

A futuristic digital landscape with people wearing AR/VR headsets and floating icons. The background is a light blue gradient with numerous small, glowing, metallic spheres floating around. Several people are shown wearing different types of AR/VR headsets. One person in the foreground wears orange-tinted glasses with a grid pattern on the lens. Another person behind them wears a black VR headset. A third person in the background wears a black AR headset. Various icons are scattered throughout the scene, including a speech bubble, a calendar, a play button, a game controller, a location pin, and a musical note. The overall aesthetic is clean, modern, and high-tech.

ACTIVATE CONSULTING TECHNOLOGY & MEDIA OUTLOOK 2025 SPATIAL COMPUTING

CREATED FOR ACTIVATE BY ASW



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Spatial computing's iPhone moment is within sight; much of the required technology, device, AI, and ecosystem is already in the pipeline

FULLY FEATURED SEE-THROUGH DEVICE

- Overlays digital information and holograms onto the user's physical surroundings, allowing users to interact with real and virtual objects simultaneously
- Early prototypes already being developed and tested – enabling 'see-through' instead of just 'pass-through'

AMBIENT, ALWAYS-ON EXPERIENCE

- Captures and processes data in real time, providing a continuous computing interface in people's daily personal and work lives
- People can wear the spatially-enabled glasses at all times, choosing their experience (clear vs. augmented)

ARTIFICIAL INTELLIGENCE AND SPATIAL INTELLIGENCE

- Development of the AI is already ahead of the device development
- Force multiplier for spatial computing functionality
- Data is processed in the device or peripheral

NETWORKED DATA ECOSYSTEM

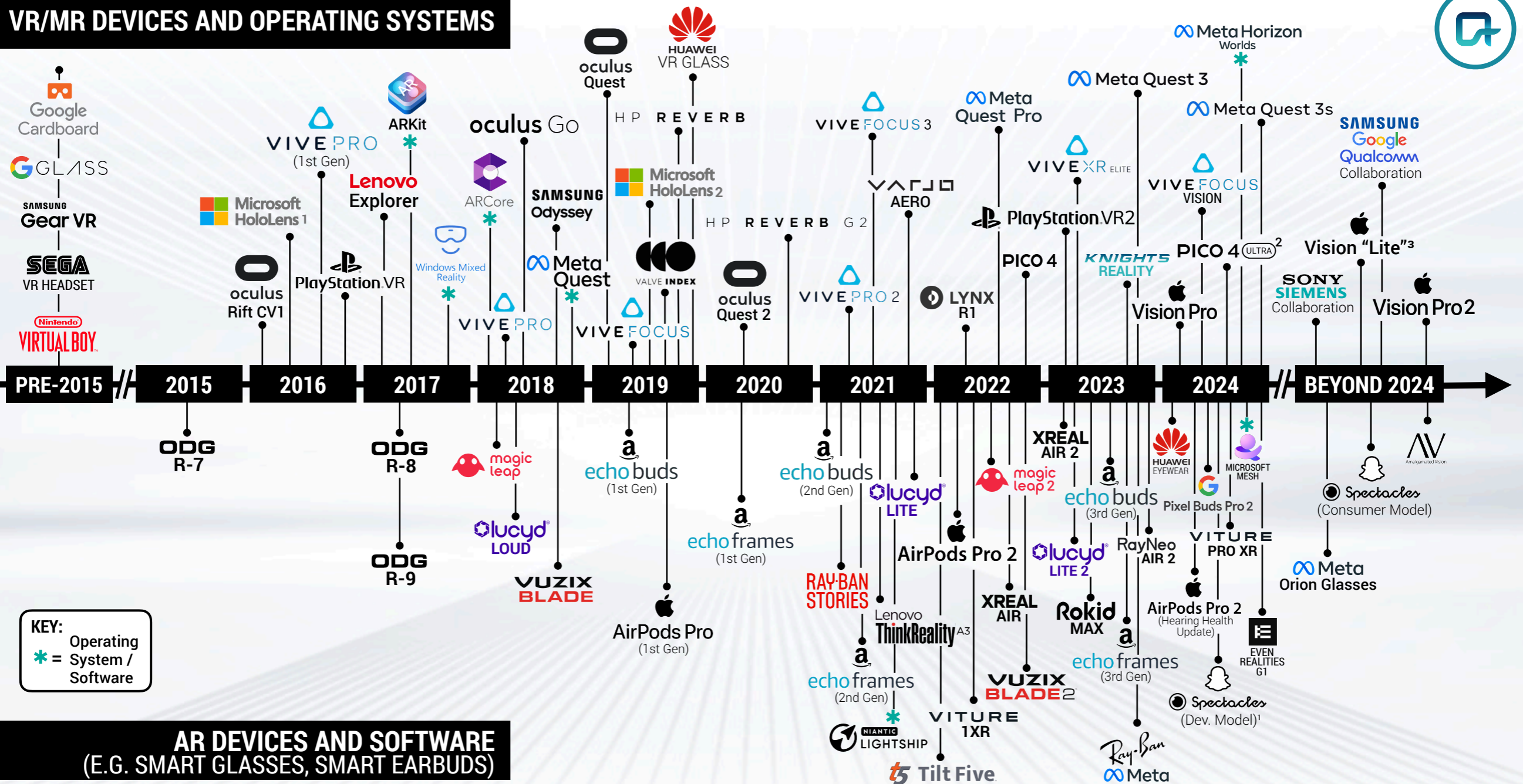
- AI trains on data captured in the wild
- Gathers and processes spatial data from devices
- Builds a network of data from all devices in the wild

CONNECTIVITY AND COMPUTE

- Enables real-time data collection with high-throughput connectivity
- Leverages expanded bandwidth coming online
- Maximizes immersion with low-latency edge computing

For well over a decade, there has been a steady journey of innovation in devices, operating systems, and software toward a mobile and AI-enabled spatial computing paradigm

VR/MR DEVICES AND OPERATING SYSTEMS



Note: Not exhaustive. Years reflect the date the device was first released to the public. 1. Spectacles (5th Gen) are only available through Snap's Developer Program. 2. As of Oct. 7, 2024, Pico 4 Ultra has not been released in the U.S. 3. Apple is rumored to be working on a cheaper version of Apple Vision Pro.
 Sources: Activate analysis, Company press releases, Company sites

Today, spatial computing experiences range from fully-immersive environments requiring advanced headsets to ambient experiences enabled through more accessible AR visual, audio, and haptic devices

SPATIAL COMPUTING EXPERIENCES

1st Generation Glasses (See-Through Glass with Smart Audio)

Digital visual and audio, with output provided largely through voice audio and rudimentary visual capabilities



AR: Augmented Reality / Phone Screen

Digital visual, audio, and haptic overlays that leverage data to enhance the physical world, delivered through AR-enabled smartphones



VR: Virtual Reality (Immersive and Pass-Through)

A view that blocks out the real-world and replaces it with a fully-immersive virtual environment, usually delivered through a dedicated VR headset device



MR: Mixed Reality (Immersive and Pass-Through)

A fusion of physical and digital worlds, which combines aspects from both VR and AR, usually delivered through a dedicated MR device



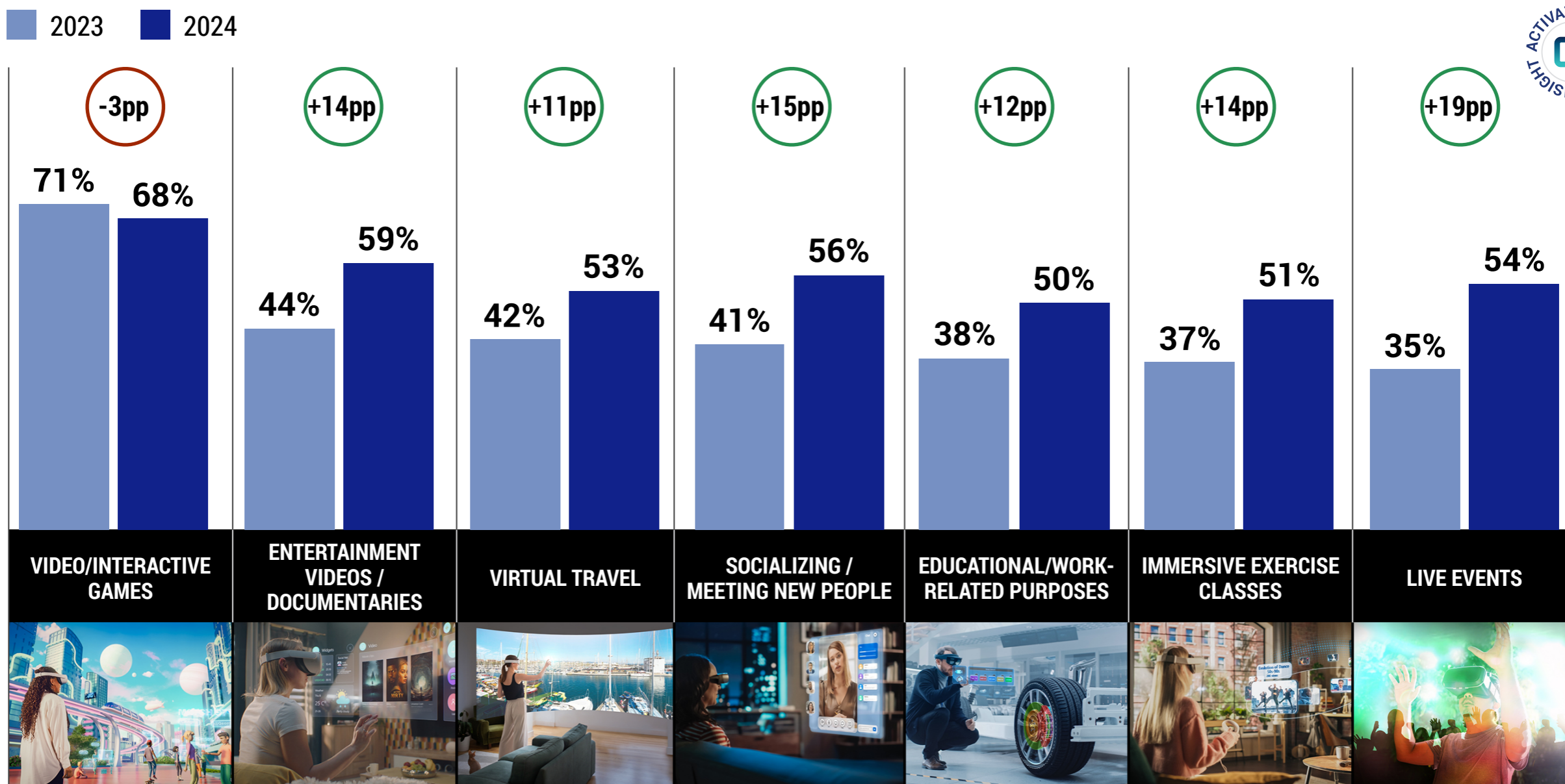
Next Generation Glasses (Fully Featured and See-Through)

Digital visual, smart audio, and haptic overlays that leverage data to enhance the physical world, provided by see-through glasses and devices



In the past, consumers purchased VR headsets for gaming and entertainment, and are now using them for a wider range of use cases beyond gaming

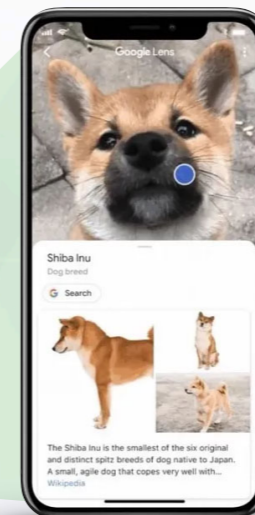
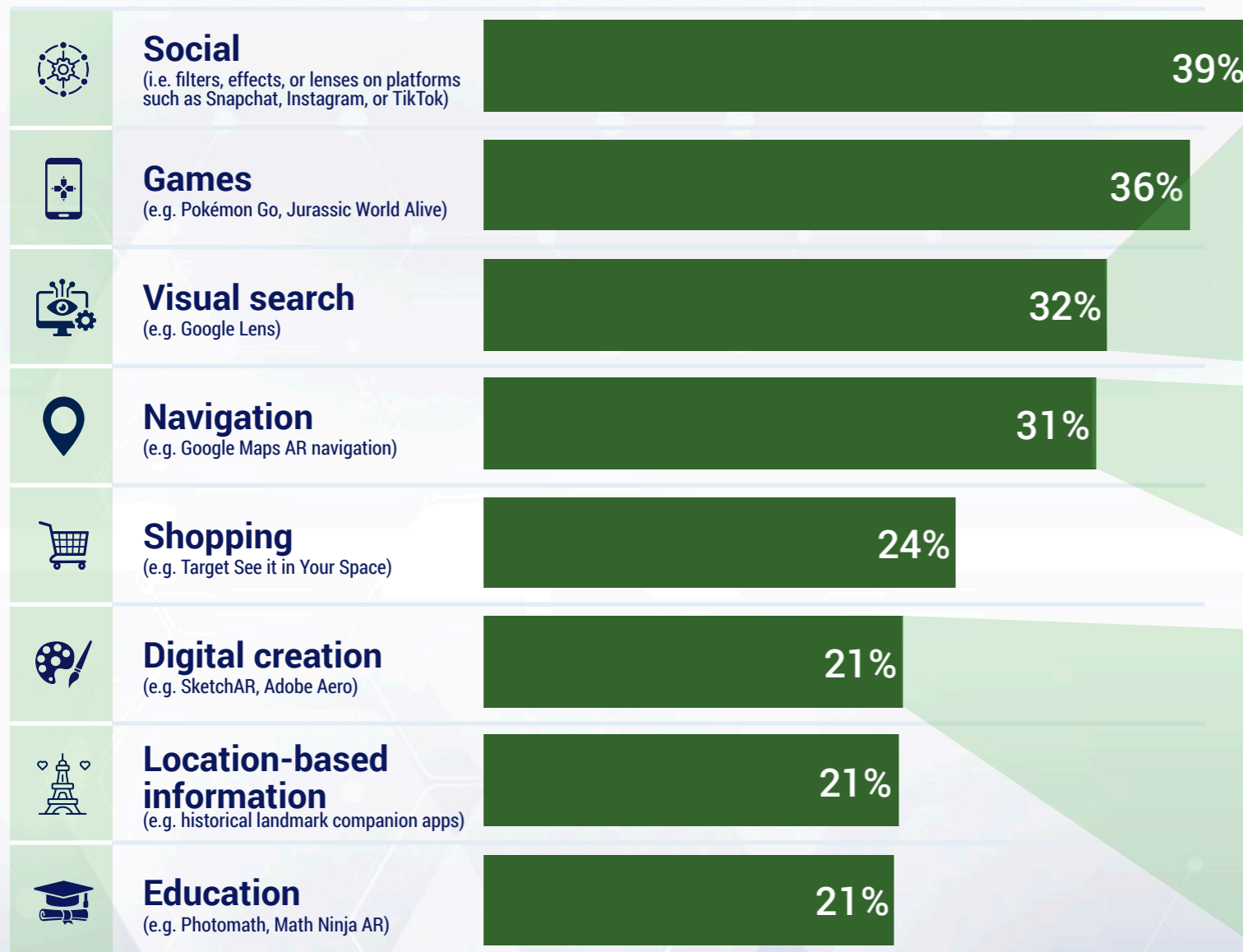
VR HEADSET USE CASES¹, U.S., 2023 VS. 2024, % VR HEADSET USERS²



1. Figures do not sum due to rounding. 2. "VR headset users" are defined as adults aged 18+ who have used a VR headset in the last 12 months. Sources: Activate analysis, Activate 2023 Consumer Technology & Media Research Study (n = 4,023), Activate 2024 Consumer Technology & Media Research Study (n = 4,004)

People are already using AR (predominantly through a smartphone) to enhance their core digital behaviors: social, gaming, search, and navigation

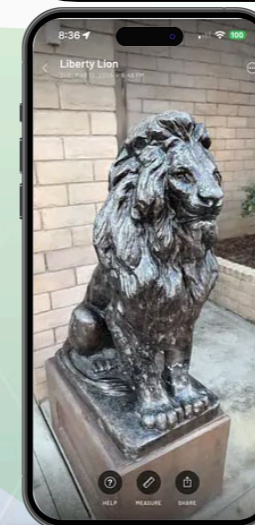
USAGE OF AR TOOLS, U.S., 2024, % ADULTS AGED 18+ WHO ARE AWARE OF AR¹



Google Lens
Google Lens identifies an object or place through a camera and overlays digital insights in real time



Apple Maps
Apple Maps uses AR to overlay step-by-step walking directions onto the phone's camera, providing real-time guidance

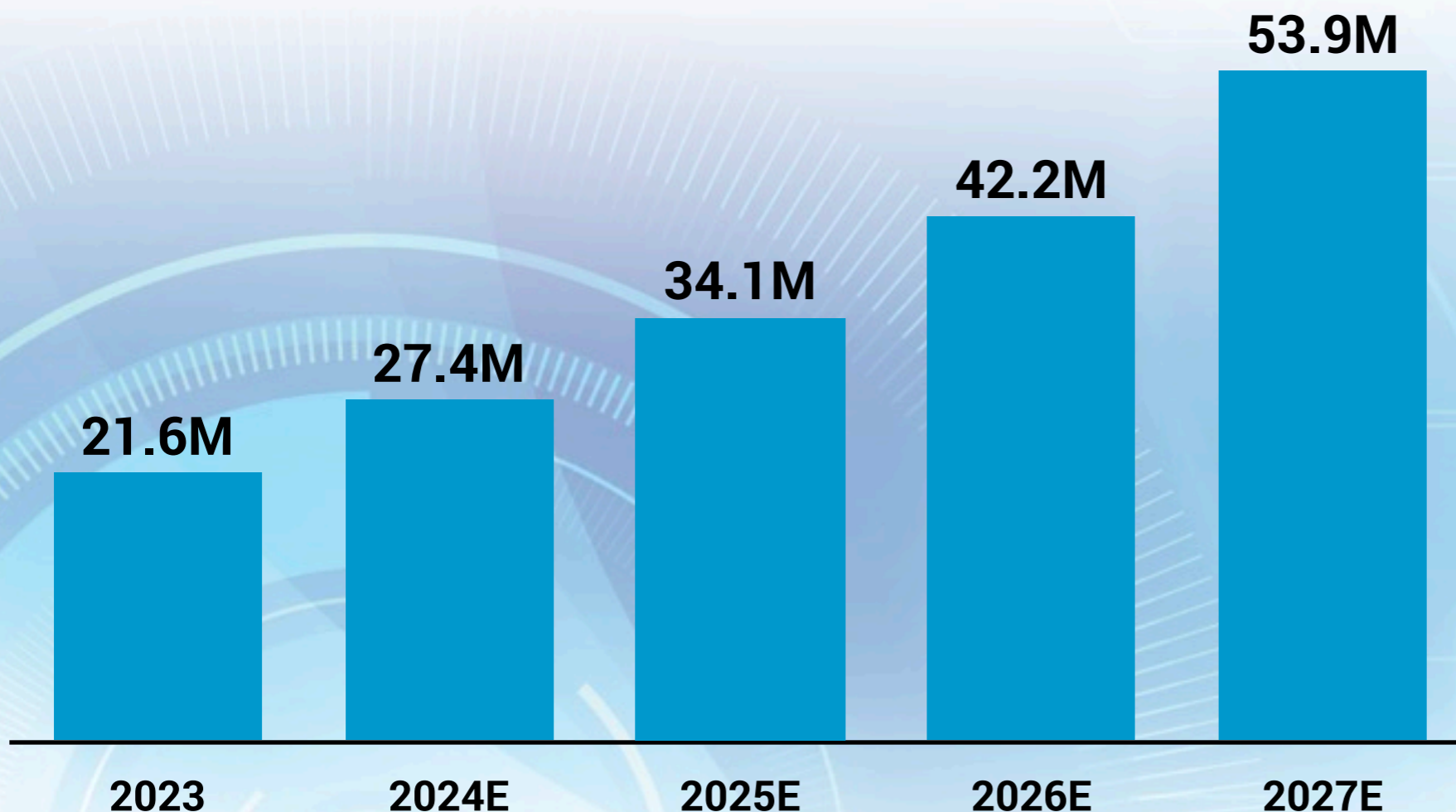


NIANTIC
Niantic Scaniverse 4 leverages AI and AR to capture environments and generate exportable 3D models



We forecast that dedicated spatial device shipments will reach over 50M units by 2027

SPATIAL HEADSET UNIT SHIPMENTS¹, GLOBAL, 2023-2027E, MILLIONS UNITS



BY 2027, SPATIAL HEADSET UNIT SHIPMENTS WILL BE:

4% of smartphone unit shipments

5% of smart home device² unit shipments

19% of personal computer unit shipments

1. Includes AR, VR, and MR headset device shipments. Excludes Google Cardboard and other headsets with no built-in technology.

2. Includes home monitoring/security, lighting, smart speakers, thermostats, and smart video entertainment.

Sources: Activate analysis, AR Insider, Company press releases, Company sites, eMarketer, International Data Corporation, Morgan Stanley, Omdia, PricewaterhouseCoopers, Road to VR, Sensor Tower, Statista, Steam Spy, Strategy Analytics, SuperData, VGChartz

For spatial computing to reach its iPhone moment, it will need to be truly artificial intelligence- and spatial intelligence-enabled, feature sophisticated displays, and be supported by networked data

PROGRESSION OF ARTIFICIAL INTELLIGENCE CAPABILITIES TOWARDS UBIQUITOUS SPATIAL COMPUTING

ARTIFICIAL INTELLIGENCE



- Features expansive, large language models with access to large amounts of spatial data (e.g. maps, geolocation)
- Lacks a truly real-world component, and running most AI models is confined to mobile, PC, or IoT devices
- Requires a smartphone or PC as a user interface

VISUAL INTELLIGENCE



- Uses front cameras as sensors to capture and analyze 2D images and audio
- Delivers responses and guidance via audio feedback or rudimentary text and displays
- Provides experiences for users through first generation AR glasses

SPATIAL INTELLIGENCE



- Represents multimodal AI interacting with the physical world, with the ability to process 3D inputs with perspective and depth
- Delivers immersive overlays and visuals
- Takes in 3D information and environments updated through data input and AI
- Will be made usable by future device and interface paradigms

AMBIENT NETWORKED SPATIAL COMPUTING



- Augments spatial intelligence capabilities with ambient, always-on data collection
- Represents the future state of ubiquitous spatial computing, with AI bridging the divide between physical and virtual worlds
- Will be made usable by future device and interface paradigms

The ubiquitous spatial device will be ambient and always-on, continuously collecting data and leveraging multimodal AI to improve immersive experiences



Spatial devices continuously gather and process real-world, 3D data to power spatial intelligence

SPATIAL MAPPING AND ENVIRONMENTAL DATA

- Hyper-location
- Geospatial
- Simultaneous Localization and Mapping (SLAM)
- Environmental sensing
- Weather and atmospheric
- Infrastructure
- Topographical



SITUATIONAL AUDIO DATA

- Ambient environmental sound
- Contextual audio cues
- User speech
- External/environmental speech



REAL-WORLD, 3D SPATIAL DATA



VISUAL DATA

- Real-world object recognition
- 3D physical spaces, dimensions, distances
- Real-world search
- Augmented navigation
- Thermal and infrared



USER INTERACTION DATA

- Hand motions / gestures
- Facial expression changes
- Body and motion tracking
- Eye tracking
- Voice
- Biometric

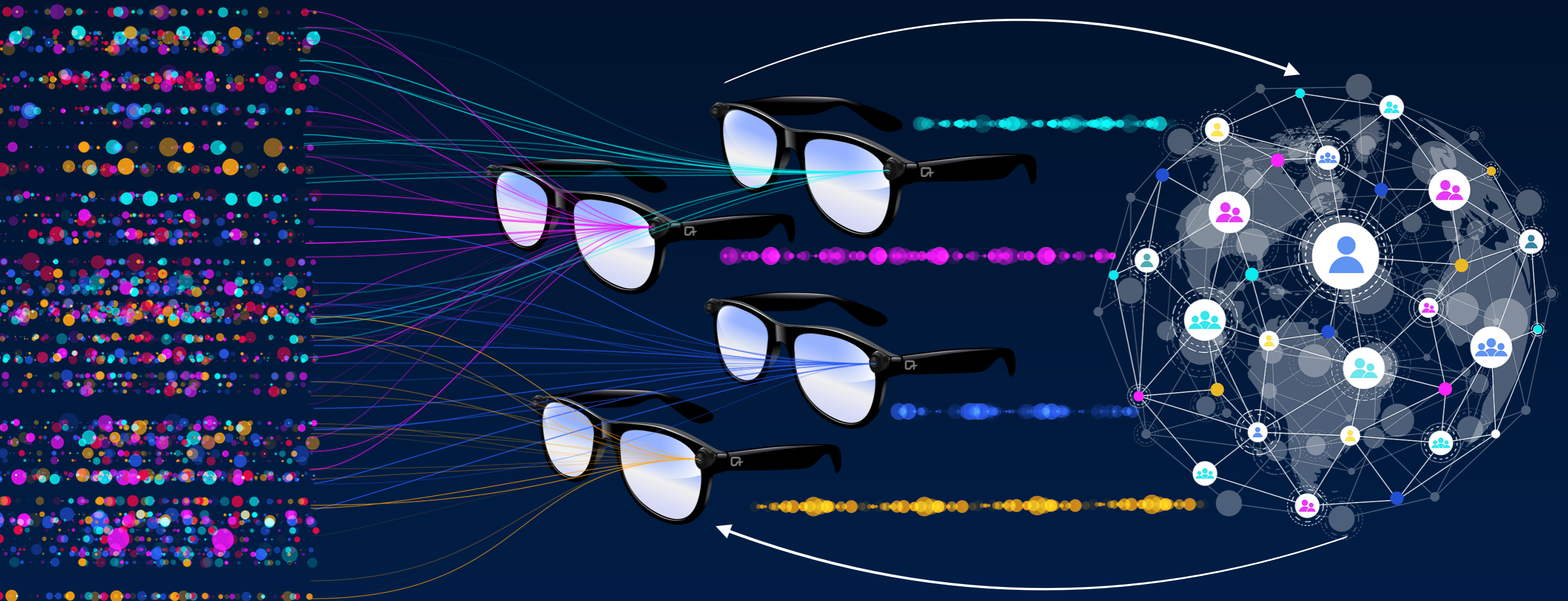


Networked spatial data enables artificial intelligence and spatial intelligence to train on data from the real world – critical to overcoming the “cold start problem”

REAL-WORLD 3D DATA
(CAPTURED THROUGH DEVICE CAMERAS, SENSORS, MICROPHONES)




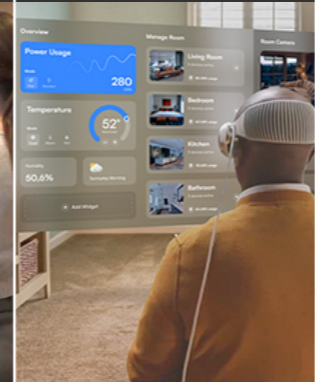






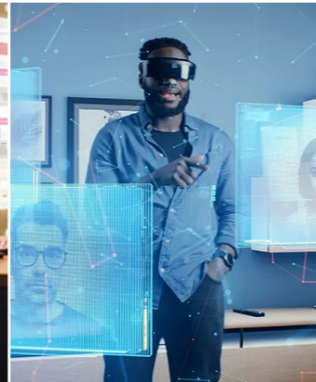





SEE THROUGH AI- AND SI¹- AUGMENTED REALITY DEVICES

NETWORKED DATA TO TRAIN AI AND SI¹ ON THE REAL-WORLD AND POWER SPATIAL EXPERIENCES



PROCESSES DATA IN REAL TIME

Ambient spatial computing will play a role in people's everyday lives and habits across consumer use cases

DAILY ROUTINE & HABITS				ENTERTAINMENT			
FITNESS	NAVIGATION	SHOPPING	HOME CONTROL	VIDEO	GAMING	LIVE EVENTS	ART
							
ENHANCED MULTI-TASKING	ORGANIZATIONAL TASKS	VIRTUAL MEETINGS	DATA VISUALIZATION	IMMERSIVE CONVERSATIONS	VIRTUAL IDENTITIES	VIRTUAL DATING	SHARED CREATION & COLLABORATION
							
PRODUCTIVITY				COMMUNICATION & SOCIAL CONNECTIONS			

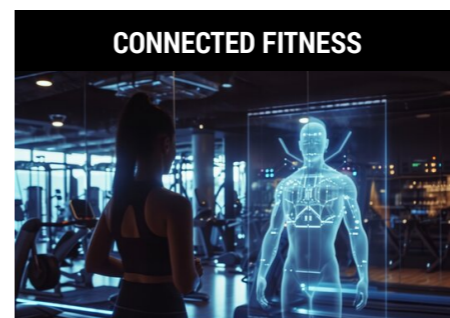
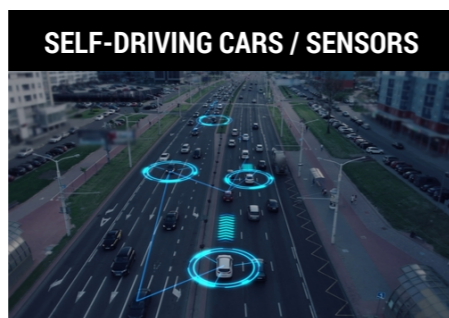
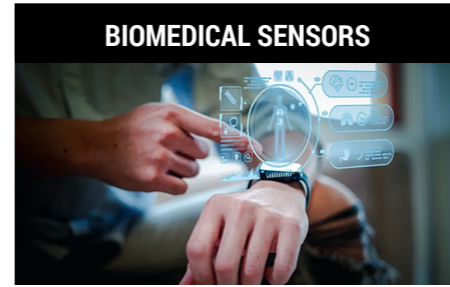
Enterprises will use spatial computing for complex use cases that enhance workflows, applying spatial data, artificial intelligence, and spatial intelligence to B2B processes

EMERGING ENTERPRISE USE CASES OF SPATIAL COMPUTING

MANUFACTURING	HEALTHCARE	INDUSTRIAL	DEFENSE
 	 	 	 
<ul style="list-style-type: none"> • Spatial technology enables manufacturers to collaborate in 3D environments, allowing teams to visualize designs and make real-time adjustments • Manufacturers can leverage spatial computing to streamline operator training by creating immersive environments to practice operating machinery 	<ul style="list-style-type: none"> • Spatial technology can enhance patient communication through enhanced visualization of medical imagery • Spatial technology assists physicians by providing simulations for medical training and real-time overlays for surgical guidance 	<ul style="list-style-type: none"> • Spatial technology enables energy companies to visualize 3D models of energy assets to improve maintenance, monitoring, and repair of dangerous or hard-to-reach areas • Warehouse employees can leverage spatial technology to guide workers through optimized paths and identify hazards or bottlenecks in real-time 	<ul style="list-style-type: none"> • Spatial technology enables drone pilots to more precisely visualize and operate drones while navigating through environments remotely • Spatial technology enables combatants to visualize real-time battlefield data (e.g. enemy positions, drone feeds, intelligence)

Spatial computing will eventually break free from the constraints of the headset and embed spatial intelligence across practically every screen in people's lives

EXAMPLE CURRENT AND FUTURE SPATIAL-ENABLED DEVICES



Ubiquitous spatial computing will be enabled by innovation across the full stack

THE SPATIAL COMPUTING STACK



SOFTWARE

Immersive applications enabling consumer use cases (e.g. immersive maps, entertainment, real-world search) and enterprise functionality



HARDWARE/DEVICE

Ambient, always-on hardware providing a constant feed of visual, audio, and motion data delivered through an energy-efficient device



OPERATING SYSTEMS

Frameworks and ecosystems enabling developers to design new spatial computing applications



SPATIAL INTELLIGENCE / GENERATIVE AI

Generative AI continuously improving and personalizing immersive, spatial environments



NETWORKED DATA

Data collected and processed in real time by spatial devices, augmented by third-party data to build complete environments (e.g. geospatial & map data)



COMPUTE

Edge computing and AI-optimized cloud platforms required for real-time data processing with low latency



CONNECTIVITY

Next generation of connectivity required for processing high volumes of data required for Spatial Intelligence functionality

Competition is increasing in the spatial operating system and device markets as companies unveil new innovations and disruptive entrants join the space

MAJOR SPATIAL OPERATING SYSTEMS























POTENTIAL SPATIAL COMPUTING DISRUPTORS/INNOVATORS



Note: Not exhaustive. Excludes devices focused exclusively on gaming purposes. 1. In Feb. 2024, Meta confirmed a partnership with LG. In Apr. 2024, Meta announced the release of Horizon OS, with new devices being built on it by Lenovo and Asus. Meta also partners with EssilorLuxottica for the Ray-Ban Meta glasses. 2. In Feb. 2023, Google, Samsung, and Qualcomm announced a partnership. 3. In Jan. 2024, Sony and Siemens announced a partnership. Sources: Activate analysis, Company press releases, Company sites

High-throughput connectivity, edge computing, and cloud innovations will be required to enable more sophisticated and mobile connected spatial experiences

6G	GLOBAL SATELLITE COVERAGE	EDGE COMPUTING AT SCALE	SPATIAL / AI-OPTIMIZED CLOUD
			
<p>     </p>	<p>      </p>	<p>     </p>	<p>    </p>
<p>Enhanced delivery of large volumes of data supporting immersive and synchronous experiences at scale</p>	<p>Global high-speed networking coverage to enable immersive navigation across all transportation and logistics through continuous connectivity</p>	<p>Ultra-low latency (<20 milliseconds for media/gaming use-cases) for optimal user experience</p>	<p>Increased storage and advanced cloud development platforms (e.g. supporting users at scale, AI-optimized cloud services/GPU access and environments)</p>

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Outlook 2025

Thank you!

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