



Web3D Consortium Medical WG Update

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Virginia Tech

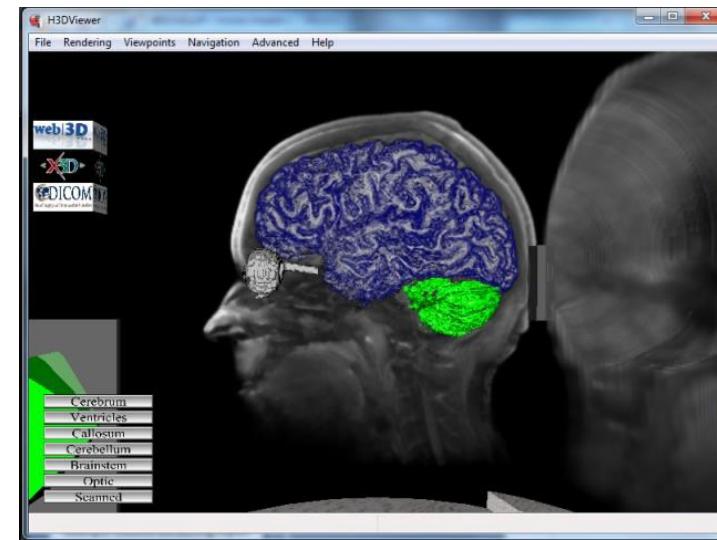
Web3D Consortium

web|3D
CONSORTIUM

Topics



- Introduction
- Rendering
 - Volume Rendering
 - Extensions
 - Other Medical data
- 3D printing (NIH 3D Print Exchange)
- Informatics
 - HL7 (FHIR)
- Next Steps



Web3D Medical WG

Funded by US Army to specify and standardize an X3D Volume Rendering Component (2006)

Notables:

- IEEE VR Workshop
- Web3D Conference workshops
- SIGGRAPH BOFS
- MOU with DICOM – n-Dimensional Presentation States
- SOU with HL7

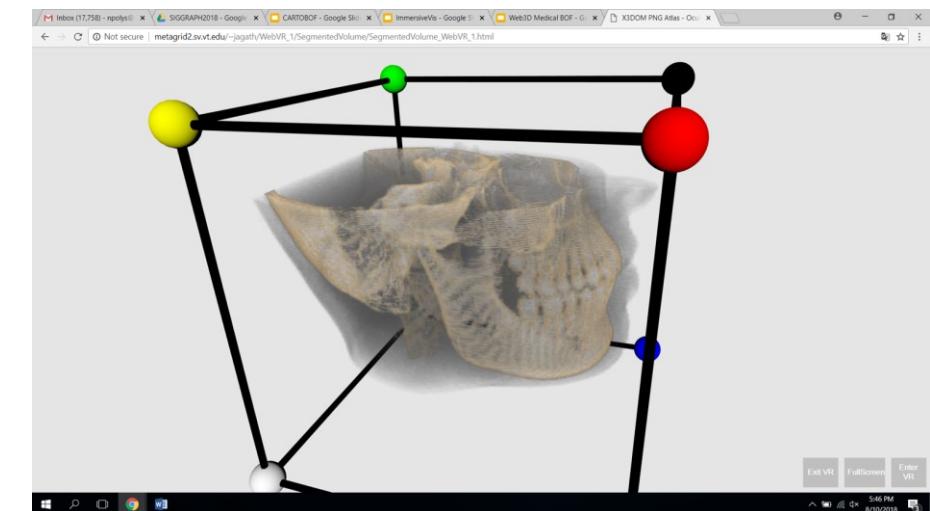
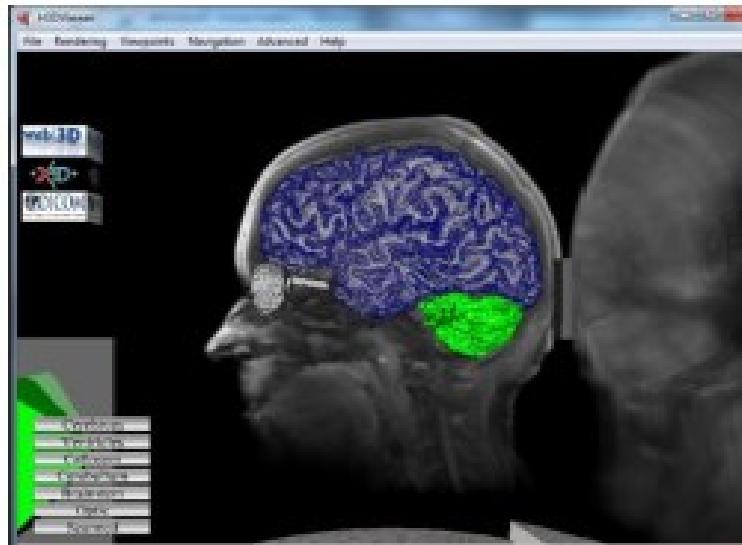
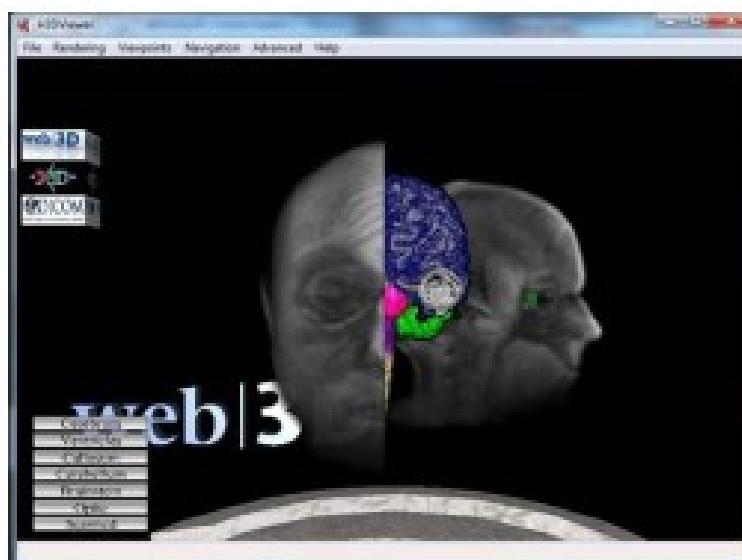
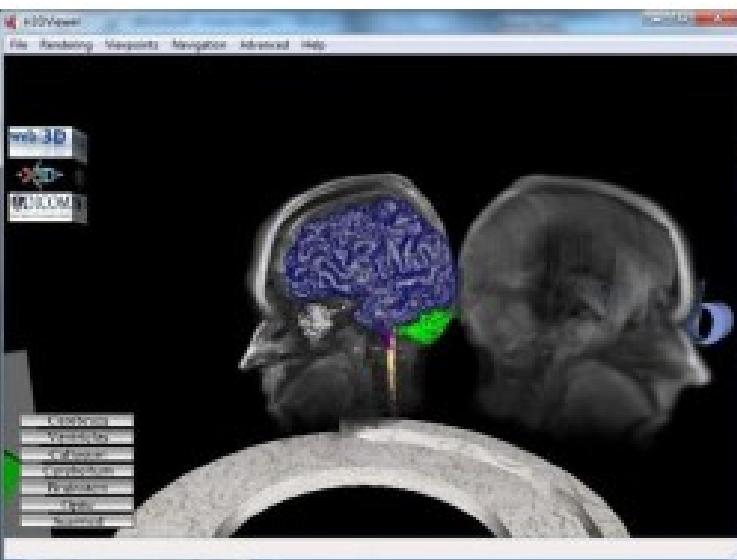
Kinds of data, kinds of stakeholders

Health and Medicine

- Exercise
- Therapy
- Simulation
- Surgery
- Genomics
- Analytics
- Networks
- ...

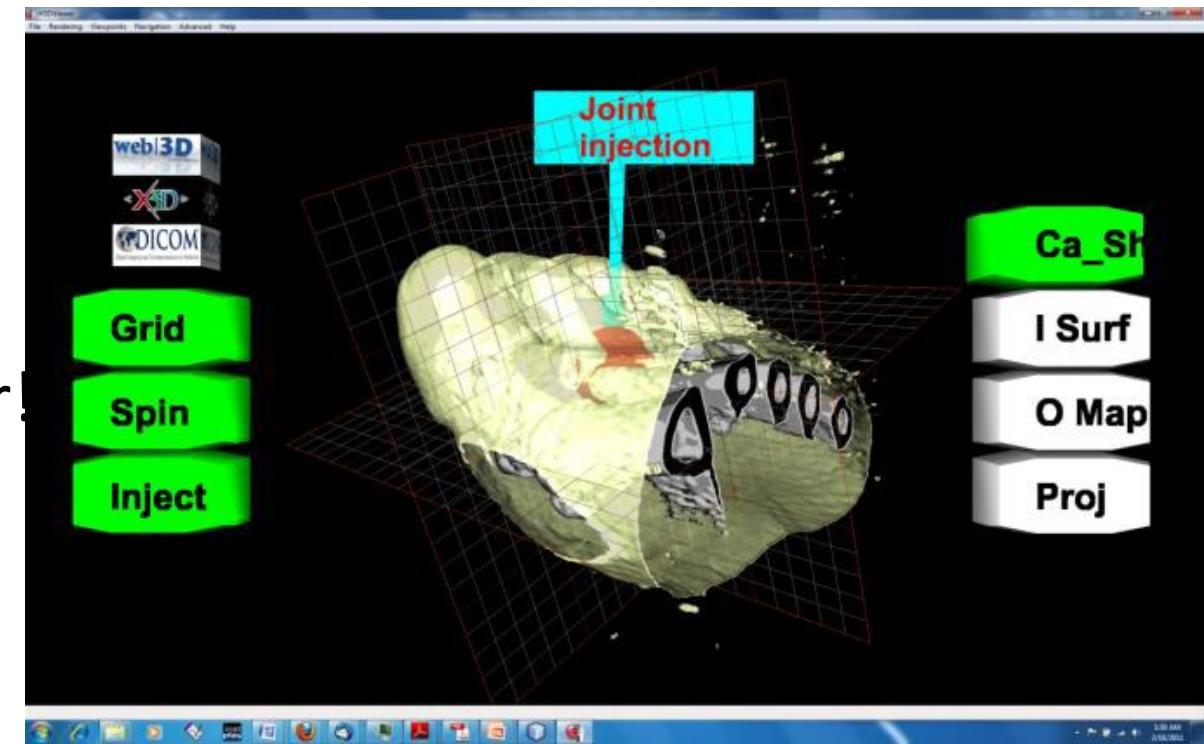
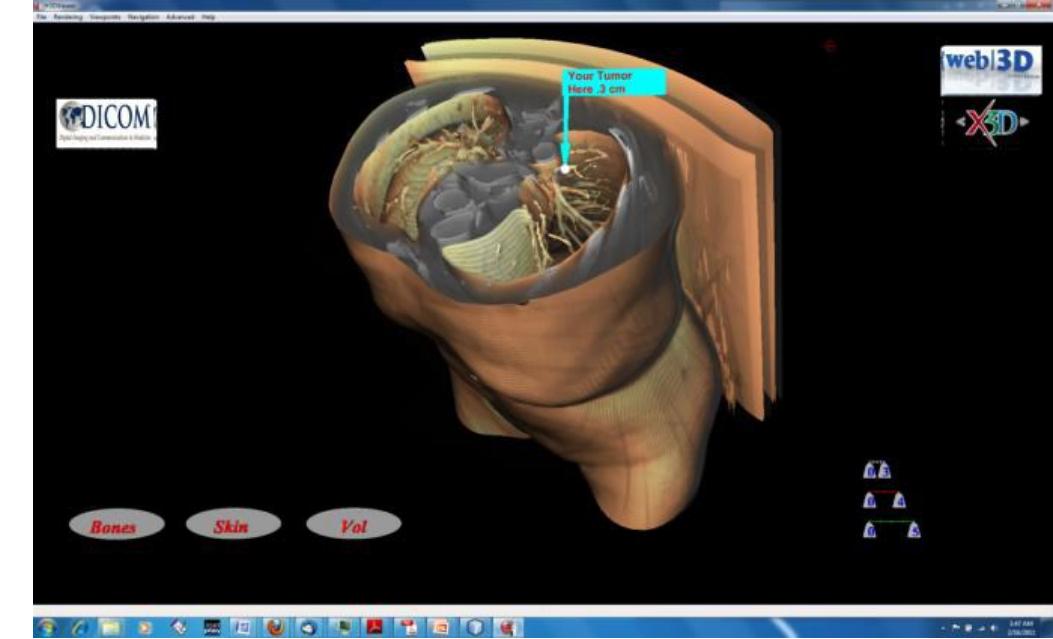


X3D Volume Rendering



Access: WWW and VR

- X3D: desktop, mobile, immersive VR/MR/AR
- Imaging
 - X3D Volume Rendering
 - TIFF stacks, DICOM, NRRD, PNG
 - Scripted automated conversions
- Molecular Visualization
- Immune Simulation
- Genomic alignment
- Polygons and volumes living together
- VR and 3D printing !!!



Access: X3D Volume Rendering

- DICOM, NRRD, TIFF:
 - <https://www.youtube.com/watch?v=ml7zfrH6A9U&t=37s>
- Segmentations and Interaction Mashup:
 - <https://www.youtube.com/watch?v=ZO3jWjW9soE>
- Cell images with corresponding surfaces:
 - <https://www.youtube.com/watch?v=srpiEBvbG-Q&list=UUoQkIIQuVbdKEBqgefLbhzw>
- Many publications (cite)

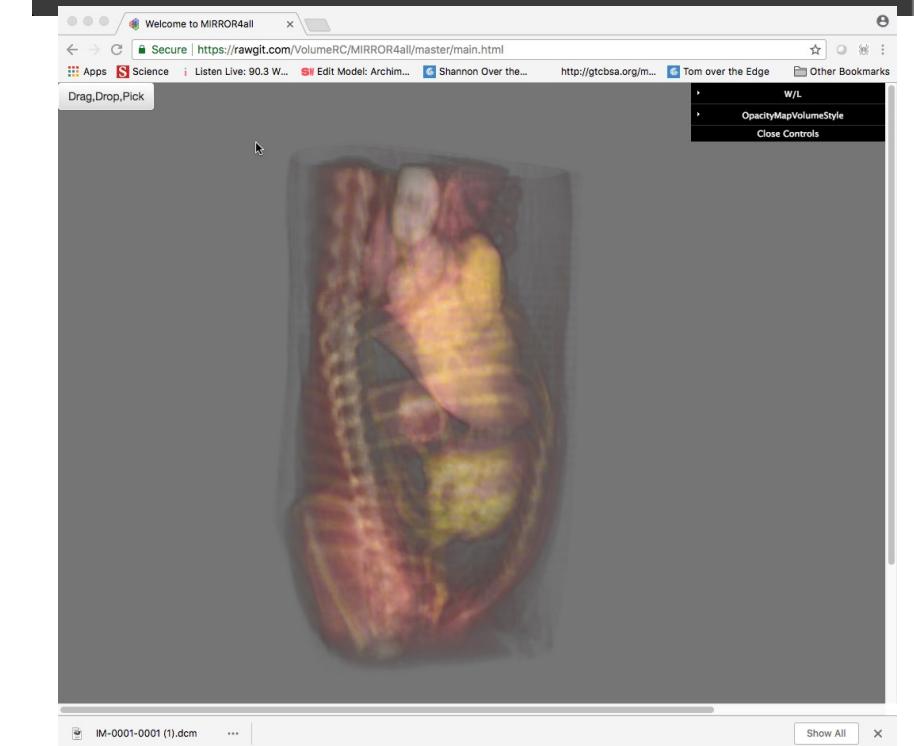
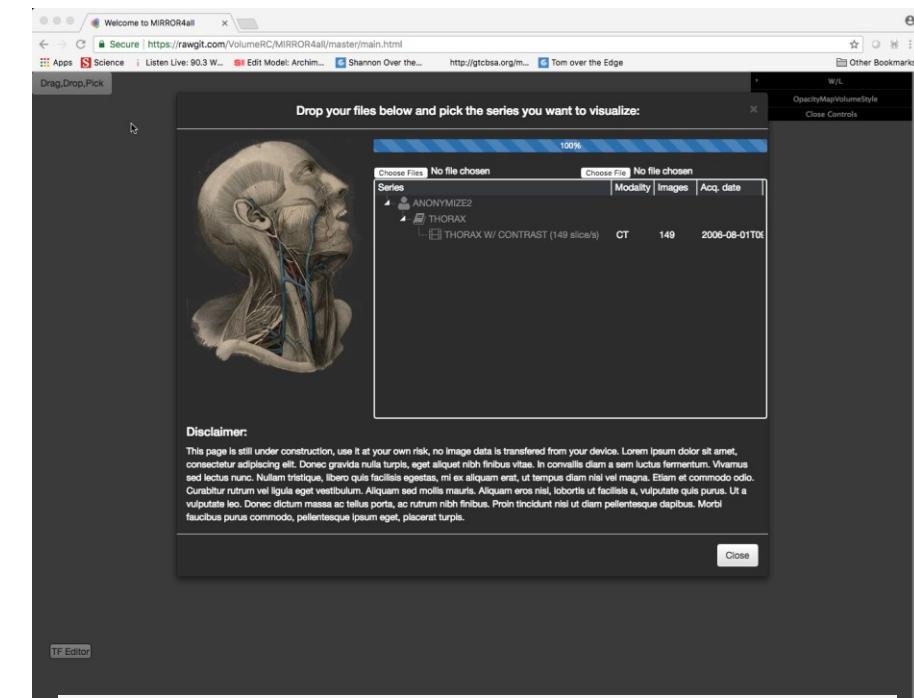
Extensions

- **ImageTextureAtlas**
 - **MovieTextureAtlas**
 - **VolumeData**
 - **MPRVolumeStyle**
-
- Ander Arbelaitz, Aitor Moreno, Luis Kabongo, Nicholas Polys, and Alejandro García-Alonso. 2017. Community-driven extensions to the X3D volume rendering component. In Proceedings of the 22nd International Conference on 3D Web Technology (Web3D '17). ACM, New York, NY, USA, Article 1, 9 pages. DOI: <https://doi-org.ezproxy.lib.vt.edu/10.1145/3055624.3075945>

Access: Web Volume Rendering in X3DOM

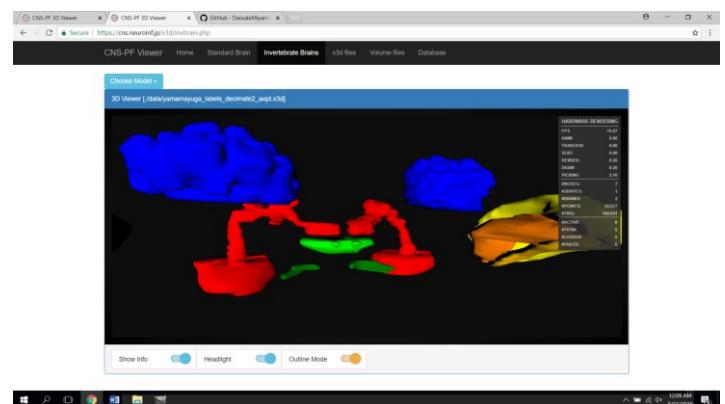
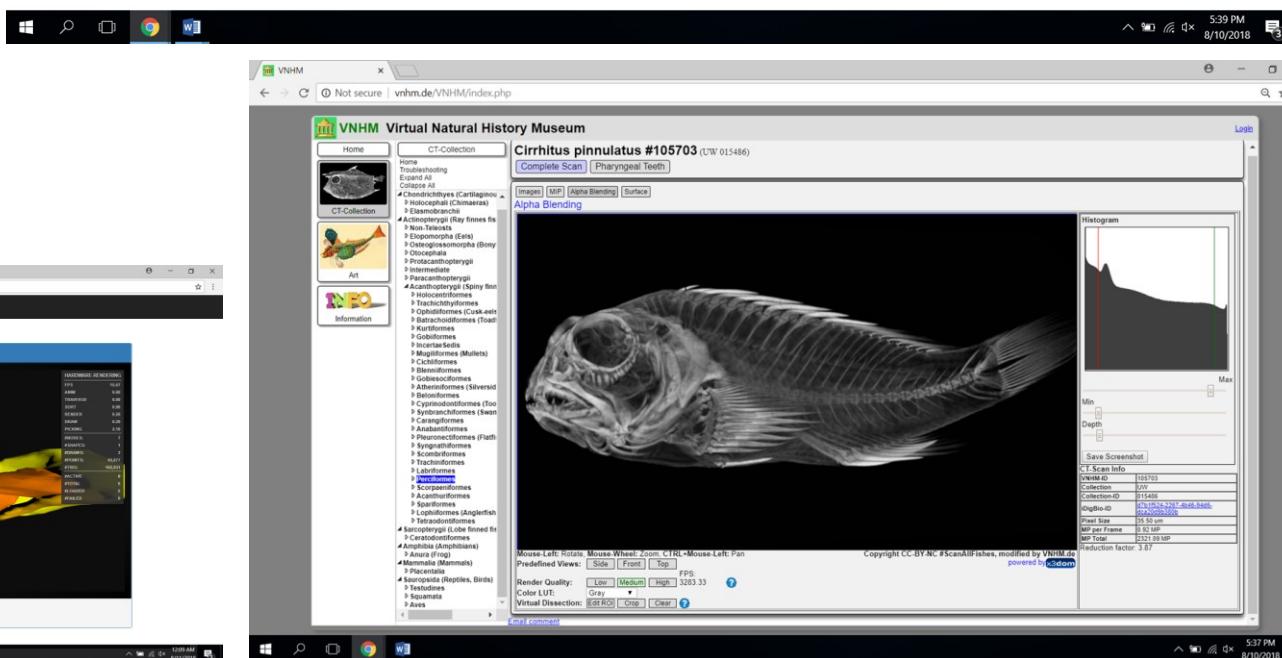
HTML5 + WebGL + X3D

- [VICOMTech: Volumerc.org](#)
 - Online drag-and-drop service for DICOM:
 - To HTML5/WebGL/X3DOM
- [Mirror4All](#) by VICOMTECH
and KShell



Access: WWW and VR

- HTML5 + X3D Portals
 - *Zebrafish genetic and neuro atlas*: zbbrowser.com
 - *Virtual Natural History Museum*: <http://vnhm.de>
 - CNS-PF [neuron viewer](#)
 - Cell image library
 - NIH 3D Print Exchange

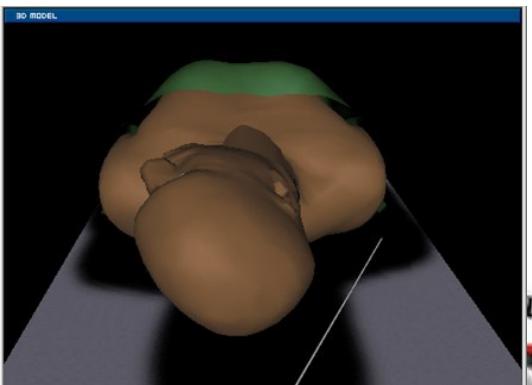


Access: WebVR

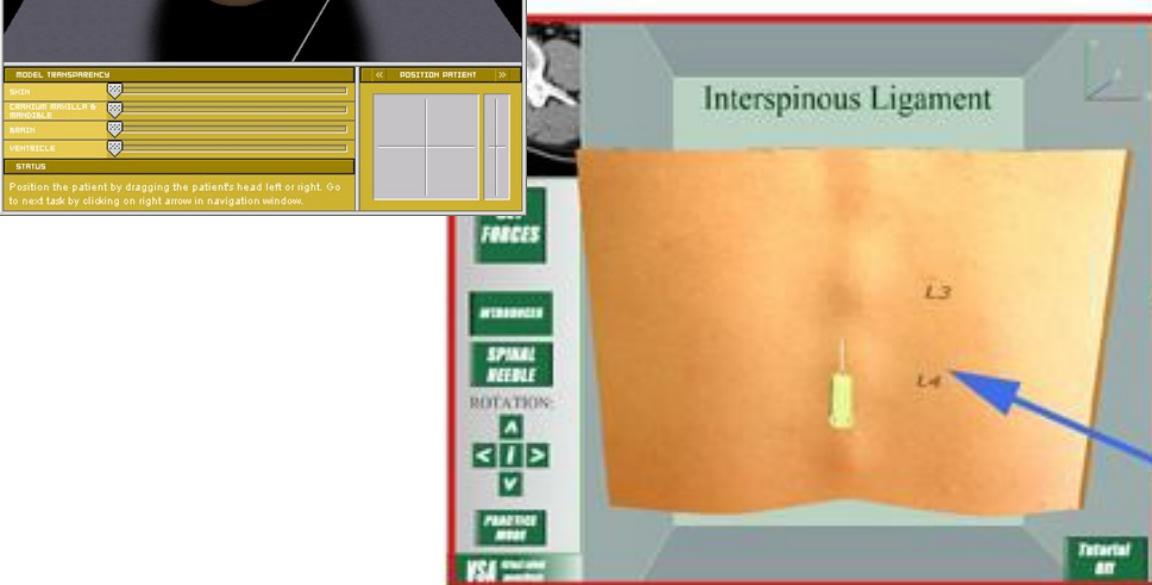
- X3D and HTML5 files
- Uses the browser as the platform
- Many headsets



Rehearsal; Consent



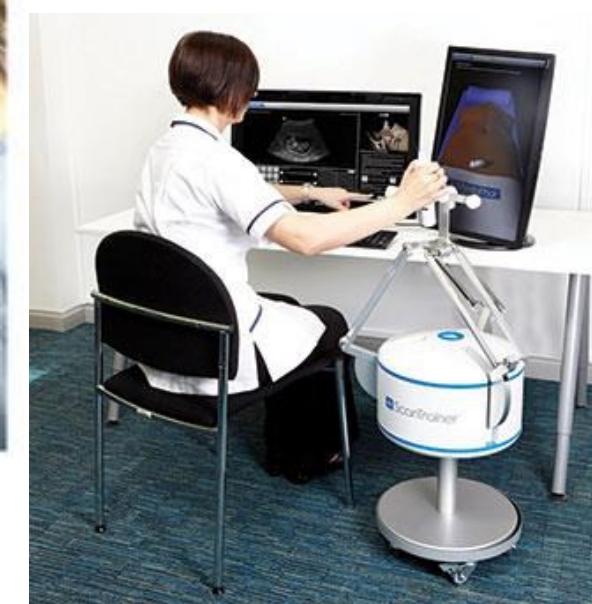
Virtual Environment



Immersive Workbench



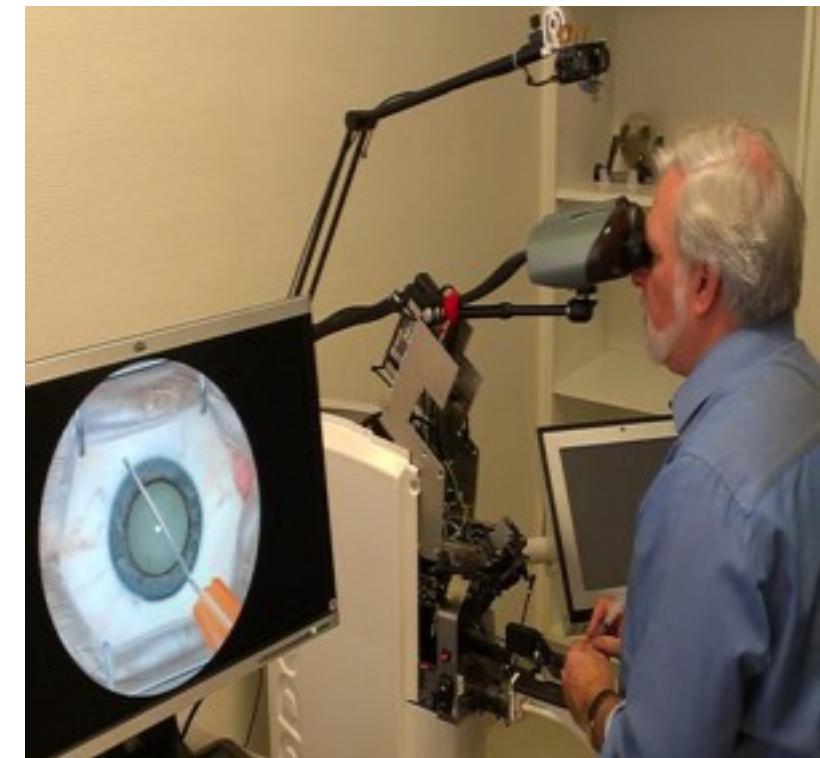
Virtual Needle



Surgical Simulation

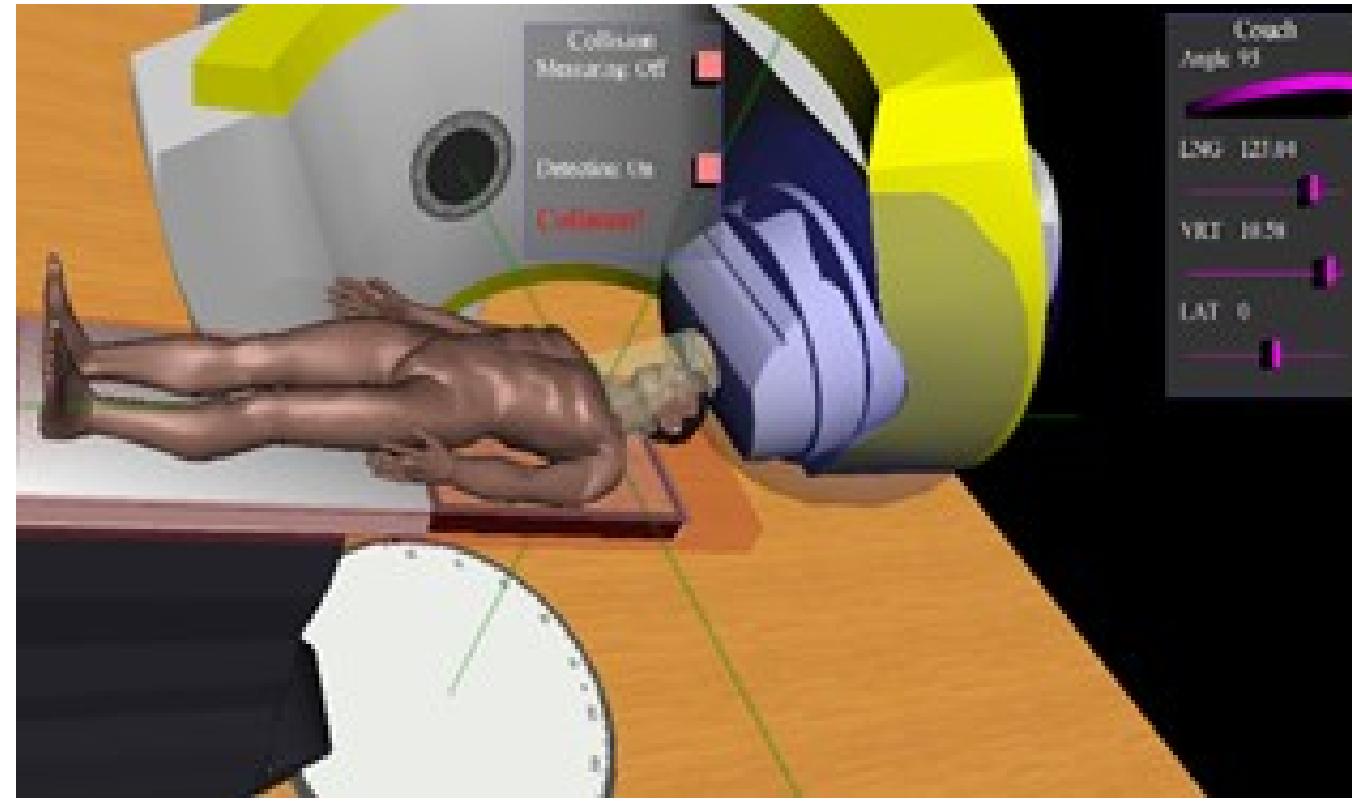
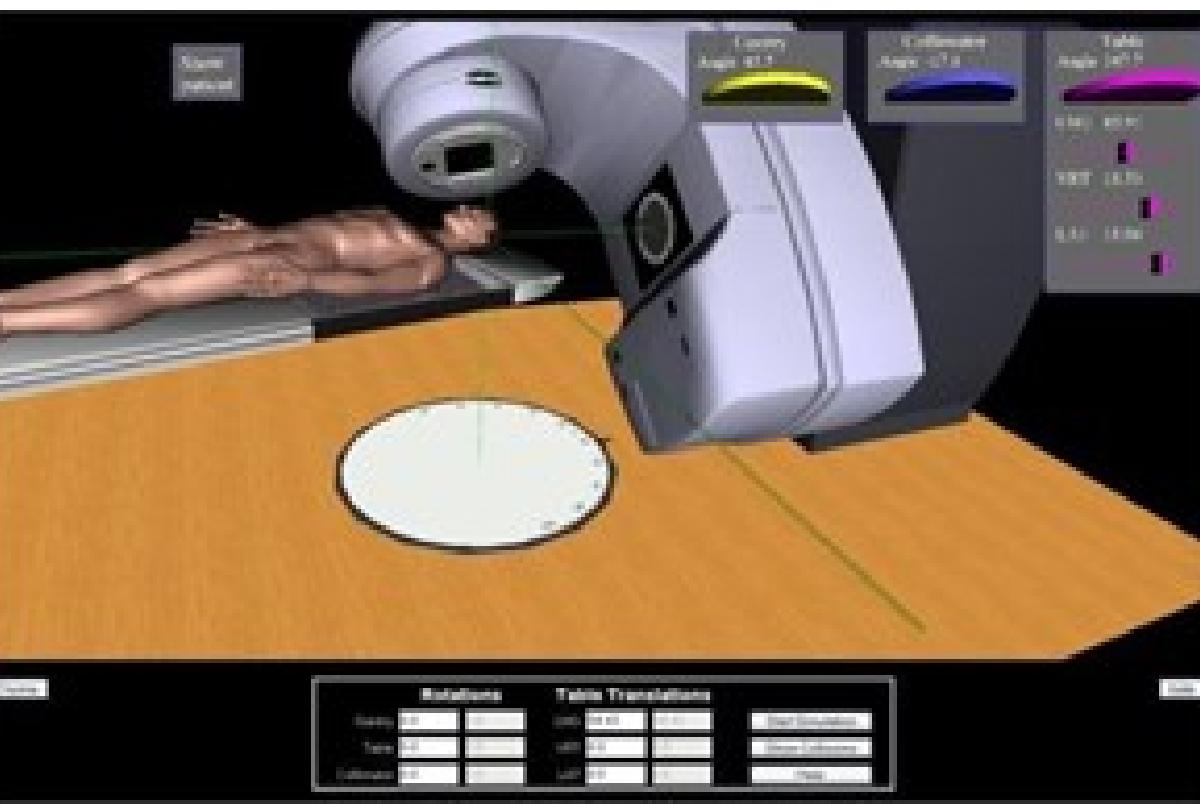
X3D as a platform for Haptic simulation and Medical training

- H3D.org
- Nigel John's trainers:
 - Eye surgery simulator
 - Ventricular catheterization training
- MMVR 2014 workshop
- “Quantizing the Void” paper



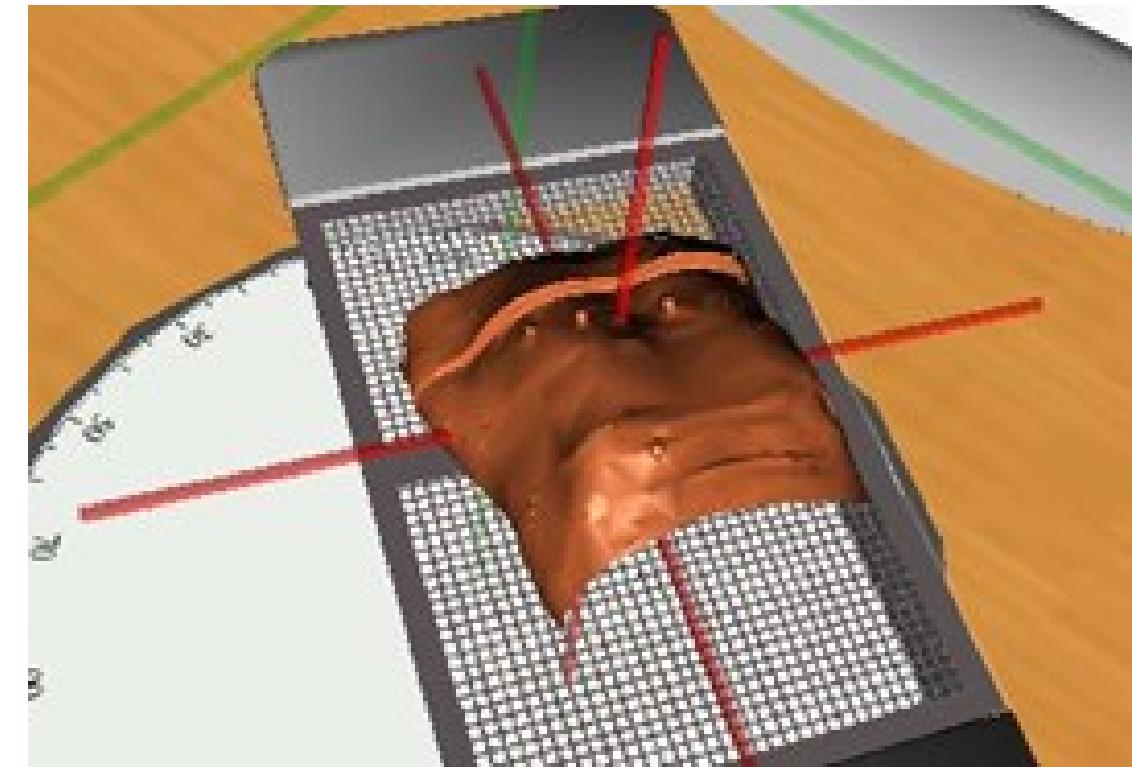
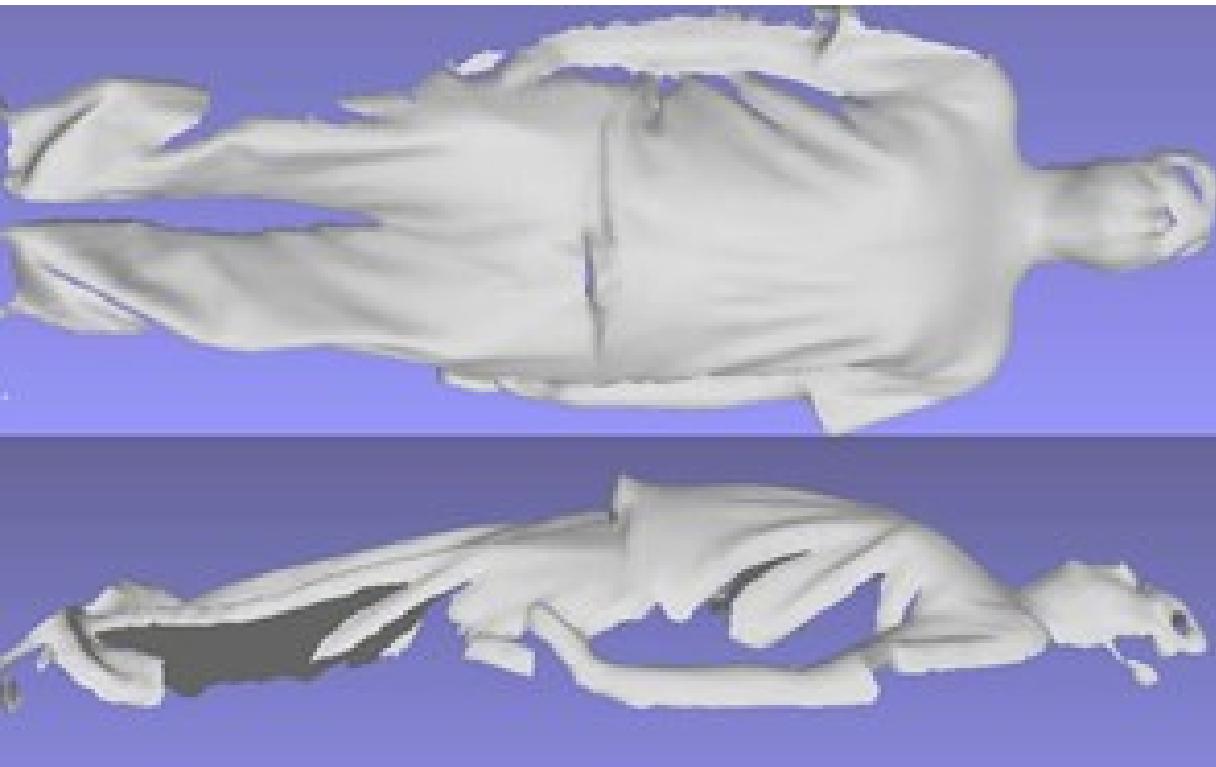
Safety and Radiation Therapy

X3D simulation of X-Ray therapy: Felix Hamza-Lup



Safety and Radiation Therapy

**Patient CT data and real-time boundary representation for the
3DRTT simulator (3DRTT.org)**



**High spatial and
temporal resolution
body scans**

www.3dmd.com



3dMD

Access: NIH X3D Printing

3dprint.nih.gov

Cyborg Beast (Original Design)

Submitted by Creighton Lab

Model ID 3DPX-000524

GENERAL INFORMATION

Statement

The Creighton University Research Group has made the Cyborg Beast files available for research and personal use. Our intention is to make this device accessible to everyone independent of their economic background. Our group is conducting extensive research (IRB # 13-16909) to identify benefit and functionality of our prosthetic design. Based on our research and feedback provided by our research participants we will update the files of our design. Our design has been improved with the help of many members of e-NABLE (<http://enablingthefuture.org/>) and the Creighton University Research Group.

Creighton University Research Group:

Jorge Zuniga PhD¹, Dimitris Katsavelis PhD¹, Jean Peck OTL, CHT², Al Bracciano EdD, OTR/L, FAOTA, FAIS³, John Stollberg OT³, Marc Petrykowski¹, Adam Carson¹, Nicole Dempsey¹, Keven Carey OT³, Cheryl Frickel OT³, Carolyn Tamm OT, CHT³, and Michael Mays¹

EXTRAS ATTRIBUTION HOW TO PRINT DOWNLOAD

DORV in functional single ventricle heart disease s/p Fontan

Submitted by Kevin Gralewski

Model ID 3DPX-001297

GENERAL INFORMATION

Dual Outlet Right Ventricle (DORV) status post Fontan as palliation for common atrioventricular canal defect causing functional single ventricle heart disease

Other features include:

- Interrupted inferior vena cava (IVC) with aygus continuation to the left superior vena cava (SVC).
- Bilateral SVCS
- Ligated native pulmonary artery (PA)
- Heterotaxy

Category Medical/Anatomical

Keywords(s)

DORV, common AV canal defect, interrupted IVC, Fontan heterotaxy

DOWNLOAD



COMPLEX OF A B21 CHICKEN MHC CLASS I MOLECULE AND A 10MER CHICKEN PEPTIDE

Autogenerated by ACUKE for ACUKE

Model ID 3DPX-009522

GENERAL INFORMATION

This Model was autogenerated from the "Quick Submit" tool.

Category Proteins, Macromolecules and Viruses

Protein Data Bank ID ZYEZ

Keywords(s)

IMMUNE SYSTEM, BF21, Immune response, Immunoglobulin Domain, MHC I

ATTRIBUTION MODEL DETAILS

DISCOVER SHARE CREATE LEARN

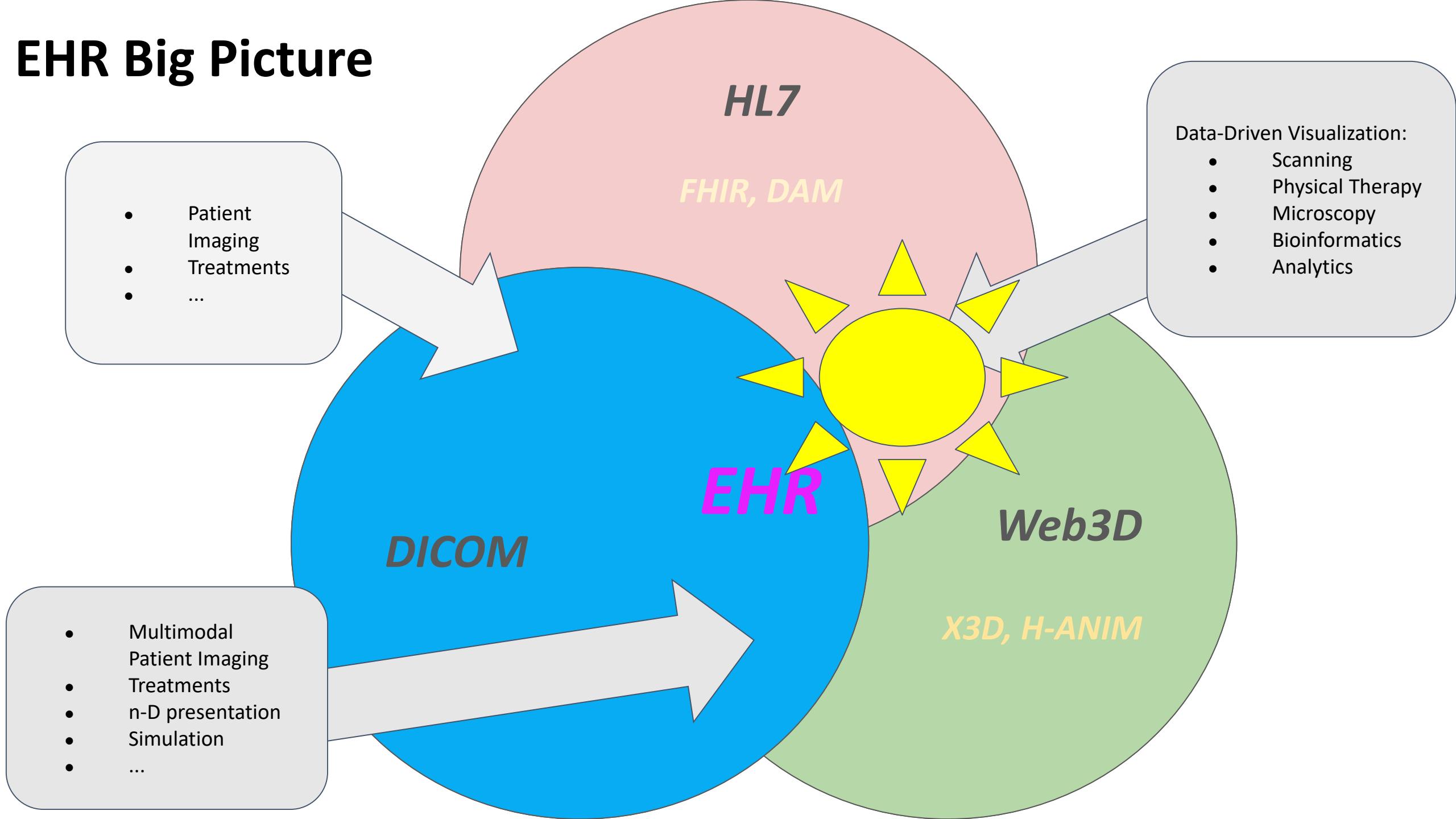
Choosing X3D for Enterprise 3D printing services

- X3D is lossless for meshes, color, metadata (STL IS NOT)
- Supported by many tools in the field (biochemistry)
- Web Services for processing translation
- CURA open source slicing toolkit for native X3D printing
 - Shapeways color printing
 - Ultimaker
 - NetFabb

HL7

- FHIR <http://hl7.org/fhir/> (FHIR)
 - Example: <https://syntheticmass.mitre.org/api.html>
- Loinc.org LOINC is a common language (set of identifiers, names, and codes) for identifying health measurements, observations, and documents. If you think of an observation as a "question" and the observation result value as an "answer."
- Where needed, codes from other standards (e.g. SNOMED CT) represent the "answer."

EHR Big Picture



Path Forward

X3D in HL7:

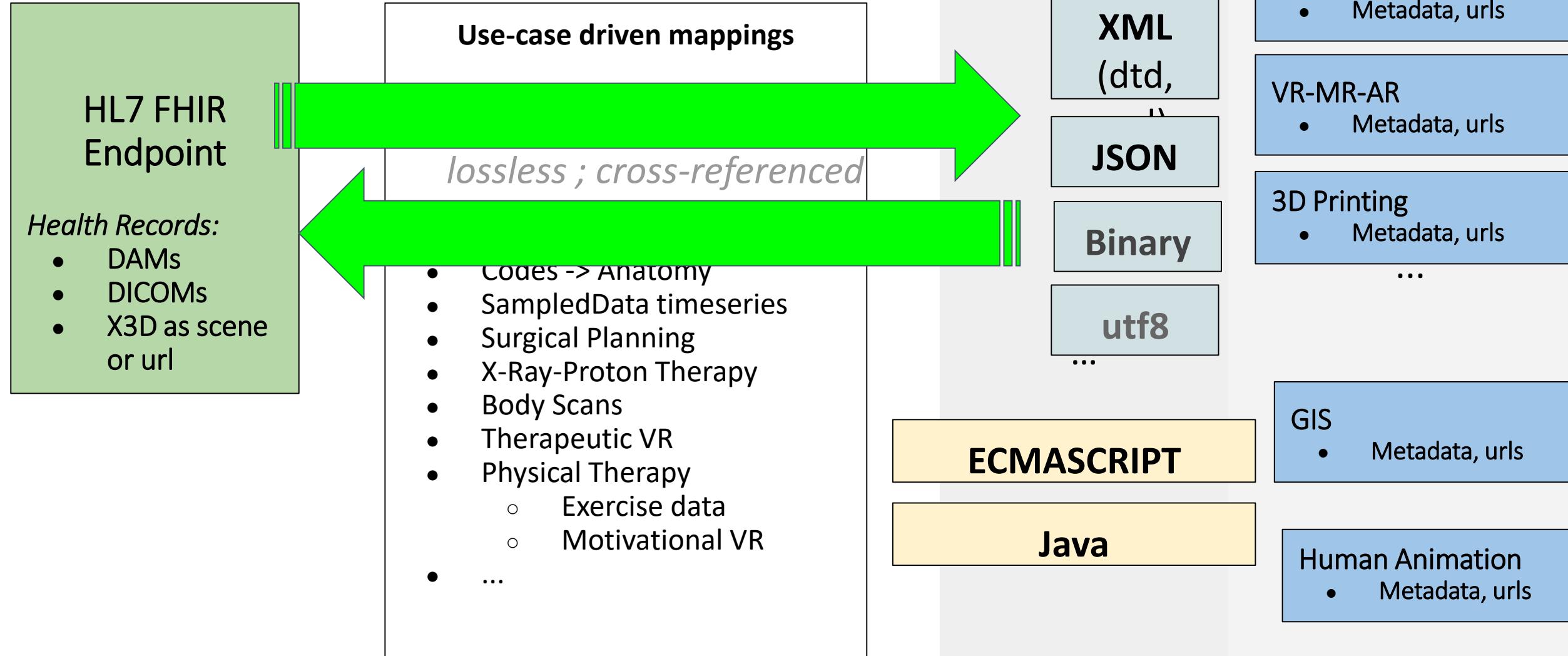
- XML & JSON payloads of X3D content in FHIR
- DAM-specific integrations

HL7 in X3D:

- Metadata vocabularies & reference practice
- Using 3D Semantic Interaction to explore high-dimensional HL7 information



Pipelines to Exchange Views on the Patient



Next Steps

- X3D 3.4 and 4.0 spec updates
- Web3D Quickstart tutorial @ AMIA 2019
- Web3D 2019
- HL7 Atlanta (September)