITY SINGAPORE
School of Art, Design and Media
College of Humanities, Arts, and Social Sciences