

SMPTE  
May 25, 2016  
Linwood Dunn Theater

# Virtual Reality Overview & Update

Philip Lelyveld

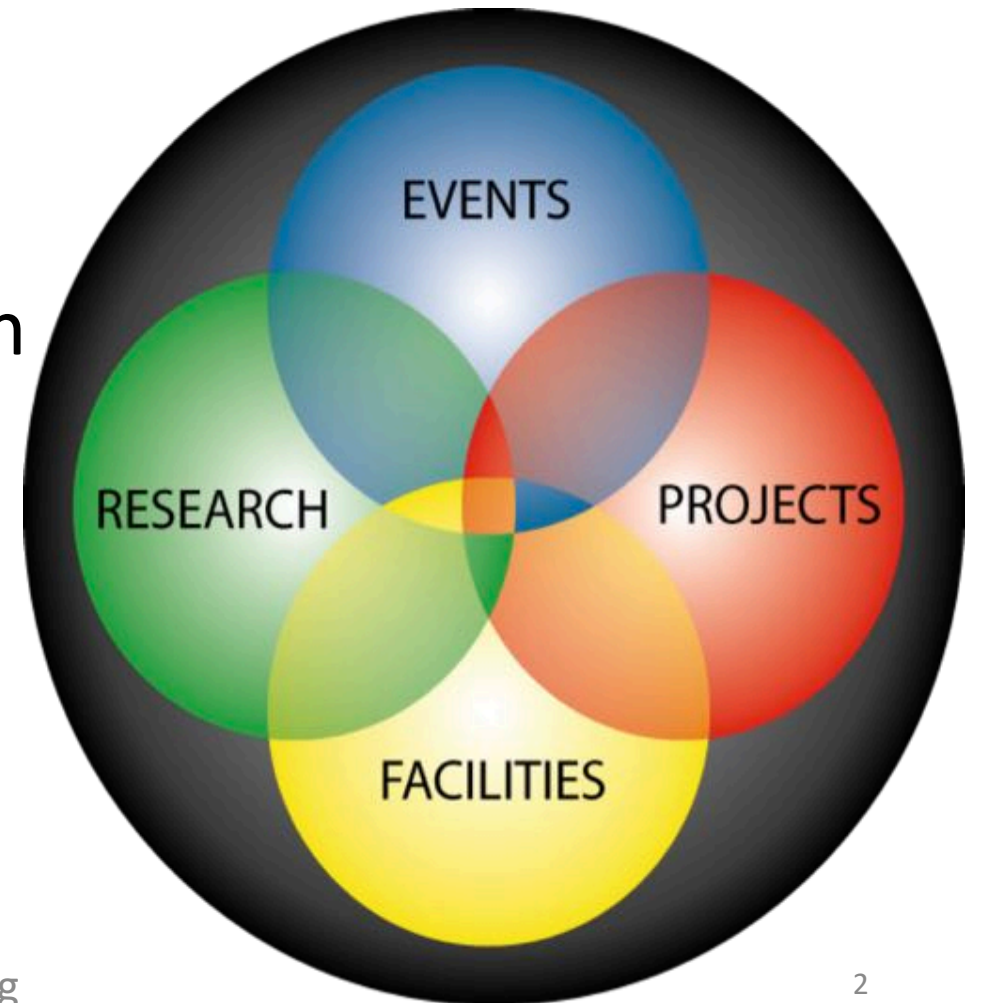
USC Entertainment Technology Center



Founded 1993 by George Lucas to  
bring together technology and  
entertainment visionaries to collaborate on  
the future of entertainment technology

## Adamantly neutral

- Discussions
- Research
- Collaborations
- Coverage



# CURRENT MEMBER COMPANIES



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ORACLE® | FRONT PORCH DIGITAL







In **Augmented Reality**, the world that you would normally see if you walked down the aisle without the screen is being **augmented – enhanced, supplemented, added to** - with additional data and experiences.

In **Virtual Reality** you are **virtually – nearly, almost** – but not really there in the grocery store aisle.

# The AR – Reality – VR Continuum

Augmented  
Reality

Real  
Environment

Virtual  
Reality



Transitional  
Mixed Reality  
Blended  
Reality

# Different ways to have a VR experience

Magic Window

Cellphone-based viewer

Head Mounted Display (HMD)

Group VR

# Virtual Reality on Cellphone or Tablet

## “Magic Window”

Swipe

Tilt and wave



Near \$0 cost of entry

PLelyveld@ETCenter.org



# Cellphone-Based Viewer with Headphones



Near \$0 cost of entry  
PLelyveld@ETCenter.org

# Head Mounted Displays with Peripherals



## Oculus Rift with Oculus Touch



# Head Mounted Displays with Peripherals

## Sitting, Standing, Walking

### Tethered versus Untethered

- Bandwidth Issue
- Compression
- Latency



# Group VR Experiences

## Location Based Entertainment



The Void opens Times Square VR Center

First attraction: “Ghostbusters: Dimensions”

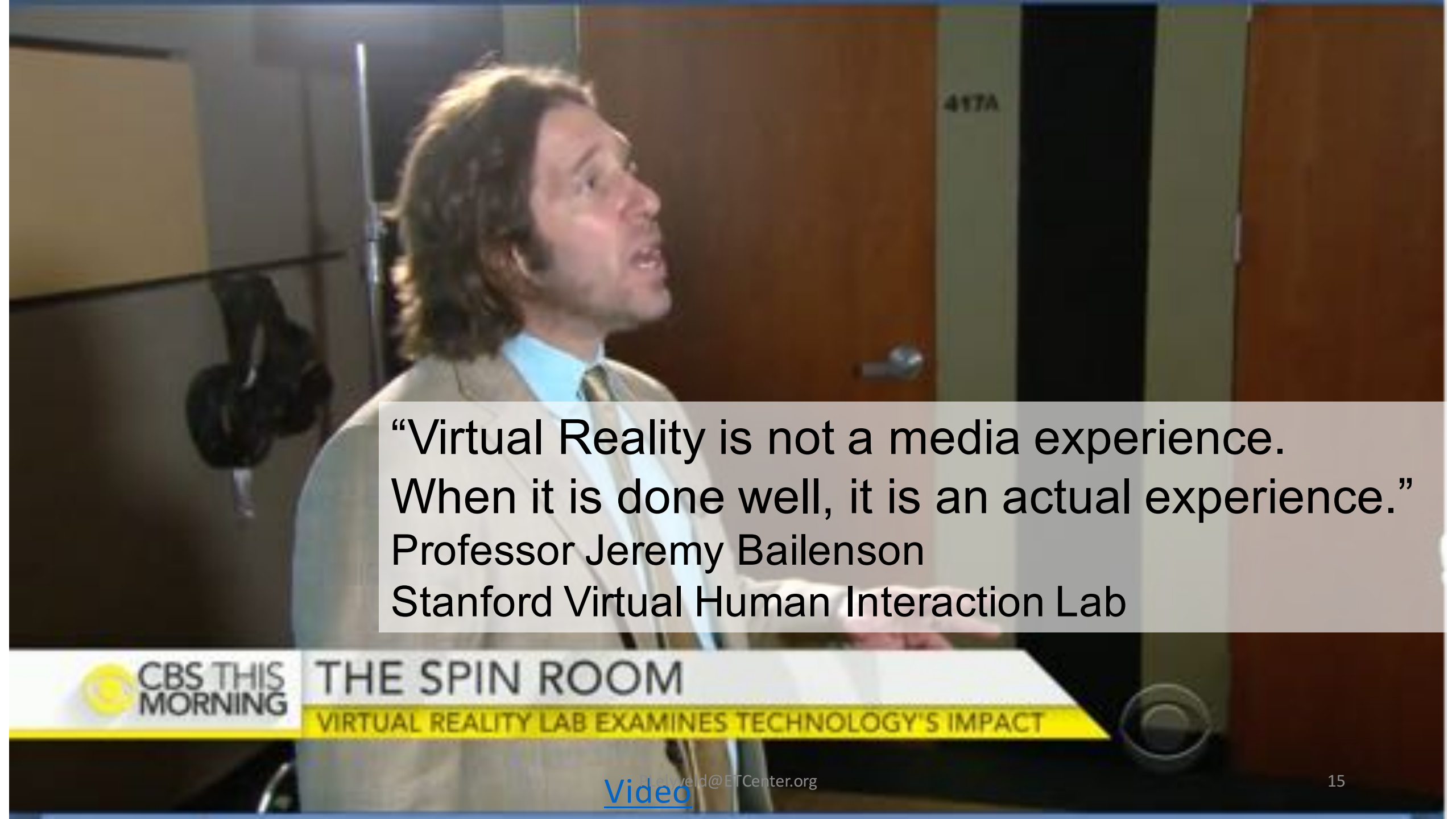
Opens July 1, 2016, developed in cooperation with the movie

# The Language of VR: Part 1

Existing tools and skills are being reworked to create something very different







“Virtual Reality is not a media experience.  
When it is done well, it is an actual experience.”  
Professor Jeremy Bailenson  
Stanford Virtual Human Interaction Lab



## THE SPIN ROOM

VIRTUAL REALITY LAB EXAMINES TECHNOLOGY'S IMPACT

# Sense of 'Presence'

1. More senses accurately engaged  
= increased presence

2. Fidelity Contract



# Heightened Sense of Empathy



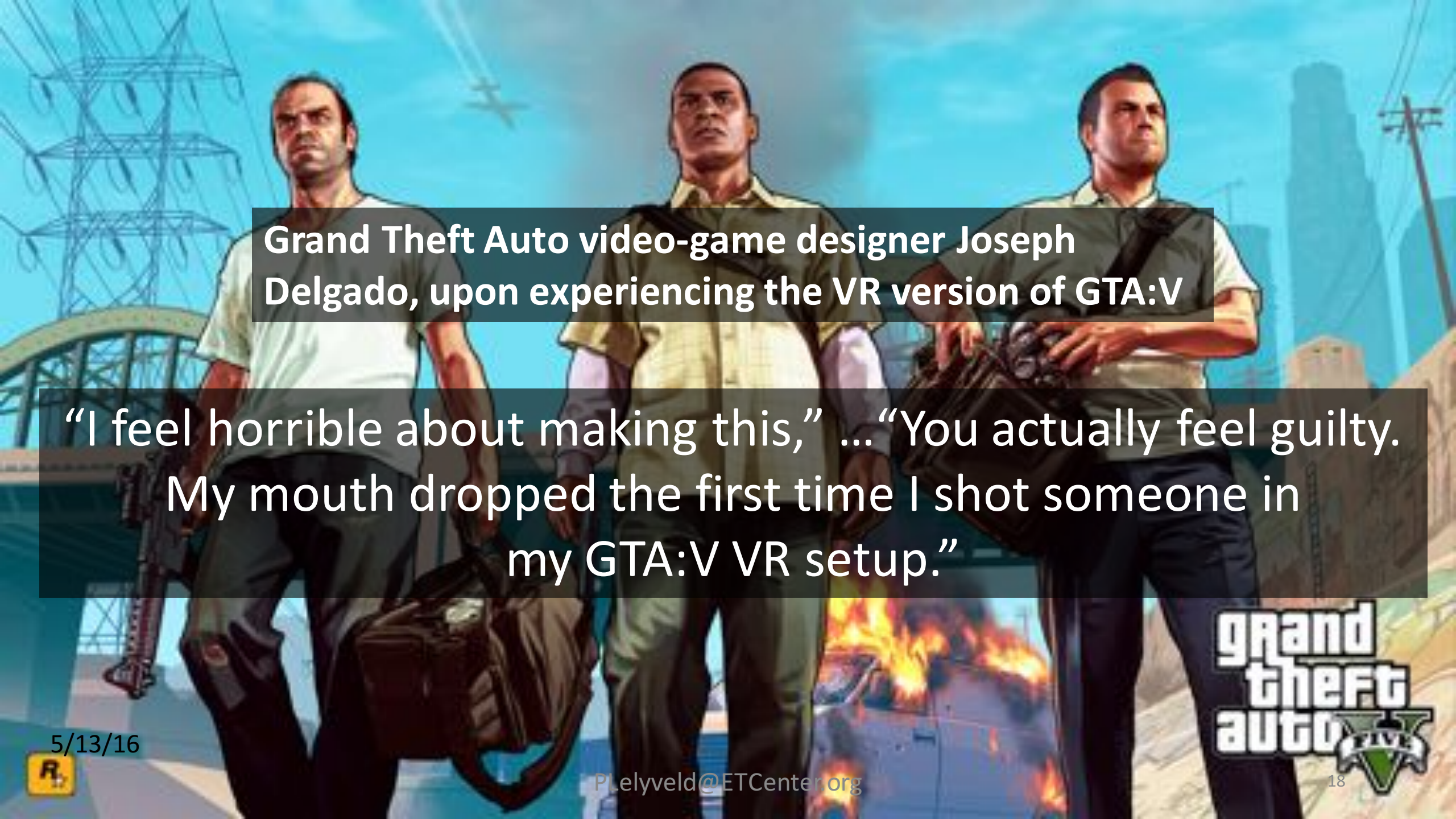
Henry

Oculus Story Studio

7/28/15

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**Grand Theft Auto video-game designer Joseph Delgado, upon experiencing the VR version of GTA:V**

**“I feel horrible about making this,” ...“You actually feel guilty. My mouth dropped the first time I shot someone in my GTA:V VR setup.”**

5/13/16



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# Heightened Sense of Empathy



**3D** facial expressions evoke stronger emotions  
than their 2D counterparts  
due to the illusion of non-mediation

# Agency



“Hunger” (Virtual Food Bank) by Nonny de la Pena

# Agency Immersive Journalism



“My Mother’s Wing”  
By VRSE for UN



The ultimate VR experience will be a story that knows you are in the story.

Mark Bolas



# Language

story telling + engagement design elements

You are in a snow storm

You must get warm in 5 minutes or you will die

s t o r m

Audio is a key 'presence' component

Players 'feel' colder as they play

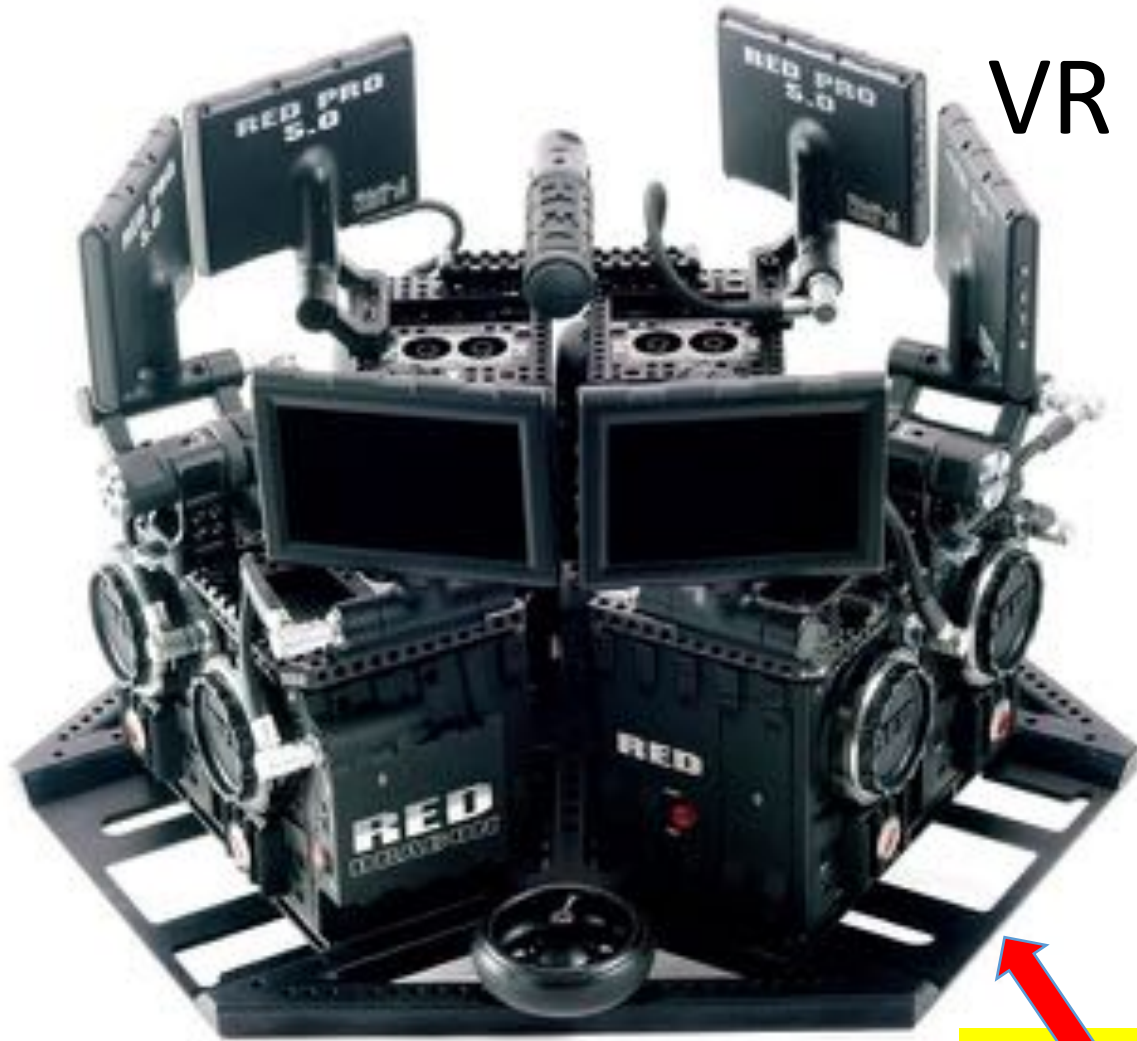
Your body moves slower as time goes on

From "Storm" by Andrick Bregman



# Tools

# VR Cameras



NextVR 360 3D Rig  
6 Red Pro 6K cameras  
60 fps  
Spatial audio capture

Captured 3D

Algorithmic 3D

Jaunt J1-24R  
Early 2016  
32K (16K per eye)  
120 fps

# Nokia OZO



Captures 360 stereoscopic 3D through:

- 195° capture with 50% overlap for 3D
- 8 synchronized global shutter sensors
- 8 integrated mikes for spatial audio

Jaunt committed to support Ozo for camera & production workflow

# Surround 360 by Facebook



Not a product; an open source design for others to build on  
2048x2048 60 fps genlocked cameras – 14 around, 1 up, 2 down

## Orah 4i live-streaming Prosumer VR camera from VideoStitch



4 fisheye lenses, 4 mikes, 4K output, 30 sec delay, ~\$3,600



# VR Cameras (consumer mkt.)



Ricoh Theta (\$350)



Bublcam from Bubl (\$799)



Kodak SP360 (2X\$290)



Samsung 360

Two 15MP cameras

360-degree video in 3,840-by-1,920 resolution

Galaxy S7 and S7 Edge, Gear VR



Nikon KeyMission 360 (\$?)  
Waterproof to 100'



Giroptic (\$499)

# Sound



*Wild – The Experience, VR short from Fox (Reese Witherspoon, Laura Dern)*

# Ambisonic Audio



TetraMic

# Binaural Audio



3Dio



# Sound

## Audio breakdown

- Live spatial audio capture
- Miked audio with position-tracking
- Audio with no position (music score)



*Wild – The Experience, VR short from Fox (Reese Witherspoon, Laura Dern)*



# Stitching



# Stitching



From talk by Anrick Bregman

# Stitching



Standard VR camera rigs can have built-in stitching software  
From talk by Anrick Bregman

# Editing tools



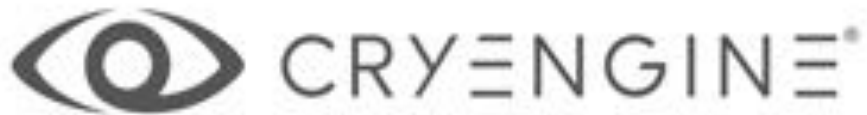
Skybox is creating a **‘direct to Rift’** player for the Adobe suite that **hangs the menus within the HMD space**



# User Interface



Game Engines



To maintain presence, **UI** for **navigation design** and information communication must be consistent with the rest of the experience

# Digital Distribution of VR

- YouTube 360
- Apple TV 360
- Hulu 360
- Amazon 360
- Netflix 360
- Littlestar
- Vrideo
- **WearVR**
- ....

**You**Tube

Search YouTube Help

YouTube Help

Upload videos > Upload instructions and settings

Upload 360 degree videos

PLelyveld@ETCenter.org

The latest and greatest VR content to your device

Get content to your inbox

Email 

OCULUS RIFT ▾ HTC VIVE OSVR SAMSUNG GEAR VR ANDROID ▾ IOS ▾

WINDOWS PHONE ▾

*Option:*

*Distribute a 4K frame, then client warps it*

*Capture at high-resol  
processing*

*Interactivity is executable code, not an MPEG stream*

*360 uses MPEG-4 and VP9 (Google) codec*

*Technical considerations*

*Bandwidth and QoS*

*Compression*

*Latency*

*Processing power*

*Local buffer/storage ...*

Google Fiber expressed  
interest in streaming VR



# Head Mounted Display

## Technical Targets

4K-8K resolution per eye

>90 frames per second rendering (vs capture)

<20 msec latency

220° field of view (FOV)

Github VR standards discussions

**Standards? Standardization efforts.**

Google put out RFCComments for embedded spatial audio standards

FB camera released as open source to drive innovation and open standards

Google DayDream VR for Android N, including reference specs for phones and Gear-like HMDs

## WebVR

This specification describes support for accessing virtual reality devices, including sensors and head-mounted displays on the Web.

## Spatial Audio RFC (draft)

*This document describes an open metadata scheme by which MP4 multimedia containers may accommodate spatial audio. Comments are welcome by filing an issue on GitHub.*

# The Language of VR: Part 2

## Live Action or CGI?

# Decision

## Camera-captured VR

Locked to camera position

The Director's Journey



## Computer Rendered VR

Free to wander (Story world)

Subtle coercion





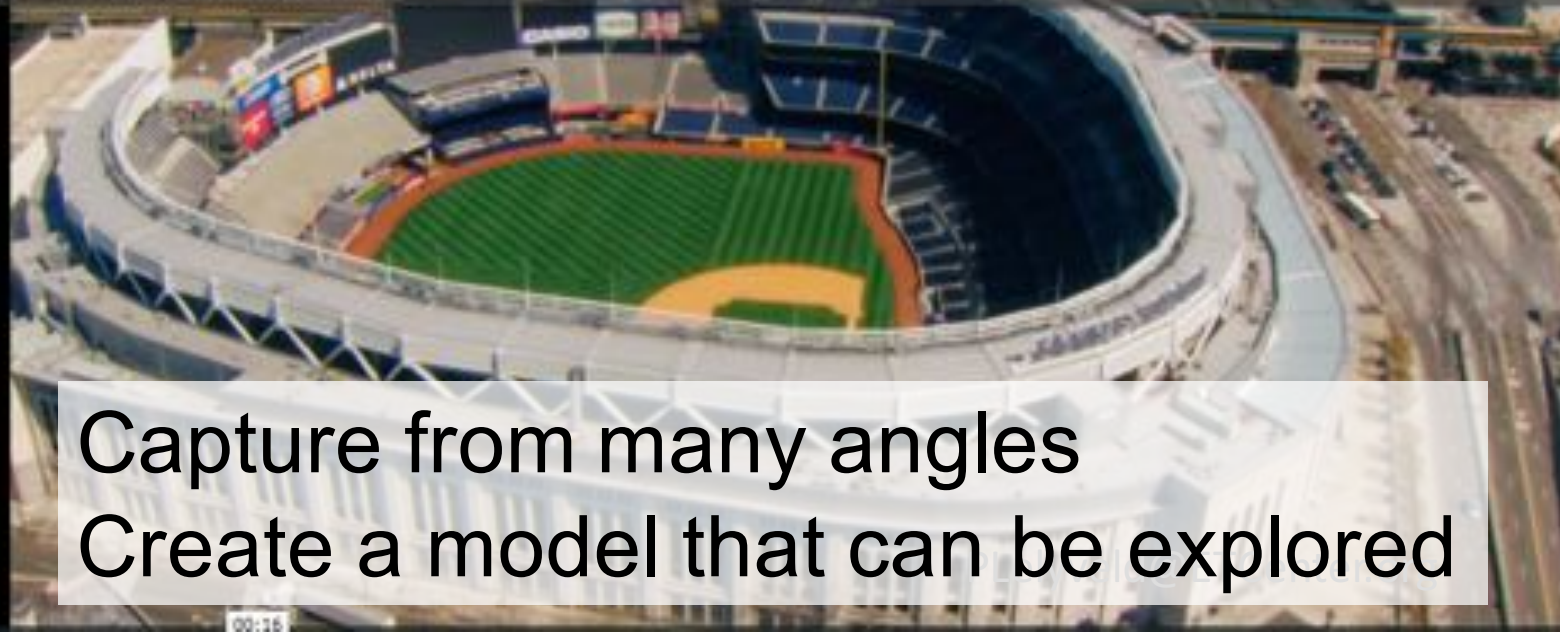
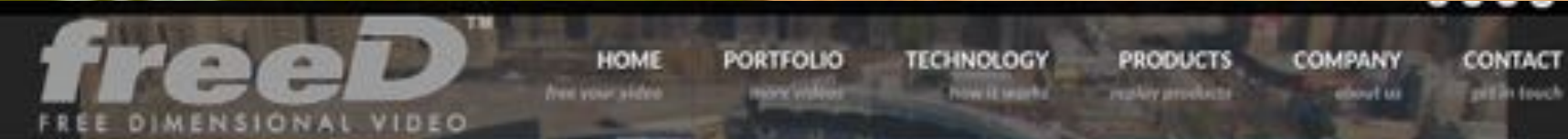
# Mixed Reality

## Spherical capture live and insert into CGI



“Volumetric capture will change everything.” Chris Edwards, The VR Company

# Hybrid - Outside to Inside 'Volumetric VR'



Capture from many angles  
Create a model that can be explored



Replay-technologies.com  
8i.com  
MS Hololens Holoport



# Lytro Cinema light-field camera

## Cinema frame today, volumetric VR in the future



Every pixel has color, direction, x/y/z position info

Every object can be separated from its surroundings – green screen

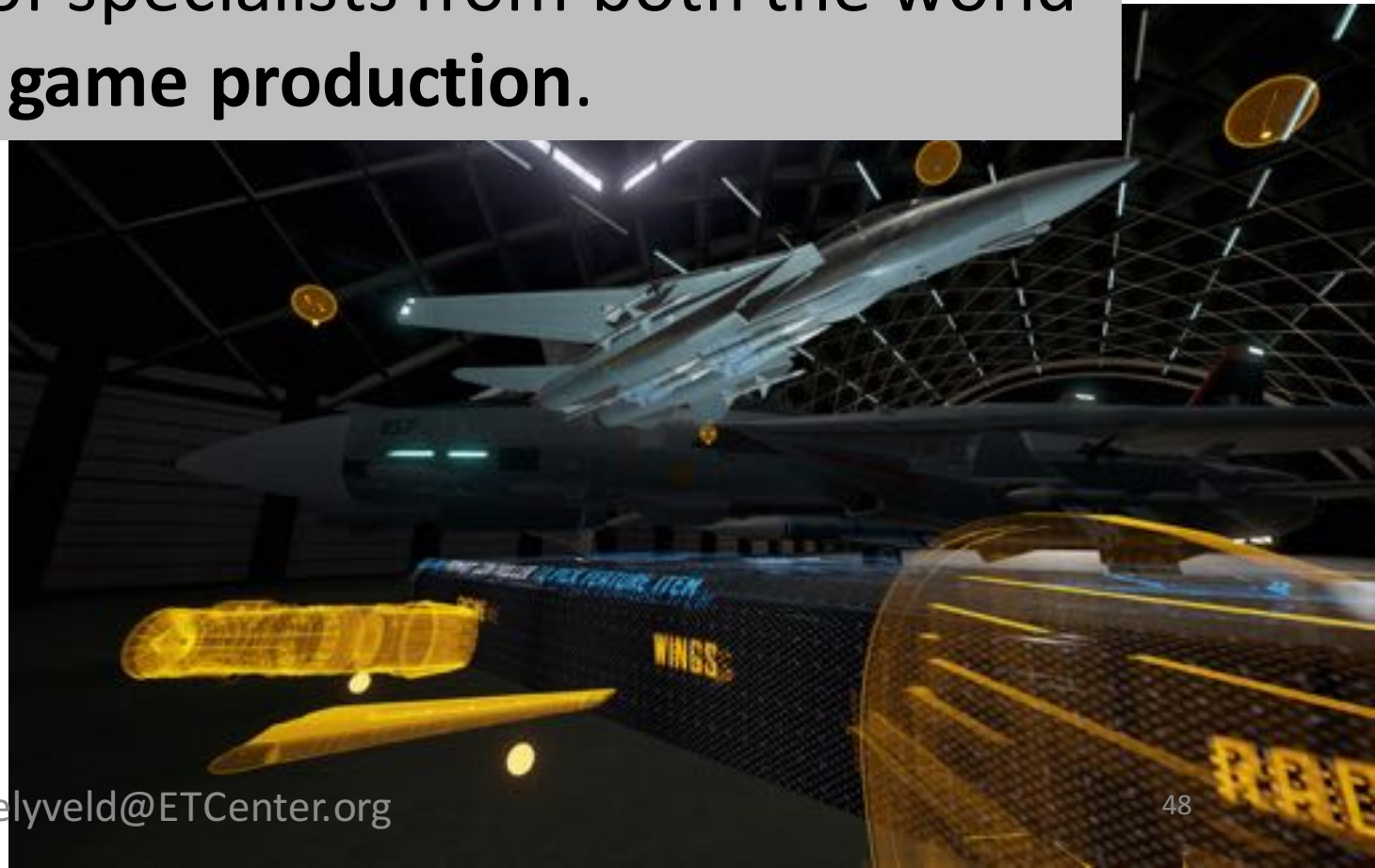
755 RAW megapixel 40K resolution, 300 FPS, *400 Gbps of data*

# Deluxe Launches VR Unit to Facilitate Industrial-Scale Virtual Reality Productions

Deluxe assembled a **team** of specialists from both the world of **visual effects** and **video game production**.

Very busy space  
- VFX experts  
- Game developers  
- ...

Variety, 4/11/16





# The Language of VR: Part 3

## Things to think about

# The Camera is Your Audience's Head!!!

We see the world differently  
sitting and standing

We don't see shaky-cam  
when we run

The world doesn't tilt when  
we tilt our heads

*Cyber-Sickness*



VR puts you in the scene  
There is no third wall to break

Maintaining presence depends on maintaining expectations in the experience

HIDE (or be able to remove) EVERYTHING THAT DOESN'T BELONG THERE

Crew  
Lights  
Equipment  
Shadows of e

Real-time remote monitoring of the shoot is being tested  
(ex. Teradek Sphere, Ozo system)

View dailies in HMD for sense of the experience

individual sensor feeds for problem

New LED light form factors can  
Or

Shoot in multiple directions (ex. 360°) and blend in post

Indoor scenes; sample the ceiling lights there, paint them out later

Capture ambient spatial audio  
Subconscious cues help you 'be there'  
And pull you out if they are missing!

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Solving problems



Green screen helmet  
onto headless torso.  
Head bounces  
differently from body.

From talk by Anrick Bregman



# The final image must be error-free

Imperfections stand out glaringly, and break presence

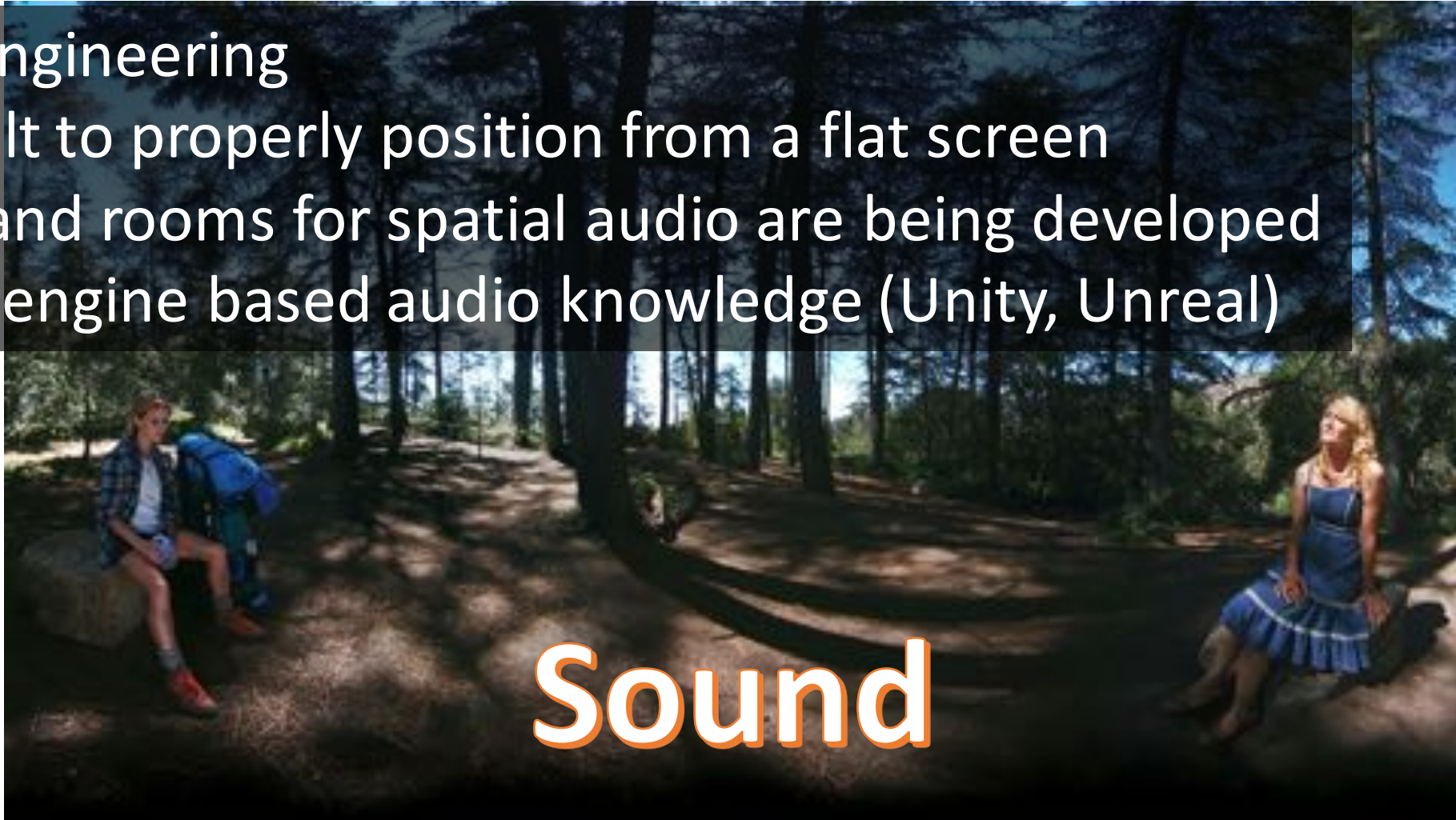
Stitching is a 3-pass process;

- algorithmic real-time first pass
- quick pass for editing work
- compositing heavy workflow with clean-up stitching

# Sound

## Audio Engineering

- Difficult to properly position from a flat screen
- Tools and rooms for spatial audio are being developed
- Game engine based audio knowledge (Unity, Unreal)



*Wild – The Experience, VR short from Fox (Reese Witherspoon, Laura Dern)*

# What's your message to SMPTE members?

Buy a cheap camera and experiment!



# Resources





TOMORROW

# VIRTUAL REALITY SEMINAR SPONSORED BY DIGITAL CINEMA SOCIETY AND BIRNS & SAWYER!!

## Los Angeles VR and Immersive Technologies Meetup

Saturday, May 21, 2016  
9:00 AM

Creative Technology Center  
604 Moulton Ave  
Los Angeles 90031, CA

Are you going?

Yes

No

34 Virtual Friends going, including:



MAY 26, 2016 - 7:30 PM

## Women in VR Spring Mixer 2016

Free order #518346620 of 1 Ticket on May 13, 2016

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# VRLA SUMMER EXPO

August 5<sup>th</sup> & 6<sup>th</sup> 2016  
Los Angeles Convention  
Center



**SoCal VR**  
**October 30, 2016**  
**Long Beach CC**



Bringing together the producing  
team in Film, Television and New Media

GUILD MEMBERS CREDITS AWARDS PRODUCED BY CONFERENCE MAGAZINE P

## PGA EAST: VIRTUAL REALITY FOR PRODUCERS: THROUGH THE LOOKING GLASS

 Tell a Friend

# New York

2/9/2016

Online registration is closed.

**When:** Tuesday, February 9  
7:00pm - 9:00pm

**Where:** Theresa Lang Auditorium, The New School  
55 West 13th St.  
New York, New York 10011  
United States

PLelyveld@ETCenter.org



# San Francisco

## Inside VR 2015

**WHEN:** December 01, 2015



## For-Profit classes



Monthly

Saturday, May 28th VRLA School focuses on the tools and processes for editing stories



# Websites

**Road to VR – [www.roadtovr.com](http://www.roadtovr.com) - latest news**

**<https://www.facebook.com/groups/Virtual.Realities/> - latest news**

<https://www.facebook.com/RoadtoVR/> - latest news

WearVR, Littlestar, Vrideo – latest content

Reddit VR – community discussion groups

UploadVR - <http://uploadvr.com>

VR Reporter - <https://virtualrealityreporter.com>

VR Scout - <http://vrscout.com>

Women in VR – [www.wivr.net](http://www.wivr.net)

Women in VR Los Angeles - <http://www.meetup.com/Women-in-VR/>

All Things VR – [allthingsvr.co](http://allthingsvr.co)

Kzero - <http://www.kzero.co.uk/blog/>

# Podcasts

**Voices of VR** - daily

Real Virtual Show - weekly

<http://a16z.com/?s=virtual+reality>

## Lists of VR and AR conferences

<http://www.apoip.org/home/events-calendar/>

<http://allvirtualreality.com/events/list-virtual-reality-events-vr-expo-exhibitions-conferences-2016.html>

<https://www.jvrb.org/events>

Modern era consumer VR is <3 years old

New art form and communication tool

**We need to bring cinematic visual and audio  
craftspeople into this field**

Paraphrased from conversation with **Jacqueline Bosnjak**, CEO, Q Department

## Think about...

How to direct attention in an open space

- Theme park and theme park ride design
- Theatre in the round
- Architecture and design

Existing skills and tools that port over to VR

Experimenting with a cheap VR camera

Learning Unreal, Unity, and other game engine UI tools



# Consumers buy experiences, not technologies

Storymaking

Social

Business

Gaming

Education



# Thank You

## Philip Lelyveld

### USC Entertainment Technology Center

