ETC®
Entertainment
Technology Center

Art, Technology, Business, and Health Aspects of 3D

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Agenda

1. How We Experience Depth
2. 3D Content Planning
3. 3D Content Creation
4. Consumer 3D Experience
5. 3D and Health
6. 3D in the Larger Context

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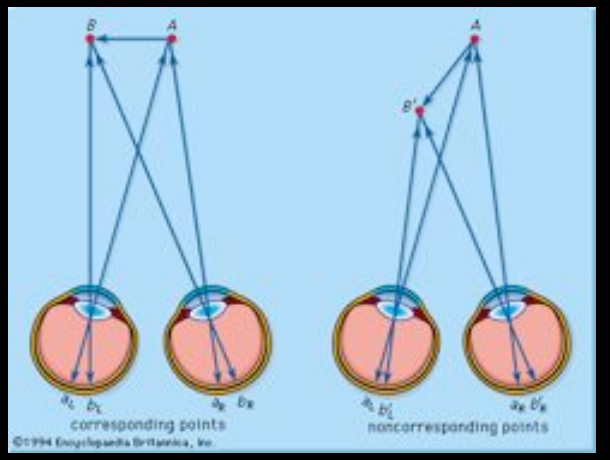
How We Experience Depth in the Real World

Monocular

Motion

Binocular



Balance and other sensory input

How We Experience Depth in Stereoscopic 3D

Monocular

Motion

Binocular

"Visual-vestibular conflict"

Balance and other sensory input

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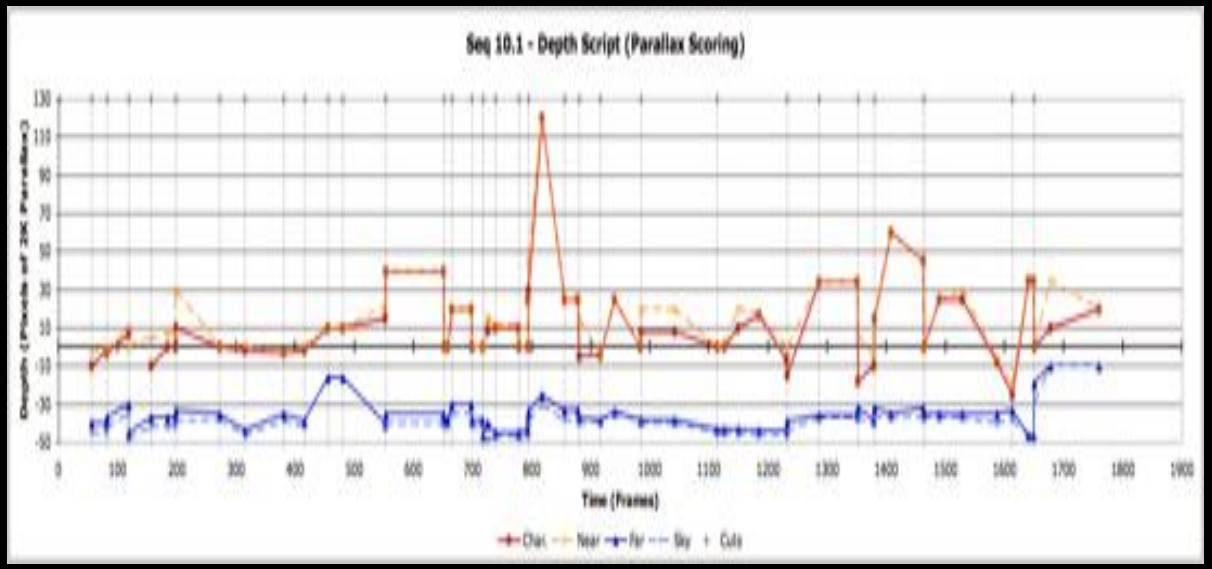
Planning

- How will 3D affect storytelling?
- The 3D “Look”
- Production Design
- Depth Scripting

Art of S3D

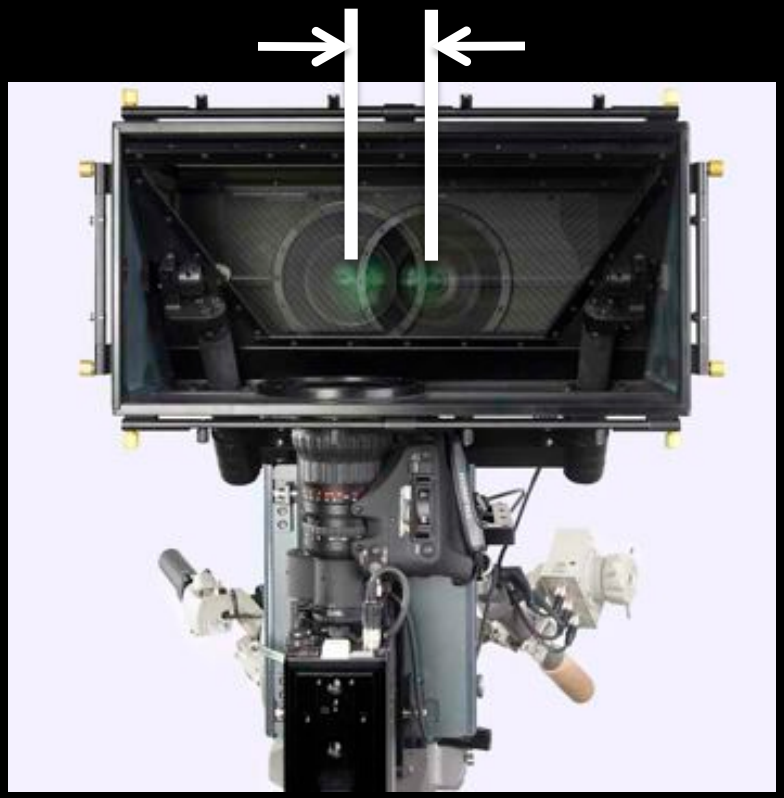
Some new 3D tools and techniques will emerge

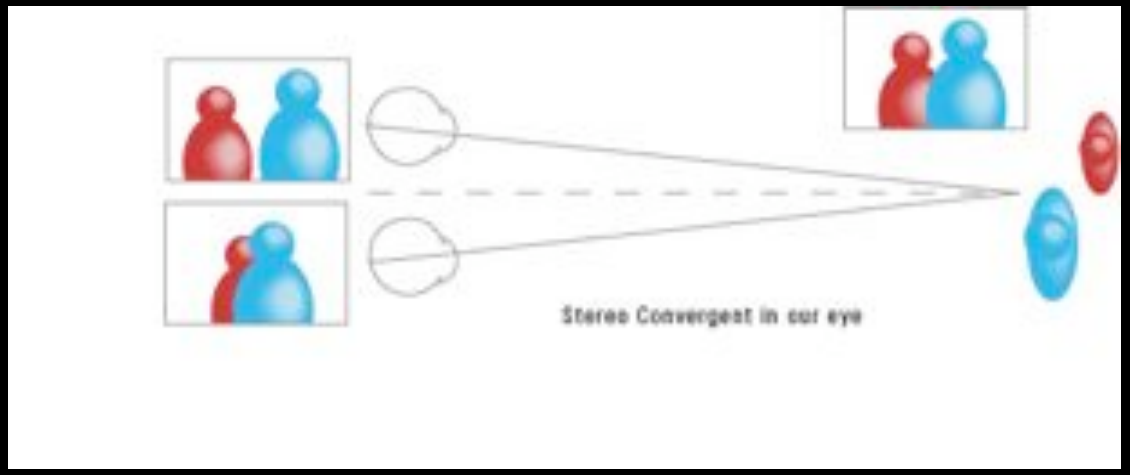


depth script

3D Previsualization

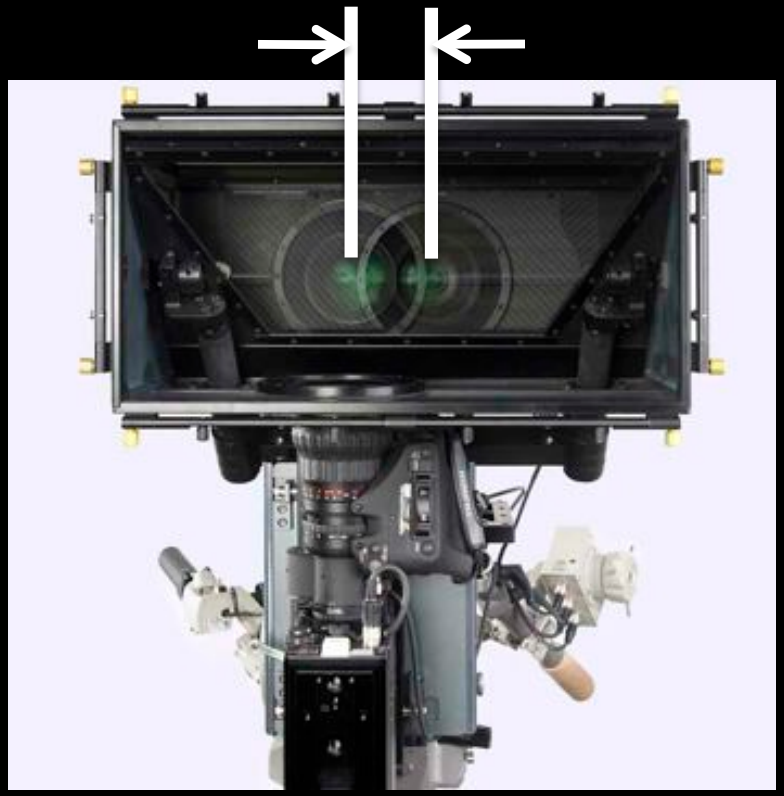
Interaxial Distance and Convergence





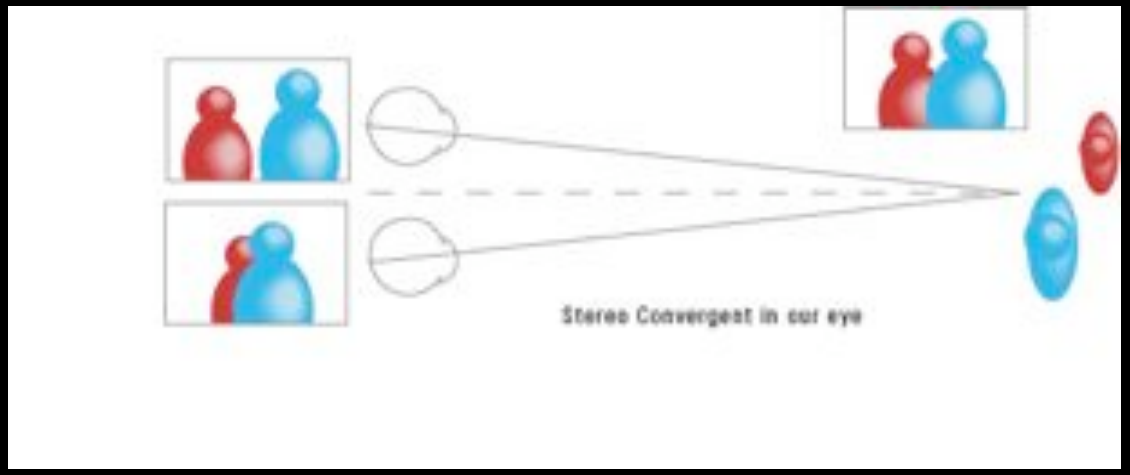
Two key factors that define…
- What you see
- How much you can change later

Interaxial Distance and Convergence



Too wide – tiny people
Too narrow - giants

Interaxial Distance and Convergence



IMAX – Parallel

Avatar – Converged on object of interest

Pirates of Carribean – Parallel, then converged in dailies

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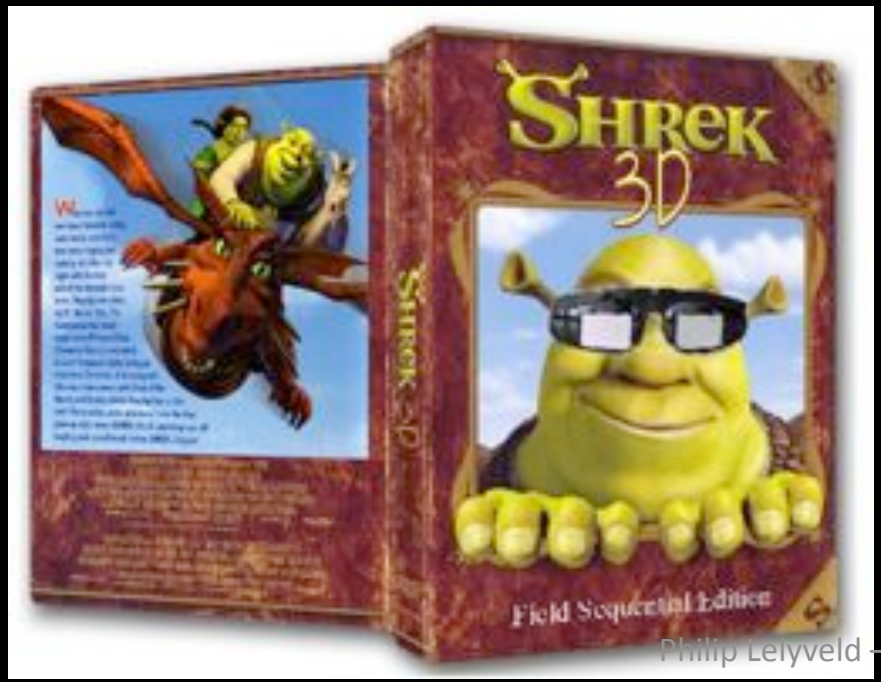
Content Creation

1. Computer Generated Images (CGI)
2. Live Action (2 image)
   - Prerecorded
   - Real time
3. 2D-to-3D conversion

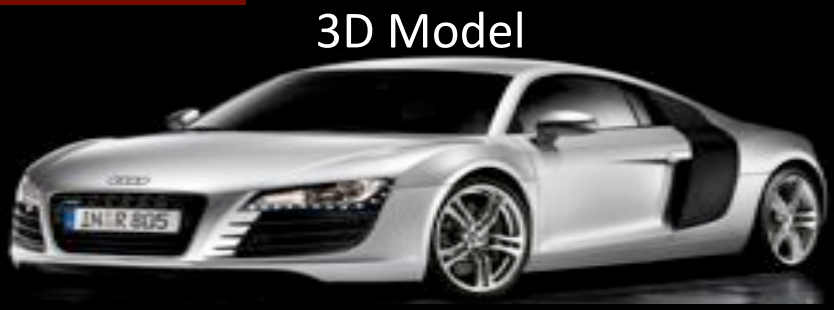
Computer Generated Images (CGI)

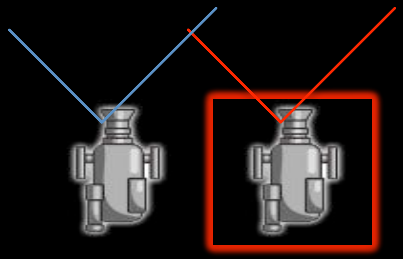
- Everything is controlled
- No alignment issues



Games (the other CGI 3D)

- Adjustable S3D





Base Camera

Right Camera
created by 3D driver

Games (the other CGI 3D)

- Adjustable S3D

- Average gamer is 34 years old
- Average gamer has been playing for 12 years
- 40% are now women (they prefer social games)

Source: Craig Allen, CEO, Spark Unlimited, 12/10 conversation

- Call of Duty: Black Ops- $650M in first 5 days
- 50 3D games coming to PS3
- Nintendo 3DS may drive consumer adoption of 3D

Live Action

- Two cameras or camera pairs
- Alignment issues

Beam splitter

Side by side

Art of S3D

Sports and live action are driving the learning curve

Camera development

Cutting among cameras

Scores, captioning, visual tools

2D to 3D Conversion Quality/Cost Tradeoff

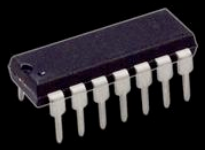
Real-Time
2D to 3D Conversion

Non-Real-Time
2D to 3D Conversion

- Painters
- Human hands

Native 3D

- Two Cameras



2D to 3D Conversion Quality/Cost Tradeoff

Real-Time
2D to 3D Conversion

Non-Real-Time
2D to 3D Conversion

Native 3D

- Painters
- Human hands

- Two Cameras

Conflicting depth cues

2D to 3D Conversion
ality/Cos

Real Time 2D-3D Conversion

3D Eye Solutions
3D Mention Media
ArcSoft
CyberLink
DDD
e-MDT
Enhanced Chip Technologies Inc
HD Logic
Himax Technologies
Marvell
Mercury Systems
Panasonic (JVC)
Quartics
Sensio
Sonic Solutions
Stergen (Vizrt)
Toshiba
Trident Microsystems
Wistron

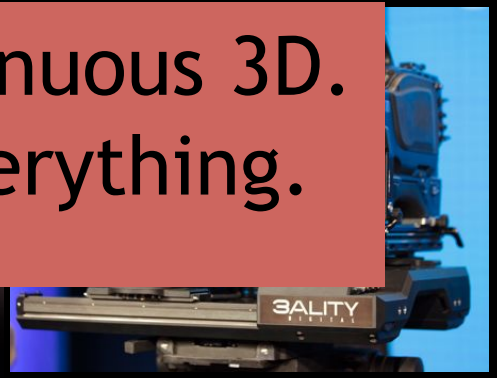
Non-Real Time 2D-3D Conversion

DDD
In-Three
Legend Films
Passmore Labs
Prime Focus
Sassoon Film Design
Stereo Pictures

ative 3D

Two
Cameras

Conversion is continuous 3D.
You can control everything.
- Phil McNally



3D Postproduction Workflow

1. Planning/Managing
2. Input/Output
3. Editorial
4. Color
5. Depth/Convergence Adjustment
6. Distortion/Disparity Fixing
7. Conversions/Transcodes
8. Visual FX/Graphics
9. Screenings/Playout

Metadata
what metadata matters?

Color Depth
16 bit? 10 bit?

Frame Rate
24 fps? 48 fps? 60i

Interaxial Distance and Convergence information

Source: Rick Baumgartner
rick@rickbaumgartner.com

3D Postproduction Workflow

Technical choices of what information gets passed through the workflow will impact the design of consumer devices and 3D experiences!

Metadata
what metadata matters?

Color Depth
16 bit? 10 bit?

Frame Rate
24 fps? 48 fps? 60i

Interaxial Distance and Convergence information

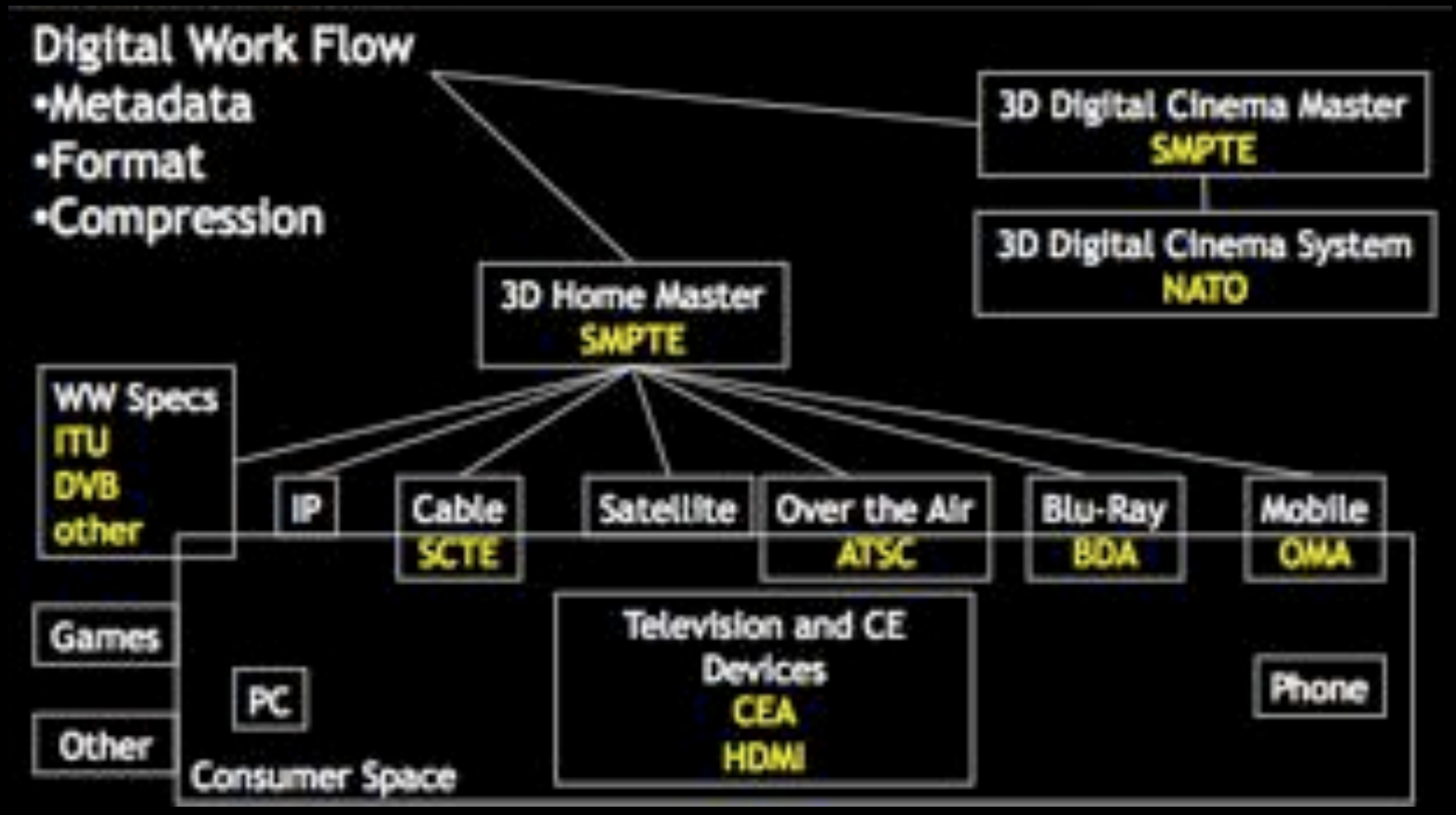
ustment

g

rick@rickbaumgartner.com

Standards Bodies

Working on 3D-related technical specifications



es related to 3D

DVB (Europe/global)
- transmission specs
- subtitle/closed caption specs
- indicating 2D / 3D available

SMPTE (global)
- subtitles / captions / overlays
- home master metadata
- home master image

MPEG Industry Forum
3D TV vocabulary

CEA (US/global)
- eyewear signaling
- HDMI transport
- closed caption

ITU (global)
- frame compatible vs 2D+depth

Standardization can come about thru:

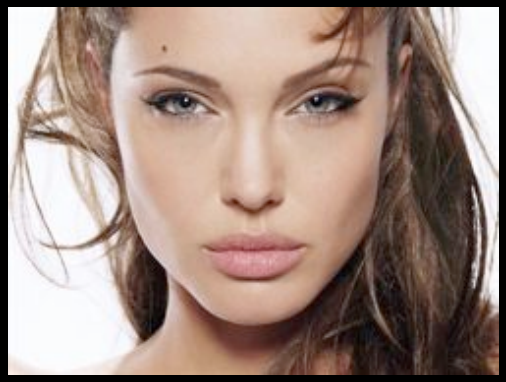
- Standards bodies
- Market power and strategic alliances
- Grassroots movements

  Ex. MP3

  - Convenience over quality
  - Community-driven open architecture solution when industry did not offer an interoperable solution

Shooting 3D - Lessons learned

Telephoto
≠
Close-up



Close-up
becomes
Big-up

Sight lines

The Emerging Language of 3D

End Game:

To transition 3D
from a special effect
to a key resource in the storyteller's tool kit

As the audience learns the conventions, the language of 3D will evolve

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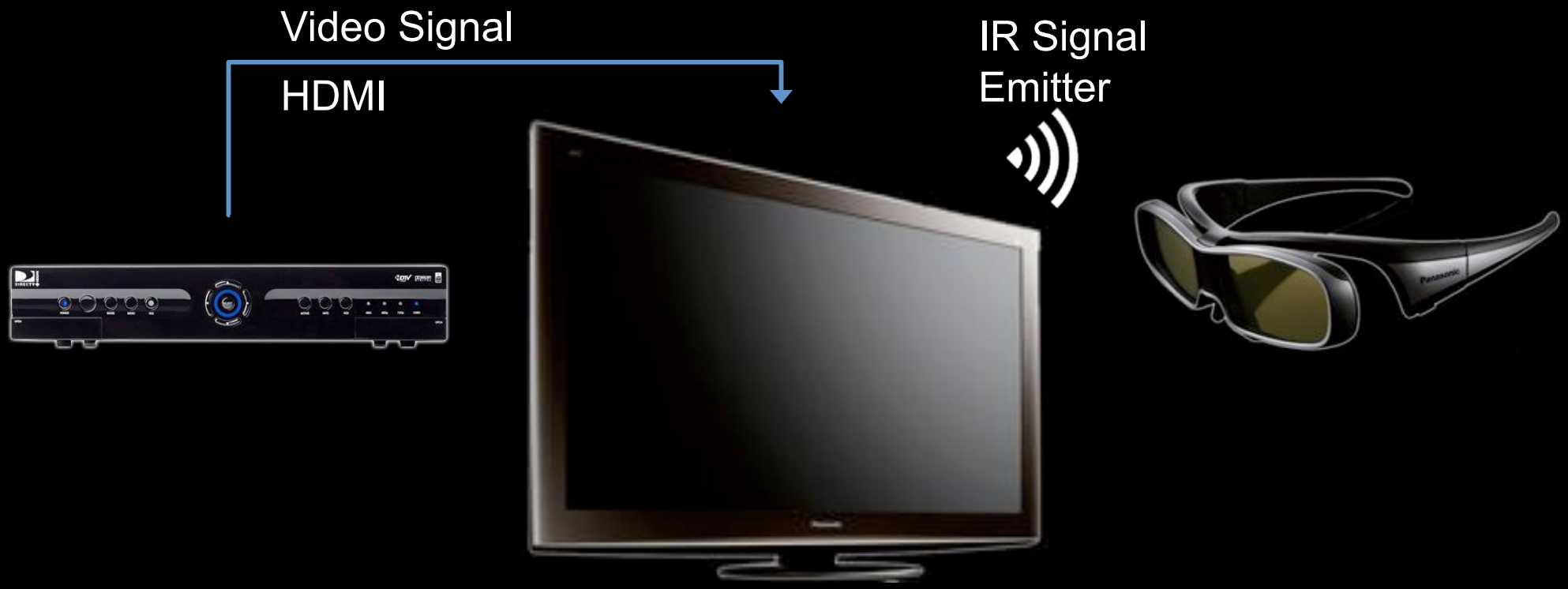
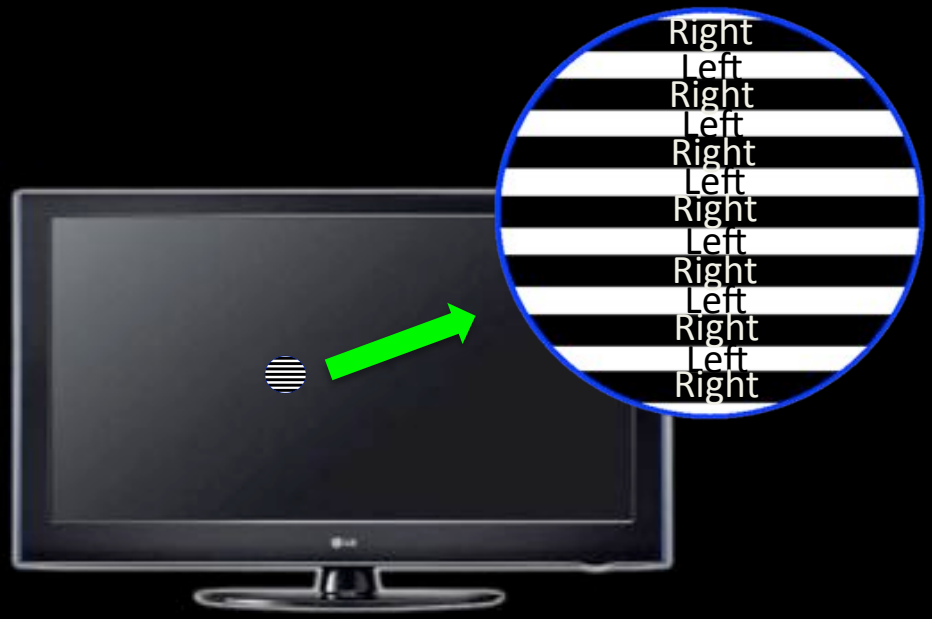
Active Shutter



Polarized



Low-cost glasses

3 Legs of the Stool

Movies

Sports/
Live Events

Games

D Choices

Glasses-free

Head Mounted Display

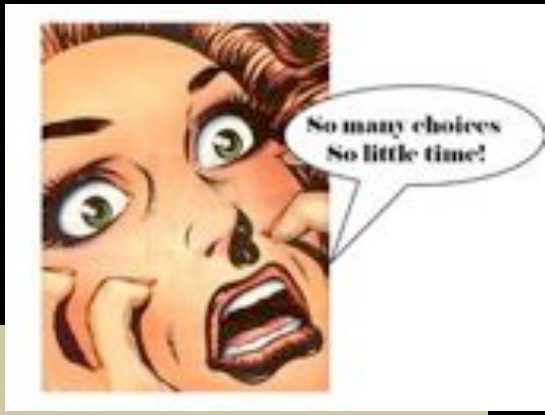
Glasses-free

Consumer 3D

TVs, laptops, phones, handheld games

Pleasant buying experience comes before a pleasant viewing experience

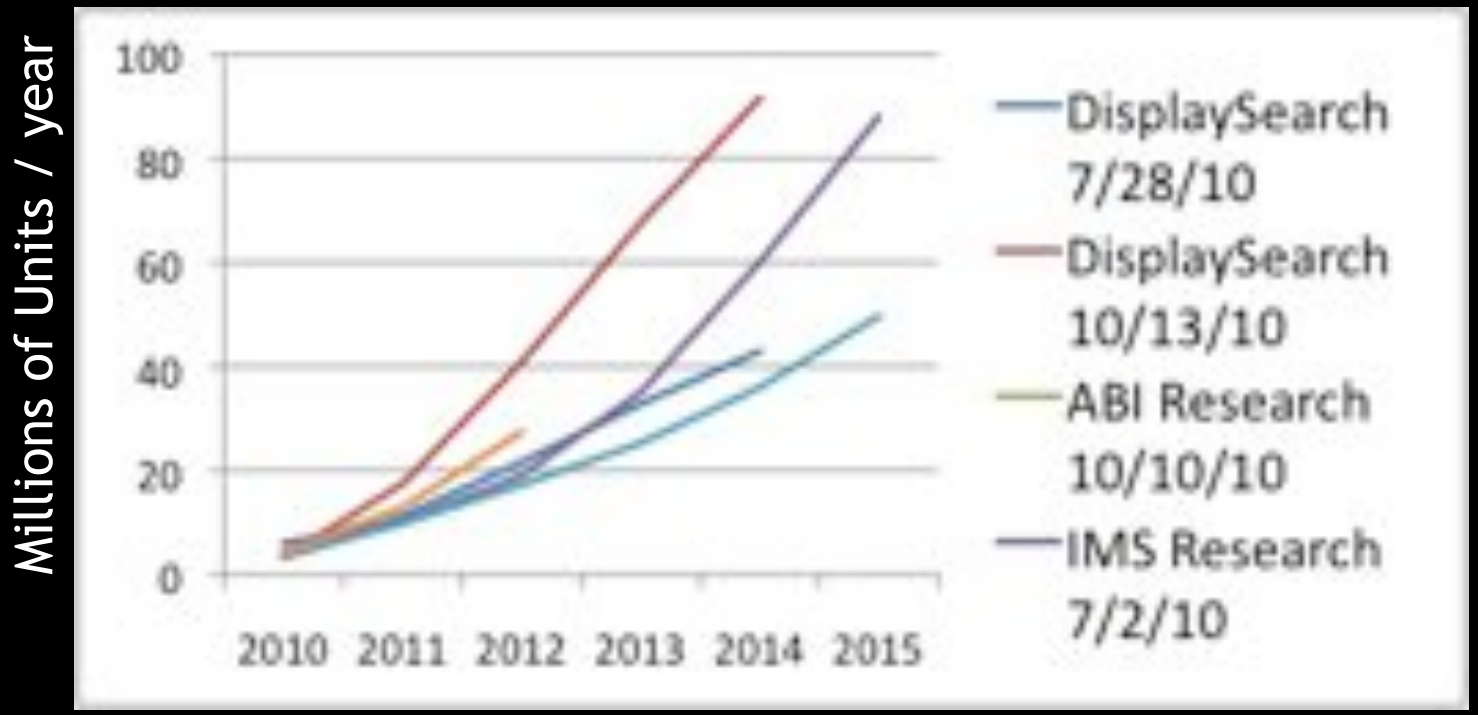
Selling 3D at Retail



Key concerns

- Consumer & Salesforce education
    - Consistency of messaging
    - Simplify
- Compelling demo (movies, sports, games)
- Interoperability / standardization (glasses)

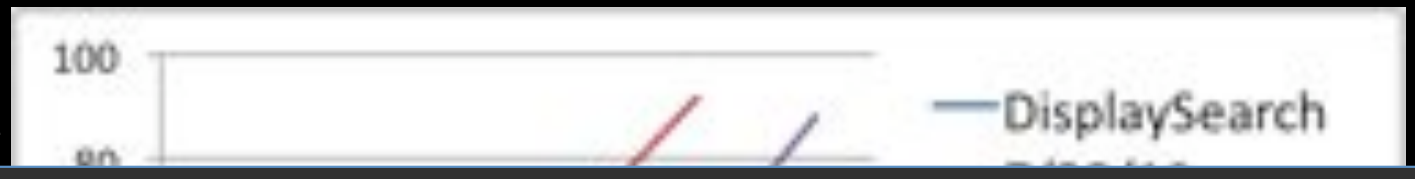
Worldwide 3D TV Forecast



3.2M to 6.2M 3D TVs sold in 2010

50M to 88M 3D TVs sold in 2015

Worldwide 3D TV Forecast



TV Makers get bad reception for 3D

Source: Wall Street Journal
December 19, 2010

Tagged to move | Prices of 3-D TVs are falling to spur demand

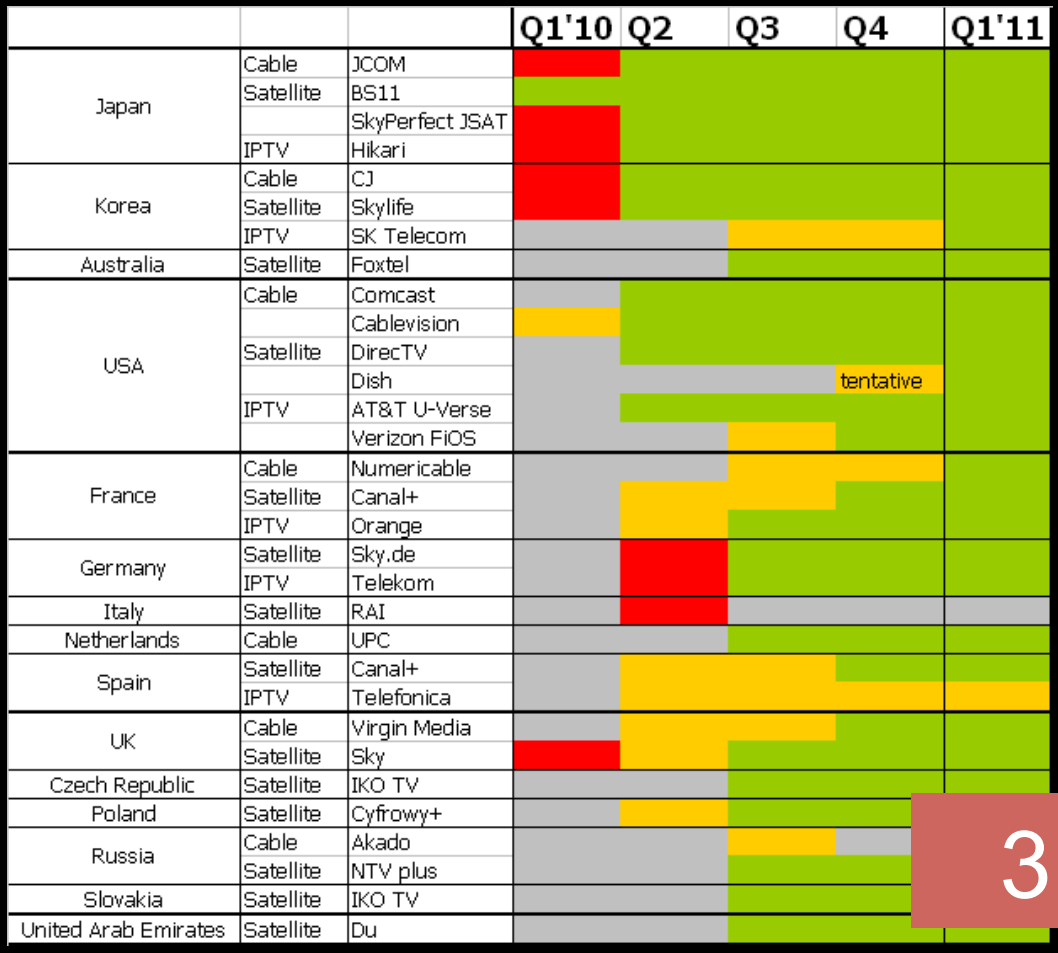
	SHARP	Panasonic	SAMSUNG	LG	SONY	TOSHIBA
Model:	60-inch Aquos Quattron 3-D TV	65-inch Viera plasma 3-D TV	65-inch 8000-series 3-D LED TV	55-inch Infinia 3-D LED TV	60-inch Bravia NX810 3-D TV	55-inch 3-D LED TV
Suggested retail price:	$5,299	$4,299	$5,999	$5,400	$4,699	$3,299
Lowest price on Bing.com:	$3,095	$3,619	$3,398	$2,291	$3,395	$1,579
Difference in price:	42%	16%	43%	58%	28%	52%

Polarized coming to consumer market
- Re-energize the market? -

LG
Vizio
others

Australia
Germany
Belgium
Brazil
Estonia
Turkey
Korea
Japan
UK
US
…

3D Content



3D Channels

3D Games

No Activity
Trial
Limited Service / Special Events
Full Service

3D Blu-ray

Source: DisplaySearch Q3'10 Quarterly TV Design and Features Report

Market Research
International 3D Society

41% of US Adults have seen a recent 3D movie

54% of US Adults expect 3DTV to be better than HDTV
66% of recent 3D moviegoers expect this

Opinion Research Corp.
1008 Adults
Oct 7-10, 2010

41% c

54% c

66

n HDTV

Opinion
1008 Adu
Oct 7-10

What to Watch in 3D

- 77% of consumers think 3DTV viewing will be geared to special events, as opposed to regular programming
- Top Genres:

nielsen

Nov. 9, 2010

Nintendo 3DS
Consumer's first personal 3D experience?

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Parameters that impact the 3D viewing experience

- Vergence / accommodation conflict (decoupling)
  - Degree – amount of conflict
  - Speed – how rapidly do you vary the conflict
  - Range (depth budget) – what is the range of in/out variability (in diopters)
  - Duration – how long does the conflict experience last
- Viewing distance and the size of the screen
- Viewing angle to the screen - perceptual distortion
- Subject's / population's optical-mechanical factors
  - Eye alignment (vertical and horizontal)
  - Bias favoring one eye over the other
  - Refractive error
  - Age and decreased speed of the eyes to focus
  - IPD vs. assumed interoccular distance of the audience (and divergence limit)
  - Stereo acuity
- Refresh rate of the screen/display versus the refresh rate of the eye/brain
  - Fast horizontal motion (e.g. objects moving horizontally on a stationary background
- Variable stereographic approaches (e.g. 3D trailers before the feature)
- Ghosting
- Left/right image alignment and balance (color, light level, …)
- Edge violation
- Ambient light levels
- Looking from 3D to 2D and back

Parameters that impact the 3D viewing experience

Technology

Art

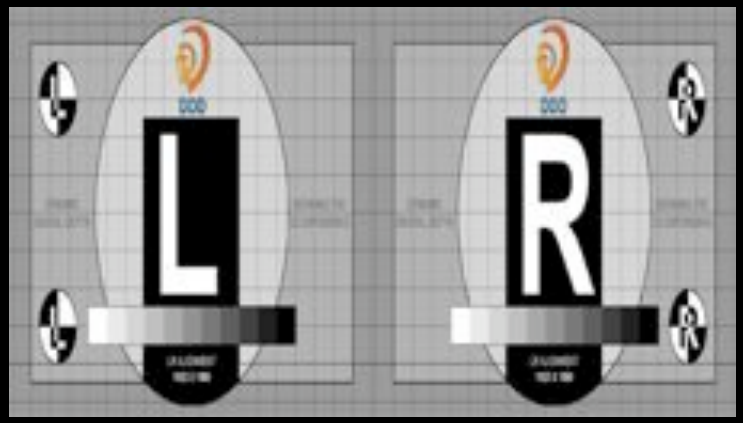
Source

Human visual system

Receiver

Viewing environment and behavior

Art Technology



Crosstalk image test chart from DDD

Crosstalk
- a form of binocular mismatch
- quantifiable test!

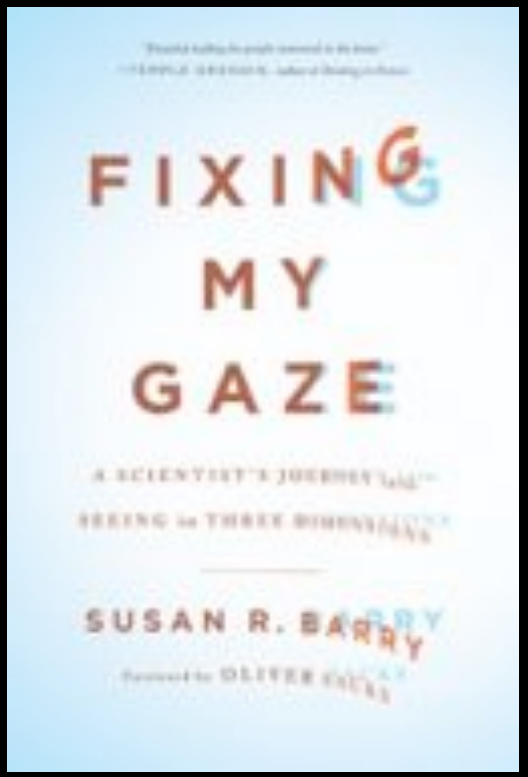
Conflicting depth cues
- binocular and monocular mismatch
- obvious in 2D-3D autoconversion

Vergence Shock
- quick cuts or jumps in 3D depth

Human Visual System

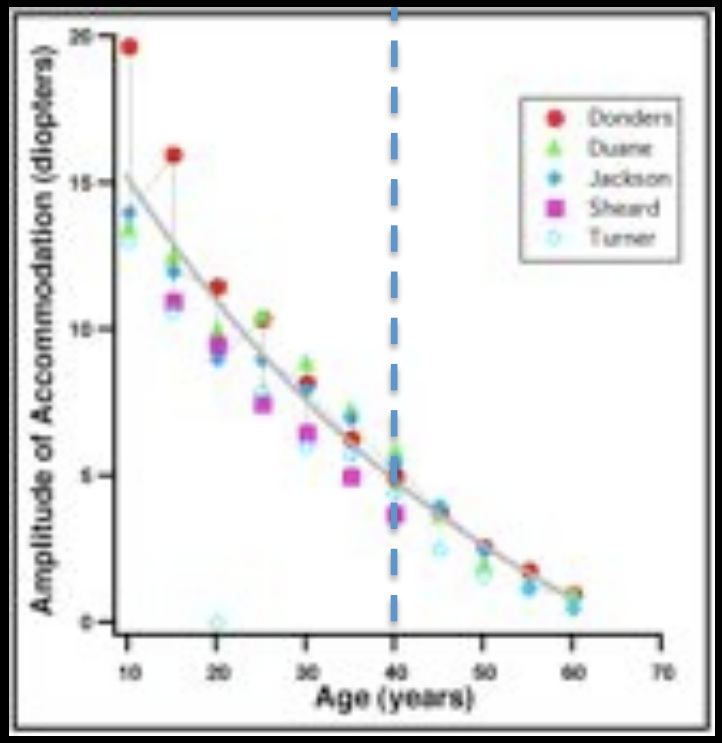
4% stereo blind

Fixing My Gaze
By Dr. Sue Barry



Human Visual System

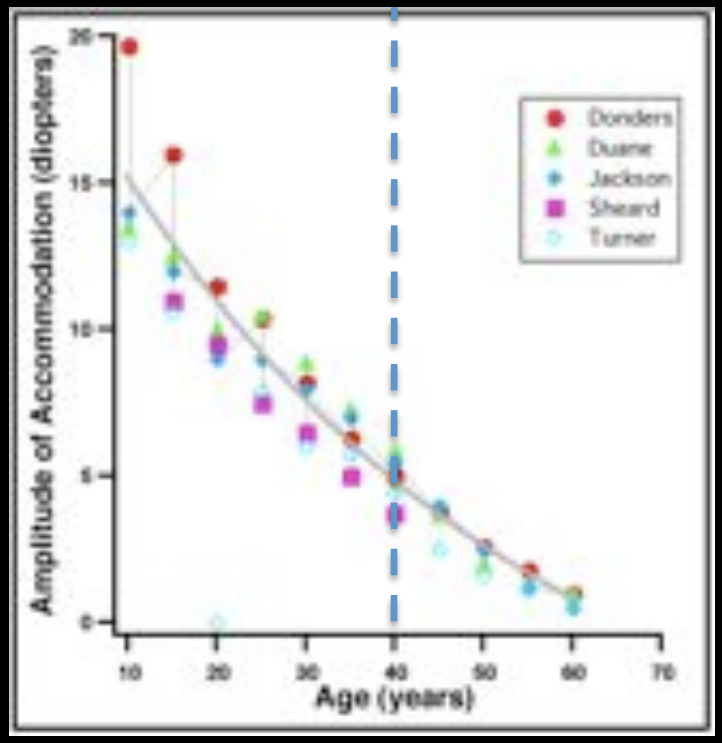
Academic Research and Vision Dynamics



Eye Exams and Binocular Vision Issues

Human Visual System

Academic Research and Vision Dynamics



- Guidelines for creating 3D
- Impact of age

Human Visual System

Eye Exams and Binocular Vision Issues

Headaches ➡ Diagnostic Tool

- Misalignment
- Vergence-Accomodation Issues
- Favoring one eye over the other

Human Visual System

Eye Exams and Binocular Vision Issues

3D 영상 안전성에 관한 임상적 권고안

(Practical Recommendation for 3D image Safety)

Ver. 1.0

For Children

Binocular Vision Disorders

Misdiagnosed as ADHD

(Attention Deficit Hyperactivity Disorder)

Viewing Environment and Behavior

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3D is global

3D Porn
Hong Kong

WildEarth TV 3D
launches 24/7 channel
South Africa

Turkey
Live Action

Argentina
Animation

Japan
Games

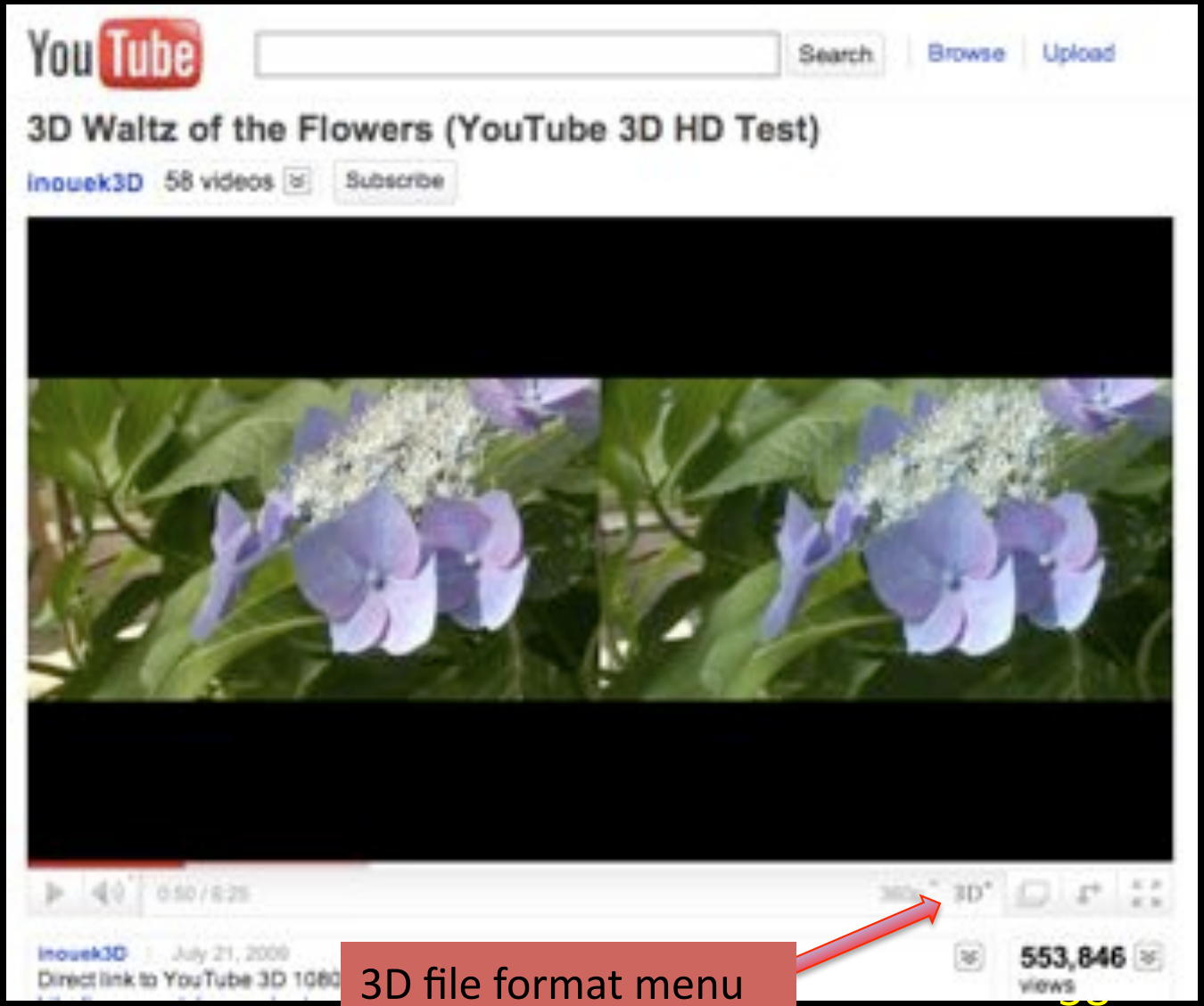
The Larger Ecosystem

2010 worldwide sales projection

- 3.4M will be 3D-capable → 42.9M by 2014
- 228M displays (2D and 3D)
- 100M will be "connected TVs"

DisplaySearch 8/10/10

DYI (“Do It Yourself”)
S3D community



Apps / devices specific to 3D content

Quantel
Pablo Neo
3D Mastering

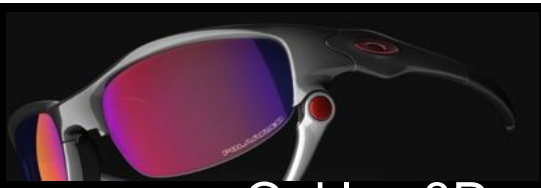
Professional

iPhone App:
Cine3D
Stereographer

CRC Depth
Estimation from
3D video

Consumer

$70 3D
Shot Cam



Oakley 3D

3dtvpubfinder.com/

3D mapping
laser backpack

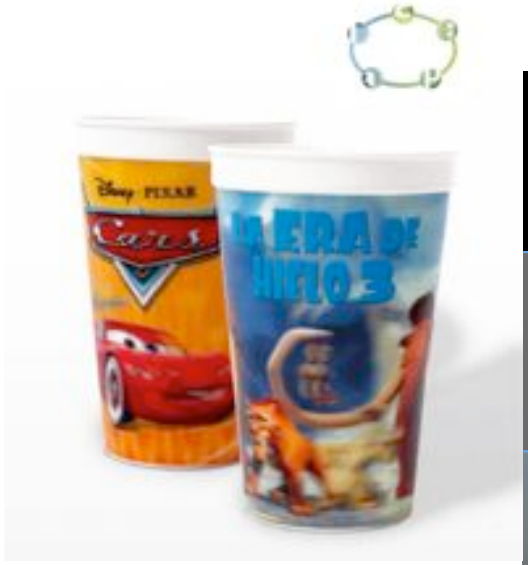
Laser Light Engines Raises $13 Million; Pacts With IMAX

Other S3D Markets

- Simulations
- Augmented reality
- Telepresence

Military

Surgery



Events / Marketing

Wonderbra 3D Billboard

Source: Daily Mail, UK 9/14/10

Education and S3D

- Discipline not an issue!*
- 29-35% after-lesson retention*
  - 10% in control group
- Greater understanding of spatial relationships+
  - sketch lesson in 3D vs 2D by control group

* Rock Island, Illinois and Boulder Valley School District, Colorado
+ Abbey School, Redding, England

7/28/10 XpanD / TI / Eon rollout to five school districts in Tx, Fl, Ca, and Co
11/18/10 Pilot program in 7 European countries

Consumers don’t buy technology, they buy the experiences that technology delivers

Conclusions

3D will be in TVs, PCs, game consoles, etc., as well as movie theatres

Conclusions

We will see how consumers use it as markets emerge

Conclusions

Entrepreneurial opportunities in the professional and consumer markets for…

Hardware
Software
Services
Support
Training/Ed.
Tools
Marketing
PR
…

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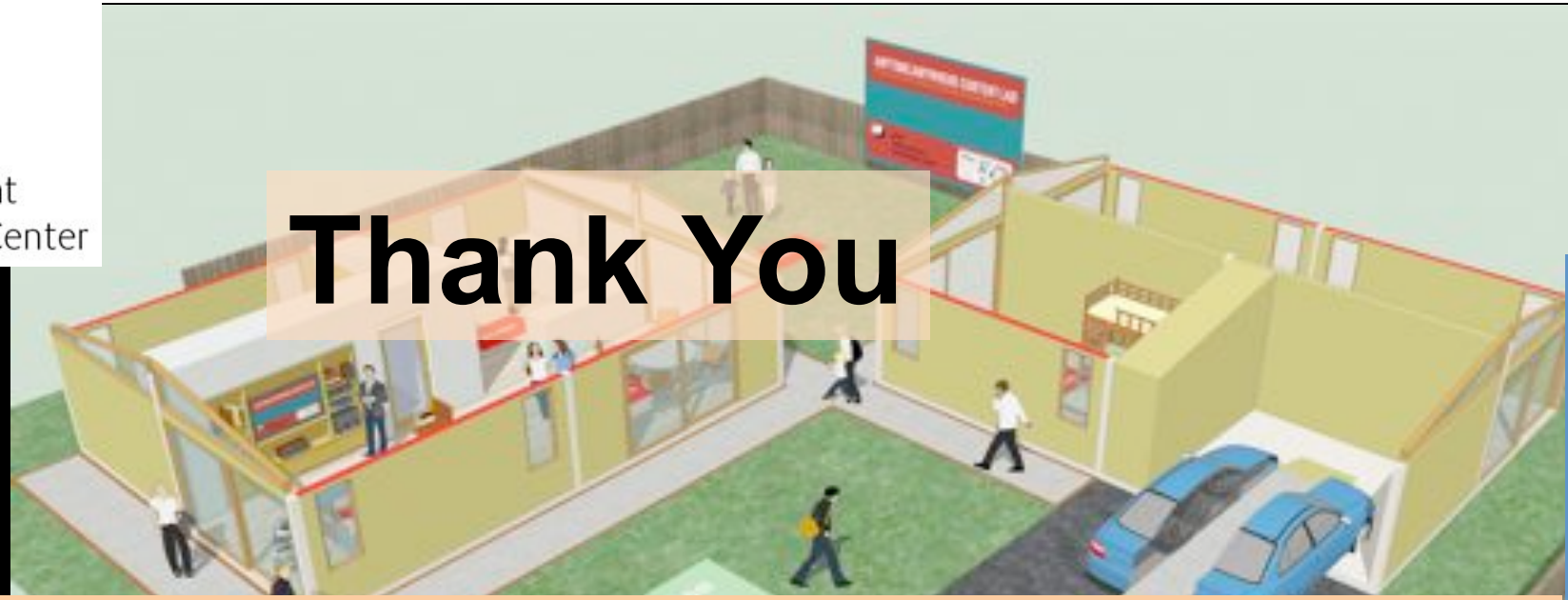

Thank You

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