

# Virtual Reality Overview & Update

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# Agenda

1. Basic Concepts
2. Types of VR Experiences (Live, CG, Social)
3. The Language of VR Storymaking
4. VR Distribution and Experiencing
5. Where Does the VR Experience Fit (uses and markets)
6. The Business Side of Entertainment VR
7. Augmented Reality



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# What is Virtual Reality (VR)

VR – Immersion in an experience unconnected to the physical world except for the input and output / display devices

No Frame



# What is Augmented Reality (AR)

AR (Augmented Reality) – virtual content overlain on the physical world





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 Continuum from Reality to Virtual



# 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



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Near \$0 cost of entry



# Cellphone-Based Viewer with Headphones



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Near \$0 cost of entry

## 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



# Location Based Entertainment



The VOID

- blended virtual and real play space
- infinitely reconfigurable

opening in Salt Lake City early 2016



# Location Based Entertainment



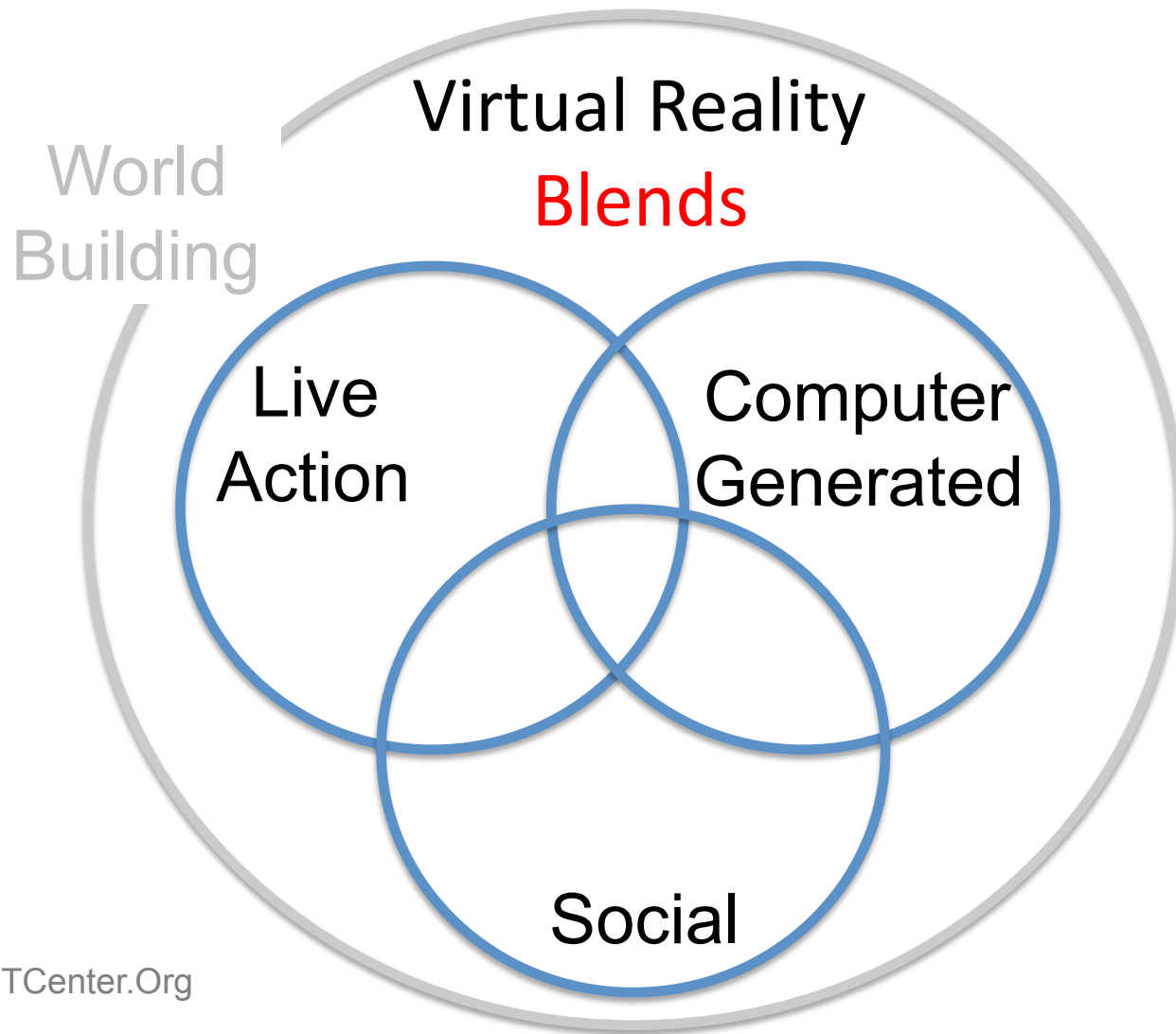
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Zero Latency  
Melbourne, Australia  
\$88AU for 50 minutes

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Do you want the audience to  
**look around, or roam freely?**

**Live Action VR** – look around  
along a fixed path



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**Computer Generated VR** – wander  
freely, non-linear storytelling /  
gaming

# Fundamental design choice

## Camera-captured VR



*The Mission, New Deal Studios*

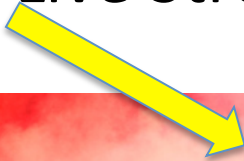
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## Computer Rendered VR



*The Blu, WEVR*

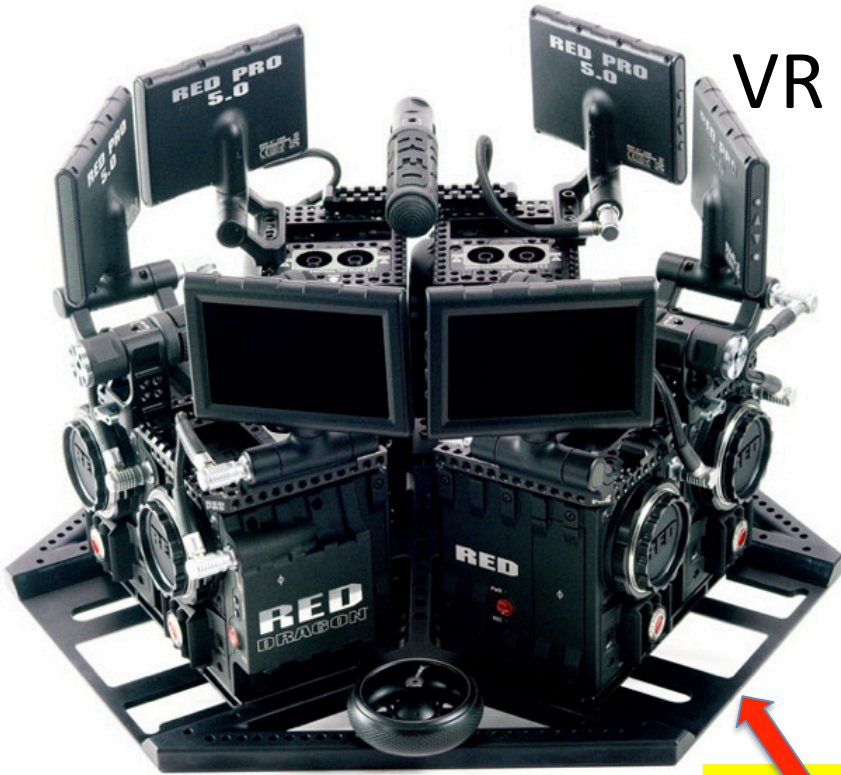
# Camera-captured VR Live Streaming or Post-Produced



Concerts, Sports, News, Story Worlds...



## VR Cameras



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



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

Captured 3D

Algorithmic 3D

## Nokia OZO



Captures 360 stereoscopic 3D through:

- 8 synchronized global shutter sensors
- 8 integrated mikes for spatial audio

Jaunt committed to support Ozo for camera & production workflow

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# Stitching



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## VR stitched panorama



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



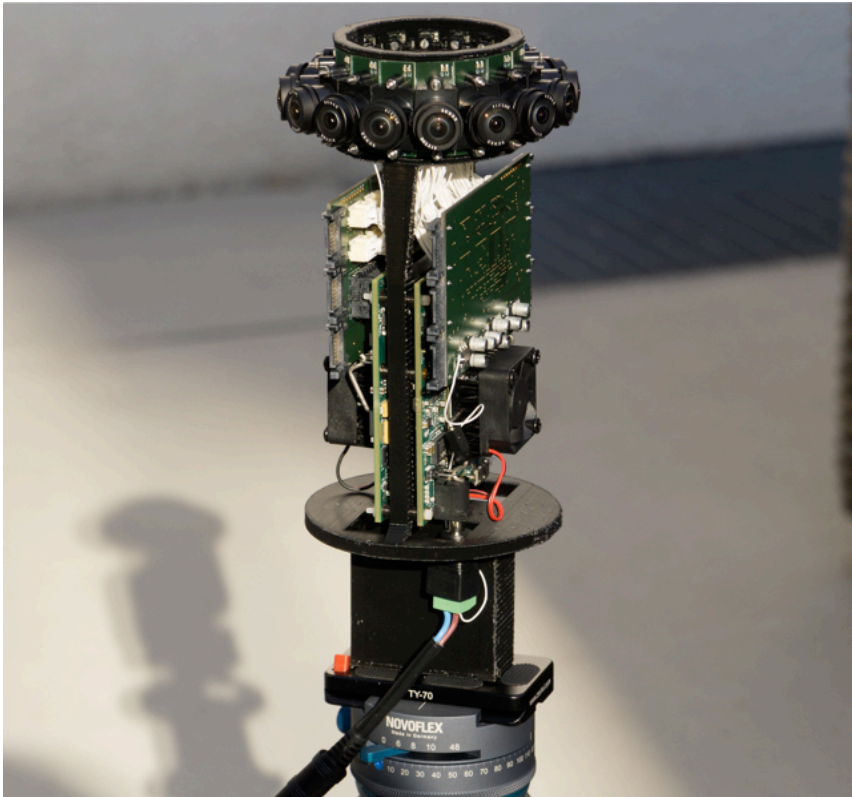
# VR Workflow

Shoot  
Dailies Stitch  
Edit + Audio  
Final Stitch  
VFX + Graphics  
Conform / DI  
Deliver Video / App

VR is the  
intersection of  
active gaming and  
passive viewing

Source: Lucas Wilson, subject-matter expert lecturer, over 20 VR shoots,  
[lucas@supersphereproductions.com](mailto:lucas@supersphereproductions.com)

# Real time VR stitched 2D sphere



## Quantum Leap By Reality Lab

One piece of a fully integrated  
video production experience  
(still in development)

Plelyveld@ETCenter.O Company founder Halsey Minor founded and built CNET Networks

Near real-time produced VR sports coming



DirecTV BKB (Big Knockout Boxing) VR

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# Sound



TetraMic



Chris Milk

Sound/audio design is a powerful storytelling element

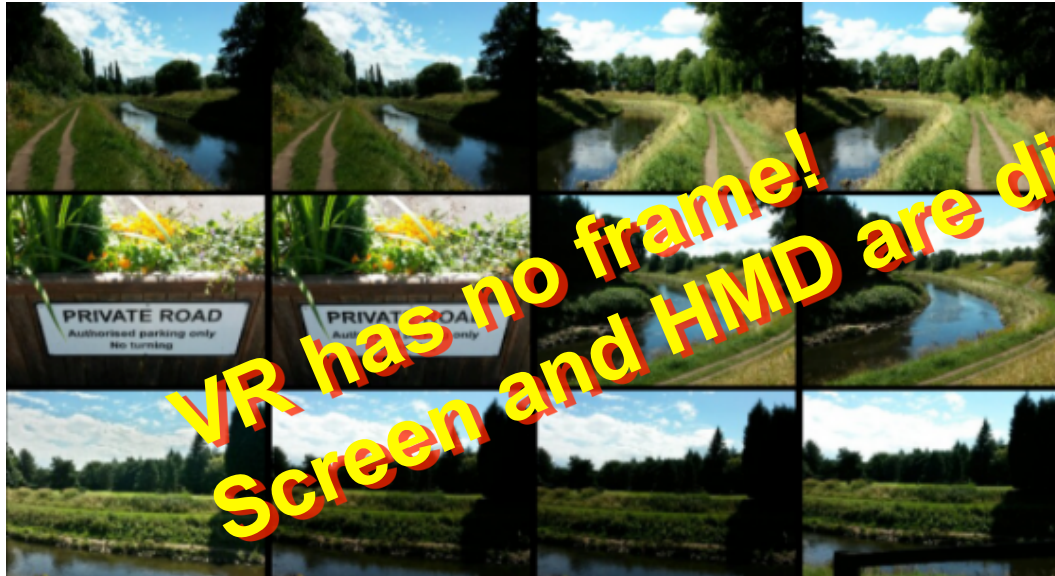
Guide attention, tell the story, override primitive graphics

Blind Swordsman

**THEY COME TO KILL YOU  
LISTEN VERY CAREFULLY  
TAP TOUCHPAD TO STRIKE**

Bronze game winner, Oculus mobile VR Jam

Test in VR  
Not on a monitor



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# Fundamental design choice

Camera-captured VR



*The Mission, New Deal Studios*

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Computer Rendered VR



*The Blu, WEVR*



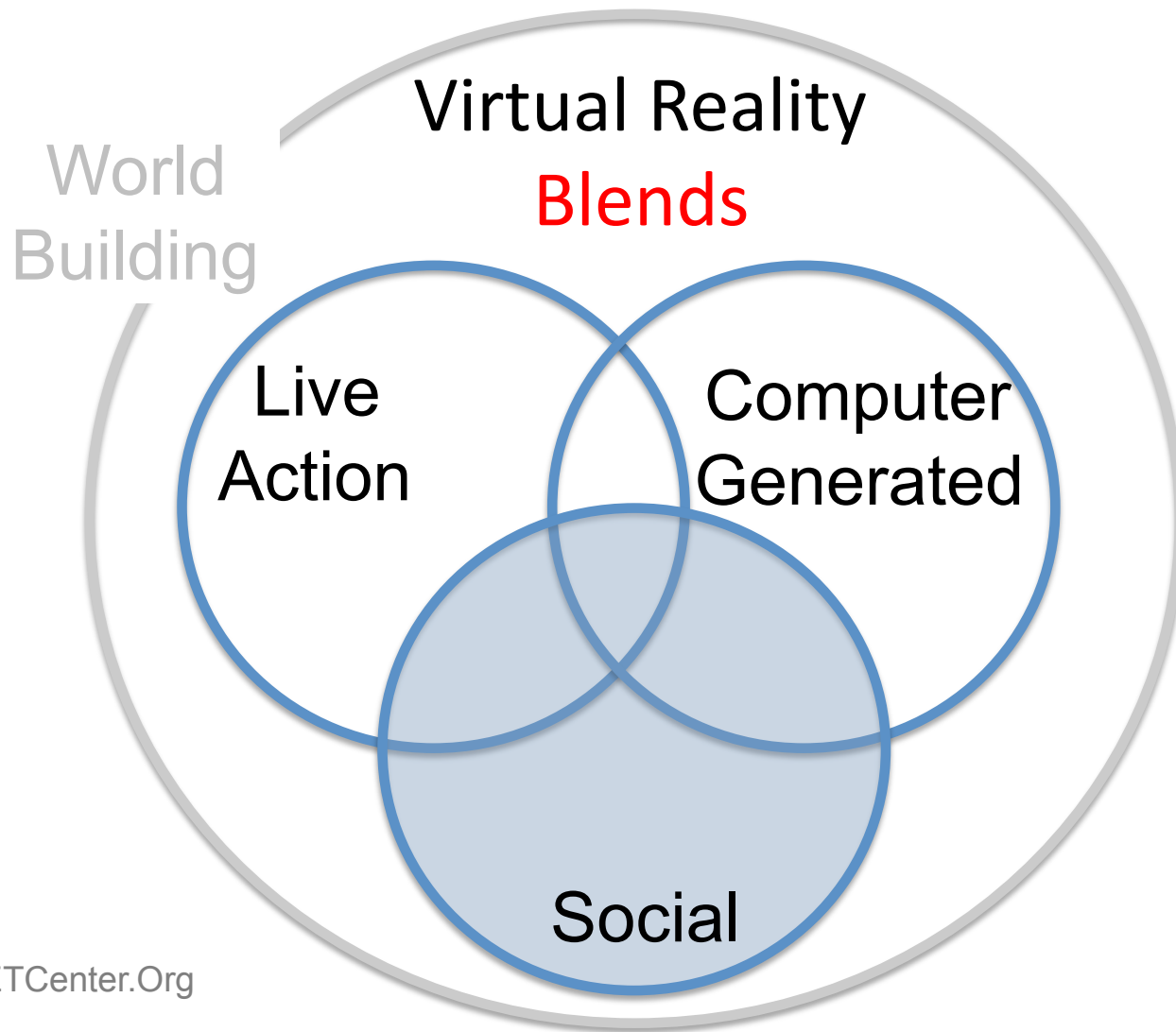
# Computer Rendered VR

## Free to wander (Story world)

“Subtle coercion”



Games have  
been doing this  
for years!



# Social VR



Social VR may be VR's killer App  
...people want to share experiences with others...

## Social VR company Altspace

Raised \$10.3 million to work towards a business plan that could include paid virtual gatherings with celebrities (7/29/15)



- users stay on the site for an average of 25 minutes
- most VR experiences last three to five minutes

# Social VR



- Spatial audio is here
- Eye and full-face tracking is coming!

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Have a reason to do VR!

Why create 360° if there is nothing to see in 270°?

JP\_whooville\_021.jpg



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Dr. Suess – visually busy all around

37

# 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*

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## Sense of 'Presence'



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## Place Presence



*Into the Storm*  
VR Experience

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Mark Bolas, Director for Mixed Reality Research,  
USC Institute for Creative Technologies



# Plausibility Presence



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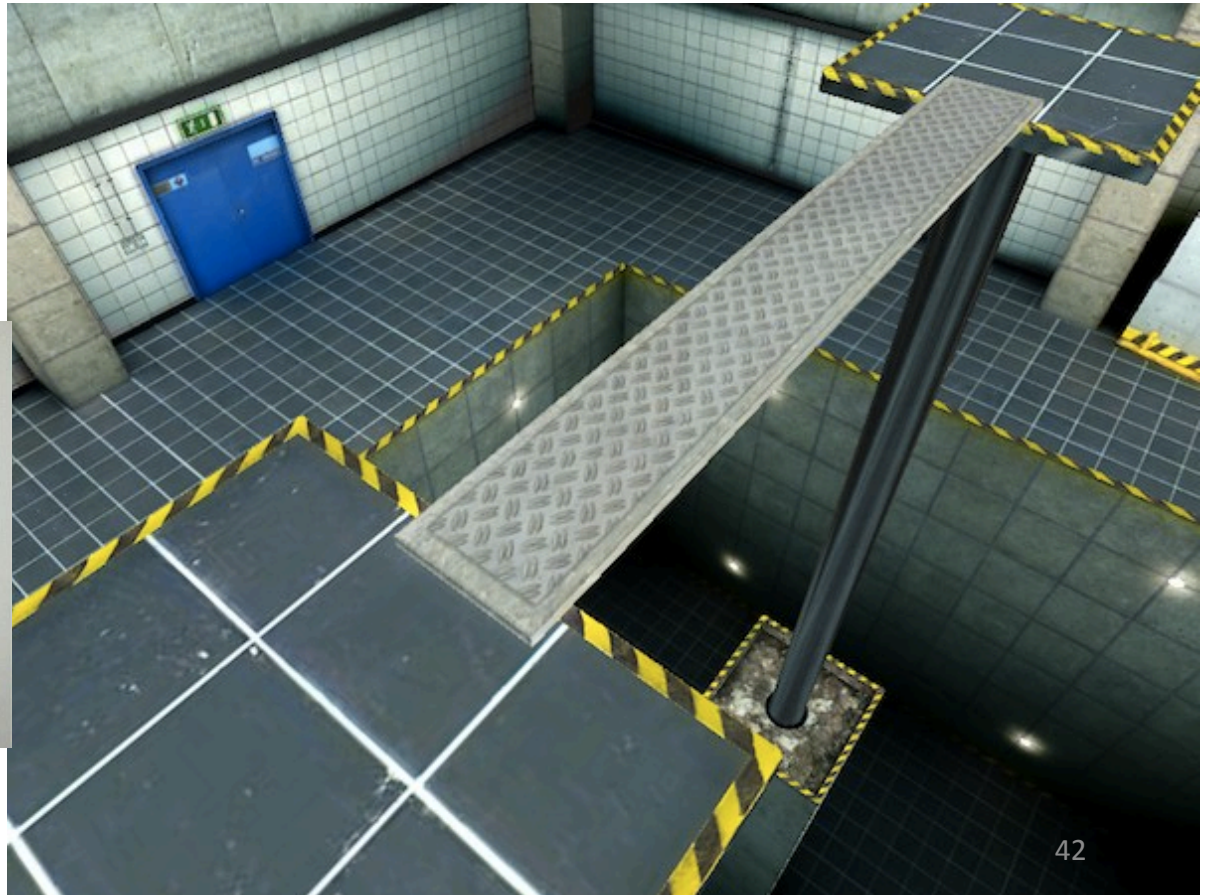


Mark Bolas, Director for Mixed Reality Research,  
USC Institute for Creative Technologies

# Suspension of disbelief over photorealism



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# Heightened Sense of Empathy



Henry

Oculus Story Studio

7/28/15



# Agency



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

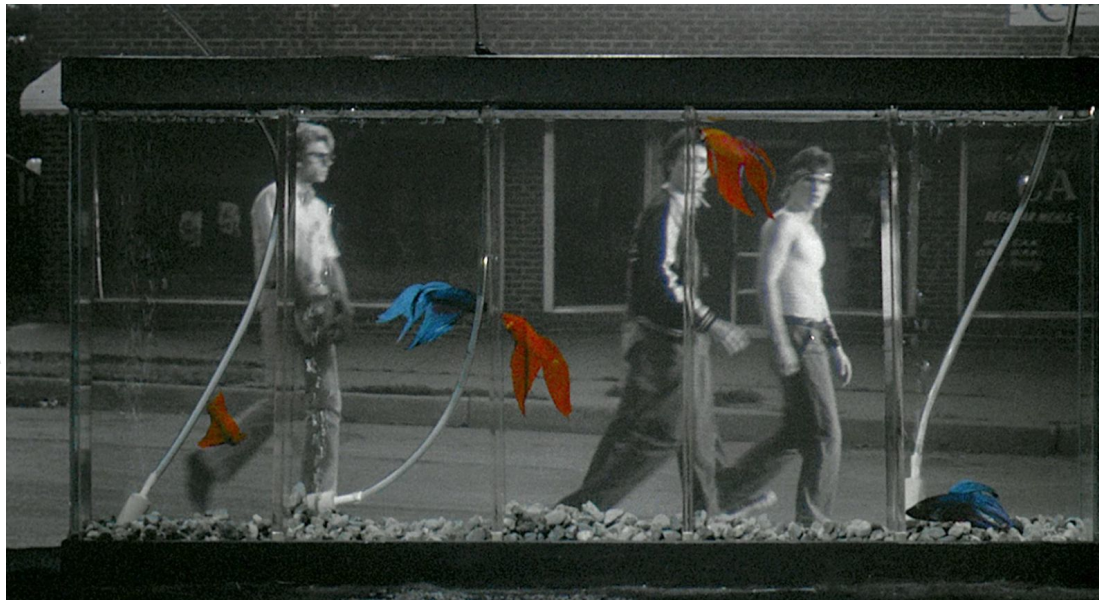
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**People will seek out the worst experience** if you don't direct them!\*

They'll look at the floor, the furniture, the plants, ....

Use visual contrast, color, brightness, detailing, and other audio/visual variables to direct the HMD-wearer's attention

**Subtle  
Coercion**



\* Interview with Aaron Pulkka, VR expert, RABBX  
Frame from Rumblefish  
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# Production Questions

Audio design

Spherical, 360, 180, zoned?

3D or 2D?

How do you;

- move?
- direct attention?
- drive a satisfying story arc?

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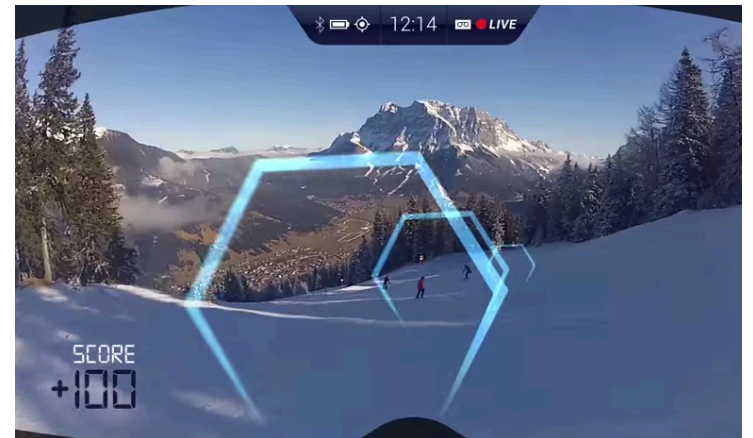
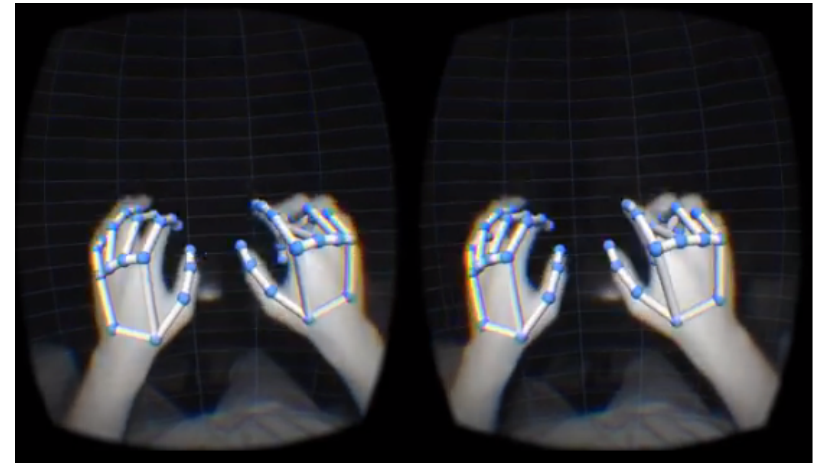
Language of VR

Content

User Interface (UI)

- Controls
- Information

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# Post-Produced Camera-captured VR

7 min. Cirq de Sole = 2.8GB 60 min =~40GB



## Live Streaming VR at Comicon



*WhiteRoom: 02BE*

A Roddenberry 360 VR movie

Conan, Walker Stalker

Live Streaming VR





## Head Mounted Display Technical Targets

4K-8K resolution per eye

>90 frames per second

<20 msec latency

220° field of view (FOV)



VantageTV – concerts  
1080p, 180° VR, spatial audio

*Option:*

*Distribute a 4K frame, then client warps it into a sphere.*

*Capture at high-resolution, distribute at what client-processing, bandwidth, and display tech allow.*

## *Technical Considerations*

*Bandwidth and QoS*

*Compression*

*Latency*

*Processing power*

*Local buffer/storage ...*

Google Fiber expressed  
interest in streaming VR

Oculus game developer guideline  
Always render frames <11ms  
2600 x 1440 at 90 fps

# The End-User VR Experience

- Latency is sum of;
- Generate (cloud?)
  - **Transmit (telcos?)**
  - Render (display)

## **Telco Infrastructure;**

- being upgraded for video anyway (business)
- VR could piggyback on (UHD / video) upgrade
- “Last mile” issue must be tackled

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## Controllers Hand, Body, Feet



### STEM by Sixence

Player can wear up to 5 wireless motion trackers

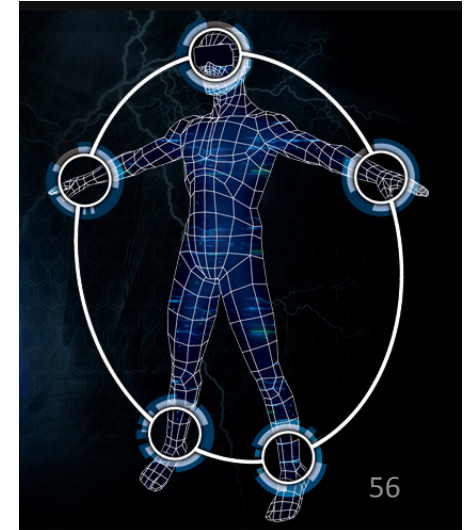
If game-enabled, can track arm and leg movement

Pre-order now (\$299 (2 trackers) to \$579 (5 trackers))

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STEM light saber demo



## Controllers Hand Tracking



Intel RealSense

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# Head and Hand Tracking in a Confined Space

## Hand-held controllers

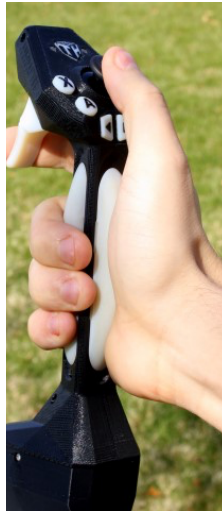
HTC Vive with Lighthouse



Lighthouse emits laser scan  
Sensors on devices detect direction



## Haptic Feedback



# Controllers Eye Tracking

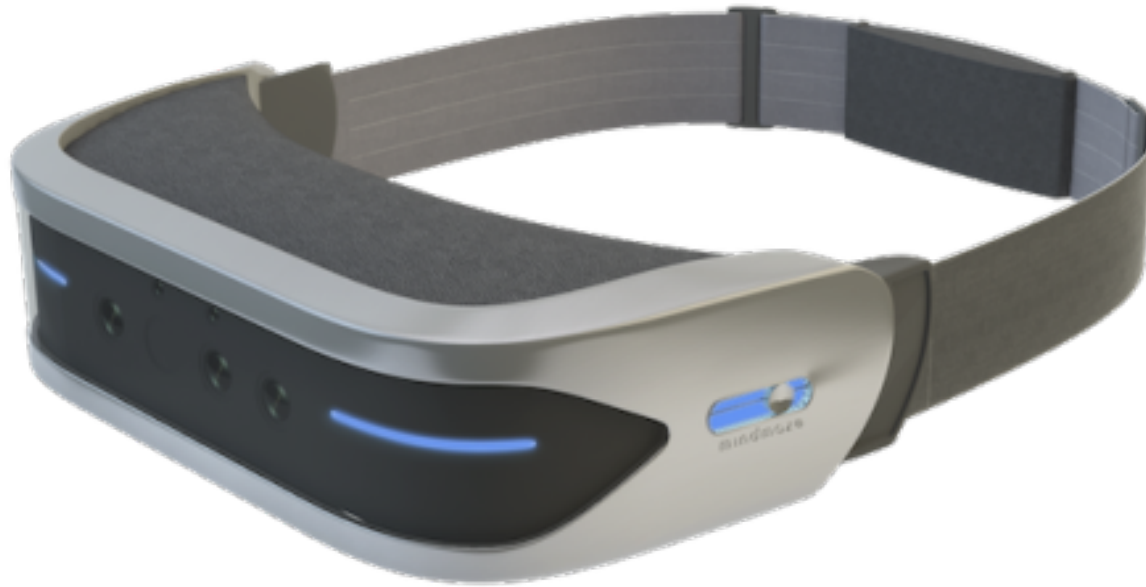


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## NeuroGaming

MindLeap virtual reality game system runs on your brain waves – no controller needed



Tech developed for medical rehabilitation

Plenty of other examples

Under 20ms latency between thought and game response

## About Face

Washable, hygienic, comfortable Oculus Rift liners



Starting at \$32

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## Professional Sports Broadcasts



TV directors have been delivering the best shot at every moment to consumers for decades.

Why would consumers want to give that up?!?!?

Integrate linear feed into the VR experience. (UI)

## Professional Sports Training



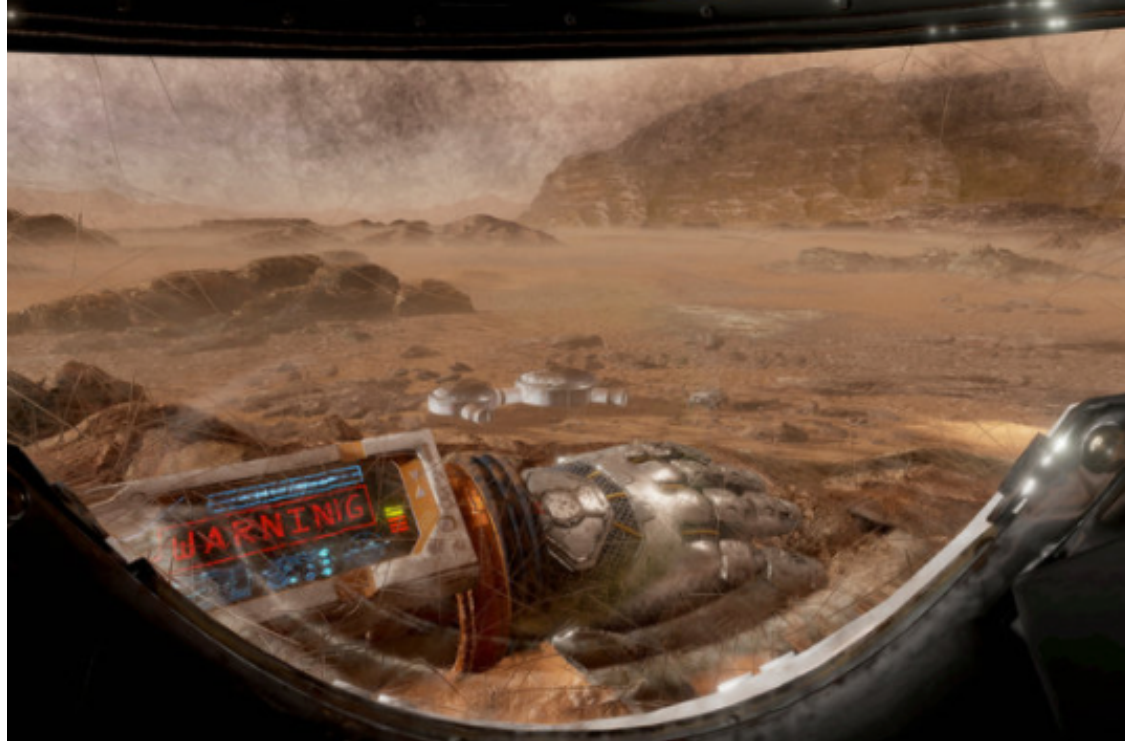
Indiana University is building a **library of VR sports plays**  
in the **Mark Cuban Center for Sports Media and Technology**



## Concerts and events (paired with Social VR)



## Story Extension



Director Robert Stromberg is creating a 15-25 minute 3D VR  
compliment to Ridley Scott's The Martian

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# News

## ABC News Says It's Taking Virtual Reality Seriously



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Jaunt processed and stitched the raw video files

ABC did all the narrative video editing

## Des Moines Register Adds VR to News Reporting



VR Farm includes text, image, video  
News story revealed by wandering

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Source: Des Moines Register Adds a Bit of Virtual Reality to News Report, Wall Street Journal, 9/22/14



# Immersive Journalism



The Displaced  
(New York Times and Chris Milk, VRSE)

Waves of Grace  
(Chris Milk, VRSE)

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# Immersive Journalism

“One Dark Night”

Trayvon Martin

Nonny de la Pena

Emblematic Group



“Hunger”

virtual food bank

Nonny de la Pena

Emblematic Group



# VR and Drones



GoPro 360Hero rig



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# Drone Racing League



Glyph HMD, “250 class” drone, 70 mph through interior space

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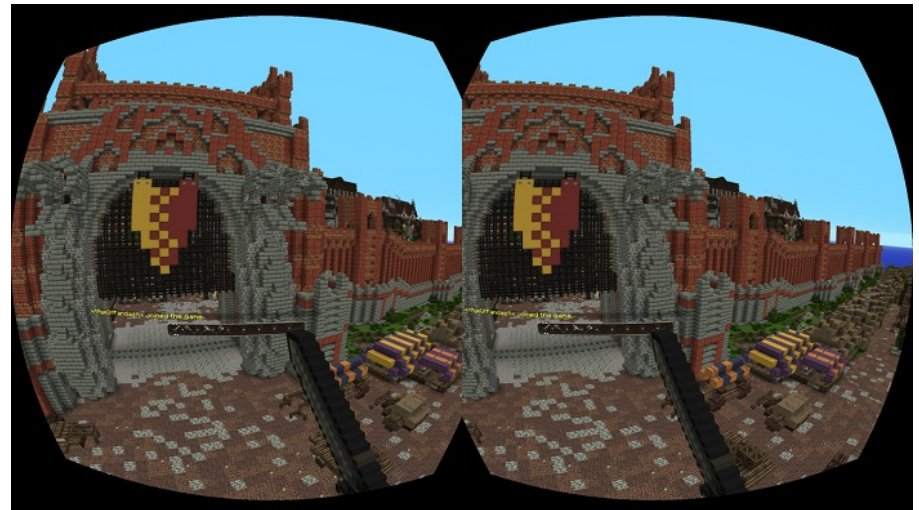


## VR as an extension of game development (a 'next generation peripheral')



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## Minecraft for the Oculus Rift





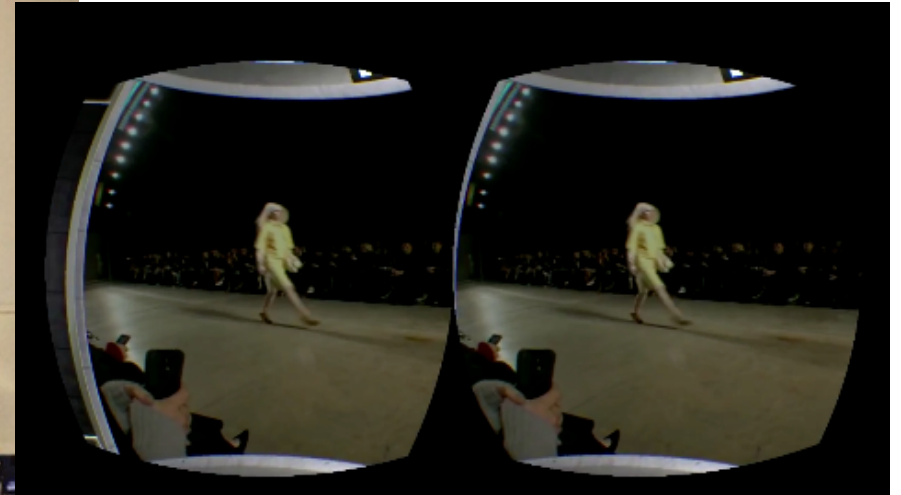
## VR as an extension of game development (a 'next generation peripheral')



# Education



## Fashion and Retail



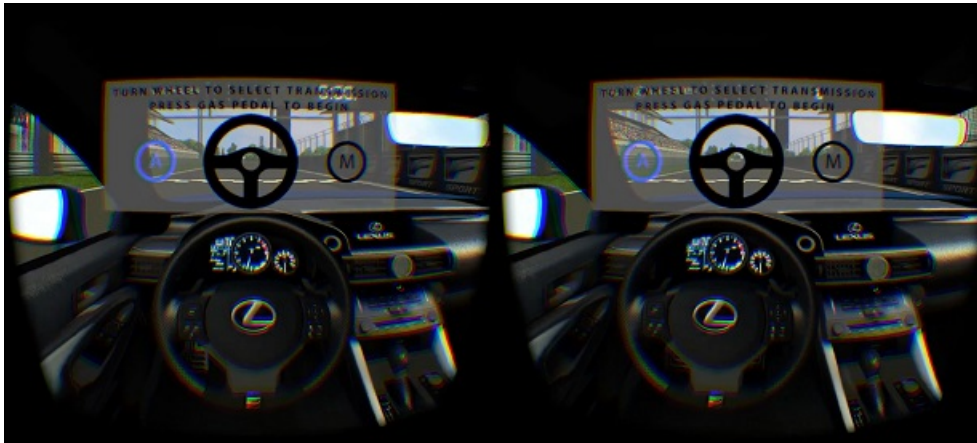
THE WORLD'S FIRST LIVE STREAM  
**IN VIRTUAL REALITY**

360° TopShop Catwalk

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## Lexus 2015 Model RC F VR Driving Experience



Steering wheel and foot pedals  
<8 weeks to create a 360 experience  
Oculus Rift Dev 2 SDK  
Traveling to US Auto Shows



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Source: Lexus creates an Oculus Rift-powered virtual test drive, Joystiq, 10/2/14

# Engineering and Manufacturing Process Simulation Training





## Evaluating Balance in Glaucoma Patients

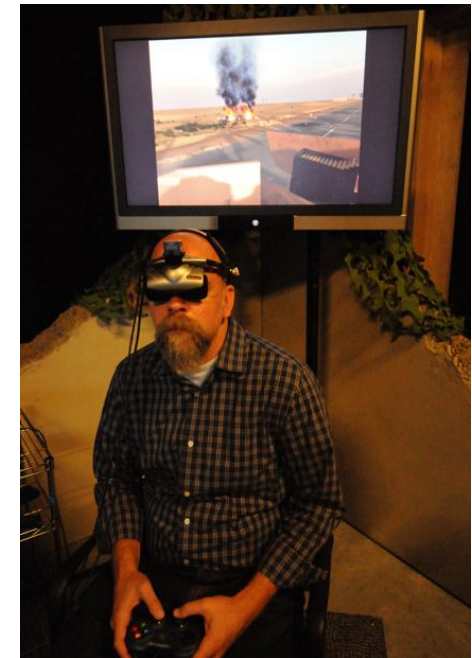


## Health

### Rehabilitation from stroke



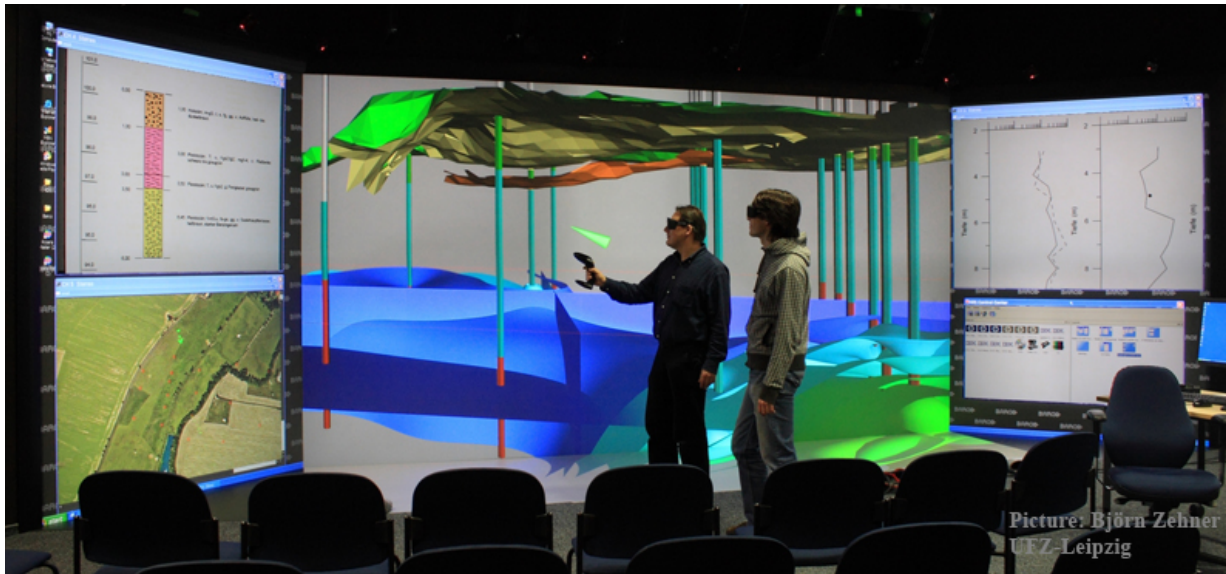
## Curing and Preventing PTSD



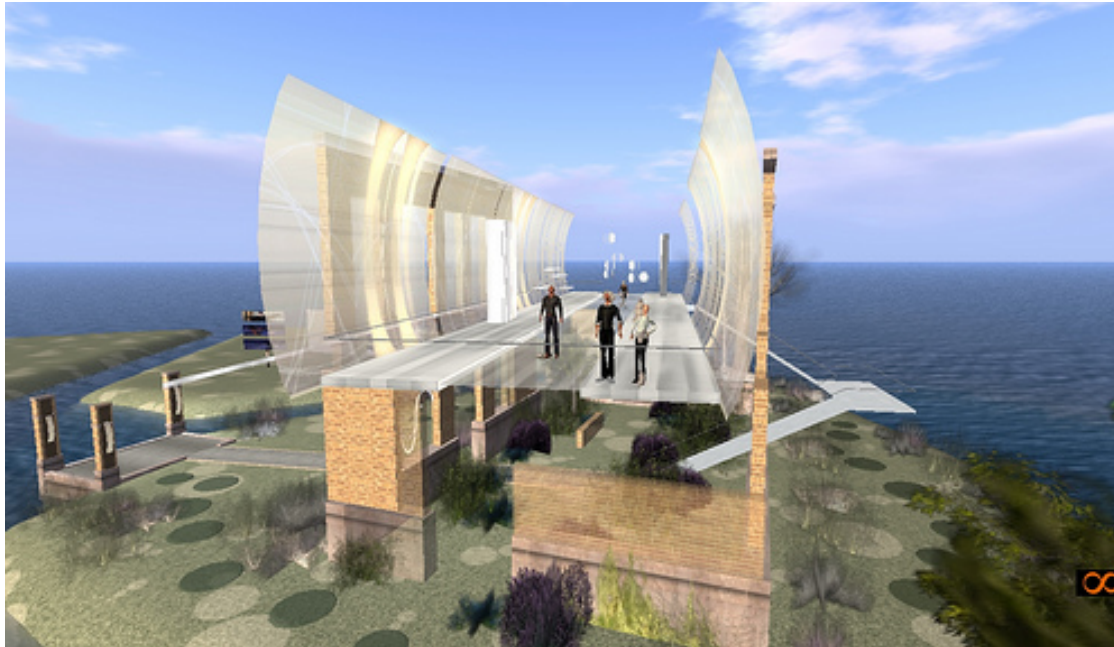
# Travel and Tourism



# Natural Resource Exploration and Management



# Architecture and Design





## Public Policy

*This tool **will help people to experience and understand** the lagoon proposals as accurately as possible, so their feedback can help us to develop a truly world-class facility.*

Tidal Lagoon (Swansea Bay, Wales) plc bid proposal includes a 3D virtual reality programme showing the proposed tidal energy lagoon in the context of Swansea Bay, Wales (7/4/13)



# Business Productivity

## Telepresence

- Meetings
- Interviews
- Training

Better executive time  
management  
with avatars!

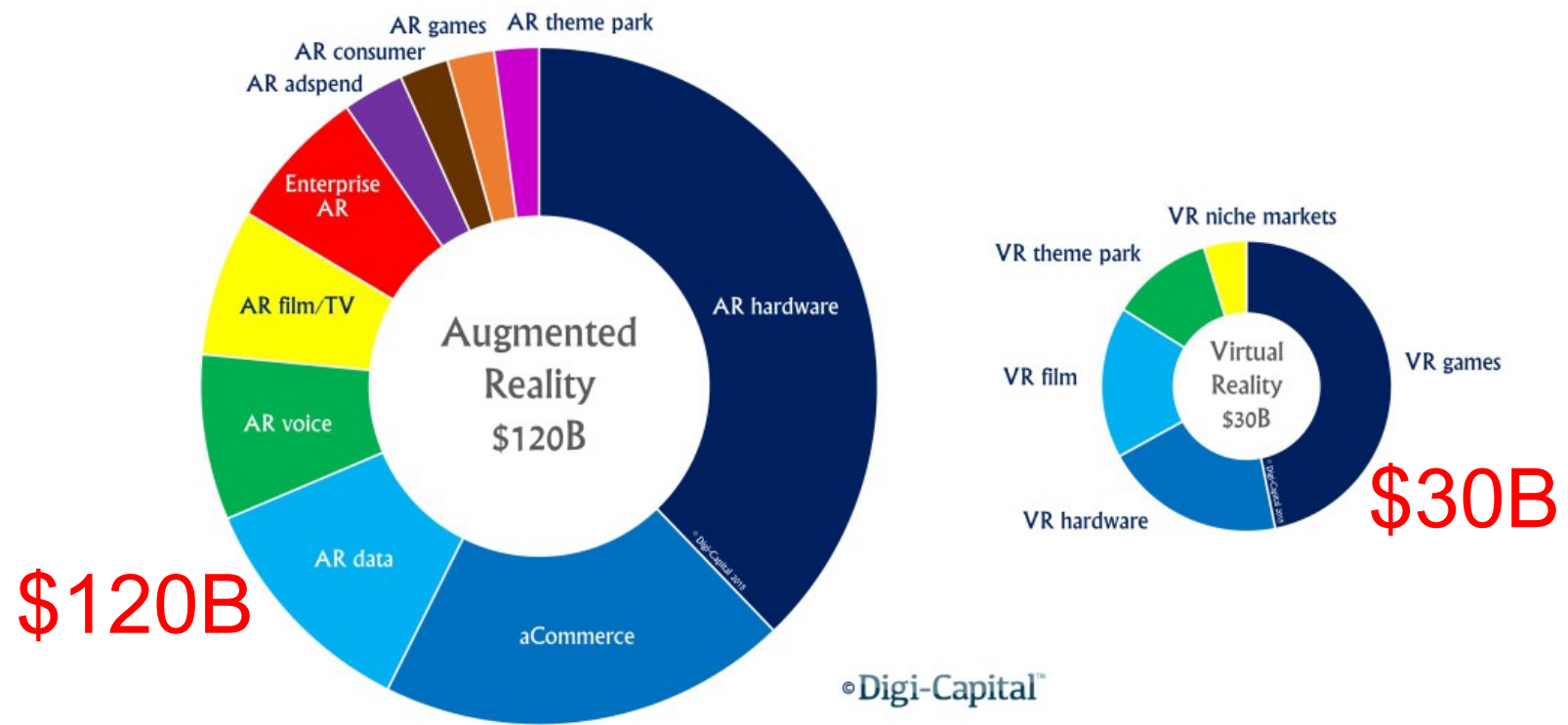


*USC's Dr. Bolas – assymetric presence, avatar  
in multiple places at once*

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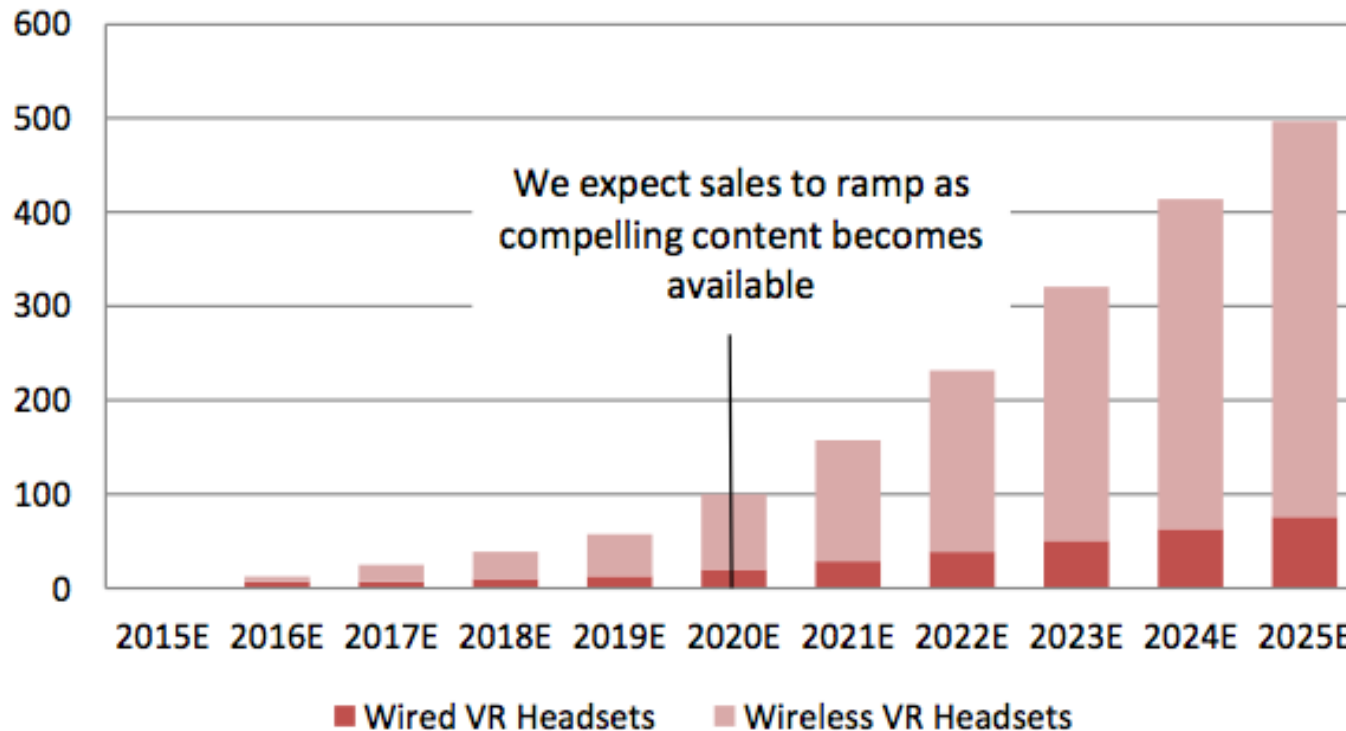
Augmented/Virtual Reality Revenue Share 2020F



Augmented And Virtual Reality To Hit \$150 Billion,  
Disrupting Mobile By 2020, Digi-capital, 4/15

## VIRTUAL REALITY HEADSET SALES

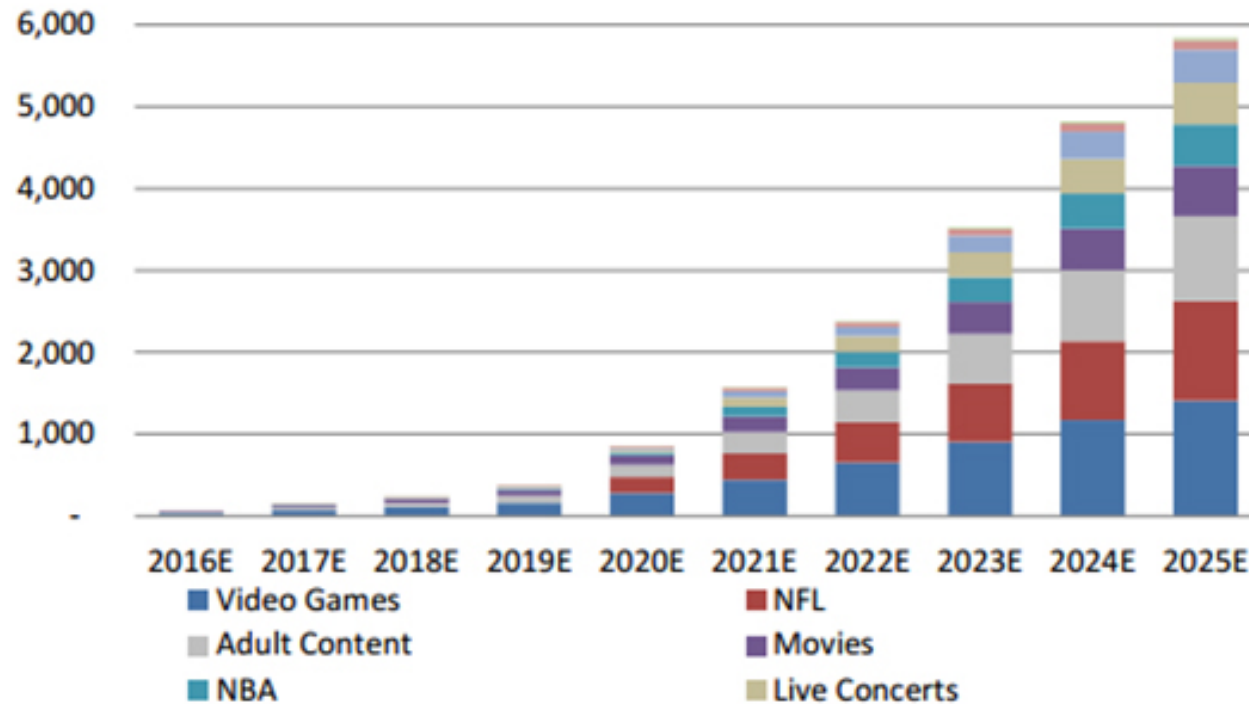
(In Millions)



Source: Piper Jaffray estimates

Plelyv Source: PiperJaffray, Next Mega Tech Theme is Virtual Reality, May, 2015

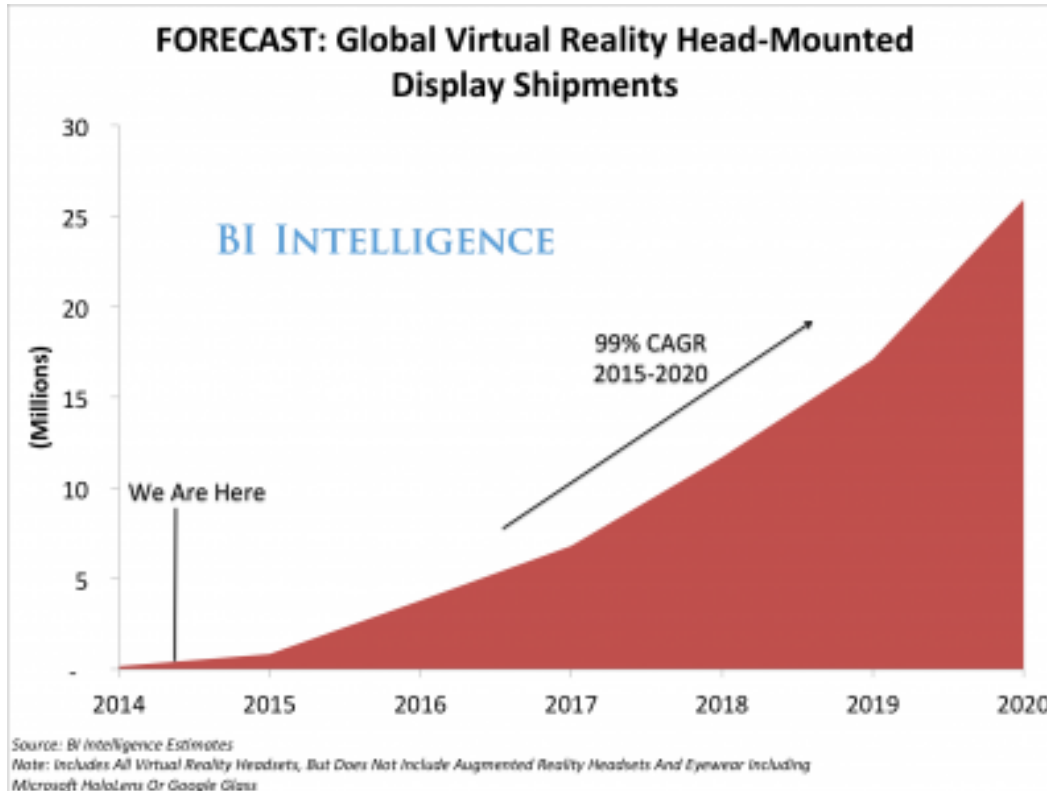
### VIRTUAL REALITY REVENUE BY INDUSTRY (In Millions)



Source: Piper Jaffray estimates

Plelyv Source: PiperJaffray, Next Mega Tech Theme is Virtual Reality, May, 2015





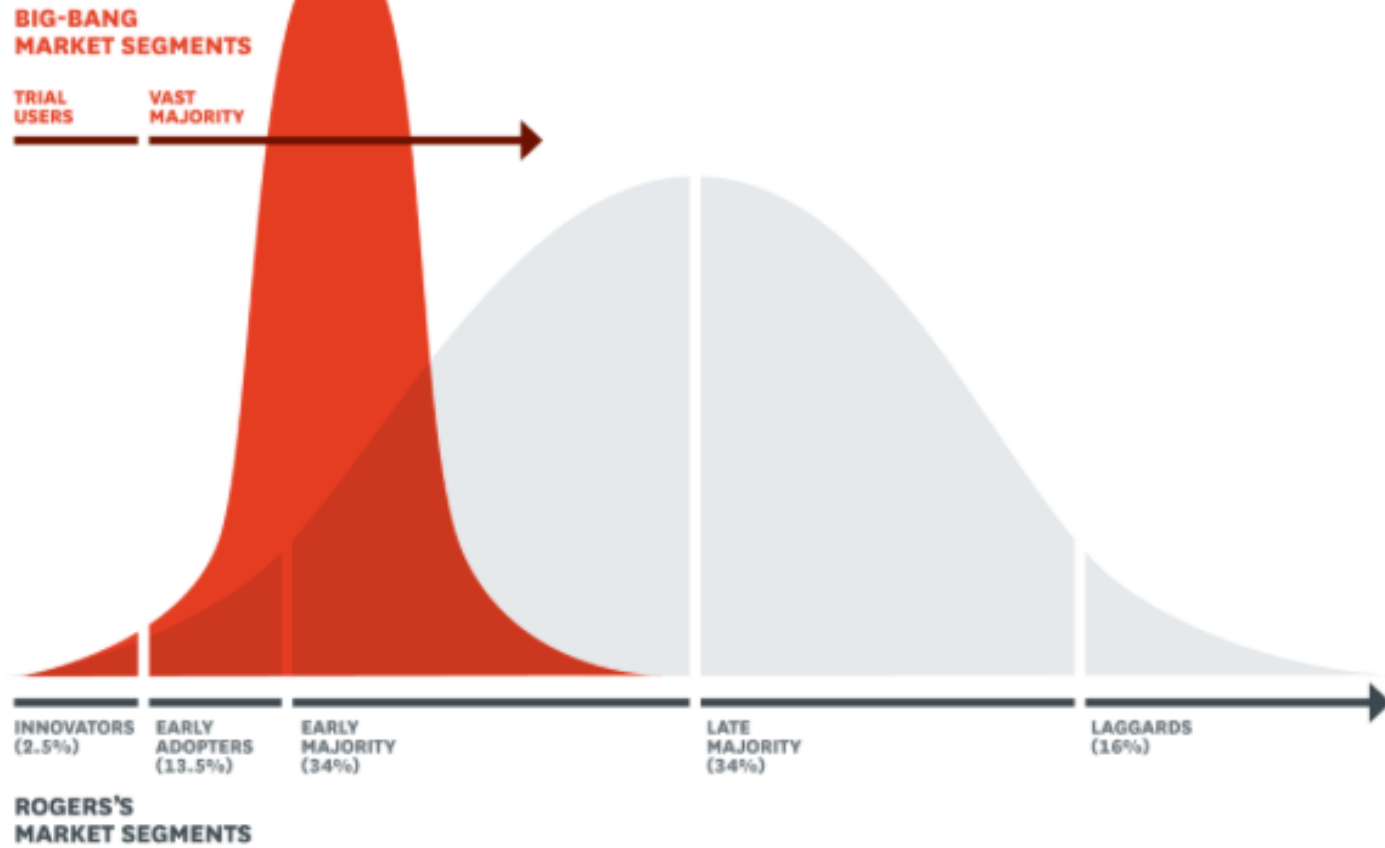
Does not include

- Software
- Services
- Peripherals
- Tablets and Phones

VR Headset shipments will grow 99% from 2015 to 2020  
VR hardware: \$37M in 2015, \$2.8B in 2020

Plalyved@ETCenter.Org  
Source: BI Intelligence, August, 2015

## Big Bang Disruption



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# Financing VR

- Budgets – **advertisers don't see the value yet**; no installed base, no metrics/ROI

Research on VR and memory retention needed!

- VR appears to trigger strong memory retention
- Some people recall VR experiences as real memories



# Financing VR

- Budgets – **advertisers don't see the value yet**; no installed base, no metrics/ROI
- Modeled budget by Sunny Midha, Greycroft Ventures
  - **\$5.128M for feature**
  - **\$0.68M for episodic VR modeled**
  - No one is paying yet; consider blend of game and video pricing models, but don't rule out social (Club Penguin subscription)
  - Don't make dedicated VR. **Build it into media mix**

Source: 10/20/15 Digital Hollywood presentation



# Brands

**Brands**

A wide range of brands are already using VR:

Bloomberg Ferrari Ford

Comedy Central Lucasfilm Ltd. Lexus Marvel

NBC Paramount Rings Volvo

**HBO**

GAME OF THRONES



HBO challenged "Game of Thrones" fans to "Ascend the Wall" in this VR game

**Marriott**  
HOTELS • RESORTS • SUITES



Marriott allows guests to order "VRoom Service" and travel the world in VR

**Red Bull**



Red Bull's viewers can virtually play pilot and do a lap of the Ascot race course in the UK

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Fortune Mag.  
10/13/15



# Financing VR - Private



Playful Corp

- \$25 million from unnamed investors
- Created the Oculus Rift-exclusive “Lucky’s Tale” VR game
- “The money dwarfs recent investments in VR-focused software companies.”

Source; VR Digest, 10/28/15

## VR Funding

- Rothenberg Ventures – River Accelerator
- VR / AR only
- \$200,000 per startup



## Kleiner Perkins

### 6 Mobile VR Use Cases We Believe In (9/10/15)

1. Watching TV in VR with your friends
2. Watching eSports in VR with thousands of fans
3. Reading a book in VR; floating page surrounded by 3D scene from the story
4. Coding in VR; on a massive virtual screen
5. Writing in VR; **isolate yourself so you can concentrate**
6. Visualizing data and objects in VR; visualize and manipulate complex multi-dimensional information

There are many others. We “can’t wait to see these hit the app stores.”

# Financing VR - Public



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# *UTA Signs Digital Content Studio Secret Location*



UTA will work with Secret Location

- ◆ to expand its business in both non-traditional and traditional media
- ◆ to advise on its social and digital media strategy

Source: Hollywood Reporter, 10/20/15



# Barriers to Acceptance

- No killer app **YET**

Occipital  
Depth-sensing VR physical collision warning system



The “oh, we forgot about that,”  
“oh yeah, we need that” factor

Product Leapfrogging

Physical objects within 1.2m appear in the virtual world

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# Health Issue

## Health – Cyber-sickness

- Sensory conflict
- Stereopsis-induced sickness (3D)
- Unnatural movement



## Health - Technical

- Latency
- Tracking registration

## Standards



Hardware  
Software APIs  
Software Plugins

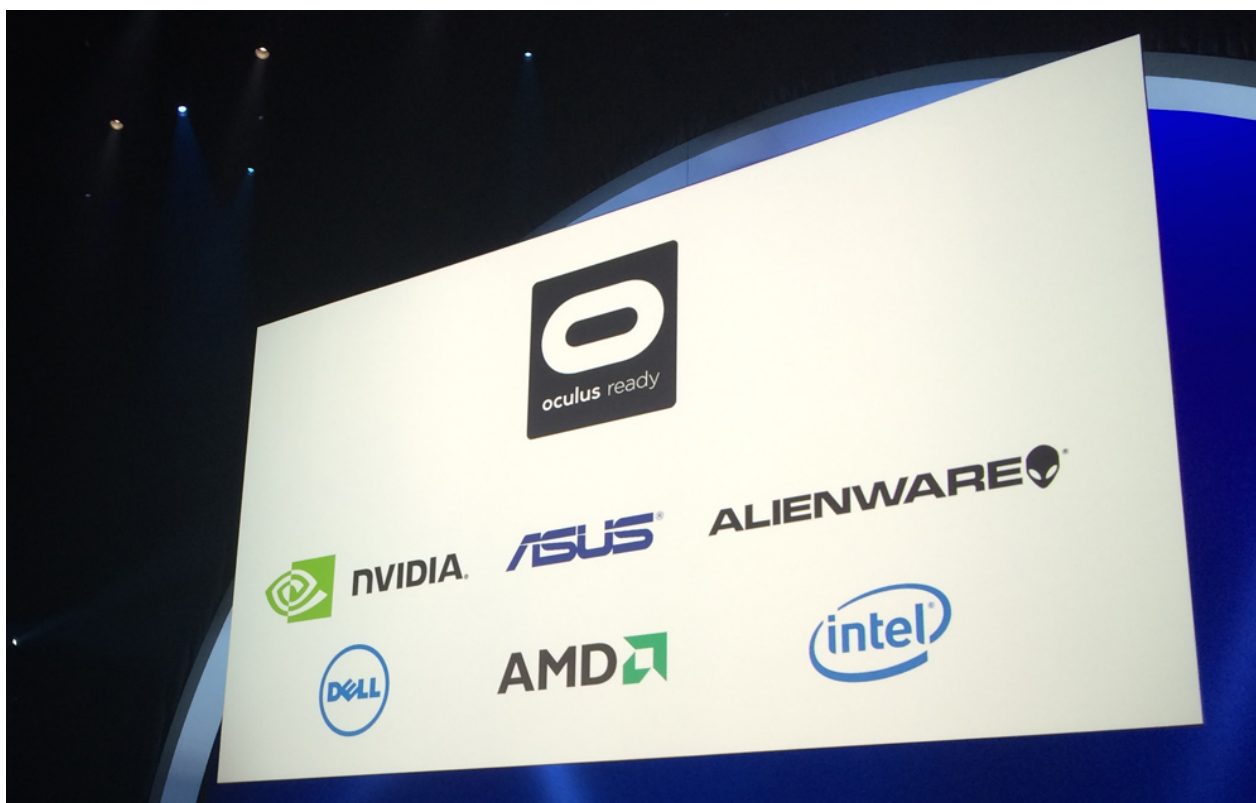
>75 Supporting companies  
and universities

OTOY  
Jaunt  
Oculus

Unreal  
Leap Motion  
Unity

See <http://www.osvr.com/join.html>  
for a breakdown by topic and company

Oculus announces “Oculus Ready,” certified PCs for VR



PCs starting under \$1,000

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PC plus Oculus starting \$1,500



## Standards Security!

Not just content security....  
Could someone hijack your VR experience?  
Could someone monitor your activity?



## Live Streaming VR

VR, Presence, Empathy, Proximity, and  
**Children**

IM360

(a joint **venture** between Immersive Media and Digital Domain)

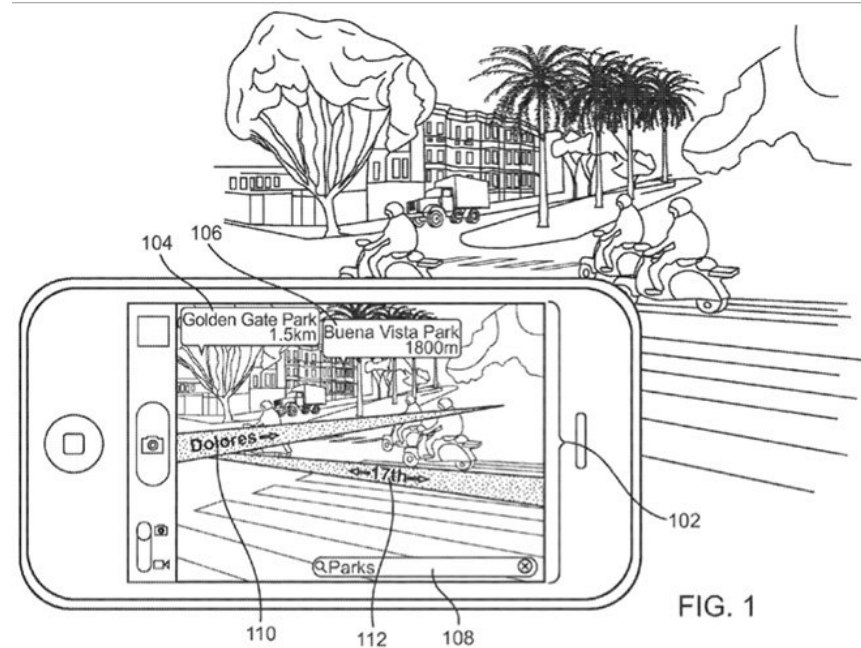
Walker Stalker at Comic Con

organizers expect to involve thousands of fans who will be on the run  
from zombies

**“Style is key to widespread adoption”**

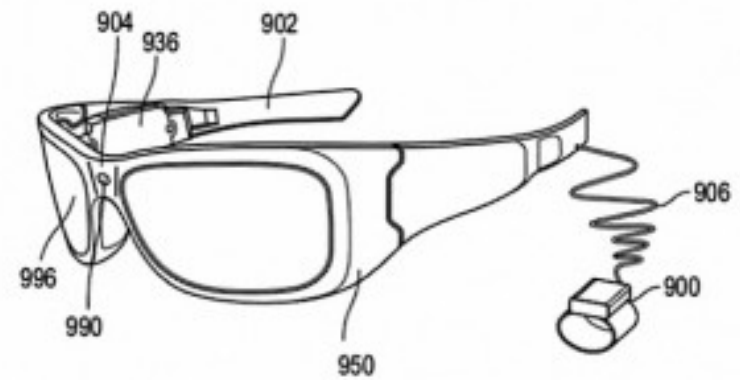
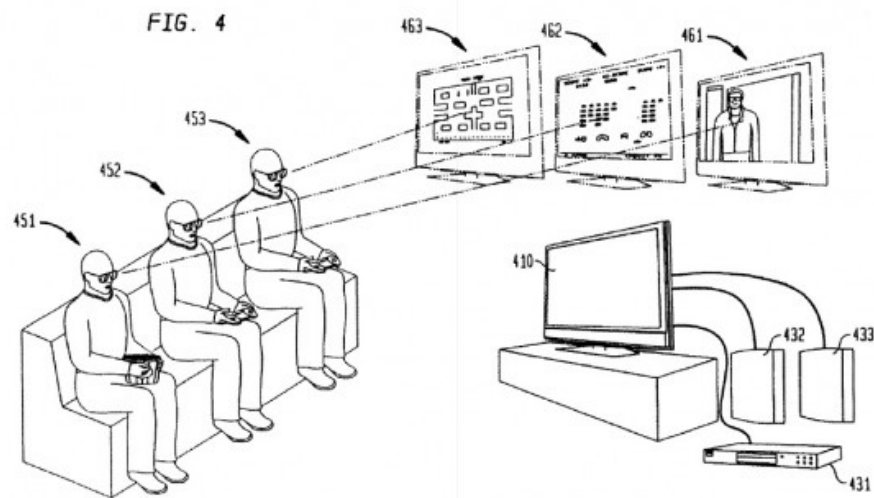
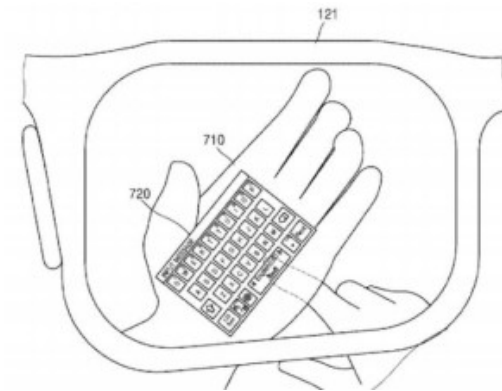
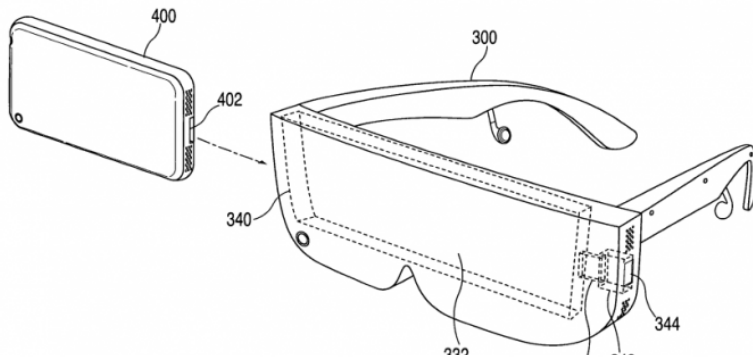
Piper Jaffray analyst Gene Munster

Apple has hired a number of people from the fashion industry recently



Source: Piper Jaffray: Apple has augmented reality R&D team, could inject AR devices with much needed style. 3/18/15

# Patents



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## Barriers to Acceptance

- No killer app
- Products are evolving quickly (hardware, software, content)
- Health concerns
- Standards, lack of
- Security
- Children
- Social
- Patent

Mostly impact HMDs





**“Never before has a technology gotten so much attention before actually getting to consumers.”**

Alexander Taussig, VC partner at Highland Capital, Forbes, 6/11/15



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# Agenda

1. Basic Concepts
2. Types of VR Experiences (Live, CG, Social)
3. The Language of VR Storymaking
4. VR Distribution and Experiencing
5. Where Does the VR Experience Fit (uses and markets)
6. The Business Side of Entertainment VR
7. Augmented Reality

## Interior Design



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Paint by Delux (UK)

# Augmented Reality Services

Extend the effectiveness of physical media through AR

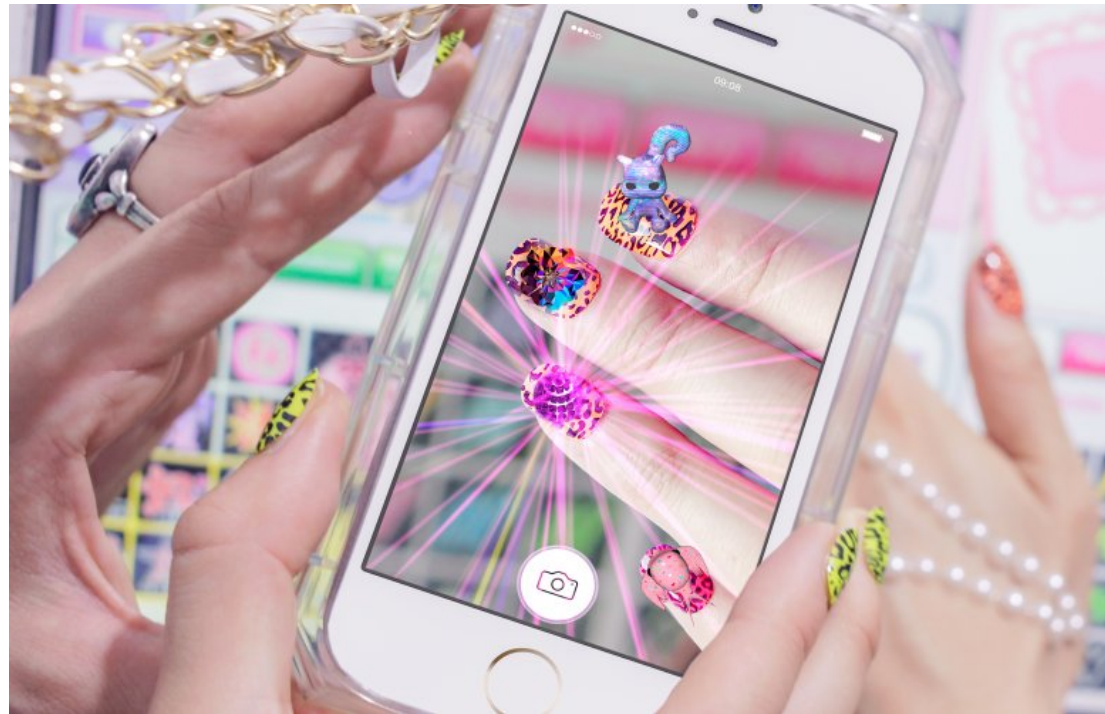


Daqri animates LEGO designs



Aurasma brings Despicable Me movie posters alive with AR bonus material

## Augmented Reality Nail Art



Metaverse Makeovers, a women-run start-up comprising artists, technologists and engineers based in Melbourne, Shanghai and Hong Kong.

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## Microsoft Buys Minecraft in part for Hololens



Minecraft for VR could "fundamentally help us change new categories," Microsoft CEO Satya Nadella says.

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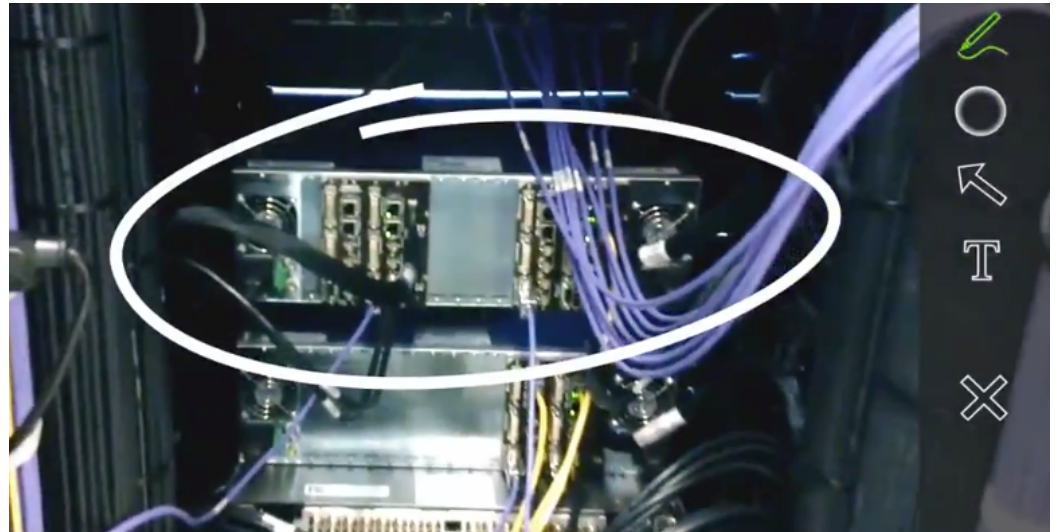
(\$2.5B acquisition)

## Augmented Reality Productivity Tool



GOOGLE TRANSLATE ADDS 20 LANGUAGES TO  
AUGMENTED REALITY APP

## Scope AR



Point your camera at that problem,  
and the expert can guide you to a solution

## Marines Explore 'Augmented Reality'

AR "lets troops go through the actual, physical motions of the skill they're training for and build muscle memory, without restricting the targets and support units."



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Source: Breaking Defense, 9/1/15



# Augmented Reality Productivity Tool



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Leap Motion hackathon winner

120



## Daqri Smart Helmet

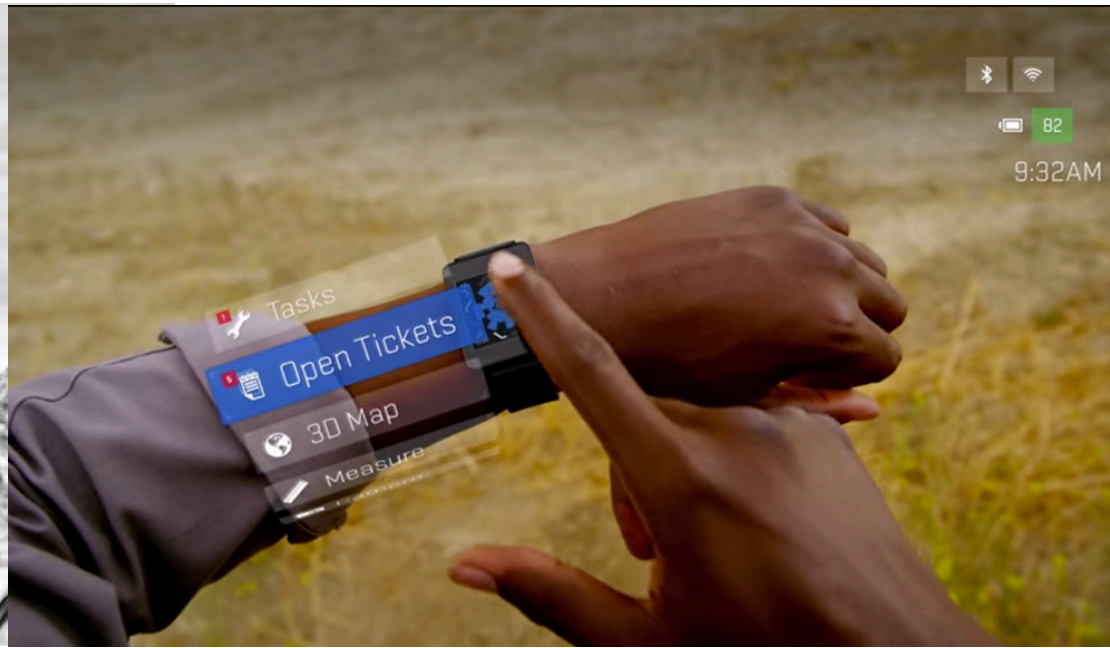
Object recognition and tracking      Location recognition  
Operations, Maintenance, Training, Education, ...



Source; <http://daqri.com>

4D Studio – AR app SDK for helmet, tablets, phones, Glass, ...<sup>121</sup>

# Augmented Reality Productivity Tool



# Augmented Reality Glasses



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Source: AugmentedReality.org Smart Glasses Market 2015 Rpt.

## Agenda

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Plelyv



## Verizon Venture Forum

### Interactive Media & Entertainment

#### – A Day Spent Contemplating Business Models –

“Generally, social and cultural factors drive movements and trends, not technology. This raises the question of whether there is an **overemphasis on VR technology itself**, rather than the social and cultural ways that media can be deployed on it. **We expect winners in this space to be those that can effectively use these new mediums to provide unique experiences that connect with users at a visceral and emotional level.**”

9/14/15

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# Consumers buy experiences, not technologies

Storymaking

Social

Business

Gaming

Education



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**Thank you**  
**Phil Lelyveld**  
UCS Entertainment Technology Center  
School of Cinematic Arts



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