

XR 기반 몰입형 원격협업 기술 동향

XR Technologies and Immersive Collaboration Trends

유병현

KIST AI·로봇 연구소 인공지능연구단
책임연구원



발표자

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UST, KIST 스쿨, AI·로봇전공, 부교수
Web3D Consortium, Board of Directors, Elected Position
Journal of Computational Design and Engineering, Associate Editor
한국표준협회, ISO/IEC JTC1 SC24, 전문위원
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KIST Webizing Research Lab

■ WRL Members

- Director: **Byounghyun Yoo**
- 2 Principal Researchers
- 4 Post-Docs & 2 MS Researchers
- 1 Ph.D. & 2 MS Students
- 2 Undergraduate Intern

More Information

- <http://wrl.kist.re.kr>
- <http://www.byoo.net>

■ Research

XR · 확장현실

- Extended Reality
- 3D Web / WebXR
- Immersive Web
- Human Factors

XAI · 설명가능한 인공지능

- Explainable AI
- Human AI Interaction

Digital Twin · 디지털트윈

- Semantic Digital Twin
- Web of Things

Members

Search



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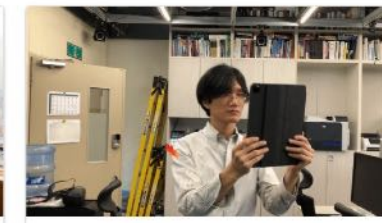
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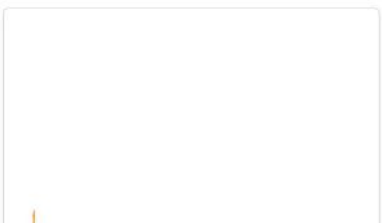
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Extended Reality Immersive Web



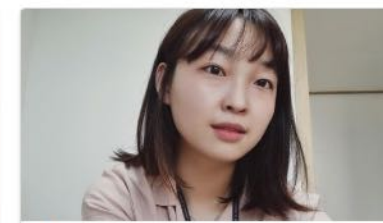
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허승연
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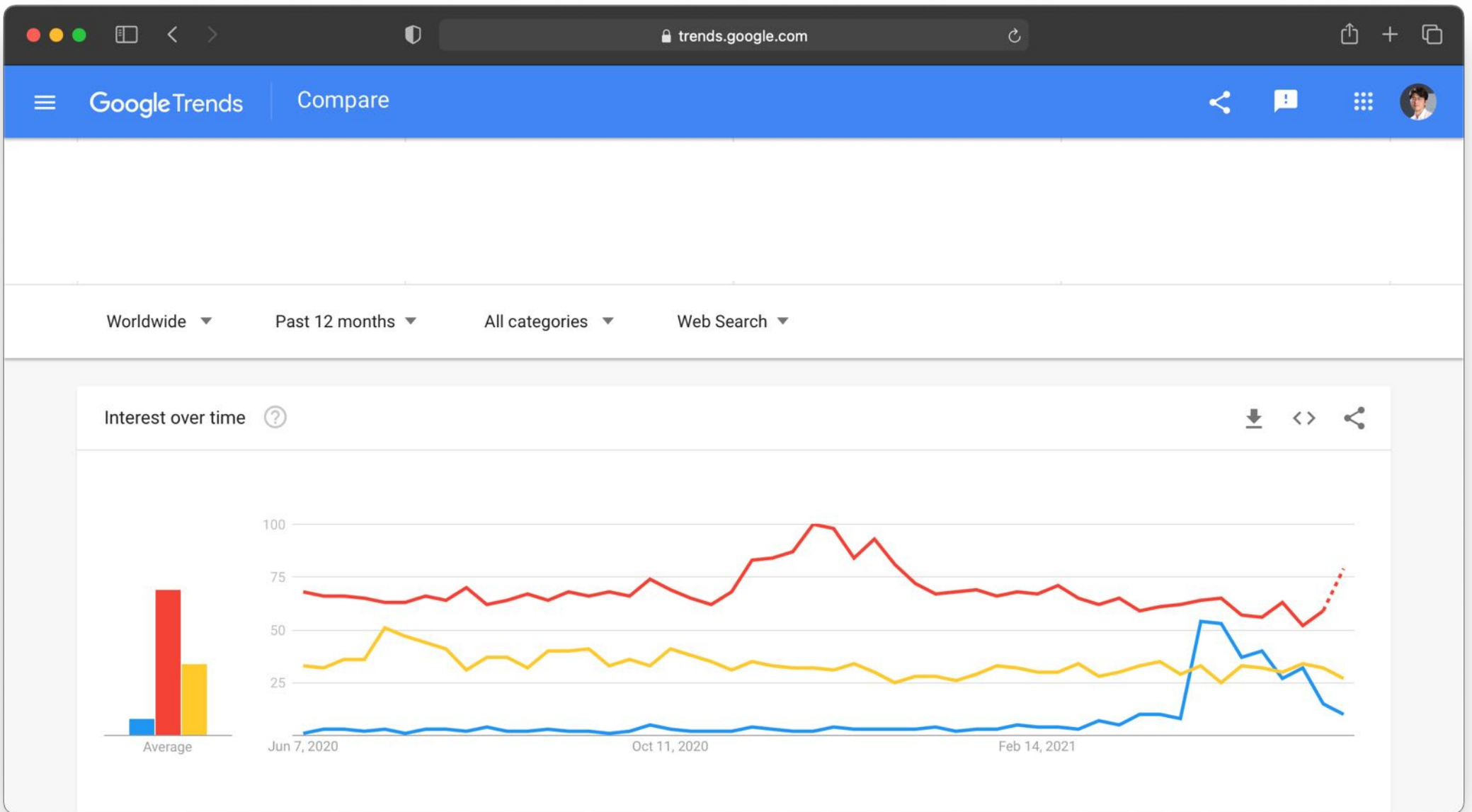
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황영범
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Extended Reality Immersive Web

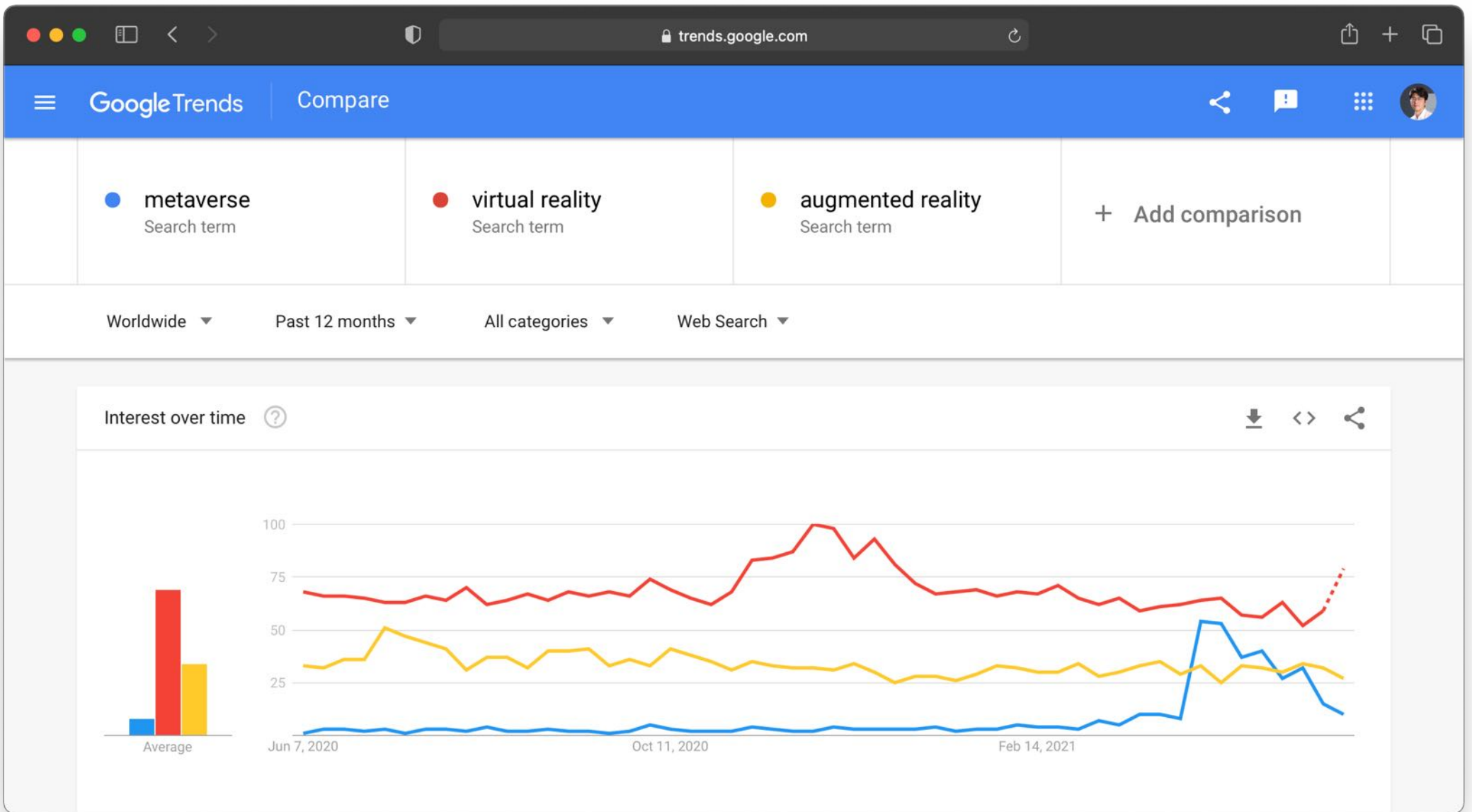


Suyeong Kim
김수영
Research Assistant Intern
Cybersickness

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1. 메타버스
2. VR/AR/XR
3. 원격협업
4. XR 기반 몰입형 원격협업





Meta
초월

+

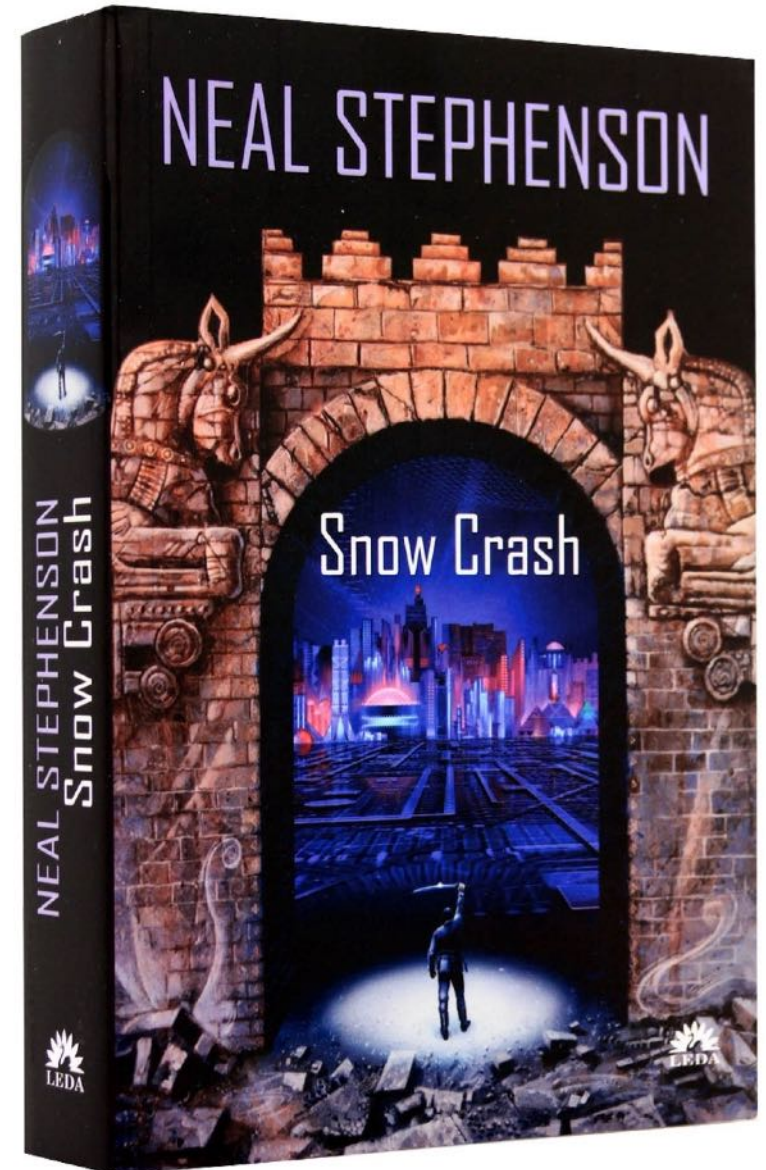
Universe
세상

현실을 초월한 가상 세상

Snow Crash – 메타버스 1.0

■ 소설 Snow Crash [Neal Stephenson '92]

- “**양쪽 눈에** 서로 조금씩 다른 이미지를 보여 줌으로써, **3차원 영상**이 만들어졌다. 그리고 그 영상을 **1초에 72 번** 바뀌게 함으로써 그것을 동화상으로 나타낼 수 있었다. 이 삼차원적 동화상을 한 면당 **2K픽셀**의 해상도로 나타나게 하면, 시각의 한계 내에서는 가장 선명한 그림이 되었다. 게다가 그 작은 **이어폰**을 통해 디지털 **스테레오 음향**을 집어넣게 되면, 이 움직이는 **3차원 동화상**은 완벽하게 현실적인 사운드 트랙까지 갖추게 되는 셈이었다. 그렇게 되면 히로는 이 자리에 있는 것이 아니었다. 그는 컴퓨터가 만들어내서 그의 **고글과 이어폰에 계속 공급**해주는 **가상의 세계**에 들어가게 되는 것이었다. 컴퓨터 용어로는 《**메타버스**》라는 이름으로 불리는 세상이었다.”



Oculus Rift DK 1

- Oculus, 2014, \$300, Kickstarter



Oculus Quest 2

- Facebook, 2020, \$299, 41만4천원



Snow Crash: 양쪽 눈, 3차원 영상, 1초 72 번, 2K픽셀, 스테레오 음향, 가상 세계, 메타버스

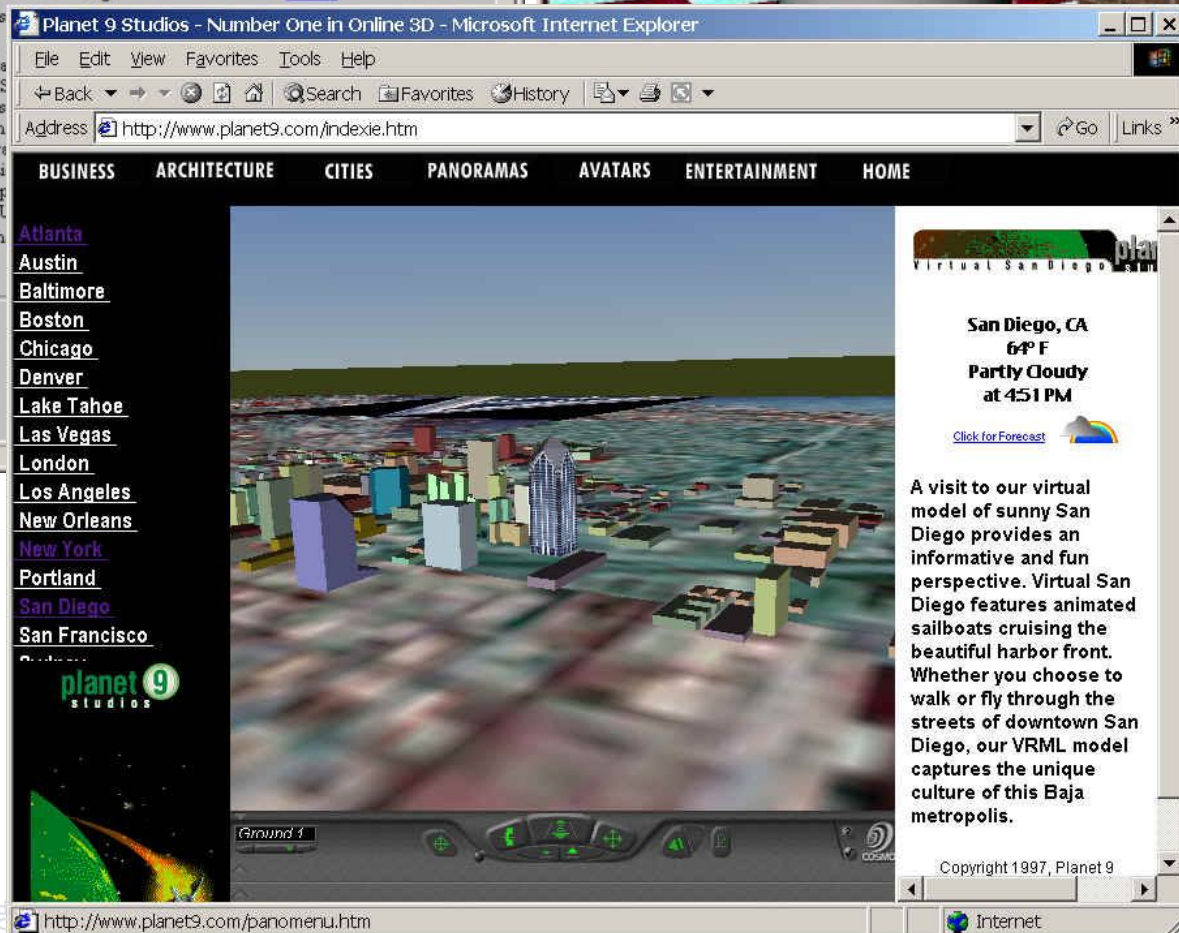
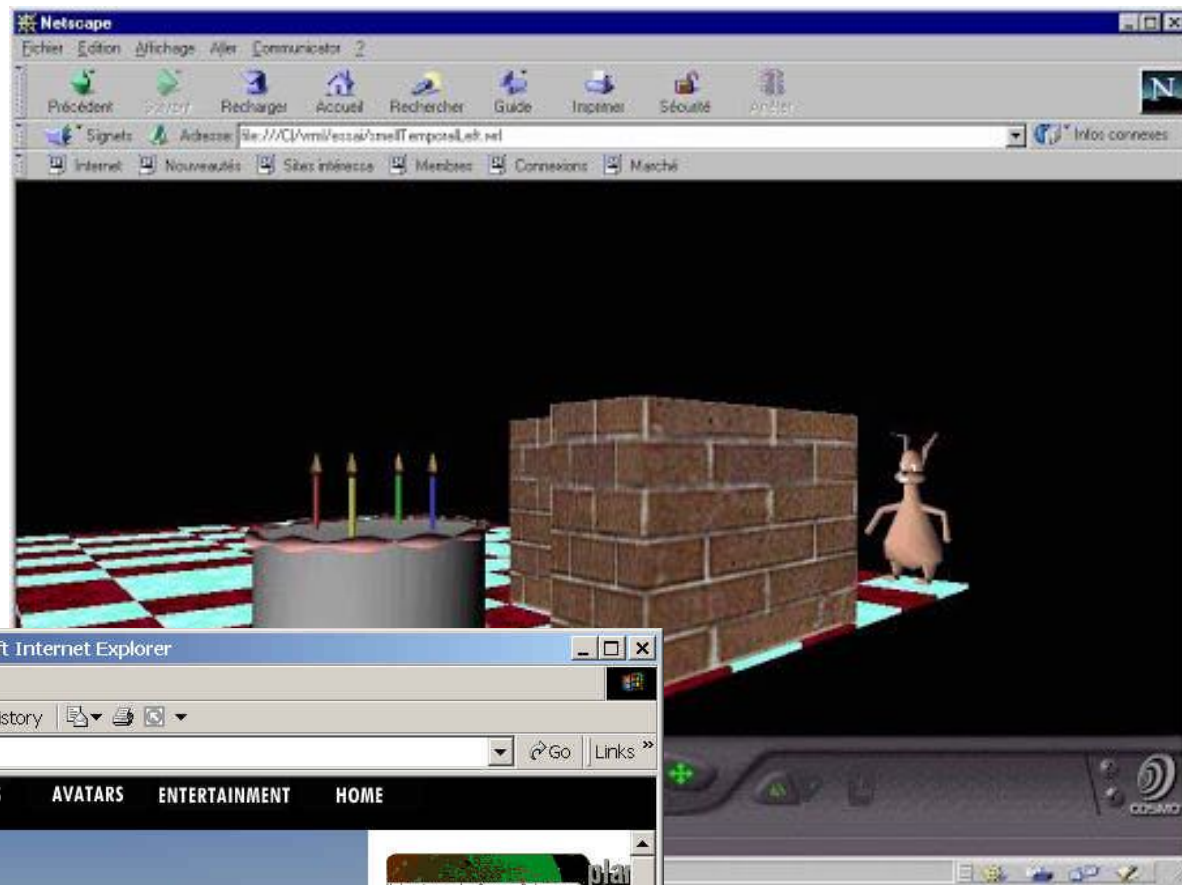
Infinite Office Concept



May 2021



VRML 1997



Web 1.0

"The mostly read-only web"

250,000 sites



Published content



user generated content



45 million global users

1996

Web 2.0

"The widely read-write web"

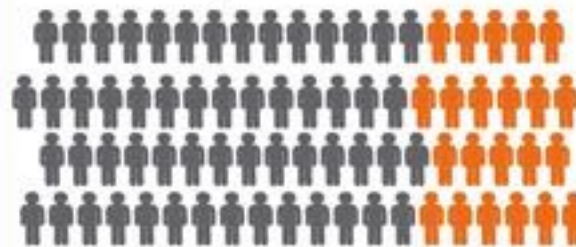
80,000,000 sites



Published content

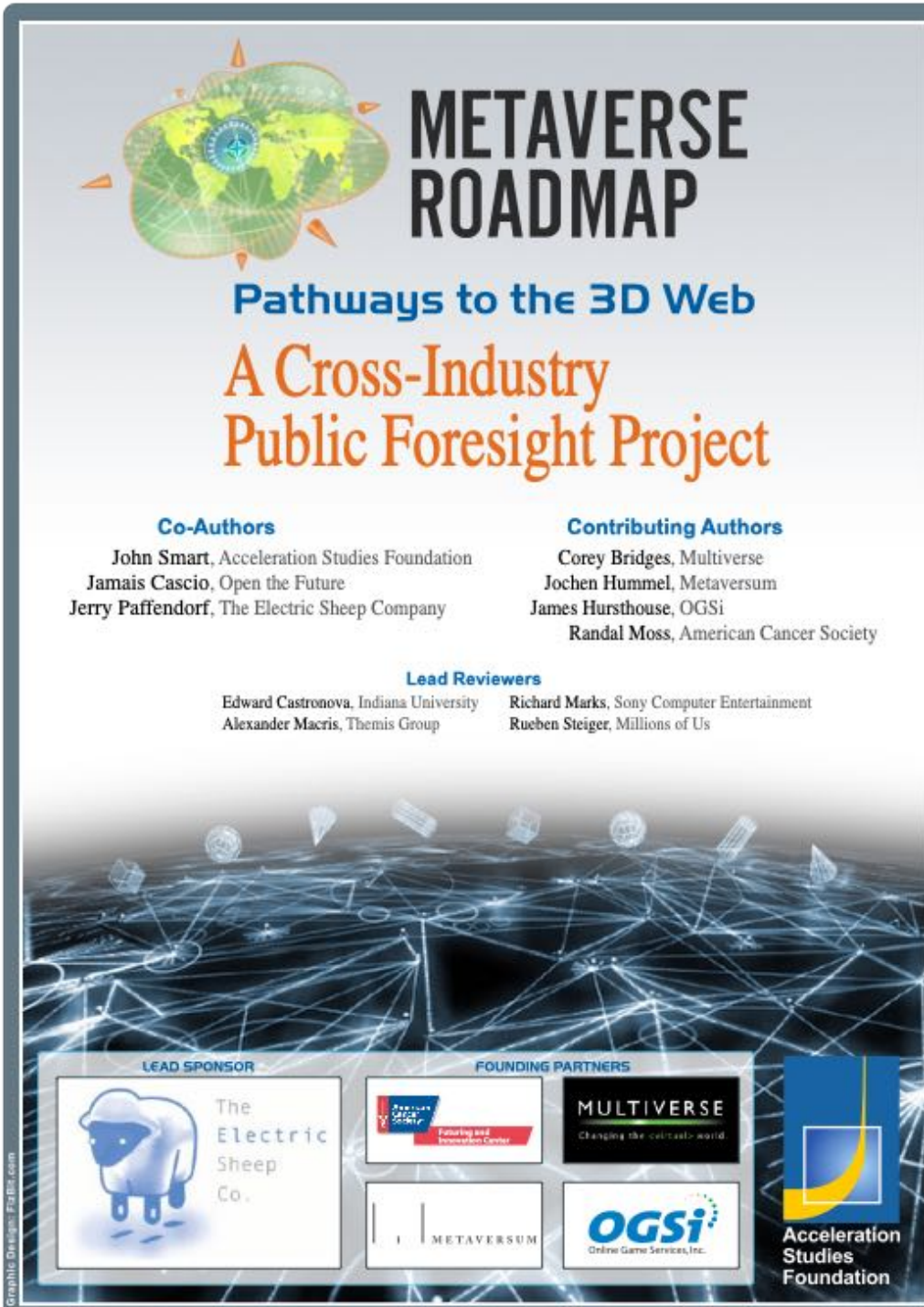


user generated content



1 billion+ global users

2006



METaverse ROADMAP


Pathways to the 3D Web






A Cross-Industry Public Foresight Project

Co-Authors
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Jamais Cascio, Open the Future
Jerry Paffendorf, The Electric Sheep Company

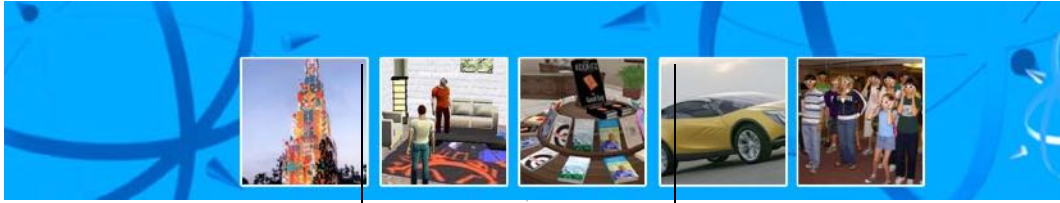
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Changing the virtual world.
 METAVERSUM
 OGSi
Online Game Services, Inc.
 Acceleration Studies Foundation

Metaverse Roadmap, 2007



What happens when video games meet Web 2.0? When virtual worlds meet geospatial maps of the planet? When simulations get real and life and business go virtual? When you use a virtual Earth to navigate the physical Earth, and your avatar becomes your online agent? **What happens is the metaverse.**

Introduction

Over the past year the Acceleration Studies Foundation (ASF) and its supporting foresight partners have explored the virtual and 3D future of the World Wide Web in a first-of-its-kind cross-industry public foresight project, the Metaverse Roadmap (MVR). We use the term Metaverse in a way that includes and builds upon Neal Stephenson's coinage in the cyberpunk science fiction novel, *Snow Crash*, which envisioned a future broadly reshaped by virtual and 3D technologies.

The MVR has "near-term" anticipation horizon of ten years (to 2017), a "longer-term" speculation horizon of twenty years (to 2025), and a charter to discover early indicators of significant developments ahead. Seeking diverse points of view, our process included an invitational Metaverse Roadmap Summit, public and expert surveys, a few workshops and roundtables at major U.S. conferences, social meetups, and a public wiki. Many helpful people from the IT, virtual worlds, professional, academic, futurist, and lay communities contributed ideas to the MVR.

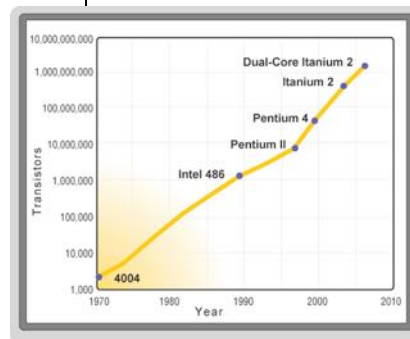
In its inaugural version, the MVR focuses on defining and exploring this major new social space. In future versions we expect to add industry-developed timelines for Metaverse technology development. Our inaugural MVR budget was roughly \$100K, paid for by our generous financial sponsors. With the resources provided we endeavored to be as multinational and inclusive as possible. With greater recognition, more visibility and more sponsorship support, we look forward to bringing an even broader range of expertise to the next version of the roadmap.

The MVR comprises two documents, both available at MetaverseRoadmap.org: 1) a set of [MVR Inputs](#) (75 pages) which summarize key insights in 19 foresight categories, and 2) this MVR Overview (22 pages + Appendix) which synthesizes some (not all) of the Inputs into a series of narratives to explain important features of the change and opportunity ahead.

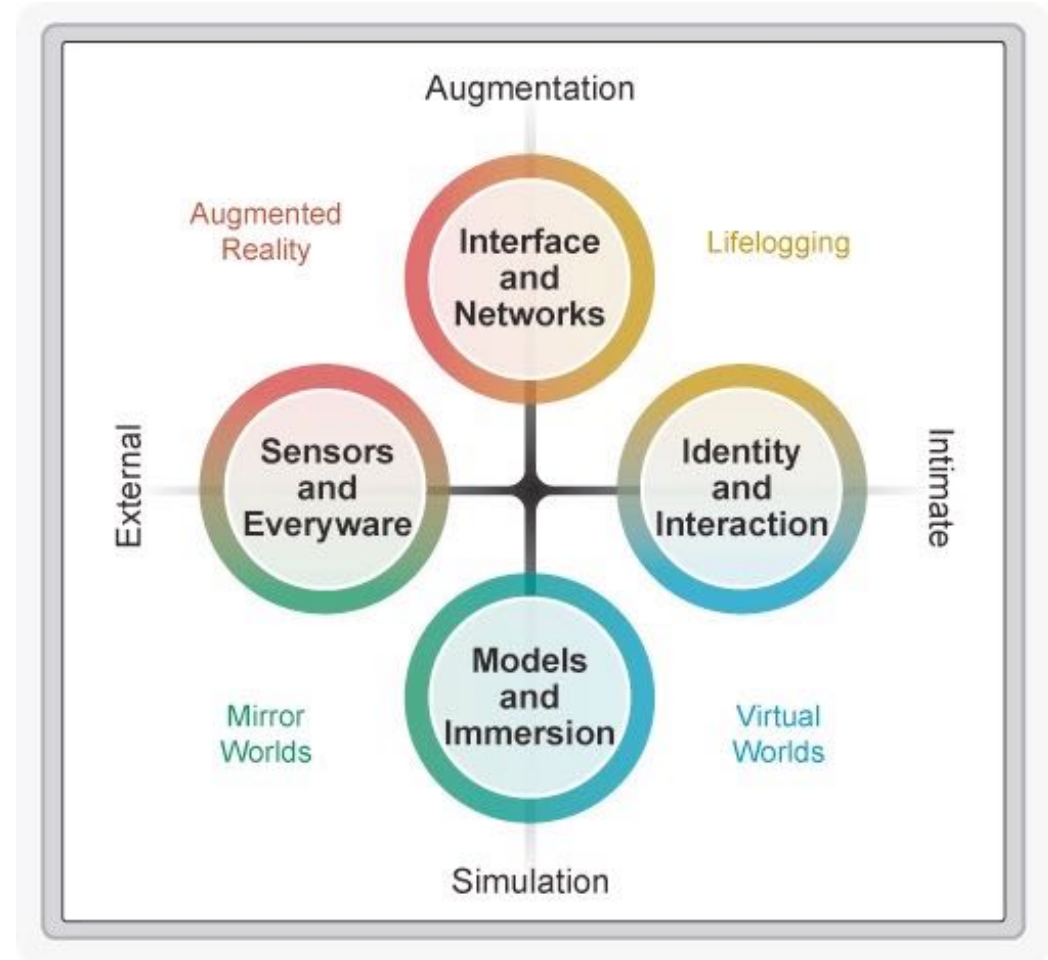
The goal of the MVR project is to regularly update our ten- and twenty-year public foresight by

periodically seeking the guidance of experts at sponsored MVR summits, and engaging in extended interaction with online communities through the use of blogs, wikis, podcasts, and other media channels.

We invite you to contribute your unique insights to future Metaverse Roadmap summits, conversations, and updates through feedback, volunteer effort, and financial support. In these early days of the Metaverse, financial sponsorship is particularly helpful to improving the quality of future roadmaps. Email us at roadmap@accelerating.org.



Moore's Law: A doubling of real computing power has occurred every 2.3 years, on average, since the birth of modern computing. Moore's Law is one of several enabling technological trends for Metaverse development.



ASF – 메타버스 2.0

■ 증강현실 (Augmented Reality)

▪ 현실에 판타지와 편의성을 입힘

- 현실공간에 2D 또는 3D로 표현되는 가상의 물체를 겹쳐 보이게 하면서 상호작용하는 환경

라이프로깅 (Lifelogging)

▪ 내 삶을 디지털 공간에 복제

- 사물과 사람에 대한 일상적인 경험과 정보를 캡처하고 저장하여 다른 사람들과 공유

거울세계 (Mirror Worlds)

▪ 세상을 디지털 공간에 복제

- 실제 세계를 가능한 한 사실적으로, 있는 그대로 반영하되 정보를 확장

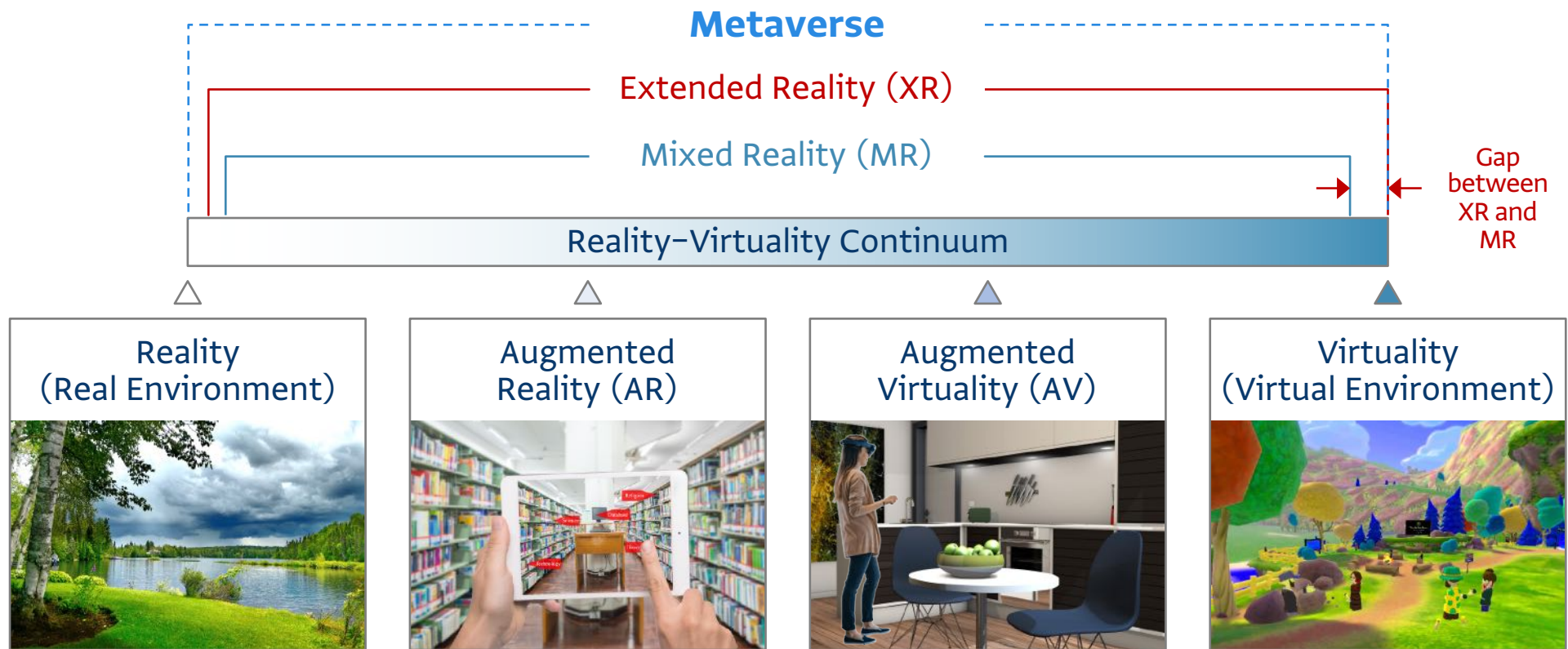
가상세계 (Virtual Worlds)

▪ 어디에도 없던 세상을 창조

- 현실과 유사하거나 혹은 완전히 새로운 세계를 디지털 데이터로 구축

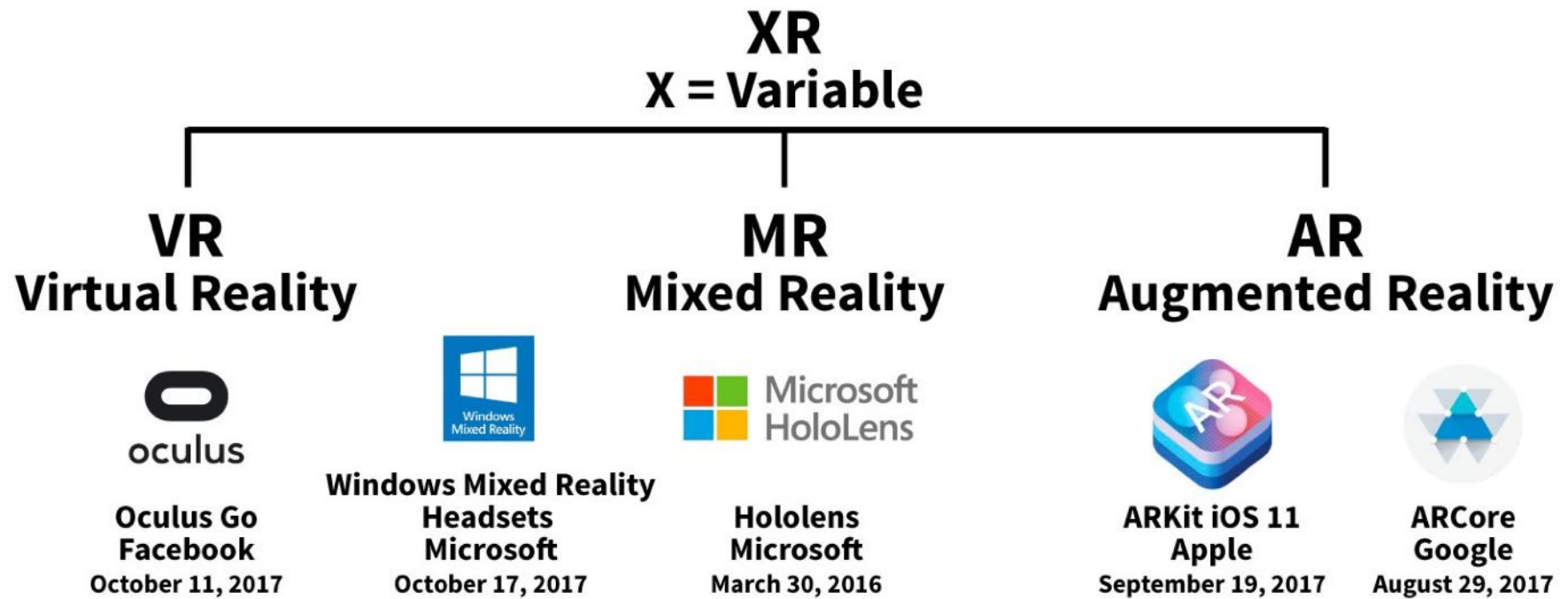
가상증강현실, 확장현실, 메타버스

- 현실에서 **현실-가상융합**을 통해 **시공간의 한계를 넘어** 다양한 형태의 **연결, 소통, 협업** 등을 지원하는 **실감 체험 기술**

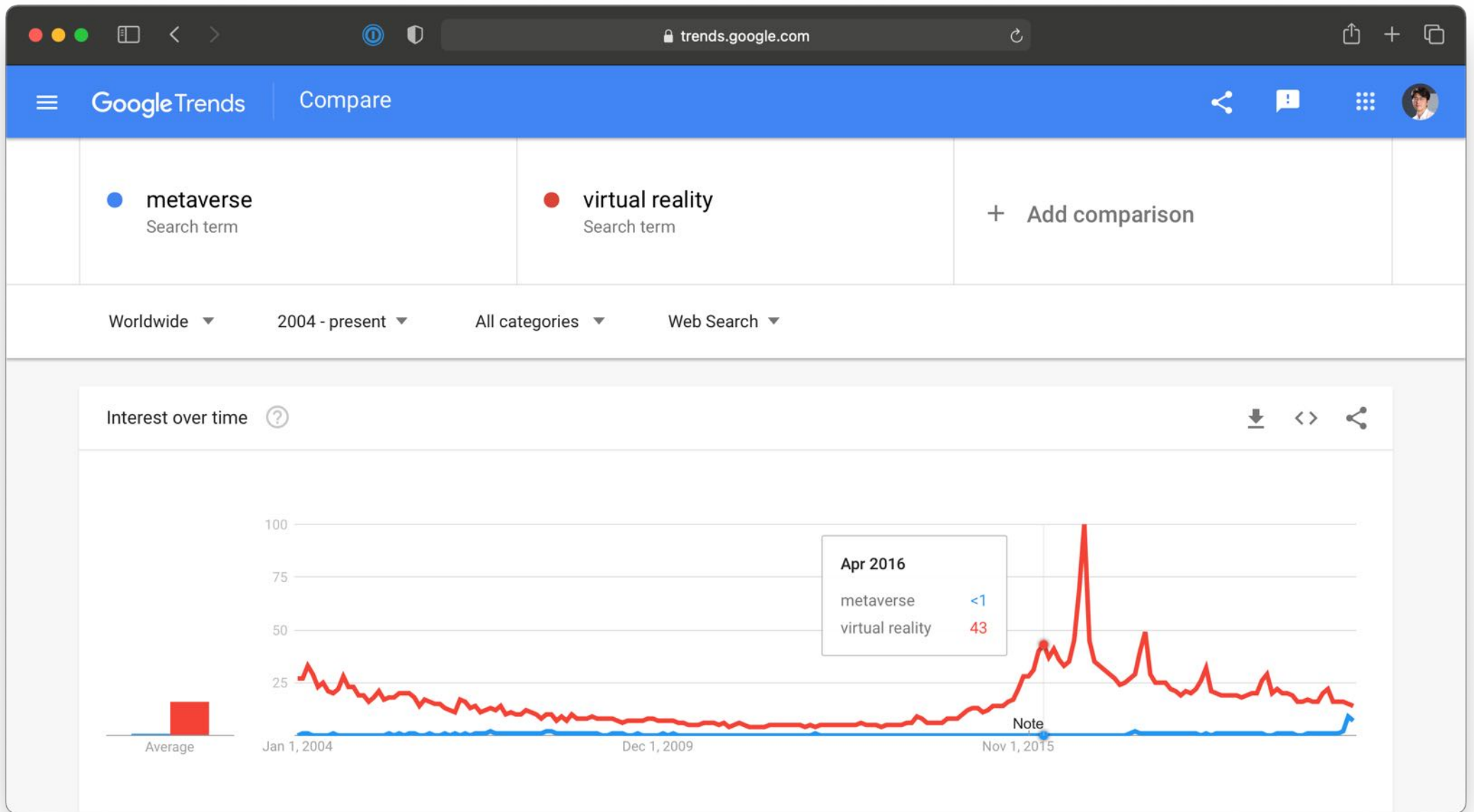


XR and **Metaverse** concept expanded from Milgram's Continuum (Yoo, 2021)

XR



What Are All These Realities? VR, MR, AR and XR 101, December 15, 2017,
<https://www.achao.design/inspire/what-are-all-these-realities-vr-mr-ar-xr-101>





HOME > News > ICT

Profitable VR Sector

VR Devices Contribute to Boosting Galaxy S7, Edge Sales

By Cho Jin-young | April 28, 2016, 05:30



Samsung Electronics' Virtual Reality (VR) devices help boost sales of the Galaxy S7

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- 10 Handok Licenses out Anti-cancer Drug T...



Oculus Rift Begins Shipping

By Dian Schaffhauser | 03/28/16



Rift has arrived. Oculus announced [in a blog](#) that it had begun shipping its virtual reality (VR) headset first to those who invested in its idea through [Kickstarter](#). Next, pre-ordered Rifts will ship out, starting "mid-week."

Everybody else will have to hold on until July. That's when the \$599 units are

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- 3 Upcoming Events, Webinars & Calls for Papers (Week of May 17, 2021)
- 4 6 Key Technologies Moving Teaching and Learning Forward in 2021
- 5 William & Mary Installs Virtual Classroom Tech for Hybrid Learning

TRENDING

- 1 COVID-19
- 2 Networking & Wireless
- 3 Teaching & Learning
- 4 Flipped/Blended

VR headset shipments 'to boom' in 2016

© 22 April 2016



Screenless VR systems that use a smartphone as a display would prove most popular, said IDC

More than nine million virtual reality (VR) headsets will be shipped in 2016, suggests research by analyst firm IDC.

Top Stories

DR Congo volcano eruption sparks mass evacuation

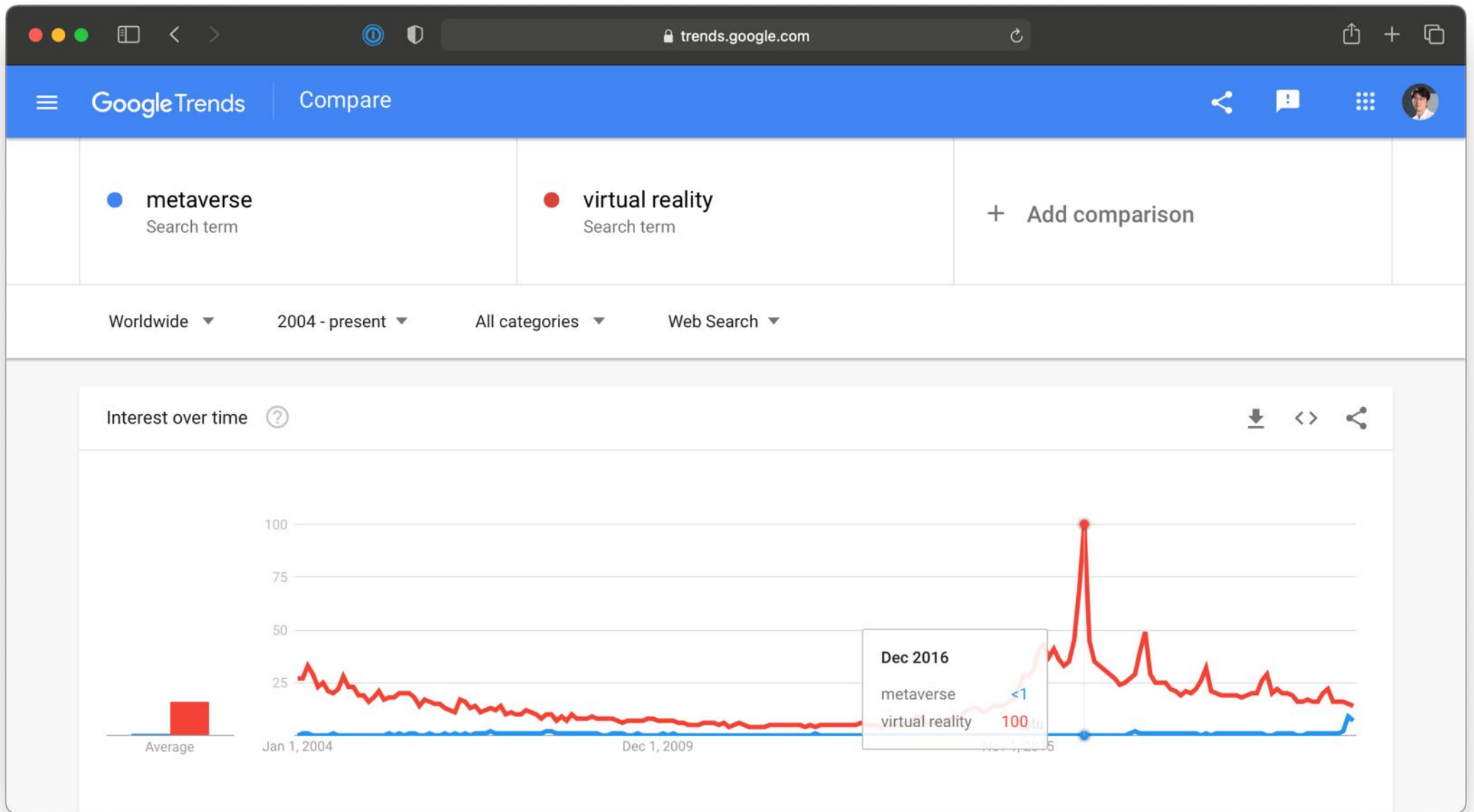
Thousands flee the city of Goma as nearby Mount Nyiragongo throws huge lava fountains into the air.

1 hour ago

India reports nearly 9,000 'black fungus' cases

IDC said it expected about two million headsets from Oculus, HTC and Sony to be shipped to consumers in 2016. The Oculus Rift headset began shipping on 28 March, HTC Vive headsets are due to start being dispatched this month and Sony's PlayStation VR should be available in October.

All these headsets are called "tethered" systems because they work with a PC or a game console that pipes images to their display.



Oculus announces new \$199 self-contained VR headset called Oculus Go, shipping in 2018

By [Adi Robertson](#) | [@thedextriarchy](#) | Oct 11, 2017, 1:23pm EDT

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Oculus sold \$5 million worth of Quest content in first 2 weeks on sale



Lucas Matney @lucasmtny / 9:33 AM GMT+9 • June 11, 2019

Comment



Image Credits: Facebook

f t in e u st standalone VR headset hasn't been out long, but VP

The Oculus Quest 2 was preordered five times as much as the original

Developers are also seeing increased sales

By [Sam Byford](#) | [@345triangle](#) | Oct 30, 2020, 3:00am EDT

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The Oculus Quest 2 (right) next to the original model. | Photo by Amelia Holowaty Krales / The Verge

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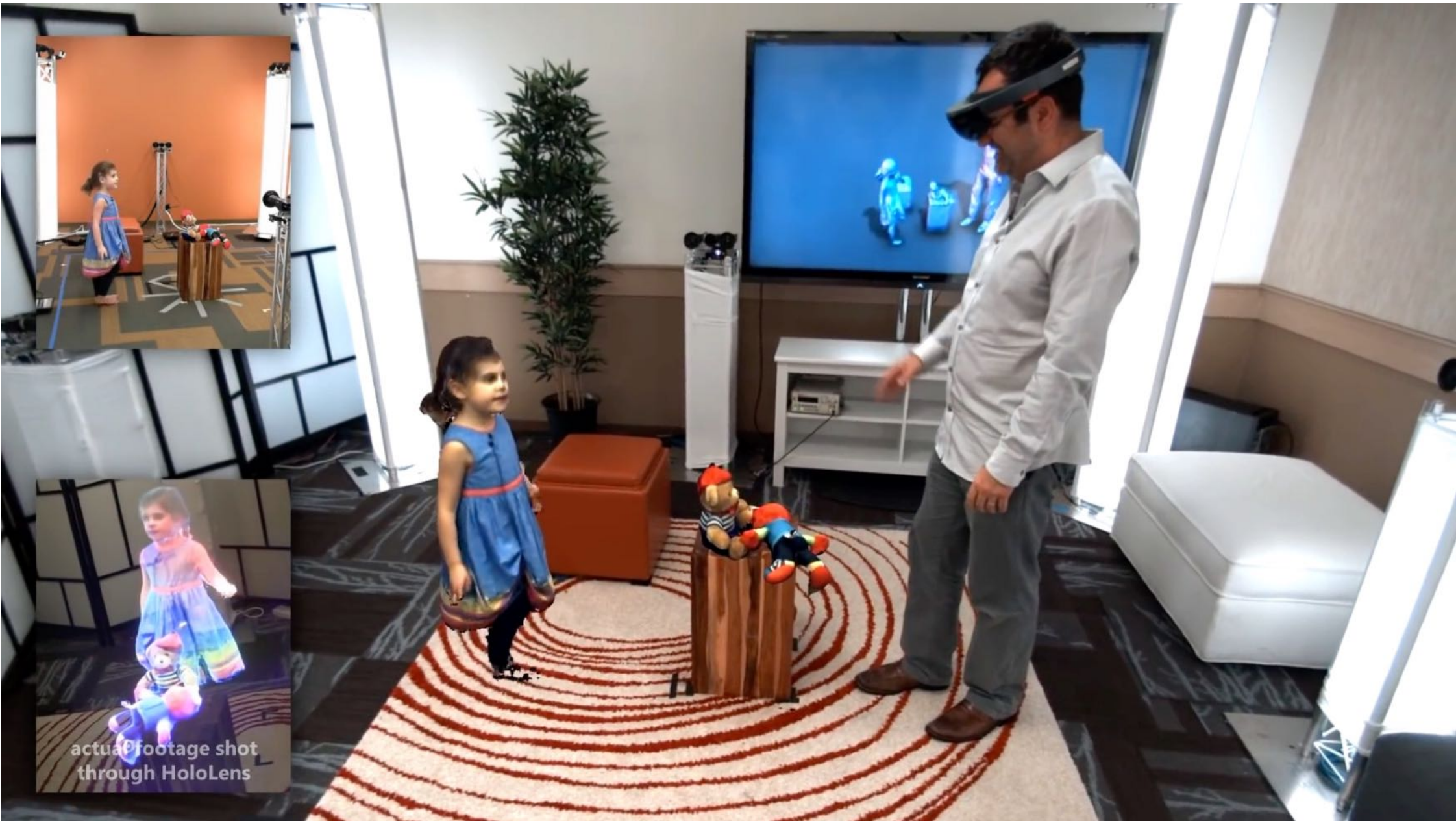
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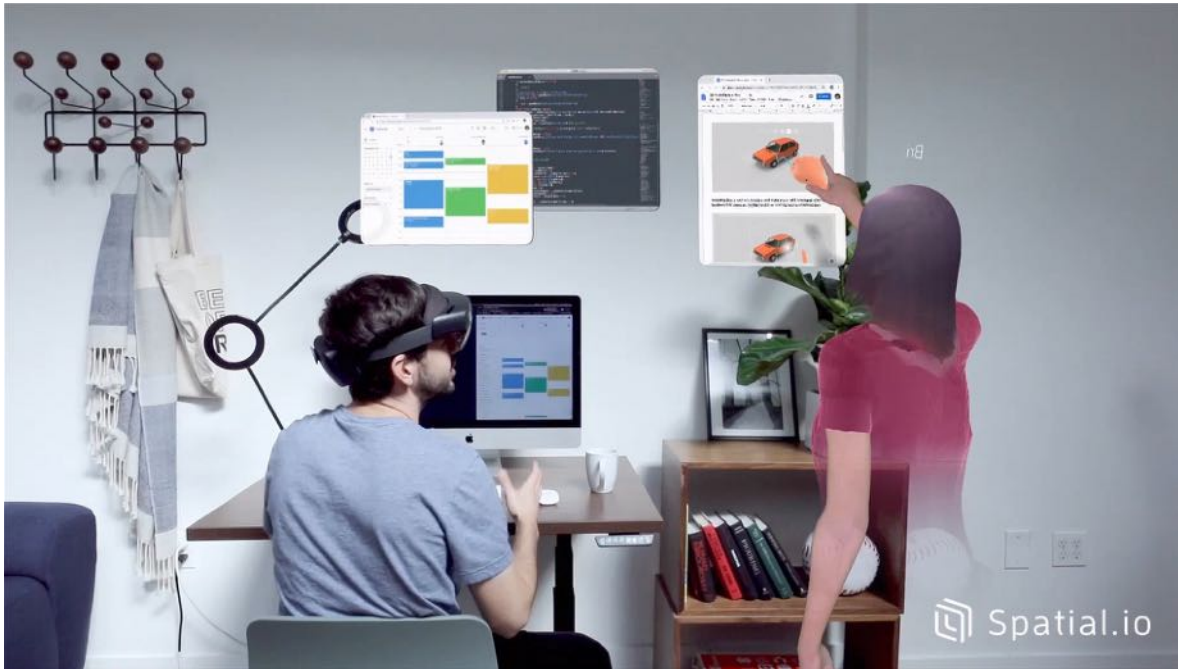
Holoportation 2016



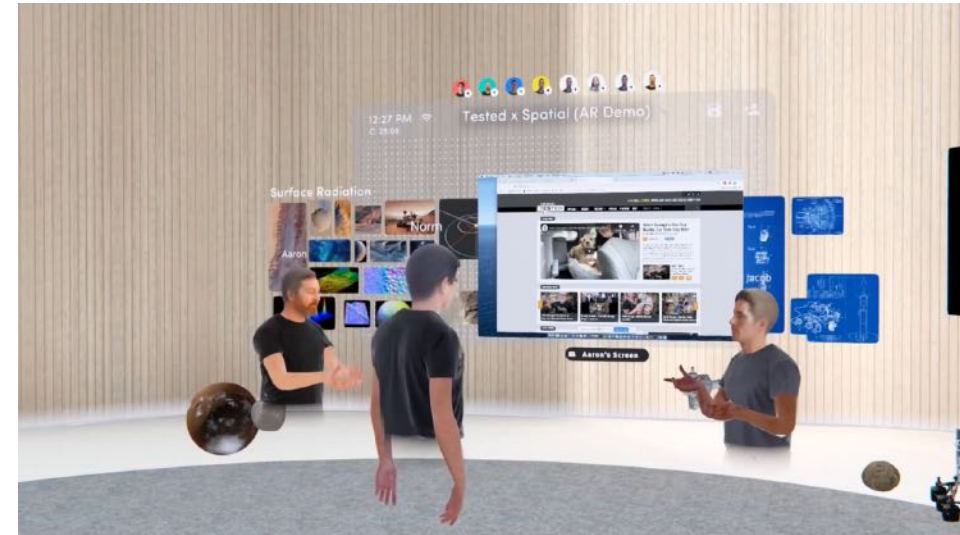
Spatial with HoloLens 2



Spatial



홀로렌즈 구동영상



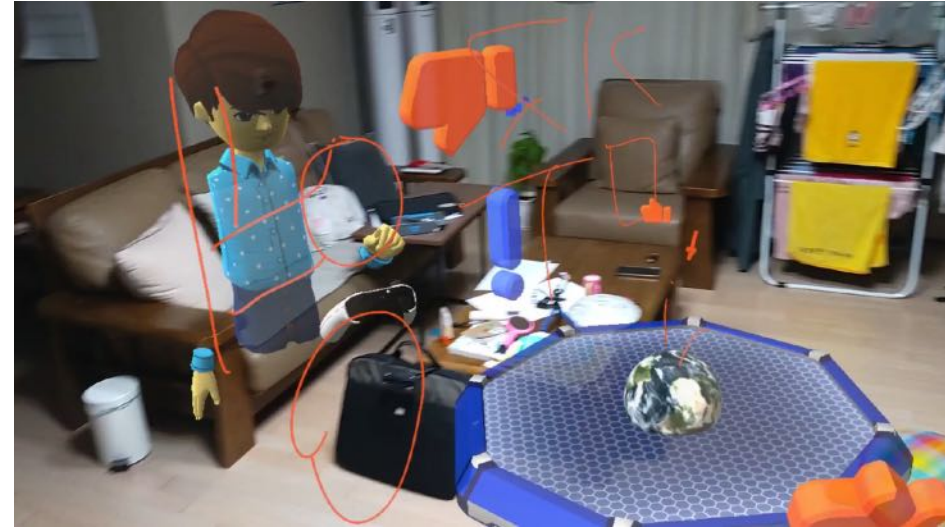
메타 퀘스트2 구동영상



o Spatial

- 최대참여자 50명 (mix of any device)
- VR/AR/MR (VR, Hololens2, PC, Mobile)
- 각자의 공간에 벽 하나를 기준으로 잡아 사용자, 객체 위치 Sync

Microsoft Mesh



o Microsoft mesh

- 최대참여자 8명
- MR (Hololens2 only)
- 객체 증강, 인터랙션, 가이드 기능

Horizon Workrooms



o Horizon workrooms

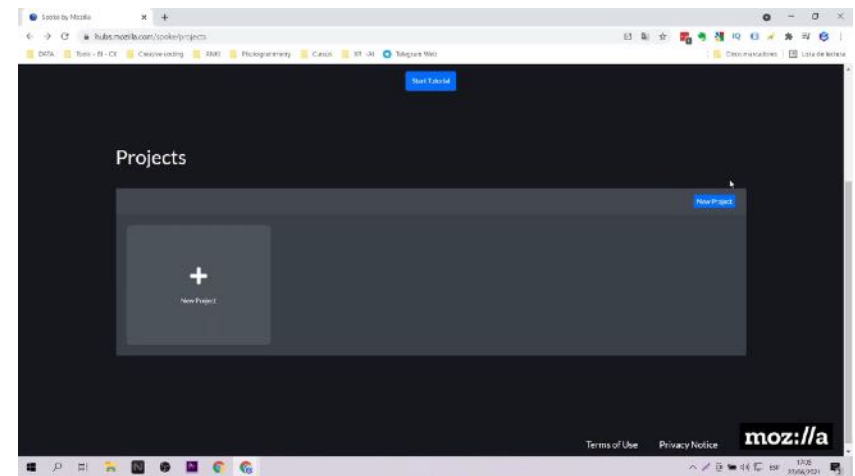
- 최대참여자 16명 (화상영상접속 + 34명)
- VR (Meta Quest2 Only)
- 자신의 자리(책상)를 기준으로 사용자 배치

Mozilla Hubs

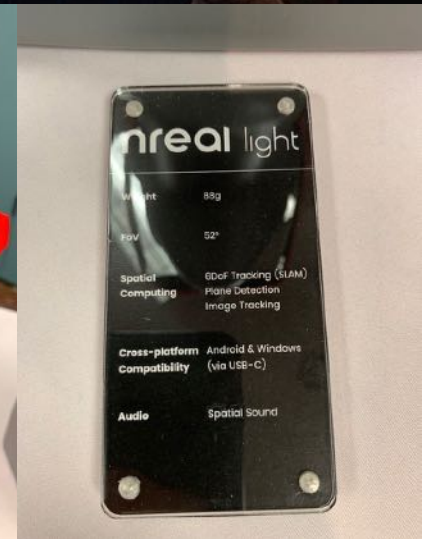


o Mozilla Hubs

- 최대참여자 50명
- VR/AR/MR (VR, Hololens, PC, Mobile)
- 가상공간에 위치한 spawn spot == 방 입장 시 현실 위치
- 컨트롤러로 사용자 네비게이션



AR 디바이스



과거의 원격지원 개념

CUSTOMER SUPPORT
IN THE PAST

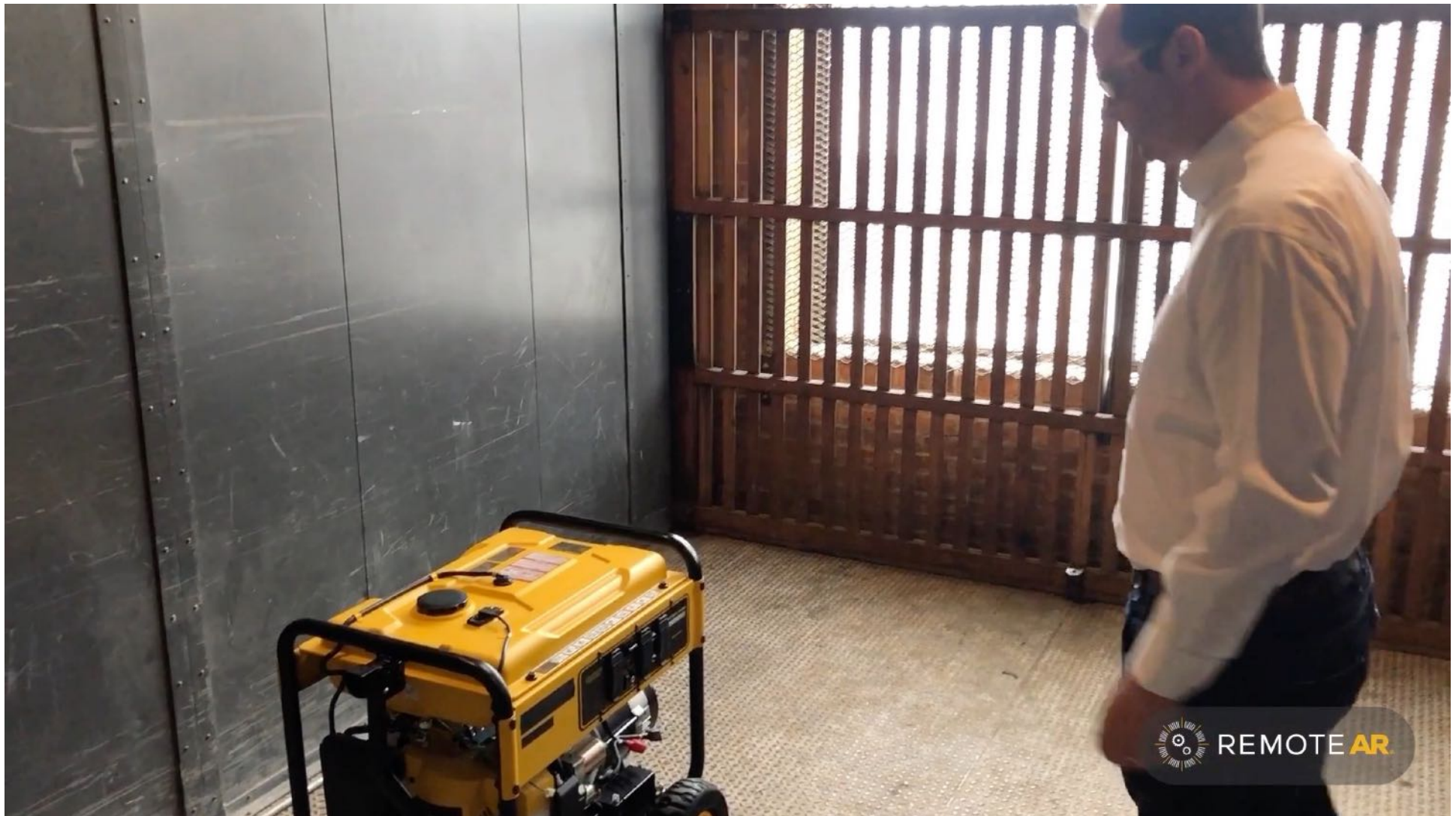
AR을 활용한 원격지원 개념



원격 AR 통화



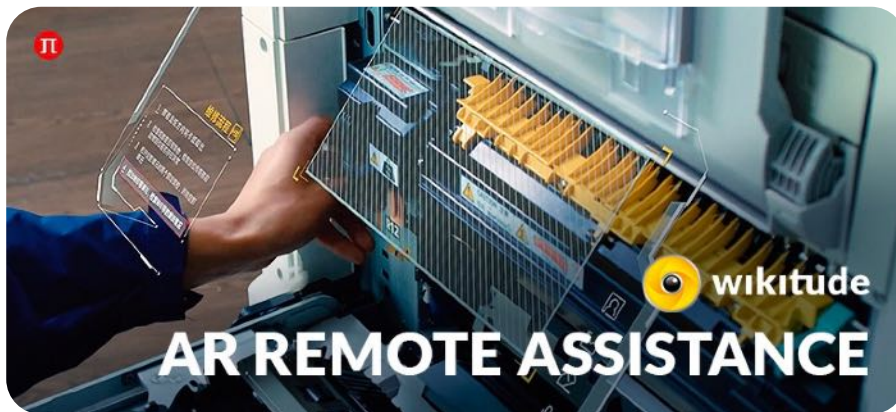
원격 AR 지원 - 단일 (증강현실) 메타버스



출처: Remote AR Youtube

기존 원격 협업 기술 (Remote AR)

- 현장의 AR과 원격지의 Remote AR을 이용한 협업
원격지의 VR 환경과 동시에 사용 불가능



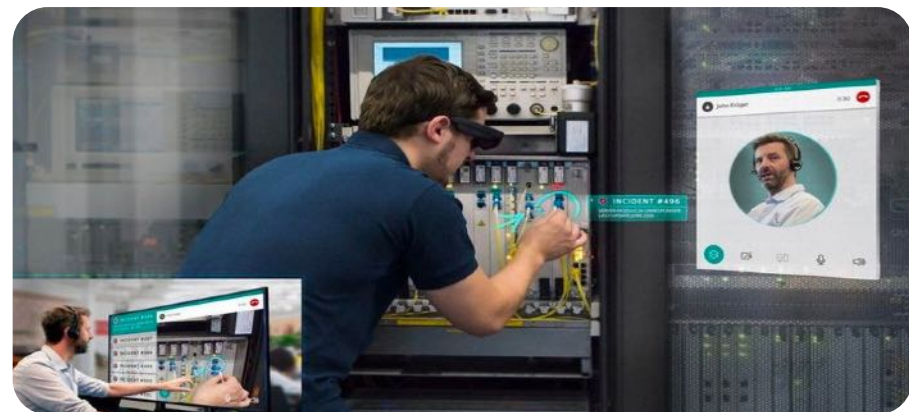
Wikitude



ScopeAR



MAXST



Reflekt

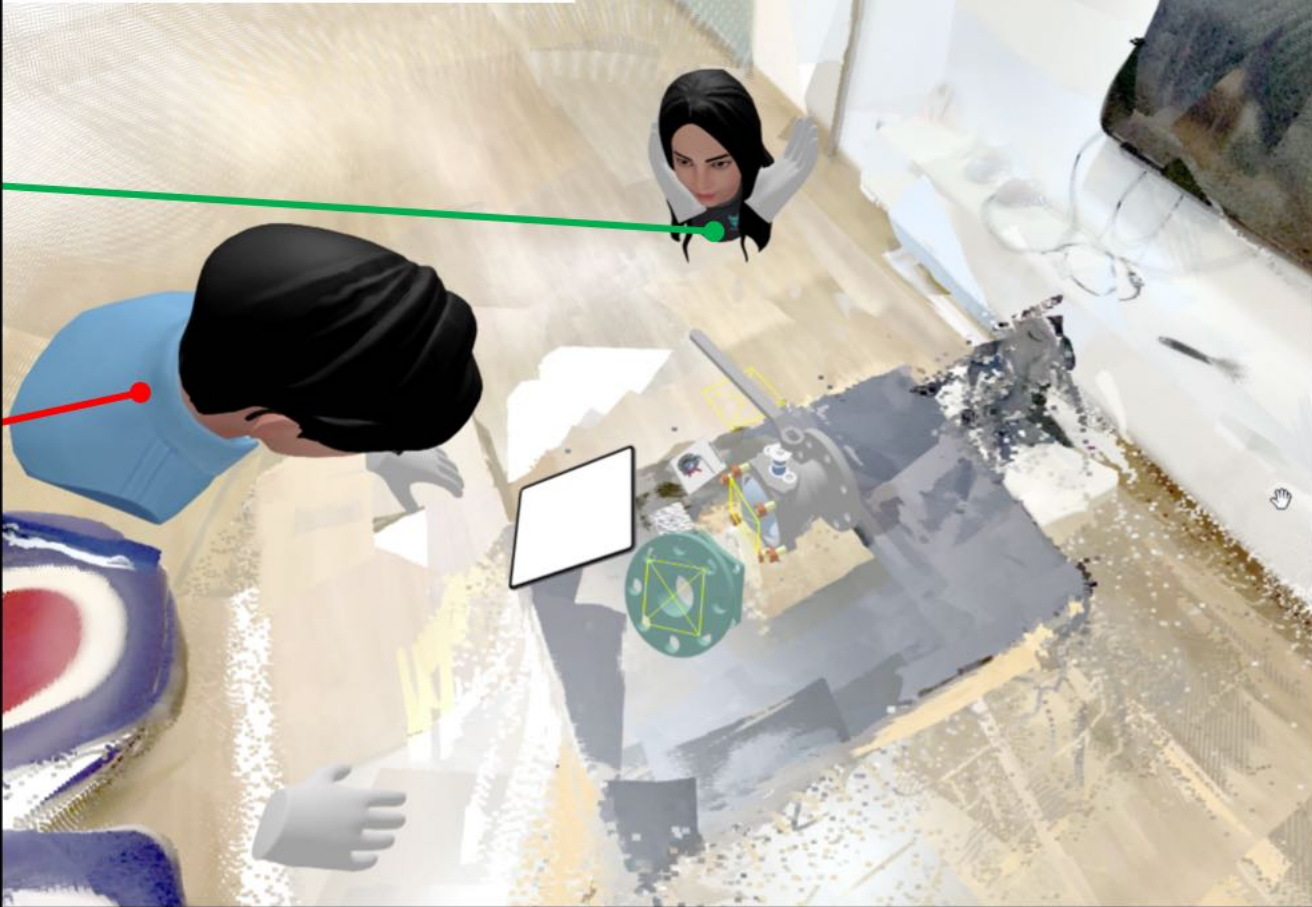
Cross-Metaverse 원격 협업

Remote VR

Cross-Metaverse



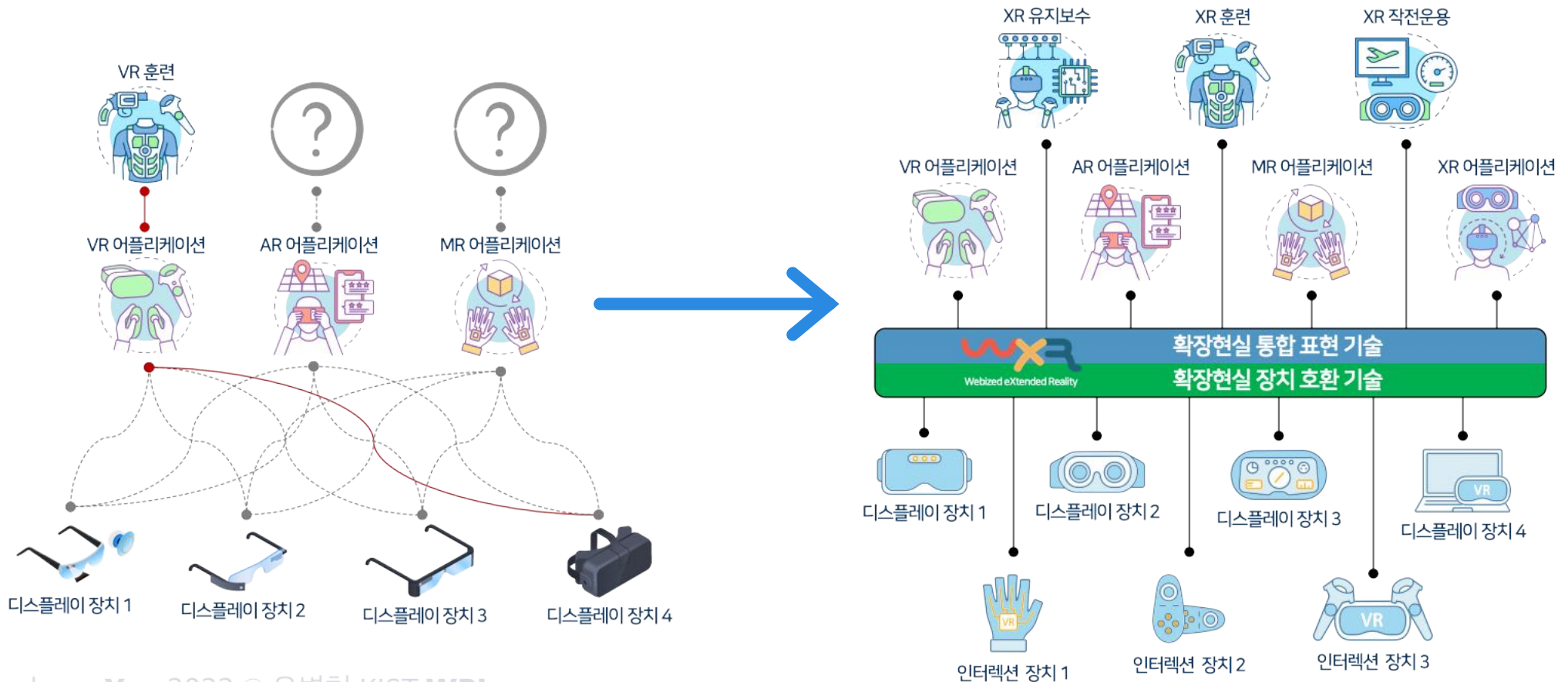
On-Site AR



AR/VR/MR 환경의 통합 표현

XR (AR/VR/MR) 환경에 무관한 XR 통합 표현 기술

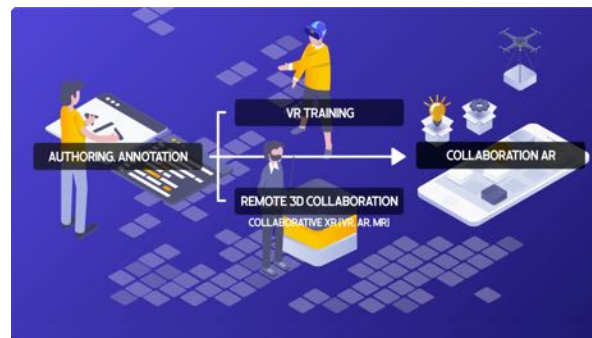
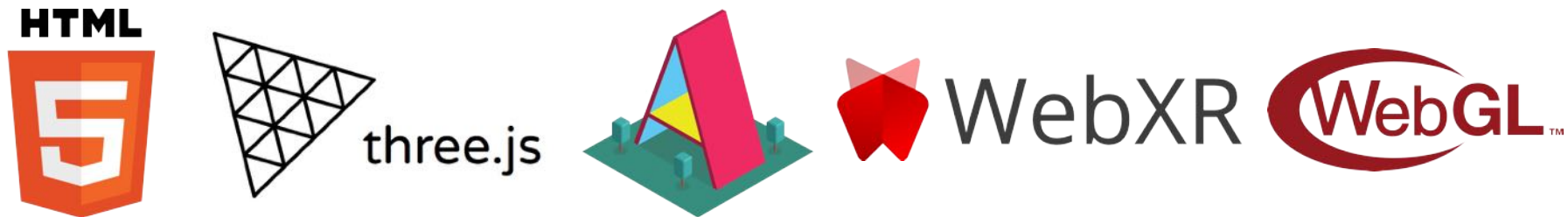
- KIST 자체 WebXR 기술 개발, W3C Immersive Web 표준 100% 호환
- 세계최초 AR/VR 단일 통합 표현, PCT, 미국, 중국 국제 출원



웹 기반 XR 운용 환경

웹 기반 다자간 XR 협업 플랫폼

- 순수 웹 표준 기반 WXR Library
- 3D, AR, VR 어떤 모드에서도 저작과 수정 및 상호 협업 가능
 - A-frame 프레임워크, Three.js, 게임패드 및 컨트롤러 입력을 매핑해주는 Gamepad API
 - HMD 트래킹, 컨트롤러 트래킹 등 WebVR 경험을 위한 WebXR Device API

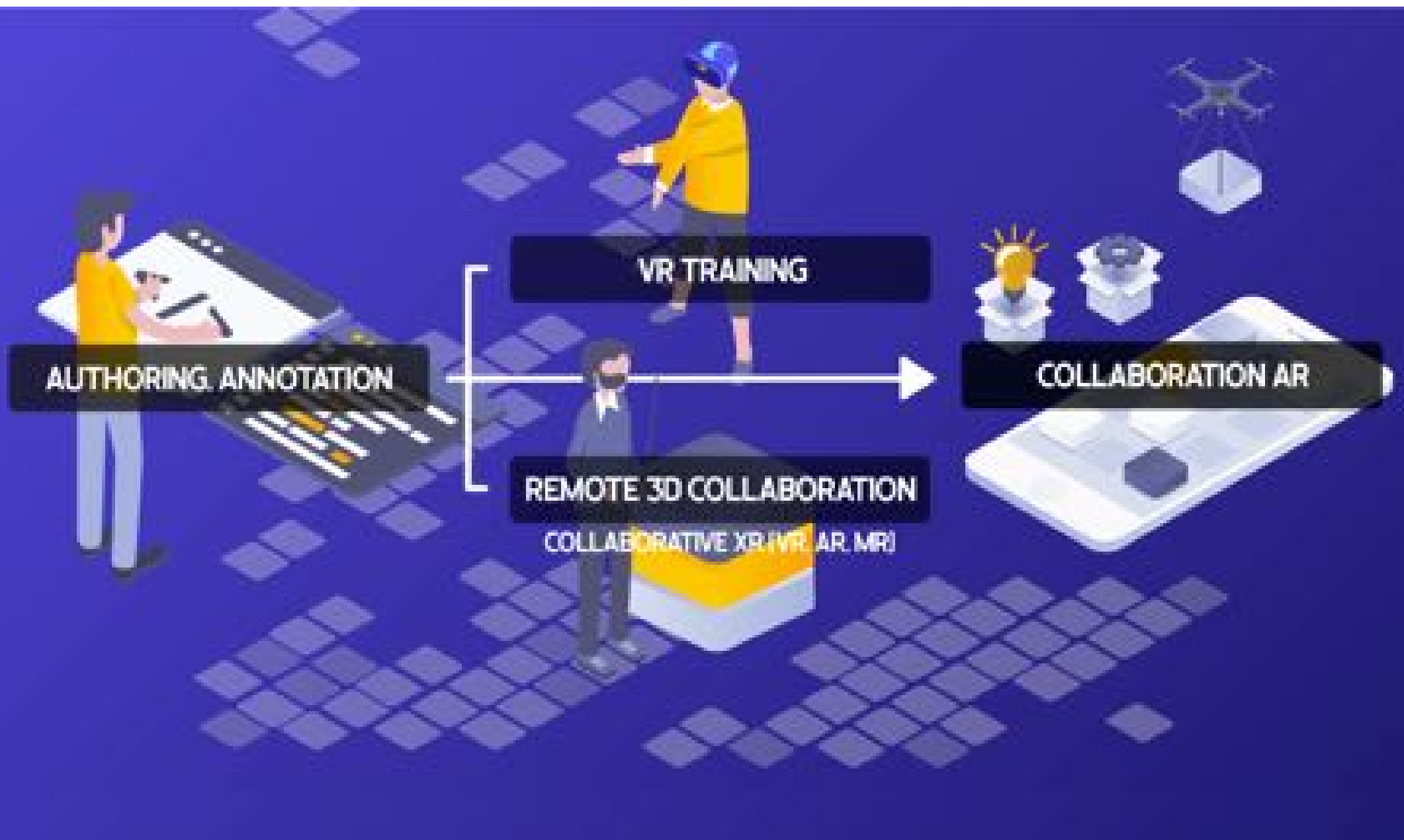


DESKTOP 3D

VIRTUAL REALITY

AUGMENTED REALITY



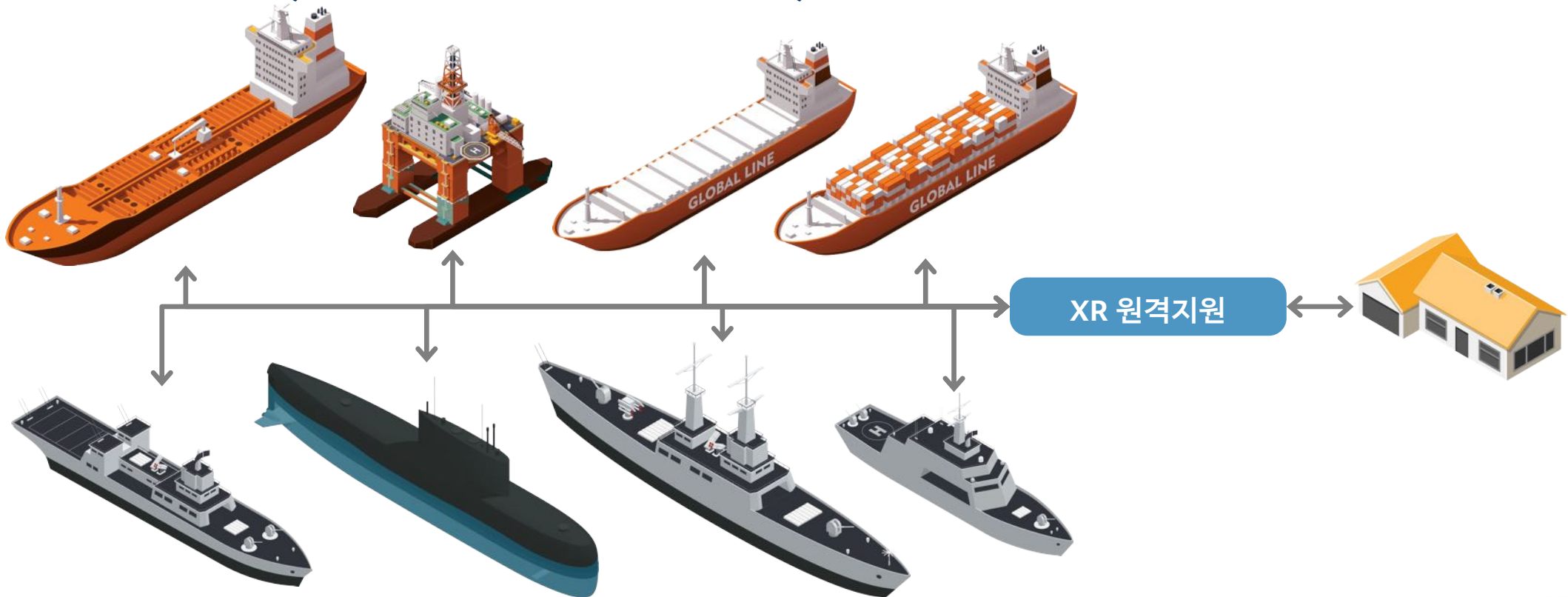


WXR을 이용하면 플랫폼별로 개발할 필요가 없음



적용 분야

- 상용 선박 및 해양 플랜트, 제조업, 국방 무기체계의 교육훈련, 원격지원 기술
 - 선박/해양 구조물, 특수선(군함), 해양 플랜트의 교육훈련, 원격정비
 - 대양, 오지의 전략 인프라 원격 정비
 - 대형 무인 공장, 사회기반시설(Infra)의 교육훈련, 운용 및 원격 정비



WORLD ECONOMIC FORUM

COMMITTED TO IMPROVING THE STATE OF THE WORLD



- 6. Collaborative Telepresence**
Soon participants in virtual gatherings will feel like they are physically together

The top 10 emerging technologies for 2019



1. Bioplastics for a Circular Economy



2. Social Robots



3. Tiny Lenses for Miniature Devices



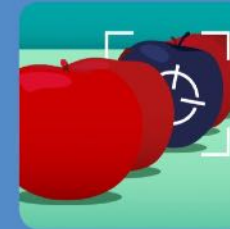
4. Disordered Proteins as Drug Targets



5. Smarter Fertilizers Can Reduce Environmental Contamination



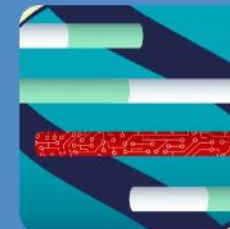
6. Collaborative Telepresence



7. Advanced Food Tracking and Packaging



8. Safer Nuclear Reactors



9. DNA Data Storage



10. Utility-Scale Storage of Renewable Energy



기업 뉴스

YTN

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두산, 5G 활용 굴삭기 8,500km 원격 조종

[5G법 만들자]① 뮌헨서 8500km 떨어진 인천 중장비 원격조종하다 사고 나면 누구 책임?

안별 기자

입력 2019.04.12 06:00



가

약 8500킬로미터(km) 떨어진 독일에서 한국에 있는 굴삭기를 원격 조종할 수 있는 시대가 열렸다. 5세대(G) 이동통신의 초저지연성 덕이다. 실시간에 가까운 속도로 반응해 지연 없는 원격조종이 가능해졌다. 지난 3일 세계 최초로 상용화된 5G 기술이 자리를 잡으면 원격조종뿐 아니라 자율주행·원격수술 분야 등에도 적용될 전망이다.

하지만 원격조종·원격수술시 사고가 날 경우 "누가 책임지느냐"가 화두로 떠올랐다. 제조사가 책임질 경우 산업 성장을 방해할 수 있고, 사용자가 책임질 경우 사용자 확보가 어려워질 수 있어서다. 또 기술적 결함인지 사용자 실수인지 가려내기 어려운 경우도 생길수 밖에 없다. 이 때문에 이 모든 것을 포괄하는 일명 '5G법'의 필요성이 제기되고 있다.

Perseverance Rover's Touchdown on Mars 2021



XR 기반 몰입형 원격협업 기술 동향



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