helps companies find growth opportunities, create winning strategies & business plans in the digital entertainment value chain.

Services include strategic consulting and market analysis with an understanding of the industry value chain and technologies.

digdia.com
Digital 3D
From Theater to Home
Why Now & How it Works
Why Now & Why This Time?

House of Wax (1953)  
June 18, 2010

1st Digital 3D  
2005

The Stewardesses  
Jaws 3D  
Polar Express (2004)

Feature Films only
The Number of 3D Screens Grow

There are about 5,000 3D screens Worldwide (June 09)

$60M B.O. (as of 9/25)
#1 for first two weeks
IMDbPro
Digital Cinema Enabled 3D

But, 3D is now a Catalyst for Digital Cinema

- Monster House (2006) – x 4 2D Box Office
- Beowulf (2007) – x 3.1, (x 12 in Russia)
- Hannah Montana (2008) – x 3.9*
- Journey to the Center of the Earth (2008) – x 3.7
- Monsters vs. Aliens (2009) – x 3.1

3D Screens typically demand $3.50 to $5 premium over 2D

Live 3D Events go for 2x to 5x normal ticket prices, sell more concessions, and put butts in seats mid-week.

* Estimated multiple based on comparison with *High School Musical 3* (2009). (IMDbPro)
The Theater

Theater in Eindhoven, NL
The 3D Projector - Polarized

- Circularly polarized (head can tilt)
- Silver screen to preserve polarization
- RealD XL – uses wasted light - 30% efficient
- RealD Sony 4K – overlays two 2K images
- masterImage
- Xpand – uses active glasses

masterImage

XpanD
The 3D Projector - Spectrum

- Dolby puts spinning filter between light and DLP to offset RGB
- Existing Matte White screen can be used
- Glasses use 50-layers of film and are more expensive (~$23)
- Glasses are washed and reused
- Slightly less ghosting than polarized system
- ~15% efficient
Vergence Accommodation Conflict

- A prime source of eye strain (headaches)
- Percival’s Zone of Comfort is subjective acceptable VAC range
- Theory: if conflict times are kept short, strain is minimized.
- Images can be “adjusted” to minimize this problem. GPU is needed in Post or in Real Time.

Marty Banks, Univ. of Calif. Berkeley study
Keystone Perception/Correction

- The mind corrects for keystone distortion when viewing a 2D picture.

- The mind does not correct for this distortion when viewing a stereo 3D picture

- *Is there an opportunity here?*

Marty Banks, Univ. of Calif. Berkeley study
Luminance

Issue:

• 3D optics throws away light
• SMPTE suggests 15 Ft-L luminance
• Most 3D projection are closer to 3 Ft-L

Solutions:

• Adjust Image Color in Post and/or with LUTs in projector
• Mechanical solutions:
  • Use higher gain screen
  • Crank up the bulb (shorter life)
  • Use smaller screen (<40’)
  • Use optical doubling

Barco stacked projectors

LUT = Look Up Table
Ft-L = Foot Lamberts
3D Sound Systems

Sound can be 3D, too.

IOSONOO system creates 32 virtual sound sources for each seat in the theater.

Audio may be a different kind of application for GPU technology.

IOSONOO in Mann 6 (L.A.)
380 speakers
Live 3D Alternative Content

NBA All Stars

3ALITY Cameras

IDC Satellites

Cinedigm Theater Network

IDC/Sensio Receiver

Doremi Server

86 Screens

Turner Production Truck

Sensio encoding

3ality/Quantel Postproduction

Christie & RealD

$20/Seat + Beer (one example)
Live 3D Ads & Games

3D Advertisements are starting to show up.

Generating such images during a live event can be a GPU challenge.

Live 3D Games in Theaters
Production

3D Camera Rig used to shoot

(1954 Universal)
Cameras may have Adjustable or Fixed:

- Convergence
- Interocular

3ALITY
(Sony cameras)

21st Century 3D
(Panasonic cameras)
Q: How do you get a 5’6” Elijah Wood to look like a 3’5” Hobbit while standing next to the 5’11” wizard played by Ian McKellen?
A: Use False Perspective

But, with 3D cameras, False Perspective doesn’t work

So, one can use Dimensionalization
Da Vinci Digital Intermediate Station
Dimensionalization

2D movies can be made to look 3D

1. Each object is digitized
2. Objects are “moved” forward and back as Director wishes
3. Closer objects are given depth and shape as needed
4. Hidden images are reconstructed
5. Final adjustments are made

Dimensionalization is perhaps the most challenging imaging task. Many steps are semiautomated, but improvements still are needed.

CGI = Computer Generated Imagery
Depth Budget & Grading

- DPs and Editors need to avoid rapid extreme depth changes to avoid eye strain
- Older people take longer to adjust
- “Fading” between depths can help
- “Depth Grading” in Post can help
- Can be challenging for 3D Live events
- Automated tools are still needed.
Floating Window

- Avoids L-R image conflicts at the sides
- Image is floated towards viewer
- L image masks left side; R image masks right side.

Opportunity: Imaging tools to help manage Floating Windows.


Ghosting

- “Ghosting” or crosstalk between L & R images is most evident in high contrast areas of a scene.
- Polarized systems have the most ghosting, but other systems have ghosting, too.

Most ghosting can be removed by a “ghost-busting” step.

Colors are adjusted on one image to offset crosstalk from the other image.

Before L

Before R

Before L+R seen from R eye

Ghost-busted R (L is also ghost-busted)

After L+R seen from R eye
Post Tools

- Editing and DI tools are 2D oriented with shoehorned 3D features
- Tools designed with 3D in mind are just starting to appear

Quantel 3D Station

- Animation tools are mostly custom (example RenderMan, Pixar)

Render farm at ILM
Home

From Hannah Montana 3D Blu-ray trailer
# 3D TV

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Autostereo 3D TV

- Philips licenses their Lenticular Lens system to a number of display companies (but no longer markets their own 3D displays)
- Alioscopy also has a Lenticular Lens system for their own displays

These displays are used primarily for Digital Signage. Example: 3D Movie Ads in Theaters

Live Interactive 3D Digital Signage is coming
3D PC & Games

- 3D computer monitors are used for Games and Industrial applications
- As 3D content becomes available* on the web, people will watch 3D videos from their PC
- When can we expect 3D Web-to-TV?

* 3D anaglyph YouTube already exists

nVidia RF actuated Active Shutter Glasses

ViewSonic 120 Hz LCD

Sony PS 3
3D Eyewear

- Yes, 3D wearable displays exist, but they have always tended to be seen as too geeky to wear.

- Sony and others are trying to make wearable displays fashionable.

Tom Hanks with Sony wearable 3D displays.

Viewer sees 3D images and what is around them
Mobile 3D

- 3D displays on phones and portable TV devices exist
- These displays are auto-stereoscopic 3D using “Parallax Barrier”, which is good for only one viewer
- Fujifilm is introducing a 3D camera & picture frame, and is said to be working on a printer for making lenticular prints
- Challenge is GPU vs. power
3D Formats to the Home

Spacial Compression

Temporal Compression

Anaglyph

100% Bandwidth, Distorted Image

2D + Delta

( Metadata)

140 to 170% Bandwidth, 100% Resolution
(or some compromise)

GPU must Encode and Decode

100% Bandwidth, 50% Resolution

Micro Polarized

Not used
Display Size vs. Interocular

How best to compensate content for screen size?

Interocular Image adjustments may be needed in real time.
Some Home 3D Working Groups

Production → Post → Digital Source Master → Digital Cinema Distribution Master → Digital Cinema Package

Digital Cinema Server → Digital Cinema Projector

3D Home Master

Blu-ray DVD → Cable → Satellite → OTA → IP → Mobile

Video Camera → Television → Game → ETC → Glasses → PC → Phone
Services include strategic consulting and market analysis

A report will be available on 3D at:

**digdia.com**

Please leave contact information for a 15% discount