

X3D User Interfaces: Toward AMD 2

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Session Outline

- Polys
- Hudson
- Zuffo
 - break
- *Activities: expressing interaction*
- Activity Review
- Summarize and Next Steps

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Goals

Provide support for rich user interface
functionality express-able without
platform dependencies

Support 3D User Interface techniques for
Navigation, Selection, Manipulation

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Describing Interaction

Different languages:

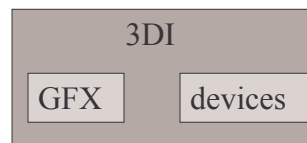
- Users
- Interface Designers
- Software Developers
- Machines

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Standardization Quandry

- What is appropriate and in the language philosophy?
 - 3DUI requires both application-oriented and content-oriented perspectives
- COMPONENTs provides a mechanism for extension



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X3D UI Goals

- Writability
- Expressiveness
- Readability
- Orthogonality (concise, complete)
- Portability (cross-platform reuse)

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X3D 3D User Interfaces

- Displays:
 - Handling ImagePlane
(size, coordinates, layers)
 - Stereoscopy
- Inputs:
 - Device binding
 - Coordinates & Access
 - Custom techniques
 - Picking

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Challenge: Displays

- X3D Scenegraph may be rendered on a wide range of sizes, resolutions, and configurations:
 - PDA
 - HMD
 - Desktop
 - Wall
 - C/R AVE
- How can the standard be improved to support robust UIs across these displays?



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UI elements: Imageplane

Canvas(es) size, units, locations :

- Absolute
 - Pixels
- Relative
 - Backsolve by FOV (specify near clip)
 - Normalized space
- Both?

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Compositing

- Layers
 - AMD 2 proposal
 - Bitmanagement: from MPEG-4 version1 (2D / 3D versions)

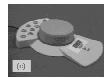
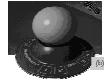
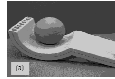
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Challenge: Input

- X3D scenegraphs may generate and consume events from a variety of devices and/or networks.

- Joystick
- Gamepad
- Trackers
- Wands ...



Joystick - forward, backward, left, right



Button 1 : menu circulate
Button 2 : menu select
Button 3 : menu on/off

- How can the standard be improved to support robust UIs across these devices?

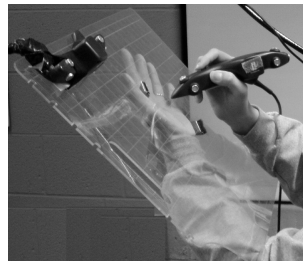
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Input devices

Local and networked:

- MIDI
- DOFs: mouse, joystick, wand, buttons...
- Trackers:
 - Head , Body
 - Objects



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Navigation

- Enumerated Metaphors: Walk, Fly, Examine, LookAt
- Desktop devices typically drive the Viewpoint according to the DOFs of the active mode
- With Head Tracking and more DOFs, what happens?
- How can we enable 'roll-your-own' techniques?

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Selection / Picking

- Raycast semantic in VRML/X3D
- Picking volumes ... pre-ordaining objects as 'pickable' ?
- Various buttons

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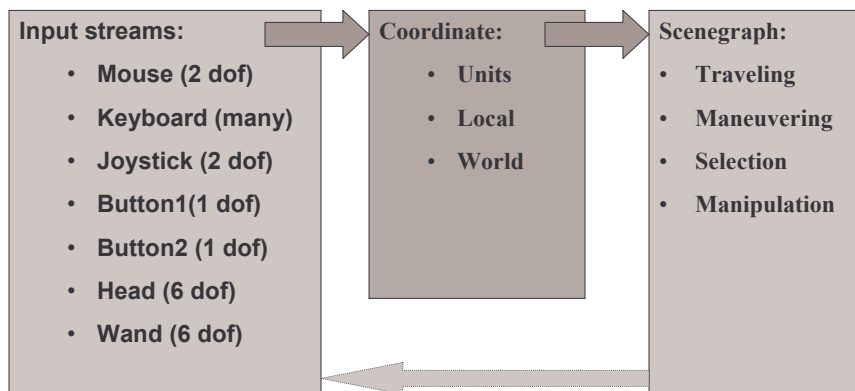
Scenegraphs and Input Devices

- Approaches
 - Tightly Coupled: data is read, mapped, and bound directly to specific locations in the application / scenegraph; eg SVE, ... VRML ...
 - Loosely Coupled: normalized tracker data lives somewhere on the network and you impose its scenegraph meaning eg DTK, ... VRPN?

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Input Problem Space-event handling



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Providing scenegraph hooks...structure

- Navigation / travel effects user's parent (locally tracked workspace) ?
- Local tracked movement: head, r_hand
- Using button events
- Generalize for desktop UI too?

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Where does the interface logic live?

Currently, inside X3D / VRML Browser:

- NavigationInfo type and speed determines the mapping of 2D mouse drag events to Viewpoint's 6 DOF
- Ray cast picking computed from 2D mouse cursor and Imageplane

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Our approaches

- Consider the desktop implicit
- Push capabilities of current standard nodeset and SAI
- Use lessons for AMD component design
- We want flexibility to define new interaction techniques – not just enumerating more modes

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Diverse ToolKit (DTK)

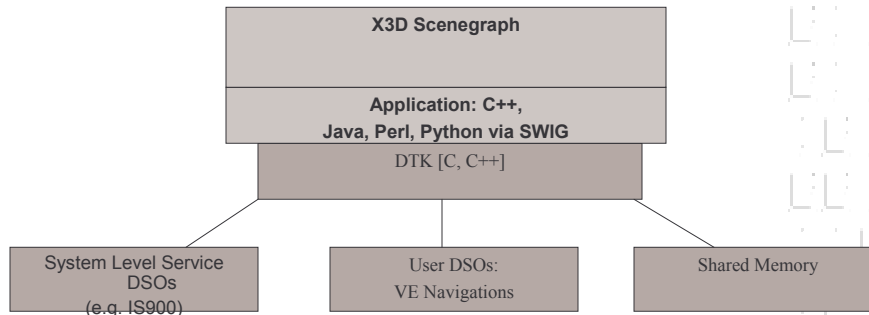
- Open-source
- Loosely coupled; DTK provides a layer
- Physical environments are set up (tracker range) and normalized to a unit coordinate cube;
- Navigations are system-level services packaged as DSOs

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System DSOs are like device drivers giving data streams their names in shared memory...

eg head, wand, tracker2, wand_joystick, button1 ,...



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Diverse GL (DGL)

- Encapsulating scenegraphs
 - Coin
 - VTK
 - OpenSceneGraph
 - OpenVRML
- Also Diverse for Performer (DPF) is a major platform at VT, NIST

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DGL architecture

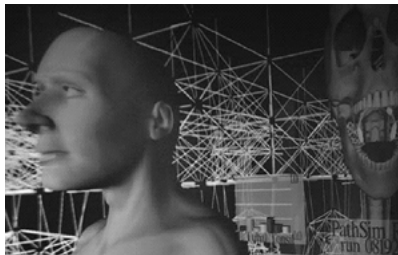
- Point to the scenegraph & tell it to render itself
- Grabs OpenGL code from scenegraph
- DGL creates windows
- DGL applies transformations from DTK navs
- Call draw callback

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DGL Coin example

- Loading VRML of PathSim, CML
- Need to connect to scenegraph to drive picking



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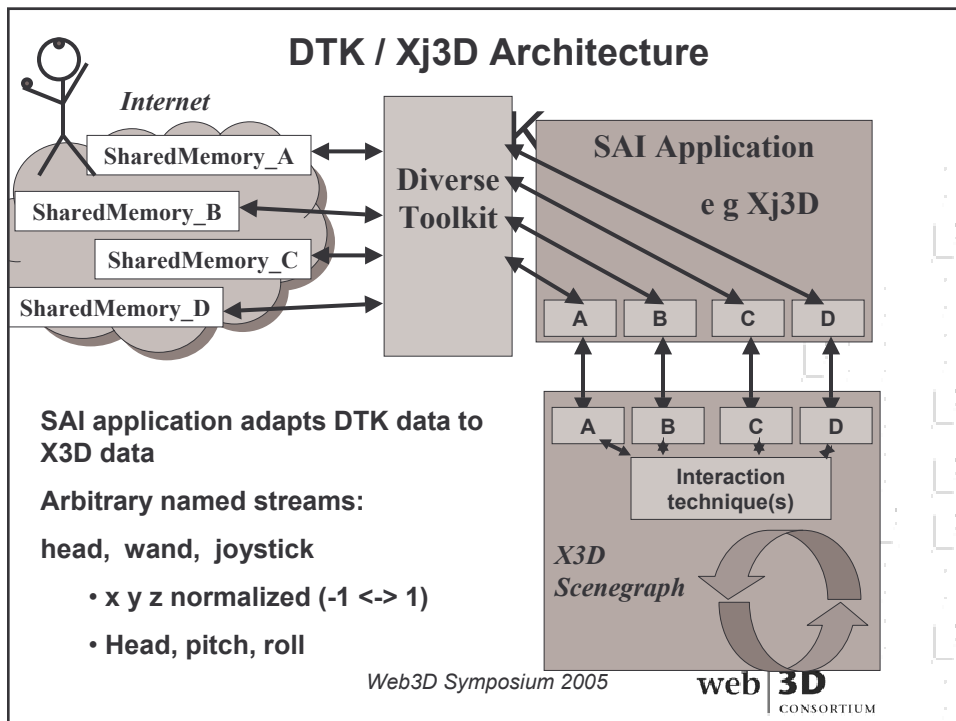
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Approach 2: DTK / Xj3D

- Input streams live somewhere out there, interpret them for X3D environment
- Use SAI to drive them into the scenegraph
- Understand the requirements for scenegraph nodes

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DTK / Xj3D scene:

- For loading scenes in CAVE / HMD
- Turn off `NavigationInfo {}`
- `ImmersiveViewpont {}`
 - `UserLocalSpace`
 - `headTracker`
- `DEF headP SFVec3fSensor {} ...`
 - via Behr et al, 2004
- `DEF Script FlybyPointing {}`
- Picking utilities needed (no 'cursor')

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In-scene scripts as filters

Driven from SAI / DTK data:

- `SFVec3fSensor {}`
- `SFRotationSensor {}`
- `SFVec2fSensor {}`
- `SFBoolSensor {}`

Interaction Techniques:

- `DEF FlyingByGaze Script {}`
- `DEF FlyingByPointing Script {}`
- `DEF SelectionByRaycasting Script {}`

• `ImmersiveViewpoint {}` – special transformation hierarchy including a Viewpoint and NavigationInfo

• `X3DPickingNode {}`

inputOutput fields on Script {} node benefit authoring ease

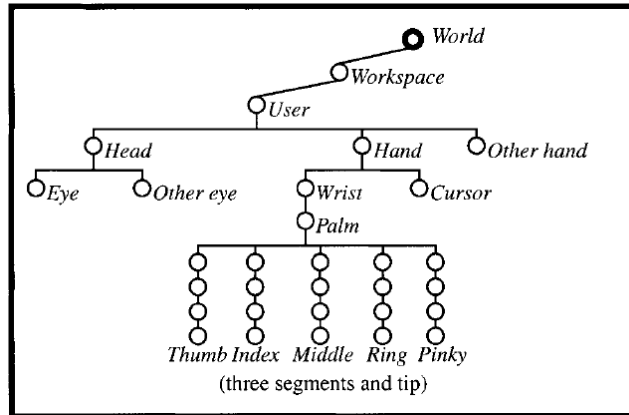
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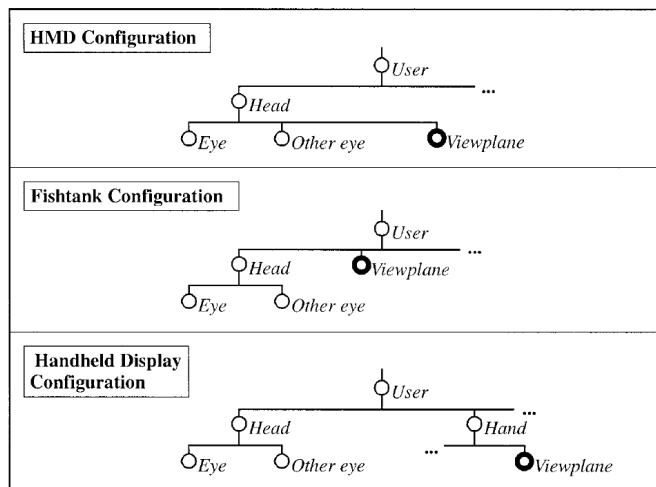
Simple Virtual Environment (SVE)

- Tightly coupled

(Kessler, D. <http://www.eecs.lehigh.edu/~dkessler/SVE/>)



SVE: note offset for tracker and eyes



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SVE Interaction Techniques

- loadWorld ()
- registerCallback: input and animation
 - registered to predefined object and events (hand, cursor, mouse, keyboard)
- Often, getWorldCoordinates () and getMatrixDistance () are used to compute 3DI behaviors
- Must setup selectable objects

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Break

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Activity

Pick one of the following scenarios below that is **not** in your domain area.

In English, describe the interactions between the user and the system that might take place in the application in order for the user to accomplish their goal. You can choose any platform or devices to address the scenario, but *start your description with high-level actions/ activities.*

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Scenarios

Construction-

"Crazy architects have drawn pipe, duct and electrical layouts for buildings that criss-cross and intersect. You have to design a system that allows you to route pipes around each other by moving them and placing in joints of various types to redirect them up and around. The attributes of the pipe (size, contents) may be important to determine the optimal layout."

Geology –

"Structural engineers and geologists are planning a new tunnel into an underground research facility. They have collected data on the formations of rock in the area and want to test the implications of various tunnel plans. You have to design an application that allows the engineer to bore and test possible tunnel routes into the rock formation. The nature of various rock types is important to the feasibility of a proposed path and experts need to understand these types in order to submit realistic routes to the simulator."

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Activity

- Video
 - Selection by Raycasting
 - Selection & Manipulation by GoGo

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Activity

- Pseudo code - GoGo
 - Set picker pos ()
 - Get reference pos () [eg head]
 - Compute anchor point pos() [eg torso point]
 - Get picker pos ()
 - Scale distance ()
 - Set picker pos ()
- Selection / Highlighting considered separately

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Activity Review

Reflect on language

- Context / frame
- Kinds of subjects, direct/indirect objects
- Verbs
- Adjectives

What system info is required for each?

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X3D User Interfaces

•Displays:

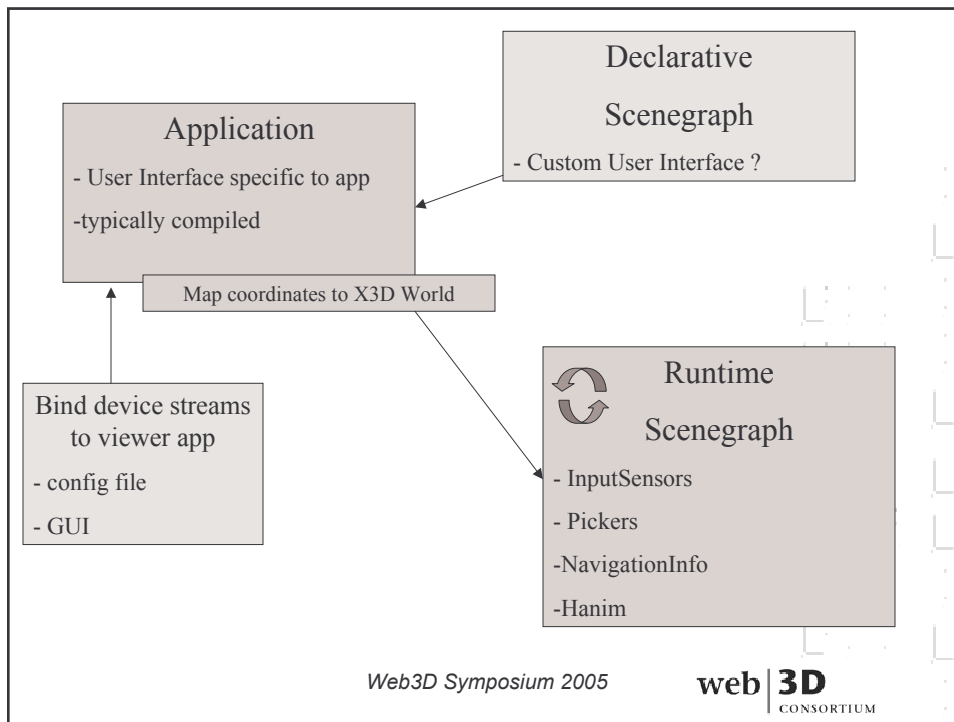
- Handling ImagePlane
(size, coordinates, layers)
- Stereoscopy

•Inputs:

- Device binding
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- Picking

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3DUI: Needed Hooks

- Imageplane layouts
- Navigation / Travel
 - User workspace, multiple trackers
 - Body representation, collision
- `getWorldCoordinates`, relative matrix operations?
- Picking
 - Variety of primitive & composed volumes

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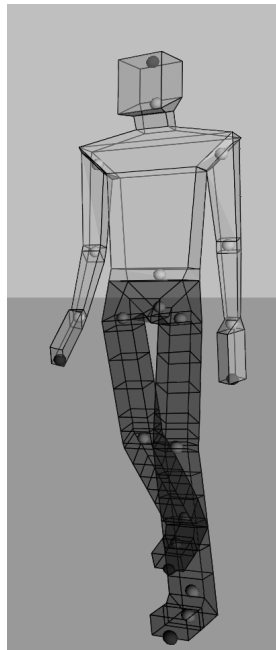
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Richness of body representation

- Leverage natural metaphors
- A common interface description?
- Ergonomic Immersion
- Need to reconcile Travel and Navigation interactions
- Need to reconcile with selection / picking interactions

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Humanoid Animation

- ISO / IEC 19774
<http://www.hanim.org/>
- Levels of Articulation 1-3

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Imageplane pros/cons

Absolute

+
+
-
-

Relative

+
+
-
-

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X3D Amendment 2

- ImagePlane: 2D and Layered UIs, HUDs ...
- Scenegraph support for a range of input streams
- NavigationInfo - incorporate H-Anim for 3DI hooks?
- Viewpoint binding semantics

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Relevant Work

- InTml – Figueroa, P.
- Contigra/Behavior3D – Daschelt, R.
- Bitmanagement techniques
- Xj3D component specs

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Thanks

- Virginia Tech University Visualization and Animation Group
- VT 3DI Research Group
<http://research.cs.vt.edu/3di/>
- Chad Wingrave
- Andrew Ray
- Dr. Ron Kriz
- Pat Shinpaugh

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