

Augmenting Museum Experiences with Mixed Reality





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Presented by Ratan Guha, School of CS

University of Central Florida



Beyond Reality

Case Studies: Sea Creatures Museum Enhancement MR MOUT Training Time Portal Experiential Movie Trailer





Inventing the Technology of the Imagination





Case Study: Education in Museums

Extending and Enhancing Educational Exhibits

Museums



The 16,000 American museums average approximately 865 million visits per year, or 2.3 million visits per day.

 Museums are a \$16 billion dollar/year industry in America.
 -1997 Census and AAM Statistics

Museums Today

Limited interaction you get to answer questions Static exhibits do not change with evolving science Location dependent You can't take it home with you Expensive Each new exhibit is a major investment

Museums Tomorrow

Highly interactive you play out "what if" scenarios Dynamic evolves with changing science/audience/objectives Location independent variants of experience can play at home/in school Incrementally inexpensive change is story upgrade or even story evolution easy to share with other centers

Benefits

 Ownership of knowledge and evolution of wisdom (long-term consequences of actions played out in front of you)
 Currency of science
 Connection to family and classroom

Economic survival for centers

Sea Creatures



Experiential Learning

Compelling Experiences

There is greatly increased competition for both leisure time and leisure dollars.

Repeatable Experiences

Repeat visitors demand changing experiences to keep them coming back.

Throughput of Content

New experiences are needed for growth in membership revenue, marketing opportunities and sponsorship dollars.

Cross-generational Experiences

Museums are visited by families and others representing multiple generations, different learning styles, and varying levels of existing knowledge.

Experiential Learning Test



A.Does the exhibit know that I am here?

B. Do I Impact the Exhibit in any way?

C. Does the Exhibit Impact me in any way?

Permanent Display



Limited learning, Never Changing, Mostly reading, No Direct bridge to school or home.

Dino Digs Transformation



Repeat experiences (visits), Changing content, Social, Physical, Interactive, Responsive, Extended depth.

Sea Creatures Video



Case Study: TRAINING **Richly Layered Experiences** All Senses All Modalities All Domains Anytime Anywhere



Mixed Reality in Military Operations in Urban Terrain

Case Study: Entertainment Experiential Movie Trailer

Looks like a film
Plays like a game
Immersed like a theme park
Embedded in retail venue

Time Portal



SCIENCE & TECHNOLOGY



The Software Engines



All are Platform Neutral

Story / Scripting / Master

Agent architecture XML-based scripting behaviors with guarded cases, triggers, guarded reflexes Al Plug-ins Basic physics engine Pluggable-interface protocol Procedural scripting

Graphics Engine

OSG (Open Scene Graph)
Cal3D
Agent peers
Occlusion

Impostors
Matte support

Audio Engine Fully 3D Peripheral Sense

Ambient, point, dynamic (3d moving)
Constrained based on speaker placement
Agent peers

Audio Capture Acoustical Situational Awareness

- Two stereo mics placed back-toback in XY configuration with cardioids pickup patterns
- Ambience was captured in courtyard near busy road at various time during the day and evening
- Captured tracks were panned to front left, front right, rear left, and rear right within the MR Sound Engine
- Virtual ambient sounds were added in post (e.g. distant explosions, gunfire, helicopter flybys, etc.)
- Virtual sounds have an increased sense of validity when mixed with real world ambient surround capture



SFX Engine

Controls physically lighting, fans, etc.

 Uses DMX protocol commonly used to control SFX in performance venues like theatres, arenas and theme parks

Examples:

- Lights that can be shot out
- Doors that can swing open
- Fans that create heightened sense of presence

Network Protocol

Simple, efficient

- Command stream (show, hide, ...)
- Control stream (position, orientation, ...)
 - Can attach control stream to trackers, physics engine, other agents

Contributing Science Melting the Boundaries in real-time









Blending the Real and the Virtual

Lighting (SNP)

Virtual light on real/virtual objects
Real light on virtual objects

Shadows

- Cast by virtual objects on real/virtual objects
 Cast by real objects
- -Cast by real of

• Fire

Creating light and shadows on real/virtual

Use color-transfer for ambient lighting (ER)

Fire/Shadows Video



Pegasus in CSB



Pegasus uncorrected

Pegasus color corrected



Sea Creatures



We wish to thank our partners





Iseinology to the Warlighter Quicker

Canon





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