

IT2EC 2022
London
26 April 2022

Visualisation – Challenges & Opportunities

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FIMechE



Outline

- **XR and Collective Training**
- **Machines & Visualization**
- **The Metaverse & Visualization**

Visualisation

Cambridge Dictionary

- the act of visualising something or someone (= forming a picture of it in your mind)
- the act or an example of creating an image, etc. to represent something

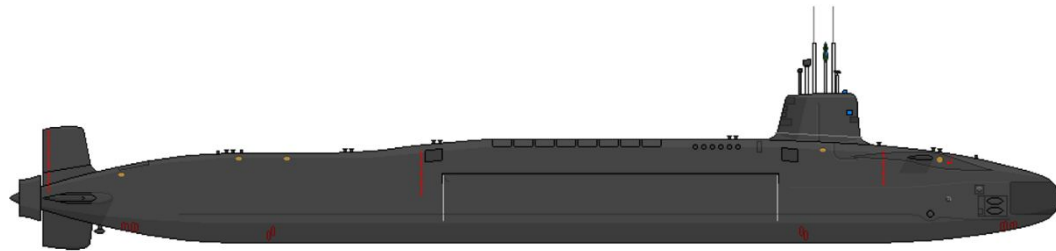
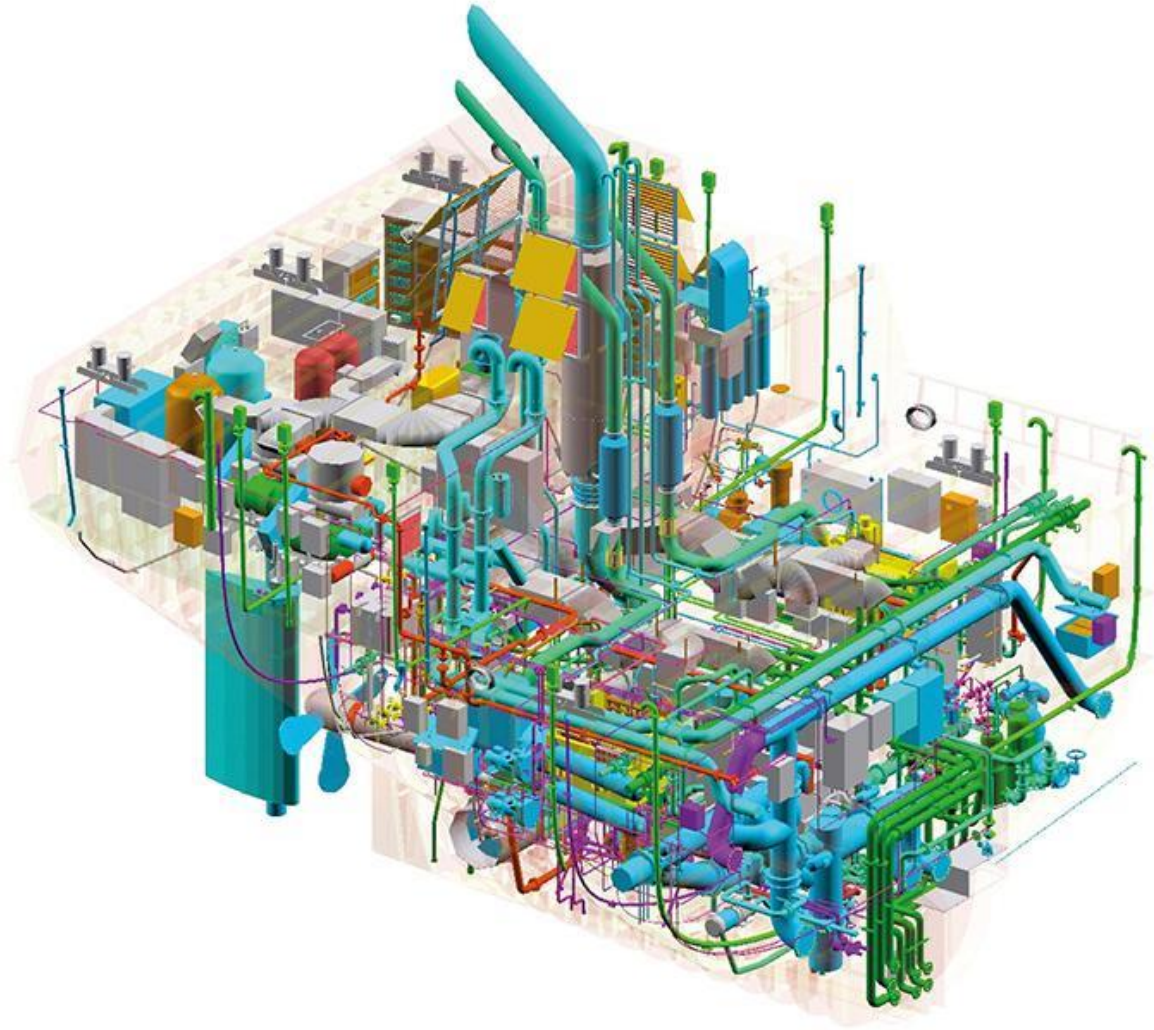


Wikipedia

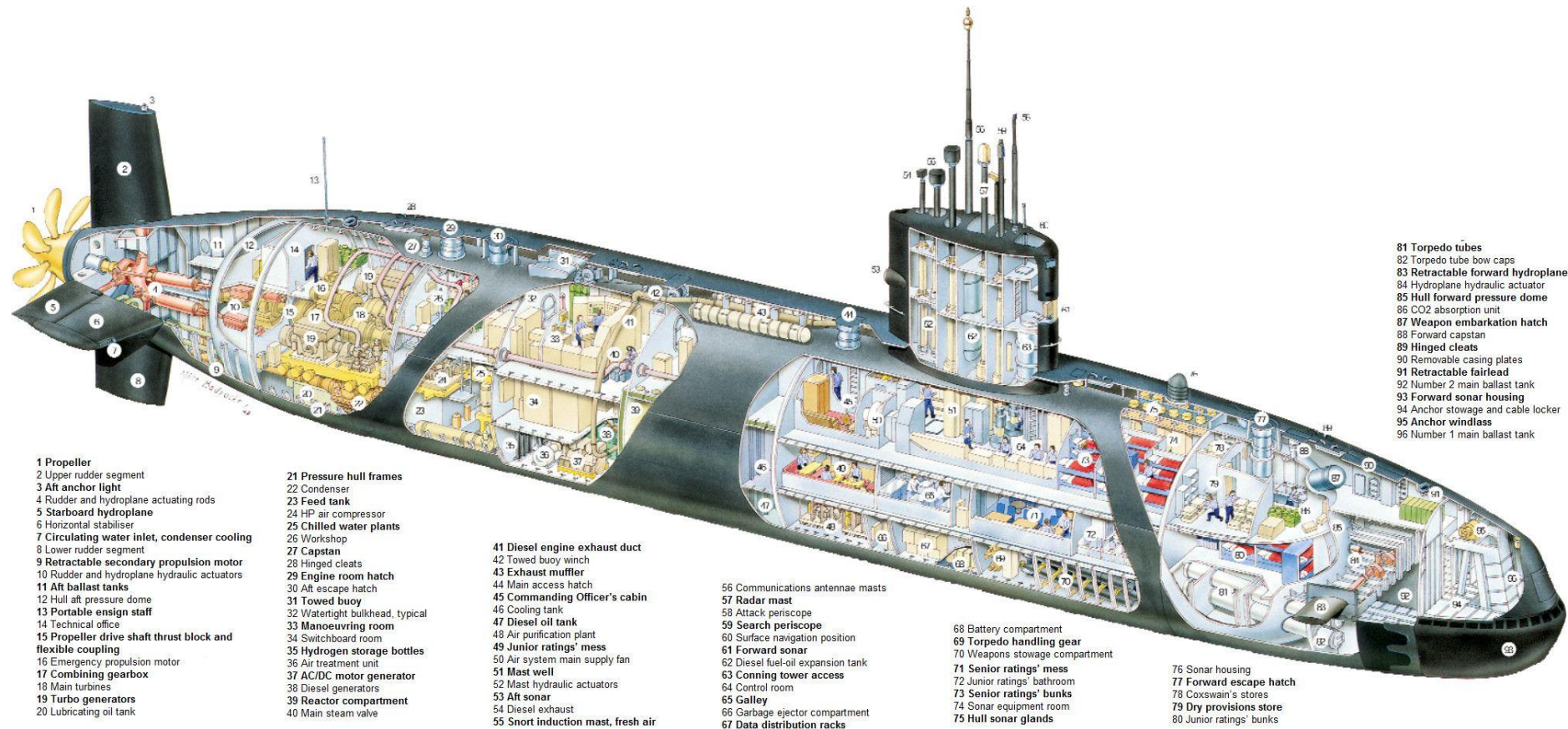
- any technique for creating images, diagrams, or animations to communicate a message



Visualisation - Physical 3D Models



Visualisation - Training & Operational Analysis



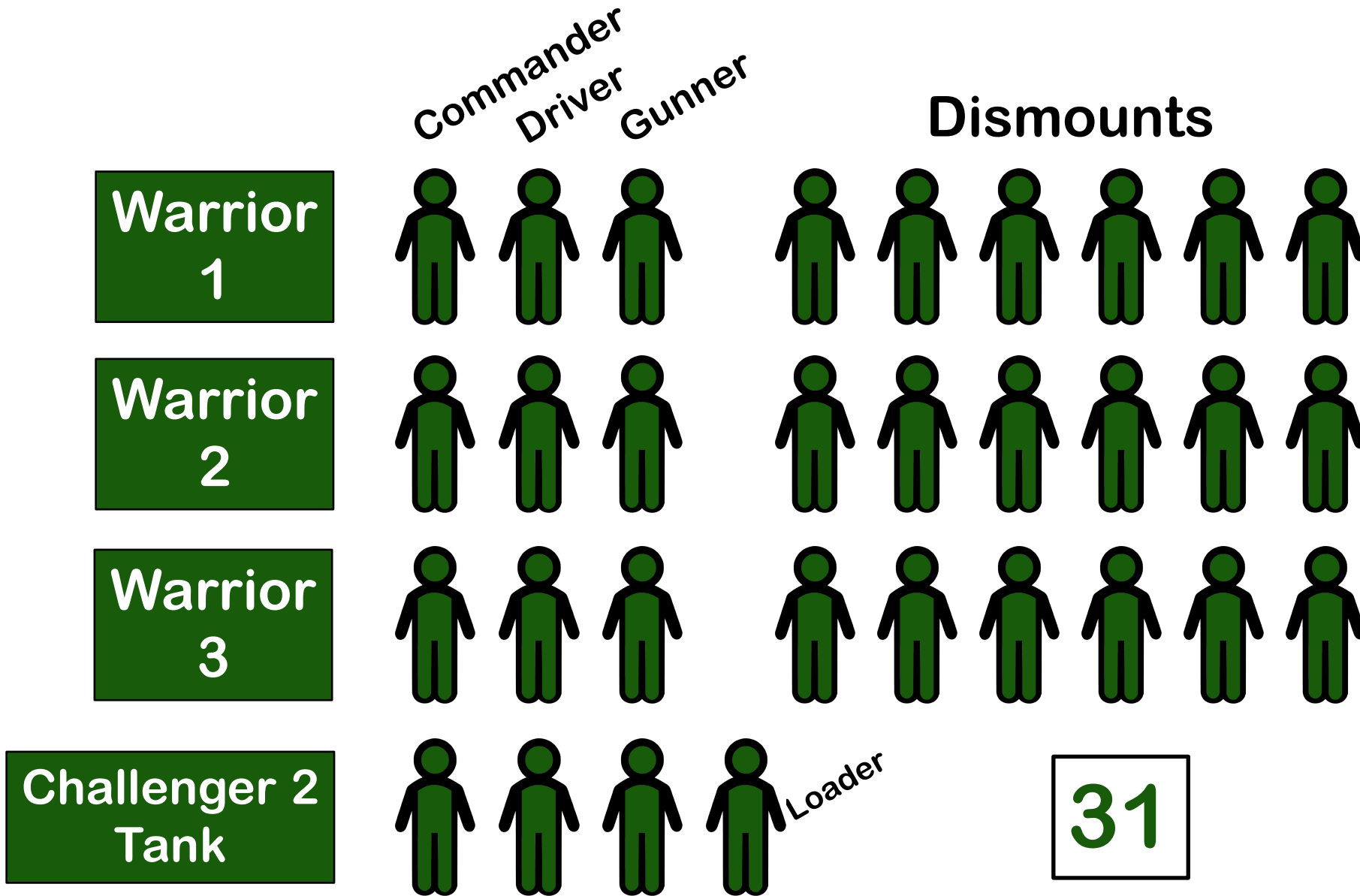
XR and Collective Training

The aim of the VRLT pilot was to identify the opportunities that Virtual Reality technology offers the (British Army) Future Collective Training System

UK Virtual Reality in Land Training (VRLT) Pilot



VRLT's Principal Training Audience



Collective Training Teamwork Taxonomy

- Leadership – character, knowledge and action that inspires
- Situation Awareness – shared mental model of team situation
- Decision Making – team collectively makes a choice
- Communication – right information, right people, right time
- Co-operation – team goals over individual's

VRLT ORBAT



UK VRLT

Battlesbury
Barracks,
Warminster
UK





VRLT1

The Video



Why VR for Collective Training?

- Immersive environment creates a challenging environment
- Can rapidly rehearse and repeatedly practice in a variety of scenarios
- Flexible, scalable, deployable and cost effective
- “in desktop simulation you look at the virtual world, in VR, you are in it”

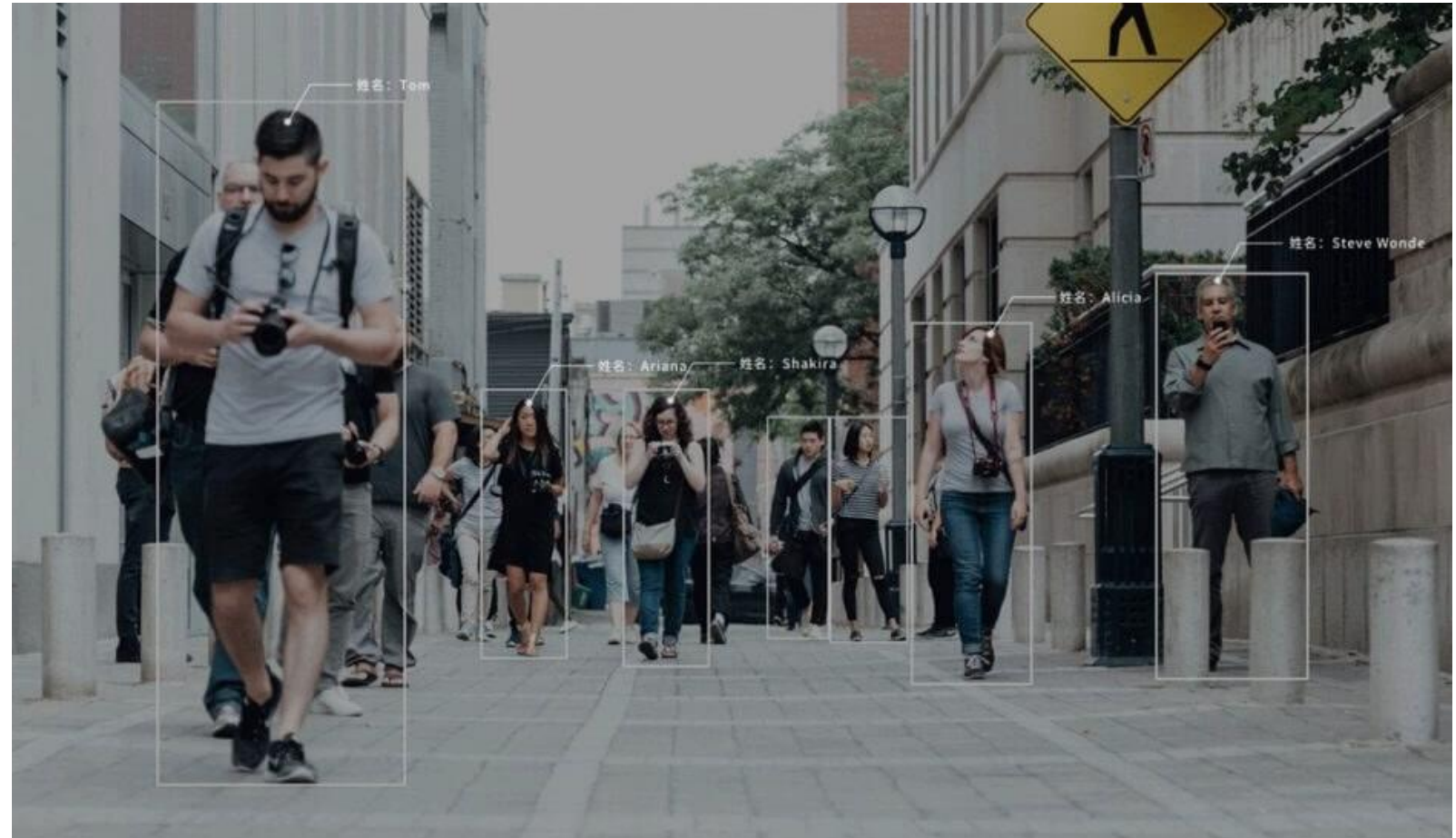


Recognition Issues — Personalised Avatar Face

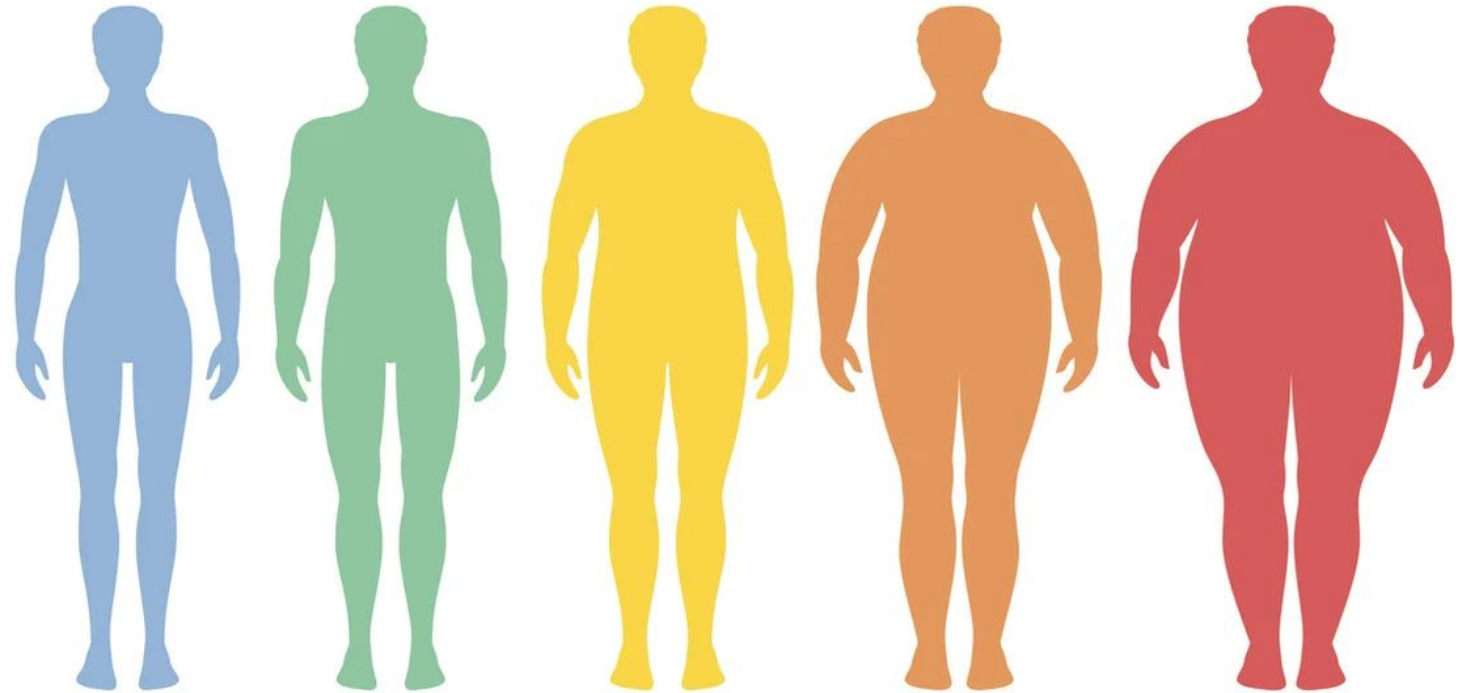


Recognition Issues — Gait

A gait is a pattern of limb movements made during locomotion.



Recognition Issues – BMI



Communication Issues — Hand Signals



Serious ArtikulationsTM

One	Two	Three	Four	Five
Six	Seven	Eight	Nine	Ten
You	Me	Come	Listen or I Hear	Watch or I See
Hurry Up	Stop	Freeze	Cover This Area	Go Here or Move Up
Enemy	Hostage	Sniper	Dog	Cell Leader
Column Formation	File Formation	Line Abreast Formation	Wedge Formation	Rally Point
Pistol	Rifle	Shotgun	Ammunition	Vehicle
I Understand	I Don't Understand	Crouch or Go Prone	Breach(er)	Gas



Unintentional Situational Awareness

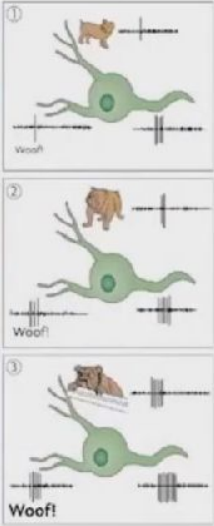


Good



Less good

Multisensory Integration



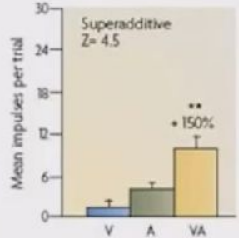
Multisensory integration

Visual Auditory Visual and auditory

V A VA

Impulses

500 ms



Mean impulses per trial

Superadditive $Z=4.5$

+150%

V A VA

Nature Reviews | Neuroscience

Steve Wozniak, Ph.D. It's 150 percent more than the current brain activation perspective of the single neuron." R. Stanford. "Multisensory integration: current brain activation perspective of the single neuron." *Nature Reviews Neuroscience* 9.4 (2008): 255-266.

Avatars: Finding a sense of self and others in the virtual world

829 views • 29 Mar 2021

18 0 SHARE SAVE ...

Microsoft Research 195K subscribers

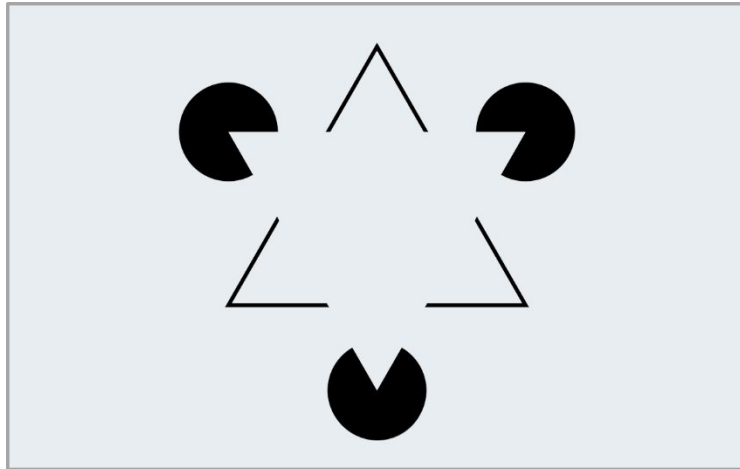
SUBSCRIBED

Multisensory Perception



Perception Challenges

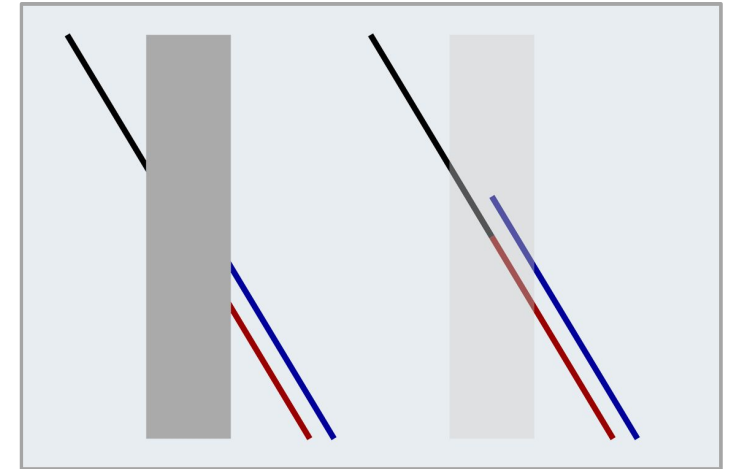
Kanizsa's Triangle



The Stroop Effect

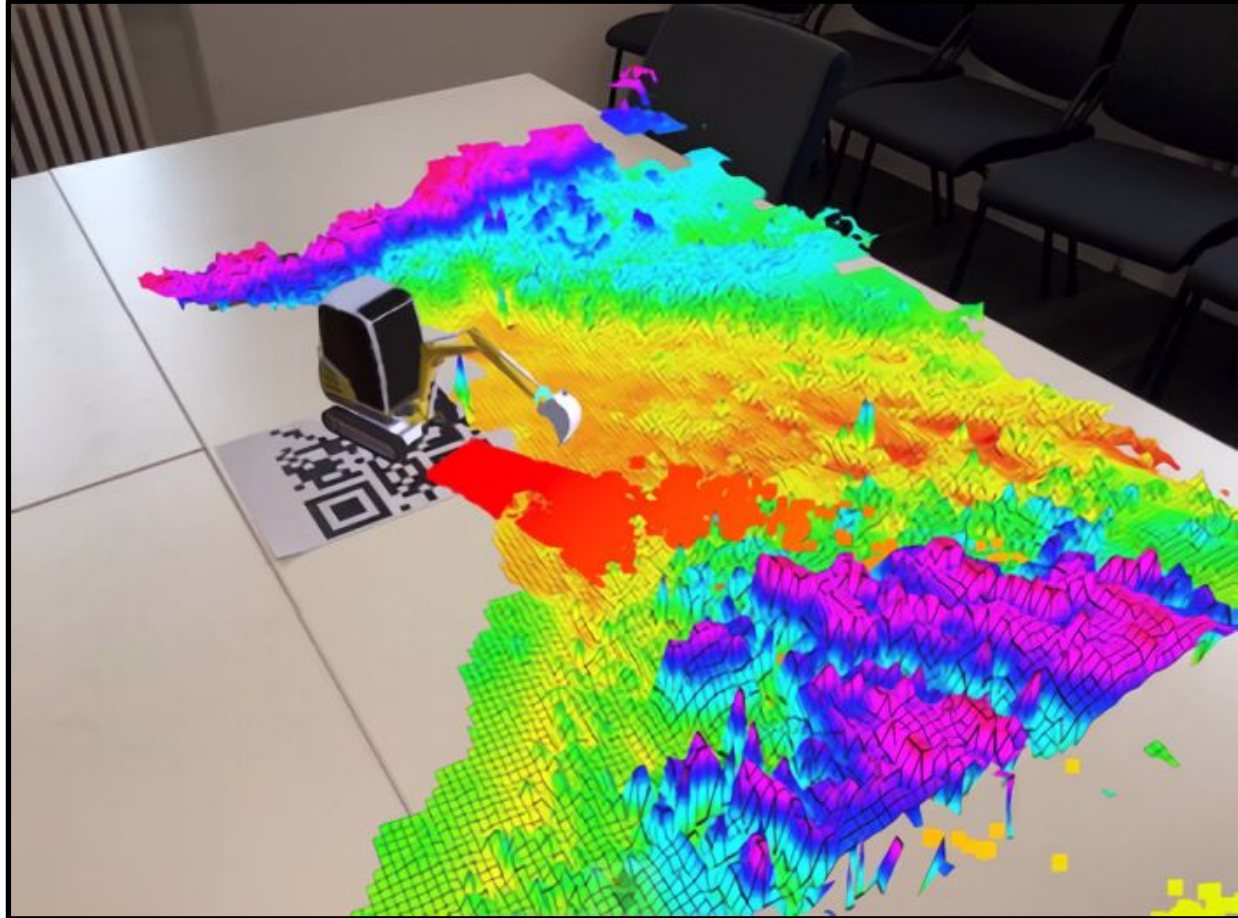


The Poggendorff Illusion



Machines & Visualisation

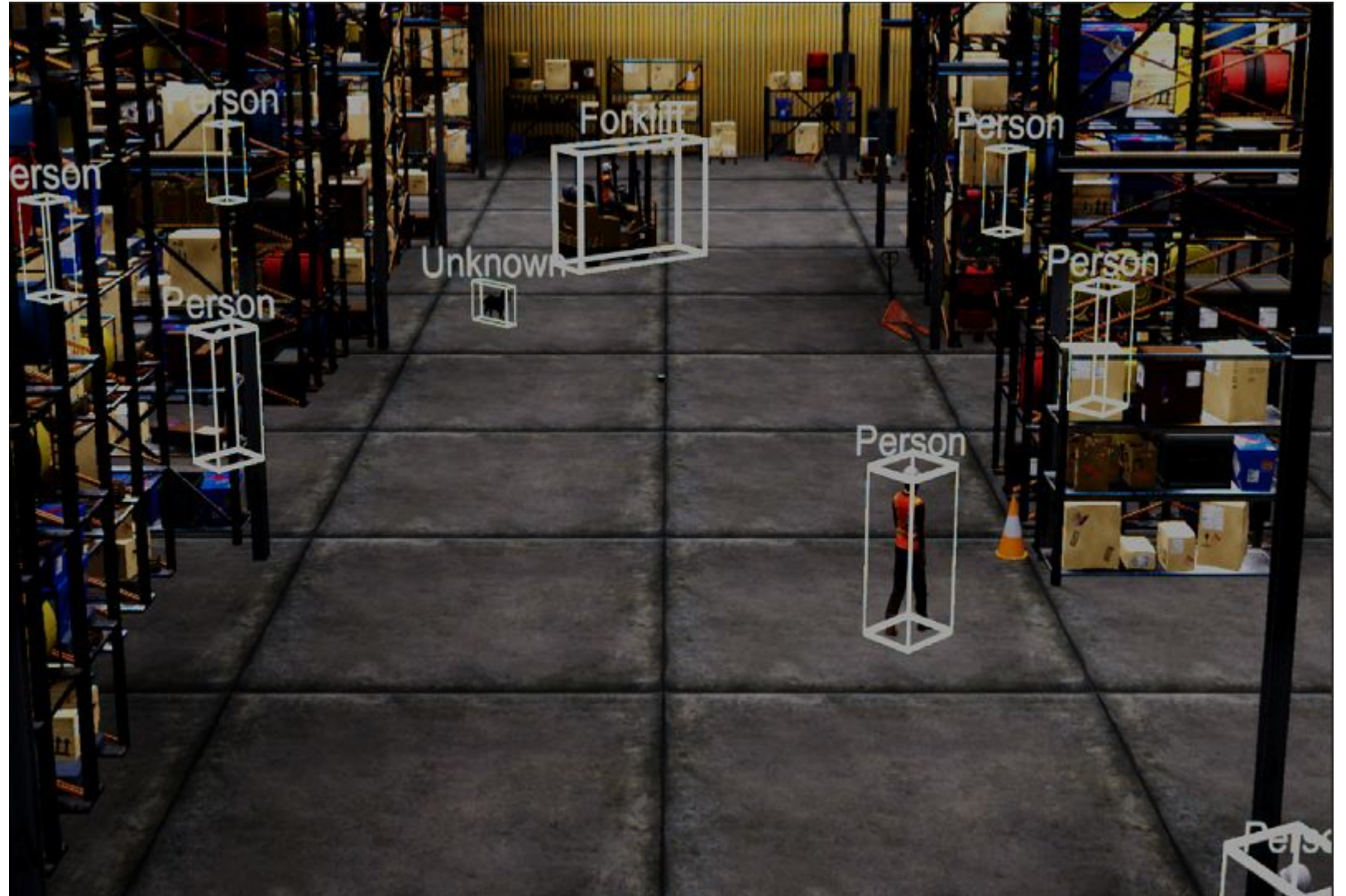
See What the Machine Sees Through AR (Augmented Reality)



Iviz



Machine Vision



Just Art?



SIGGRAPH 2021

Skoltech
Skolkovo Institute of Science and Technology

DronePaint: Swarm Light Painting with DNN-based Gesture Recognition

Valerii Serpiva, Ekaterina Karmanova, Aleksey Fedoseev,
Stepan Perminov, Dzmitry Tsetserukou
Skolkovo Institute of Science and Technology
Moscow, Russia.

- Authors: V. Serpiva, E. Karmanova, A. Fedoseev, S. Perminov, D Tsetserukou
- Laboratory: Intelligent Space Robotics and VR/AR Lab.
- University: Skolkovo Institute of Science and Technology, Russia
- Conference: ACM Siggraph 2021, Emerging Technologies

Eye Tracking



The Metaverse & Visualisation

Previously ...

**HalldaleGroup**
Pioneering simulation training, education, and learning

Has the Military Been Building the Metaverse?



"Metaverse" is a portmanteau of the prefix "meta" (meaning beyond) and "universe" and is a persistent collective virtual shared space.

ANDY FAWKESNOVEMBER 24, 2020

It seems that most tech company CEOs are mentioning the metaverse this year. What is the metaverse, why is it important and is the military already building it? MS&T Editor Andy Fawkes reports.

Towards the end of the 20th century as interactive 3D virtual worlds and connectivity of computers advanced, many science fiction writers and filmmakers envisaged a future where the real and virtual worlds would come together and sometimes be indistinguishable. In *Ender's Game* (1985) the protagonist thought

2020



OPPORTUNITIES FOR MILITARY M&S TO CAPITALISE ON GAMING TECHNOLOGIES AND COMPETENCES

MSG-184- NATO Modelling & Simulation Group (NMSG) Symposium
21/22 October 2021

Mr Andy Fawkes, Vedette Consulting (UK)
Mr Matthew Hemsley, Vedette Consulting (UK)
Mr Douglas Henry, Dstl (UK)
Mr Brian Wardman, Dstl (UK)

**Simulation Interoperability Standards Organization**
"Simulation Interoperability & Reuse through Standards"

The Military's Metaverse

SIM-2021-Presentation-22 (SIMbrief)

**Andy Fawkes, Think Company, UK**

2021 SIMposium21-22 September 2021



Serapis SSE28.1 – Innovation Call

"Military Metaverse CONOPS"

28 February 2022

Andy Fawkes & Nick Cheshire
Vedette Consulting

**Amara's Law**
"We tend to overestimate the effect of a technology in the short run and underestimate the effect in the long run."
Roy Amara (1925 – 2007); Head Stanford Institute for the Future

Vedette Consulting

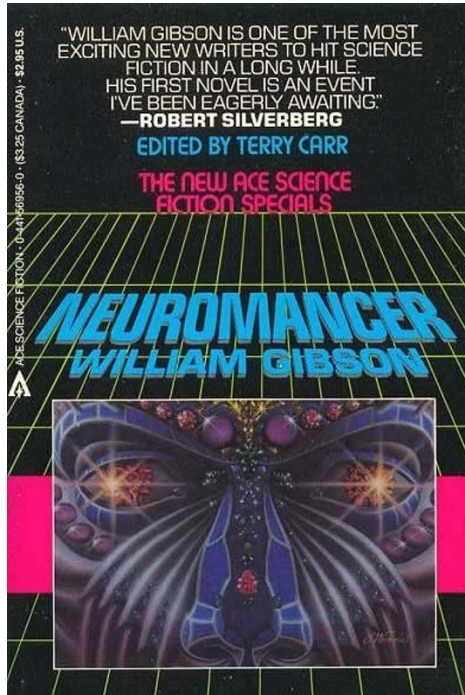
2021

2021

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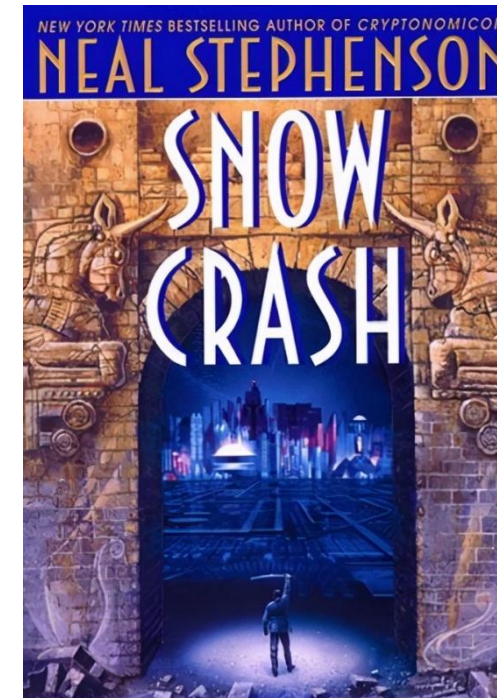
Some Historical Context ...

1984



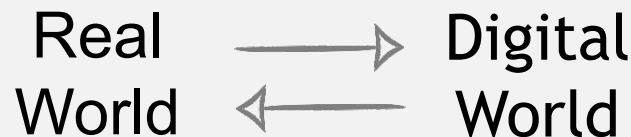
Created by Gibson, the word “**Cyberspace**” is popularised and “*had no real semantic meaning*” a “*mass consensual hallucination*” in computer networks

1992



Stephenson creates the word “**Metaverse**”, a portmanteau of "meta" (meaning beyond) and “universe”

“ ... a computer-generated universe ... ”

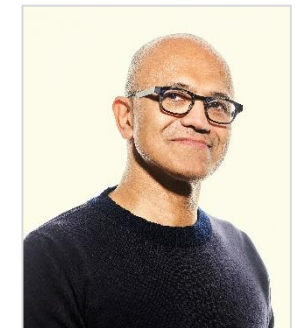


What is the Metaverse?

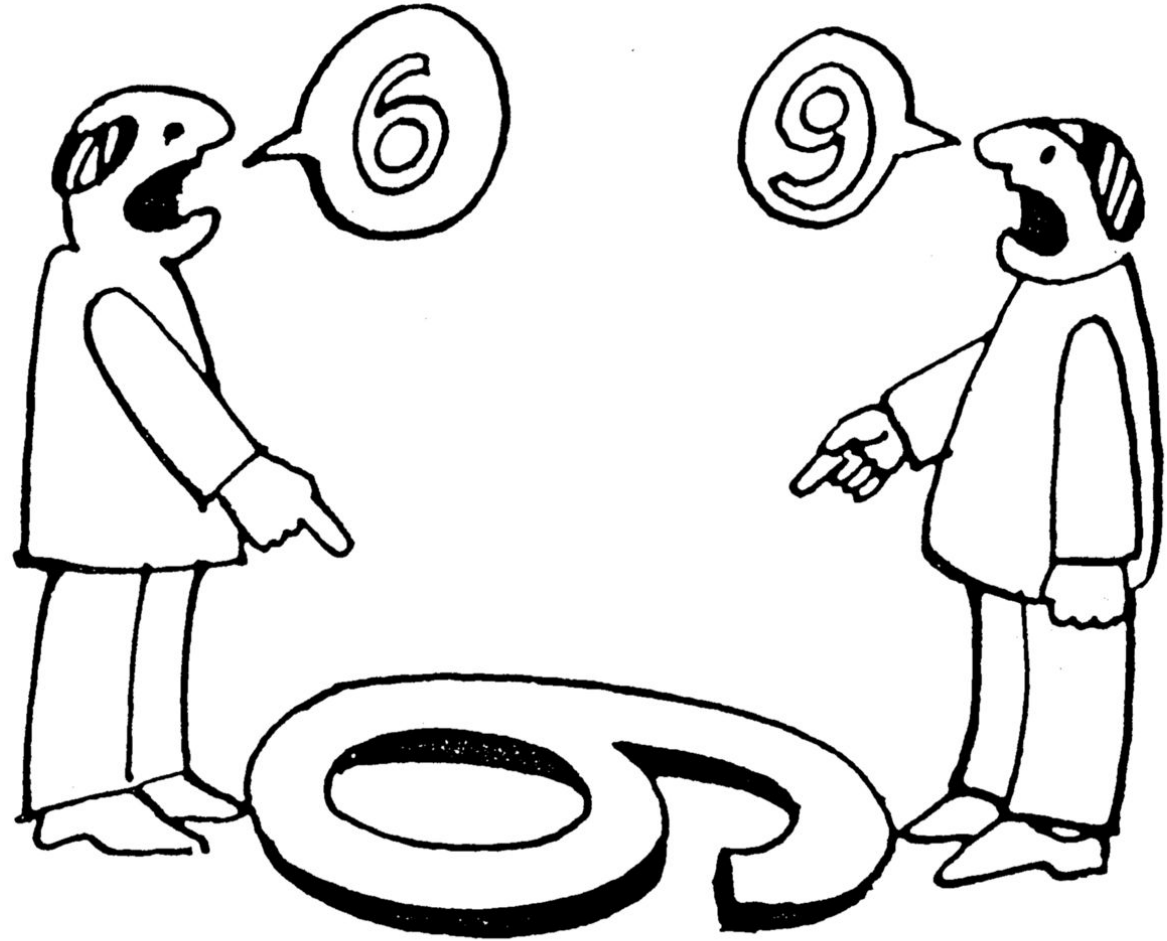
- “computer-generated universe that their computers draw on their goggles and pump into their earphones ... an imaginary place known as the Metaverse”
 - Neal Stephenson, author of the 1992 science fiction novel Snow Crash
- “A concept of a future iteration of the Internet, made up of persistent, shared, 3D virtual spaces linked into a perceived virtual universe”
 - Wikipedia
- “The metaverse is a seamless convergence of our physical and digital lives, creating a unified, virtual community where we can work, play, relax, transact and socialize.”
 - “Opportunities in the Metaverse” 2022
- “The metaverse enables us to embed computing into the real world and to embed the real world into computing ...”
 - Satya Nadella, CEO Microsoft, Microsoft Ignite Nov 2021



J.P.Morgan

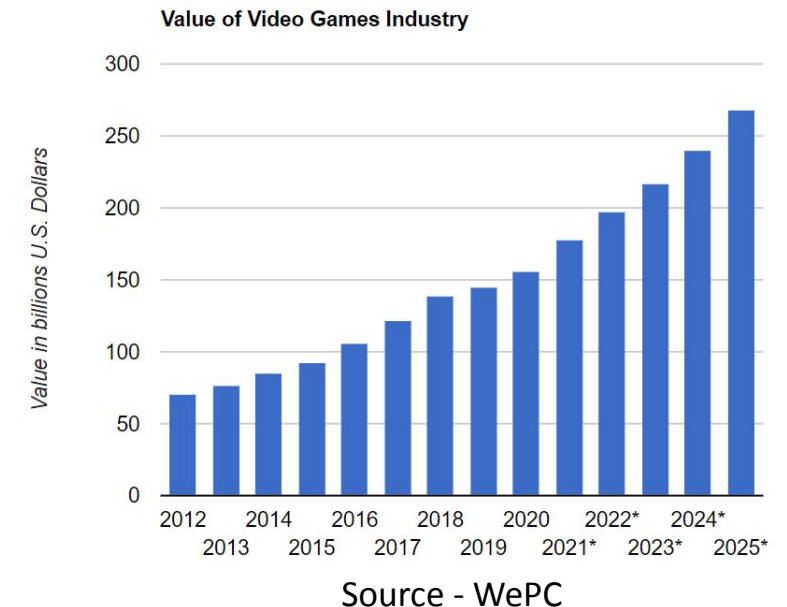


Different Perspectives



What is Different Now?

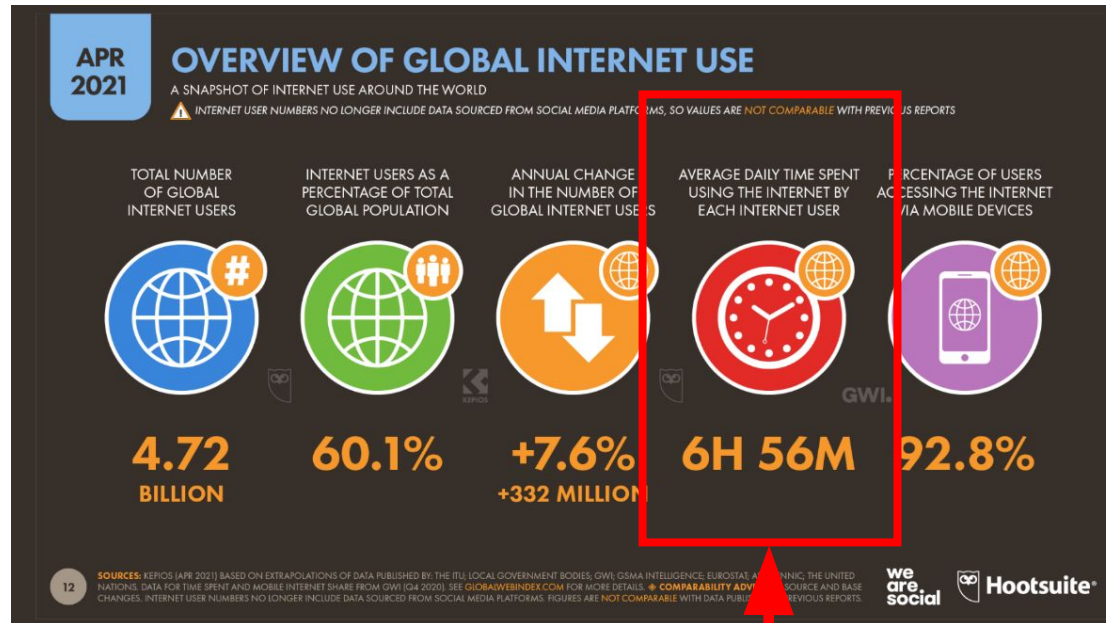
- **Computing Power and Availability**
- **Network Capacity and Reach**
- **Data Storage and Discoverability**
- **XR (VR/MR/AR)**
- **Ubiquitous Gaming**
- **Investment by Big Tech Companies, e.g.**
 - Microsoft
 - Nvidia
 - Meta/Facebook
- **The Pandemic**



The (2D) Internet & Gaming Now Dominate our Waking Lives ...

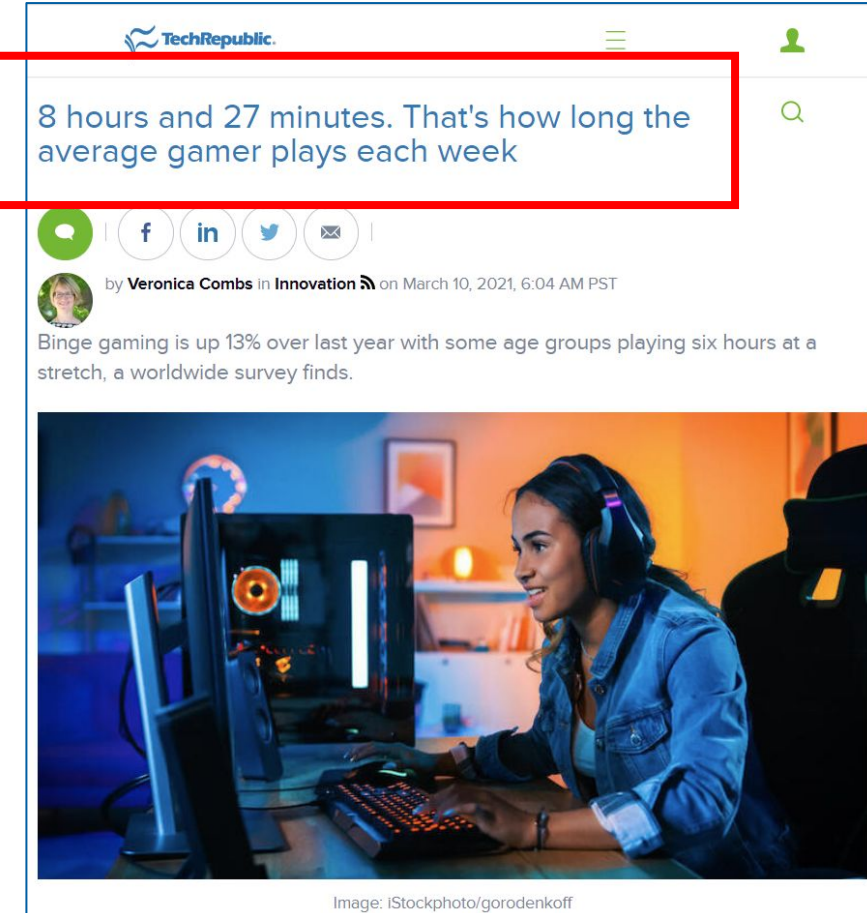
Gaming
>1 hr/day

8 hours and 27 minutes. That's how long the average gamer plays each week



<https://datareportal.com/reports/digital-2021-april-global-statshot>

Internet
7 hrs/day



Science Fiction?

Are we already
living in a
(2D) Metaverse?

Or alternatively, a
Hybrid-verse or
Proto-Metaverse?

Some Common Metaverse and Defence M&S Themes

- **Interoperability**
- **Digital Asset ownership**
- **Security**
- **Networking**
- **Computing**
- **XR/Human-Computing Interfaces**
- **AI**
- **Data & Analytics**
- **User engagement/experience**
- **Community**

Metaverse Big Picture

A Convergence of Technologies & Human Behaviours



Some Contemporary “Proto-Metaverse” Developments

- **Microsoft**

- Mesh - a collaboration and communications platform supporting virtual collaboration across multiple devices and the Microsoft Metaverse Apps Stack

- **Nvidia**

- Omniverse™ a scalable, real-time reference development platform for 3D simulation and design collaboration

- **Varjo** Reality Cloud – “Teleport VR”

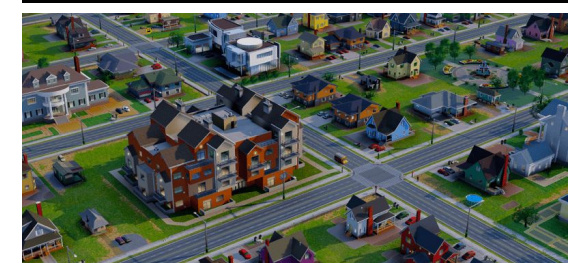
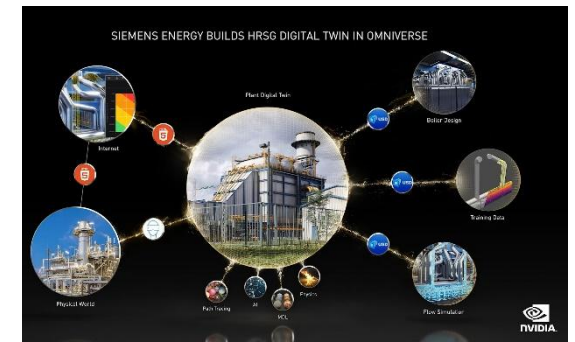
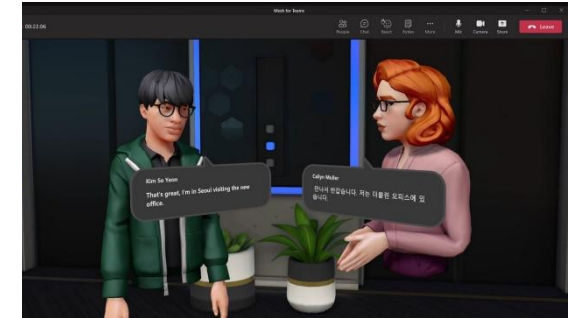
- **Meta Quest 2** HMDs reportedly sold >10m (> sales than Xbox consoles in 2021)

- **Epic Games** Unreal – supports mobile, XR, through to flight sim domes (CAE)

- **Roblox** - 164m monthly active users, creating and playing 3D games, played by >50% US children (<16) in 2020

- **Second Life** – launched 2003, a persistent 3D virtual world (GDP \$650m (2022))

- **Decentraland** - open source 3D virtual world platform with NFT-based land ownership (opened Feb 2020)



A Defence Perspective on the Metaverse

The concepts of virtual reality and avatars in a persistent virtual world(s) remain, however,

the metaverse can be considered now to also embrace a wider **convergence of technologies** of varying maturities that are **bringing the physical and digital worlds together** and

represents the next evolution of computing, a trend from 2D, to 3D, interaction, presence and immersion between humans, machines and the digital world.

The metaverse could be considered a long standing vision without a fixed roadmap to achieve it, but one that is much closer than it was before.

Metaverse Headlines

The current interest/hype reflects a distant vision that does not seem so distant now

The metaverse is not one technology, but an umbrella term for many converging M&S and wider technologies

No one is currently saying it will be a single virtual world

The metaverse will embed computing into the real world and embed the real world into computing

The metaverse is of great significance to defence M&S and the wider digital domain

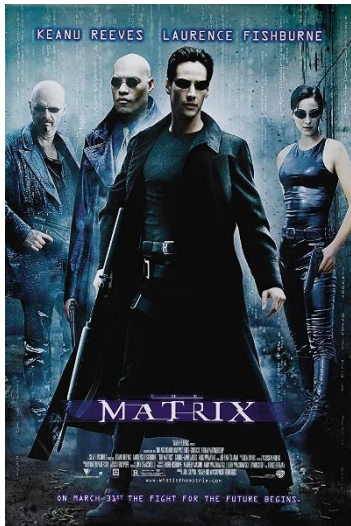
The weight of \$ external to defence will drive developments, which are likely unpredictable

Defence needs to be an “intelligent customer” for metaverse technologies and standards

A “Military Metaverse” could exploit metaverse-related standards, technologies and approaches, and provide now a unifying vision for future defence enterprise-wide M&S services

Back to Science Fiction...

1999



2009



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Questions?

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