Web3D Quickstart

AMIA Summit 2019
San Francisco
March 25, 2019

Anita Havele
Executive Director, Web3D Consortium
Anita.havele@web3d.org

Paving the Road to Interoperable 3D Graphics with Open Standards

WWW.Web3D.ORG

WWW.Web3D.ORG/web3d-quickstart

Our Standards X3D **and** H|anim

Motivation

Virtually everything in our world is 3D especially human data

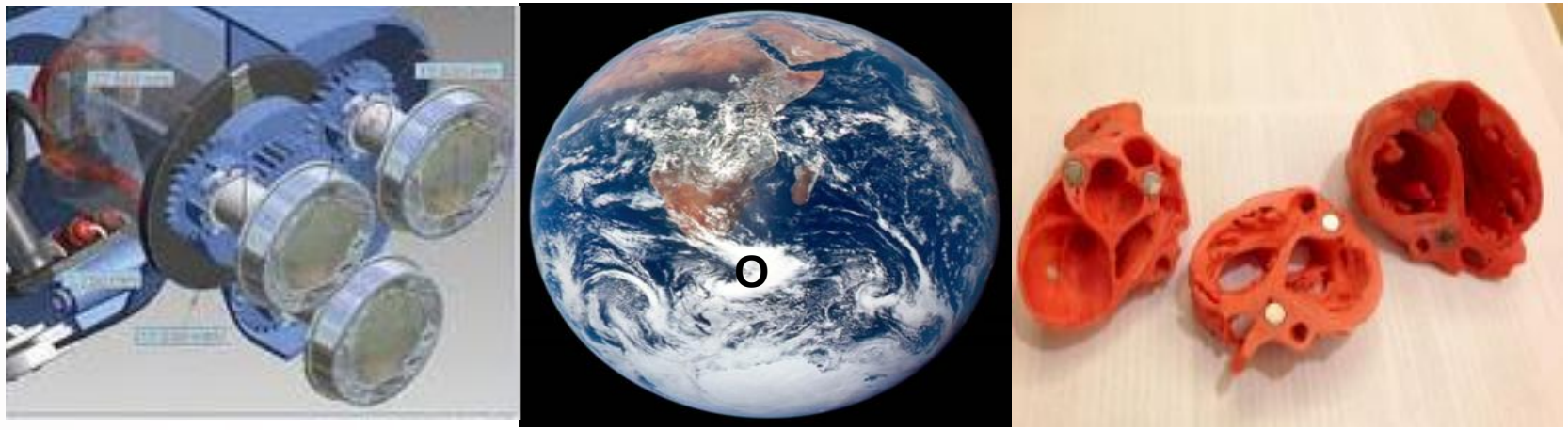
Today’s hardware and software supports efficient 3D Technologies

We need open standards to improve exchange and reproducibility

Cross-fertilize informatics communities, knowledge, and practice

Extend standards and practices for better future outcomes

X3D: Open royalty-free interoperable standard for enterprise 3D



Founded in 1997, International Standards Development Organization
Non-Profit, Member Funded
Our members span from academia, research, industry, government, and professionals

Web3D Standards Family

X3D Version 3.3

X3D Version 4.0 (HTLM5 Compatible) Dec 2019

HAnim Version 2

Complete normative and informative detail to specify an abstract human form

ISO standard, openly published and royalty-free

What is X3D?

Second Generation VRML
A complete Solution for 3D on the Web

Real-Time * Web Based * Interactive * Animation * Extensible * Scriptable

+

File Formats:
XML, ClassicVRML, JSON, Binary

Run-Time Engine:
Two Open source Implementations –
X_ITE and X3DOM

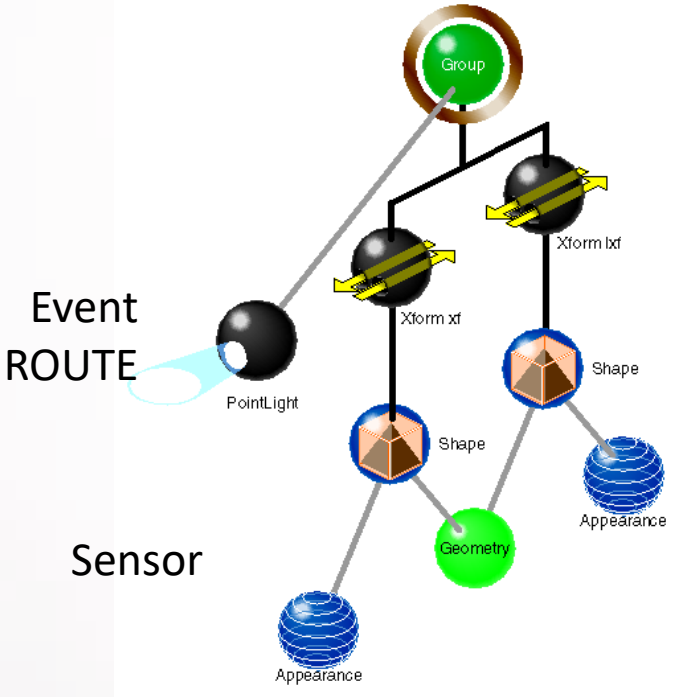
Meshes * Lights * Materials * Textures * Shaders * Annotation * Volume * Audio/Video * AR/VR

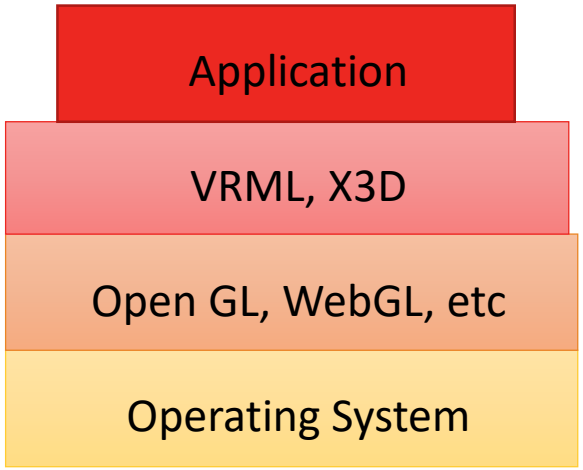
Foundations

A layer above media and rendering libraries

Multiple implementations including open source codebases

3D Scene graph includes the Transformation graph and the Behavior graph





Extensible 3D (X3D): A Hypertext Markup for 3D

- **Like HTML, X3D has a content model that enables the spatial layout of media elements (images, audio, video, text) and links**
- **Like HTML, X3D is platform - independent**
- **Like HTML, X3D can be scripted with JavaScript**
- **Like XML, X3D is extensible using DTD and Schema**

Web Programmers Vs Graphics Programmers

Renderers vs Markup

Draw a Red Cube

OpenGL

83 lines of compiled C code

X3D

```
<x3d>
    <scene>
  <shape>
    <appearance>
    <material diffuseColor='1 0 0'> </material>
    </appearance>
    <box></box>
  </shape>
    </scene>
  </x3d>
```

Based on VRML, supports several APIs

Modular components, Extensible, Scriptable

Efficient and scalable Open 3D Standards

“The HTML of 3D Graphics ”

“The next generation 3D Web for all domains ”

X3D: Create once - Run Anywhere

The Web is the platform

All browsers

All platforms

Making 3D an ordinary media by publishing to the Web

Principals of Web3D

- Open source and royalty-fee ISO standard
- Evolving open standard that converges with other industry standards
- Quality Assurance tools for conformance
- Interoperable
- Secure (Binary encryption, Digital Signature, Compression)
- Platform Agnostic (All platforms all browsers)
- Stable that stands the test of time (Archiveable)

Extensible 3D X3D

Geospatial
Medical
Design
3D Printing
3D Scanning

Simulation
Humanoid Animation
VR Technologies
Augmented Reality

X3D: Your backbone for new dimensions of 3D

X3D: Foundation for All Industry Verticals

Cultural Heritage

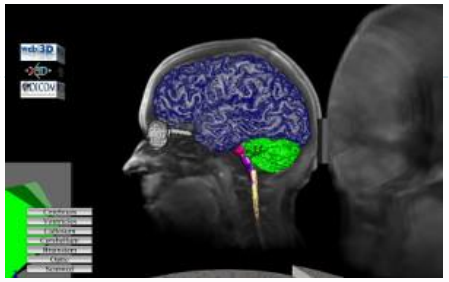
Geospatial

CAD

3D Printing

Mixed
Augmented Reality

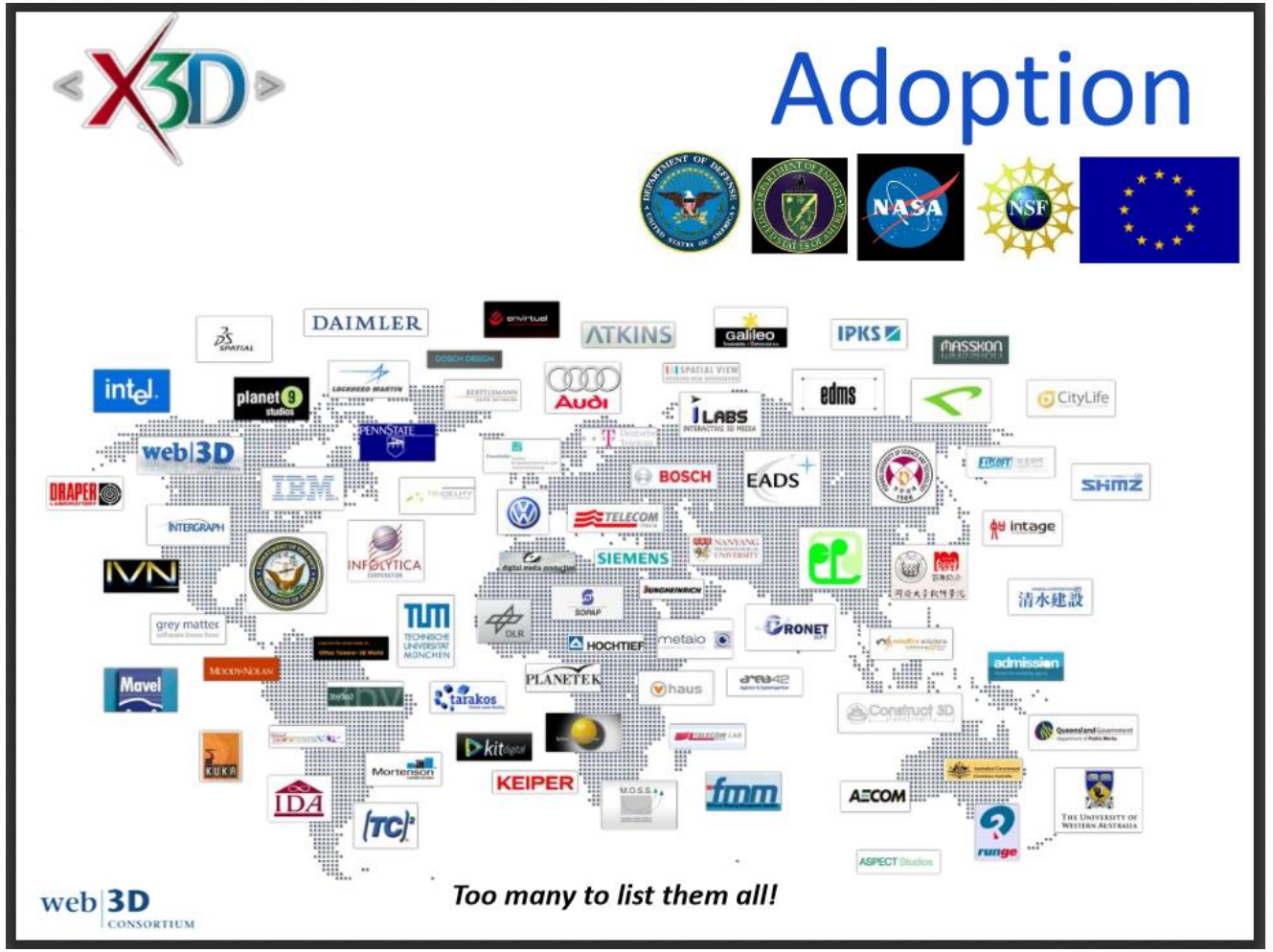
Medical



HAnim

3D Scanning

Who is using X3D?



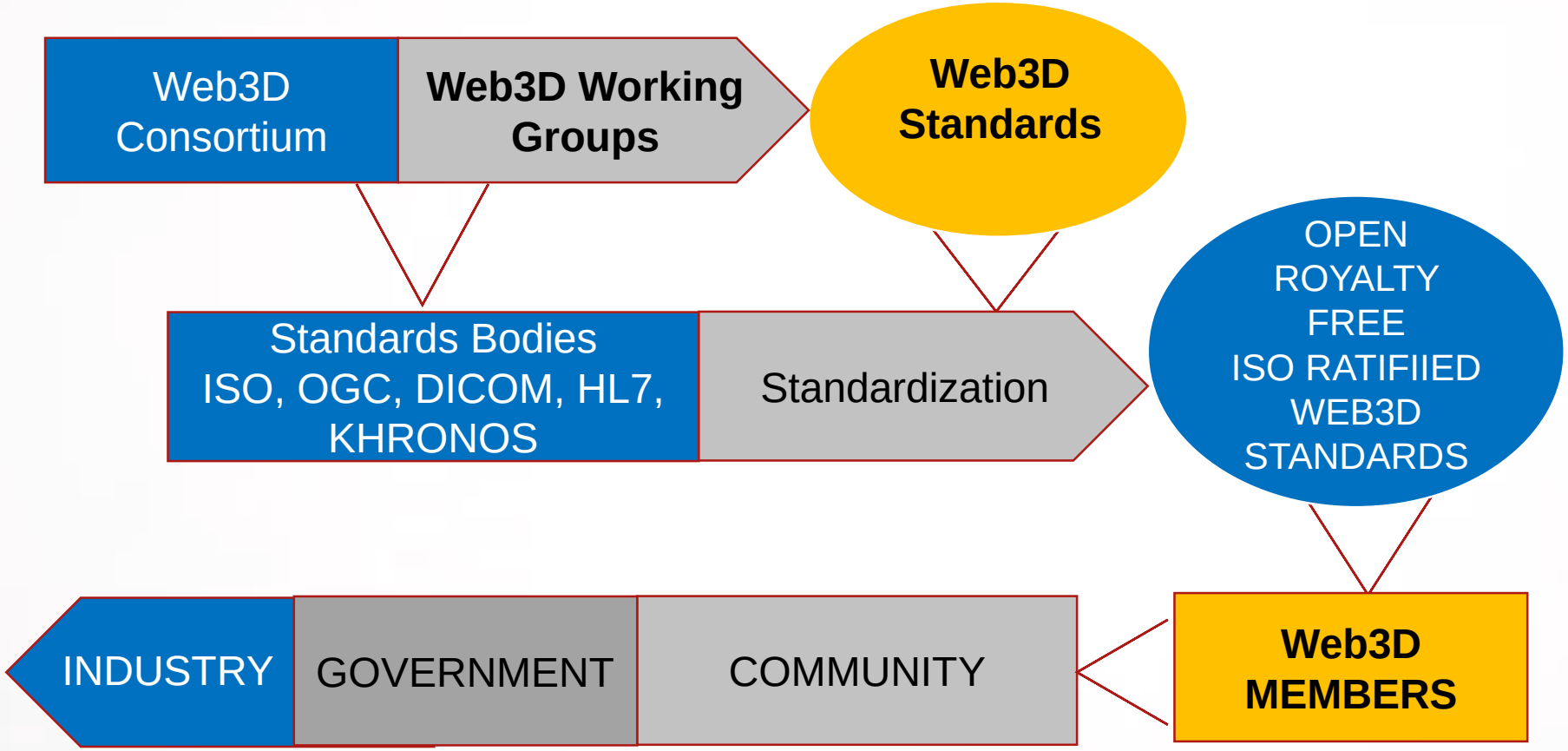
Web3D is a Community Effort

Technologists Researchers Engineers Students Clinicians

Hobbyists IT Specialists Educators Developers Consultants

Web3D Standardization Process

Volunteers and Members Work Together on Standards



Web3D Standardization Process

Volunteers and Members Work Together on Standards

Web3D Working Groups:

- X3D
- HAnim
- Medical
- Geospatial
- Mixed Augmented Reality
- Cultural Heritage
- Design Printing Scanning
- Semantic Web

New Directions

Working with HL7 community opens new doors

X3D in HL7:

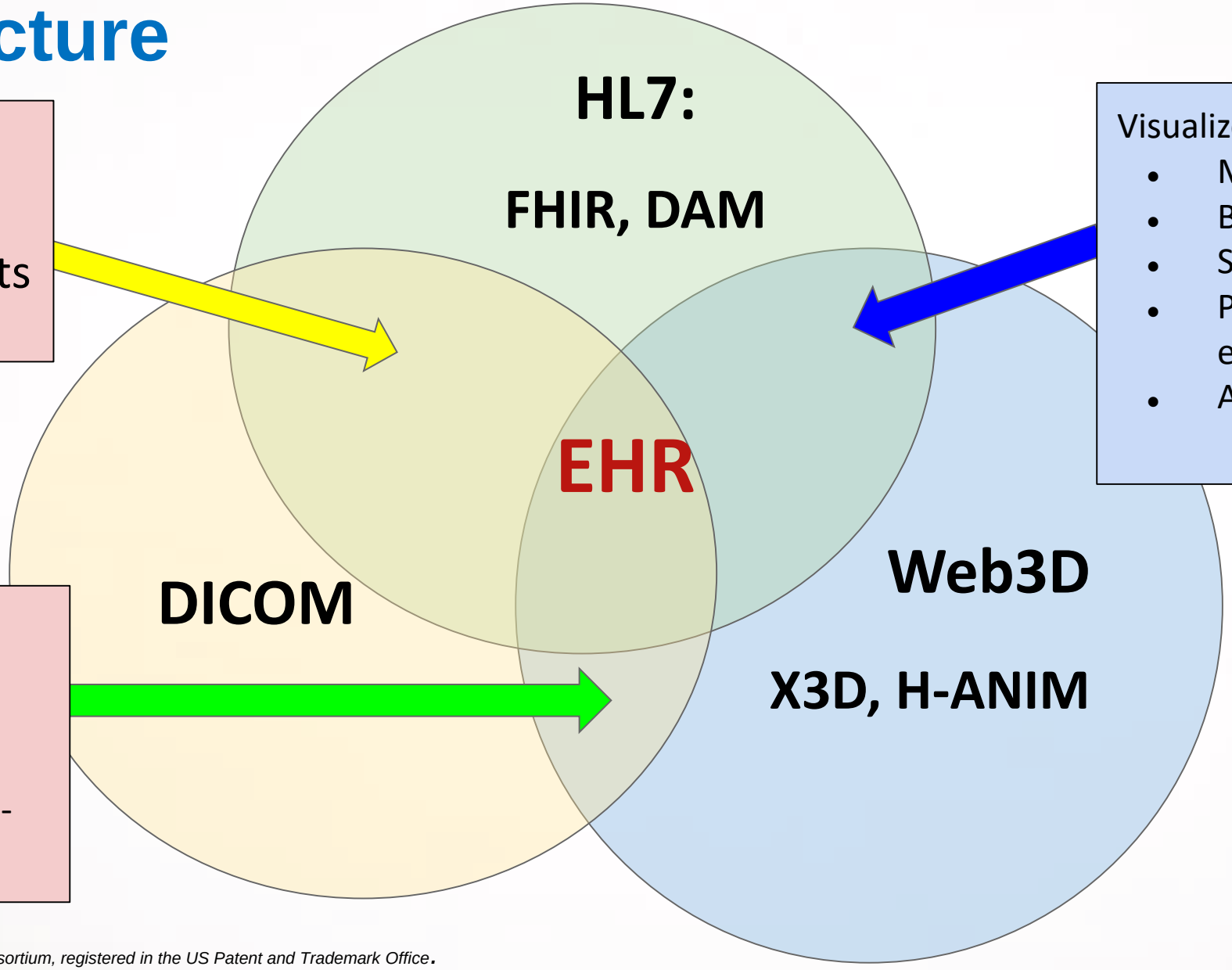
- XML & JSON payloads of X3D content in FHIR
- DAM-specific integrations

HL7 in X3D:

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

EHR Big Picture

- Patient Imaging
- Treatments
- ...



Visualize:

- Microscopy
- Bioinformatics
- Scanning
- Physical Therapy & ergonomics
- Analytics

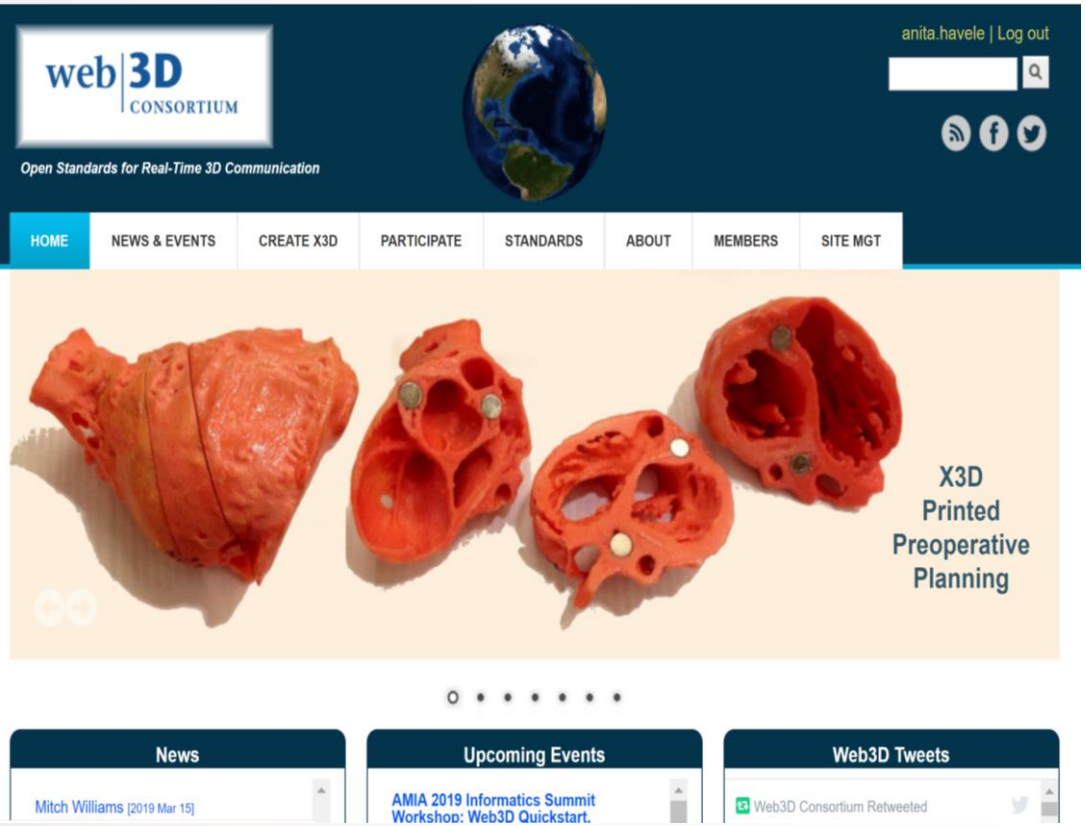
- Volume viz
- Meshes
- Segmentations
- 3D printing (STL, supplement 208 - X3D, 3MF, OBJ)

Kinds of data, kinds of stakeholders

Health and Medicine

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

Web3D Resources: www.web3d.org



Membership: Web3D.org/join

Web3D Standards: Web3D.org/standards

Work Groups: Web3d.org/working-groups

Learn: Web3d.org/Web3d-quickstart

Events: Web3D.org/events

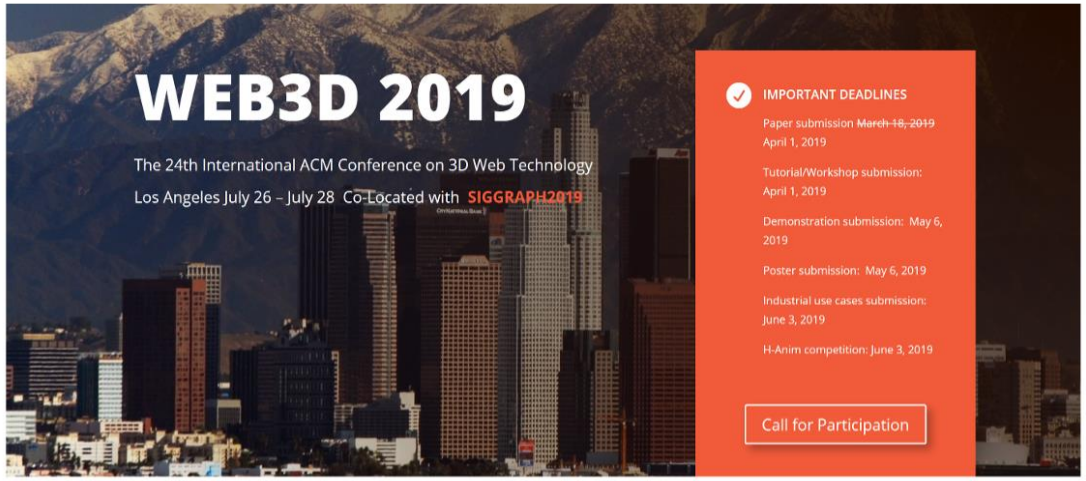
Web3D Affiliates: Web3D.org/about/laisons

International Mobilization

- **Annual Outreach activates engage communities of interest**
- **SIGGRAPH/ Eurogaphics Web3D Conference (22 years)**
- **Workshops & exhibits at SIGGRAPH**
- **VR Hackathons worldwide**
- **Showcases & regional meetings**
- **X3D and members appear regularly at:**

  IEEE VR, Supercomputing, MMVR, IITSEC,
- **X3D an enabler in many domains**

VR Hackathon in Poznan
17-19 June 2018



Eurographics ACMSIGGRAPH web3D Consortium

Web3D 2019

24th International Conference on 3D Web Technology

July 26-28th, 2019
Los Angeles, USA

Co-located with SIGGRAPH 2019

Join expert 3D graphics technologists: share and learn about research, development, and practice related to Web-based interactive 3D applications

Technologies, Applications:

VR/AR/XR, HTML5, X3D, WebGL, 3D Streaming, compression, and transmission, WWW and mobile 3D, content creation, publishing technologies, 3D tools. International community!

Medical * AR/VR * 3D Printing

Humanoid Animation

Papers * Tutorials

Workshops * Demos

http://www.web3d2019.org

info@web3d2019.org

web3D CONSORTIUM

Why Participate in Web3D?

Learn and collaborate with peers, customers, competitors, and potential partners

Influence new standards in ways that matter to your business

Support Web3D's vision by becoming a member today

www.web3d..org/join

Join and Participate

Would you like to join in?

- Participants always welcome
  - http://www.web3d.org/join

What are we overlooking?

suggestions are always welcome

- x3d-public@web3d.org

Join us at

- **Web3D 2019 July 25-28 – Los Angeles, CA**
- **SIGGRAPH 2019 July 25-28 – Los Angeles, CA**

Contact
Anita Havele
Executive Director,
Web3D Consortium
Anita.Havele@Web3D.org

Web3D Medical Use Cases: Possibilities are endless

- Virtual visits
- Surgical scheduling
- Family tree
- Drug structures
- Genomic structures
- Clinical support
  - Exercise physiology involving respiratory system, cardiovascular system, muscular system
  - Organ models
- Patient support
  - Mental health
  - Behavior modification
  - Fall prevention
  - Aging
  - Consent for research – showing what is proposed
  - Consent for surgery – surgery prer-planning
  - Pain management
- GIS
- Others……..

3D Printed Heart

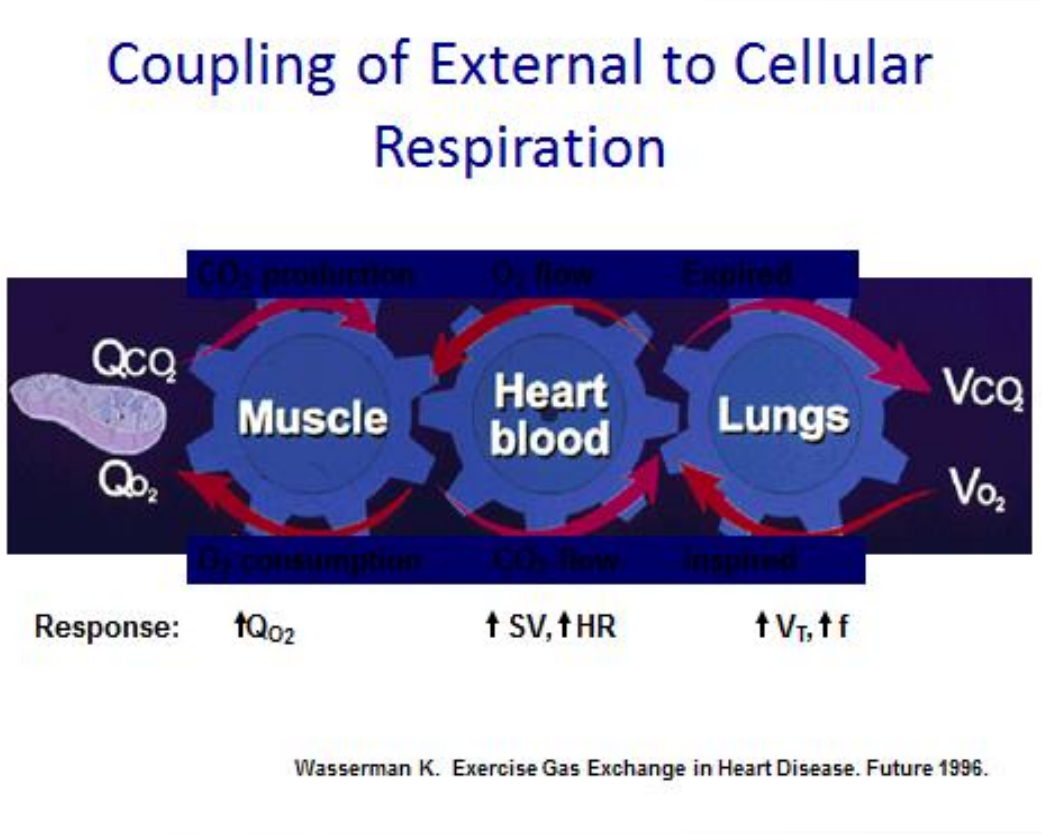
From the patient's MRI, a model was 3D printed and fitted with magnets

Exercise Physiology Testing

Web3D Member Collaboration

Pilot Visualization for **THEMES** (Terminology Harmonization in Exercise Medicine and Exercise Science) Data Standards Project.

Wasserman Exercise 9-panel Plots



Wasserman Exercise 9-panel Plots

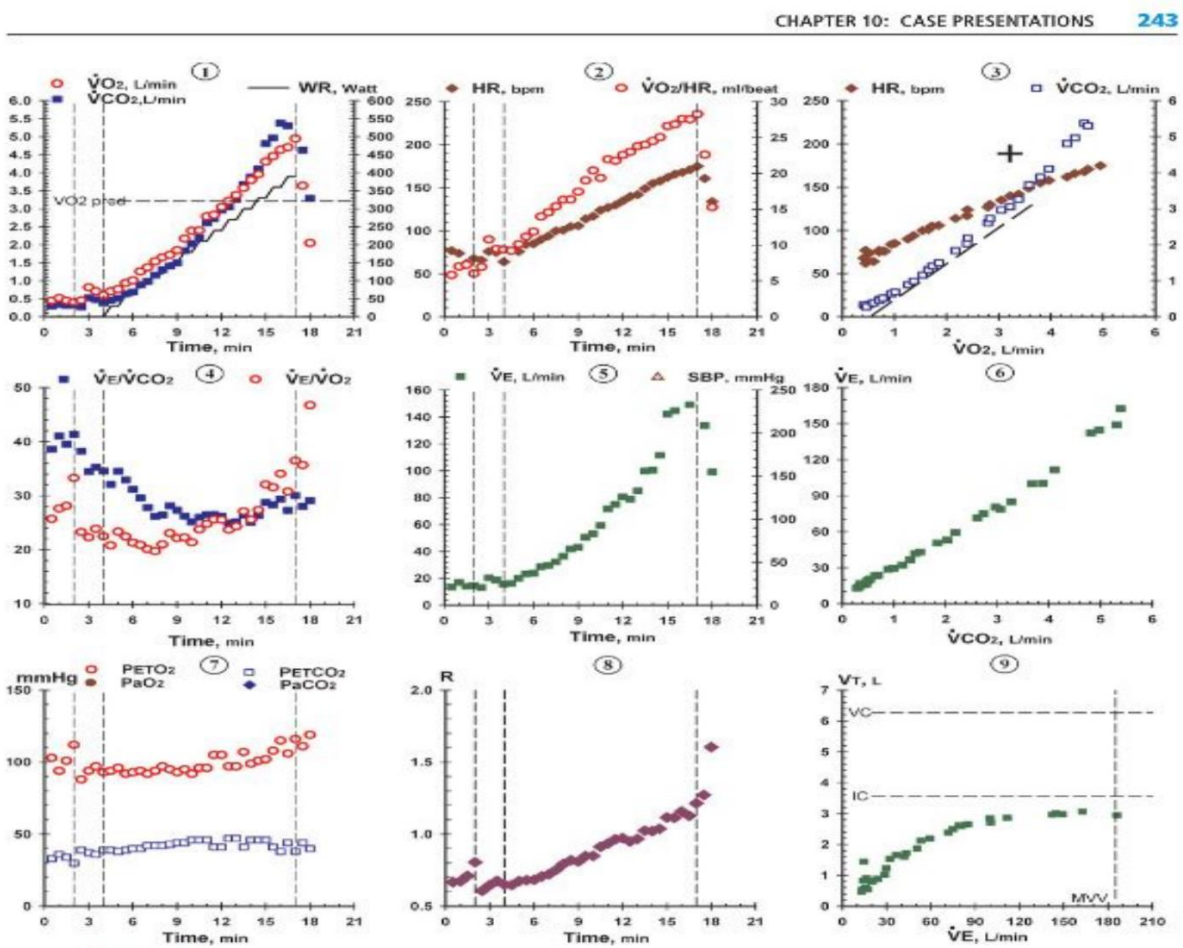
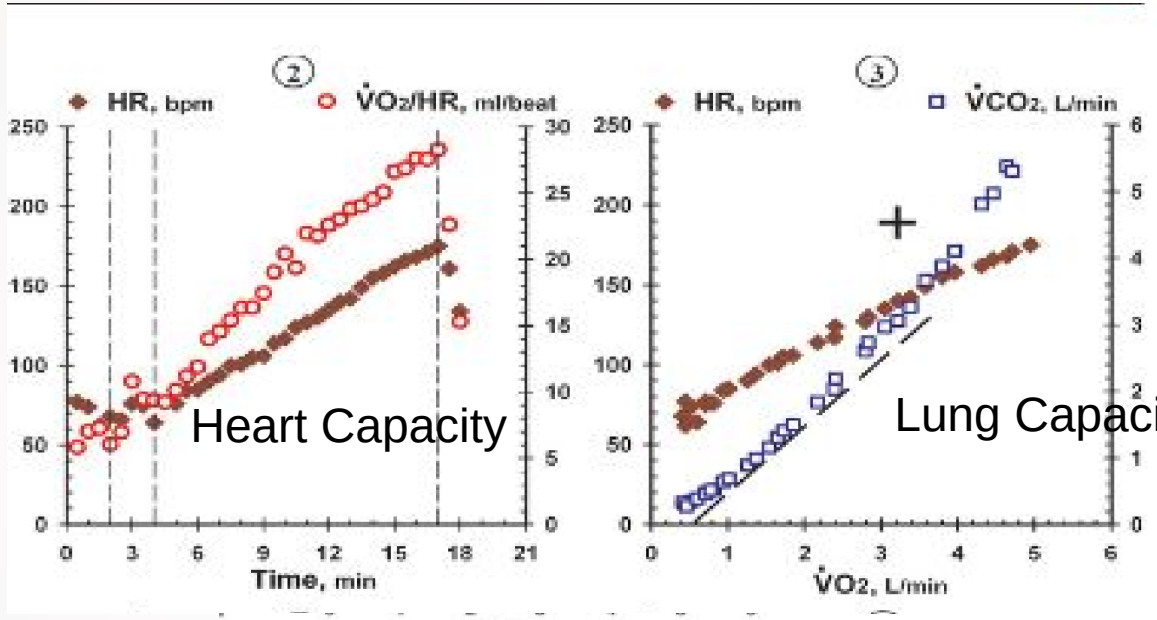


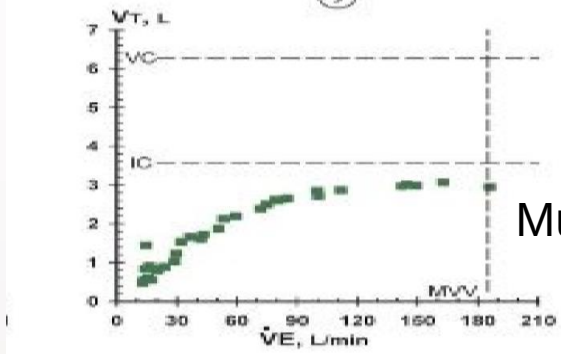
FIGURE 10.2.1. *Vertical dashed lines* in the panels in the left and middle columns indicate, from left to right, the beginning of unloaded cycling, start of increasing work rate at 30 W per minute, and start of recovery. In **panel 1**, the increase in work rate (right *y*-axis) is plotted with a scale of 100 W to 1 L of $\dot{V}O_2$ (left *y*-axis) such that work rate is plotted parallel to a $\dot{V}O_2$ slope of 10 mL/min/W. In **panel 3**, $\dot{V}CO_2$ (right *y*-axis) is plotted as a function of $\dot{V}O_2$ (*x*-axis) with identical scales so that the *diagonal dashed line* has a slope of 1 (45 degrees). $\dot{V}CO_2$ increasing more steeply than $\dot{V}O_2$ defines CO_2 derived from HCO_3^- buffer, as long as $\dot{V}E/\dot{V}CO_2$ (**panel 4**) is not increasing and P_{ETCO_2} (**panel 7**) is not decreasing, simultaneously. The *black + symbol* in **panel 3**

Normal Athletic Male

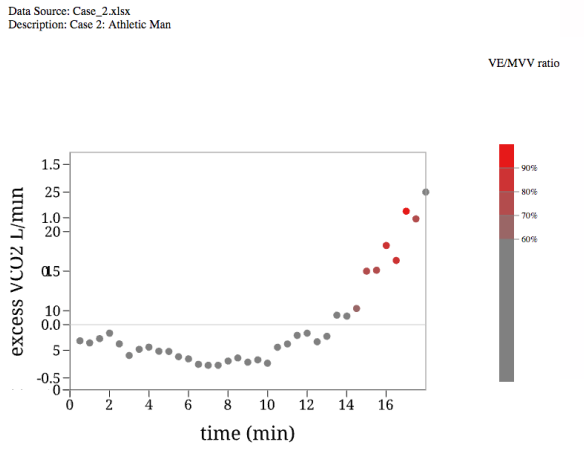


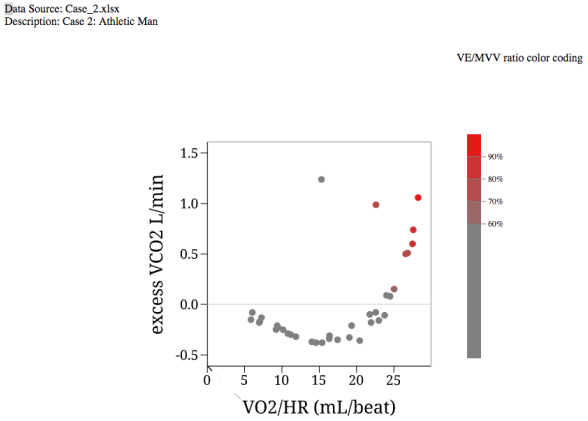
Heart Capacity

Lung Capacity



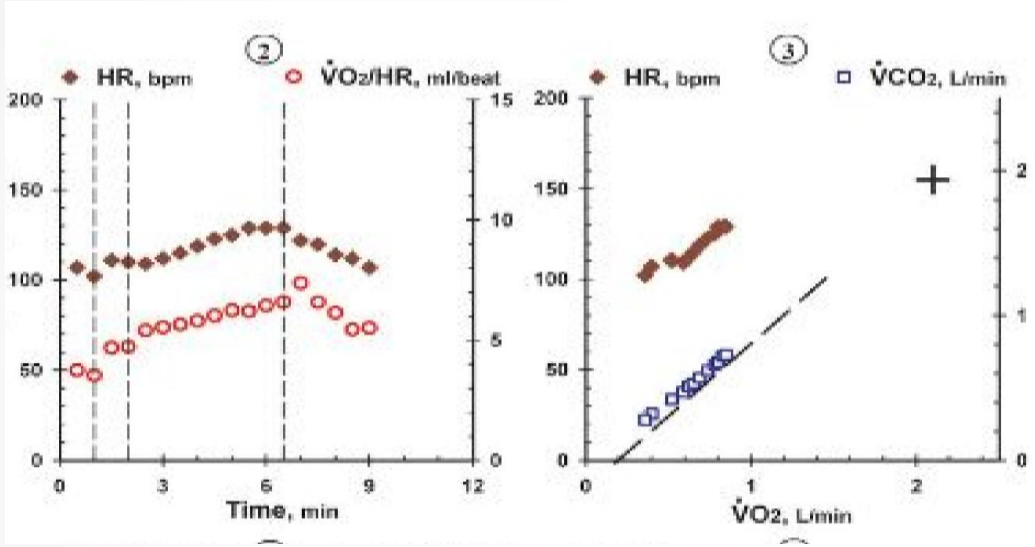
Muscle Capacity





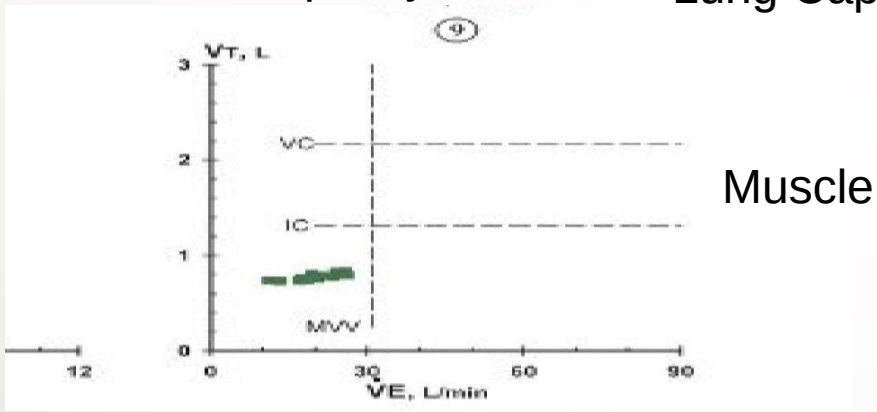
Demo by Vince Marchetti – www.Kshell.com

Severe Emphysema

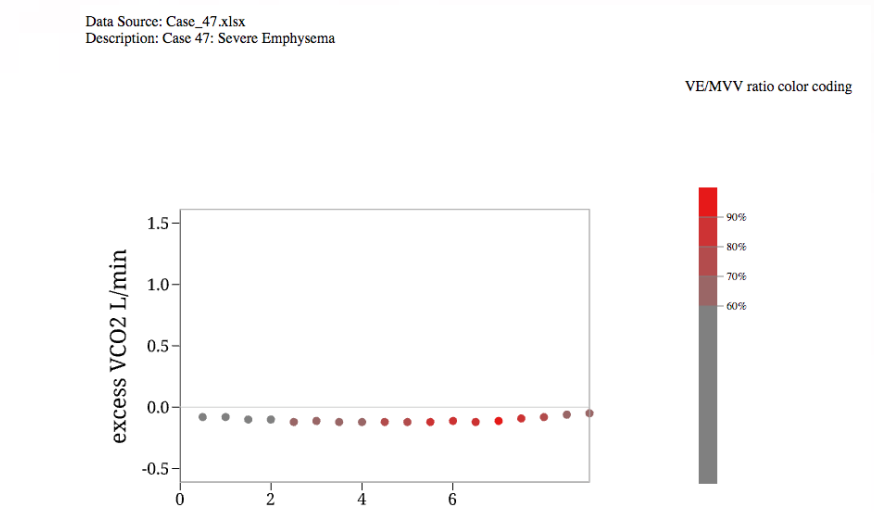


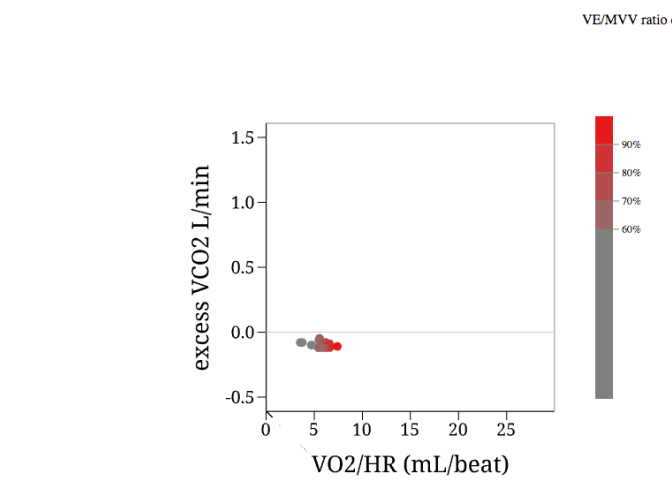
Heart Capacity

Lung Capacity



Muscle Capacity

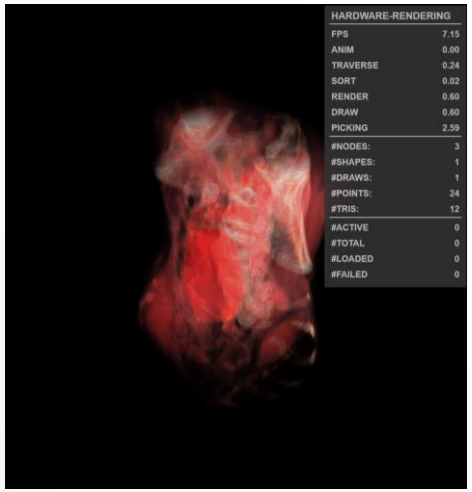




Demo by Vince Marchetti – www.Kshell.com

X3D Volume Rendering Component

Standardized in X3D 3.3 - **International Standardization of reproducible real-time, interactive volume visualization -Launched by US ARMY TATRC - Developed by Web3D Consortium**



MIRROR4ALL

Drag and drop DICOM images for 3D Volume rendering

DICOM Data Set: GE MEDICAL SYSTEMS HiSpeed NX/i CHEST CT 149

Join and Participate

Contact
Anita Havele
Executive Director,
Web3D Consortium
Anita.Havele@Web3D.org

Would you like to join in?

- Participants always welcome
  - http://www.web3d.org/join

Anything else? What are we overlooking?

- Improvements, suggestions are always welcome
  - x3d-public@web3d.org

Join us at

- **Web3D 2019 July 25-28 – Los Angeles, CA**
- **SIGGRAPH 2019 July 25-28 – Los Angeles, CA**
-