Web3D Consortium Medical WG Update

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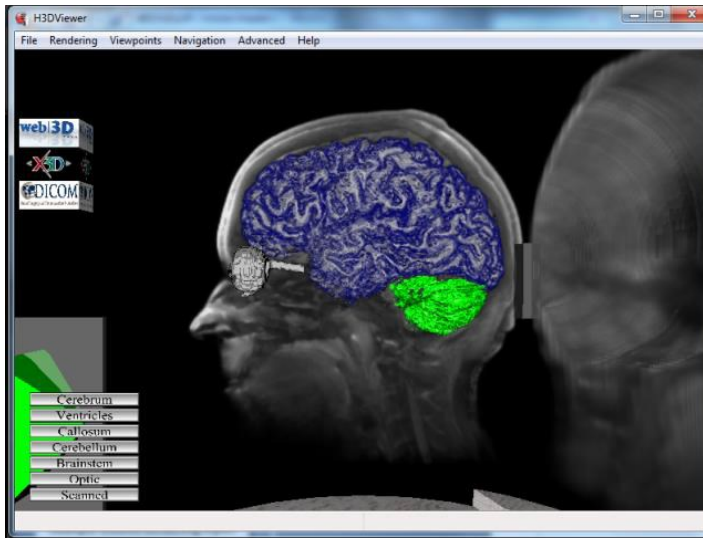
Web3D Consortium

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

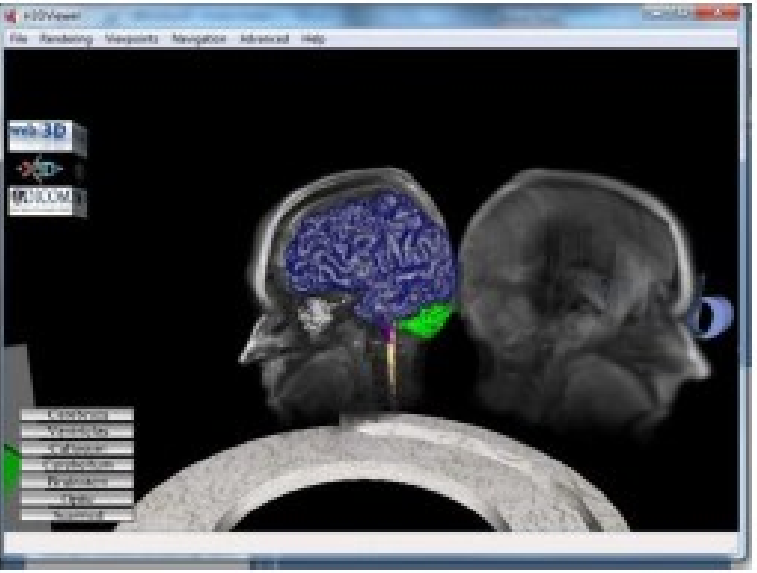
Kinds of data, kinds of stakeholders

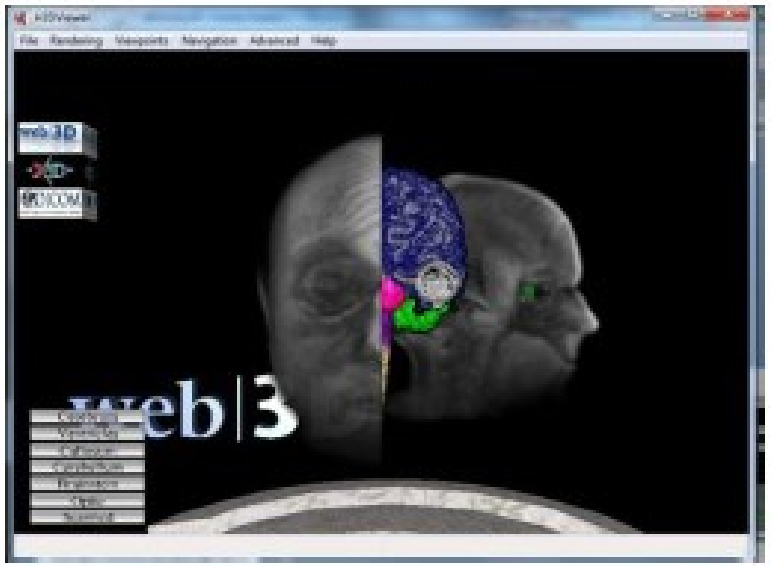
Health and Medicine

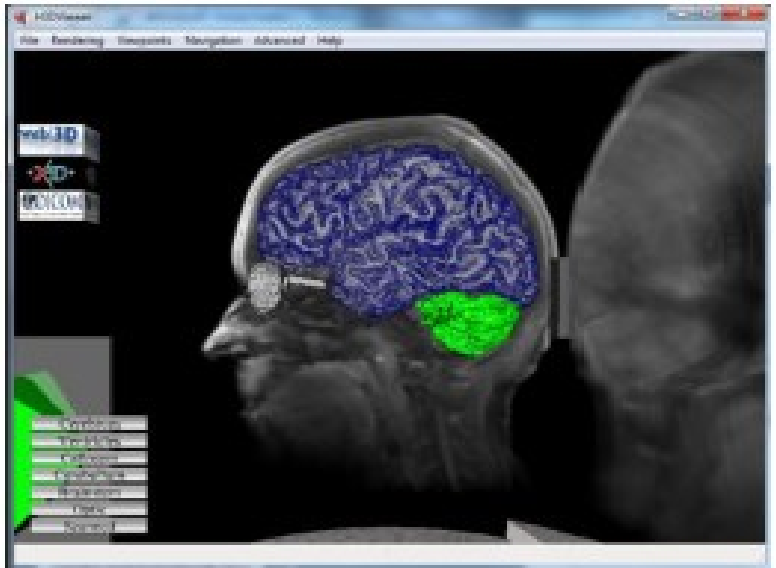
- Exercise
- Therapy
- Simulation
- Surgery
- Genomics
- Analytics
- Networks
- …

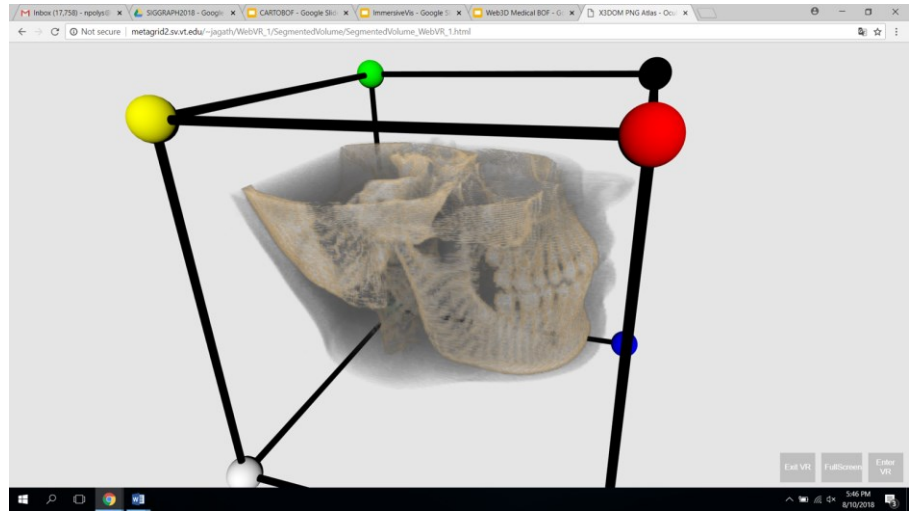
H|anim
HUMANOID
ANIMATION
WORKING GROUP

X3D Volume Rendering



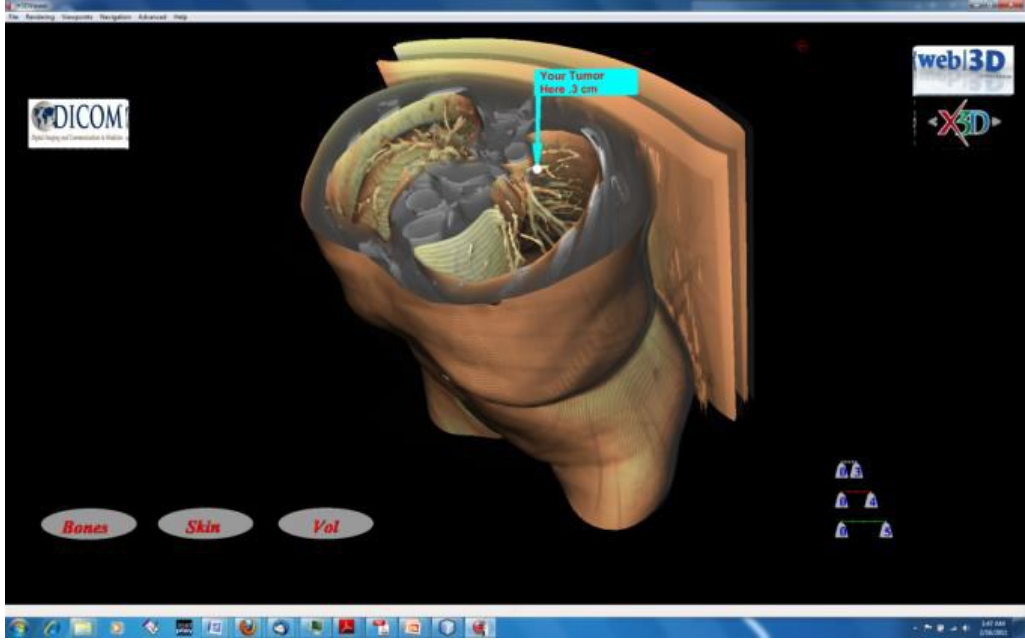


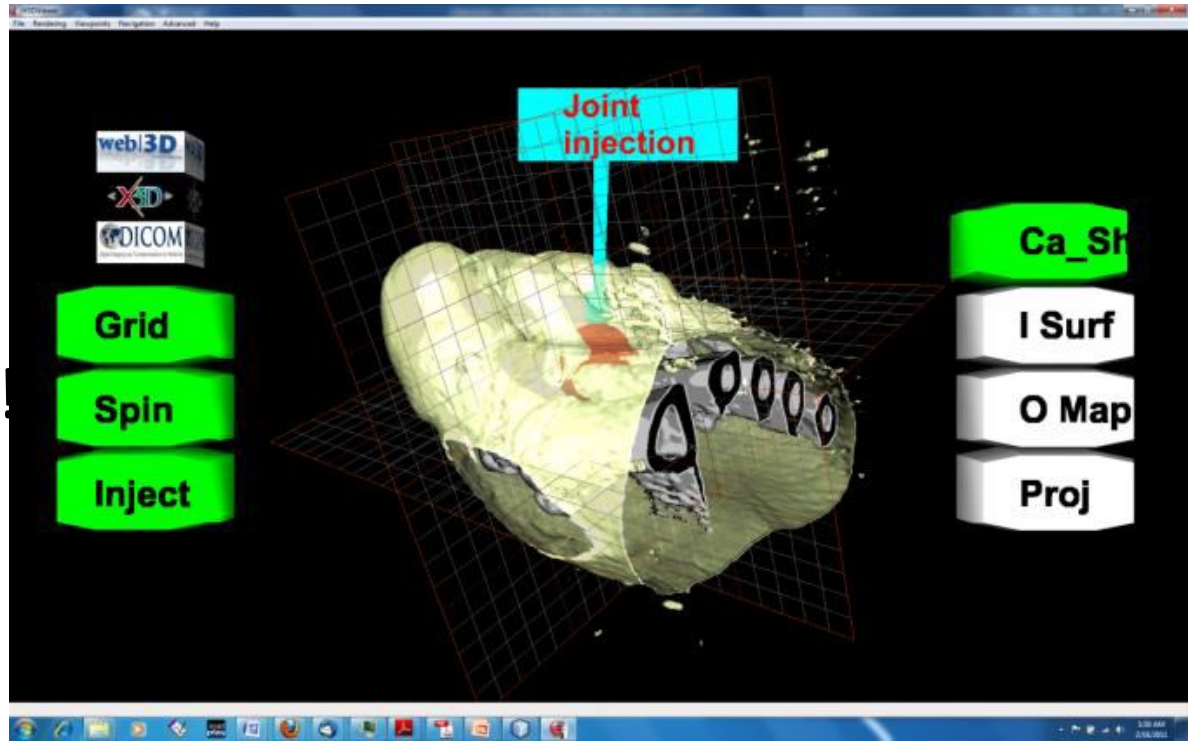




Access: WWW and VR

- 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 !!!





web3D CONSORTIUM

Access: X3D Volume Rendering

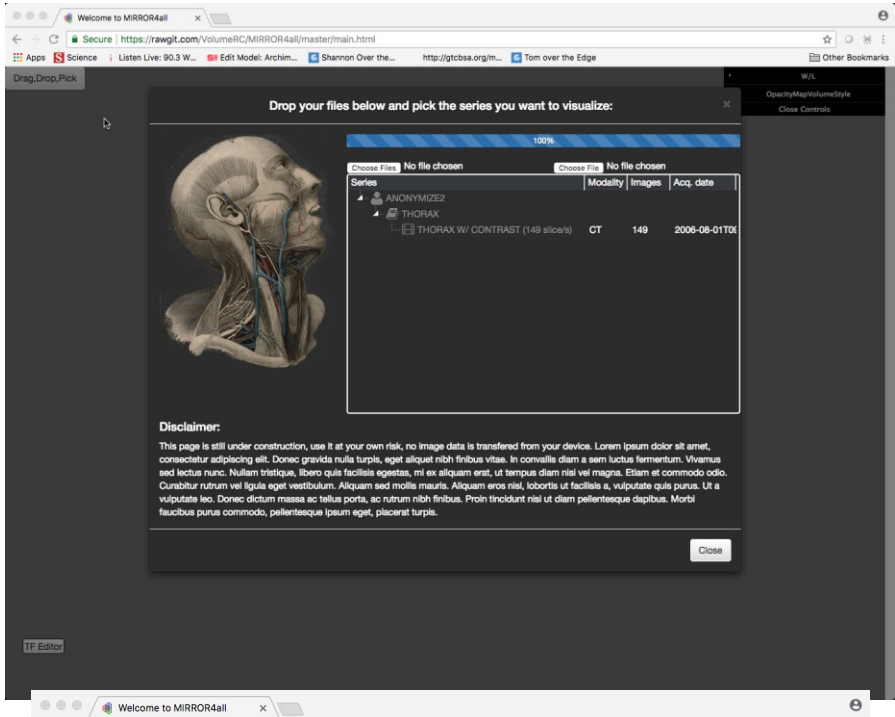
- DICOM, NRRD, TIFF:
  - https://www.youtube.com/watch?v=mI7zfrH6A9U&t=37s
- Segmentations and Interaction Mashup:
  - https://www.youtube.com/watch?v=ZO3jWjW9soE
- Cell images with corresponding surfaces:
  - https://www.youtube.com/watch?v=srpiEBvbG-Q&list=UUoQklIQuVbdKEBqgefLbhzw
- Many publications

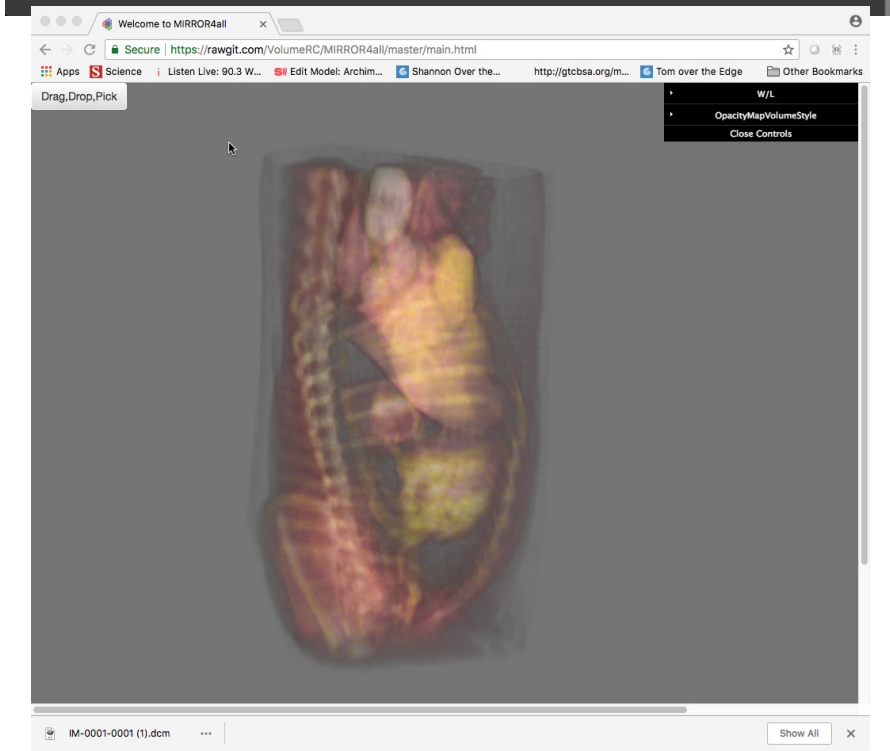
Extensions

- ImageTextureAtlas
- MovieTextureAtlas
- VolumeData
- MPRVolumeStyle

- Ander Arbelaiz, 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



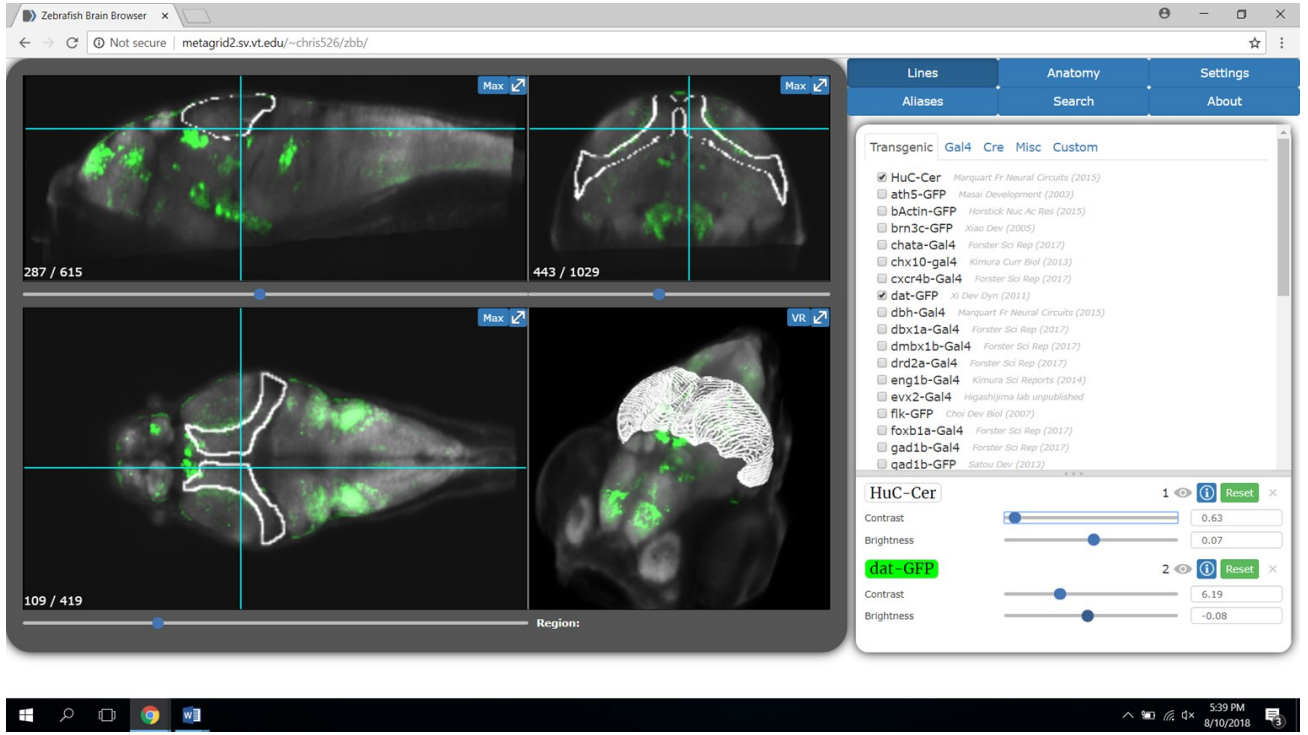


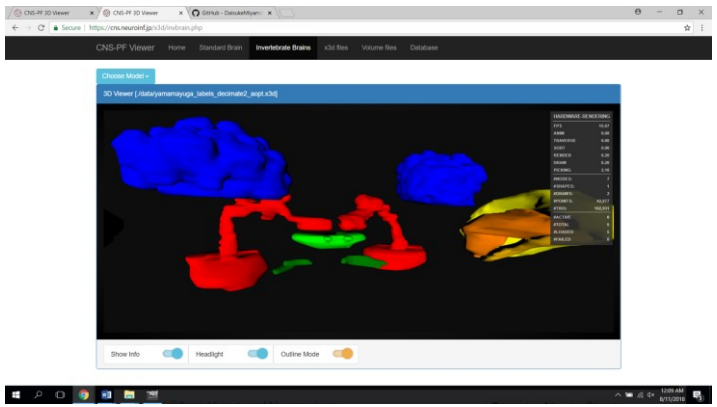
HTML5 + WebGL + X3D

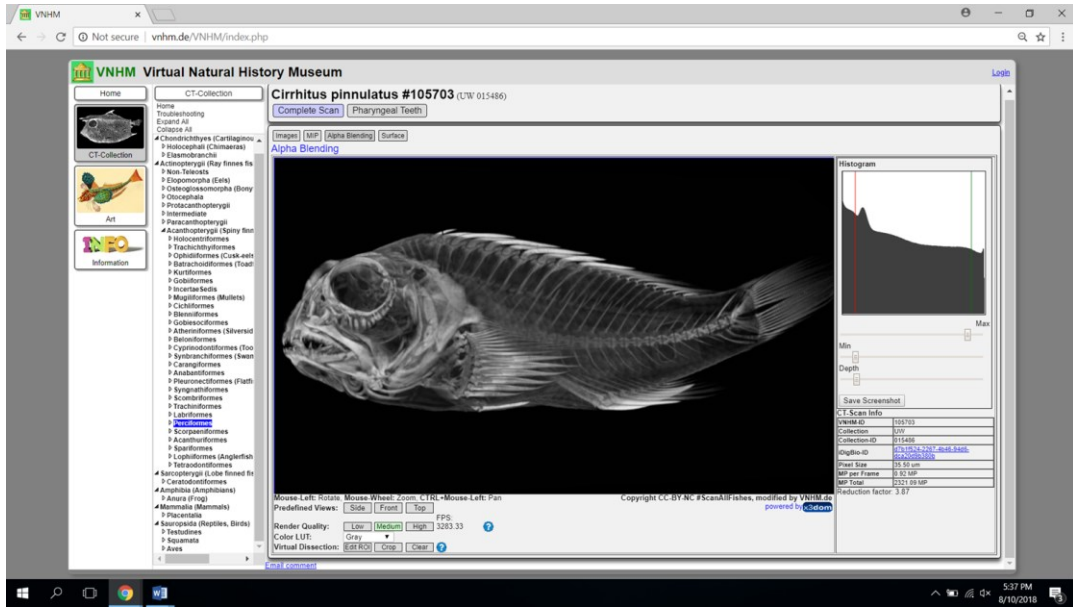
- VICOMTech: Volumerc.org
- Online drag-and-drop service for DICOM:
  - To HTML5/WebGL/X3DOM Mirror4All by VICOMTECH and Kshell
  - Open source python processing scripts

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



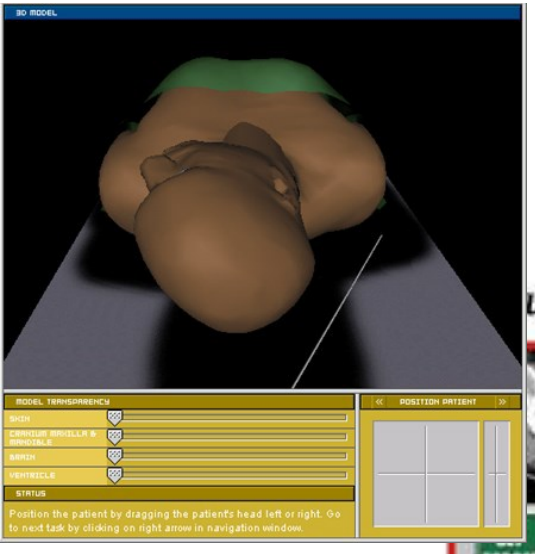




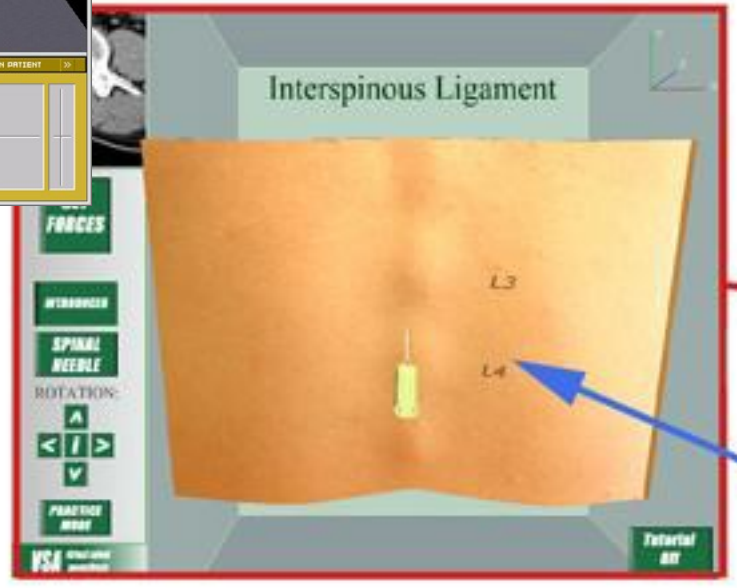
Access: WebVR

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

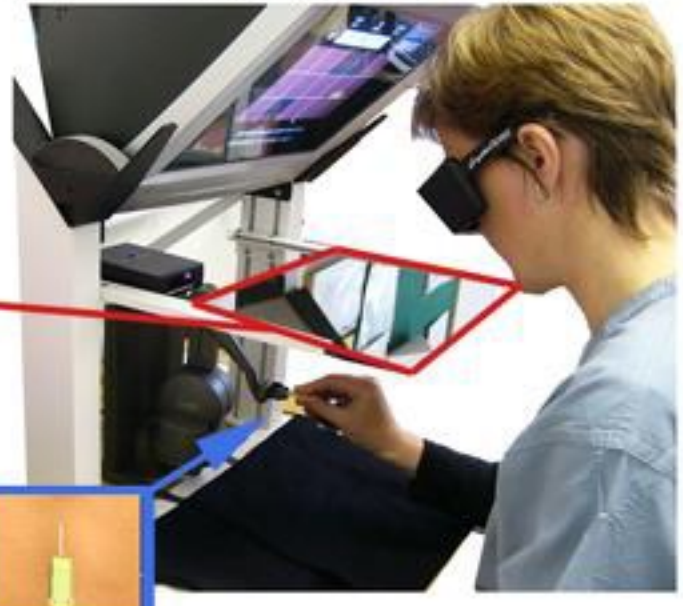
Rehearsal; Consent



ual Environment



Immersive Workbench

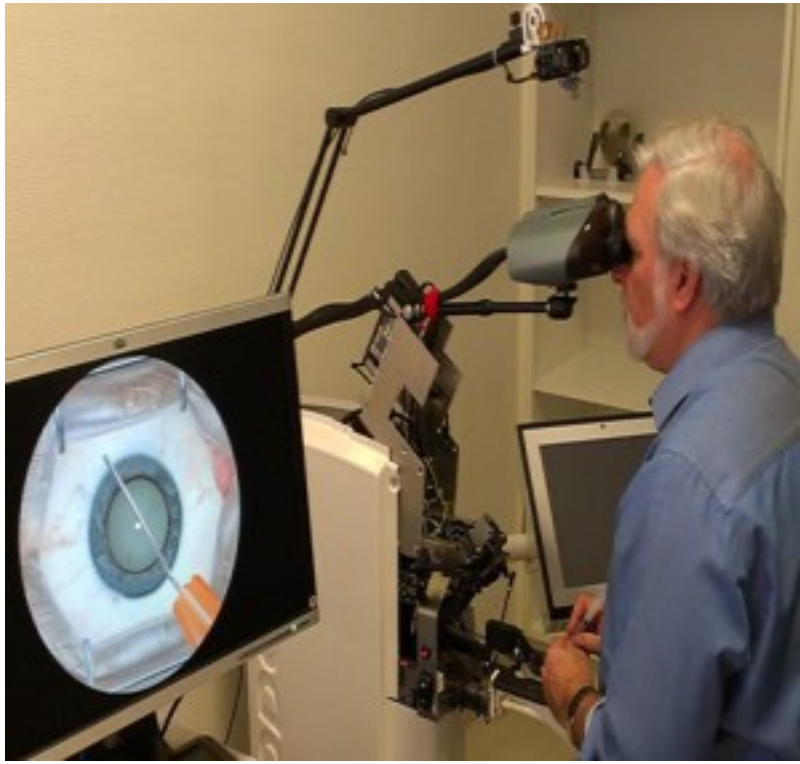


Virtual Needle

Surgical Simulation

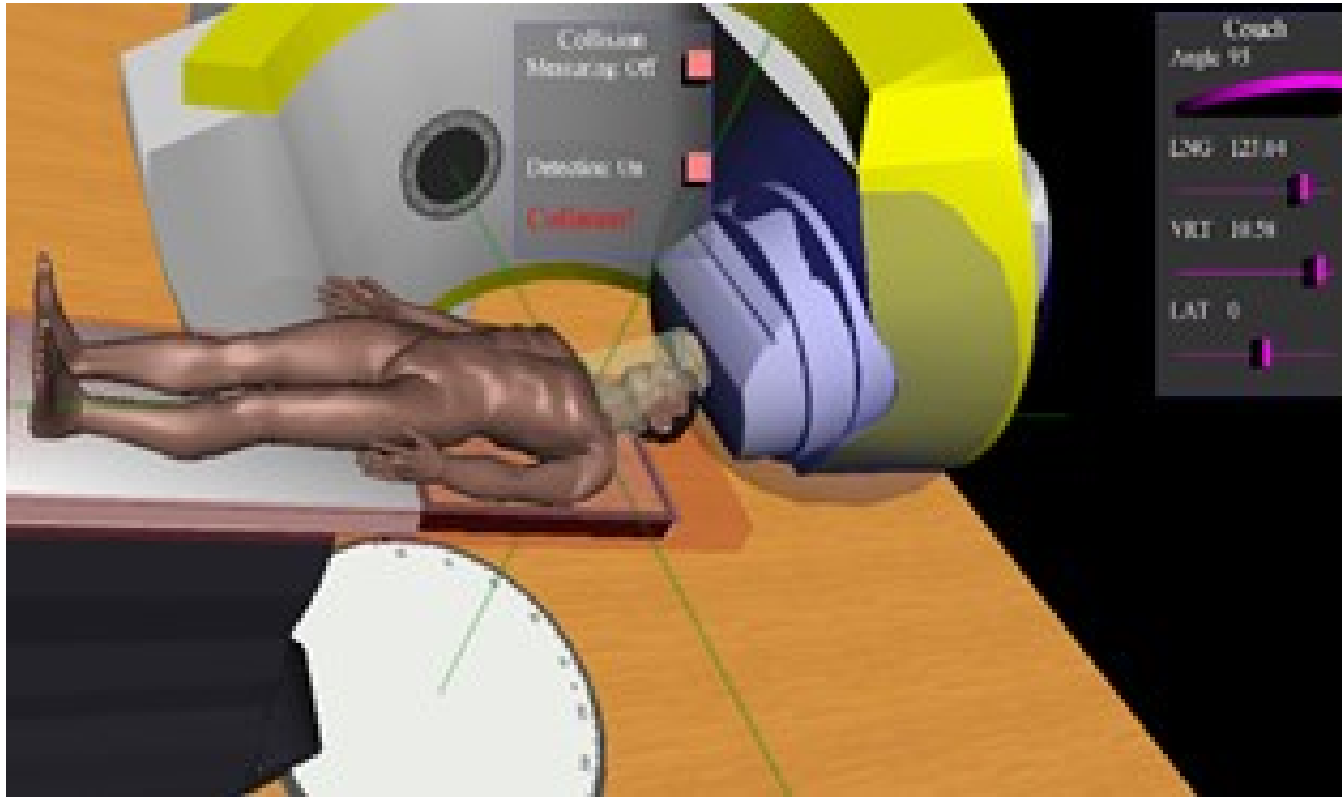
X3D as a platform for Haptic simulation and Medical training

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



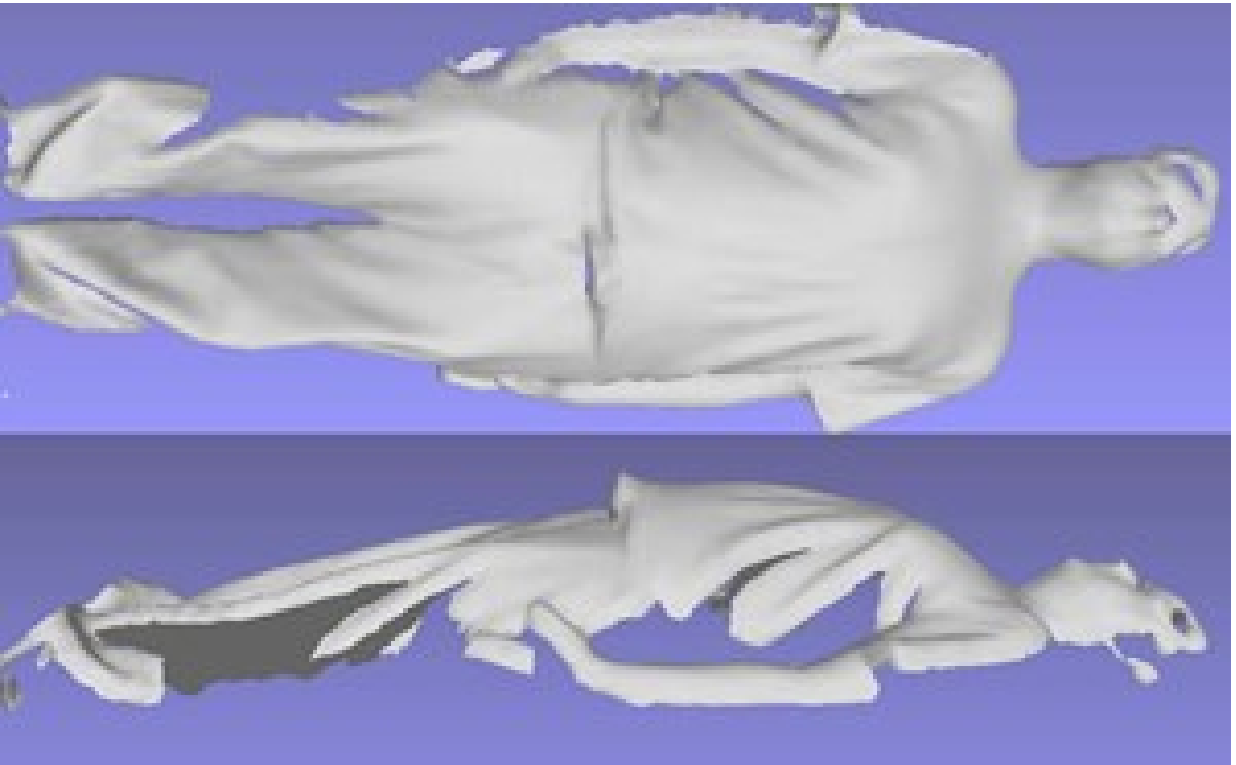
Safety and Radiation Therapy

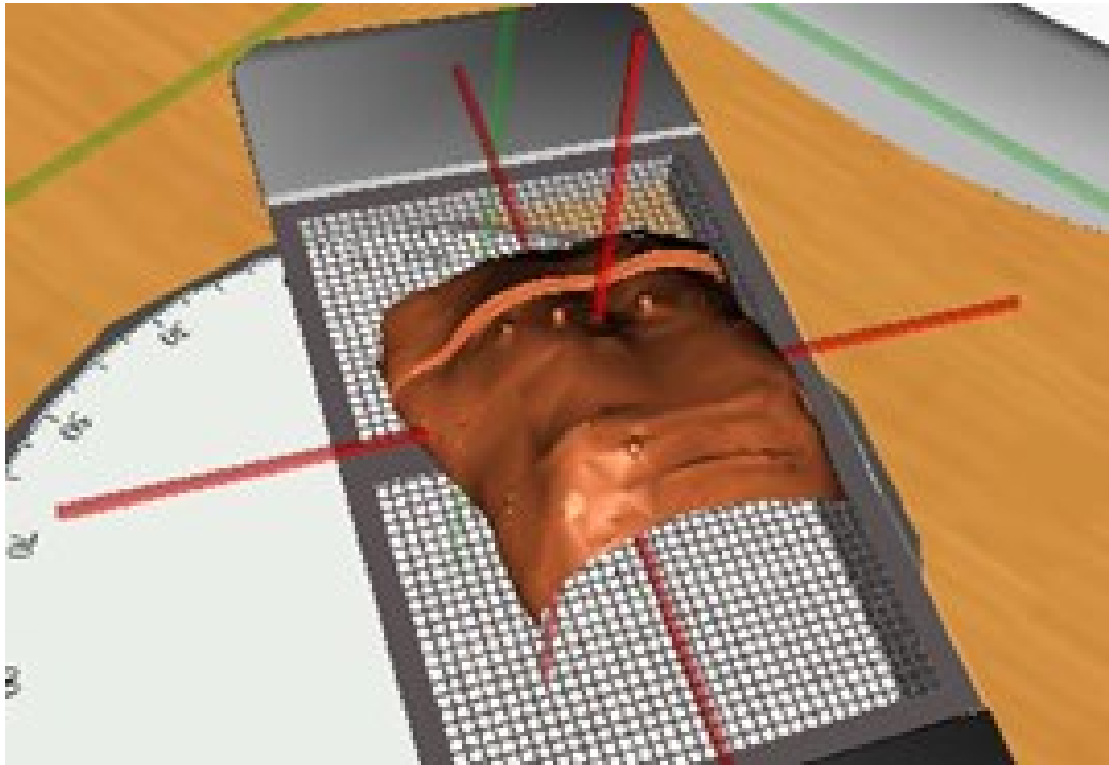
X3D simulation of X-Ray therapy: Felix Hamza-Lup



Safety and Radiation Therapy

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

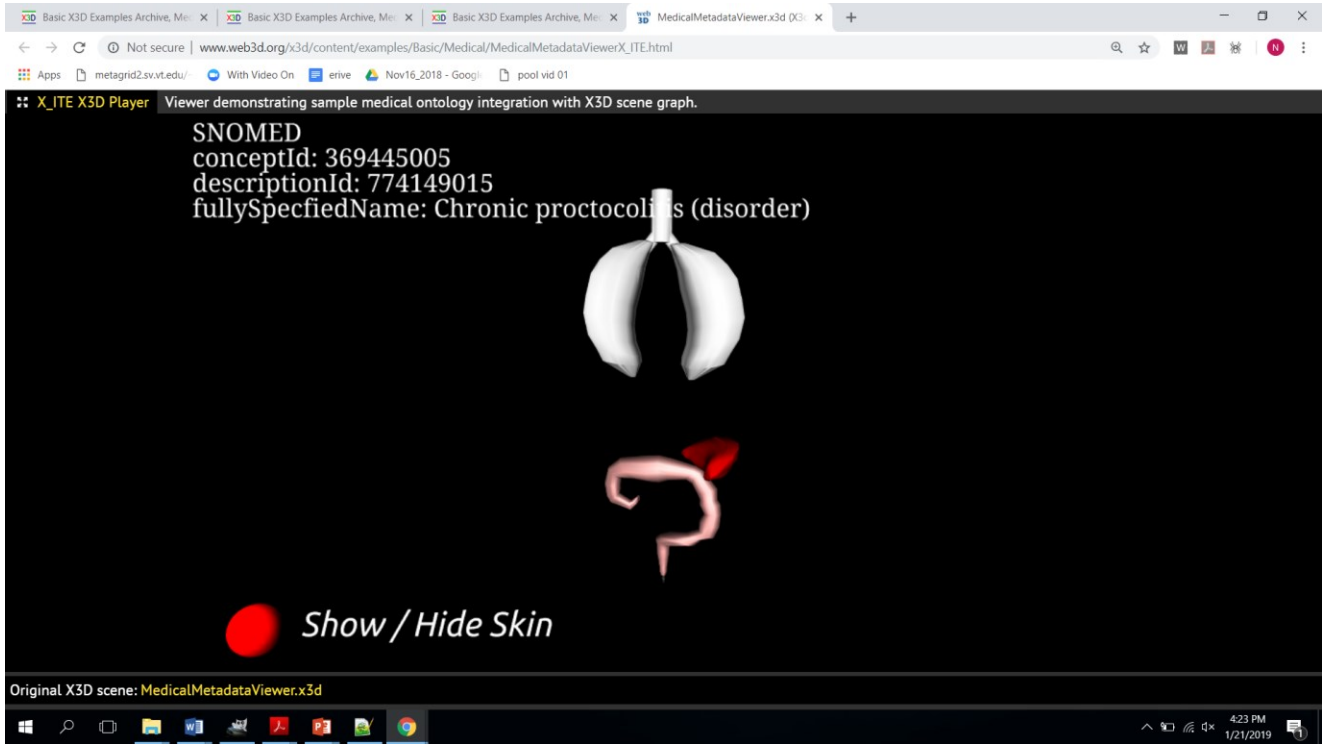




SNOMED and FMA in an X3D Scenegraph

- ***X3D Example Archives:*** **Basic, Medical, Medical Metadata**
- MetadataSets demonstrating sample medical ontology integration with X3D scene graph.

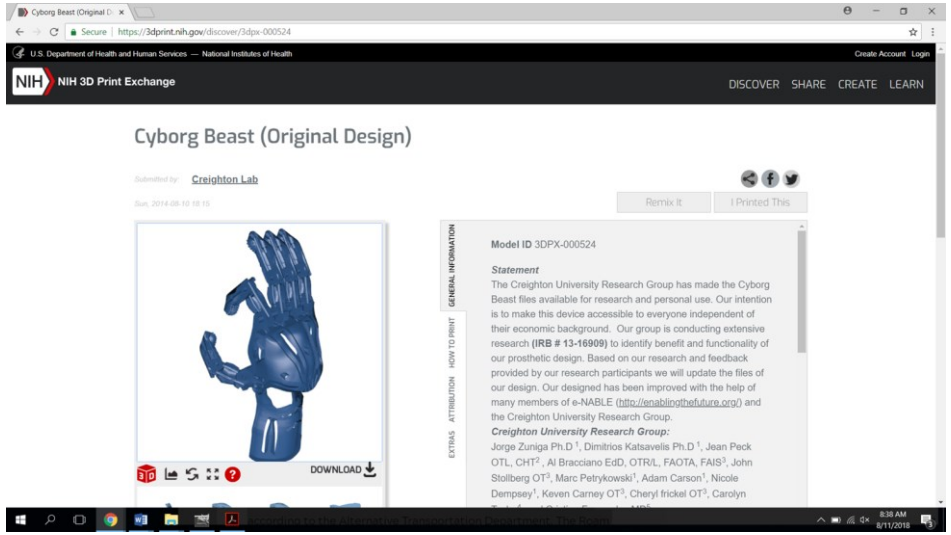
http://www.web3d.org/x3d/content/examples/Basic/Medical/index.html



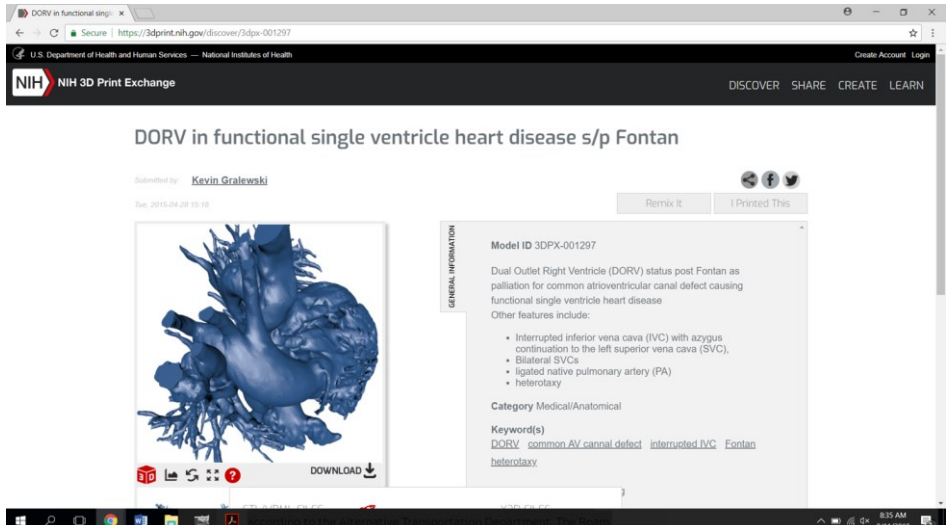
High spatial and temporal resolution body scans

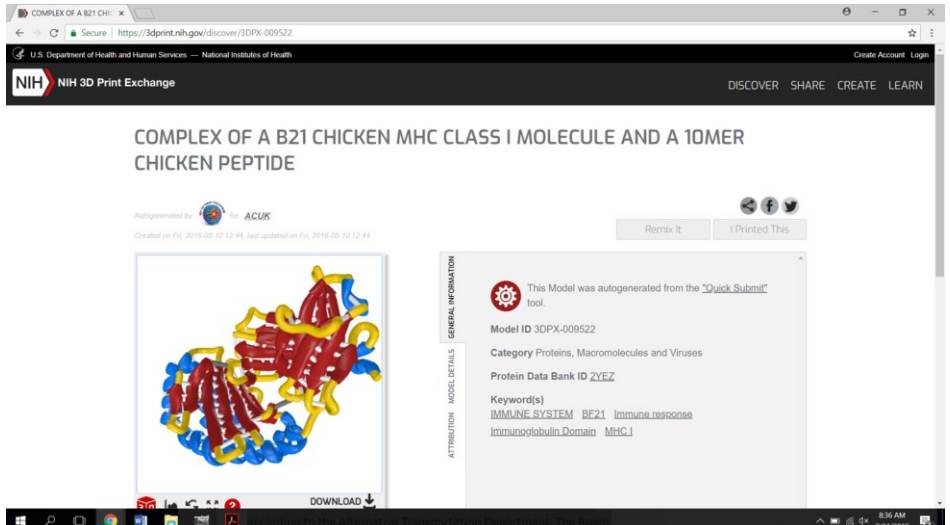
www.3dmd.com

Access: NIH X3D Printing 3dprint.nih.gov



NIH 3D PRINT EXCHANGE





web 3D CONSORTIUM

Choosing X3D for Enterprise 3D printing services

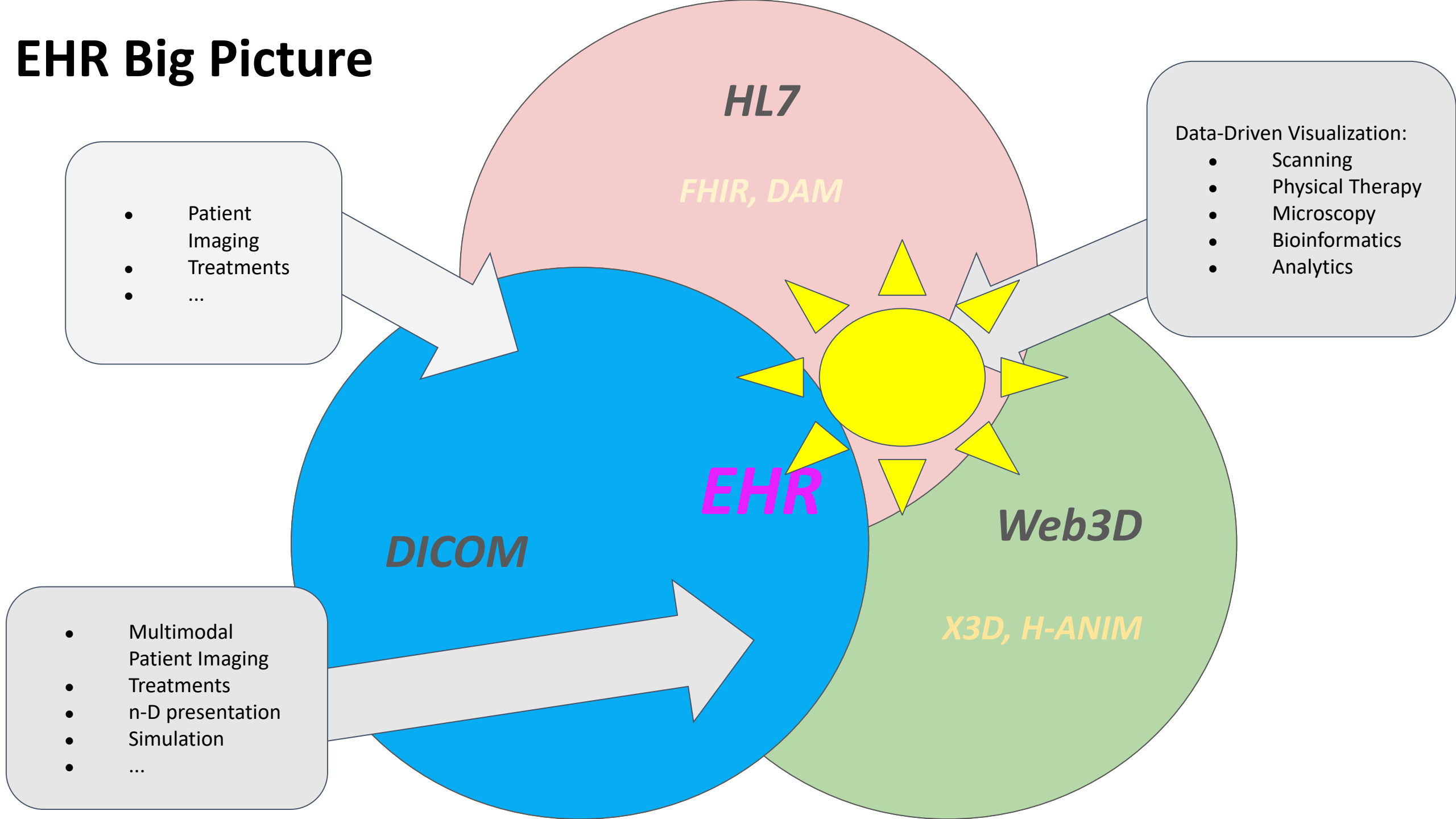
- X3D is lossless for meshes, color, metadata (STL IS NOT)
- Supported by many tools in the field (biochemistry)
- Web Services for processing translation
- CURA open source slicing toolkit for native X3D printing:
  - Shapeways color printing
  - Ultimaker
  - NetFabb

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

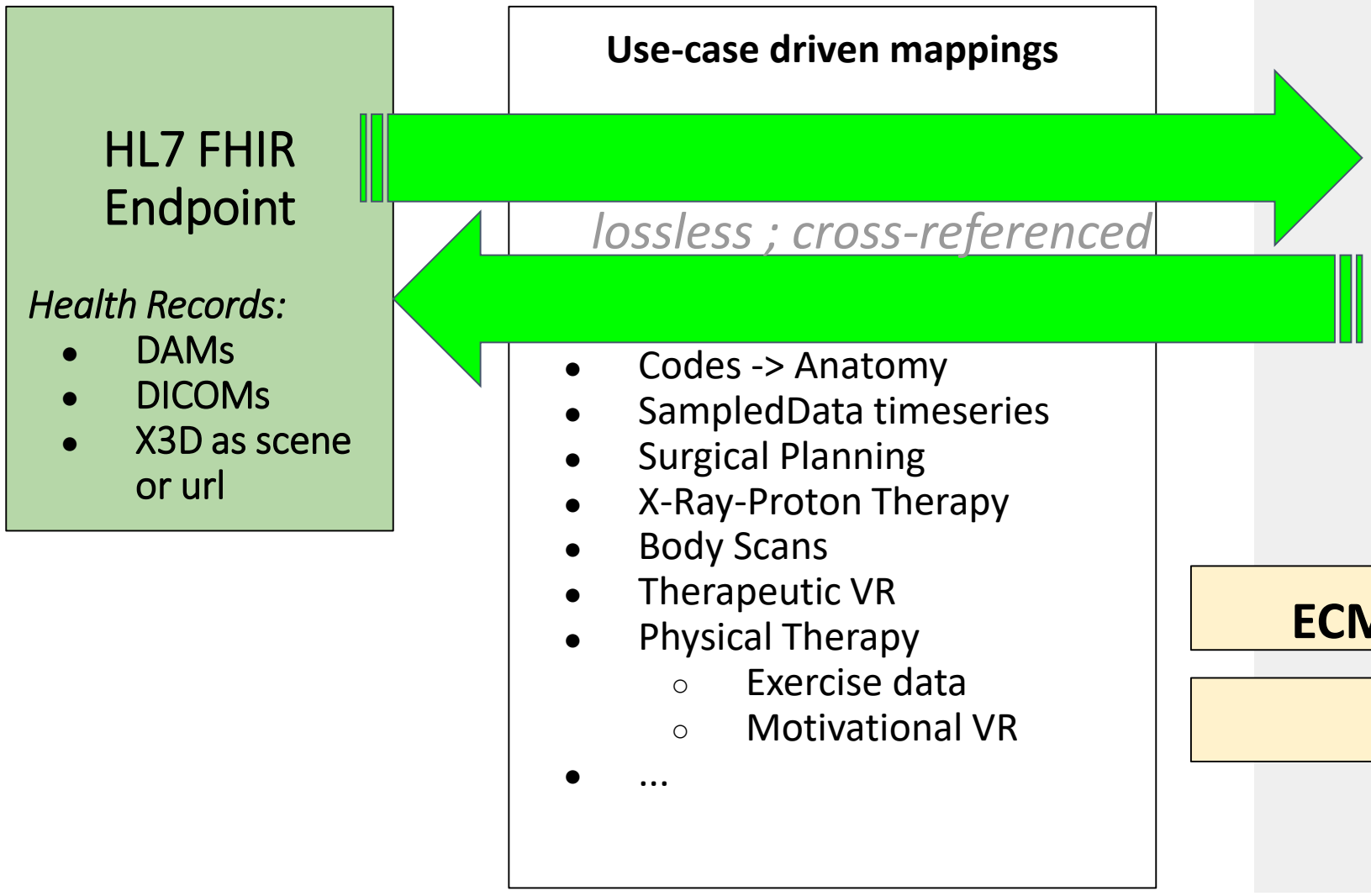
X3D in HL7:

- 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



HL7, DICOM: ANSI, ISO *W3C, IEEE* *Web3D ISO-IEC*

Next Steps

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

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