

Birds of a Feather

Humanoid Animation

ISO/IEC 19774

SIGGRAPH 2015

2015. 08. 10

William Glascoe, Myeong Won Lee, and Don Brutzman

Web3D Consortium 



Agenda

- Our Contest!
- Web3D Consortium and X3D Graphics
- H-Anim Demonstrations
- Authoring Experience
- Joint Hierarchy and Initial Pose
- H-Anim Node Set
- New Work Item Proposal status
- How to Join us!
- Discussion (Q&A)

H-Anim 3D Music Video Contest

H-Anim character animation and music composition

- Location: Online international contest
Model and animate LOA1, LOA2 or LOA3 H-Anim characters
- Organizers: Web3D Consortium
KSA (Korean Standards Association)
- Proposal: H-Anim WG Meeting, January 2015
- Web3D Roadmap: Web3D Conference, June 2015

Tentative Schedule

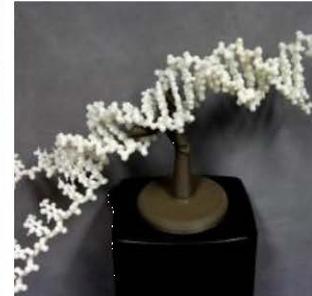
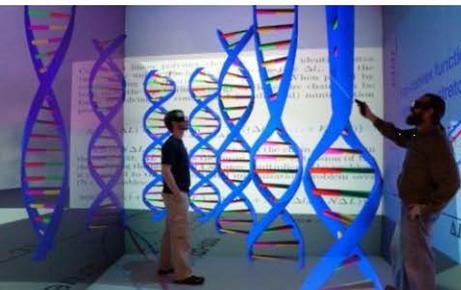
- Announcement: October 2015 & Web3D mailing list
- Submission deadline: March 2016
- Submission file format: *.wrl *.x3dv *.x3d *.x3dom *.avi *.mp3
- Review: April 2016
- Announce prizes: May 2016
- Demo: SIGGRAPH 2016

The Web3D Consortium

Web3D.org

Open Standards for Real-Time 3D
Communication

web|3D



www.web3d.org



- ***Content*** is King !
 - Author and deploy interactive 3D assets and environments with confidence, royalty-free
 - Required:
Portability, Interoperability, Durability
- Not-for-profit, member-driven organization
- International community of creators, developers, and users building evolving over 20 years of graphics and web technologies
- Open Standards ratification (ISO/IEC)

- Correctness via a huge number of tests
- [X3D Resources](#) describe tests in detail
 - [XML header and DOCTYPE](#) checking for correct document headers
 - [Well-formed XML](#) checking
 - [X3D Specifications: DOCTYPE and Schema Validation](#) checking for valid X3D nodes, fields and values
 - [X3D Schematron](#) rule checking to verify semantic correctness and detect internal-consistency problems
 - [X3D to ClassicVRML conversion](#) checks a variety of legal X3D constructs
 - [Regular expression checking](#) for malformed floating-point numbers and excess leading zeros
 - [X3D to XHTML conversion](#) pretty-print listing to check online URL links, document ROUTE connections, and provide node tooltips
- *New:* [X3D Tidy](#) helps authors automatically correct fixable errors

*Cross-platform Scene Graph
representations with
multiple encodings and APIs:*

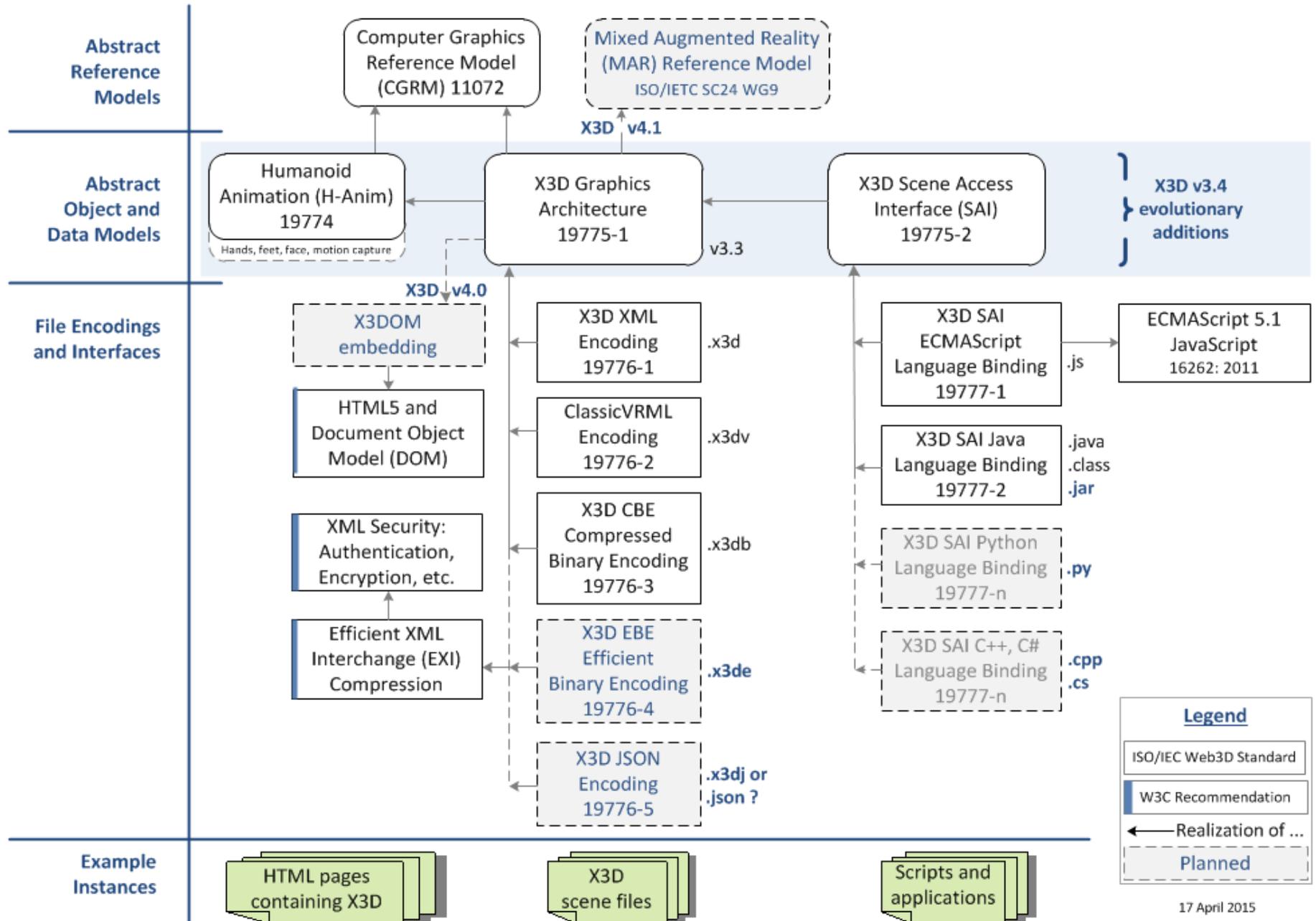
- **Extensible 3D (X3D)**
 - Rich 3D content model including support for:
DCC, CAD/BIM, Geospatial, Volume Vis,
HTML5/WebGL (X3DOM)...
- **Humanoid Animation (H-Anim)**
- **Virtual Reality Modeling Language (VRML)**



- Extensible 3D (X3D) Graphics
 - Royalty-free, International, Open Standard
 - Publish, view and archive
 - interactive 3D models via the WWW
- Archival stability - an enduring strength
- Repeatable examples – make it your own!
- Quality assurance ensures stability
- No showstoppers: beyond the plugin barrier
- Achieved “Breakout velocity”

- Single abstract architecture always defines “how X3D works” no matter how it is applied
- Multiple file encodings
 - XML for Web, HTML, security, etc.
 - Classic VRML
 - Efficient Binary for small size and streaming
 - JavaScript Object Notation (JSON)
- APIs for coders
 - JavaScript, Java, others possible

X3D Graphics Standards: Specification Relationships



- Embed X3D scenes directly into HTML pages
- x3dom.js player means no plugins needed
 - Huge benefit for reaching end users everywhere
- Open source, active community, great support
- Maturing rapidly: 61% coverage of full X3D
 - Need 20 nodes for X3D Immersive Profile (VRML)
 - Need 14 nodes for suggested HTML Profile
 - Web authors can then publish with full confidence
 - Doable by December 2015?

- SRC: Shape Resource Container
 - Compressed geometry, streamability
 - Also usable in other encodings
- EXI: Efficient XML Interchange
 - Compressed XML, W3C std, many codebases
 - Compatible w/XML Security: XML Encryption and XML Digital Signature (authentication)
- “Best of both worlds” meets requirements and improves Compressed Binary X3D

- Data structures using JavaScript syntax
- Goal: facilitate loading of X3D scene graphs in other data-driven visualization libraries
 - Three.js, d3.js, X3DOM, etc.
- Experimental version available
 - Applied to 3800+ X3D scenes
 - X3dToJson stylesheet bundled in X3D-Edit
 - Discussing loaders, syntax on X3D Public mail list

- [X3D Resources](#) list and summarize numerous assets that are available to support both X3D Graphics and its compatible predecessor, Virtual Reality Modeling Language (VRML97).
- [X3D Scene Authoring Hints](#) provide collection of style guidelines, authoring tips and best practices to improve the quality, consistency and maintainability of X3D scenes.

- Develop solutions for technical challenges and opportunities
- All experience levels welcome!
- Proven process for perennial results
- Open activity + member-benefit activity
- Web3D Consortium provides immense value
- <http://www.web3d.org/working-groups>

- Lots of work
 - Medically correct level of detail
 - Hands and feet, poses, facial animation
 - Motion-capture streaming, matching BVH
 - Confirming, improving support for skin meshes
- Corresponding standards
 - H-Anim functional standard
 - X3D Graphics abstract specification matches

- Interoperable standards for representing human anatomy via various image modalities
- Volume visualization techniques are mature and repeatably implemented
- DICOM is partner for volume visualization and other topics

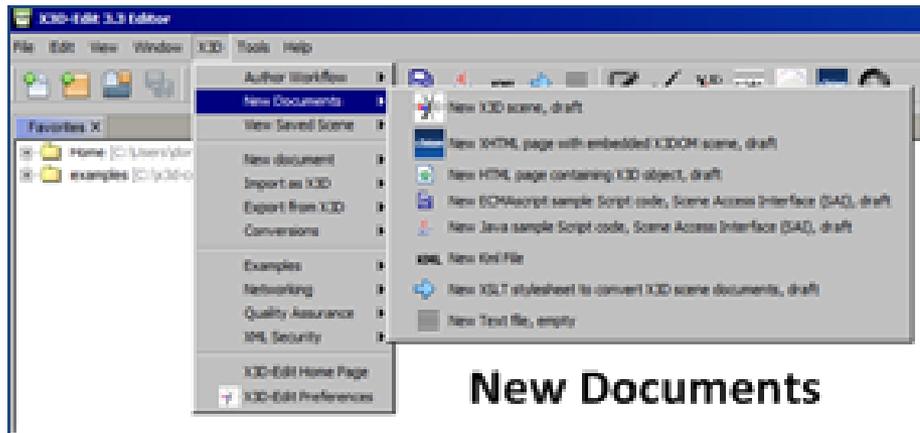
- PTM: projective texture mapping
- Advanced material and lighting models
- Many others listed on [X3D V3.4 website wiki](#)
- Pragmatic process to steadily extend X3D
 - Functional description written for specification
 - 2 or more implementations (emphasis X3DOM)
 - Example scenes to demonstrate interoperability



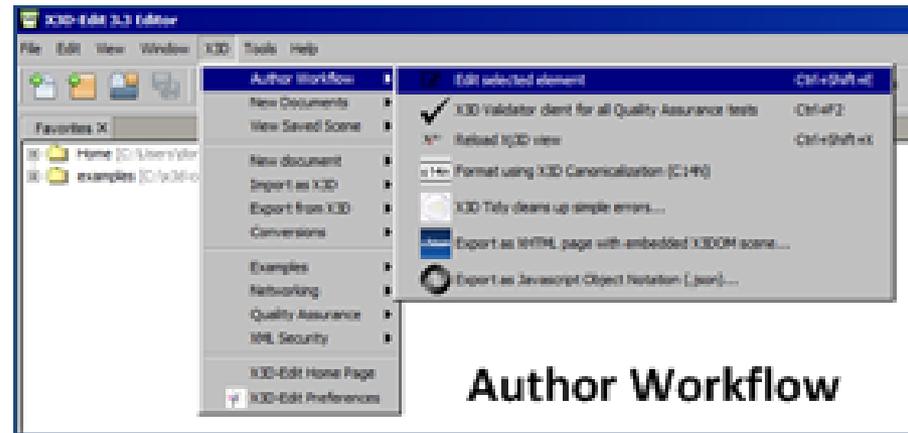
[Web3D Conference H-Anim w/Bullet Physics](#)

- Free open-source editor using Java, Netbeans
- Implements 85% of X3D specification
- Integrates Xj3D player, launches all others
- Monthly updates
- Development and testing of new X3D features
 - X3D Validation: 9 separate Quality Assurance tests
 - X3D Tidy: finds and fixes common scene “gotchas”
 - New release: regularizing workflow

X3D-Edit Workflow



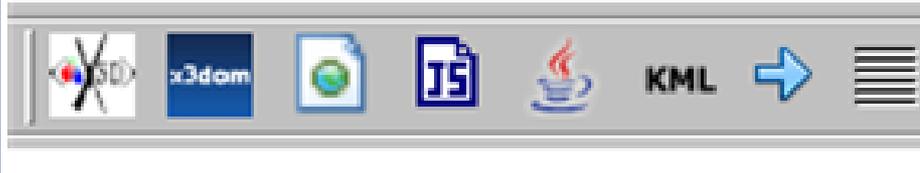
New Documents



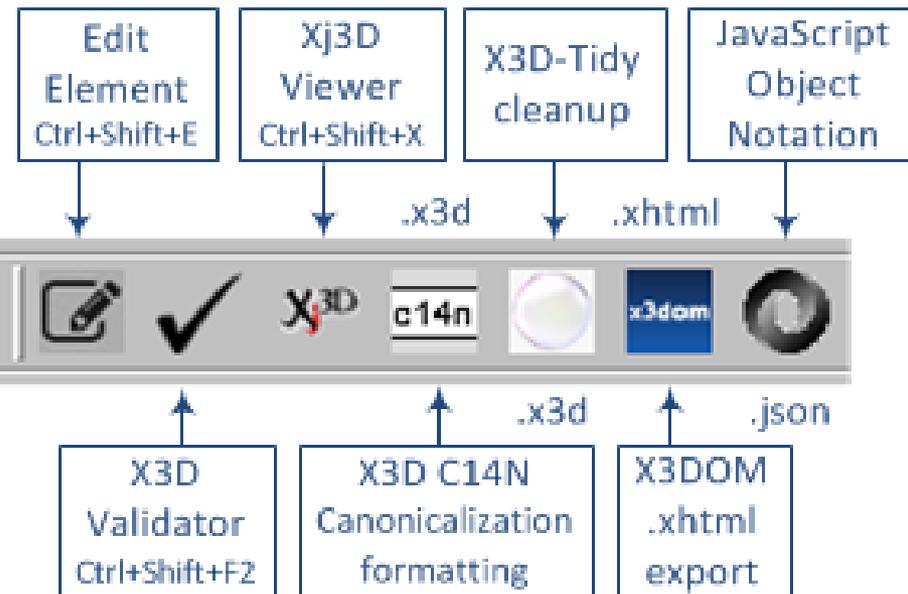
Author Workflow

create new file document

XML X3DOM X3D
 .x3d .xhtml .html .js .java .kml .xslt .txt



X3D-Edit 3.3





X3D Validator



This Web application checks X3D scene validity.

Choose a local .x3d scene:

No file selected.

Enter an online .x3d url:

- 9 separate tests bundled together <https://savage.nps.edu/X3dValidator>
- Also available within X3D-Edit authoring tool

- [Xj3D](#) is an open-source Java viewer and application codebase for X3D graphics scenes
- Multiple format-conversion, filter capabilities
- Numerous tool usages including off-screen image rendering of scene viewpoints
- 68% coverage of X3D v3.3 Specification

The Authoring Experience



Client Realtime 3D Rendering - for Scalable Interactivity

BS Content Studio - new release of 3D tool - based on 10 years of components



3D Engine - BS Contact



- High performance
- Cross-platform, cross-browser
- C++ Plugin and X3DOM (WebGL) export
- OEM versions

R & D - Development Projects



- EC Projects
- ZIM Projects
- Innovation Projects
- Customer Projects

Tools - BS SDK



- BS SDK
- BS Content Studio
- Standards VRML, X3D, CityGML, Collada, STL, etc.

3D Content - Creation Services



- GIS / CAD
- 5-10cm resolution
- Online capable
- [RNV Demo](#)

Customer Case Studies

Customer success stories

[Watch the video](#) [More Information](#)

News / Technical News

Bitmanagement wins contract for new R&D project 3DLiveVis

[More Information](#)

Developer Area

Development resources at hand

[Jobs](#) [More Information](#)

Download Center

New BS Contact 8.0 Web 3D

[More Information](#)

Case studies

Browse by:

[All \(54\)](#) |
 [New \(16\)](#) |
 [3D animation \(7\)](#) |
 [3D modeling and texturing \(11\)](#) |
 [3D rendering \(10\)](#) |
 [Dynamics and effects \(4\)](#) |
 [UI workflow & pipeline \(22\)](#)

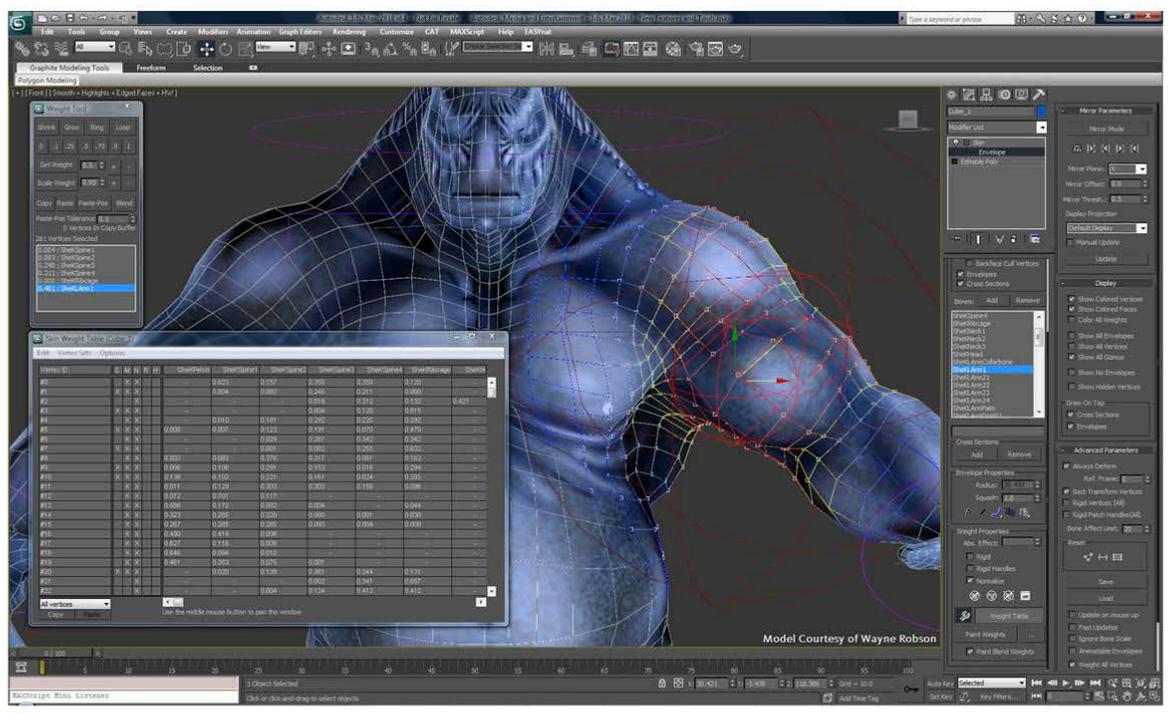
Buy

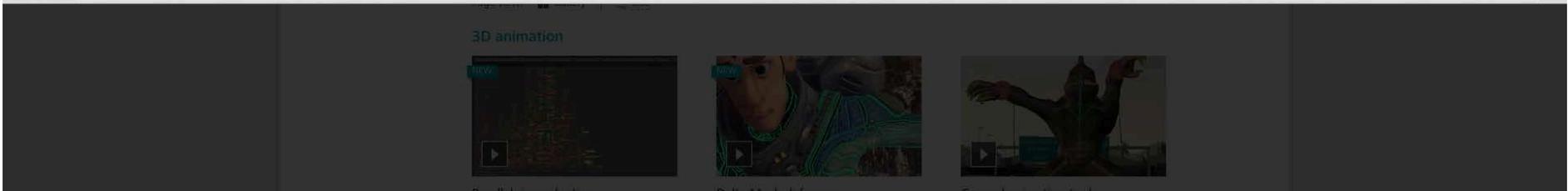
Support & learning

Page view | Gallery | Filter

General animation tools

Work with keyframe, Dopesheet, and procedural tools.





Geodesic Voxel Binding

Get high-quality skinning results in less time. (video: 1:05 min.)

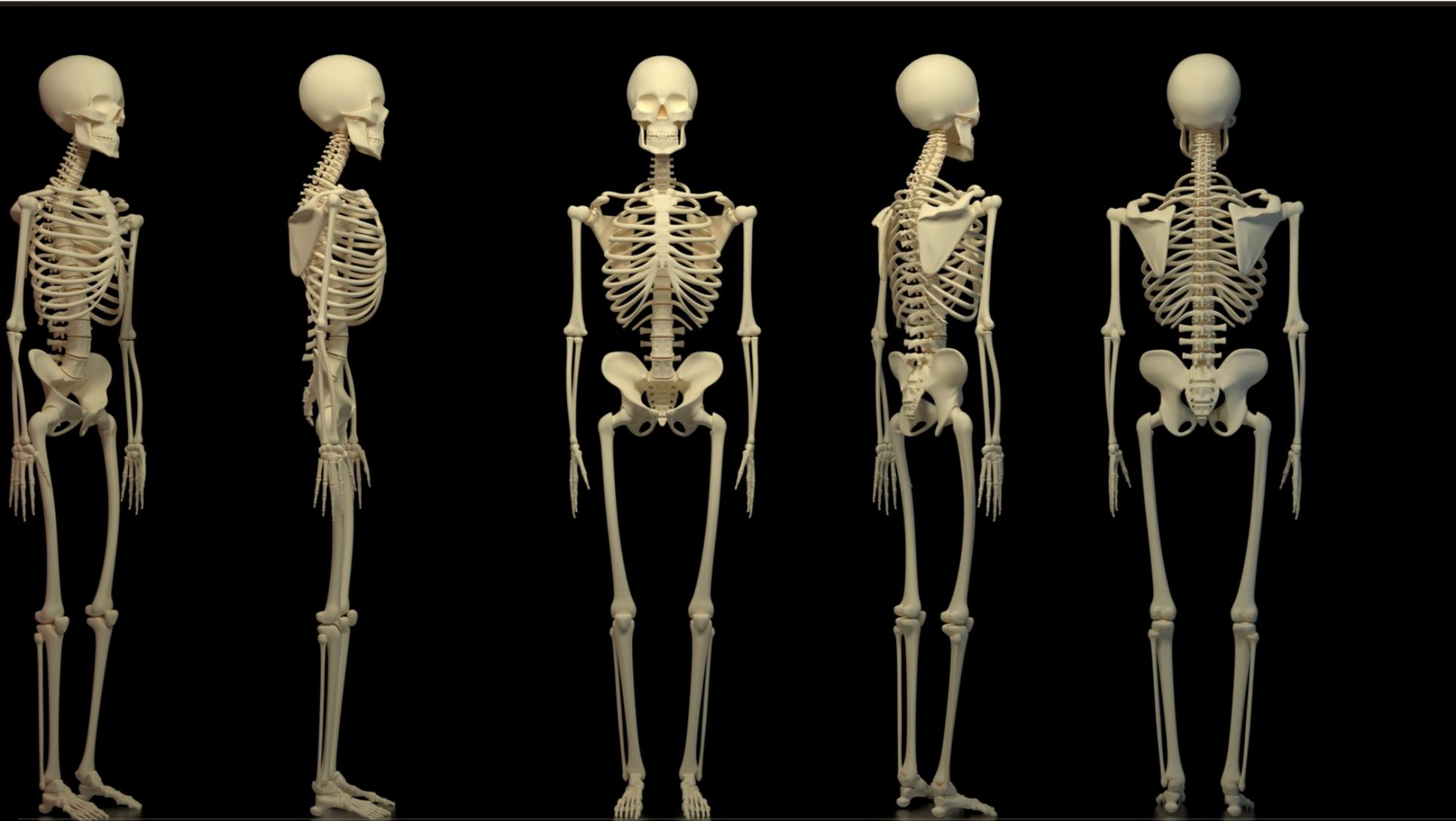
FOLLOW AUTODESK

- Facebook
- Twitter
- YouTube
- LinkedIn
- All social

- 3D printing
- 3D printing software
- Drafting software
- Painting software
- Student downloads
- Design engineering
- Civil engineering
- PLM
- Character animation
- Movie editing
- Installation, registration & activation
- System requirements
- Releases/updates
- Account Management
- Community resources
- Consulting
- Training & certification
- Subscription
- Support offerings
- Localization/translation
- Partners & special offers

- Gallery
- Workshop releases
- Newsroom
- Trade Center
- Autodesk Foundation
- Autodesk Labs
- Autodesk Research
- Autodesk University

I-Pose

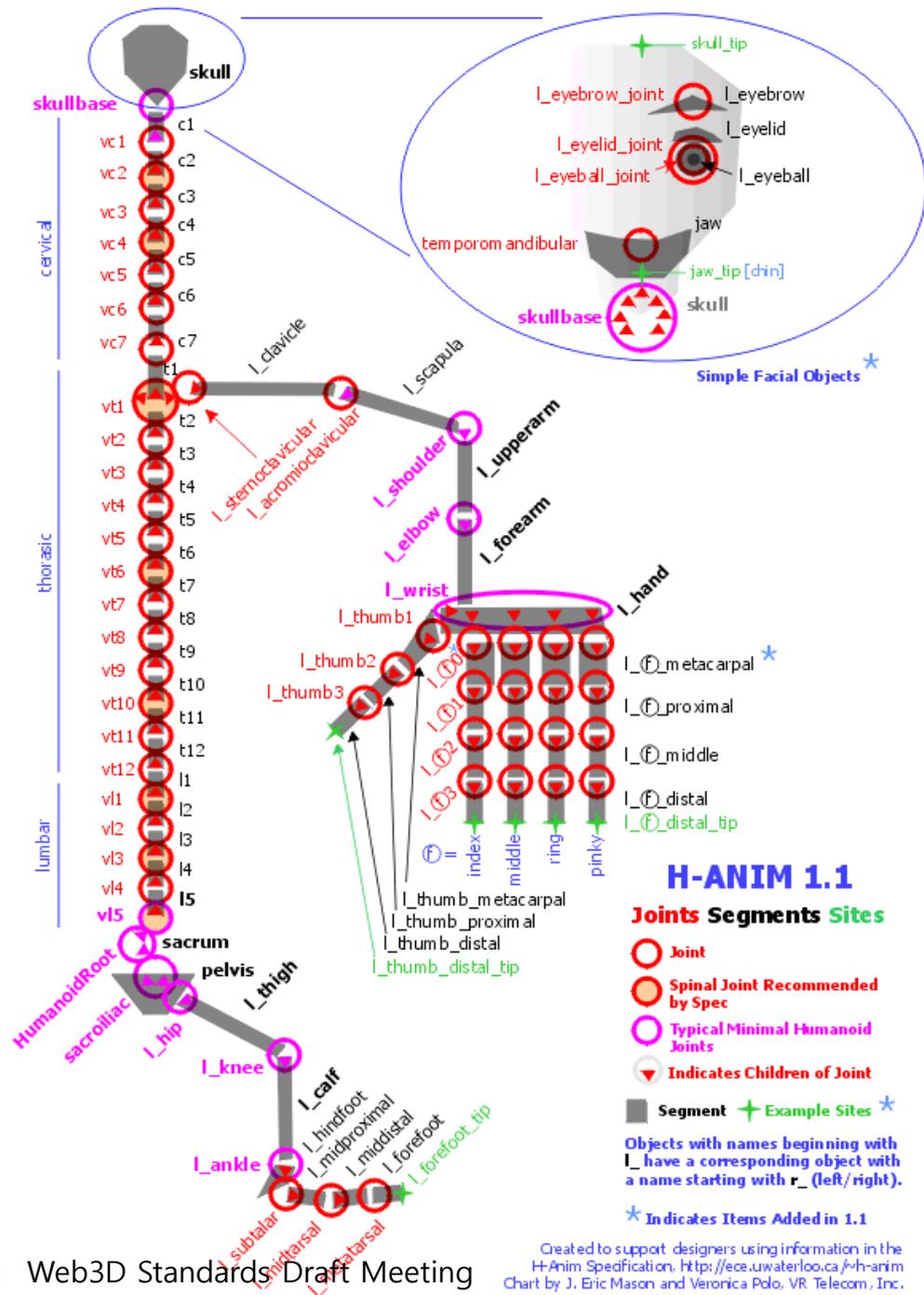


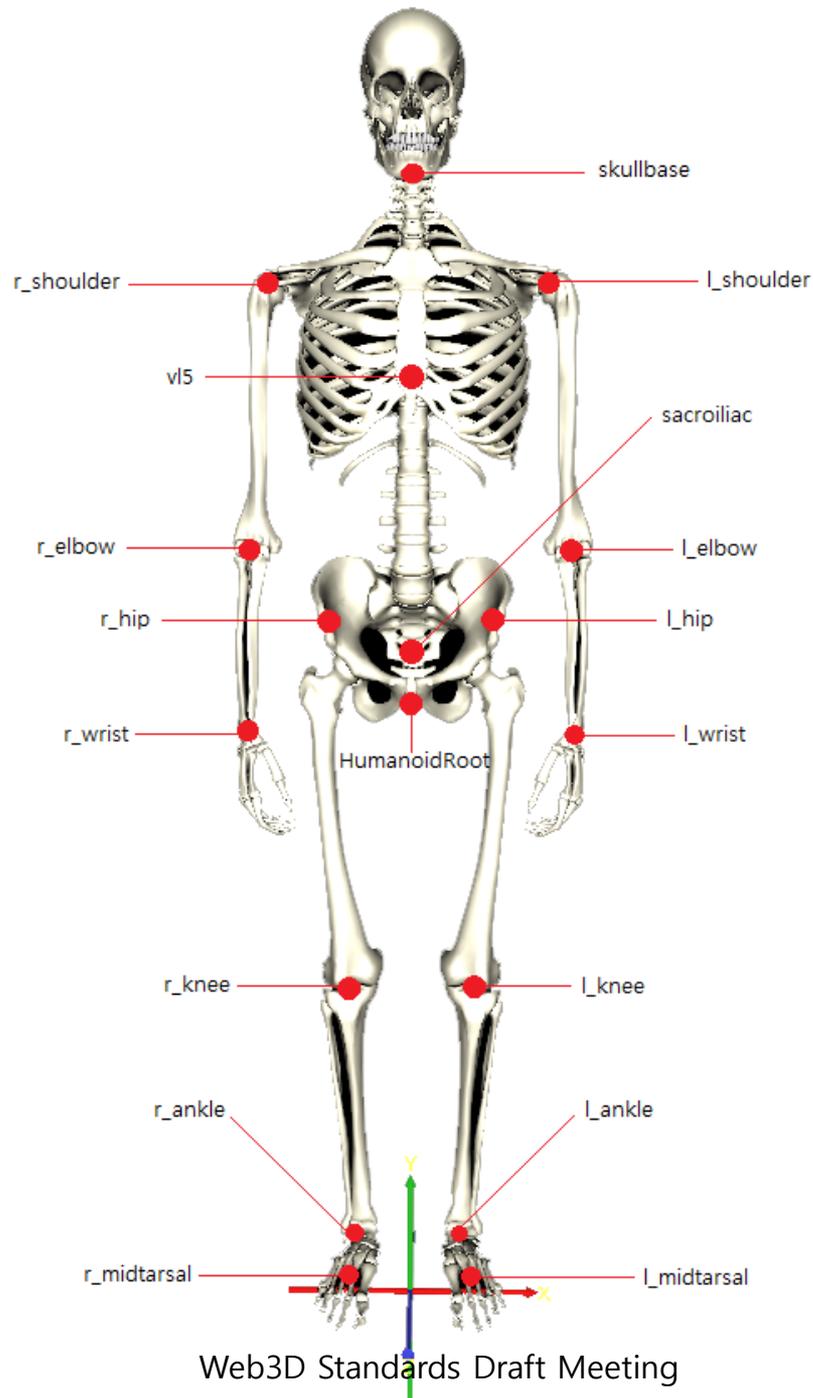
Levels of Articulation

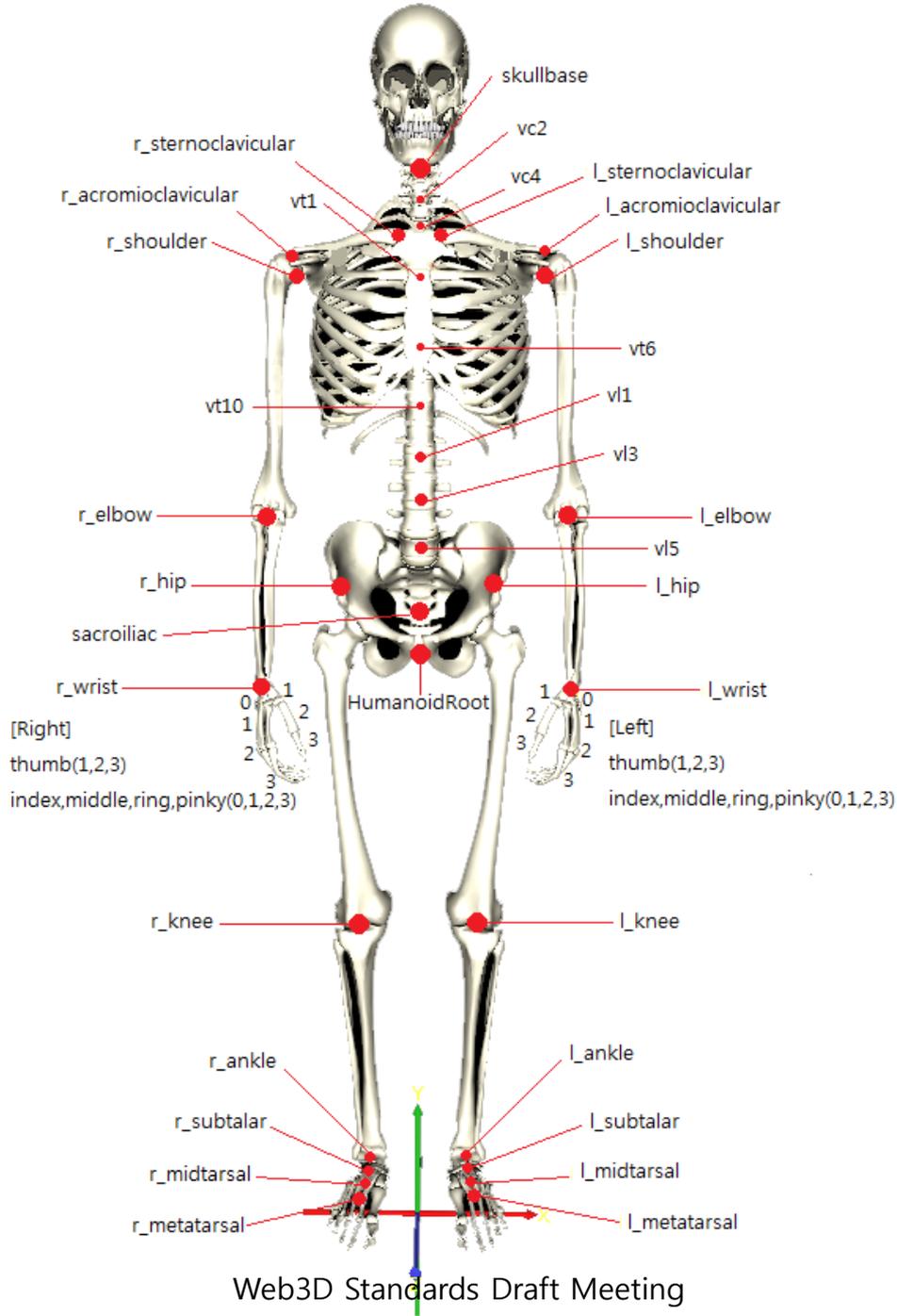
	LOA1	LOA2	LOA3
No. of joints	18	71	94
No. of segments	18	71	94
Representation details	Basic joint hierarchy	More spinal joints and finger joints	More spinal joints than LOA2 and 7 eye joints
Motion capture devices	MS Kinect	Part of LOA2 joints available depending on MoCap devices (between LOA1 and LOA2)	None
Animation levels	Simple humanoid animation	Detailed animation (e.g., Fingers on piano or guitar)	Upgraded detailed in facial animation (e.g., eye gazing) overall more natural movements

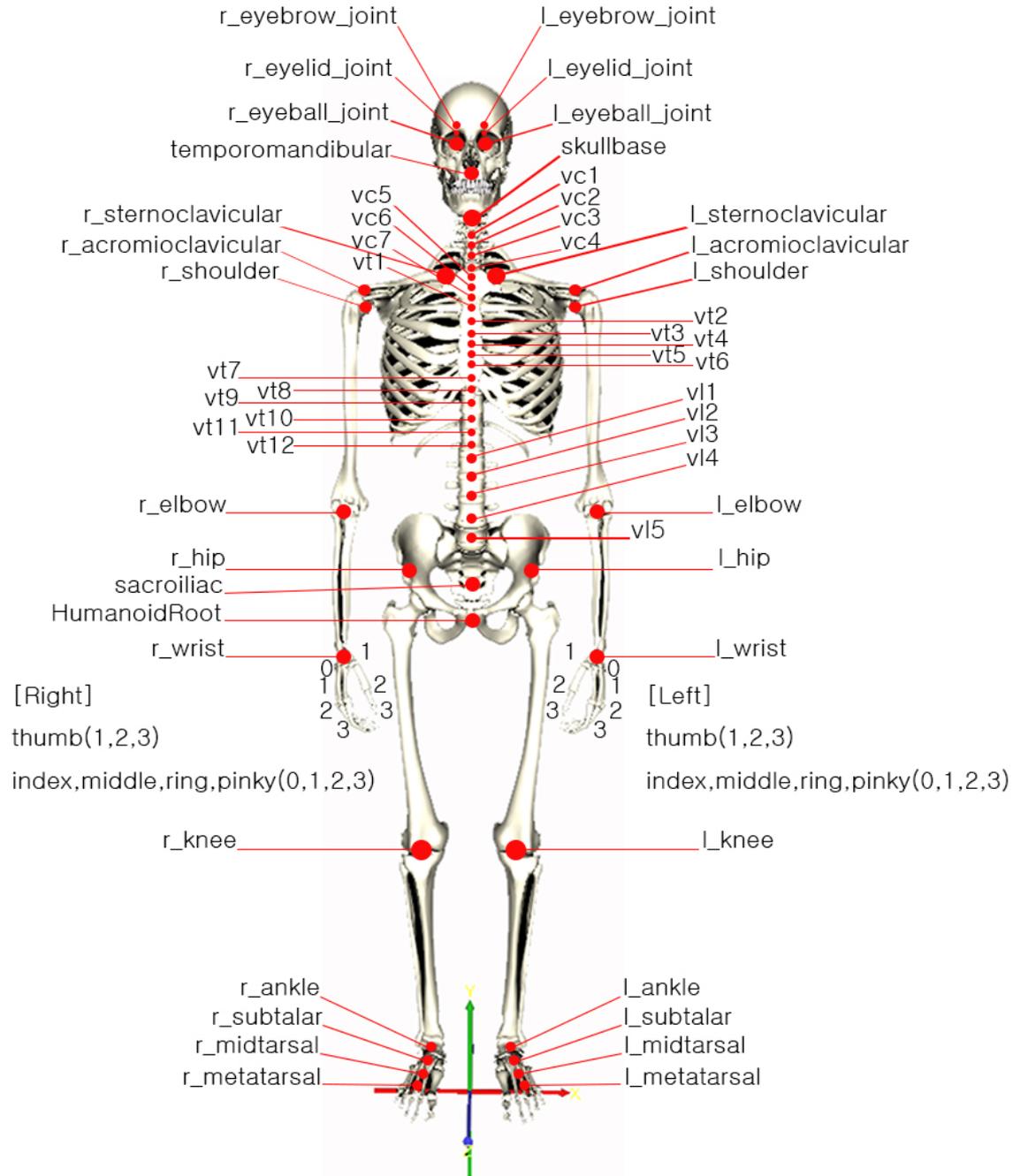
Joint Hierarchy

ISO/IEC 19774 Humanoid Animation

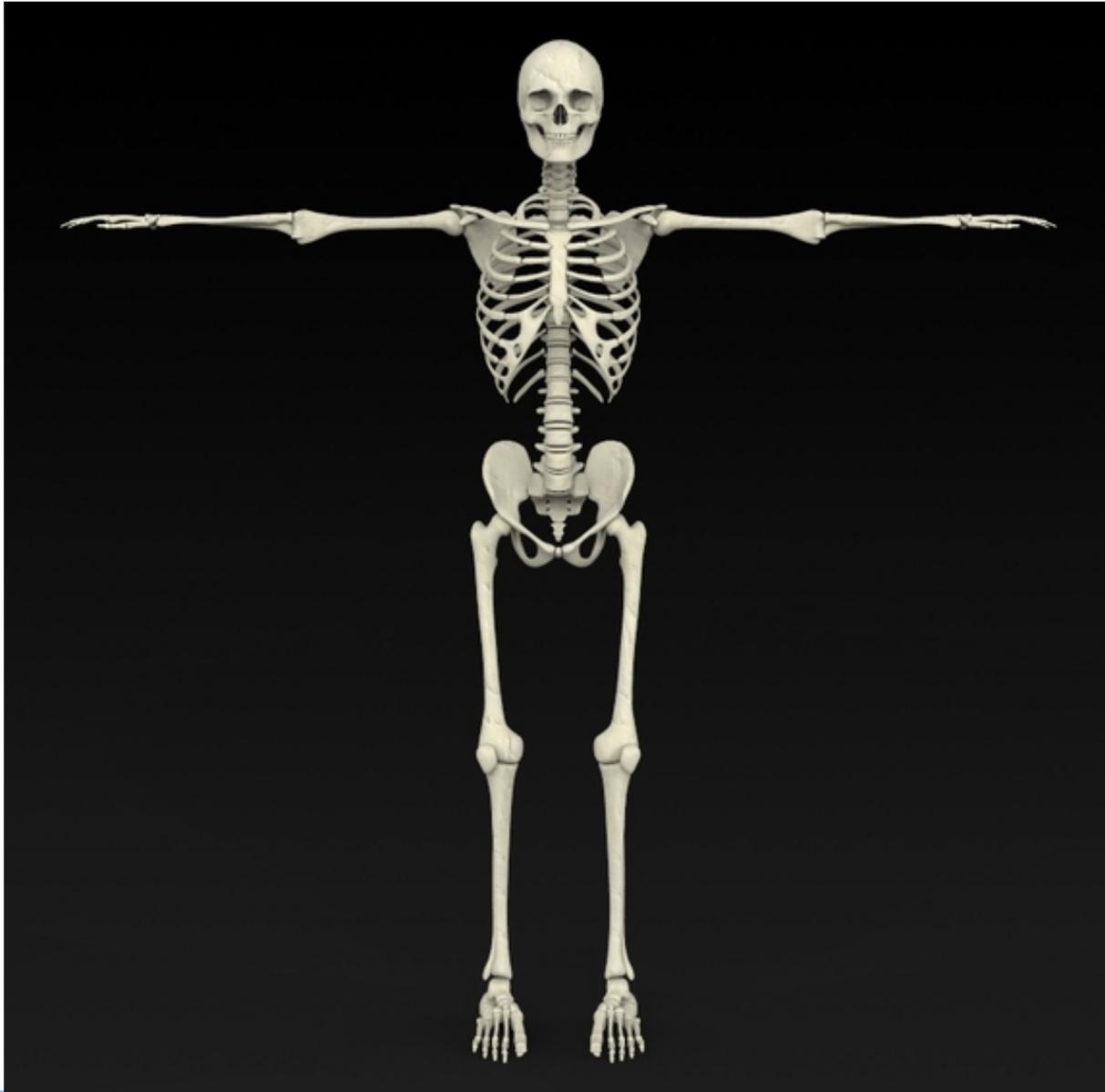




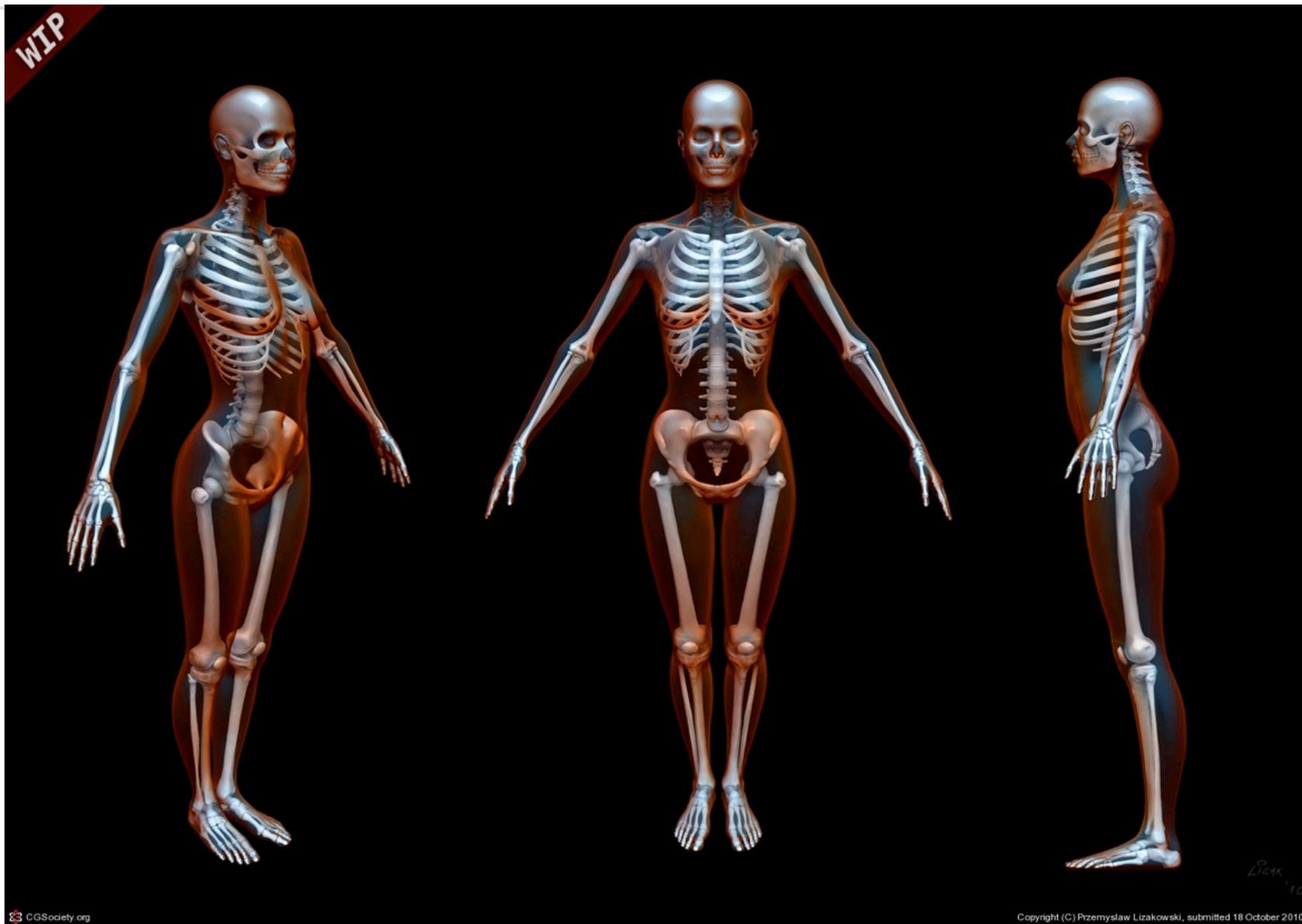




T-Pose



A-Pose



HAnimDisplacer

```
HAnimDisplacer : X3DGeometricPropertyNode {  
  MFInt32 [in,out] coordIndex [] [0,∞) or -1  
  MFVec3f [in,out] displacements []  
  SFNode [in,out] metadata NULL [X3DMetadadataObject]  
  SFString [in,out] name ""  
  SFFloat [in,out] weight 0.0 (-∞,∞)
```

HAnimHumanoid

```
HAnimHumanoid : X3DChildNode, X3DBoundedObject {
  SFVec3f    [in,out] center          0 0 0    (-∞,∞)
  MFString   [in,out] info            []
  MFNode     [in,out] joints          []      [HAnimJoint]
  SFNode     [in,out] metadata        NULL    [X3DMetadataObject]
  SFString   [in,out] name            ""
  SFRotation [in,out] rotation        0 0 1 0  (-∞,∞)|[-1,1]
  SFVec3f    [in,out] scale           1 1 1    (0,∞)
  SFRotation [in,out] scaleOrientation 0 0 1 0  (-∞,∞)|[-1,1]
  MFNode     [in,out] segments        []      [HAnimSegment]
  MFNode     [in,out] sites           []      [HAnimSite]
  MFNode     [in,out] skeleton        []      [HAnimJoint, HAnimSite]
  MFNode     [in,out] skin            []      [X3DChildNode]
  SFNode     [in,out] skinCoord        NULL    [X3DCoordinateNode]
  SFNode     [in,out] skinNormal      NULL    [X3DNormalNode]
  SFVec3f    [in,out] translation     0 0 0    (-∞,∞)
  SFString   [in,out] version         ""
  MFNode     [in,out] viewpoints      []      [HAnimSite]
  SFVec3f    []      bboxCenter        0 0 0    (-∞,∞)
  SFVec3f    []      bboxSize          -1 -1 -1 [0,∞) or -1 -1 -1
```

HAnimJoint

```
HAnimJoint : X3DGroupingNode {
  MFNode      [in]      addChildren      [HAnimJoint,HAnimSegment,HAnimSite]
  MFNode      [in]      removeChildren   [HAnimJoint,HAnimSegment,HAnimSite]
  SFVec3f     [in,out]  center           0 0 0   (-∞,∞)
  MFNode      [in,out]  children         []      [HAnimJoint,HAnimSegment,HAnimSite]
  MFNode      [in,out]  displacers       []      [HAnimDisplacer]
  SFRotation  [in,out]  limitOrientation 0 0 1 0  (-∞,∞)|[-1,1]
  MFFloat     [in,out]  llimit           []      (-∞,∞)
  SFNode      [in,out]  metadata         NULL    [X3DMetadataObject]
  SFString    [in,out]  name             ""
  SFRotation  [in,out]  rotation         0 0 1 0  (-∞,∞)|[-1,1]
  SFVec3f     [in,out]  scale            1 1 1   (0,∞)
  SFRotation  [in,out]  scaleOrientation 0 0 1 0  (-∞,∞)|[-1,1]
  MFInt32     [in,out]  skinCoordIndex   []
  MFFloat     [in,out]  skinCoordWeight  []
  MFFloat     [in,out]  stiffness        [0 0 0] [0,1]
  SFVec3f     [in,out]  translation      0 0 0   (-∞,∞)
  MFFloat     [in,out]  ulimit           []      (-∞,∞)
  SFVec3f     [in,out]  bboxCenter       0 0 0   (-∞,∞)
```

HAnimSegment

```
HAnimSegment : X3DGroupingNode {
  MFNode [in] addChildren [X3DChildNode]
  MFNode [in] removeChildren [X3DChildNode]
  SFVec3f [in,out] centerOfMass 0 0 0 (-∞,∞)
  MFNode [in,out] children [] [X3DChildNode]
  SFNode [in,out] coord NULL [X3DCoordinateNode]
  MFNode [in,out] displacers [] [HAnimDisplacer]
  SFFloat [in,out] mass 0 [0,∞)
  SFNode [in,out] metadata NULL [X3DMetadataObject]
  MFFloat [in,out] momentsOfInertia [0 0 0 0 0 0 0 0 0 0] [0,∞)
  SFString [in,out] name ""
  SFVec3f [] bboxCenter 0 0 0 (-∞,∞)
  SFVec3f [] bboxSize -1 -1 -1 [0,∞) or -1 -1 -1
```

HAnimSite

HAnimSite : X3DGroupingNode {

MFNode	[in]	addChildren		[X3DChildNode]
MFNode	[in]	removeChildren		[X3DChildNode]
SFVec3f	[in,out]	center	0 0 0	(-∞,∞)
MFNode	[in,out]	children	[]	[X3DChildNode]
SFNode	[in,out]	metadata	NULL	[X3DMetadataObject]
SFString	[in,out]	name	""	
SFRotation	[in,out]	rotation	0 0 1 0	(-∞,∞) [-1,1]
SFVec3f	[in,out]	scale	1 1 1	(0,∞)
SFRotation	[in,out]	scaleOrientation	0 0 1 0	(-∞,∞) [-1,1]
SFVec3f	[in,out]	translation	0 0 0	(-∞,∞) [-1,1]
SFVec3f	[]	bboxCenter	0 0 0	(-∞,∞)
SFVec3f	[]	bboxSize	-1 -1 -1	[0,∞) or -1 -1 -1

New Work Item Proposal Status

- Tools and examples
 - LOA1, LOA2, LOA3 model converter: wrl-to-x3d hanim
 - LOA1, LOA2, LOA3 H-Anim motion viewer
 - LOA1, LOA2, LOA3 H-Anim motion editor
 - LOA4 H-Anim hands and feet
 - LOD1, LOD2, LOD3 H-Anim facial animation
- ISO standards development
 - ISO/IEC 19774 Humanoid Animation Part 1: Architecture (WD)
 - ISO/IEC 19774 Humanoid Animation Part 2: Motion Capture (WD)
 - ISO/IEC 19774 Humanoid Animation Part 3: Facial Animation (NWIP)

Get Involved !

Drive the future of Web3D technologies:

- Open Listserves and public wiki
- Weekly Working Group telecons
- Members' Area, SDO Liaisons
- Open Source codebases
- Web3D Example sets
- Current Projects include:
 - X3DOM = HTML5 + X3D + WebGL
 - Cultural and Natural Heritage
 - Blender, Unity, ... importers / exporters
 - VR & AR visualization services
 - ... *see more online!*



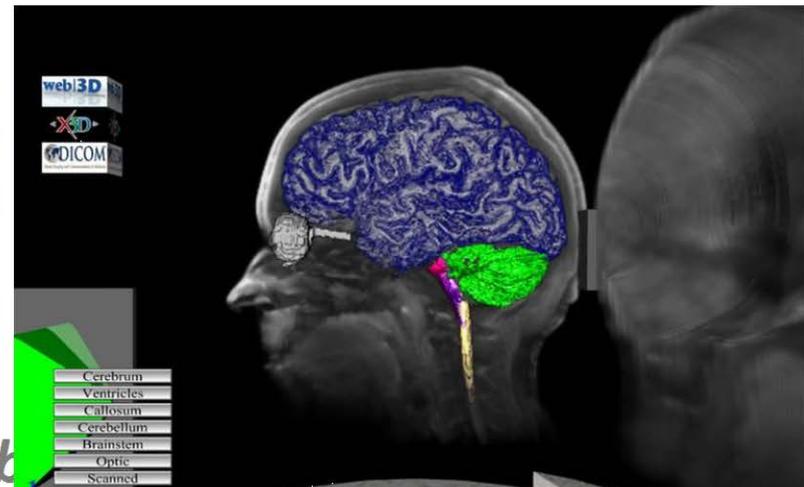
- Keep charging! Many good things happening.
- Many opportunities to contribute in 2015
 - Weekly teleconferences, mail list
 - When to merge X3D v3.4 with X3D v4.0?
- Regularize, improve our group processes
 - Tracking and resolving specification issues
 - Put specification documents under version control

- Align with Mixed and Augmented Reality Reference Model
- Improve Humanoid Animation
- Apply CAD-export design pattern to unlock Building Information Model
- Co-locate Web3D Conference 2016 to the SIGGRAPH2016

- Do you want to get involved?
- Exciting projects w/ potential for broad impact are looking for energetic developers
- The motivated w/ s/w development and Web authoring experience are encouraged to start and collaborate in developments
- Talent needed! - maybe you? Opportunities are here!
- <http://www.web3d.org/projects/wish-list>

Learn More!

Booth 1018



NOW

LETS TALK ABOUT IT!