Using X3D, H-Anim, and SCORM to Create Reusable, Interactive 3D Instruction

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Agenda

• Advanced Distributed Learning
• Reusable Learning Objects
• Shareable Content Object Reference Model (SCORM)
• Shareable Simulation Assets
• An Approach to Creating Reusable Simulation Components
Advanced Distributed Learning (ADL)

• Advanced Distributed Learning is:
  — Learning that takes place anywhere and at any time it is required.
  — A term used to describe any of a number of initiatives aimed at promoting the accessibility, interoperability, reusability, and durability of instructional content.

• Consortia developing ADL specifications:
  — Instructional Management System (IMS) Global Learning Int’l
  — IEEE Learning Technology Standards Committee (LTSC) Int’l
  — Aviation Industry CBT Committee (AICC) Int’l
  — ARIADNE EU
  — PROMETEUS EU
  — ADL Initiative US
Relationship of ADL to Specification Consortia and Standards Bodies

- AICC
- ARIADNE
- Dublin Core
- IMS
- ALIC

ADL

IEEE/W3C

ISO

R&D Concepts

Spec Consortia

Test-beds & Prototypes

Standard Bodies

Reference Models

"Prototype Development & Assessments"

Draft Technical Specifications

Accredited Standards

Approved Standards
Reusable Learning Objects

Repository of Learning Objects

Common:
- Metadata
- Content Model
- Packaging

Learning Management System (LMS)

Common:
- Launch Mechanism
- API
- Data Model

Browser

RLO

Assets

Launch

Learner Info

Scoring, etc.

Learner Profiles

Updates

Learner Data
Instructional Content: Reusability and Context

Source: Autodesk
Web-based Learning Content Issues

What problems are we trying to solve?

• Can’t move a web-based course from one Learning Management System (server) to another

• Can’t reuse web-based content pieces (objects) across different LMS systems

• Can’t create searchable learning content libraries or media repositories
Sharable Content Object Reference Model (SCORM)

Learning Management System (LMS)
- Repository
- Management
- Delivery
- Tracking

SCORM Run Time Environment

SCORM Content Aggregation Model
- Data Model (from AICC)
- Launch, Communication API (from AICC)
- Meta-data Dictionary (from IEEE)
- Content Packaging (from IMS)
- Content Structure (derived from AICC)
- Meta-data XML Binding and Best Practice (from IMS)
- Sequencing and Navigation (IMS & ADL)

Source: Adapted from ADLNET.org
ADL “ilities”: Functional Requirements for Learning Objects Under ADL

• Learning content should have the following characteristics:
  – Accessibility
  – Interoperability
  – Reusability
  – Durability
SCORM Content Aggregation Model

• Content Model
  — Nomenclature defining the content components of a learning experience

• Meta-data
  — A mechanism for describing the components of the content model

• Content Packaging
  — Defines how to represent the intended behavior of a learning experience and package resources for movement between systems

• Sequencing and Navigation (Introduced in 2004)
  — Defines predictable, consistent ordering and delivery of learning activities
Shareable Content Components

• Asset
• Sharable Content Object (SCO)
• Content Aggregation

Introduced in SCORM 2004
• Sharable Content Asset (SCA)
Content Aggregation
SCORM 2004 Metadata

• Directly references the IEEE 1484.12.1-2002 LTSC* Learning Object Meta-data (LOM) Standard

• SCORM defines which data elements are mandatory for describing:
  — Assets
  — SCOs
  — Content Aggregations
  — SCAs
  — Packages
Meta-data Information Model

• Describes the available data elements permitted to build SCORM conformant meta-data records
• Broken into nine categories based on definitions found in the LOM Information Model

  • General
  • Lifecycle
  • Meta-metadata
  • Technical
  • Educational

  • Rights
  • Relation
  • Annotation
  • Classification
Content Information Package

Package Interchange File

Package

Manifest

Meta-data

Organizations

Resources

(sub)Manifest(s)

Physical Files:
(The actual Content, Media, Assessment, Collaboration and other files)

Content Structure

SCO & Assets
How do we extend this for Web3D?

• 3D Objects with Embedded Simulations as Assets
• Using Virtual Humans as Mentors and Role-playing Actors
• Example
Reusable 3D Simulation Objects

• In simulation-based e-Learning, a single, complex simulation object may cost more to develop than any of several Learning Objects that embed it.

• We wish to create 3D Simulation Objects that can be aggregated as SCORM assets, and re-used among many Shareable Content Objects.
Content Model for 3D Simulation Objects

Adapted from: Autodesk
Implementation of 3D Components

A PROTO node, with metadata defining capabilities and interfaces, that encapsulates appearance and behaviors defined by built-in, script, and extension nodes.
Metadata for 3D Components

What is it?
- Human, vehicle,…

What are its units?
- Kilometers, degrees,…

What can it do?
- Walk, speak, fly,…

What do I need to run it?
- X3D Profile, Scripts

How do I communicate with it?
- Interface with other components

Standard SCORM 1.2 Metadata

Metadata
1. General
2. Lifecycle
3. Meta-metadata
4. Technical
5. Education
6. Rights
7. Relation
8. Annotation
9. Classification
3D1.Component Class.
3D2.Run-time
3D3.Spatial
3D4.Interface
3D5.Behaviors

PROTO Node
Incoming Events
Outgoing Events

Higher Level
3D Component
or
Shareable Content Object
Interactive Multimedia Instruction

• Interactive Multimedia Instruction (IMI) is the most prevalent type of e-Learning today.
• Content (usually Web pages) sequencing may be linear, simple, or complex.
Using X3D in IMI

• Why use interactive 3D instead of video?
  — Lower bandwidth
  — Higher interactivity
  — Navigation and exploration

• Why use X3D?
  — XML syntax integrates easily with Learning Content Management Systems (LCMSs)
  — Significant content repositories available
  — Extensible to provide simulation APIs.
Using H-Anim in IMI

• Roles for Virtual Humans
  — Mentoring: More motivating than sound alone
  — Demonstrating: Can show complex procedures
  — Role-playing: Communication and human interaction skills
  — Interpreting: Sign-language

• Why use Animation?
  — Does not require live talent
  — Easy to edit

• Why use H-Anim?
  — Supports personalization and internationalization
  — Easy to upgrade models later
IMI Instruction Using Virtual Humans

Learning Points
- Vocabulary
- Grammar
- Dialect / Accent
- Customs
- Body Language / Gesture

Storyboard
- Actors
- Situation
- Dialog
- Actions
- Student Interactions

Mentor
- Introduction
- Explanations
- Remediations
- Supplemental Info

Voice Recording

Animation

Modeling

Script

Design Phase

Implementation Phase
Example 3D Component: Virtual Human
Scenario Control

- Scenario Control File
- 3D Sim API
- ScenarioControl PROTO Node
- Human Behavior SCRIPT Node
- Human Character PROTO Node
- Vehicle Behavior SCRIPT Node
- Vehicle PROTO Node
SCL-Edit: IMI Authoring Tool

• Supports IMI Level 3-4 Course Design
• Uses Xeena: Same XML Editor as X3D-Edit
Example: Checkpoint Scenario

• Developed by Vcom3D in partnership with the U.S. Defense Language Institute and Naval Postgraduate School.

• Teaches elements of Iraqi Culture, Customs, and Dialect.
Iraqi Checkpoint Scenario

• Family of four approaches checkpoint on road to Baghdad
• Student, playing the role of soldier, must properly interact with each family member to:
  — Get Background Information
  — Check IDs
  — Conduct Search
• Student’s actions influence outcome
• Mentor acts as guide and provides remediation
Scenario Development Methodology

• Identify learning objectives.
  — “Hot points”, but subtle
• Map objects to context of checkpoint scenario.
• A priori write script/storyboard with “directions”
  (the cues, gestures, intonation, etc.)
• Videotape to verify and elaborate upon what
  was identified a priori.
Demo Caveats

• Work in progress
  — “Hot off-the-press”
• Rerecording narration
• Major role of mentor – scenario-specific
• Making other enhancements
• The real learners will have had approximately 2 semesters of Modern Standard Arabic language training at DLI
Demonstration

Video Recording
Non-Interactive
250KB / sec

3D Simulation
Interactive
5KB / sec