

Humankind 2.0: The Technologies of the Future

3. Virtual and Augmented Reality

Piero Scaruffi, 2016



See <http://www.scaruffi.com/singular/human20.html>
for the full text of this discussion

Virtual Reality in 2016

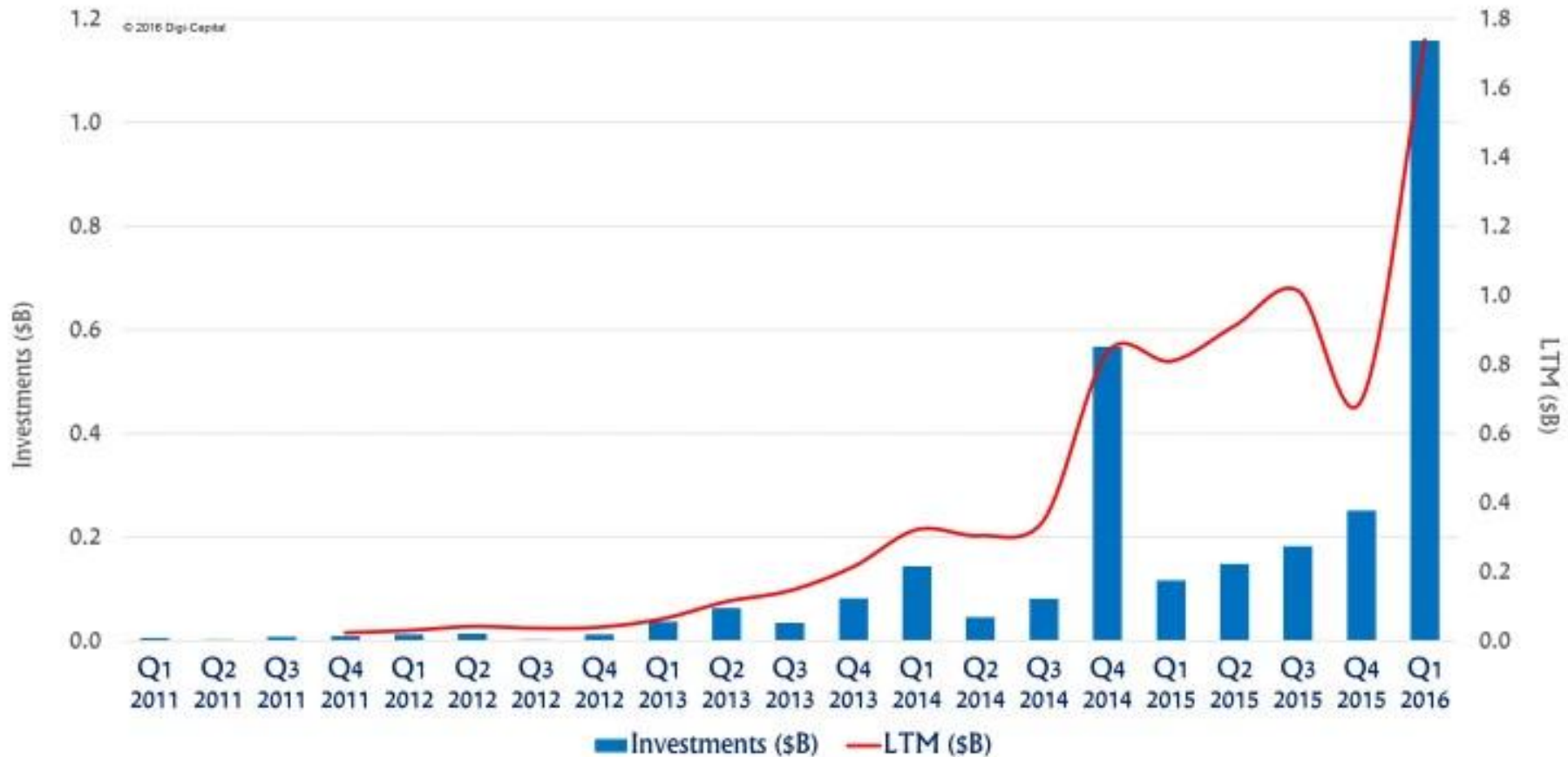


The Virtual Reality bubble?

- VC investment in VR 2015: \$692 million
- April 2015-March 2016: VCs invest \$1.7 billion in the 12 months leading to March 2016
- Q1 of 2016: VC invest \$1.2 billion in VR, but mostly Magic Leap
- May 2016: There are four AR/VR unicorns already (Magic Leap, Oculus, Blippar, MindMaze)

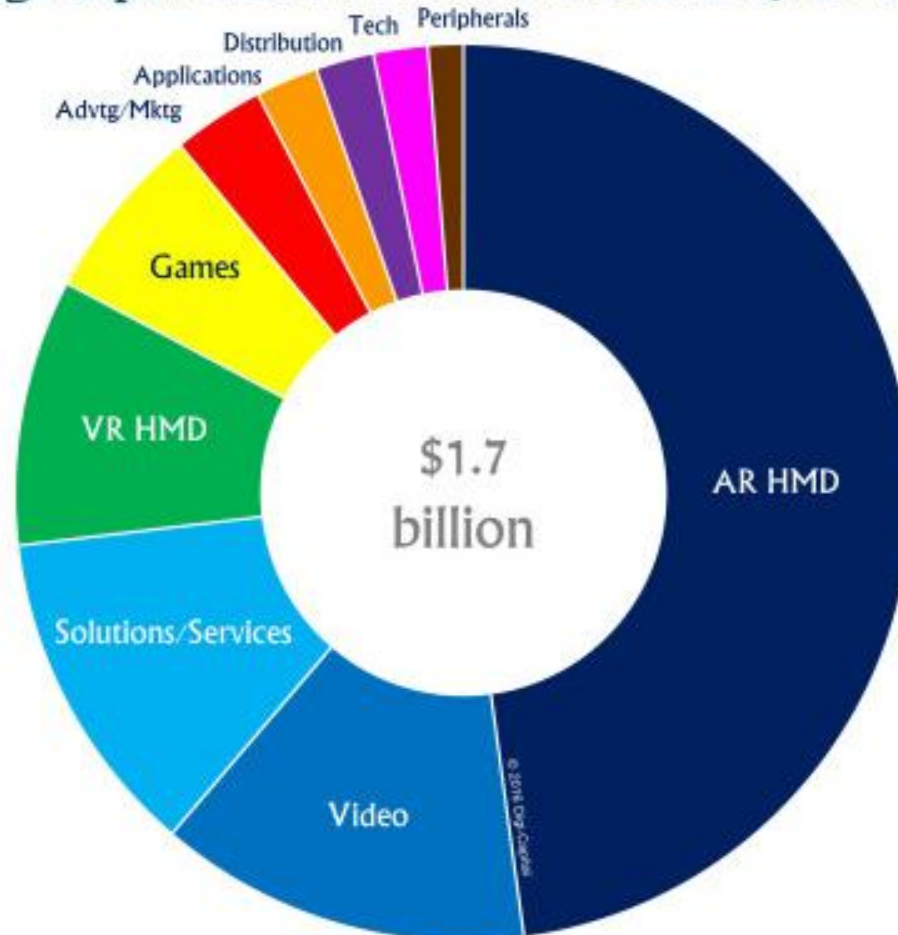
The Virtual Reality bubble?

Digi-Capital™ AR/VR Investments (\$B)



The Virtual Reality bubble?

Digi-Capital™ AR/VR Investments LTM to Q1 2016



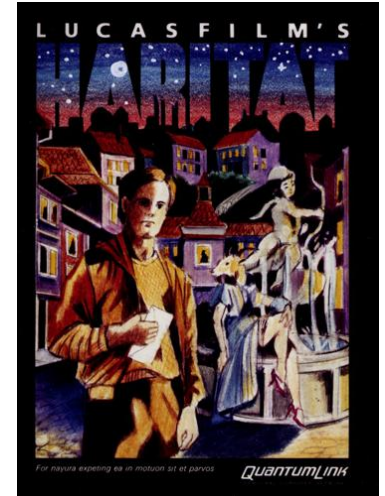
A Brief History

- Ivan Sutherland, Univ. of Utah (1969, funded by the CIA)
- Michael McGreevy (1984, NASA)
- Thomas Furness (1986, funded by the airforce)
- Jaron Lanier (VPL, 1985)



A Brief History

- Lucasfilm's "Habitat" (1986)
- Nintendo's Power Glove (1989)
- CAVE at the University of Illinois (1992)
- MMORPGs



A Brief History

- The 1990s
 - Sega VR (1993)
 - Nintendo's Virtual Boy (1995)
 - Future Vision Technologies' head-mounted display Stuntmaster (1995)
 - “The Matrix” (1999)



A Brief History

- The 2000s
 - Online virtual worlds and avatars
 - Habbo Hotel (Finland, 2000)
 - Gaia Online (Silicon Valley, 2003)
 - Second Life (Silicon Valley, 2003)
 - There.com (Silicon Valley, 2003)
 - IMVU (Silicon Valley, 2004)



A Brief History

- The 2000s
 - Second Life: some famous avatars



Extropia DaSilva



Sophrosyne Stenvaag floating above Extropia Core in *Second Life*.



A Brief History

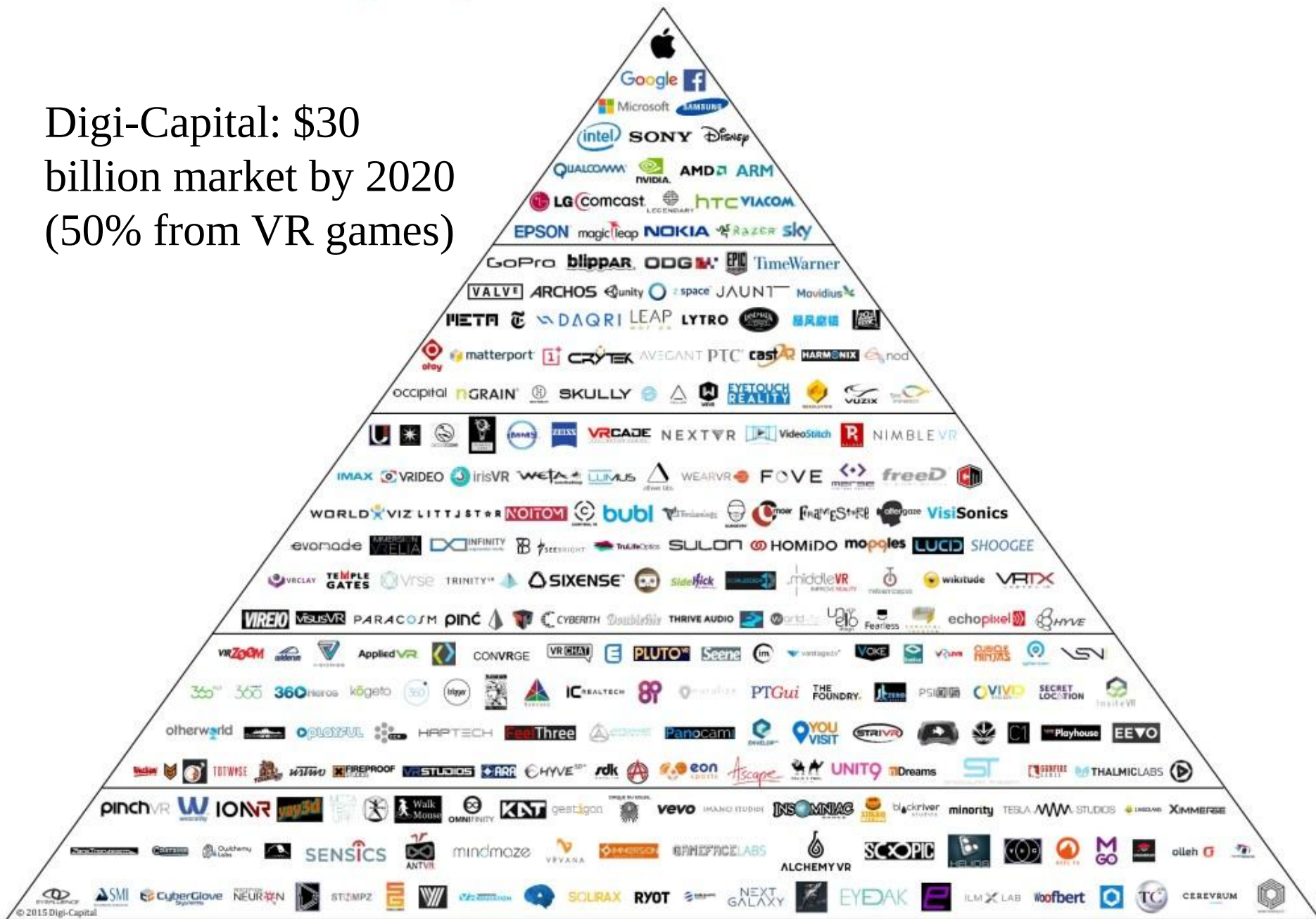
- The 2000s
 - The cost of LCD screens declines thanks mainly to Hitachi's In Plane Switching design and Samsung's Multi-domain design
 - The cost of 3D motion capture declines (Microsoft Kinect, 2010)



KINECT
for XBOX 360

Digi-Capital™ AR/VR Leaders Q4 2015

Digi-Capital: \$30
billion market by 2020
(50% from VR games)



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Virtual Reality

- Mostly for games, partially for marketing and simulation
- Main target: the consumer
- Viewers (2014-15): Oculus Rift, Samsung Gear VR, Google Cardboard



Virtual Reality

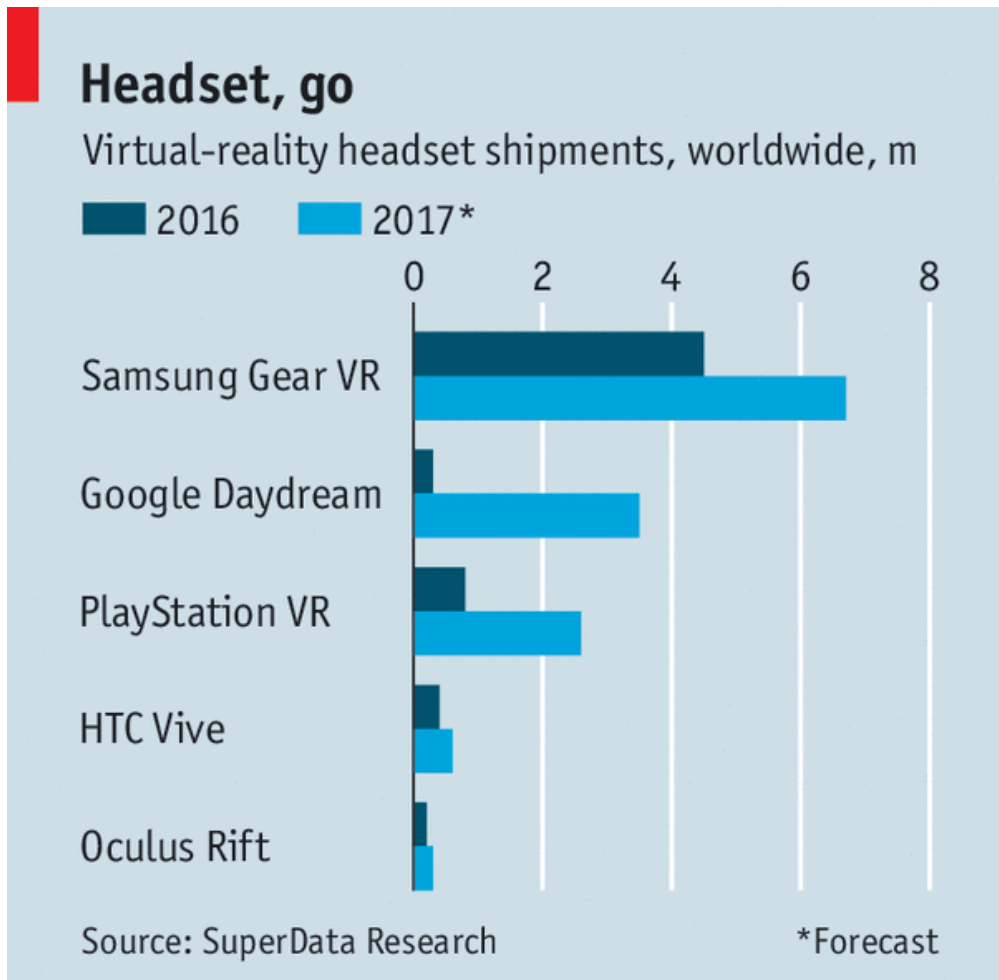
- Tethered to computer, small range of movement: Facebook Oculus
- Tethered to computer, large range of movement: HTC Vive
- Smartphone required: Samsung Gear VR, Google Cardboard

Virtual Reality

- Stand-alone headset (no PC/smartphone required)
 - Intel's Project Alloy
 - Intel to open-source the Alloy hardware
 - Microsoft Windows Holographic to add support for virtual- and augmented-reality headsets to all Windows 10 PCs



Virtual Reality



Virtual Reality



- Content

- Cameras: Jaunt VR, Matterport, Lucid VR, Google's Jump, Intel's RealSense camera
- Stories: NextVR, NY Times (2015)
- 3D Video: 8i



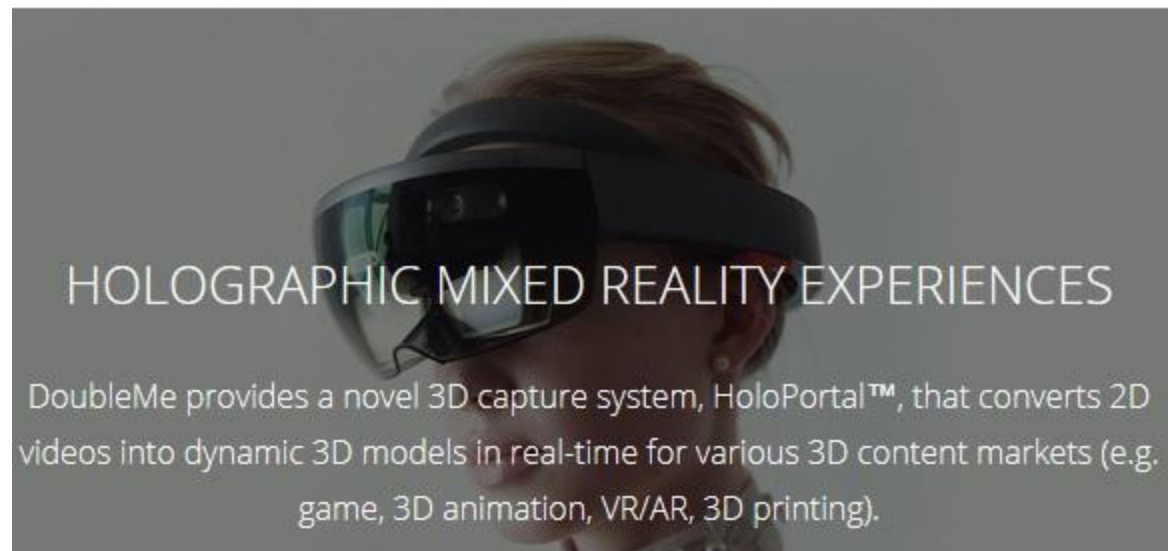
Virtual Reality

- Content
 - End-to-end virtual reality:
 - GoPro
 - Six-camera Omni VR
 - Partnerships with 100+ developers
 - LiveVR wireless streaming tool
 - GoPro VR video channel



Virtual Reality

- Content
 - DoubleMe: convert 2D into 3D



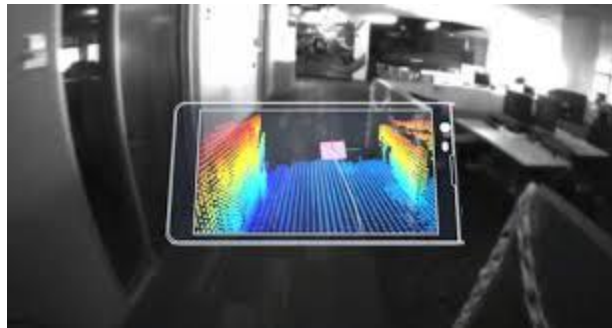
COMPETITIVE LANDSCAPE

Condition One



Virtual Reality

- Problem: motion sickness
- Solutions:
 - Faster processors: Qualcomm Snapdragon 820 (2016)
 - Google/Intel/Qualcomm's Project Tango



Virtual Reality

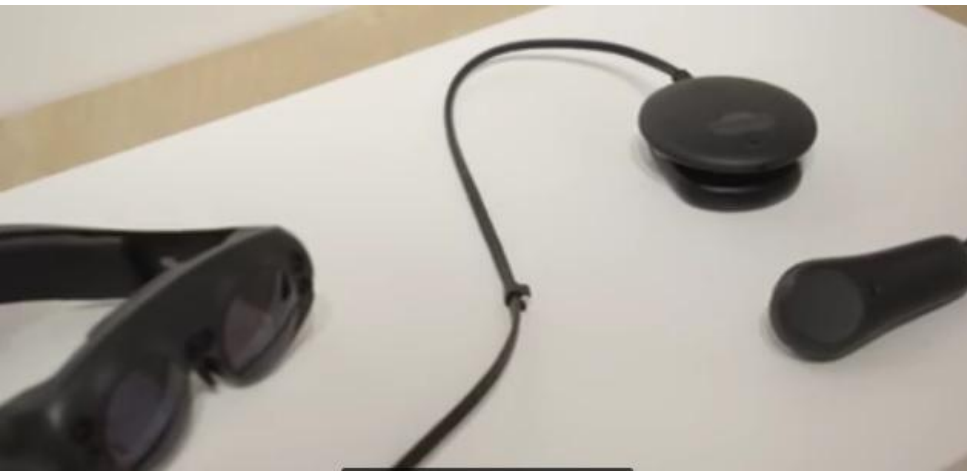
- The near future
 - Near-eye light field technology: Magic Leap (\$4.5 billion valuation in Jan 2016)
 - Spatial tracking (where your head is): HTC Vive and Lighthouse
 - Smartphone VR: enabled by Google's Project Tango



Virtual Reality



magic leap



Virtual Reality

- Magic Leap's first product in August 2018



The Washington Post



By **Geoffrey A. Fowler**
Technology columnist
August 29

Tech's “next big thing” is looking more like a “maybe in a few more years thing.”

TECH TIMES | 28 August 2018

Oculus VR Founder Palmer Luckey Very Disappointed With Magic Leap Headset, Says It's 'A Tragic Heap'

Virtual Reality

- Applications
 - Gaming: Facebook Oculus Rift
 - Pain Relief: DeepStream
 - Training
 - Immersive Journalism



Nonny_de_la_Peña's "Project Syria" (2014)

Experiencing Reality

- The future of "distance learning"
 - Stanford/ zSpace (Sunnyvale)
 - Unimersiv (San Mateo)
 - Alchemy VR (London)
 - Immersive VR (Ireland)
 - Google's Pioneer Expeditions



zSpace Virtual Holographic Display

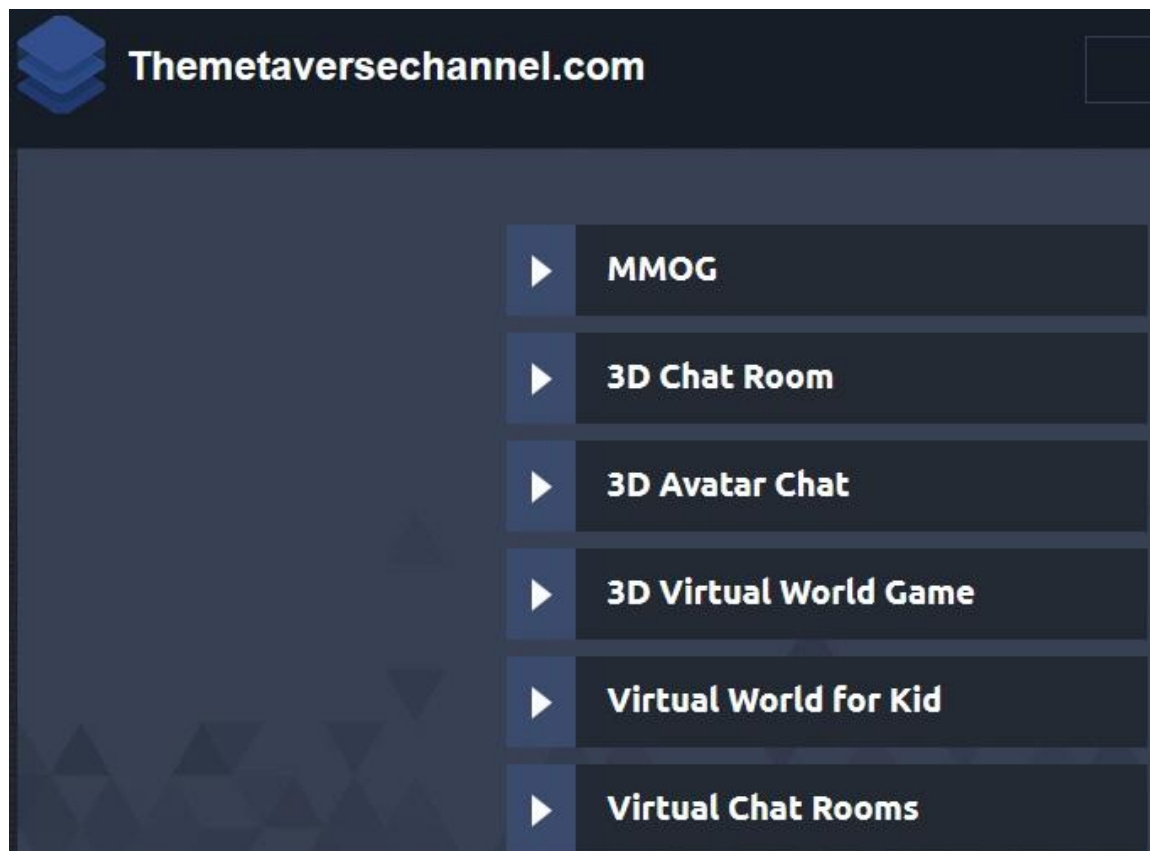
Stanford Clinical Anatomy Department

The zSpace display is a "virtual holographic display," which, by virtue of built-in eye tracking, and with natural stylus-based interaction, gives the 3D models a presence. We are currently using the system as a virtual dissector, allowing faculty to take apart the models, with labels and annotations giving them a realistic presence. Clinicians who have experienced this see the possibilities for immersive patient education experiences using models that compare normal and pathological anatomy. Specifically, Stanford's Eye Clinic, Ear, Nose, and Throat Clinic, Hand Clinic, and Plastic Surgery.



Experiencing Reality

- The future of "distance learning"
 - Metaverse Channel



Experiencing Reality

- The future of news
 - Nonny de la Pena's "Project Syria" (2014)
 - The "reader" becomes an "observer", and therefore is much more likely to "feel" the story instead of simply "hearing" it.
 - Chris Milk, founder of VR storytelling company Vrse (2014): "Clouds Over Sidra" (2015)



Experiencing Reality

- Virtual reality: immersive content
 - E.g.,: Guardians' “solitary confinement”

Guardian launches its first VR project: an experience of solitary confinement



The Guardian (2016)

Experiencing Reality



The old way to make you
feel that you are there

Experiencing Reality

- Documentary

A virtual reality experience just won an Oscar for the first time

Alejandro G. Iñárritu's project explores the experience of Mexican refugees

Oct 27, 2017,



Google's VR filmmaker, Jessica Brillhart



Experiencing Reality

- Tribeca 2015
- Venice Biennial 2017

BY MATT BARONE | MARCH 31, 2015

Experience Virtual Reality at the Tribeca Film Festival

These five events, all scheduled at the Festival's new creative hub Spring Studios, will show how VR is becoming more popular and accessible than ever before.



 **LA BIENNALE DI VENEZIA**

BIENNALE CINEMA



VENICE VIRTUAL REALITY
31 August – 5 September 2017

Experiencing Reality

- Documentary
 - Chernobyl 360 on Kickstarter (2016)



Marketing

- Framestore's Volvo app
- YouVisit's guided tours of hotels
- Outlyer's interactive advertisements
- Matterport for real estate



Art Museum

- HTC Vive Arts (2017)
 - Partnerships with London's Royal Academy of Arts, Taipei's National Palace Museum, Paris' National Museum of Natural History, Washington's Newseum, St Petersburg's Hermitage, London's Tate Modern, etc



HTC VIVE Launches VIVE Arts, A Multi-Million Dollar Global VR Program To Advance Creation And Appreciation Of The Arts

Virtual Reality enhances the overall museum experience and content creation;

Vive Studios will bring some of the world's most fascinating, historic and beautiful art installations into the home through VIVEPORT



Teleporting to Shows

- Multiplication of tickets
 - Attend the show as if it was happening now and here
 - The "live" experience is different from being at home.



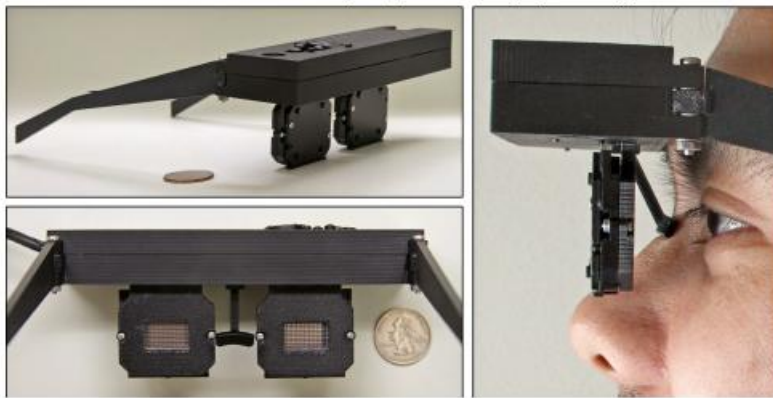
Virtual Reality

Holographic Meetings, e.g. Mimesys

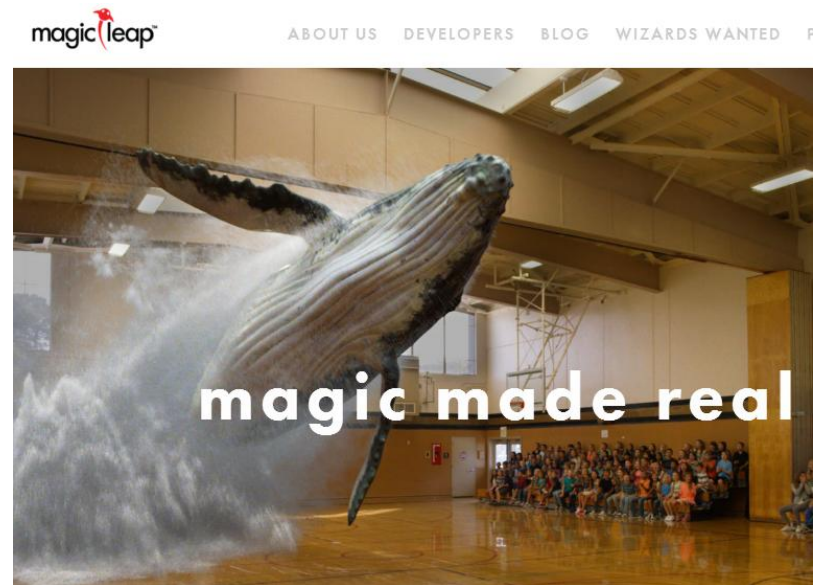


Virtual Reality

- Nvidia (2013) and Magic Leap (2016? - \$600M in funding in 2015!): the near-eye light field display



Nvidia 2013



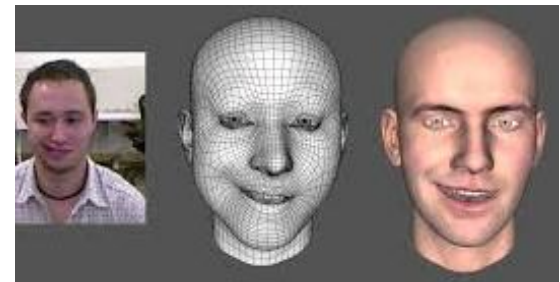
Virtual Reality

- Smartphone VR
 - Google's Project Tango (2014), a phone + developer kit with advanced 3D sensors that help the phone track motion and build a visual map of rooms using 3D scanning



Virtual Reality

- Apple
 - 2013: acquired PrimeSense - motion-detection technology
 - 2015: acquired Metaio - augmented reality
 - 2015: acquired FaceShift - animated avatars
 - 2016: acquired FlyBy - ?



Virtual Reality

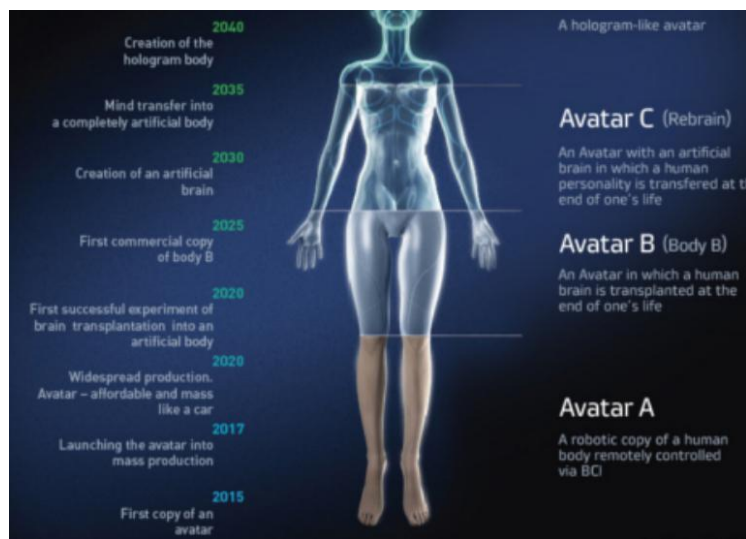
- A world of avatars



Dmitry Itskov



Upload Your Brain Into A Hologram:
Project Avatar 2045 – A New Era For
Humanity Or Scientific Madness?



Virtual Reality

- 3D scanning + VR/AR

Forbes

Billionaires Innovation Leadership Money

2,586 views | Jul 29, 2017, 10:25pm

**Using 3D Scanning and
Augmented Reality To Connect,
Create And Preserve**

Augmented Reality

- 1990: Tom Caudell (Boeing) coins the term “augmented reality”
- 1999: ARToolKit (Hirokazu Kato & Mark Billinghurst)
- 2008: augmented reality on CNN

Beam me up, Wolf! CNN debuts election-night 'hologram' 2008



From the original
1999 paper

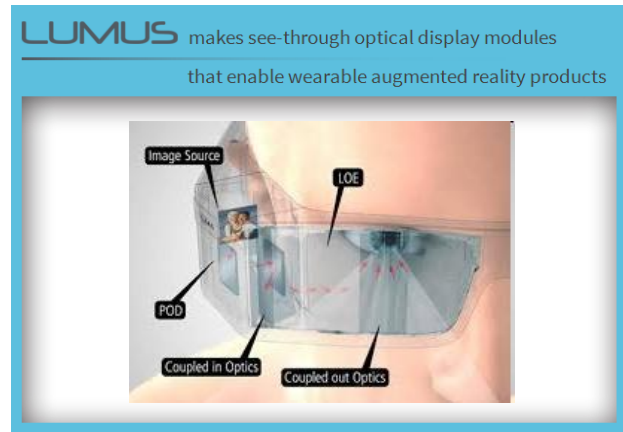
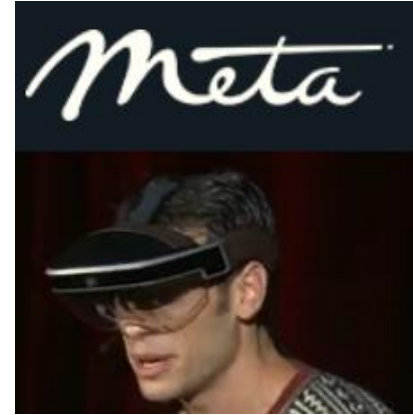
Augmented Reality

- 2009: Eyepet
- 2014: Daqri's Smart Helmet



Augmented Reality

- Main target: the office
- Meta: see-through display (2014)
- Microsoft HoloLens (2015)
- Intel RealSense ZR300 (2016)
- Lumus (Israel): see-through display
- Blippar (Britain): visual discovery app



Augmented Reality

- Meta's workspace (2017)
- Mira's headset (2017)



Meta's Workspace 2017

Augmented Reality

- Blippar (Britain): visual discovery app
- MindMaze (Switzerland): stroke-rehabilitation therapy



Augmented Reality

- Augmented reality: immersive fun
 - E.g.,: Evening Standard's blippable Queen selfie (2015)



The Evening Standard offered a feature allowing readers to appear in an image with the Queen.

September 2015

Augmented Reality

- Augmented reality superimposes virtual objects on the physical world
- Has Pokémon Go Paved the Way for Adoption of Augmented Reality?



Augmented Reality

- Augmented reality
 1. Location tracking (Pokemon Go)
 2. 2d AR on smartphones (e.g. the back of a cereal box): passive experience
 3. 3d AR on headsets (holograms that can be manipulated and can be explored): fully immersive/interactive room-scale experience



Augmented Reality

- Augmented reality
3d AR on headsets



Augmented Reality

- City guide



<https://www.slideshare.net/Funk98/eye-tracking-and-its-economic-feasibility>

Augmented Reality

- A visual Wikipedia for every single place and object in the world, a geographically distributed web of webs
- Wherever you look, you will open a universe of information
- Augmented reality glasses will turn our flat world of information into a multidimensional universe of universes.

Augmented Reality



Augmented Reality

- Like a universe of universes



Augmented Reality

- Medical applications

ARIA 2019
AR IN ACTION
Jan 14th @ MIT Media Lab



Genevieve Mak
Helio Browser &
Web Platform at Magic Leap



Vik Parthiban
Researcher @ MIT Media Lab,
Formerly with Magic Leap



Steve Feiner
Professor of Computer Science at
Columbia University



John CC Fan
President, CEO, Chair of the
Board at Kopin Corporation



Rus Gant
Director, Harvard Visualization
Research and Teaching Lab



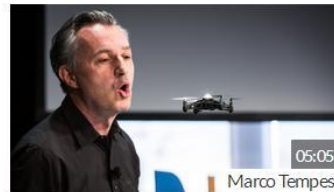
Ramesh Raskar
Assoc Professor @ MIT Media Lab
Founder & Entrepreneur



Jocelyn Scheirer
Entrepreneur, Scientist
& Artist at MIT



Mike Festa
President at VR AR Association



Tiny Flying Robots - Inventing the L...



Collaborative AR and VR | Steve F...



Augmented Reality Education Tool



The Future of History | Beth Hill | A...



AR at the Harvard Viz Lab | Rus Ga...



AR's First Killer App is Collaborati...



Augmented Surgeons and 'Anatom...



Art & Design in the Built Environm...



City of Sparkles AR | Yane Liu | ARL...

Augmented Reality

05.05.17

SCOPIS
medical

Microsoft HoloLens becomes an AR assistant for spinal surgery

A new mixed reality platform could improve accuracy

Scopis Introduces the First Mixed-Reality Surgical Holographic Navigation Platform Integrating Microsoft HoloLens for Open and Minimally-Invasive Spine Surgery



Augmented Reality

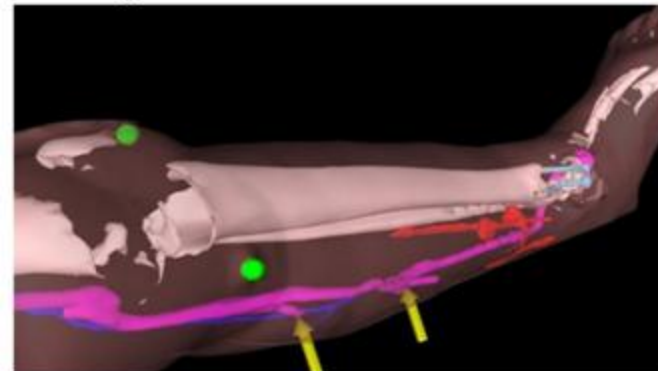
- Medical applications
 - Augmented Surgery



Imperial College
London

31 January 2018

Augmented reality helps surgeons 'see through' tissue to reconnect blood vessels



Augmented Reality

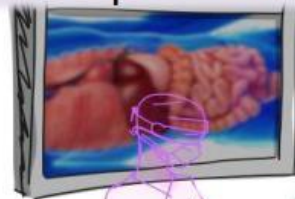
- Medical applications
 - Augmented Surgery



Ramesh Raskar

Capture:

Millions of Surgery Videos
Library of Complications

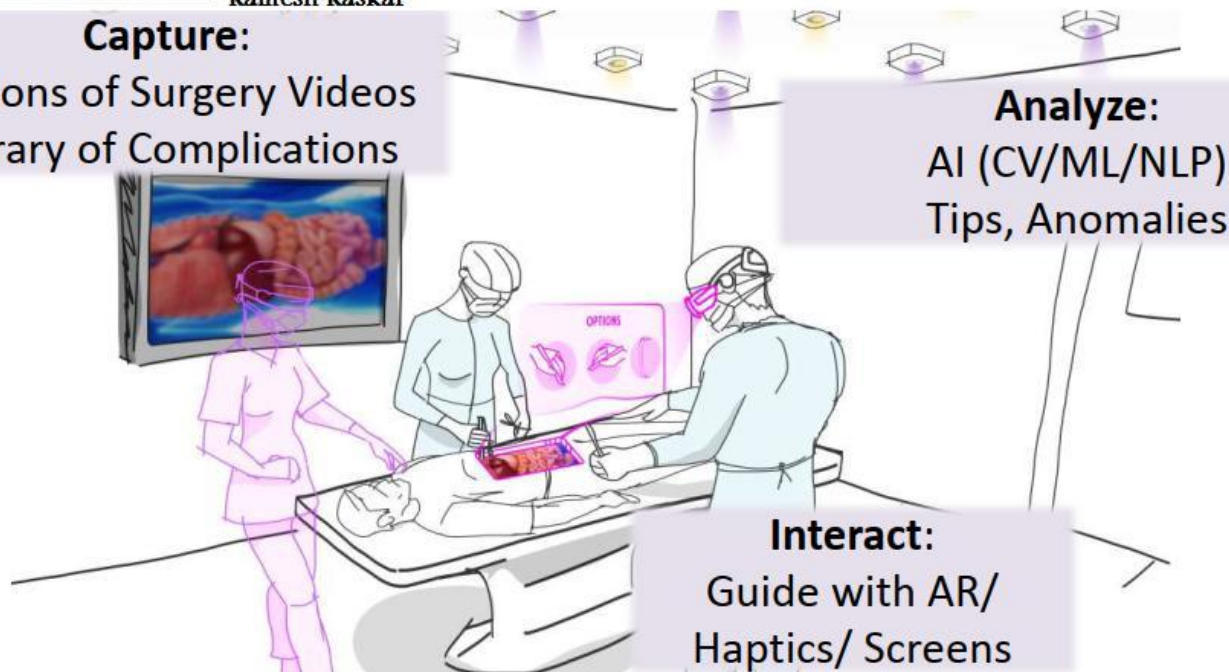


Analyze:

AI (CV/ML/NLP)
Tips, Anomalies

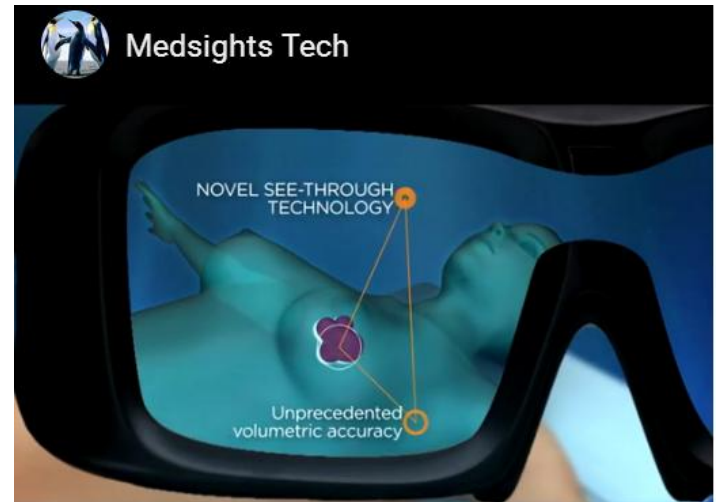
Interact:

Guide with AR/
Haptics/ Screens

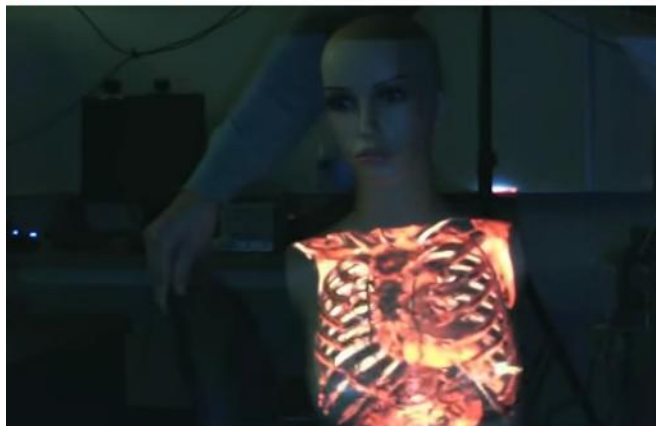


Augmented Reality

- Medical applications
 - Augmented imaging



ProjectDR allows doctors to "see into" patients' bodies



Augmented Reality

- Medical applications
 - Physical therapy

Augmented reality learning environment for physiotherapy education

20 Mar 2018

David Kelly , Thuong N. Hoang , Martin Reinoso, Zaher Joukhadar, Tamara Clements & Frank Vetere



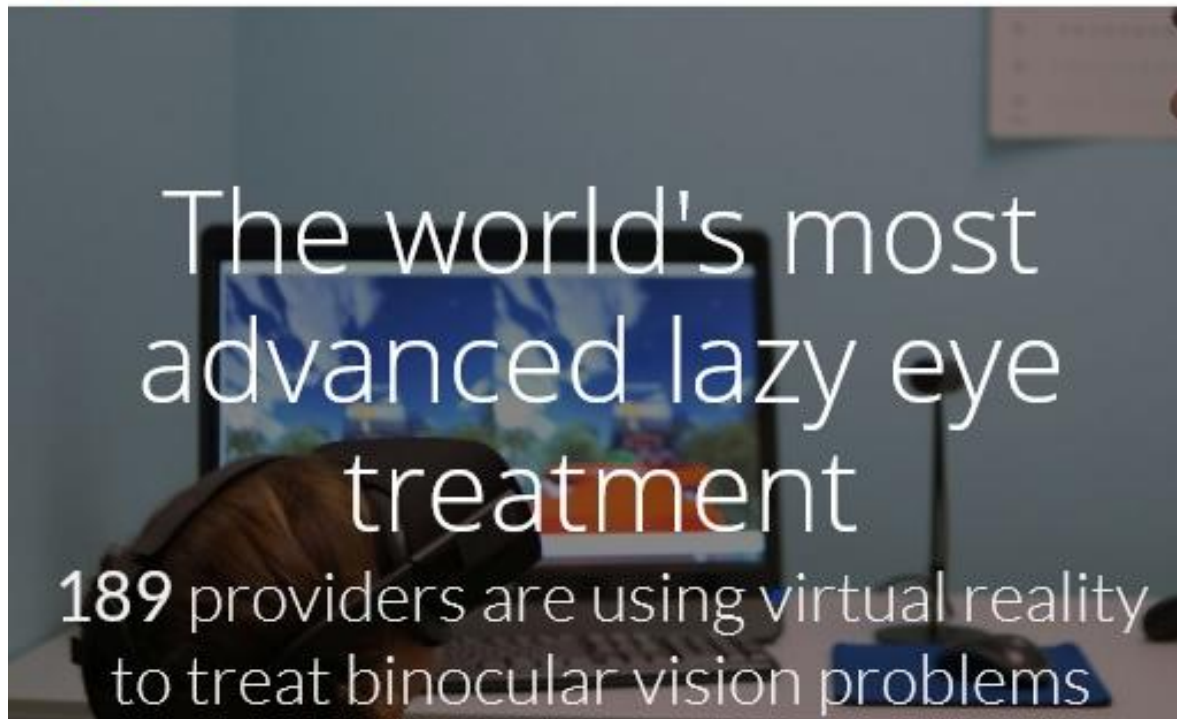
Spark Delivers Augmented Reality Physical Therapy Exercises at Home

BY: FG Team 10 May 2018



Augmented Reality

- Medical applications: vision improvement



Augmented Reality

- Medical applications: anti-stress



Augmented Reality

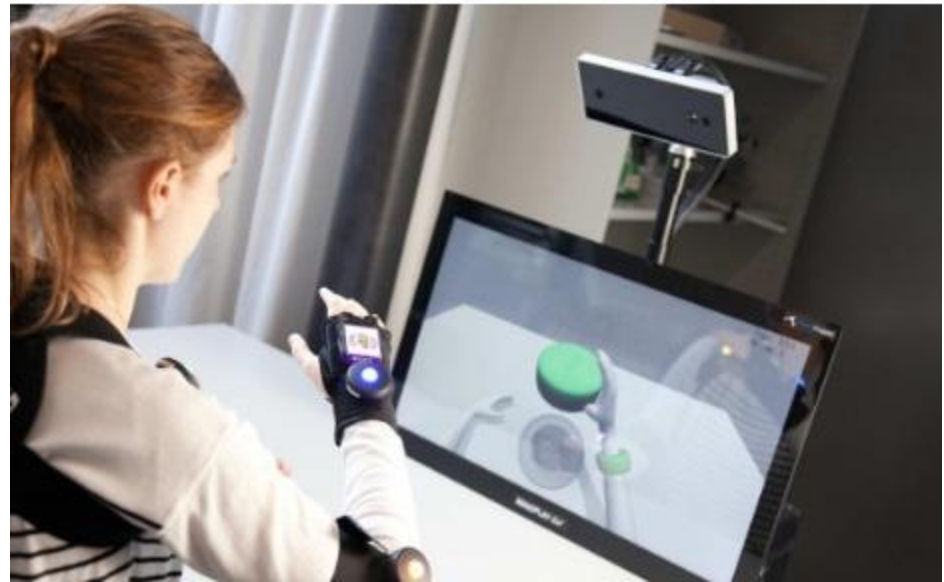
- Medical applications: stroke rehabilitation

VB

GAMES

Switzerland's MindMaze raises \$100M
in funding for VR for stroke victims

DEAN TAKAHASHI @DEANTAK FEBRUARY 17, 2016 4:30 AM



Augmented Reality

- Medical applications

More Than 200 Emerging Medical VR/AR Companies
Targeting Multiple Clinical Sectors and Specific Indications

Acute Pain	Addiction Medicine	ADHD	Anxiety Management	Autism Spectrum Disorder	Chronic Pain
Cognitive Assessments	Depression	Disability Solutions	Emergency Medicine	Medical Education & Training	Ophthalmology
Orthopedics	Palliative Care	Patient Education	Phobias PTSD	Physical Medicine and Rehabilitation	Preventive Medicine
Respiratory Medicine	Senior Care	Stroke & TBI	Surgical Procedure Planning	Surgical Skill Training	Uncomfortable Procedure Mitigation

Augmented Reality

- The windshield!

PHOTONICS
MEDIA photonics.com

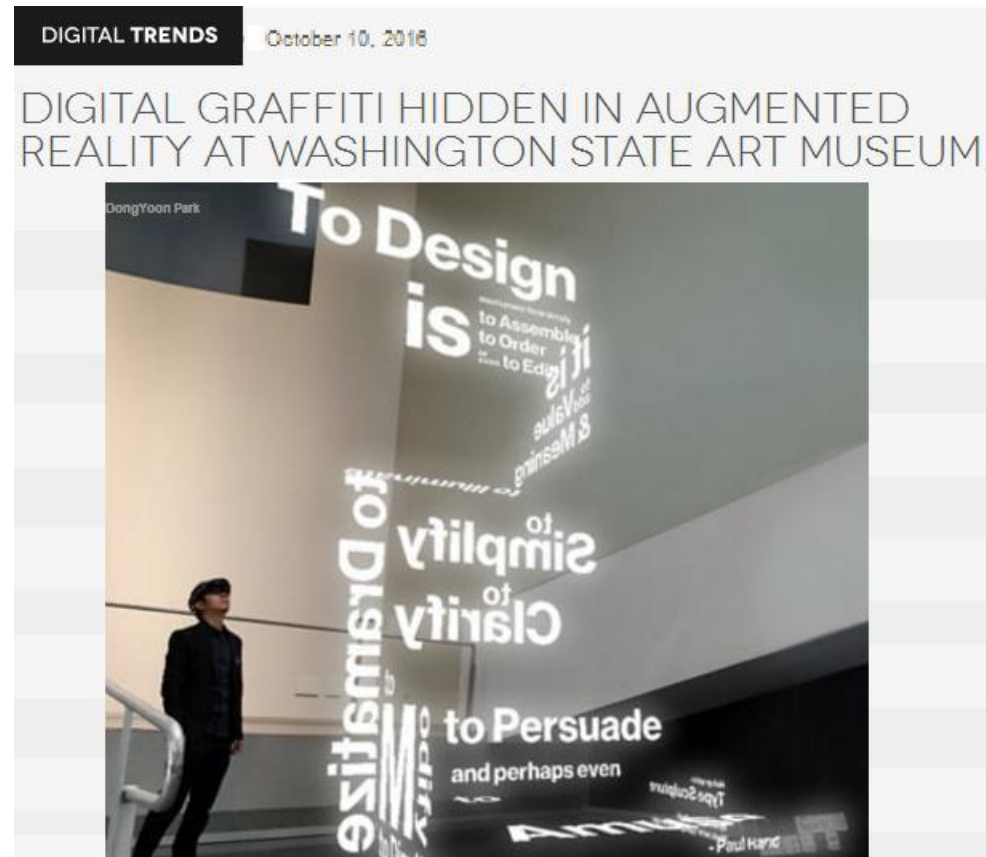
Feb 2016

Augmented Reality Is Coming to Your Windshield



Augmented Reality

- The landscape becomes a blank canvas
- AR becomes a new way to send messages that can even be 3D objects
- A new dimension of chatting



Digital sculpture visible only with Hololens
(Seattle, 2016)

AR/VR Contact Lenses

**WeChat parent Tencent leads
\$3M investment in augmented
reality contact-lens company**

Innovega February 20, 2017



AR/VR Contact Lenses

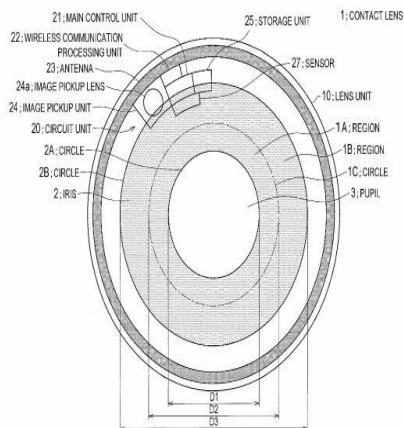
Sony

(19) **United States**
 (12) **Patent Application Publication** (10) Pub. No.: US 2016/0097940 A1
 SAKO et al. (43) Pub. Date: Apr. 7, 2016

(54) CONTACT LENS AND STORAGE MEDIUM
 (71) Applicant: SONY CORPORATION, Tokyo (JP)
 (72) Inventors: YOICHIRO SAKO, TOKYO (JP); MASANORI IWASAKI, KANAGAWA (JP); KAZUNORI IWAYASHI, TOKYO (JP); TAKAYASU KON, TOKYO (JP); TAKATOSHI NAKAMURA, TOKYO (JP); TOMOYA ONUMA, SHIZUOKA (JP); AKIRA TANGE, TOKYO (JP)
 (21) Appl. No.: 14/785,249
 (22) PCT Filed: Feb. 12, 2014
 (86) PCT No.: PCT/JP2014/053217
 § 371(c)(1), (2) Date: Oct. 16, 2015
 (30) Foreign Application Priority Data
 May 2, 2013 (JP) 2013-096972

Publication Classification
 (51) Int. CL. G02C 11/00 (2006.01); H04N 5/225 (2006.01); G02C 7/04 (2006.01)
 (52) U.S. CL. CPC: G02C 11/10 (2013.01); G02C 7/04 (2013.01); H04N 5/2252 (2013.01)

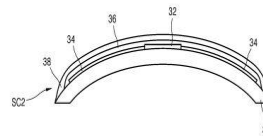
ABSTRACT
 [Object] To provide a contact lens and storage medium capable of controlling an image pickup unit provided in the contact lens.
 [Solution] Provided is a contact lens including: a lens unit configured to be worn on an eyeball; an image pickup unit configured to capture an image of a subject, the image pickup unit being provided in the lens unit; and an image pickup control unit configured to control the image pickup unit.



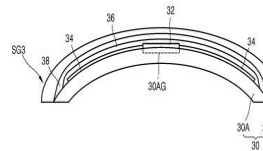
Samsung

공개특허 10-2016-0037008

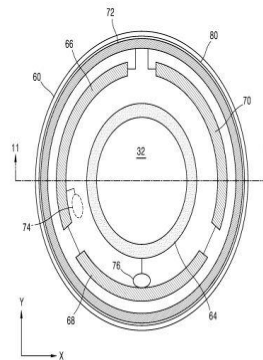
도면7



도면8



도면9



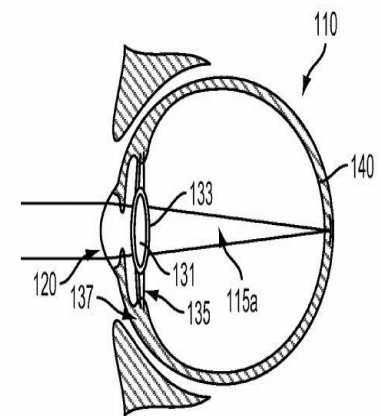
Google Patent

(19) **United States**
 (12) **Patent Application Publication** (10) Pub. No.: US 2016/0113760 A1
 Conrad (43) Pub. Date: Apr. 28, 2016

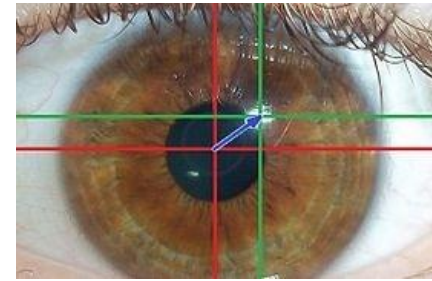
(54) INTRA-OCULAR DEVICE (57) **ABSTRACT**
 (71) Applicant: Google Inc., Mountain View, CA (US)
 (72) Inventor: Andrew Jason Conrad, Malibu, CA (US)
 (21) Appl. No.: 14/522,710
 (22) Filed: Oct. 24, 2014

Publication Classification
 (51) Int. CL. A61F 2/16 (2006.01)
 (52) U.S. CL. CPC: A61F 2/1627 (2013.01); A61F 2/1648 (2013.01); A61F 22/50009 (2013.01)

An intra-ocular device includes an electronic lens that can be controlled to control the overall optical power of the device. The device can be installed within a flexible polymeric material shaped to conform to the inside surface of a lens capsule of an eye. Accommodation forces applied to the device and/or polymeric material via the lens capsule can cause a change in the optical power of the device and/or polymeric material. Further, such accommodation forces can be detected by an accommodation sensor of the device and the optical power of the electronic lens can be controlled based on the detected accommodation forces. Operated in this way, the device and polymeric material can restore a degree of accommodation to the eye that is related to existing mechanisms for controlling such accommodation, i.e., forces exerted by the eye via the lens capsule.



Reader's Attention



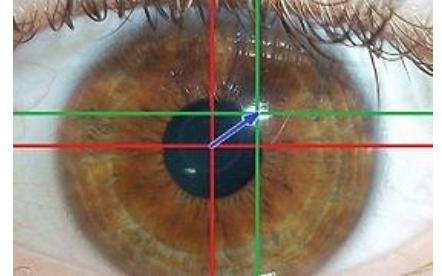
- Technology for tracking readers interest
 - Eye tracking data for qualitative website testing

Here is what
your eyes
see



Reader's Attention

- Technology for tracking readers interest
 - Eye tracking data



Here is what
you don't
see

Reader's Attention

- Technology for tracking readers interest
 - Eye tracking data

Google buys Eyefluence eye-tracking startup

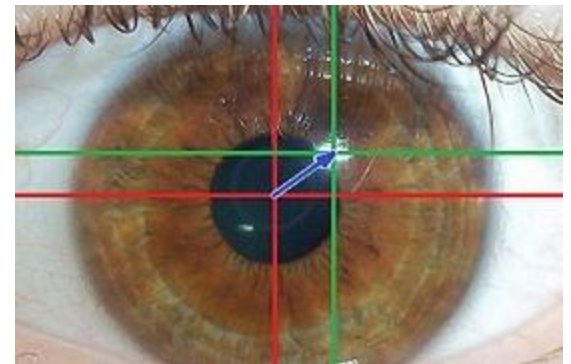
Posted Oct 24, 2016 by [Lucas Matney \(@lucasmtny\)](#)



04:49

Control your computer with your eyes

TE



DigiLens & BMW partner on a Smart Motorcycle Helmet



DIGILENS 



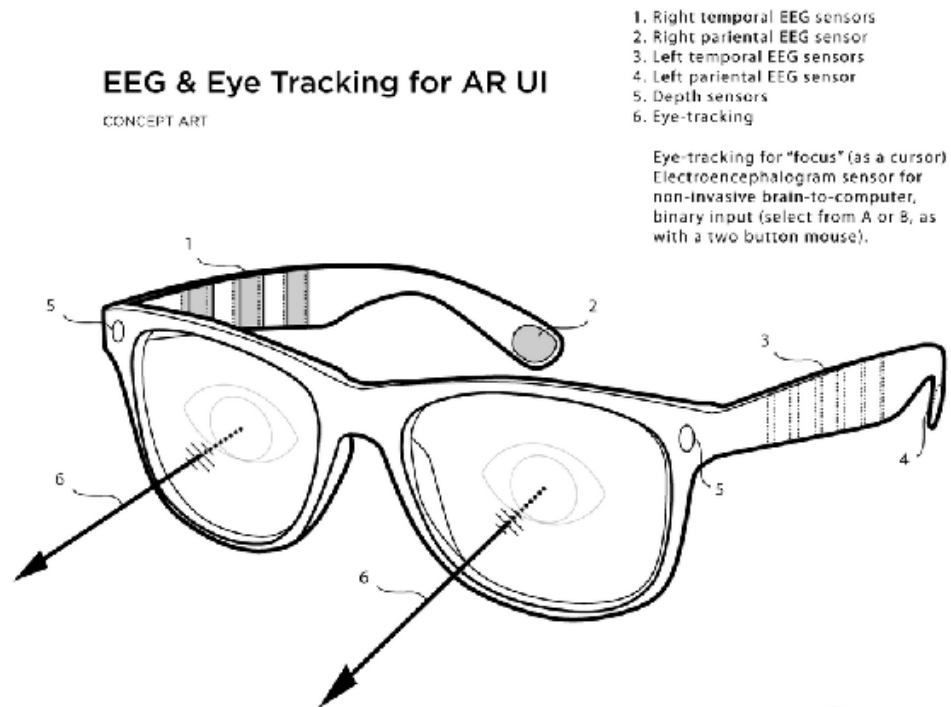
Reader's Attention

- Technology for tracking readers interest
 - Eye tracking + Augmented Reality



Reader's Attention

- Technology for tracking readers interest
 - The future? EEG + Eye tracking



Eye Tracking Tech

- 5G democratized AR



FEB 23, 2019

Ericsson, Singtel, Optus, and OPPO achieve international AR video call

The end-to-end, real-time augmented reality (AR) video call took place between Singapore and Australia over Ericsson's 5G networks – bringing us a step closer to the wide scale deployment of immersive mixed reality applications.



Ericsson D-15 Labs



Eye Tracking Tech

- 5G enables eye tracking AR smartphones

THE VERGE

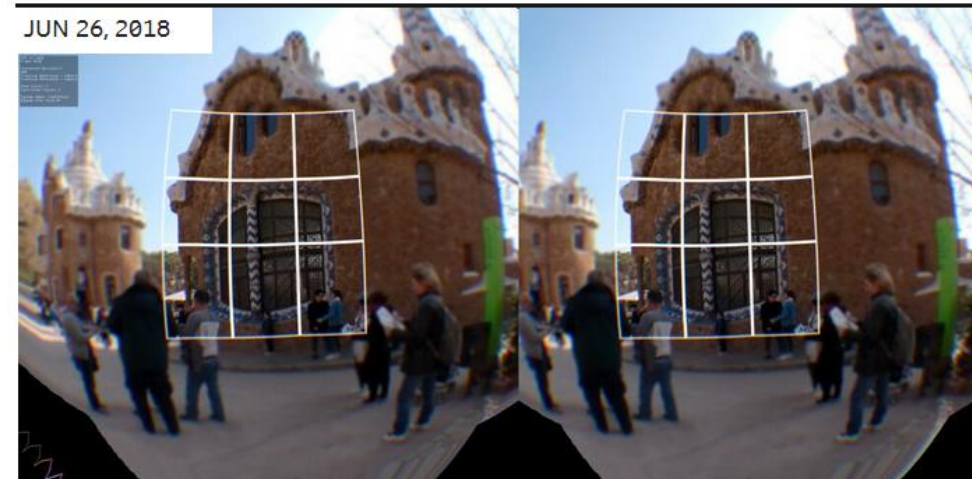
Qualcomm is pushing to make VR and AR headsets work with 5G phones



Qualcomm's 5G phone-powered, eye-tracking VR/AR headsets are coming in 2020

 ericsson.com

5G and eye-tracking enabling mobile VR



Motion Capture

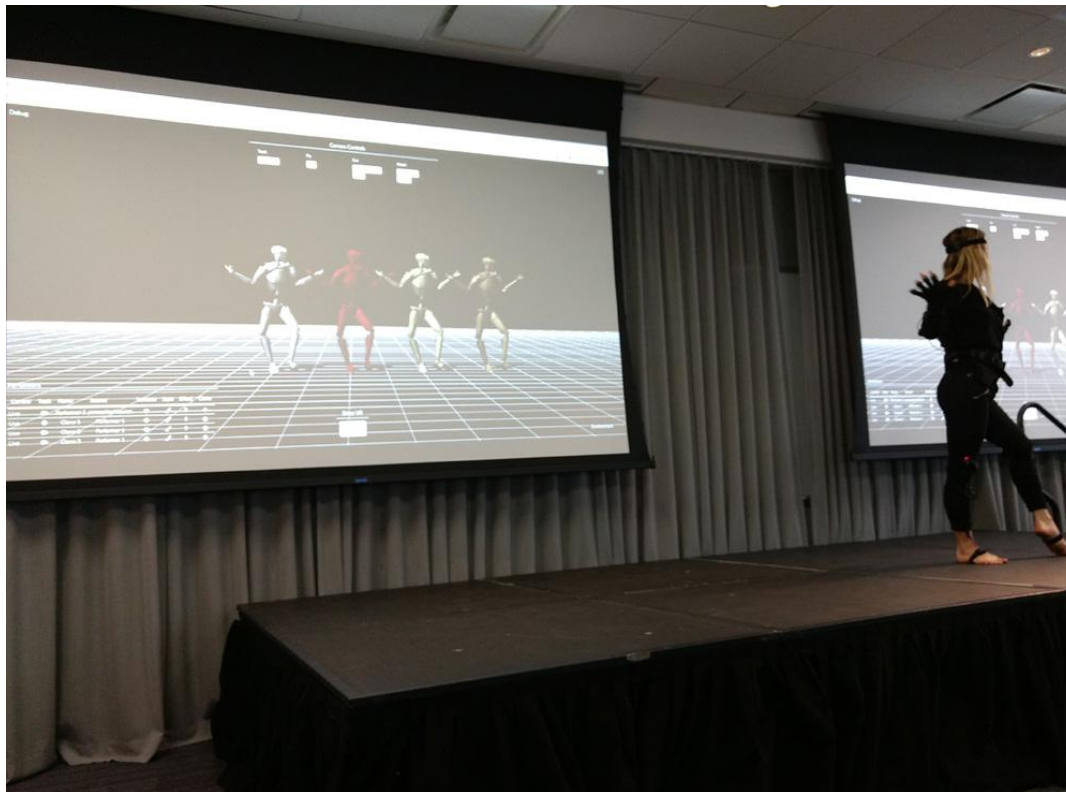
- Technology for tracking readers interest
 - Installing the motion-capture suit



 **Openperform**
<https://www.openperform.org>

Motion Capture

- Technology for tracking readers interest
 - Synchronized avatars



Motion Capture

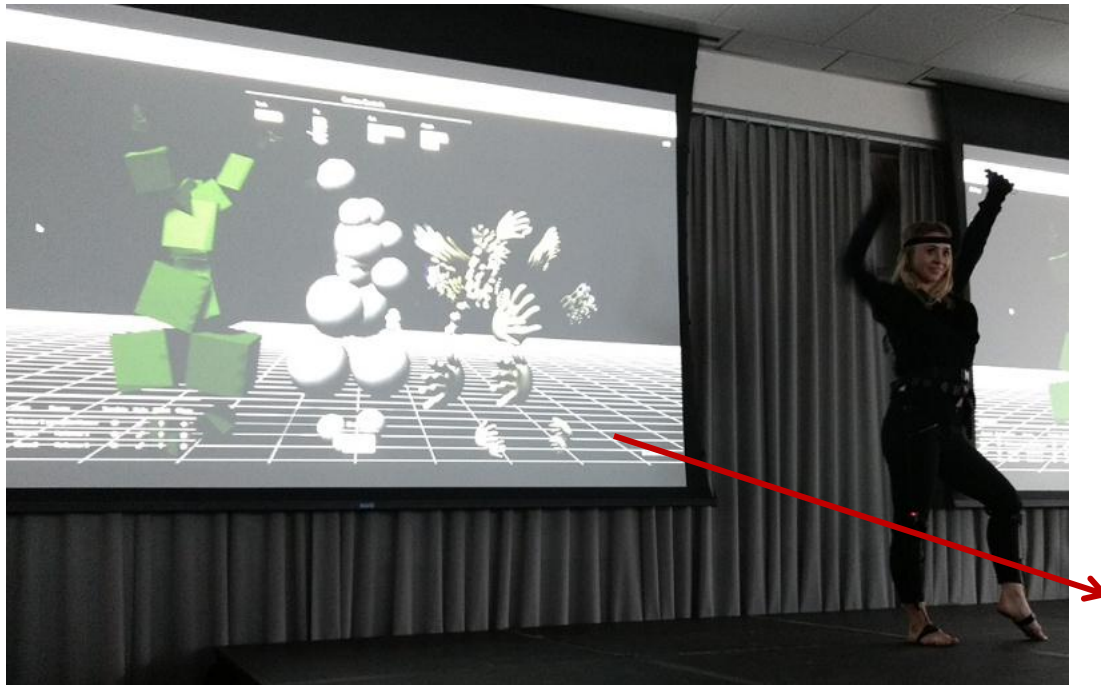
- Technology for tracking readers interest
 - Delayed avatars



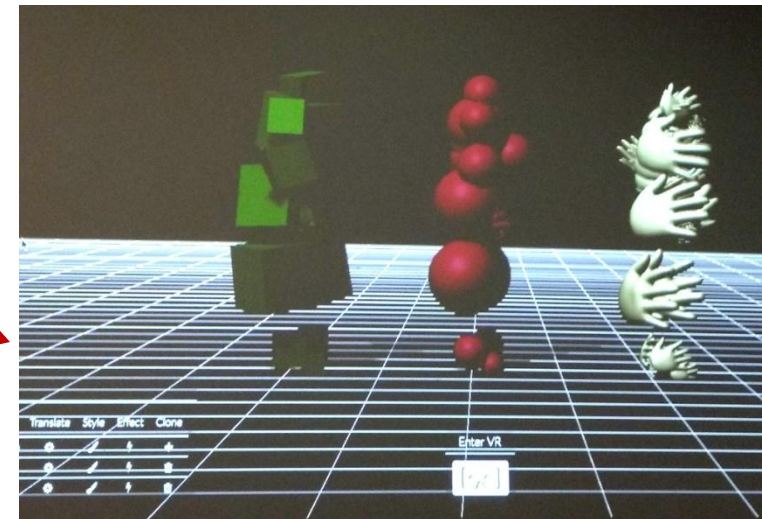
 **Openperform**
<https://www.openperform.org>

Motion Capture

- Technology for tracking readers interest
 - Iconized avatars



 **Openperform**
<https://www.openperform.org>

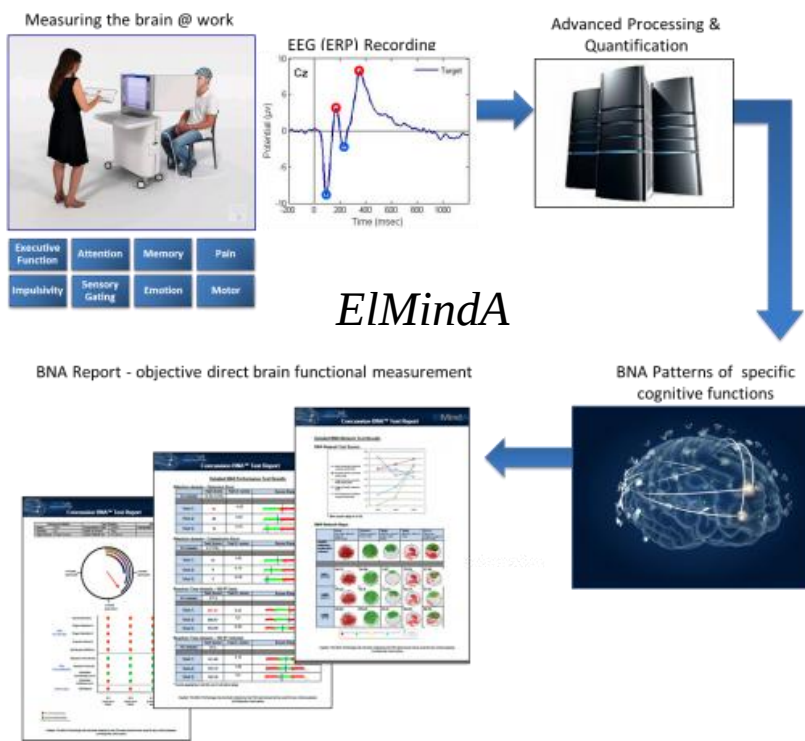


Artificial Friendliness

- Brainwave sensors:
 - SOSO (South Korea)
 - ElMindA (Israel)



2 channel brainwave Device



Virtual and Augmented Reality for Connecting People



Berkeley
UNIVERSITY OF CALIFORNIA

Gregorij Kurillo

Teleimmersion Lab @ UC
Berkeley

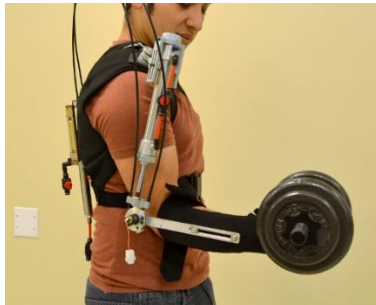




<http://tele-immersion.citris-uc.org>



HART Lab
Human-Assistive Robotic Technologies Lab
<http://hart.berkeley.edu/>



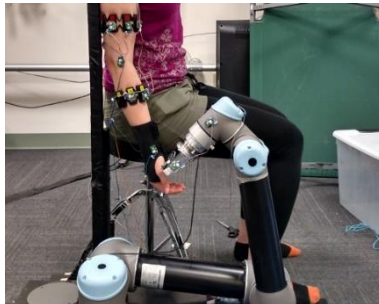
Exoskeletons



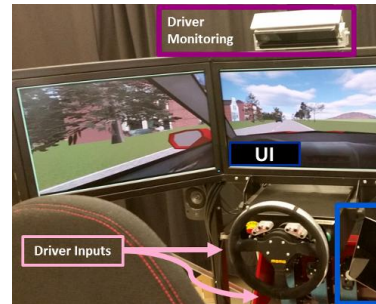
**Human-Robot
Collaboration**



Soft Robotics



**Human Kinematic &
Dynamic Modeling**

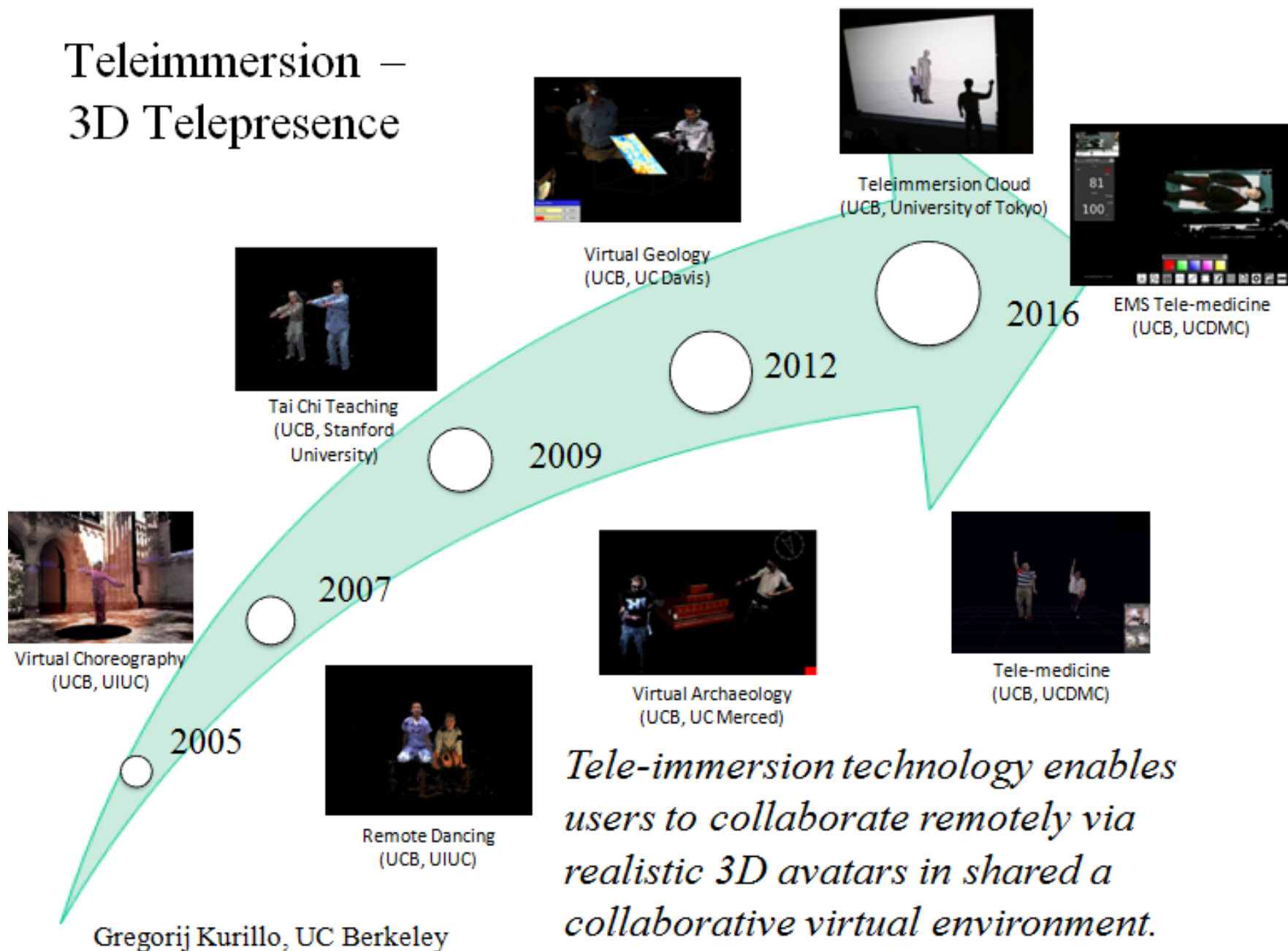


Smart Vehicles



**VR & AR for
Telemedicine**

Teleimmersion – 3D Telepresence



Tele-immersion technology enables users to collaborate remotely via realistic 3D avatars in shared a collaborative virtual environment.

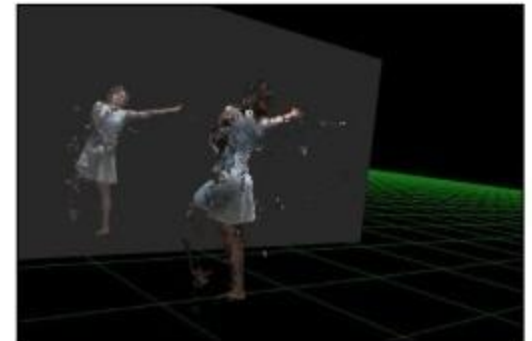
Teleimmersion

- First application: Distributed Dance
 - Collaboration with University of Illinois at Urbana-Champaign (2001-08)
 - Real-time interaction of dancers across the network



Teleimmersion

- First application: Remote collaborative dancing



Current application: Augmented Telemedicine Platform

Tele-rehabilitation

- Collaboration with UC Davis Medical Center (2014)
- Use of Microsoft Kinect camera to connect patient and caregiver for assessment and physical rehabilitation.
- Remote assessment of function in clinical trials (reduce costs, travel etc.)

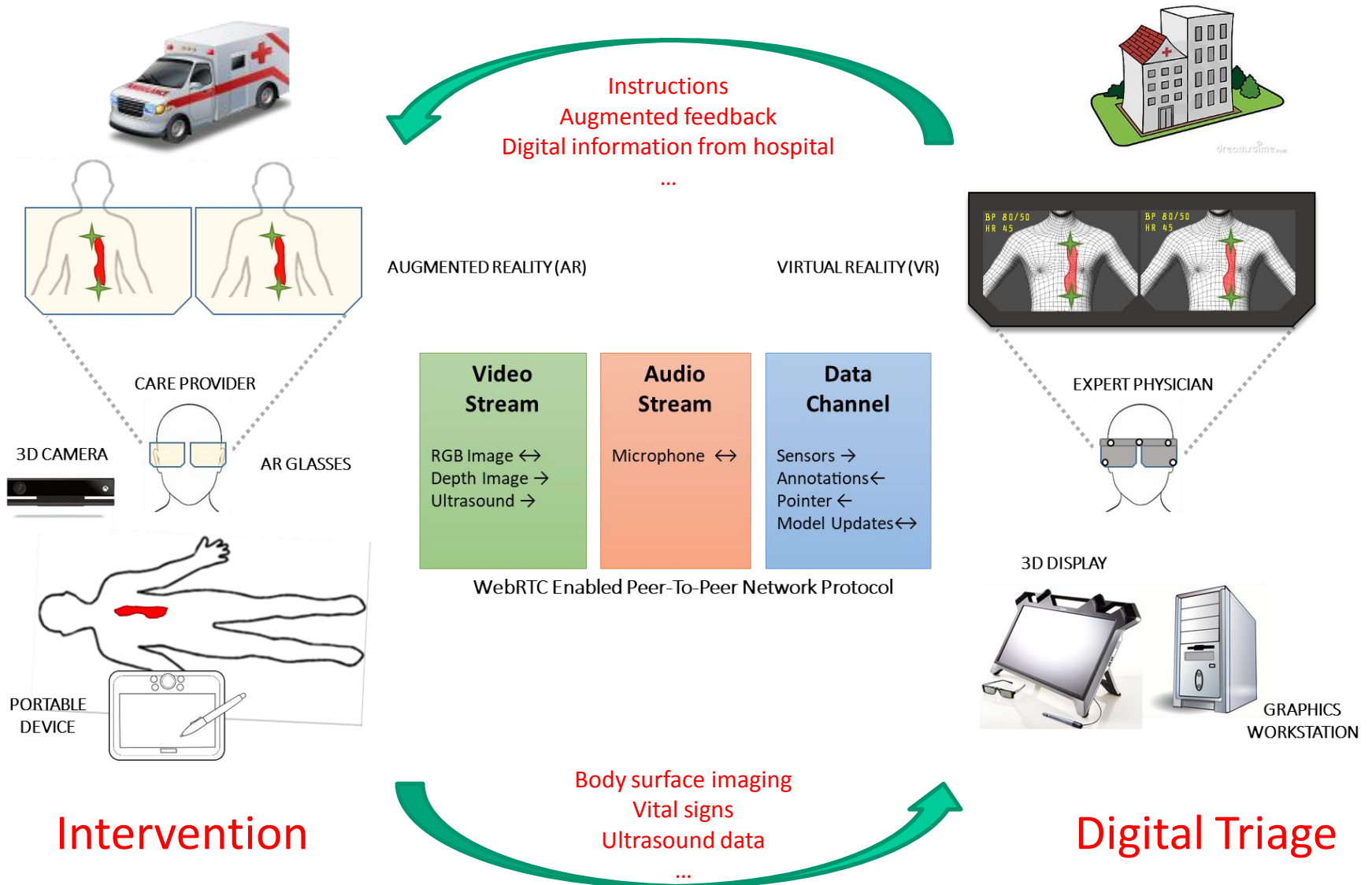


Tele-consultation

- Use of tele-immersive technology to connect remote expert and worker in the field.
- Goals are to improve communication, facilitate more informed decisions, and reduce errors due to miscommunications between remote teams.
- Technology to bridge virtual and augmented reality.

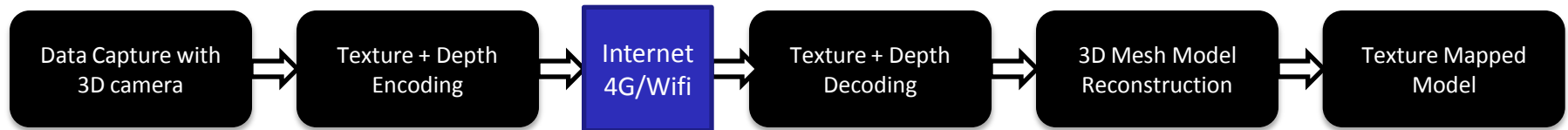
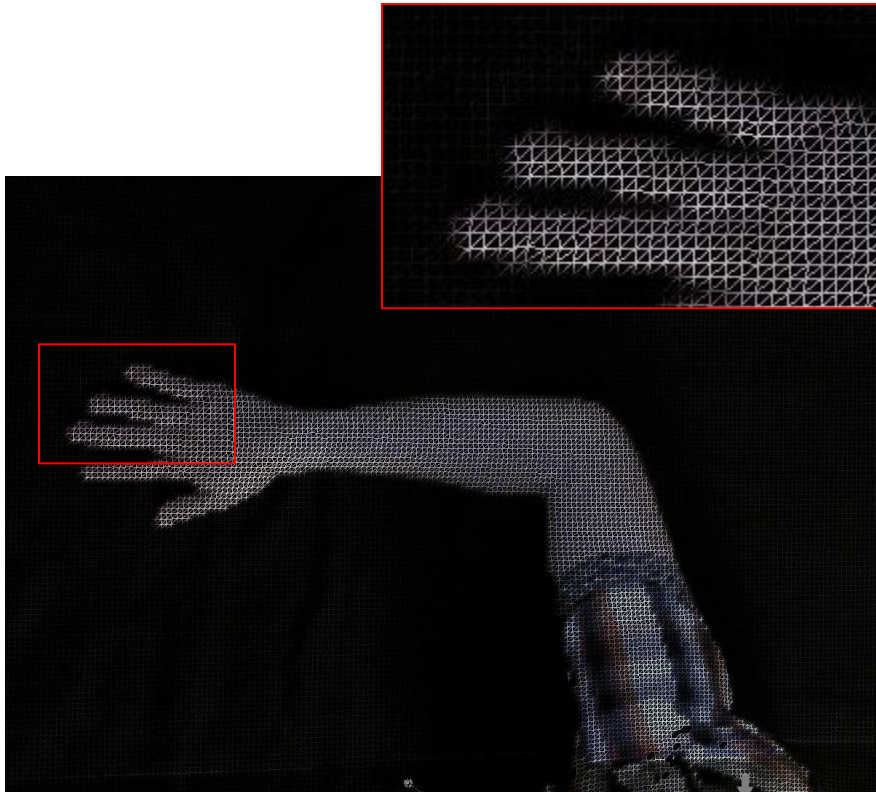


Augmented Telemedicine Model (2016)



3D Reconstruction and Visualization

Expert Side



VR Interaction - Annotations

Expert Side



VR Interactions - Measurements

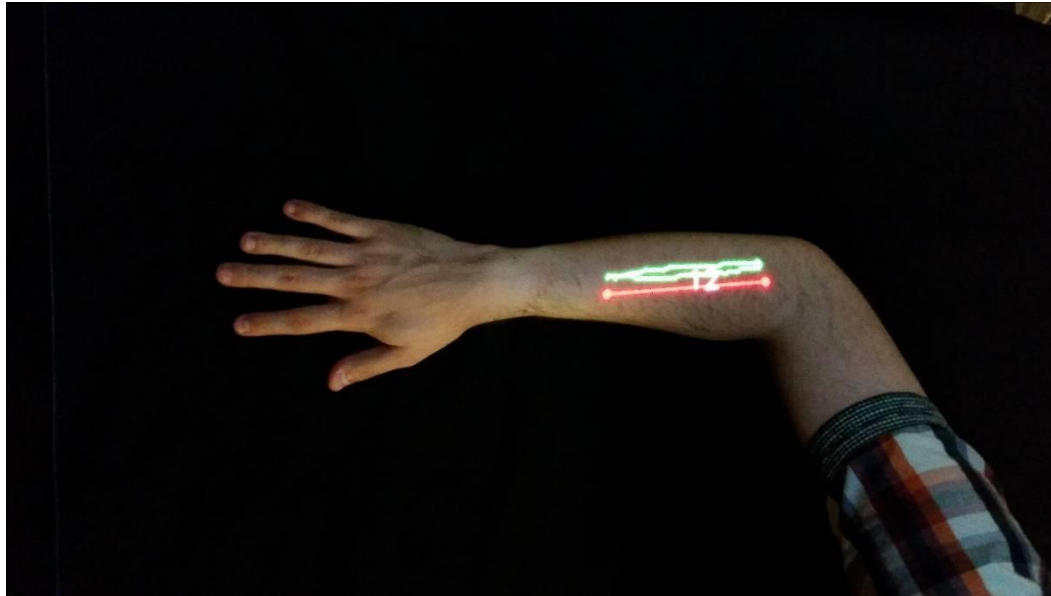
Expert Side



AR Feedback

- ▶ Digital annotations created by the expert are transmitted over the network and projected onto the body area in real time.

Patient Side



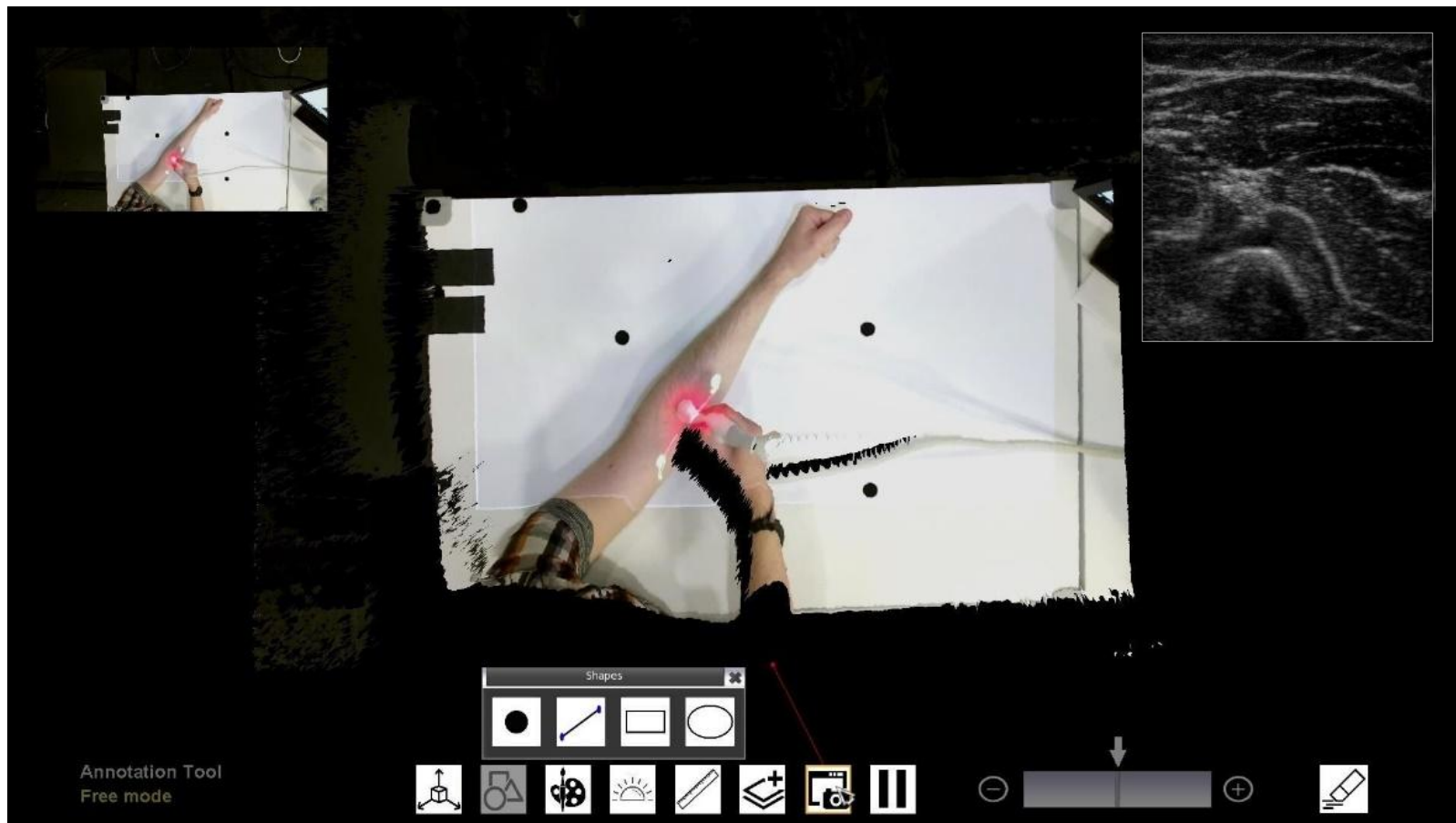
Expert Side



Patient Side

Streaming of Ultrasound Video

Expert Side



Technological Barriers

Cameras

- Efficient multi-camera use (occlusions, multi-resolution...).
- Automatic, user-friendly calibration.
- Synchronization of active multi-cameras.
- Low fidelity, low frame rate

Networking

- Network is still bottleneck (latency, bandwidth).
- Dedicated compression techniques for 3D.
- Synchronization of multiple streams.

Display

- Lack of immersive 3D displays.
- Head mounted VR displays and facial occlusion.
- AR displays are currently still too bulky.

Interaction

- Gesture-based interaction is still unreliable.
- Intuitive interface devices

Artificial Friendliness

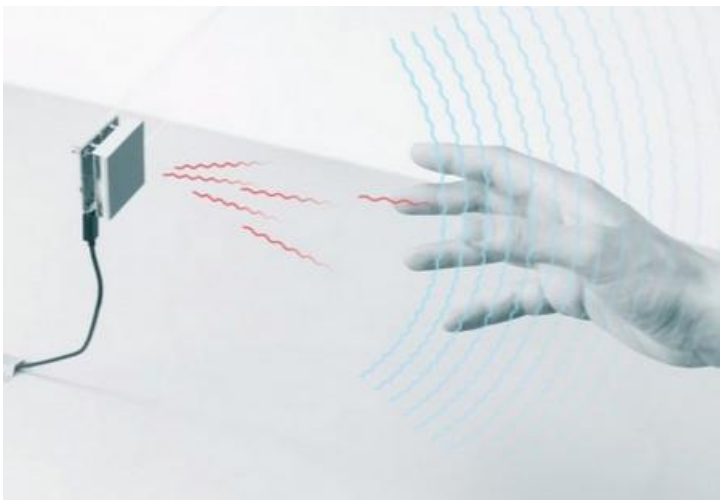
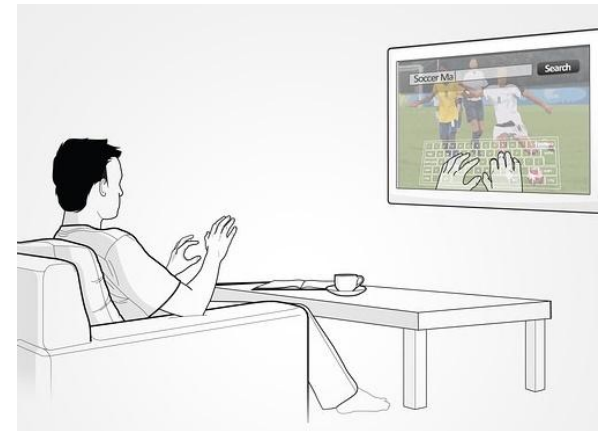
- Gesture-based control of devices



(Source: Hashem AL-Ghaili
<https://www.youtube.com/watch?v=ceN3grs0fWw>)

Artificial Friendliness

- Gesture recognition
 - Pebbles (Israel, 2011 - acquired by Oculus)
 - Google's Project Soli (2015): based on the principle of the radar



Artificial Friendliness

- Simulation



Artificial Friendliness



- Optical touch
 - Any surface becomes a keyboard (Lumio)
 - Any surface becomes a touch-screen (Touchjet)



Touchjet Pond (Formerly TouchPico) is a tiny handheld projector that turns any surface into a giant touchscreen. It is an interactive Android PC with projected touch interface and wireless streaming

Experiencing Reality

- The experience of "watching" content can be completely different.
- We live in a world in which the "attention span" has been constantly reduced.
- Virtual reality can be the perfect antidote to the trend towards “multi-tasking”
- Virtual reality is a medium that "forces" absolute focus on the content



Experiencing Reality

- A new dimension in human-machine interaction, one in which the machine is not a distraction but an aid to concentration
- Virtual reality enables interaction based on everything that we do: gazes, gestures, body movement, and some day maybe even breathing and thinking.
- Not “watching” or “listening” but “experiencing”



Experiencing Reality

- The future of "distance learning"
 - Stanford/ zSpace (Sunnyvale)
 - Alchemy VR (London)
 - Immersive VR (Ireland)
 - Google's Pioneer Expeditions



zSpace Virtual Holographic Display

Stanford Clinical Anatomy Department

The zSpace display is a "virtual holographic display," which, by virtue of built-in eye tracking, and with natural stylus-based interaction, gives the 3D models a presence. We are currently using the system as a virtual dissector, allowing faculty to take apart the models, with labels and annotations giving them a realistic experience. Clinicians who have experienced this see the possibilities for immersive patient education experiences using models that compare normal and pathological anatomy. Specifically, Stanford's Eye Clinic, Ear Clinic, Hand Clinic, and Plastic Surgery.



Experiencing Reality

- What is missing from virtual reality:
the other senses
- Multi-sensory reality



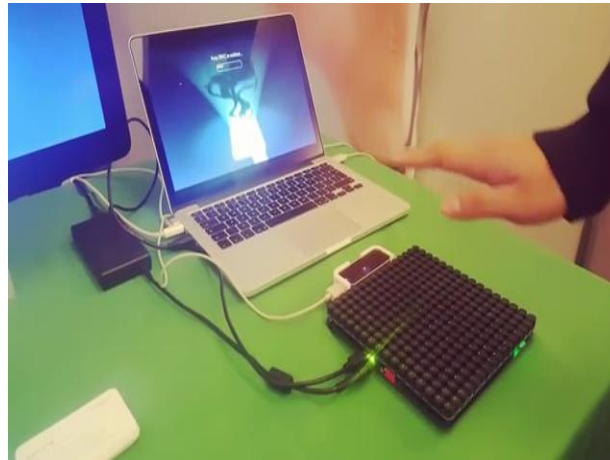
Adrian Cheok, Mixed Reality Lab

Experiencing Reality: Touch



SubPac

Delivers low frequencies to body



UltraHaptics

Soundwaves create touch sensation



KEIO MEDIA DESIGN
KEIO UNIVERSITY GRADUATE SCHOOL OF MEDIA DESIGN

The Rev Synesthesia Suit adds full-body haptic feedback to VR

Rez Infinite Synesthesia Suit

(by students Yukari Konishi, Nobuhisa Hanamitsu, Benjamin Outram, and Kouta Minamizawa at the Keio University Graduate School of Media and Design in Japan)

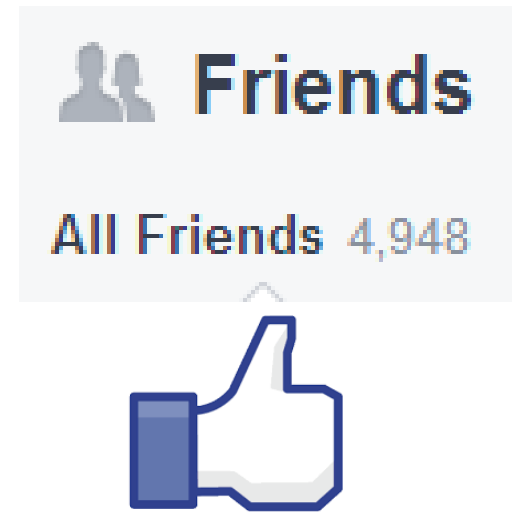
Melissa Merencillo

Experiencing Reality: Smell



Social or Anti-social?

- Email (1972): death of the handwritten letter, but it allows people to keep in touch much more frequently
- Videogames (1970s) turn computers into an antisocial medium
- Facebook and Wechat (2000s): shallow "social" life
- Facebook has a Like button but not a Dislike button
- Friendship became a commodity
- Worse: Facebook makes money out of your friendships
- Your social life is someone else's business model



Social or Anti-social?

- "Second Life" (2003): the future of social media?
- Socializing in a virtual world (in a world that doesn't exist)



Social or Anti-social?

- "Second Life" (2003): a place for business meetings and brainstorming

Learning in a Virtual World:
Using SL for Medical Education
Virtual Worlds Best Practices in Education



Spiral Theas (Robin Heyden)
Chimera Cosmos (Liz Dorland)
John Winograd (John Weicha)
Islet Sabra (Elliot Sternthal)

March 14, 2010
In Second Life

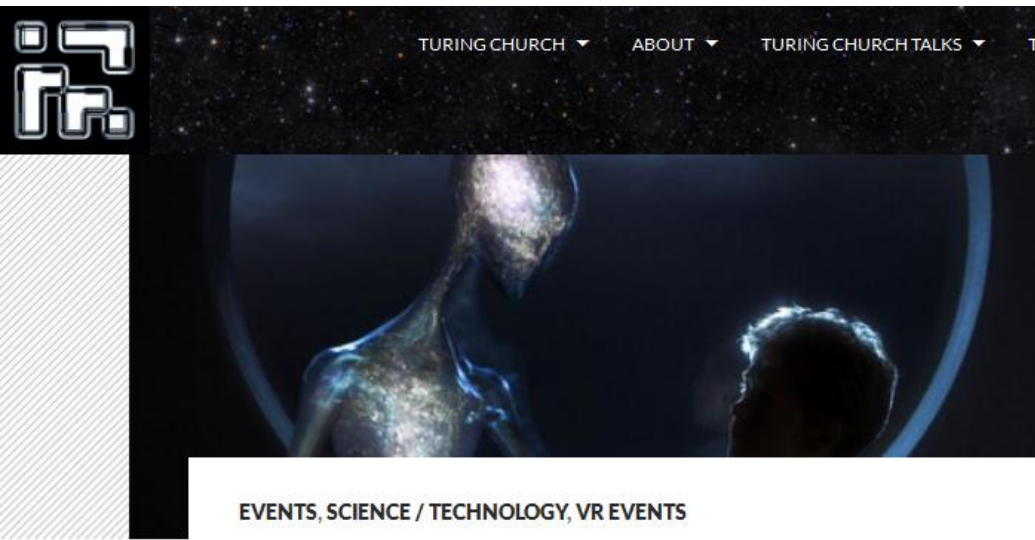
I-Room – a Virtual Space for Intelligent Interaction

Austin Tate, Director of the
Artificial Intelligence Applications Institute,
University of Edinburgh
2011



Social or Anti-social?

- "Second Life" (2003): classes, conferences and lectures



The screenshot shows a webpage for a Second Life event. At the top, there's a navigation bar with links: 'TURING CHURCH', 'ABOUT', and 'TURING CHURCH TALKS'. Below this is a large, dark, abstract image featuring a glowing, ethereal figure. The main text area has a header 'EVENTS, SCIENCE / TECHNOLOGY, VR EVENTS' followed by the title 'SUSAN SCHNEIDER ON MACHINE CONSCIOUSNESS AT THE UPCOMING TERASEM COLLOQUIUM IN SECOND LIFE'. At the bottom, it shows the date 'DECEMBER 4, 2015', the user 'GIULIO PRISCO', and '11 COMMENTS'.

TURING CHURCH ▾ ABOUT ▾ TURING CHURCH TALKS ▾ T

EVENTS, SCIENCE / TECHNOLOGY, VR EVENTS

SUSAN SCHNEIDER ON
MACHINE CONSCIOUSNESS AT
THE UPCOMING TERASEM
COLLOQUIUM IN SECOND
LIFE

🕒 DECEMBER 4, 2015 👤 GIULIO PRISCO 💬 11 COMMENTS



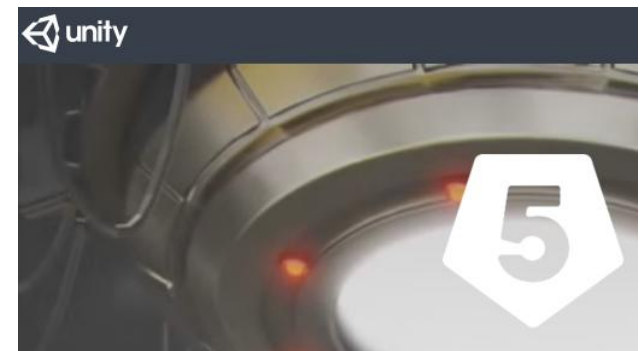
Social or Anti-social?

- VR documentaries
 - Nonny de la Pena's "Project Syria" (2014)
 - The "reader" becomes an "observer", and therefore is much more likely to "feel" the story instead of simply "hearing" it.
 - Chris Milk, founder of VR storytelling company Vrse (2014): "Clouds Over Sidra" (2015)



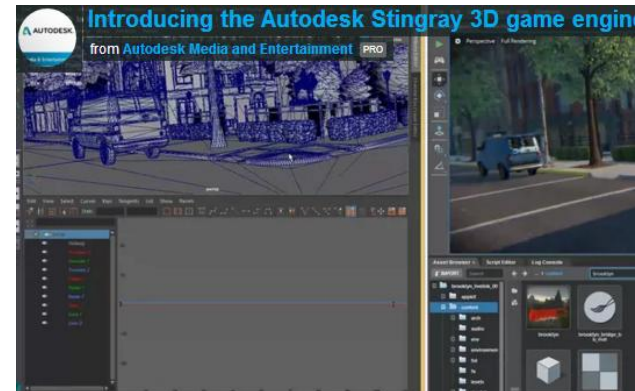
Virtual Reality

- The Virtual World Creators
 - Unreal Engine 4
 - Razer OSVR or Open Source Virtual Reality
 - EON Reality
 - Worldviz
 - Unity 5
 - Unity EditorVR (2016)



Virtual Reality

- The Virtual World Creators
 - Improbable (London, 2012)
 - Autodesk's Stingray (2015)



Virtual Reality

- The Virtual World Creators
 - OpenSim (2007), an open-source multi-platform, multi-user 3D application server (compatible with Second Life)



Virtual Reality

- The Virtual World Creators
 - VR business today: mostly devices to "consume" virtual reality, not the tools to create virtual world
 - Penrose Studios' virtual-reality film, "The Rose And I" (2016)



Virtual Reality

- The Virtual World Creators
 - The future of "writers": create a world and escort the viewer
 - I will escort you into my world and we will socialize in it.
 - "Life" will not be about going to a place that preexists but about going to the places that we design.



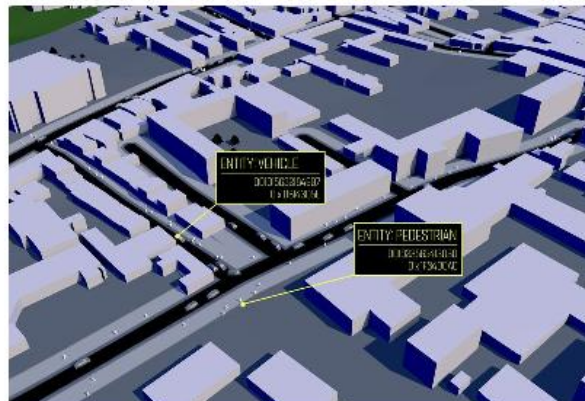
Virtual Reality

- The Virtual World Creators
 - The future of urban planners: simulate the city

WIRED

If we're living in a simulation, this UK startup probably built it

UK's latest \$1billion startup.



IMPROBABLE

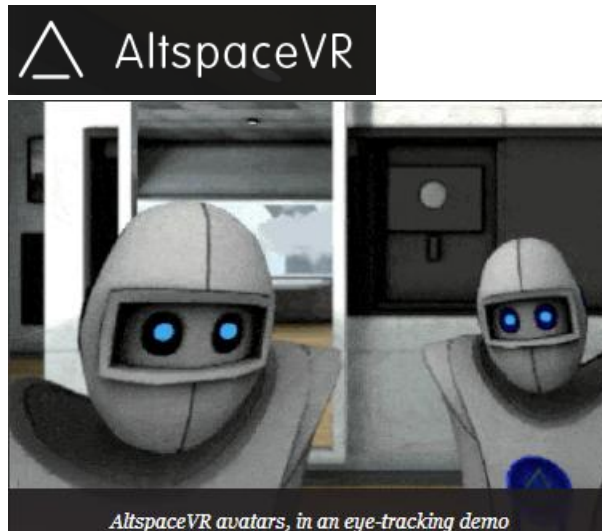
Virtual Reality

- The Virtual World Creators
 - Vrtuoso (2018)



Social Virtual Reality

- Hang out with real people in virtual reality
- Altspace (Redwood City, 2013)
- High Fidelity (San Francisco, 2013)



Social Virtual Reality



Facebook Spaces

“Interactive Virtual Environment



BigScreen

“Social Virtual Desktop App”

The Metaverse

- 2006 Roblox (Bay Area)
- 2014 The Sandbox (Britain)
- 2015 Decentraland (Argentina)
- 2015 Cryptovoxels (New Zealand)
- 2017 Epic Games' Fortnite
- 2017 Somnium Space (Britain)
- 2018 Upland (Silicon Valley)

When AI meets VR



- Artificial Intelligence creates "artificial beings", and Virtual Reality creates an "artificial world"
- The beings that inhabit a virtual world are avatars of real people...
- ...but could also be independent beings that exist only in that world (self-creating avatars)
- You will not know who are avatars of real people and who are artificial avatars



Kristi Krueger with her Second Life® avatar

When AI meets VR

- Artificial Intelligence can be used to "power" your own avatar.
- My avatar in Second Life disappears when i am not playing.
- A.I. could keep it awake and playing even when i am not in Second Life.
- Eternalize yourself!

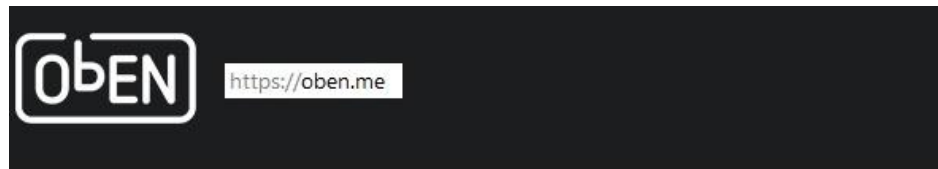
LifeNaut

Website: lifenaut.com

Founded: 2010



Lifenaut
Botanic
Oben



Personal 3D Visual Avatar

Instantly create your personal 3D avatar from one selfie on your smartphone. |



When AI meets VR

- The new generation of avatars could be "autonomous" avatars that (who?) learn your personality and then continue living in Second Life even when you "switch off"



Pre-programmed AI Avatar "Bot" as Patient

Ohio State Univ SL Medical Center

When AI meets VR

- Magic Leap (2018)



Meet Magic Leap's almost-human AI assistant

Mica, its highly realistic AI assistant.



AR Communications

- Magic Leap (2018)
- Twilio (2018)
- Spatial (2018)



**Twilio & Magic Leap
Deliver First Live
Demo of Avatar Chat
Communications App**

10/19/2018



Reality Check

- In 2007 Gartner Group predicted that 80% of Internet users would have an avatar in a virtual world by 2011
- In 2013 Kzero forecasted 2014 sales of virtual reality headsets "to exceed 200,000".
- Statista predicted that in 2016 Samsung would sell 5 million Gear VR.
- In 2015 not even 1% of Internet users had an avatar in a virtual world.
- There was no virtual-reality headset available in 2014 for the mass market
- Samsung shipped 4.5 million units worldwide in 2016 (competitors Sony, HTC and Oculus shipped a combined 1.4m units)

A Roadmap

- 2010s:
 - 3D modeling and 3D display
 - Motion sensors
 - Devices to experience VR with smartphones (mobile VR)
 - Videogames
 - Marketing applications
 - Business presentations (Microsoft HoloLens)
 - 3D CAD/CAM/Printing
 - Avatars for health care
 - Avatars for investment

A Roadmap

- 2016-17: Driven by the headsets
- 2017-18: VR goes social
- 2018-19: Driven by the market
- Desktop VR

A Roadmap

- 2020:
 - From passive 3D 360-degree video to “true” active VR
 - Active VR, not just passive: you "control" the real world, not just "experience" it.
 - A new generation of motion sensors
 - Total immersion media:
 - Journalism
 - Cinema
 - Training/education/simulation

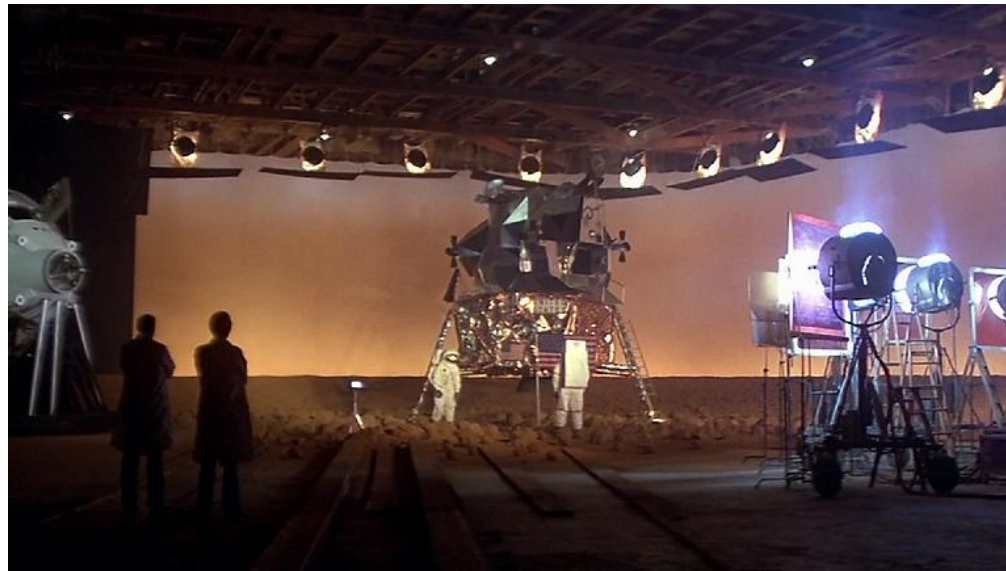
A Roadmap

- 2025:
 - Brainwave sensors

Dangers

- Mis-information
 - A realistic movie can convince a lot of people that its story is true
 - You are even more likely to believe what is "happening" in the virtual world
 - The danger is that virtual reality will be used to spread all sorts of false information in a very effective way.

“Capricorn 1”



Hyper-Reality

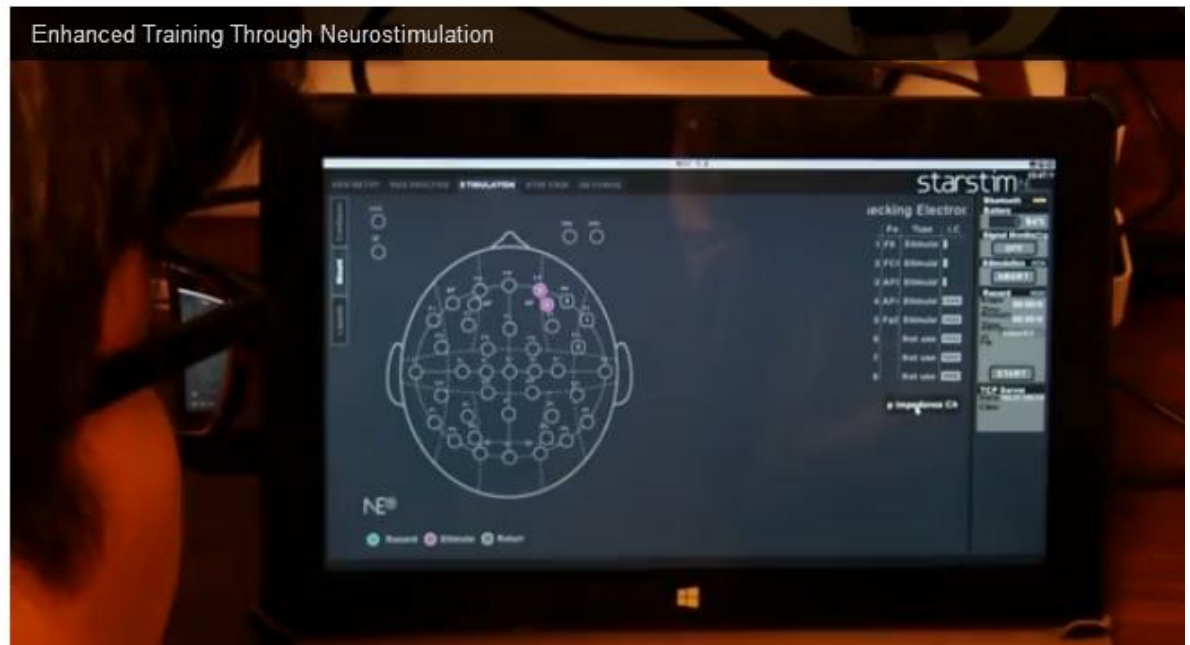
- Live streaming
 - 2015: Periscope in the top 10 most popular social-networking apps on both Google Play and the App Store
 - YouNow
 - Meerkat
 - Facebook Live
- In virtual reality you hide yourself, you become someone else, while in live streaming you are "naked in front of everybody"
- Maybe they complement each other?



Neuro-Reality

- Virtual reality is "vulnerable" to neuroscience.
- E.g., Matthew Phillips (HRL) trains people by transferring the brain waves of an expert into the brain of a novice

HRL DEMONSTRATES THE POTENTIAL TO ENHANCE THE HUMAN INTELLECT'S EXISTING CAPACITY TO LEARN NEW SKILLS



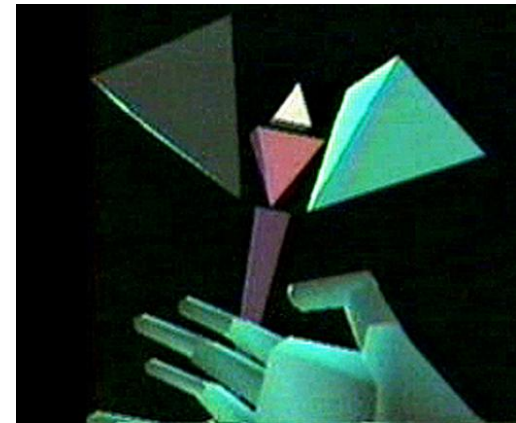
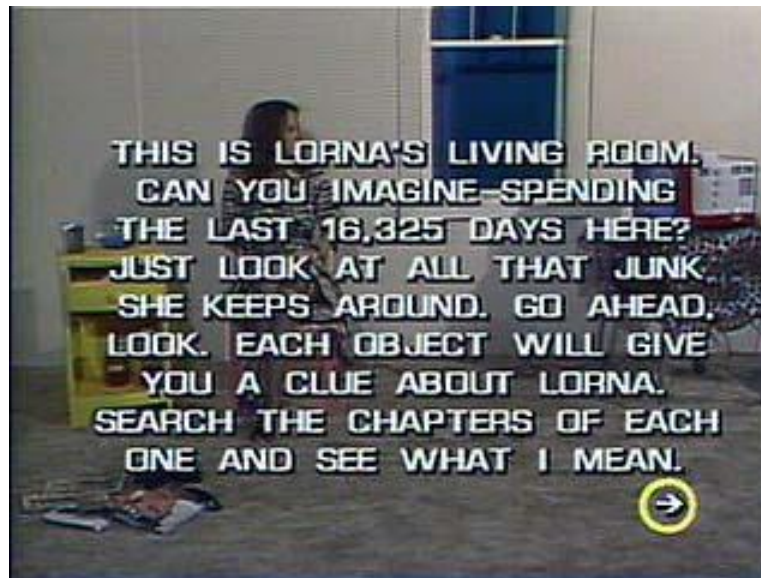
Philosophy

- Zhuang Zhou/ Chuang-Tzu (4th c. BC): *"I did not know whether it was Zhou dreaming that he was a butterfly, or it was now a butterfly dreaming that it was Zhou"*
- Nick Bostrom: Are we living in a simulation? (2003)



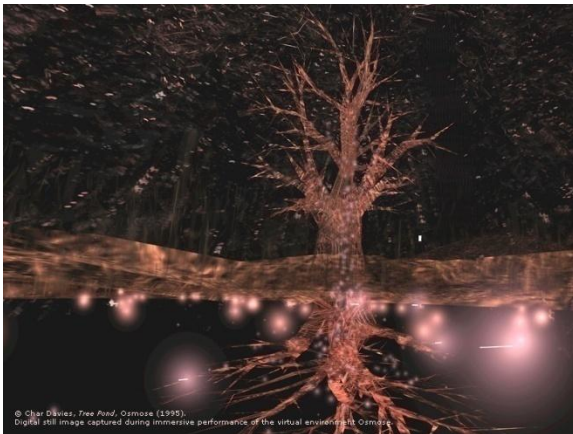
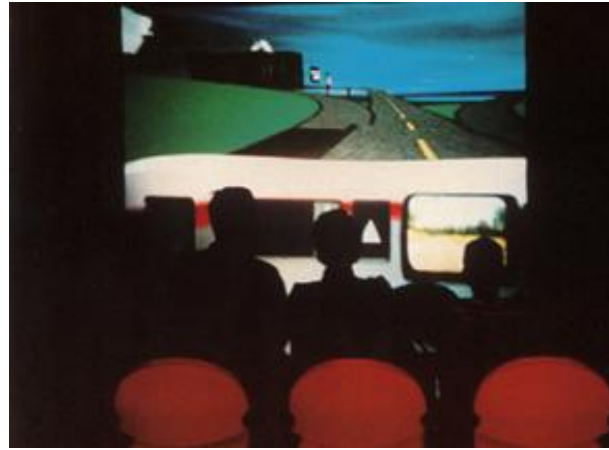
Art

- Myron Krueger
- Jeffrey Shaw
- Lynn Hershman
- Nicole Stenger: “*Angels*” (1992), the first immersive movie



Art

- Peter d'Agostino
- Michael Naimark
- Charlotte Davies
- Kazuhiko Hachiya



Osmose (1995)

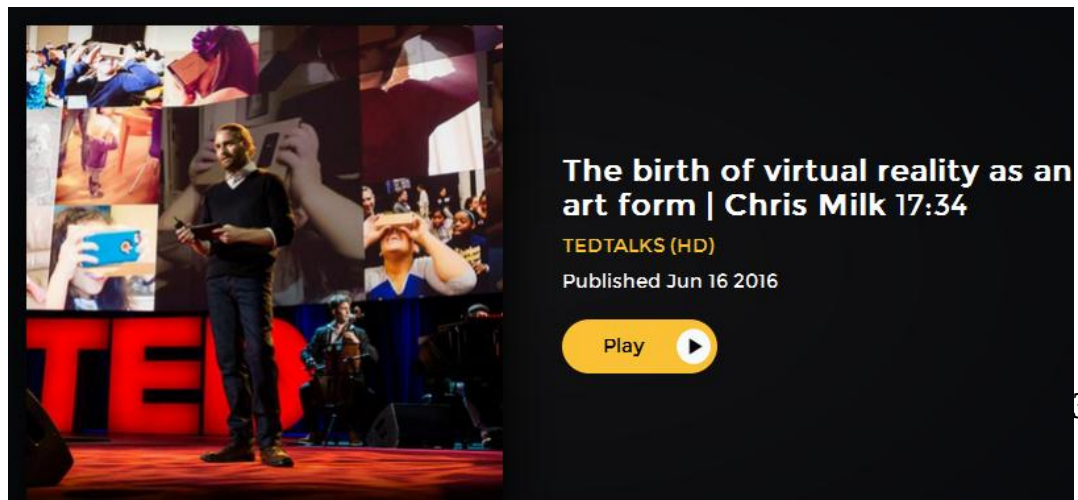


Art

- Rachel Rossin

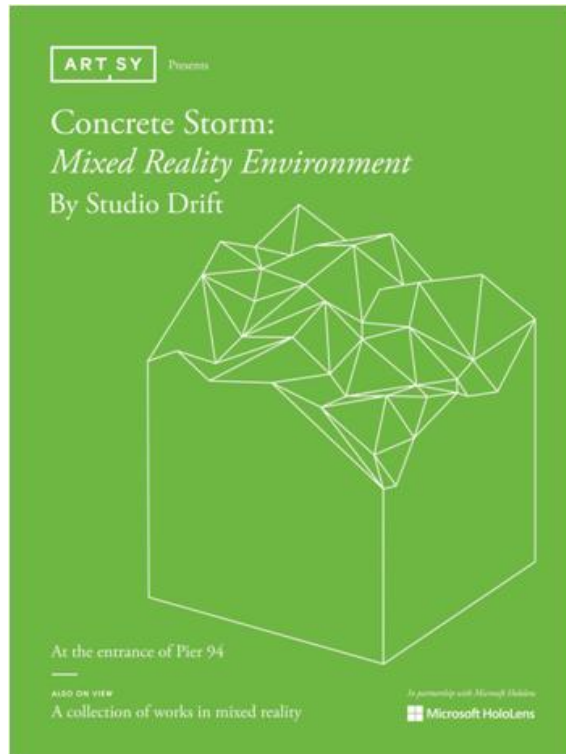


- Chris Milk



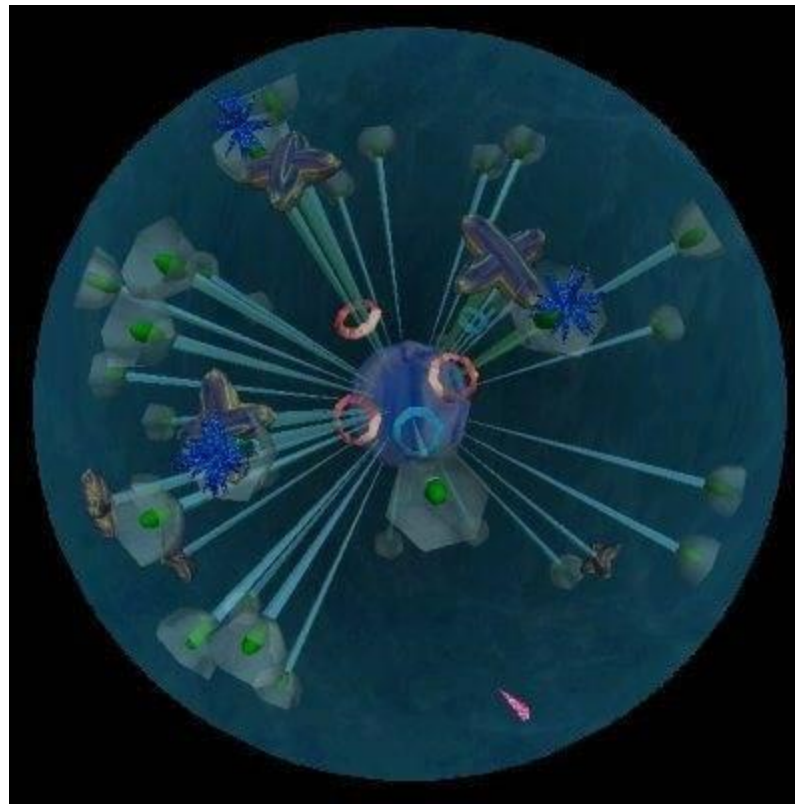
Art

- Studio Drift:



Art

- John Klima



“Glasbead (2000)

Art

- Hayoun Kwon



The Bird Lady

Hayoun Kwon



Art



Human Conference Sensors



EEG AR: Things We Have Lost



I Must Be Seeing THINGS

Manifest.AR

Invisible ARtaffects - Turning FACT Inside Out



Diminished City



Biomer Skelters



FACT Sky Museum

Art

- Mel Chin

Artist Mel Chin Floods Times Square With Virtual Reality Art to Sound the Alarm on Climate Change

The prophetic artwork is a team-up with Microsoft HoloLens.

Sarah Cascone, July 12, 2018



Art

- Janani Balasubramanian: AR game “Heisenberg”



Art

- Jennifer Steinkamp (1958, USA)
 - “You” (2016)
 - “Womb” (2019)



Art

- Tribeca 2015

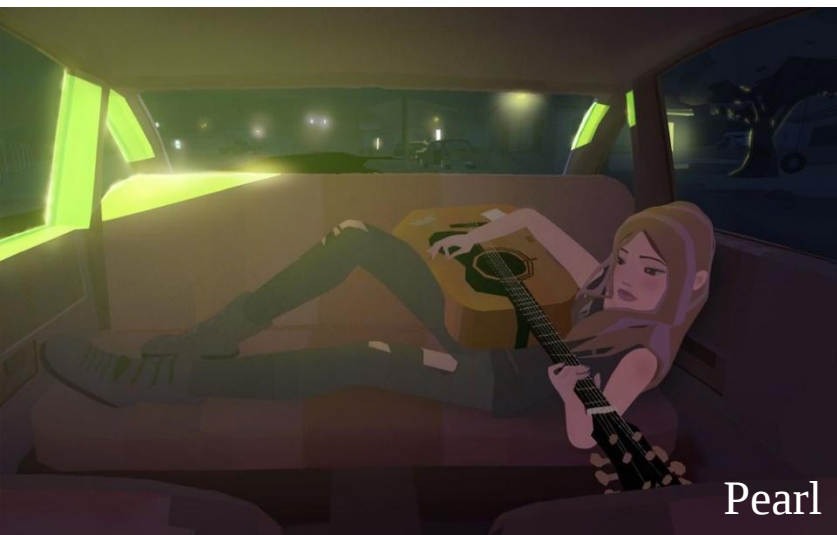


The Machine To Be Another: Embodied Narratives

Project Creator: BeAnotherLab

Art

- Tribeca 2016
 - Baobab Studios: Invasion!
 - New York Times: Seeking Pluto's Frigid Heart
 - Tyler Hurd: Old Friend
 - Patrick Osborne: Pearl
 - Anthony Ferrante: Killer Deal
 - S.E.N.S. VR



Art

- Tribeca 2017
 - Steven Schardt: Auto
 - The Protectors (Imraan Ismail & Kathryn Bigelow)
 - Jérôme Blanquet : Alteration
 - Ethan Shaftel: Extravaganza
 - Selly Raby Kane: The Other Dakar
 - Arden's Wake
 - Apex



Apex

Art

- Tribeca 2018
 - “Arden’s Wake, Tides Fall”
 - “Battlescar”

Art

- HTC Vive Arts (2017)
 - Partnerships with London's Royal Academy of Arts, Taipei's National Palace Museum, Paris' National Museum of Natural History, Washington's Newseum, St Petersburg's Hermitage, London's Tate Modern, etc



HTC VIVE Launches VIVE Arts, A Multi-Million Dollar Global VR Program To Advance Creation And Appreciation Of The Arts

Virtual Reality enhances the overall museum experience and content creation;

Vive Studios will bring some of the world's most fascinating, historic and beautiful art installations into the home through VIVEPORT



[illegible]

-

Art

- Alejandro Inarritu
 - Carne y Arena (2017)



Art

- Tamiko Thiel (1957, USA)
 - Beyond Manzanar (2000)
 - Clouding Green (2012)
 - Gardens of the Anthropocene (2016)
 - Unexpected Growth (2018)

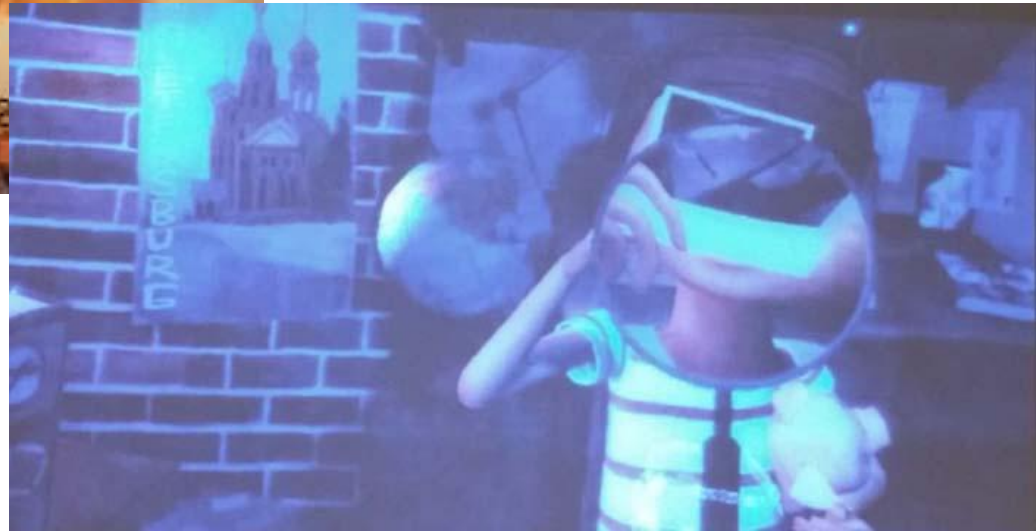


“Gardens of the Anthropocene” (2016)

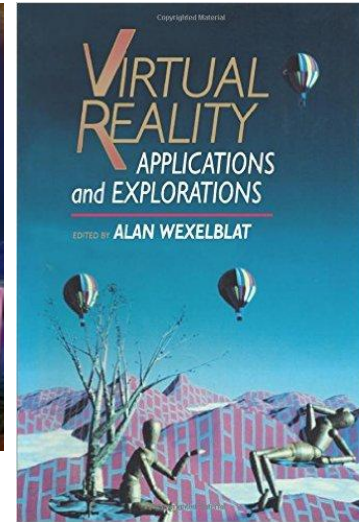
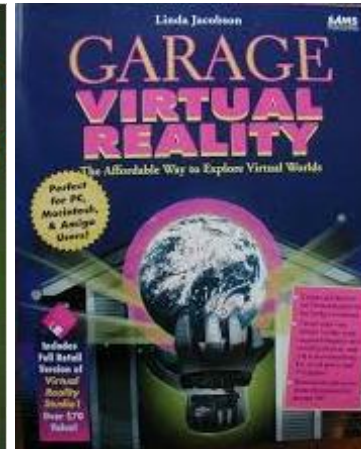
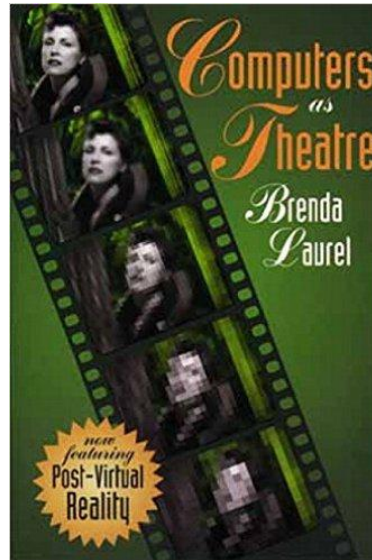
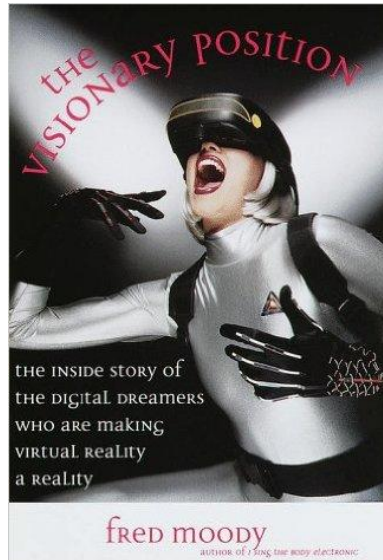
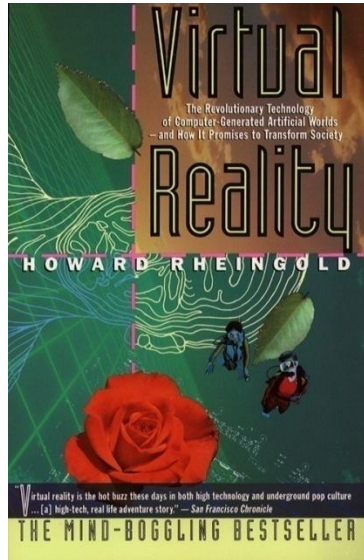


Art

- Fable Studio
 - Wolves in the Walls (2019)

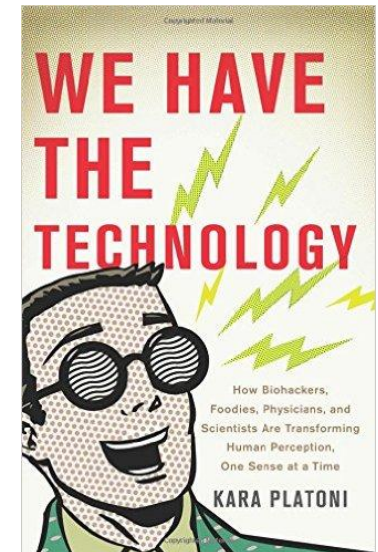
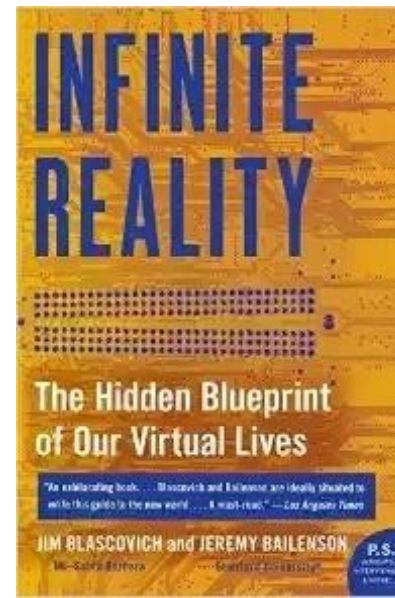
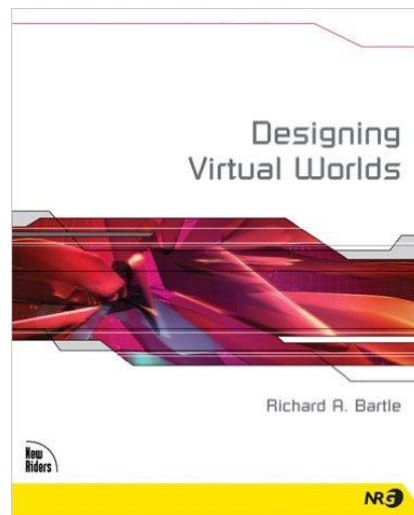


Bibliography



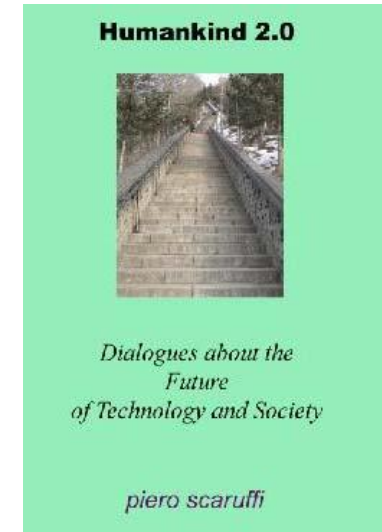
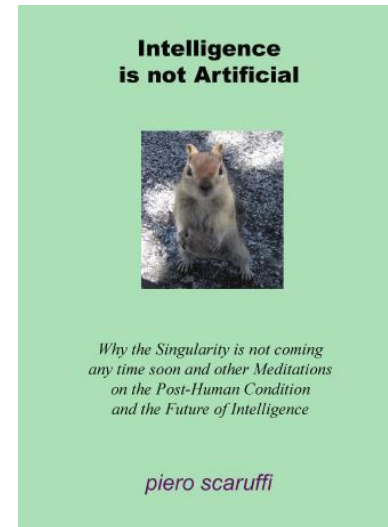
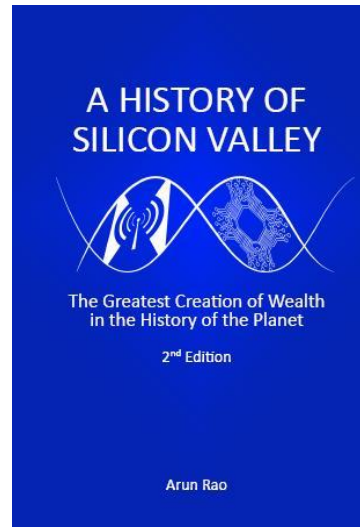
1990s

2010s



Contact

- www.scaruffi.com



See <http://www.scaruffi.com/singular/human20.html>
for the full text of this discussion