

Creating 3D Scenes for the Browser

Leonard Daly
President, Daly Realism
20 Jan 2014



What is X3D

Extensible 3D Graphics



A royalty-free format
and run-time for
interactive, animated
3D scenes with real-
time rendering in the
browser



X3D Capabilities

Technical

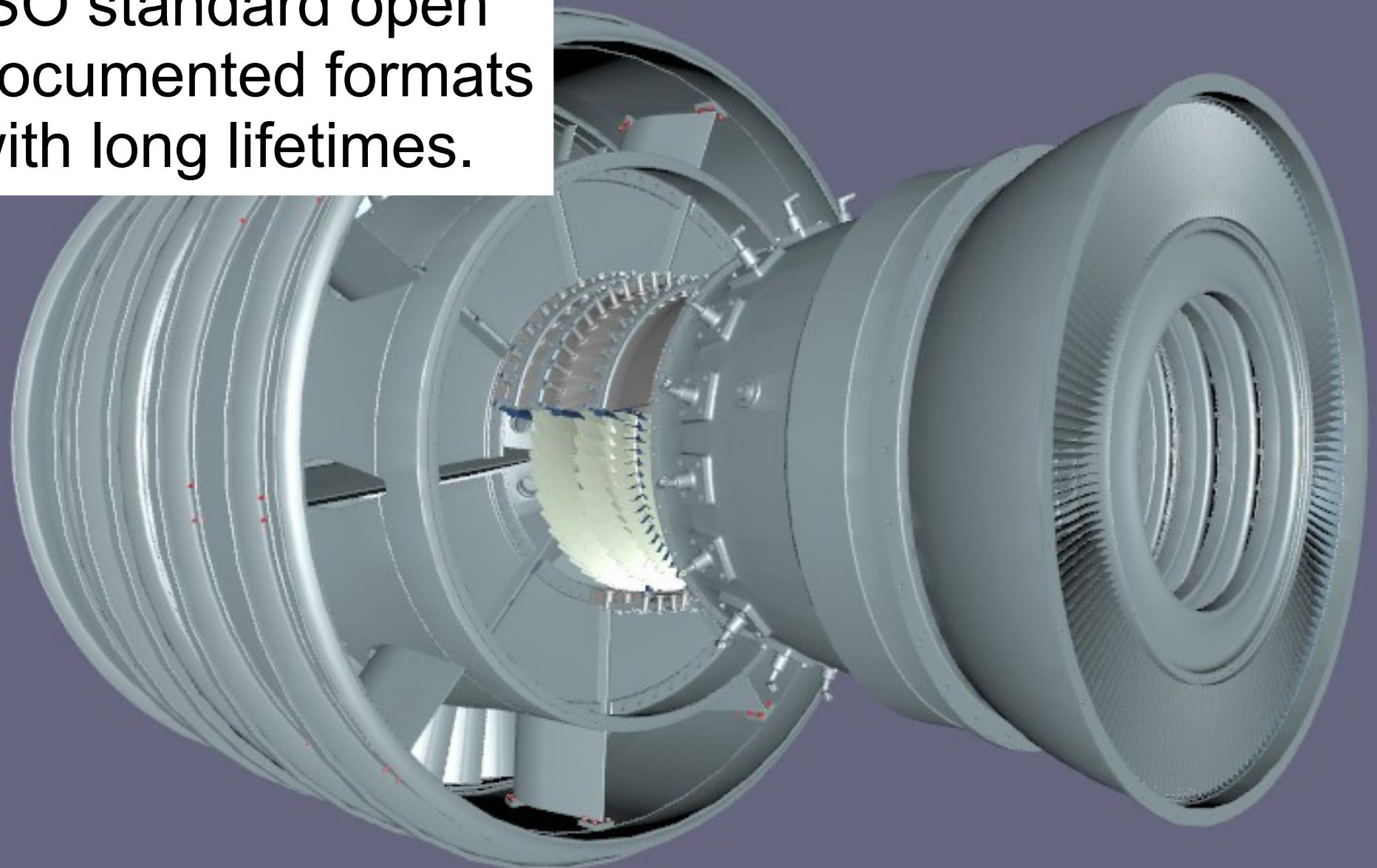
- Interactive
- Lighting
- Shaders
- Movable Cameras
- NURBS / CAD
- Volume Rendering
- Geospatial
- Particle Systems
- Physics

Business

- ISO approved
- Open standard
- 5 encodings
- HTML5 Compatible
- Well documented

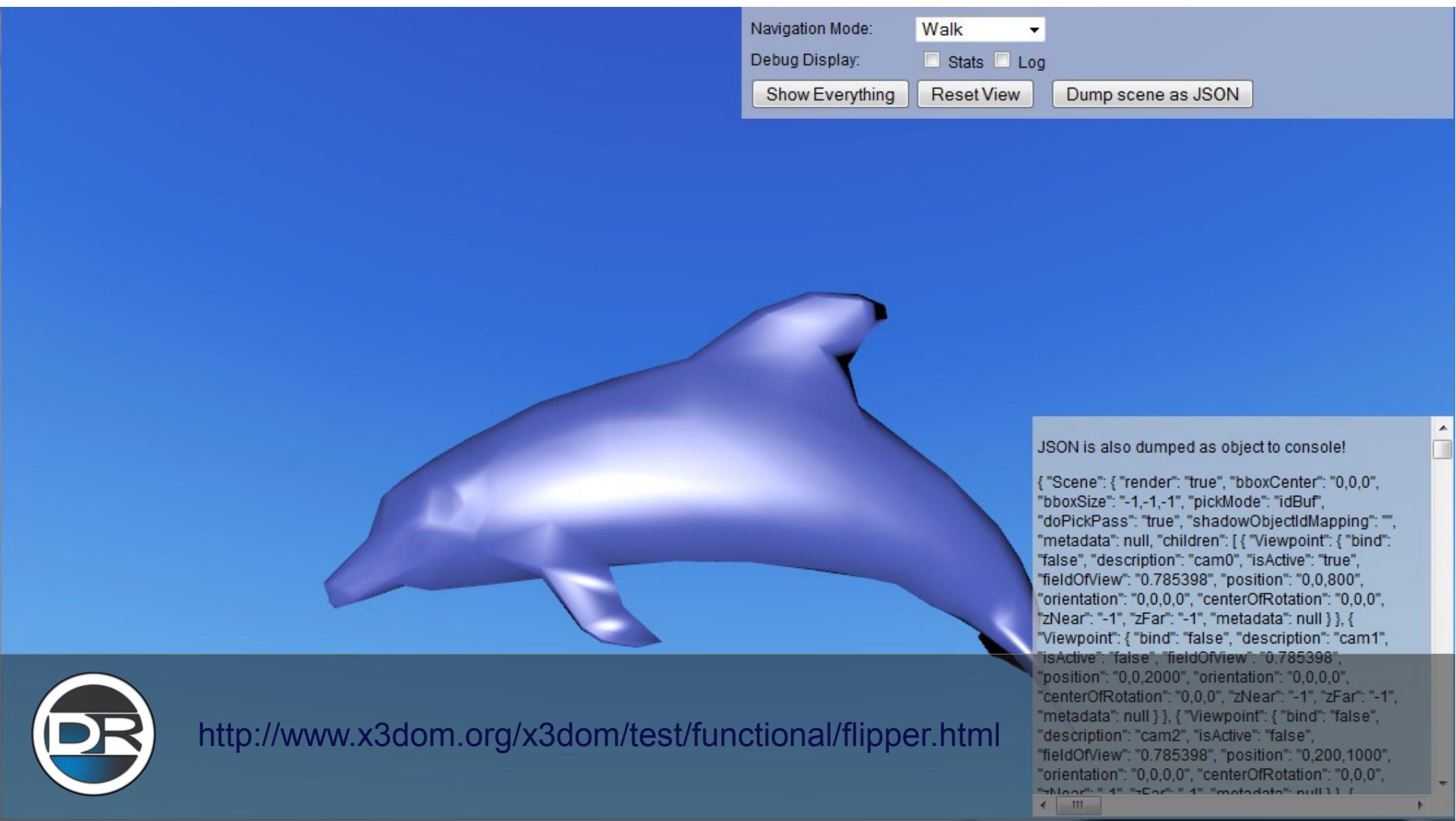


ISO standard open
documented formats
with long lifetimes.



<http://examples.x3dom.org/binaryGeo/engine/model-bg.html>

Three standardized encodings (XML, Binary, Text) two in development (JSON, Encrypted)



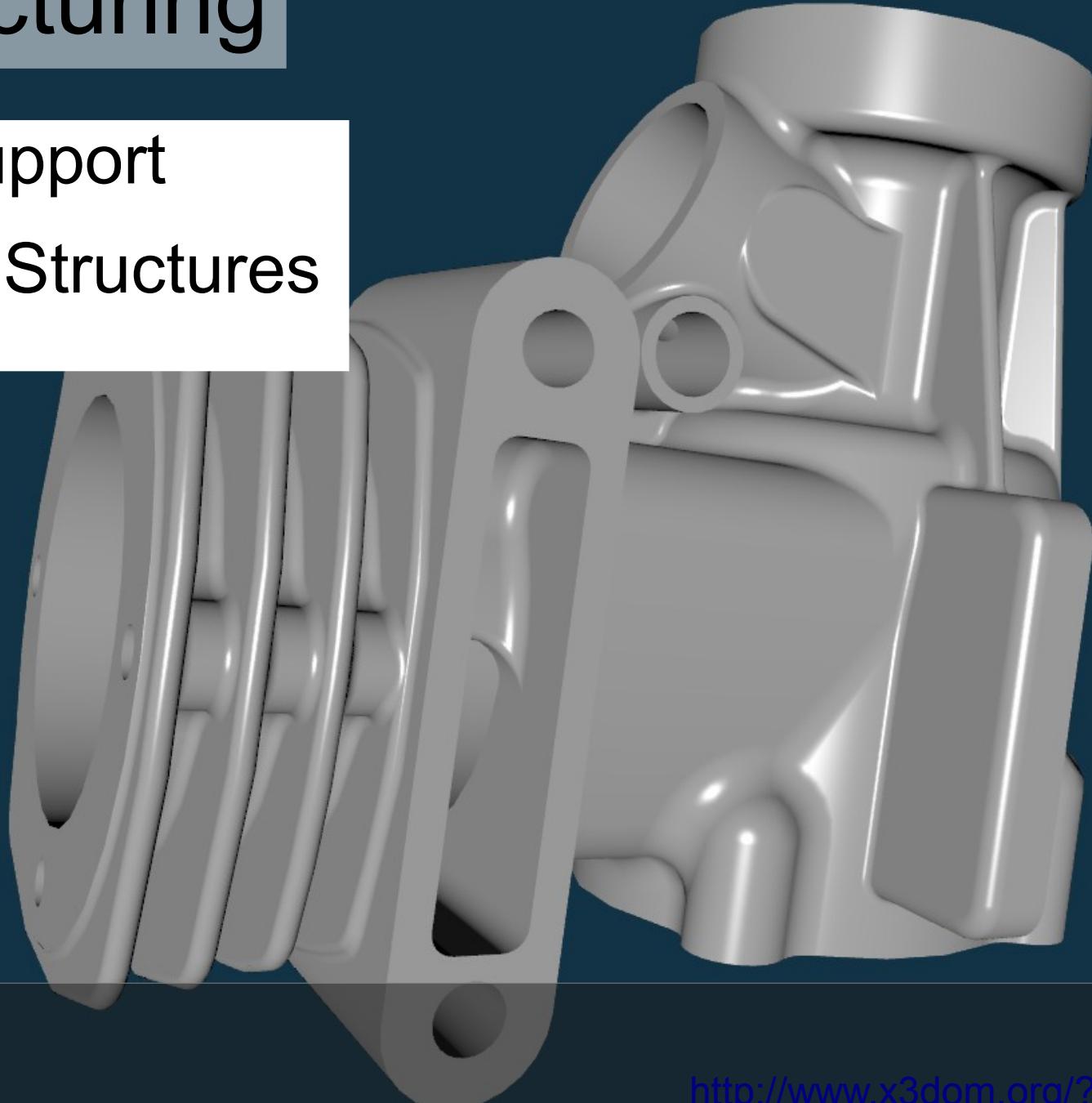
Industrial – Drilling rig w/shadows



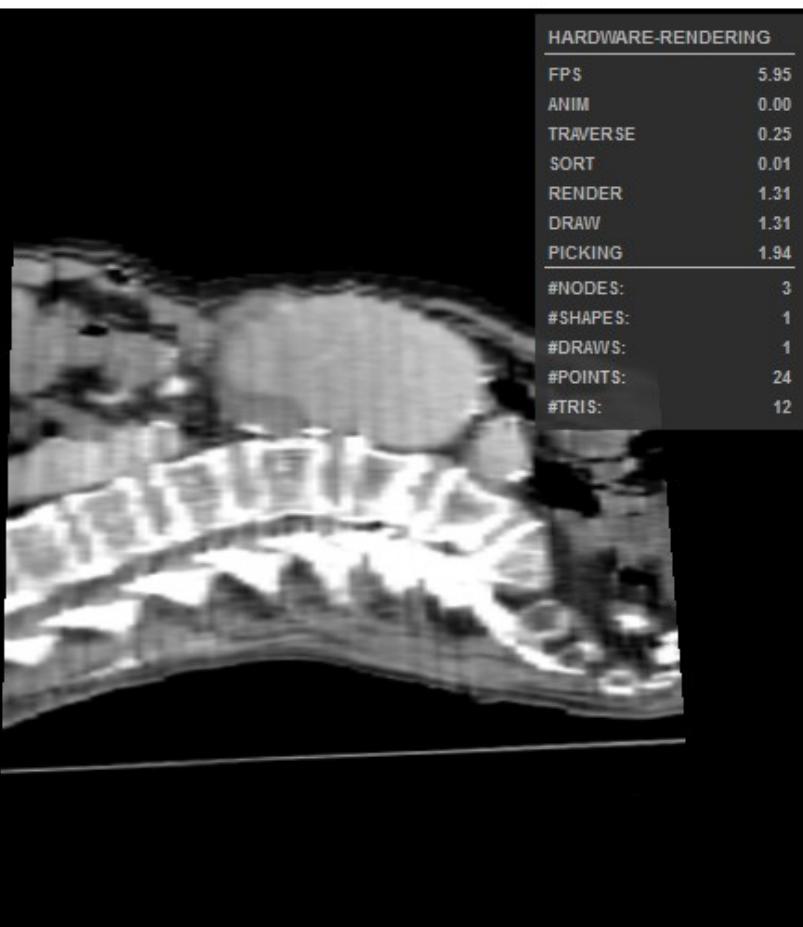
http://examples.x3dom.org/binaryGeo/oilrig_demo/index.html

Manufacturing

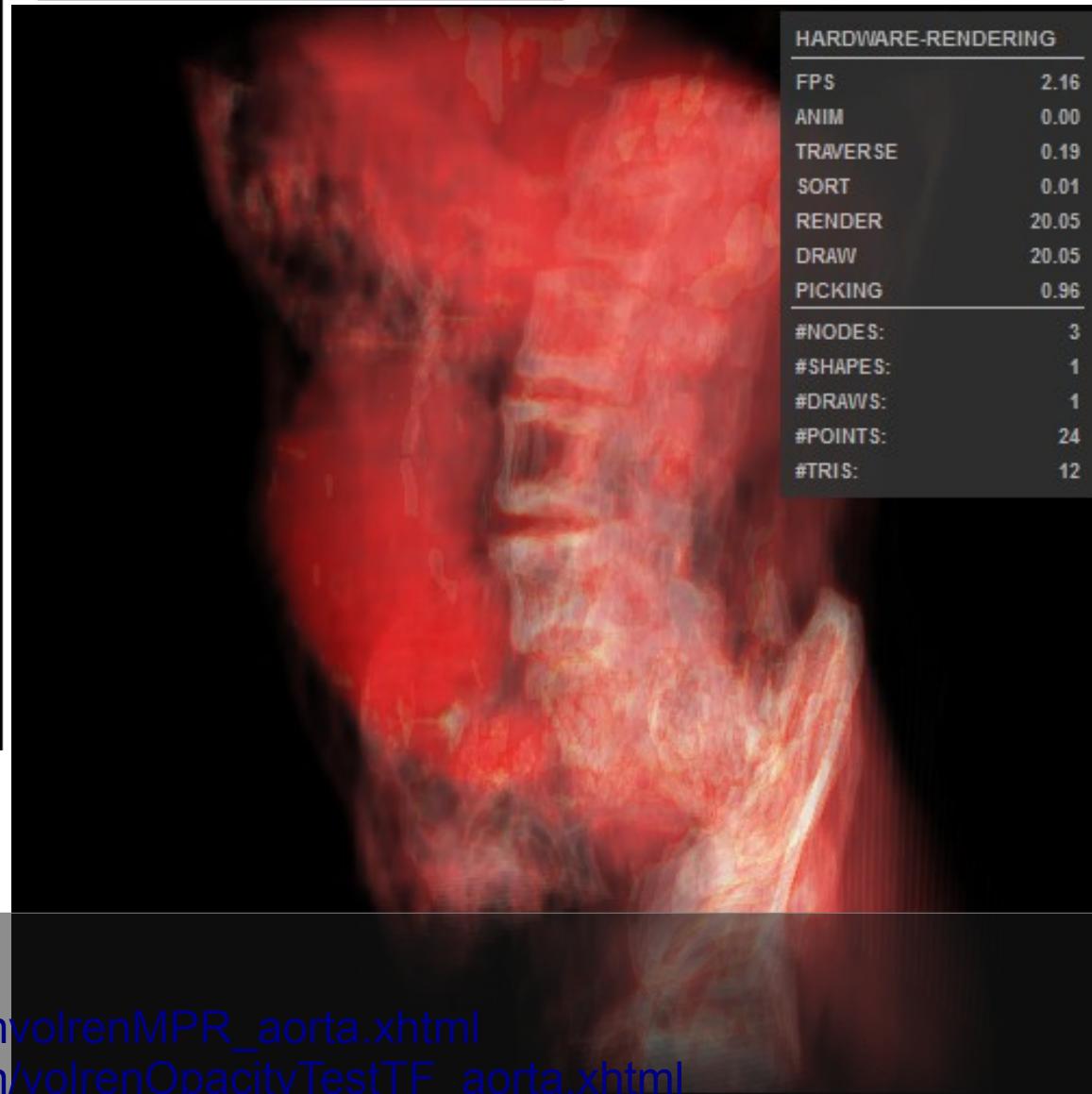
NURBS support
CAD Data Structures



Medical



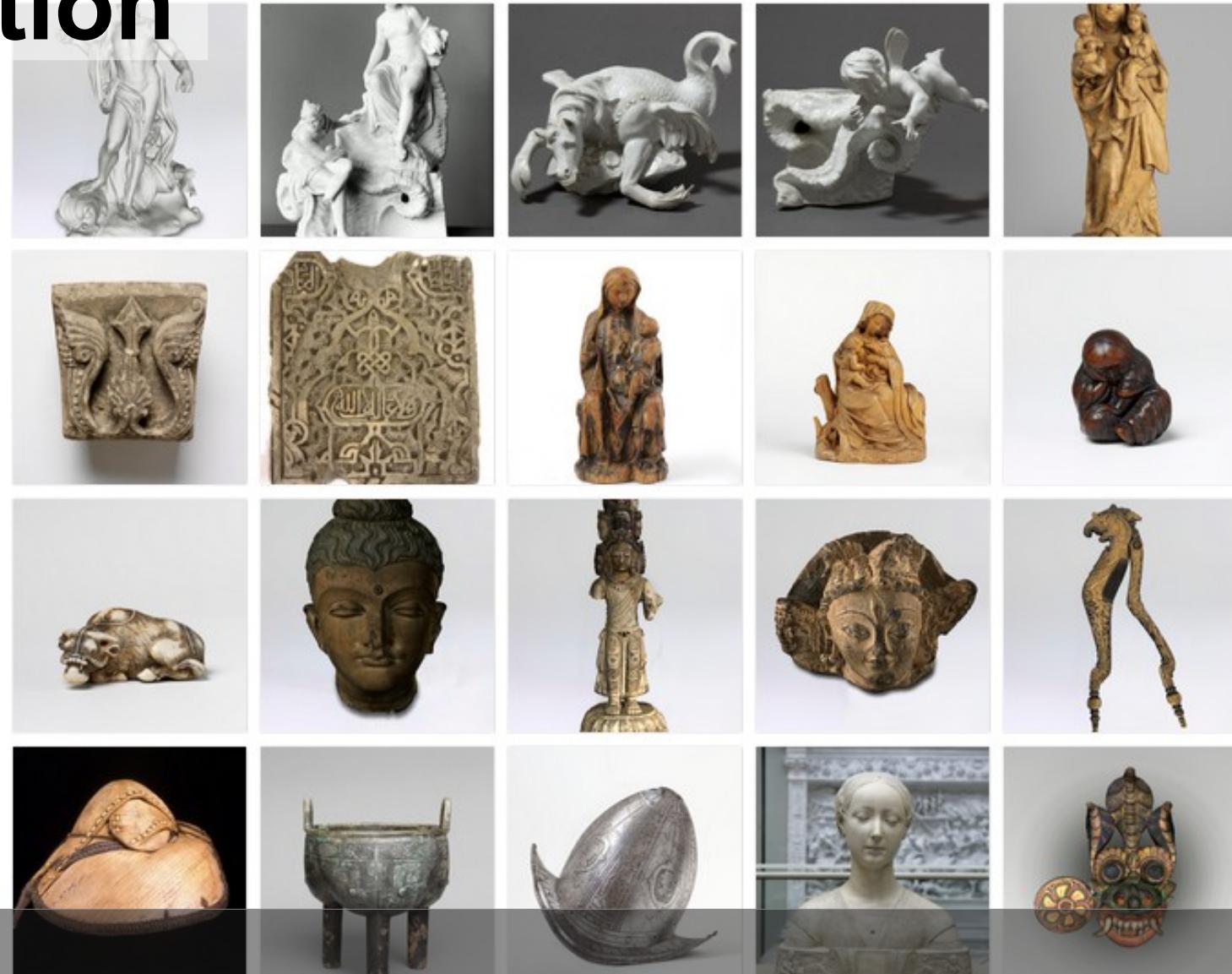
Choose positionLine with slider:



http://examples.x3dom.org/volren/volrenMPR_aorta.xhtml

http://examples.x3dom.org/volren/volrenOpacityTestTF_aorta.xhtml

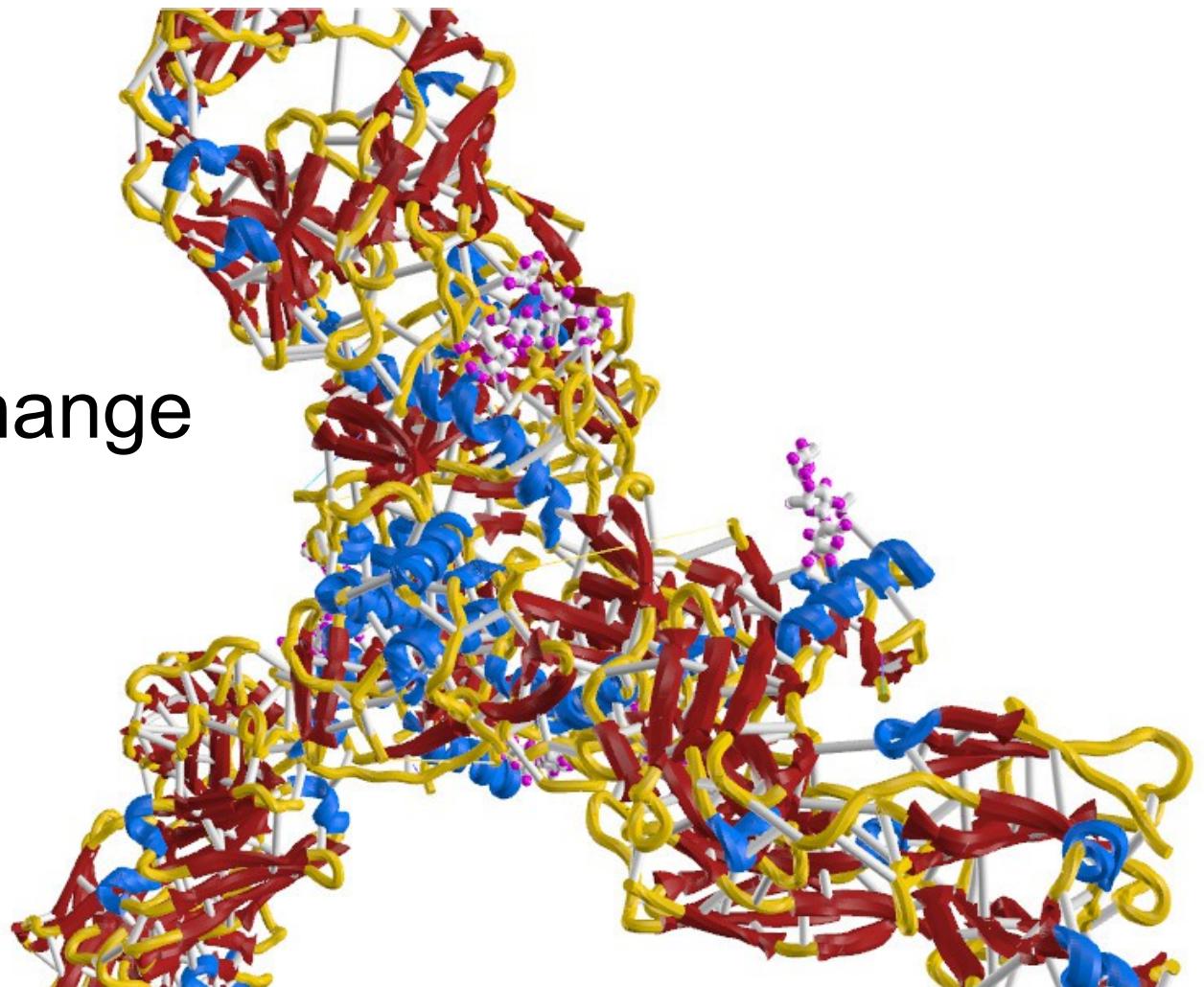
Cultural Preservation



<http://www.3dcoform.eu/x3domCatalogue/>

3D Printing

NIH 3D Print Exchange



<http://3dprint.nih.gov/discover/3dp/000626/x3d>

GIS



Darmstadt building visualization
with CityServer3D



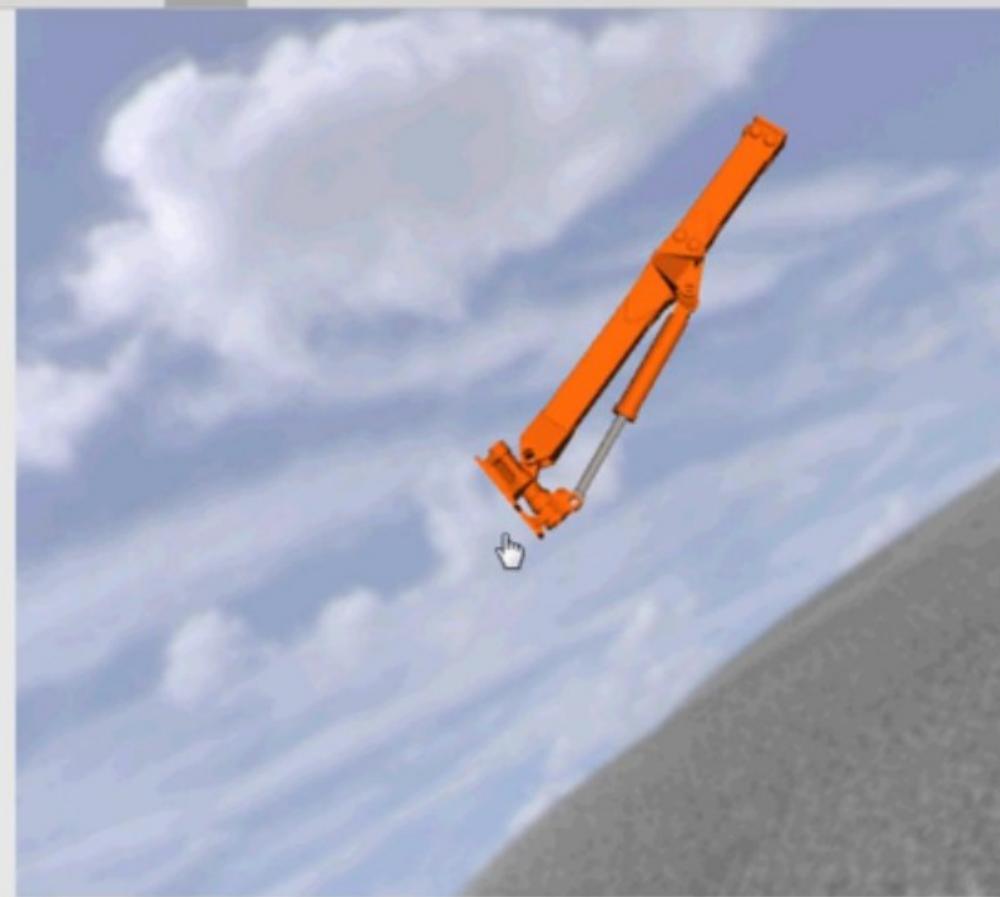
<http://www.cityserver3d.de/en/webvisualisation/>

Networking

CAD simulation
with networking
through web-
sockets to X3DOM
display

```
kaantoytunnuslaskutus-1 comp-kaantoytunnuslaskutus-1
kallistussylinteri_runko-1 comp-kallistussylinteri_runko-1
kallistussylinteri_varsi-1 comp-kallistussylinteri_varsi-1
kallistussylinterikorvake-1 comp-kallistussylinterikorvake-1
kehto-1 comp-kehto-1
paapuomi-1 comp-paapuomi-1
```

Move the boom

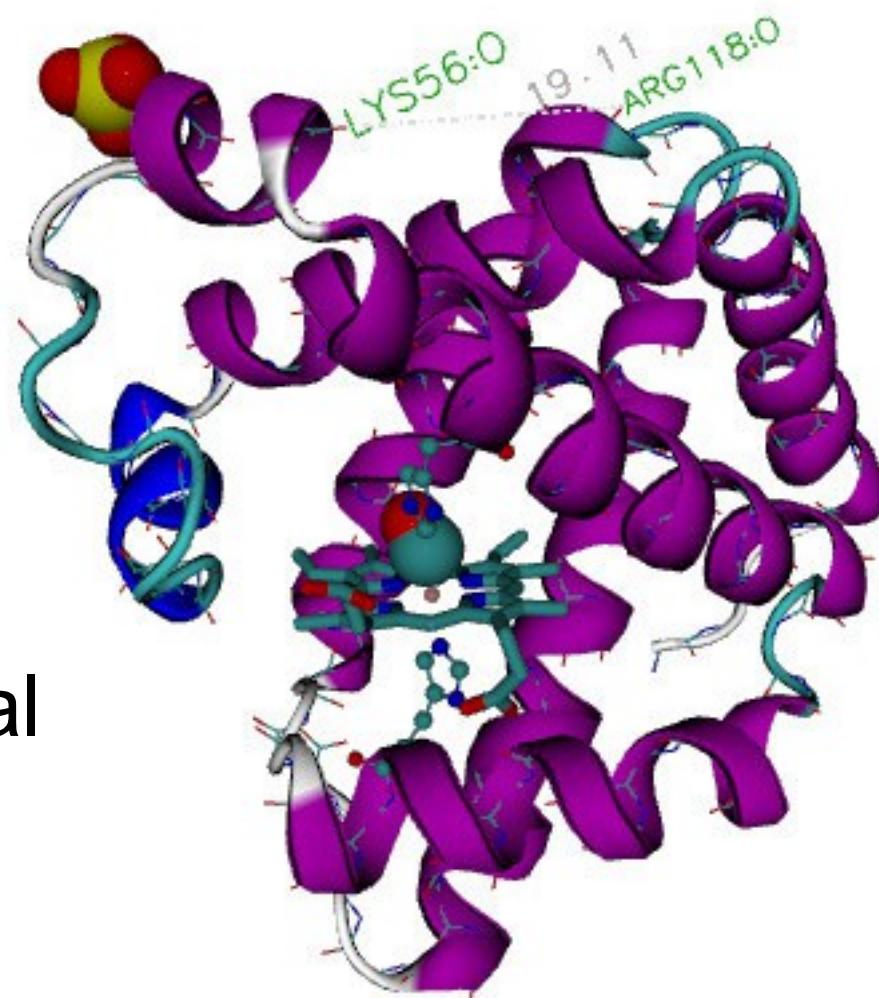


<http://www.x3dom.org/?p=2826>



Scientific Visualization

Myoglobin from Visual
Molecular Dynamics



18.52 fps
anim: 0
traverse: 1
sort: 0
render: 15
#Tris: 97756
#Pnts: 58196

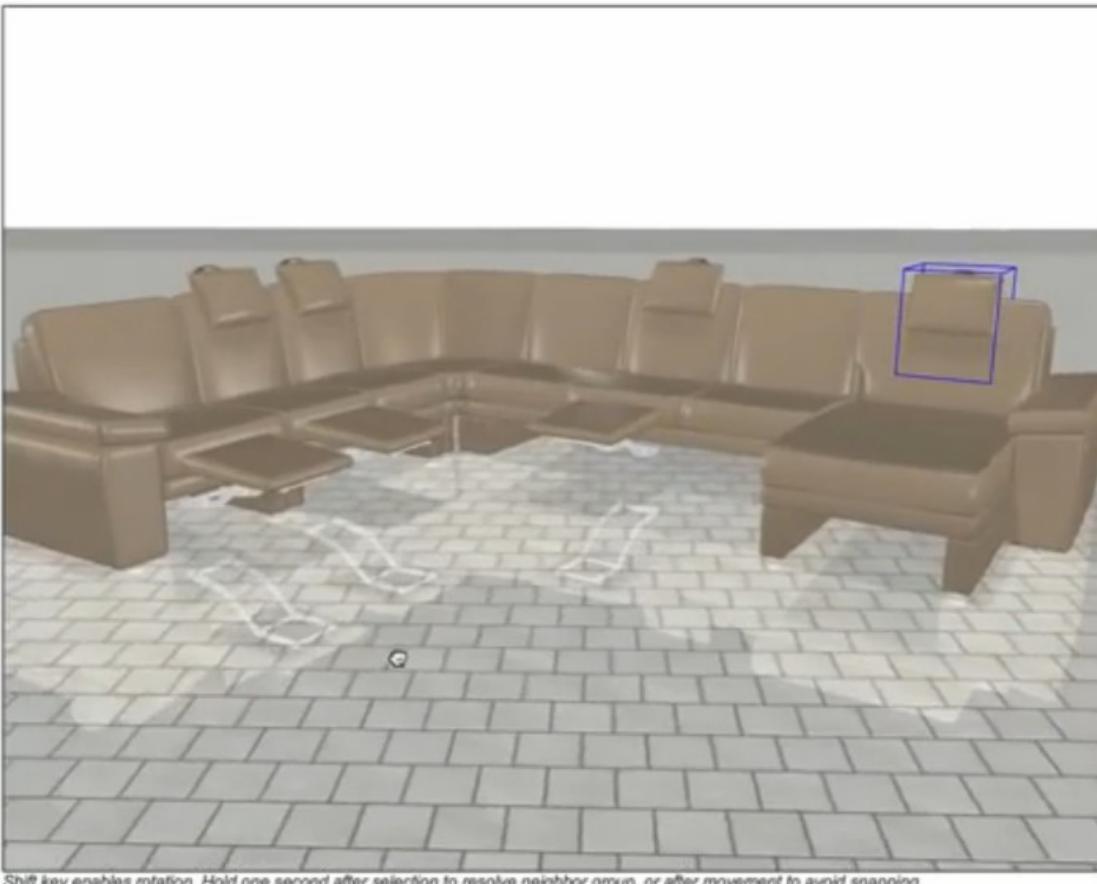


Consumer Products

Prototype
furniture
configurator

iG.Explorer

Mode: Multi Product Planning, Keep Selection
Scene: <http://www.intelligentgraphics.biz/I.G.GFX/Data/Fmmunzer.Care4.Columbia.0842.x3d> -> t24
Selection: t24_... (Fmmunzer.Care4.0842)



intelligentgraphics

Examples

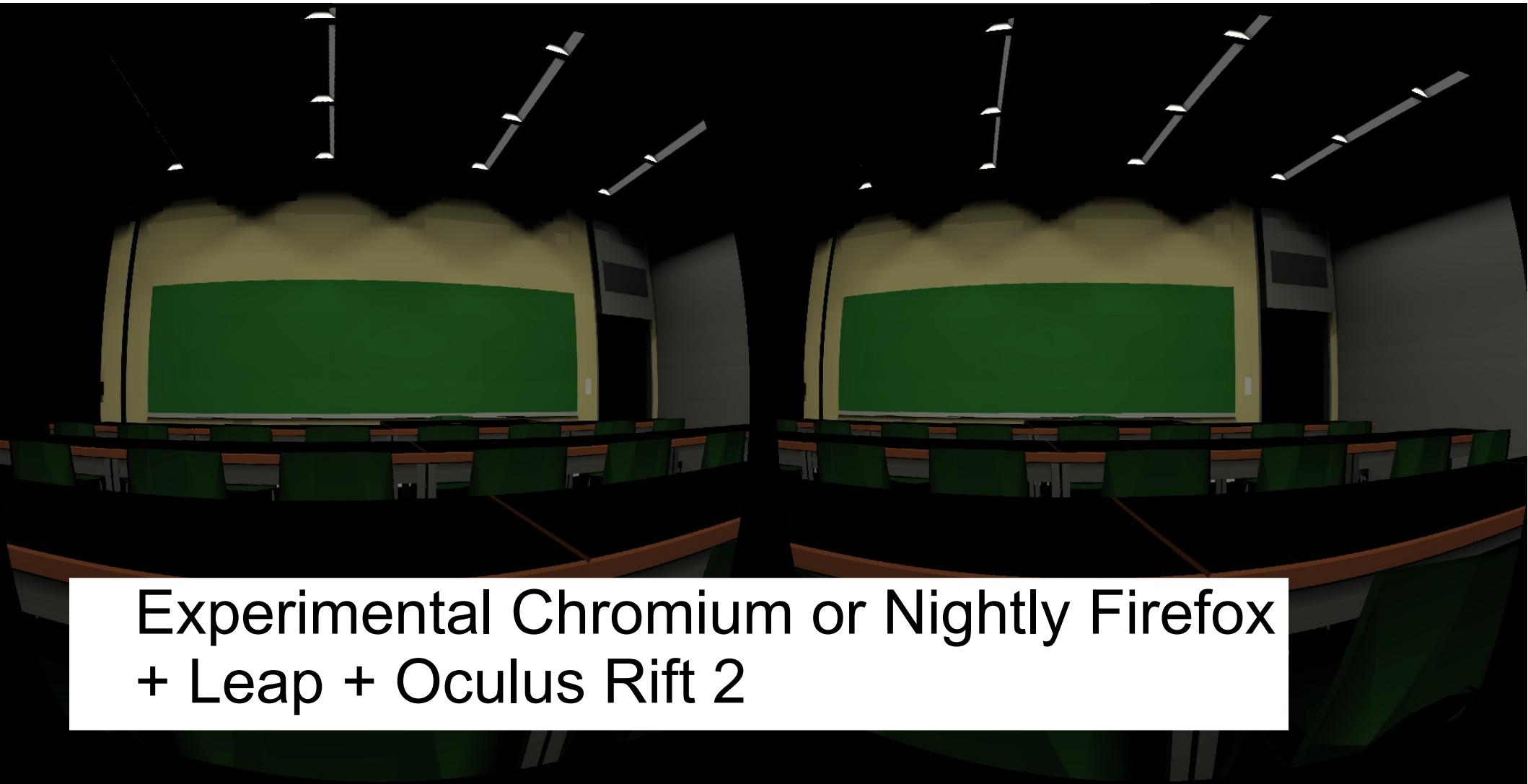
FM Munzer Samples

- Add Ons
- 0800 Leg Rest
- 0840 Head Rest
- 0842 Head Rest
- Test Materials
- Assign Cover_122_76
- Assign Cover_122_682
- Assign Cover_122_238
- Assign Cover_410_96
- Assign Cover_289_569
- Standard
- 0010 None
- 0013 None
- 0050 None
- 0100 None
- 0106 None
- 0151 Right
- 0153 Left
- 0166 Right
- 0168 Left
- 0192 None
- 0197 None
- 0200 Two-sided, Straight
- 0201 Right
- 0202 None
- 0203 Left
- 0236 Right
- 0238 Left
- 0260 Two-sided, Straight
- 0261 Right
- 0262 None
- 0263 Left
- 0264 Right
- 0269 Left
- 0275 Two-sided, Straight
- 0276 Right
- 0277 None
- 0278 Left
- 0300 Two-sided, Straight
- 0301 Right
- 0303 Left
- 0305 Two-sided, Straight
- 0306 Right
- 0308 Left
- 0310 Two-sided, Straight
- 0311 Right
- 0313 Left
- 0451 Right
- 0453 Left
- 0476 Right
- 0478 Left
- 0520 Two-sided, Corner
- 0600 Two-sided, Corner



<http://www.x3dom.org/?p=3671>

Web VR

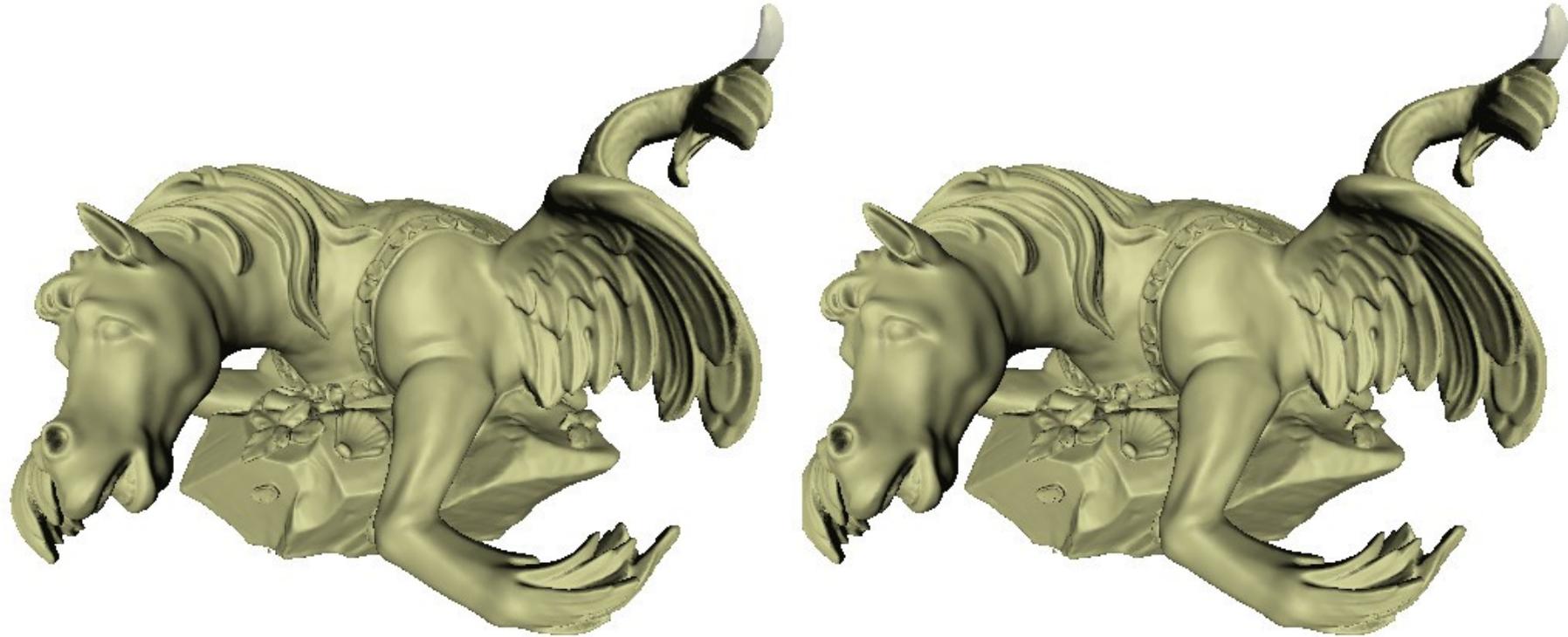


Experimental Chromium or Nightly Firefox
+ Leap + Oculus Rift 2



<http://www.x3dom.org/?p=3973>

Stereoscopic Phone Display



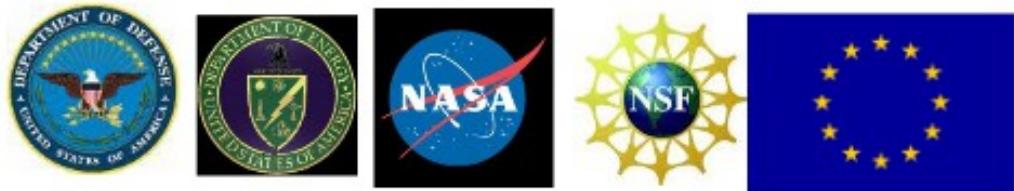
- Use Cardboard to display and rotate models
- Split screen rendering using shaders



<http://realism.com/x3d-tools/fbx-converter/DR-Kelpie>



Adoption



A photograph of a complex industrial facility, likely a refinery or chemical plant. The image is dominated by a dense network of silver-colored pipes of various sizes, some with black insulation. These pipes are supported by a white steel framework. In the background, there are large white storage tanks and more industrial structures. The lighting is bright, creating strong highlights and shadows on the metallic surfaces.

Production Pipeline



Create 3D Content

- Maya, Blender, etc
- Watch polygons, texture size, animations
- 1,087,716 triangle model
<http://examples.x3dom.org/buddha/model-bg.html>



<http://examples.x3dom.org/buddha/model-bg.html>

Convert to X3D

- Blender
- Meshlab
- X3D-Edit
- FBX Converter
- Other conversion tools (partial list below)



<http://realism.com/x3d-tools/fbx-converter/>

<http://www.web3d.org/x3d/content/examples/X3dResources.html#Conversions>

Insert into Web Page

- Use HTML5
- Add X3DOM Libraries
- Add X3D tags
- Instructions below

HTML



Add Page/X3D Interactions

- JavaScript Based
- Supports jQuery
- Supports AJAX
- JSON loader
- Respects Cross-Site Scripting security restrictions
- Future support for XML encryption



Summary

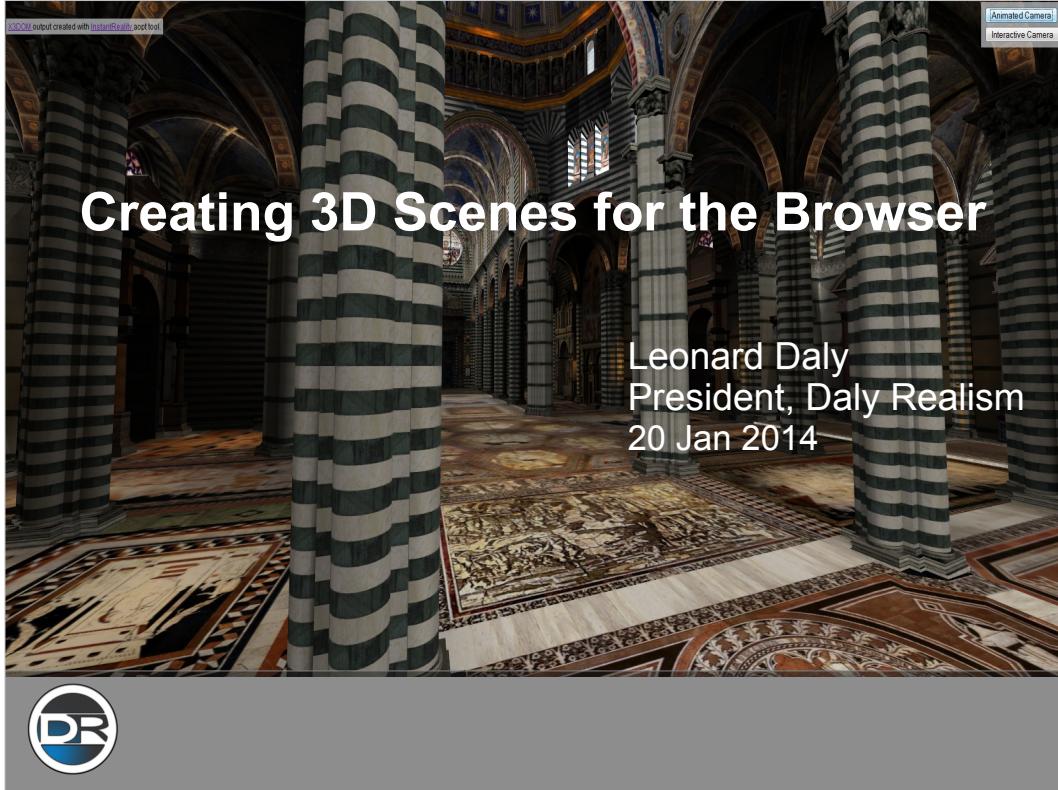
- Technical capabilities
- Long-lifetime
- Public safety
- International review
- Well specified and documented
- **X3D is Serious VR**



Attributions

- Web3D logo and X3D mark owned by Web3D Consortium
- Flipper model in public domain from Naval Postgraduate School
- JSON loader from Yvonne Jung (Fraunhofer and Hochschule Fulda)
- Medical models from Virginia Tech and Fraunhofer
- NIH models in public domain from 3D Print Exchange
- CAD Simulation with Networking by Semogen (YouTube video:
<https://www.youtube.com/watch?v=rx9qEkvtTpT8>)
- Consumer products sofa from Intellographics
- Industrial Pipes by Kabacchi (
<https://www.flickr.com/photos/kabacchi/5329449840/in/photostream/>) CC BY 2.0
- Various logos from their owners, no claim is made on those marks
- All other X3D/X3DOM content reused with permission from Fraunhofer





Leonard Daly is an Internet consultant specializing in web applications and 3D systems architecture. This presentation highlights the capabilities and advantages of using X3D for Serious Virtual Reality

Background from
<http://examples.x3dom.org/Demos/Siena/siena.html>

What is X3D

Extensible **3D** Graphics



A royalty-free format
and run-time for
interactive, animated
3D scenes with real-
time rendering in the
browser



More information available at
<http://www.web3d.org/x3d/what-x3d>

X3D Capabilities

Technical

- Interactive
- Lighting
- Shaders
- Movable Cameras
- NURBS / CAD
- Volume Rendering
- Geospatial
- Particle Systems
- Physics

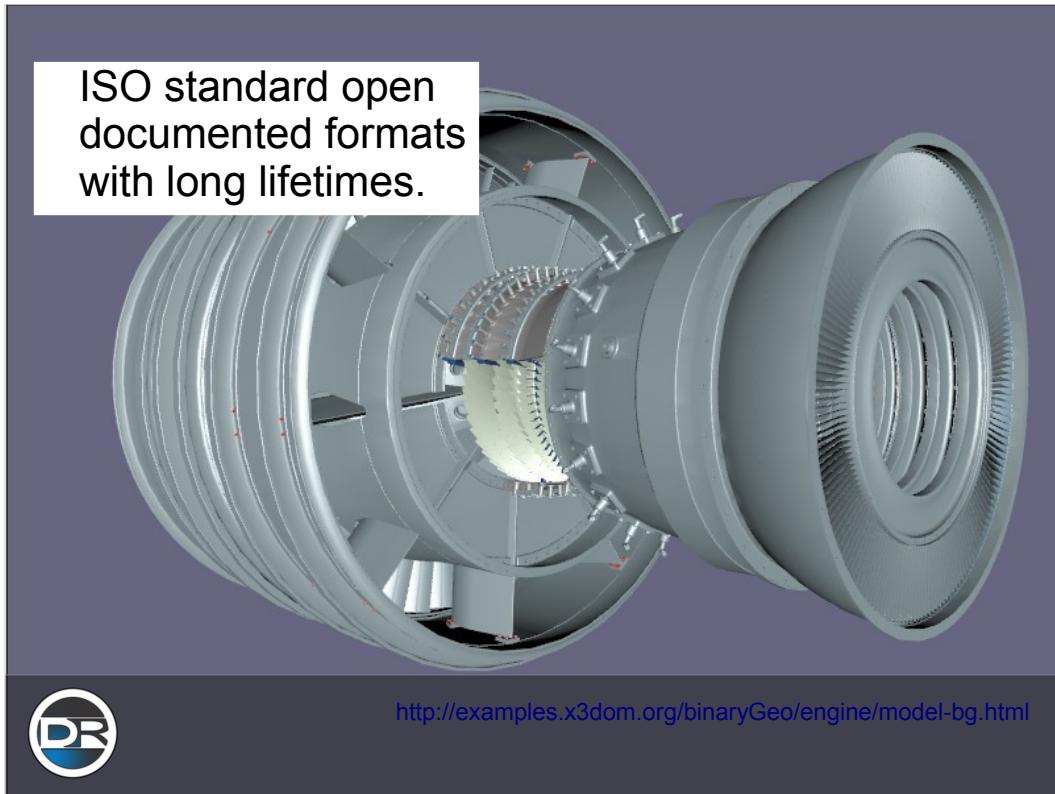
Business

- ISO approved
- Open standard
- 5 encodings
- HTML5 Compatible
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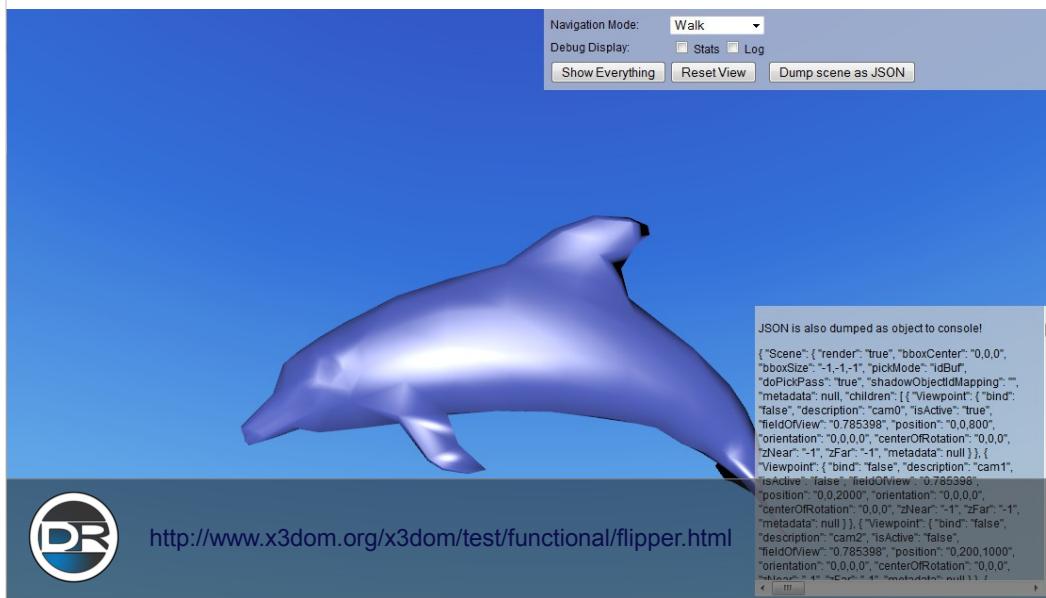
For examples of X3D use, see

<http://www.web3d.org/example> or the slides that follow



Binary encoding of aircraft engine CAD model. Demo
at
<http://examples.x3dom.org/binaryGeo/engine/model-bg.html>

Three standardized encodings (XML, Binary, Text) two in development (JSON, Encrypted)



JSON encoded model with loader for X3DOM. Demo
at
<http://www.x3dom.org/x3dom/test/functional/flipper.html>

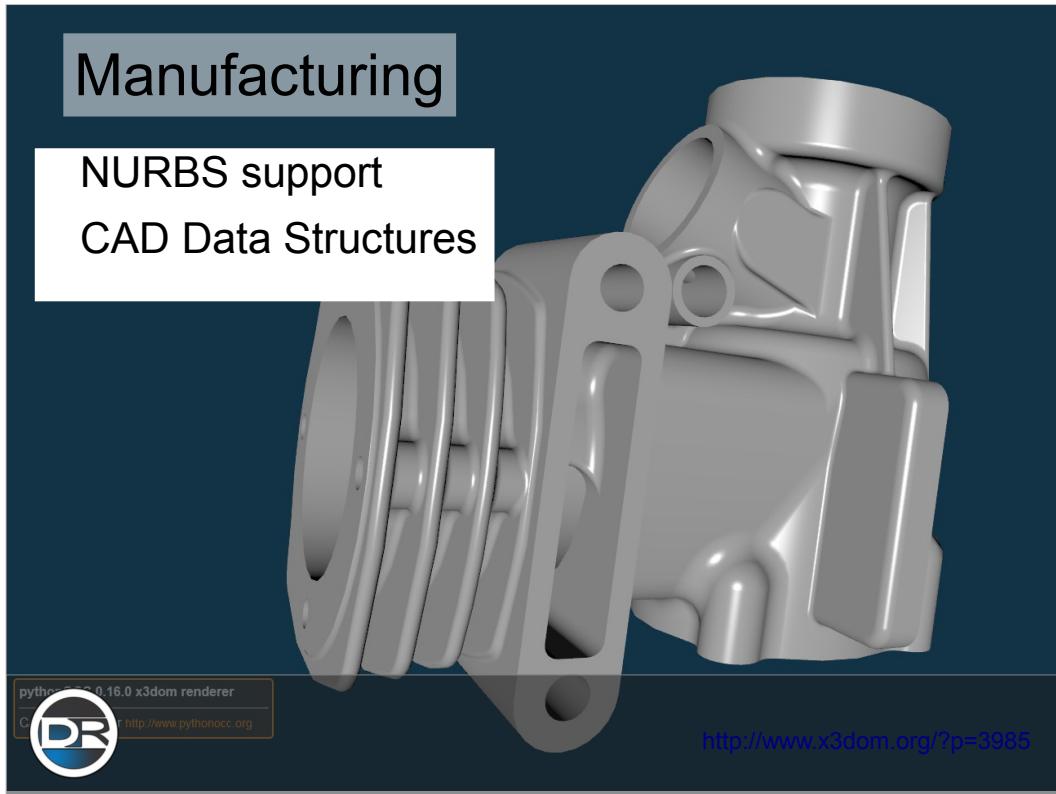
Industrial – Drilling rig w/shadows



Oilrig interactive CAD model with real-time shadows.

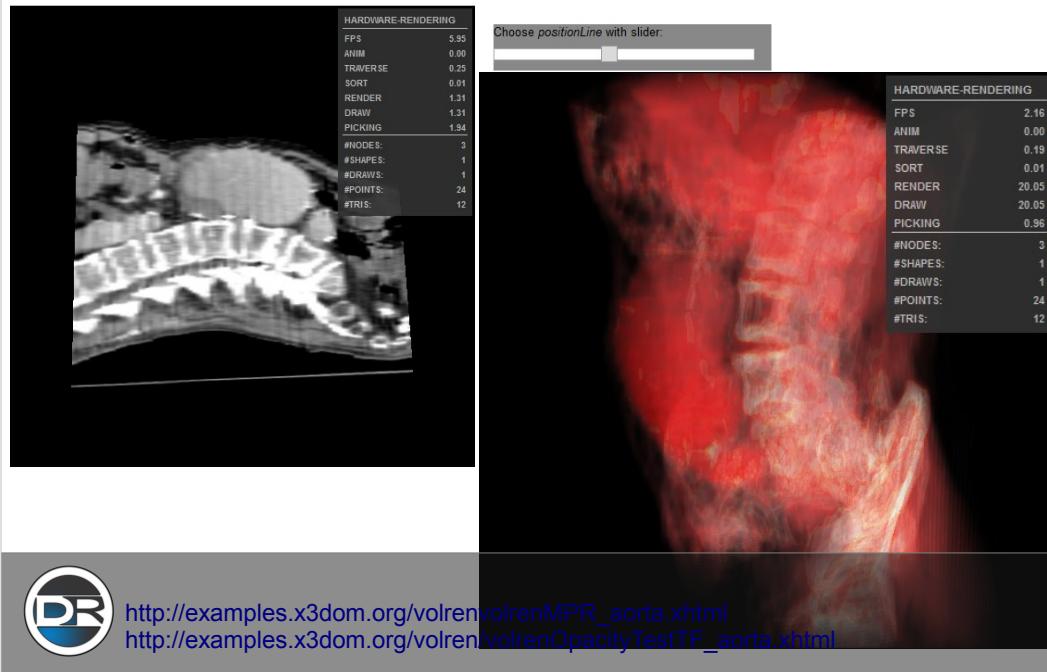
Detail down to large bolts. Demo at

http://examples.x3dom.org/binaryGeo/oilrig_demo/index.htm



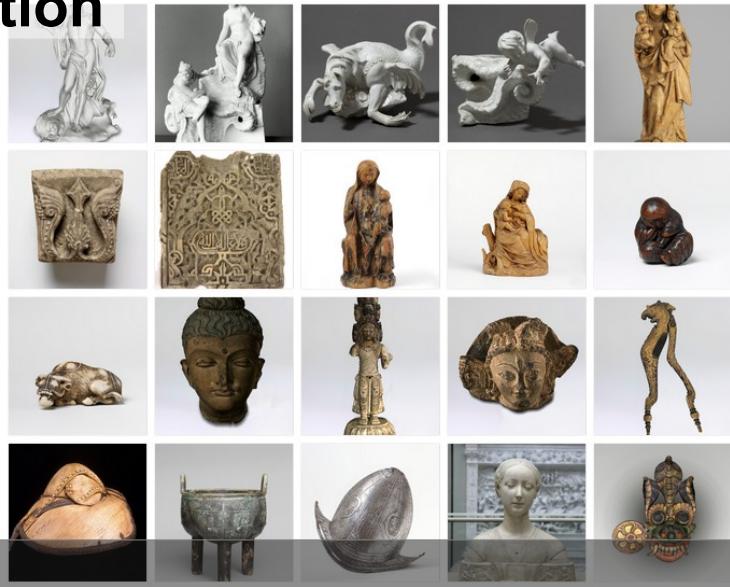
Converted from a CAD model that uses BRepS using
PythonOCC. Demo at
<http://www.x3dom.org/?p=3985>

Medical



Interactive volume rendering. The left image shows a cut plane through the spine (
http://examples.x3dom.org/volren/volrenMPR_aorta.xhtml). The right image is a volume render of the chest region (
http://examples.x3dom.org/volren/volrenOpacityTestTF_aorta.xhtml). Both demos are interactive.

Cultural Preservation

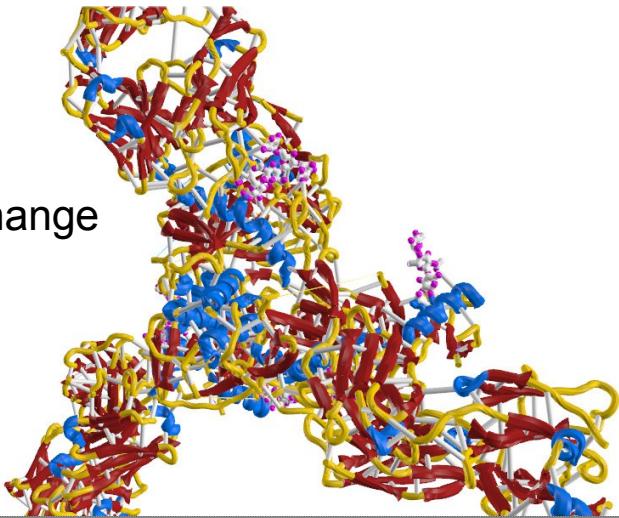


<http://www.3dcoform.eu/x3domCatalogue/>

Scanned 3D museum artifacts stored with 3D geometry and textures. The catalog is available at <http://www.3dcoform.eu/x3domCatalogue//>. Each model can be individually examined,

3D Printing

NIH 3D Print Exchange



<http://3dprint.nih.gov/discover/3dpx/000626/x3d>

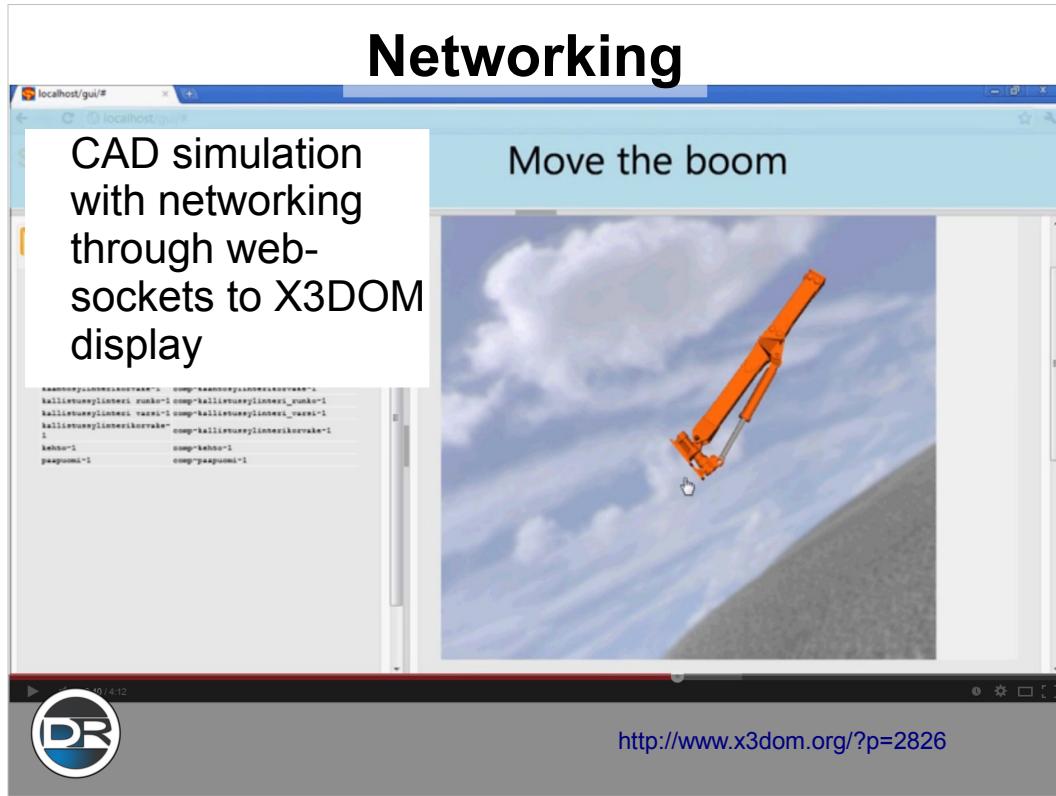
3D model of Ebola from NIH's 3D Print Exchange. The Print Exchange contains printable open source and public domain models of many different health-related objects. These are suitable for education and research. This model is available at
<http://3dprint.nih.gov/discover/3dpx/000626/x3d>

GIS



<http://www.cityserver3d.de/en/webvisualisation/>

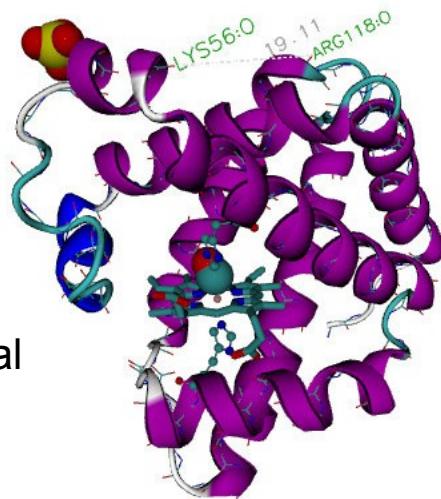
City model of Darmstadt, Germany. It uses CityServer to provide the models, textures, placement, and other features. The viewable model is at <http://www.cityserver3d.de/en/webvisualisation/>



Visualization of CAD simulation through a network (WebSockets) interface. The description along with a link to the screen-capture video is at <http://www.x3dom.org/?p=2826>.

Scientific Visualization

Myoglobin from Visual
Molecular Dynamics



18.52 fps
anim: 0
traverse: 1
sort: 0
render: 15
#Tris: 97756
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<http://www.x3dom.org/?p=1919>

Visual Molecular Dynamics (VMD) system natively
exports X3D for visualization. Description at
<http://www.x3dom.org/?p=1919>

Consumer Products

Prototype furniture configurator

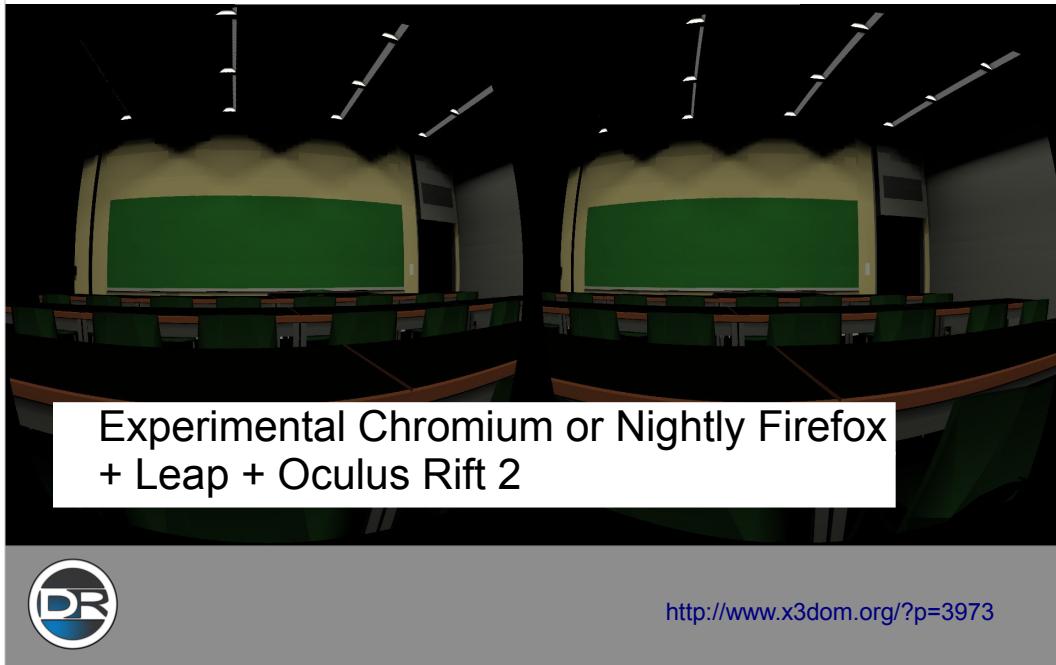


The screenshot shows a 3D model of a modular sofa in a software environment. The sofa is composed of several brown leather-like components. A blue rectangular selection box highlights a specific part of the sofa's backrest. The background features a brick floor and a plain wall. On the right side of the screen, there is a sidebar titled "intelligent graphics Examples" which lists various "FM Munzer Samples" such as "0800 Leg Rest", "0840 Head Rest", etc.

<http://www.x3dom.org/?p=3671>

Intelligraphics has developed an online furniture configurator that allows consumers to design their furniture from modular components. The fabric, color, and details can all be selected. See <http://www.x3dom.org/?p=1919> for a description with a link to the video showing how it is used.

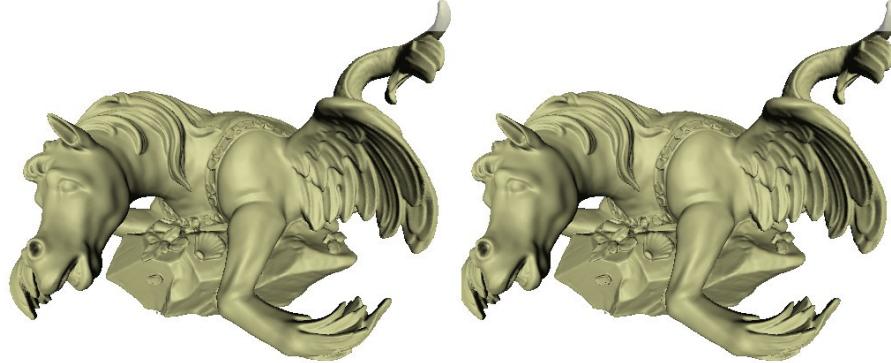
Web VR



<http://www.x3dom.org/?p=3973>

Designed to run in an Oculus Rift with Experimental Chromium or Firefox Nightly builds, this demo shows a classroom. The demo is at <http://examples.x3dom.org/Demos/ClassroomVR/classroom->

Stereoscopic Phone Display



- Use Cardboard to display and rotate models
- Split screen rendering using shaders



<http://realism.com/x3d-tools/fbx-converter/DR-Kelpie>



Adoption



Production Pipeline

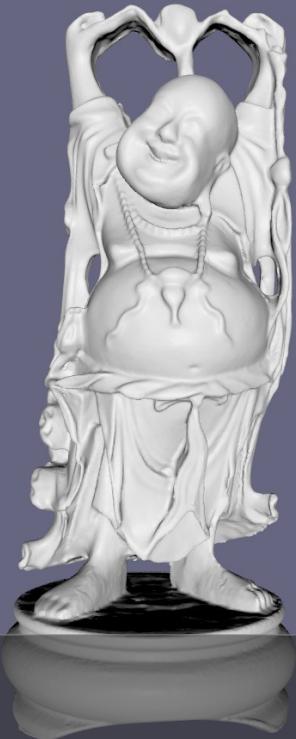


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<http://realism.com/blog/add-x3d-your-webpage>

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