



**Supporting 3D/VR Technologies in Academic  
Libraries: Curation and Preservation Challenges**

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CLIR Postdoctoral Fellow**



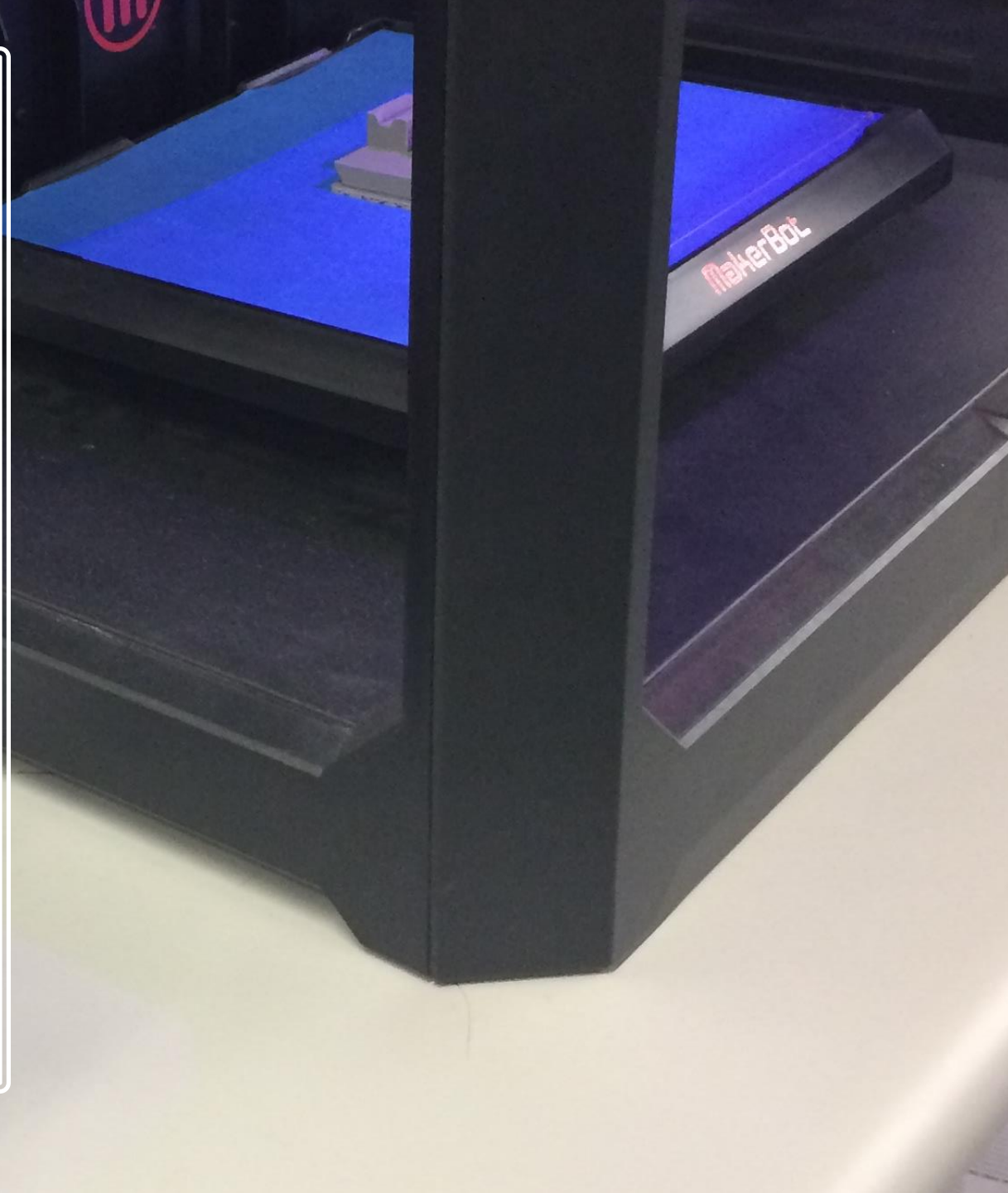
# Growth in 3D Modeling

- **Production Techniques**

- Structured Light
- Photogrammetry
- Laser
- Computed Tomography (CT) Scanning
- Reflectance Transformation Imaging (RTI)

- **Collections**

- Commercial: [sketchfab.com](http://sketchfab.com), [thingiverse.com](http://thingiverse.com)
- Academic: [morphosource.org](http://morphosource.org)



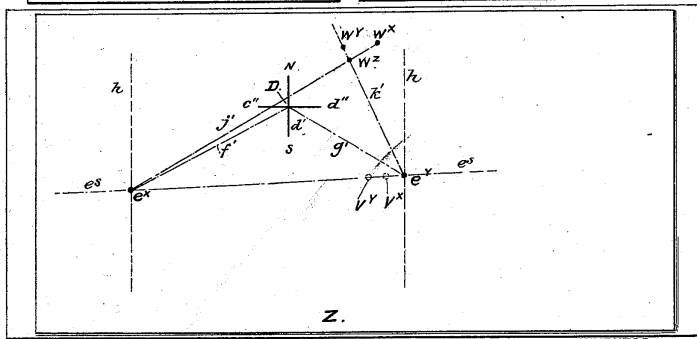
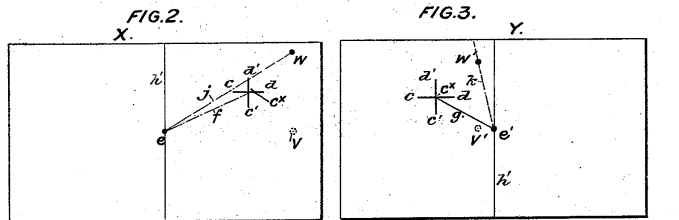
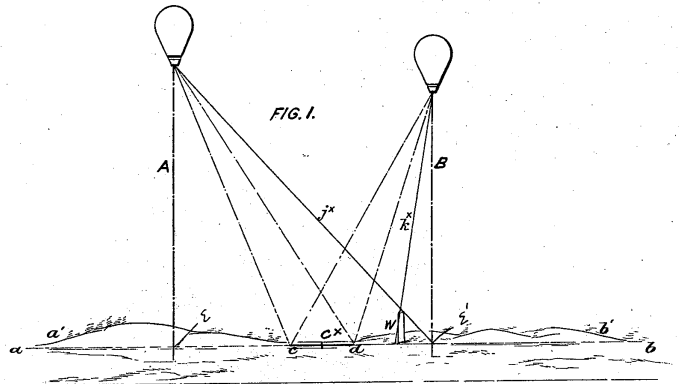
(No Model.)

2 Sheets—Sheet 1.

C. B. ADAMS.  
METHOD OF PHOTOGRAMMETRY.

No. 510,758.

Patented Dec. 12, 1893.

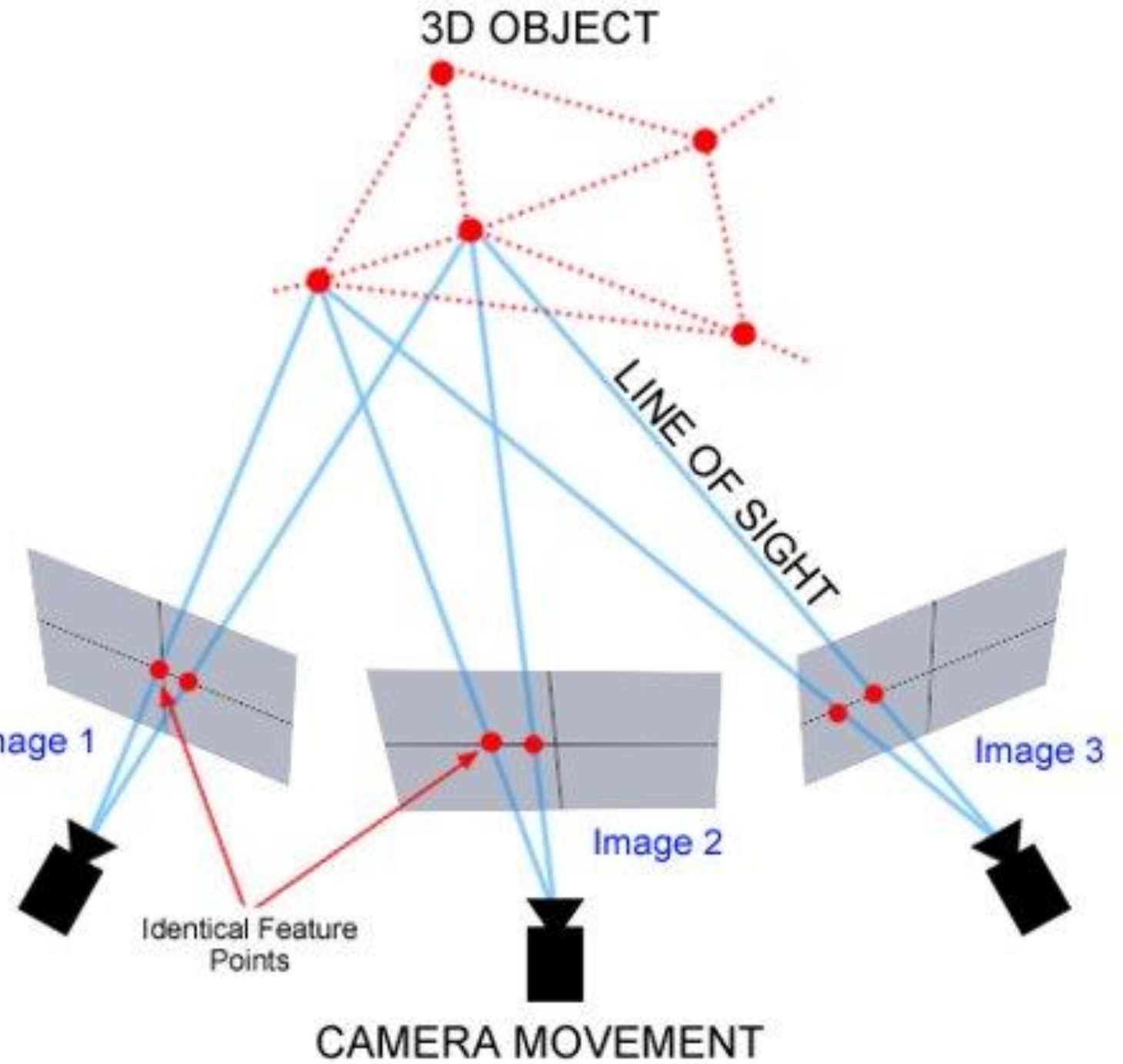


WITNESSES:  
*And E. Dietrich*  
*W. D. Blount*

INVENTOR  
*Cornelia B. Adams*  
 BY *Munn & Co.*

[http://www.pbcgis.com/topography/blair\\_balloon\\_patent.pdf](http://www.pbcgis.com/topography/blair_balloon_patent.pdf)

THE NATIONAL LITHOGRAPHING COMPANY,  
WASHINGTON, D. C.



# OBJ File generated by MeshLab

#

####

# Object AMUD1\_scaled\_SMALL2.obj

#

# Vertices: 90023

# Faces: 179999

#

####

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vn 0.995393 0.014513 0.094775

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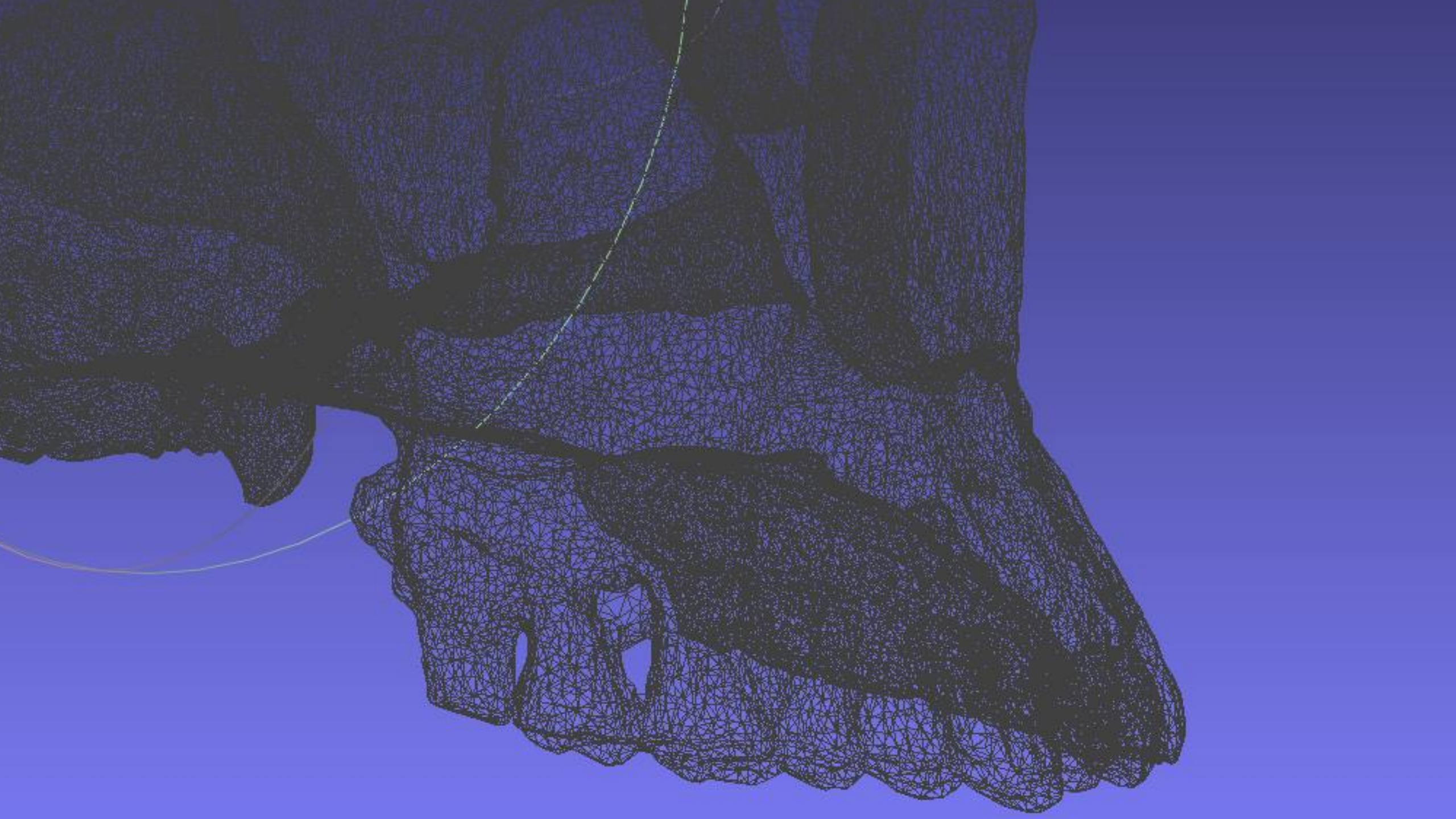
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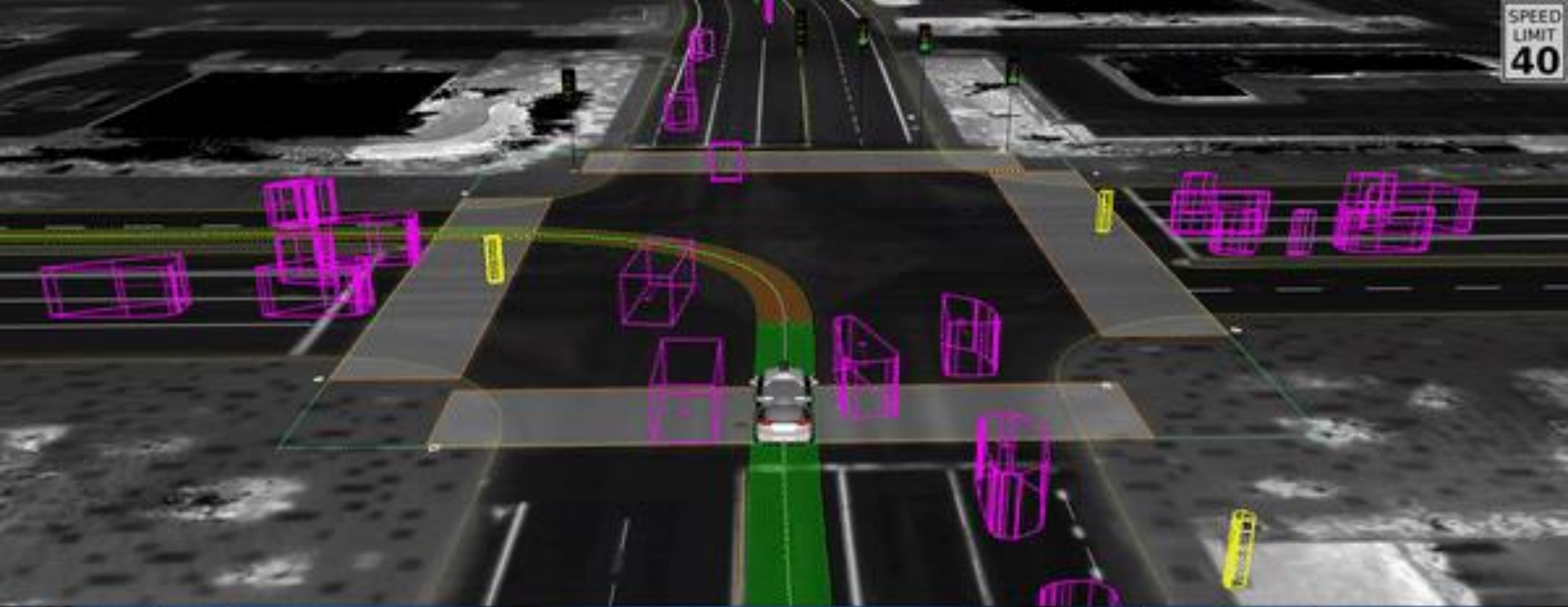
<http://digitallife3d.org/>



<http://the-arcives.org/>

<https://sketchfab.com/models/38315a821d0342a5a1189a7144f18b25>



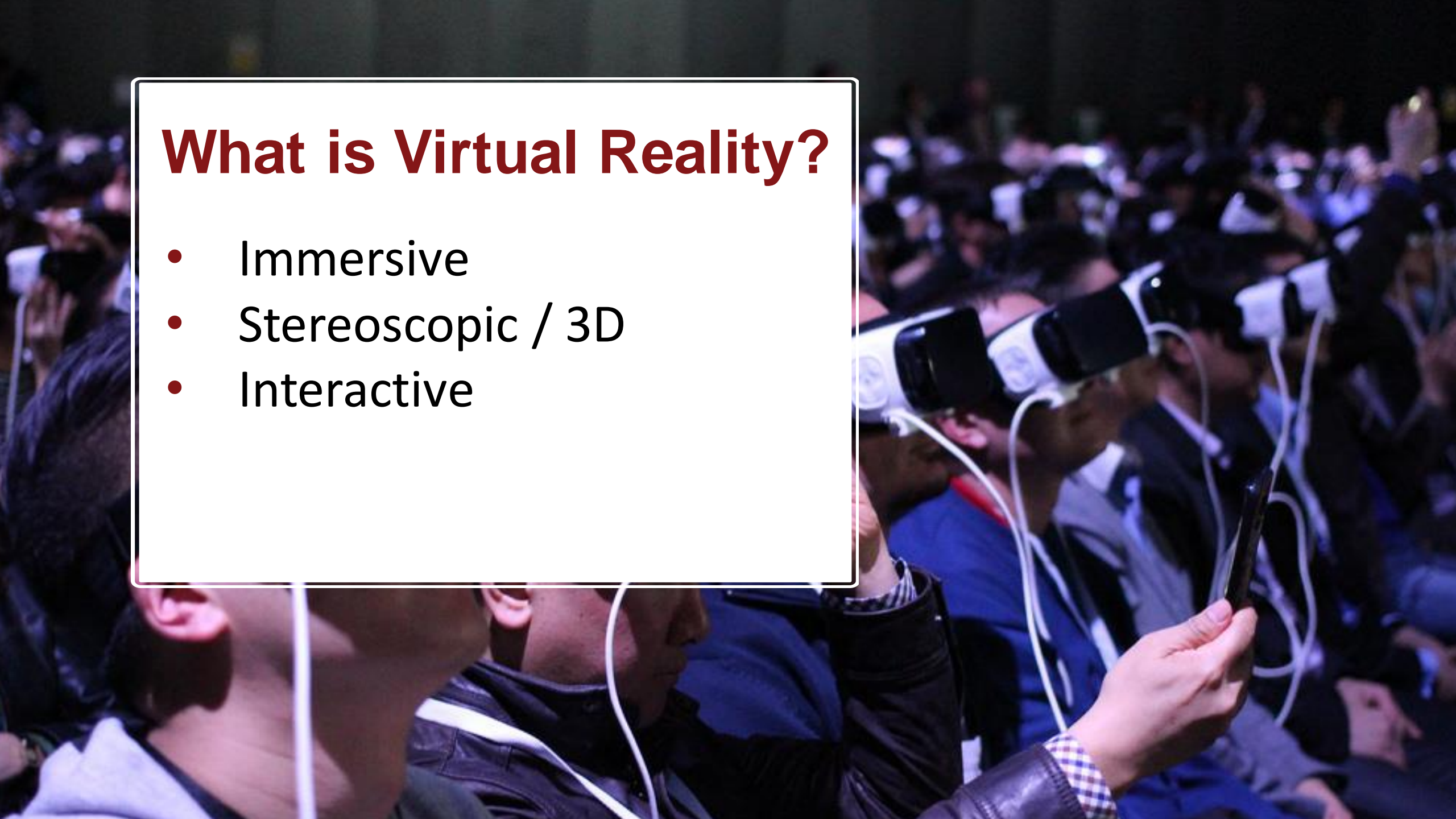


<https://medium.com/waymo/simulation-how-one-flashing-yellow-light-turns-into-thousands-of-hours-of-experience-a7a1cb475565>



# What is Virtual Reality?

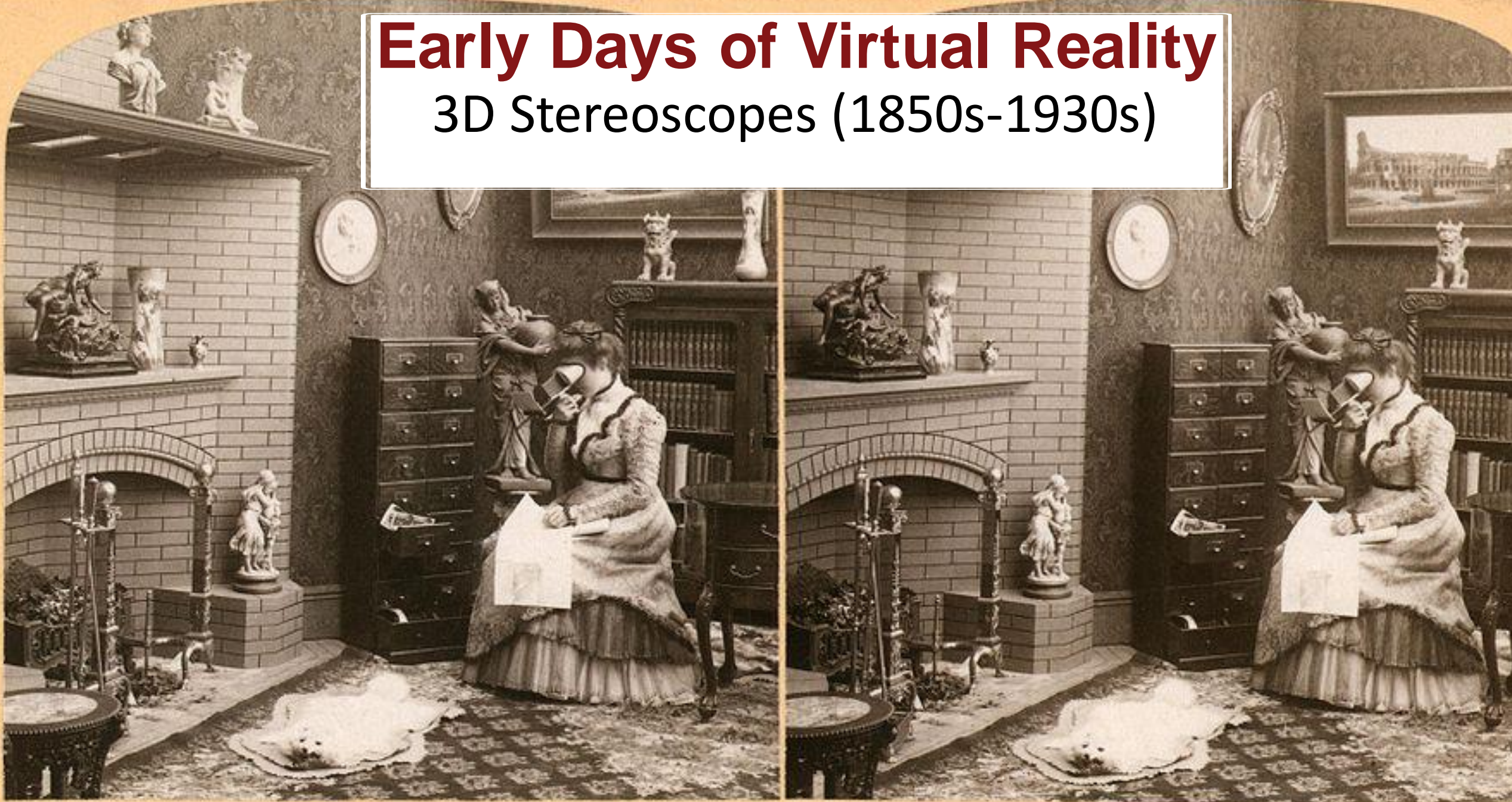
- Immersive
- Stereoscopic / 3D
- Interactive





# Early Days of Virtual Reality

## 3D Stereoscopes (1850s-1930s)



The Stereograph as an Educator—Underwood Patent Extension Cabinet in a house Library.  
Copyright 1901 by Underwood & Underwood.

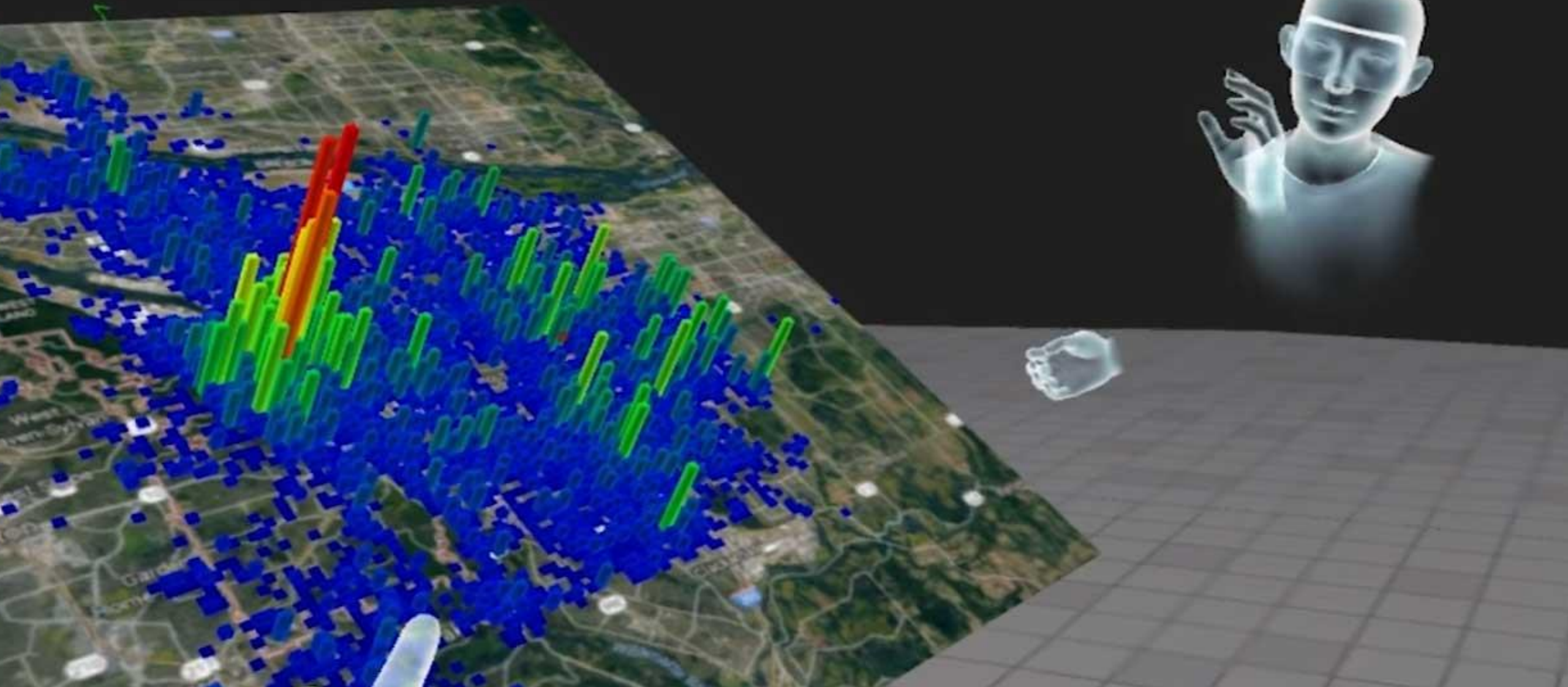


# Benefits of VR

- **Expand Access**
  - Fragile Artifacts
  - Inaccessible
  - Large/microscopic
- **Embodied Analysis**
  - Natural Interface
  - Expanded Field of Vision
  - Stereoscopic, Depth
- **Presence & Collaboration**



# Immersive Data Visualization: iViz





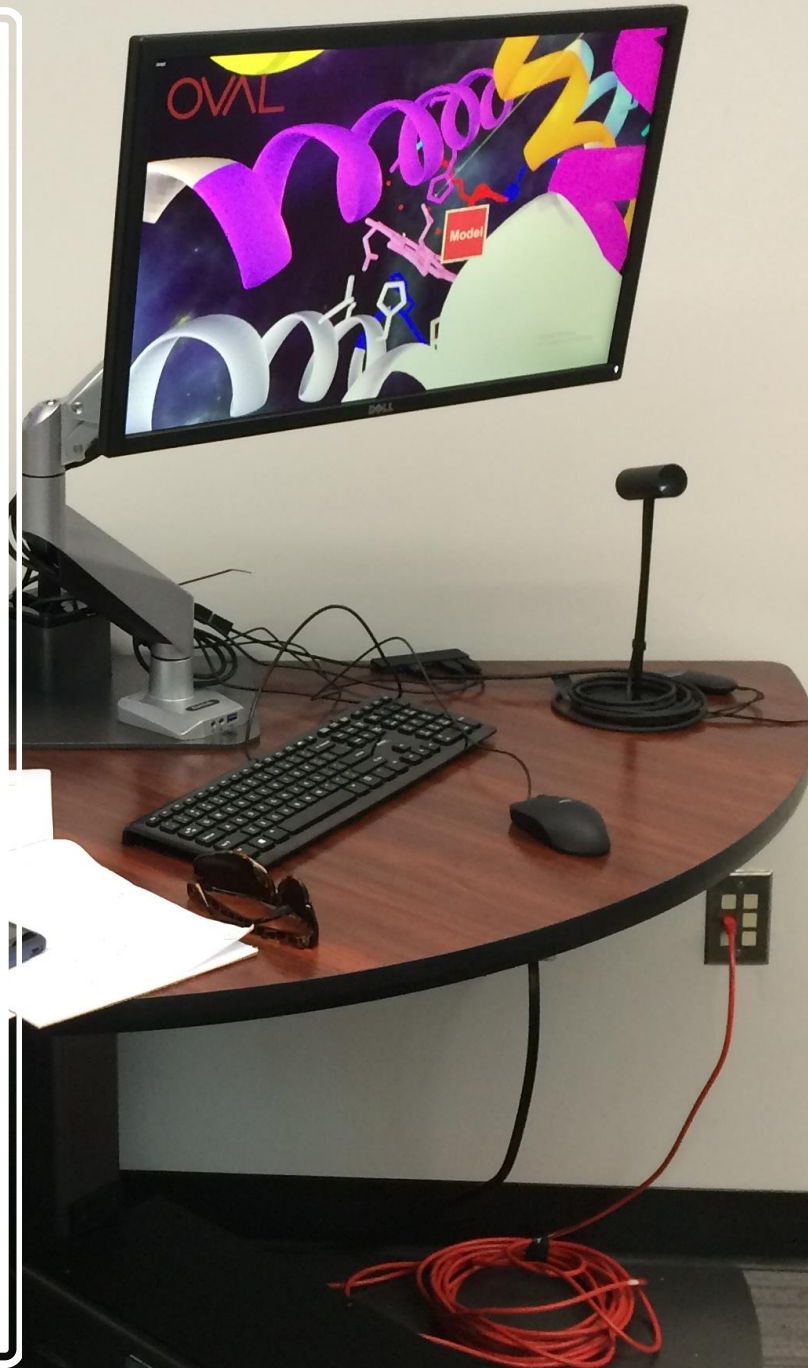
A photograph showing a group of people, including students and staff, using VR headsets in a library setting. One person in the foreground is wearing a pink beanie and a grey shirt, sitting in a white and grey VR workstation. Other people are visible in the background, some also using VR headsets. The scene is dimly lit, suggesting an indoor environment.

# Virtual Reality at OU Libraries

- **Making VR Accessible Across Campus**
  - 1000+ VR Sessions in 2016
  - 3000+ VR Sessions in 2017
- **Supporting Diverse Fields**
  - Architecture, Biochem, Anthropology, Medical Imaging, English
- **VR Systems Available Across Campus**
  - 8 Oculus Rift Workstations
  - 10 Oculus Rifts Donated by Oculus
  - 2 HTC Vive

# Research on VR Impact

- Data Collection from Fall 2017 Undergraduate Classes
  - Biochemistry (N=6)
  - Anthropology Class (N=28)
- Significant Findings for Anthro Students
  - **Positive impact on self-efficacy:**
    - Spatial Skills
    - VR Technology Use



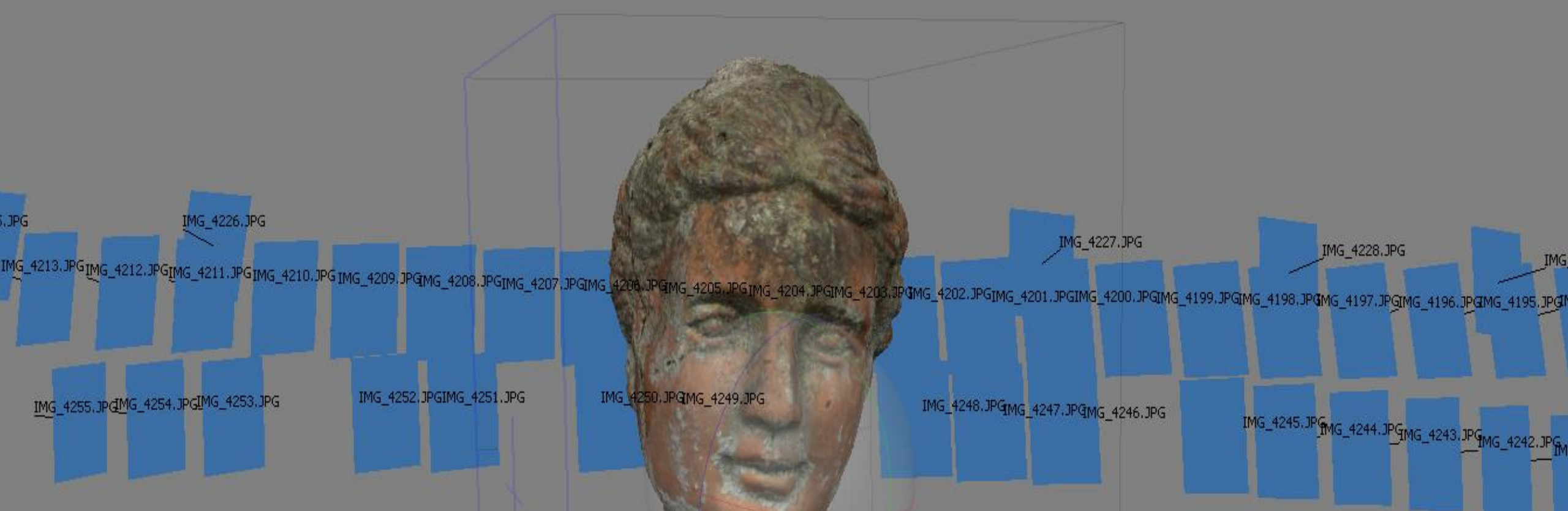


# VR Content - Sustainable File Formats

- OBJ Files
- COLLADA (.dae)
  - Open, ISO Standard
  - XML-based
  - Embed Metadata
- Color/Texture Files
- .x3d Format
  - Open, ISO standard

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      <author></author>
      <authoring_tool>FBX COLLADA exporter</authoring_tool>
      <comments></comments>
    </contributor><created>2017-01-27T21:06:40Z</created>
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    <revision></revision>
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name="centimeter"></unit><up_axis>Y_UP</up_axis></asset>
```

## COLLADA Metadata Header



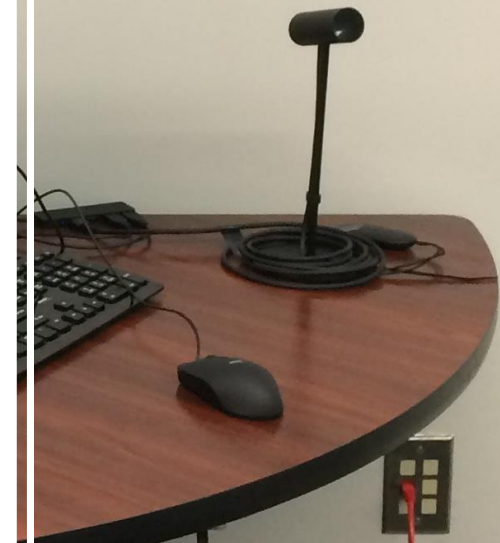
# Photogrammetry Workflow





# Metadata for 3D

- No Agreed Upon Standards and Best Practices
- Projects
  - [CARARE](#)
  - [3D-ICONS](#)
  - [Archaeology Data Service](#)
- Paradata for Cultural Heritage
  - [London Charter](#)



OK

# Metadata

- **Descriptive**
  - MODS XML
- **Production / Paradata**
  - Who created it? What techniques/tools?
- **Technical**
  - File types, resolution, polygon counts
- **Structural**



## **VR Platform - Challenges**

- Hardware/Software Obsolescence
  - Risks to Continued Access
  - Accessing Archived Content
- Software Versioning
  - Impact on Reproducibility

# Preserve Data Created in VR

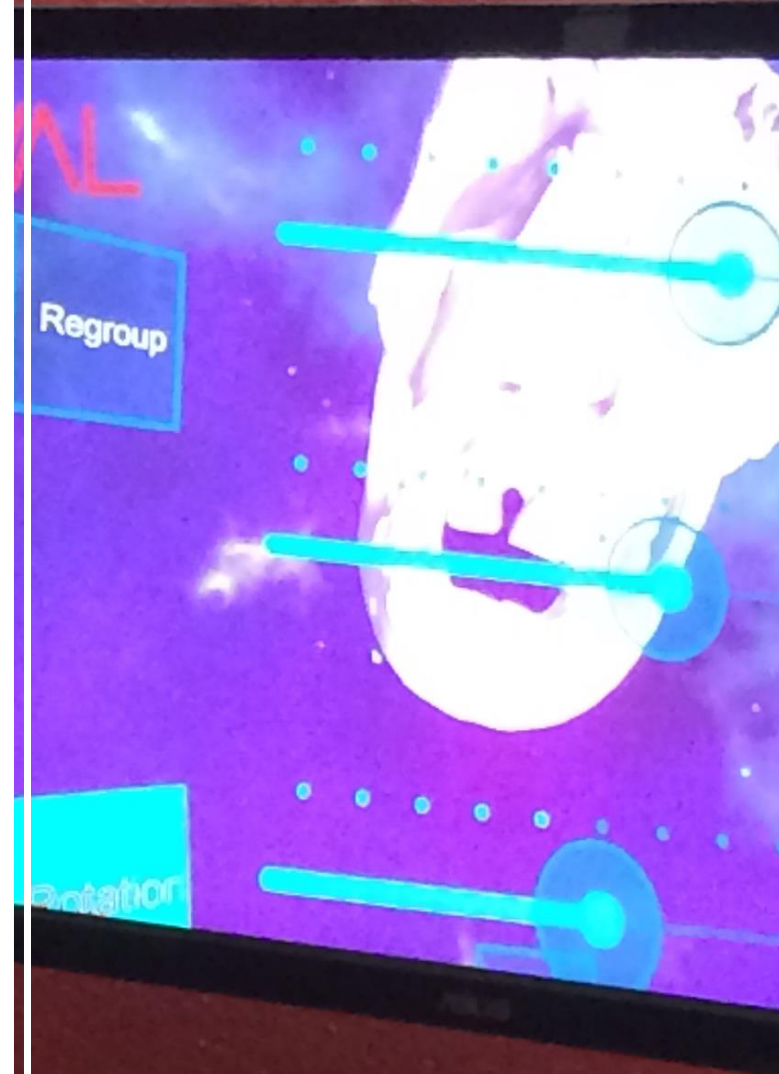
- Annotations
- Measurements
- Videos





# Preservation Approaches

- Document Configuration of System
- Plan for Emulation
- Follow Standardization Initiatives
  - Khronos Group / OpenXR  
<https://www.khronos.org/openxr/>
- Recording “The Experience”
- “Computer Museum” Approach



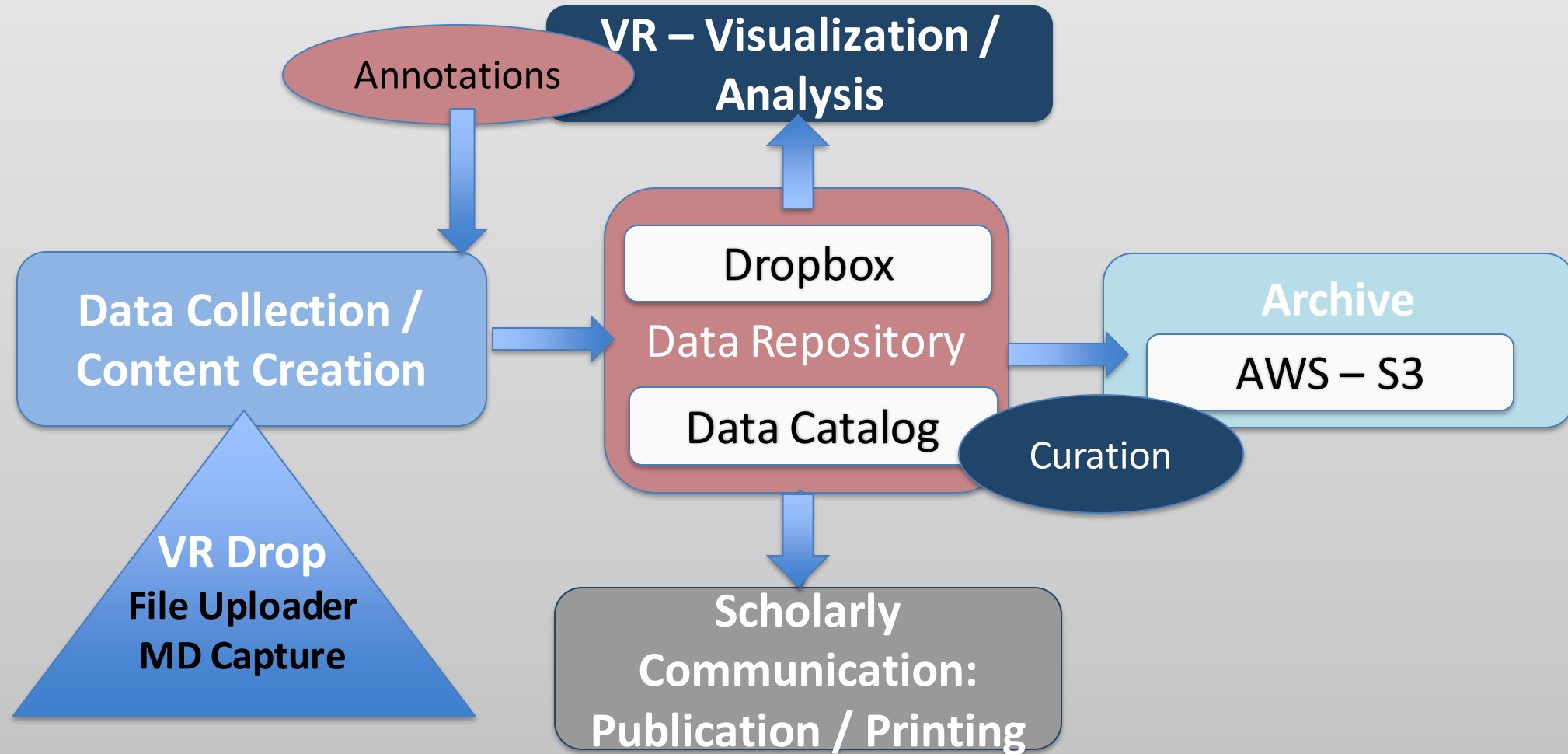
# VR Platform – Directions Forward

- Support Researchers
  - Issue DOIs for OU Software Releases
  - Citation Guidelines for Scholars
- Archiving Code: Github > Zenodo
- Archive Authoring Software / Document Configurations





# 3D/VR Research Data Ecosystem



# Developing Library Strategy for 3D & VR Collection Development and Reuse

- With Virginia Tech & Indiana University
- IMLS Funded National Forum Grant
  - **Forum A:** Content Creation and Publishing (March 1-2, DC)
  - **Forum B:** Visualization and Analysis (June 13-15, Norman)
  - **Forum C:** Repository Practice and Standards (Sept. 17-18, Chicago)





# CLIR 3D/VR Colloquium

- Support from CLIR, UC-Santa Cruz, Temple, and OU
- Participants from a Range of Backgrounds:
  - Academic Librarians
  - Humanities Scholars
  - Biologists
  - Weather Researchers
  - 3D Animators
  - Commercial 3D Hosting Platform
- <http://vrpreservation.oucreate.com/Colloquium/>

# Findings: Areas for Further Work

- Define Role of the Library: Consultation / Infrastructure
- Define Roles & Responsibilities for Preservation
- How to Get 3D/VR to Be Taken Seriously as Research?
  - Ensuring Transparency for Research
  - Peer Review, Publishing, Tenure
- Many Stakeholders Need to be Part of the Conversation
- Look to Fields Where 3D Creation is Accepted Practice



# Next Steps

- CLIR 3D/VR Colloquium: CLIR Report (Fall 2018)
- IMLS White Paper (Fall 2018)
- NSF Grants with OU Faculty
  - Biology
  - Chemical Engineering
- Grant to Fund Cyberinfrastructure for 3D/VR

# Q&A

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**CLIR Postdoctoral Fellow in Data**  
**Curation**

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