Computer Graphics for Large-Scale Immersive Theaters

Course Notes

Course # 25

SIGGRAPH 2003
SAN DIEGO
Computer Graphics for Large-Scale Immersive Theaters

Course Organizer
Ed Lantz – Spitz, Inc.

Course #25
8:00 am - 5:00 pm
Computer Graphics for Large-Scale Immersive Theaters

Presentors:

Ed Lantz - Spitz, Inc.
Brad Thompson - Spitz, Inc.
Garland Stern – Spitz, Inc.
Kevin Scott – Evans & Sutherland
David Beining – LodeStar Astronomy Center
Carter Emmart – American Museum of Natural History (Morning Session)
Course #25

Computer Graphics for Large-Scale Immersive Theaters

Introduction to Large-Scale Immersive Theaters

Ed Lantz
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Historic Progression of Immersive Environments:

- 30,000 B.C.E. Chauvet Caves
- 1,500 B.C.E. Temple of Amon, Egypt
- 16th Century Sistine Chapel
- 1788 Barker’s Panoramas
- 1826 Daguerre’s Panoramas
- 1895 Lumière Cinématographe
Historic Progression of Immersive Environments

**Dome Theater Evolution**

- **1897**
  - Carl Zeiss’s “Model 1” Planetarium

- **1923**
  - Armand Spitz’s “Model A” Planetarium

- **1946**
  - Mike Todd’s Todd-AO

- **1962**
  - “Spacarium” fisheye cinema

**Widescreen Film Evolution**

- **1897**
  - Raoul Brimion-Sanson’s “Cineorama”

- **1939**
  - Fred Waller’s “Cinerama”

- **1953**
  - 20th Century Fox’s Cinemascope

- **1955**
  - Mike Todd’s Todd-AO

See MEGASYSTEMS Large Format Film History - www.870.com/lfhis.htm
American Widescreen Museum http://www.widescreenmuseum.com/widescreen/intro.htm
Historic Progression of Immersive Environments...

1970
IMAX Large-Format Film

1973
Omnimax: Planetarium & Large-Format Film

1983
Evan’s & Sutherland’s Digistar 1 Hemispheric Video

1997-2003
Digital Domes

1999
Digital Cinema
Visual Immersion

Walk-In Immersive Display - Visual Display with Simultaneous High Resolution and Wide Field-of-View

- Excites Nearly the Entire Retina
- Strong Sense of Presence
- Invokes Opto-Vestibular Response in Brain
  - Thrill-ride or cybersickness possible
- Horizontal FOV >140°, Vertical FOV >40°
Large Scale Immersive Theaters

- Simulator Rides
- Digital Domes
- Planetaria
- Omni Large-Format Film Theatres
Digital Dome Theaters

Partial Dome Theater

Full Dome Theater
Digital Dome Theaters

• Full Dome or Partial Dome Video Projection
• Multiple Edge-Blended Projectors or HD Fisheye
• 55 Existing/Planned Theaters by 5 Manufacturers
• Many Use Pre-Rendered, Pre-Recorded Shows
  • High resolution digital video server technologies
• Realtime Graphics Use Increasing
  • Audience or presenter interactivity
• Growth Primarily in Planetarium Market
A New Medium!

• It’s Video, Not Film
  • End-to-end digital productions
• Relatively Affordable Productions are Possible
  • Live action using HDTV
  • Animation with desktop tools
  • Spherical compositing tools available
  • Real-time interactivity
• Independent Productions
  • Open to experimentation by students, producers
• May become “Cinema of the Future”
A Challenging Medium

- Large Image Frame Size (4k x 4k)
  - Shows can require multi-terabytes of storage
- Production Workflow is Cumbersome
  - Rendering & editing tools not optimized for sphere
- Playback/Projection Systems are Complex
- Few Industry Standards
  - No “Digital Dome” professional society… yet
- Niche Market
  - 50 theaters with varying goals, needs and budgets
  - Largely within non-profit “planetarium” market
Digital Dome Theater Integrators

- Evans & Sutherland - Salt Lake City, UT
- GOTO Optical - Japan
- Spitz, Inc. - Chadds Ford, PA
- Sky-Skan - Nashua, NH
- SEOS/Trimension - Burgess Hill, UK
- Silicon Graphics & Partners – Mountain View, CA
- Zeiss – Jena, Germany
Sampling of Digital Dome Theaters...

- Northern Lights Centre - Watson Lake, Yukon
- Volkswagen’s Autostadt - Wolfsburg, Germany
- LodeStar Planetarium - Albuquerque, NM
- AMNH/Hayden Planetarium - New York City
- Exploration Place - Wichita, Kansas
- Bibliotheca Alexandria - Alexandria, Egypt
- Papalote Museo del Niño - Mexico City
Northern Lights Centre
Watson Lake, Yukon Territory

- Opened 1997
- Panoramic video
- 14m dome screen
- 3x 9” CRT’s
- Spitz star projector
- 5.1 sound
- Integrator: Spitz
Volkswagen Autostadt
Wolfsburg, Germany

• Opened 2000
• Fulldome video
• 14.7m dome screen
• 4x Barco DLP’s
• Spitz & Furneaux Stewart
LodeStar Astronomy Center
New Mexico Muesum of Natural History and Science
Albuquerque, NM

• Opened 2000
• Fulldome video
• 16.8m dome screen
• 6x 9” CRT’s
• Digistar II projector
• 5.1 sound
• 140 seats
• Integrator: SkySkan
Hayden Planetarium
Rose Center for Earth and Space
American Museum of Natural History
New York, NY

- Opened 2000
- Fulldome video
- 7-pipe SGI Onyx
- 21m dome screen
- 7x 12” CRT’s
- Spatialized sound
- Integrators: SGI, Trimension, AMNH

Photos © D.Finnin/AMNH
Boeing CyberDome Theater
Exploration Place
Wichita, Kansas

- Opened 2000
- Fulldome video
- 18.3m dome screen
- 6x 9” CRT’s
- Real-time 3D
- 170 Interactive seats
- 5.1 sound
- Integrator: E&S
Bibliotheca Alexandrina
Alexandria, Egypt

- Opened 2001
- Panoramic video
- 14m dome screen
- 3x 9” CRT’s
- 8/70 film projector
- Spitz star projector
- 5.1 sound
- Integrator: Spitz
Papalote Museo del Niño
Mexico City

- Opening 1Q 2004
- Fulldome video
- 23m dome screen
- 9x Barco DLP’s
- Over 9M pixels
- 24,000 lumens
- 5.1 sound
- 283 seats
- Integrator: Spitz
Smaller Digital Dome Systems

- Low-Resolution Fisheye Theaters
  - 1024x1024 fisheye
- Simple & Affordable
  - Single SXGA projector
  - Highly accessible medium
- Primary Users are Small, Educational Planetariums
  - Dome diameters up to 10 meters
- 3 Competing Systems Introduced in 2002:
  - E&S Digistar® 3 SP
  - Minolta MediaGlobe™
  - Spitz SciDome™
Digital Dome Theaters are Growing in Number...

Year of Public Opening

# Theaters Sold

projected
Sparking An Explosion of Quality Productions...

*Stars of the Pharaohs*
Evans & Sutherland

*Legends of the Night Sky: Orion*
AVI/Spitz

*Infinity Express*
Sky-Skan

*Wonders of the Universe*
Evans & Sutherland

*Dark Star Adventure*
Spitz Creative Media
Digital Dome Theaters

More than a planetarium…
More than a movie theater…
It’s a portal into cyberspace, virtual environments and the new world of electronic information.

As an artistic medium, digital domes are the closest thing yet to crawling inside the artist’s head.
Special Thanks To:

Spitz, Inc.
DVS Digital Video, Inc.
Elumens Corp.
JVC Americas Corp.
Reuben H. Fleet Science Center

Also thanks to the numerous artists, producers and students who contributed content for this morning’s immersive video showcase!
Photo Credits

Temple of Amon and Sistine Chapel  Photos Courtesy Prof. Hugh Lester, Tulane University

Robert Mitchell, Barkers Panorama at Leicester Square, courtesy The British Museum, London

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