Augmented tomorrow: AR experiences beyond smartphones and AR filters

Exploring consumer expectations and needs in an evolving XR landscape

Methodology

This report presents insights from Ericsson ConsumerLab research on XR. Data for this study was collected through both in-depth interviews and online surveys.

Qualitative research

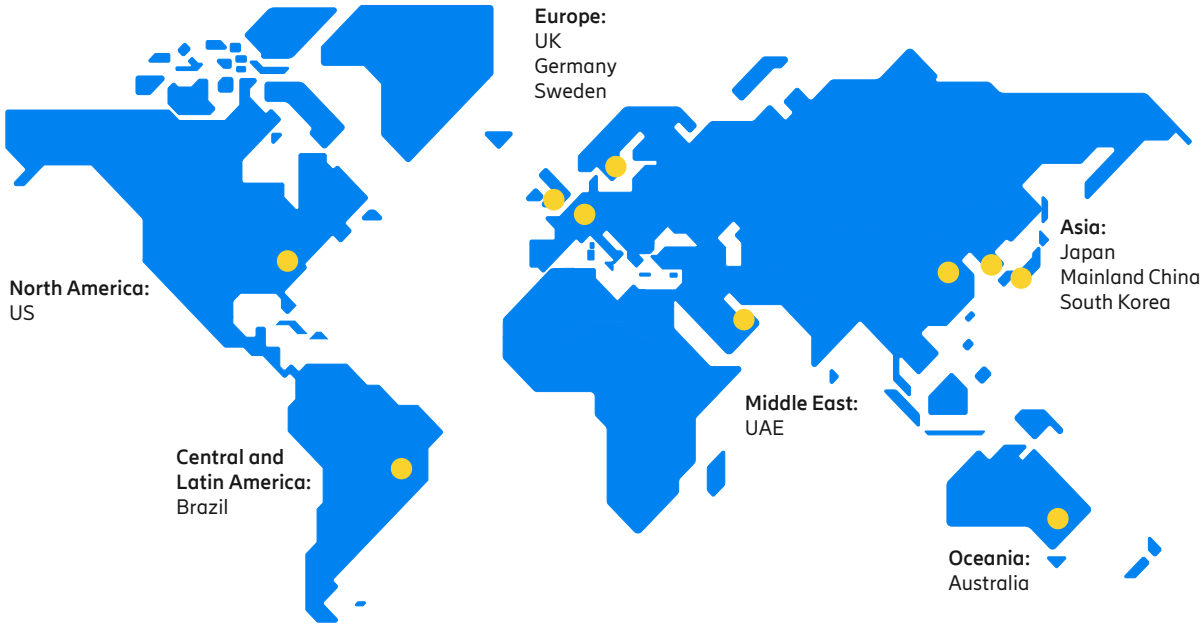
22 in-depth interviews were conducted between April and June 2023 with 12 current AR/VR users, 7 industry experts and 3 XR startup companies: TagSpace, forwARdgame and EyecandyLab (now part of Accedo). Interviewees were located in the US, Japan, South Korea and Germany.

Quantitative research

An online survey was fielded between July and August 2023 in 10 markets. The sample consists of 10,000 early adopters aged 15 to 69, with 1,000 from each market, who use smartphone AR apps and/or VR/AR/MR headsets/glasses at least every other week or plan to do so in the next five years. The sample represents 280 million early adopters in the markets surveyed. While early adopters are a small fraction of consumers globally, their early adopter profile makes these individuals important when exploring how wider groups of consumers might use these technologies in the future. The respondents were asked a range of questions about their current usage, the perceived benefits, challenges, future adoption intention, and expectations around XR-powered experiences in the next five years.

Terminology

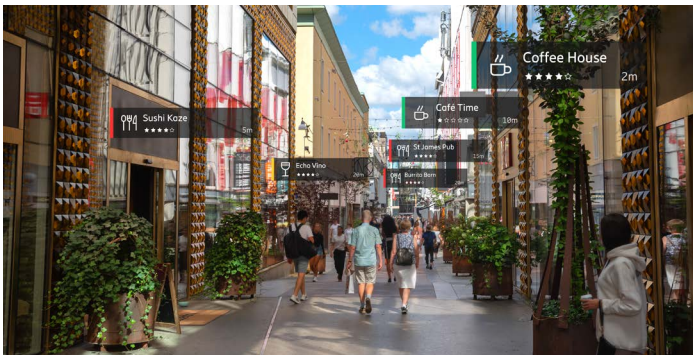
Extended reality (XR) refers to a range of technologies, including augmented reality (AR), virtual reality (VR), and mixed reality (MR), that combine physical and digital environments to create immersive experiences. Headsets, glasses as well as smartphones are the common devices used to bring these technologies to life.



Key findings

01. Consumers combining smartphones and AR devices will double in the next five years

Despite low satisfaction with current smartphone AR experiences, those that combine smartphone and VR/AR/MR headsets/glasses tend to be happier. Over the next five years, the share of such combined use is projected to double. Furthermore, consumers expect lightweight and portable AR/MR devices becoming essential companions to smartphones.



02. Consumers are hungry for on-the-go AR devices and willing to pay 20 percent more for the portability

Today, VR/AR/MR headsets/glasses are largely limited to home use, serving as shared household devices. However, three-quarters of consumers anticipate the availability of portable AR devices, likely in glasses form, for outside-of-home and on-the-go use in the next five years, expressing a willingness to pay a premium for such devices.

03. As AR technology advances in adapting to geospatial surroundings, the range of XR experiences will become more diverse and demanding on 5G

Current consumer AR experiences center on information, navigation, and social AR filters. As geospatial AR technology progresses, the use case landscape will expand to include more diverse applications featuring precise location tracking and enhanced environmental awareness. Examples of such applications are AR sports viewing and concerts, public digital arts, and augmented tourist displays. This expansion will demand 5G networks to deliver consistent, real-time experiences.

04. Bystander privacy still looms large, hindering device adoption

Bystander privacy, referring to consumers feeling exposed to others scanning them with AR devices, remains a critical concern among consumers, with 60 percent expressing apprehension globally. This worry significantly reduces the share of users intending to adopt AR devices by 18 percentage points.

Introduction

Extended reality (XR) technology allows for greater immersion in virtual realities or the enhancement of the physical world by blending digital and physical elements, adding new layers of meaning and experience.
This enables new and exciting ways to engage with the world around us, whether it be through shopping, socializing, or artistic expression.

Augmented reality (AR) plays a significant role in various industries and has become more accessible to average consumers in recent years through smartphone AR apps. Today, many young consumers are obsessed with AR filters and lenses on social apps. While other age groups find AR apps to be convenient and efficient in wayfinding, translation and product try-on or fitting during the shopping journey. However, consumers face many challenges with today's smartphone AR experiences, from limited content, low quality of experience, physical strain, and social acceptance. Similarly, the availability of consumer-friendly XR headsets is still limited, with virtual reality (VR) headsets being the most widespread option. Consumer-friendly AR headsets/glasses are still emerging. However, industry experts believe XR technology, especially AR, will significantly impact consumers and society, with the potential to replace smartphones in the future and become the next paradigm shift. According to the International Data Corporation (IDC), AR headsets are expected to grow in 2024, even though at a slower pace compared to VR headsets, but diversification among the different products will increasingly address more needs. (idc.com report 2023).

Since 2017, ConsumerLab has explored the growing consumer expectations in XR in several reports. In the report titled 'Merged reality', we explored how both AR and VR could potentially transform consumers' daily life. This report uncovers current consumer XR adoption and future expectations for augmented reality experiences and devices in the next five years.

Together, smartphones and AR/MR devices can elevate consumer AR experiences

The industry is set to deliver new devices and experiences to consumers, looking for the next big thing and aiming for a killer device and use cases with the potential to replace the smartphone. Consumers are curious, but so far, no revolution has taken place, XR devices, AR, VR and Mixed Reality (MR) glasses and headsets are still mostly a curiosity.

The smartphone´s place in consumers' lives is indisputable, it's nearly an extension of users' bodies. Its position and how intertwined it is in our lives makes it hard for consumers to imagine another type of device replacing it. For most consumers, the smartphone is the entry point for AR experiences and they see the smartphone as a suitable platform for more real-time access and practical AR experiences. Popular AR experiences on smartphones are AR filters/lenses on social media apps, AR navigation apps, AR translation apps, and AR gaming. Interest in smartphone AR apps has been increasing steadily as insights from the latest Consumer Lab report 5G value: Turning performance into loyalty (2023) indicated a 50 percent increase in daily time spent on smartphone AR experiences between 2021 and 2023 among 5G users. If you ask consumers, the smartphone is here to stay.

However, consumers want to experience AR out and about in society, and while the smartphone remains a versatile and convenient option for basic AR experiences, consumers face issues with using it. A main hassle is how smartphone AR is limited by a small screen, it also tires the arm when the smartphone is held up and it has low immersiveness. In addition, two out of ten say there's just not enough relevant content. Consumers also desire more advanced experiences that involve integrating spatial awareness of their surroundings and 3D mapping of objects to provide more immersive experiences.

The situation is not much better when it comes to VR/AR/MR headsets/glasses available on the market today. Even though as many as 44 percent claim these devices provide joyful experiences, many find currently available devices unattractive and bulky with limited content, batteries, device overheating, and them causing nausea also preventing prolonged usage. The form factor is largely due to technological limitations related to lenses, battery consumption and performance, which are necessary to provide a good user experience. Users connect both the style, usefulness and the possibility to integrate devices into daily life with what they are willing to pay, leading to many that find the current devices both pricy and less useful.

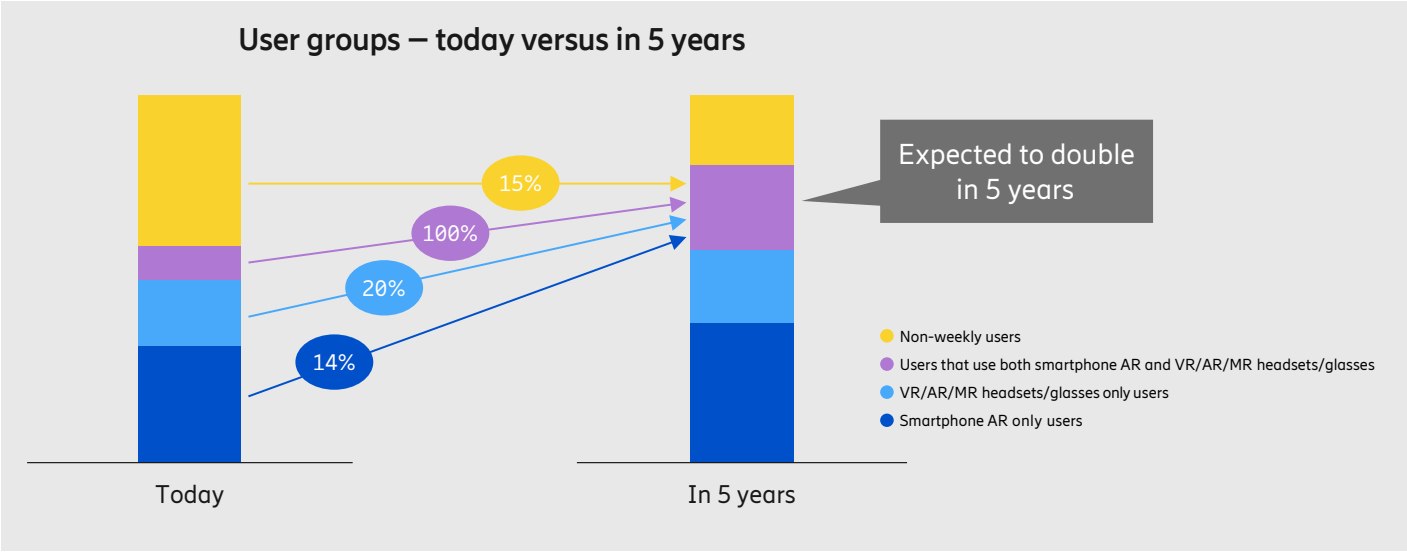
> You get like a more interactive experience (with headsets). It's just kind of cool to see what somebody would do if they could place things within the environment you're in. It's plenty of fun.
>
> _ XR headset user, the US

However, there is a silver lining when we delve into differences in satisfaction with current smartphone AR experiences among different user groups. Despite the overall satisfaction level hovering around 47 percent among active users, those who combine smartphone AR with VR/AR/MR devices report much higher satisfaction levels, with approximately a 14-percentage point increase compared to those who don't (namely, 54 percent versus 40 percent). But what factors contribute to their higher satisfaction? A closer look at their attitudes towards technology and level of engagement with current smartphone AR experiences sheds some light.

Those who combine smartphones with VR/AR/MR headsets/glasses are typically early adopters of technology, with 70 percent indicating their inclination to adopt new technology ahead of most people. In contrast, among those solely using smartphone AR, only 42 percent are early technology adopters. To some extent, this explains the higher satisfaction among combined users, as it is commonly understood that early adopters tend to be more tolerant of the limitations of new technology.

Furthermore, when looking at engagement levels with smartphone AR experiences today, those who engage in combined use tend to be heavy users and have more positive attitudes towards AR apps. Overwhelmingly, 88 percent use multiple AR apps, and 45 percent find the apps joyful. On the other hand, smartphone AR-only users tend to be lighter users with less positive attitudes towards AR apps, with about 54 percent using multiple apps and 34 percent finding the apps joyful. For example, some smartphone AR-only users primarily use AR social filters/lenses or gaming apps, while others primarily focus on practical applications like navigation or translation.

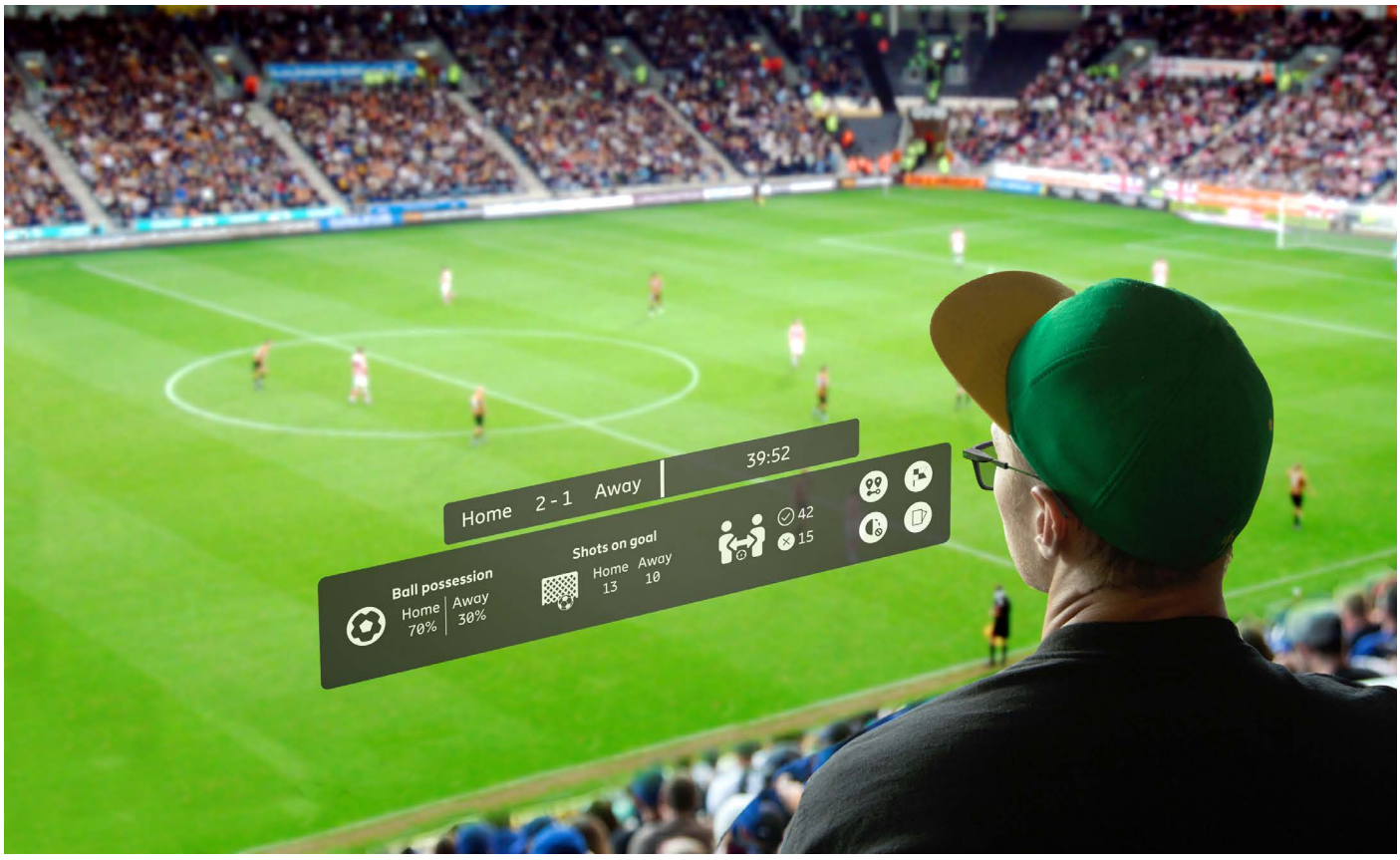
Today, 1 out of 10 consumers engage in combined use of smartphone AR and VR/AR/MR devices. Looking ahead, this number is expected to double in the next five years, signaling consumers' growing anticipation of increased acceptance and broader adoption of the technology. However, this anticipation is contingent on experiences and devices continuing to improve and become more engaging and user-friendly.



A slice of life, the role of AR devices in the next five years

Today, AR/VR/MR headsets/glasses are mostly used at home and are perceived as communal devices. 64 percent of users share their devices within the household today. It is also common for family members to use devices bought by someone else in the household. This emphasizes the homebound and communal nature of the devices today.

Looking forward, even though most consumers will still consider home being the primary use location, they want to take AR/MR devices beyond the confines of their homes, with 75 percent expressing such desire. This shift mirrors the journey of the telephone, which evolved from a stationary, shared household device to a mobile and personal one. A main characteristic of the telephone was that it was physically connected to a place and in collective use, the mobile phone reimagined this. Initially, the mobile phone suffered from many of the same challenges AR/MR devices do today and usage was limited due to the form factor, price, network coverage and social acceptance. But as devices became more advanced, sleek, affordable and socially acceptable, they eventually earned their place as the personal, everyday device we see in everyone's hands today. If AR/MR devices become strongly associated with personal values and identity, much like smartphones are today, they will be an essential part of consumers' lifestyles and not easily shared, even if they may not be as ubiquitous.



The significant appeal of out-of-home experiences

Consumers' desire to take AR devices outside of home is apparent when it comes to the desired use cases in the future. Consumers have already demonstrated significant interest in out-of-home and on-the-go experiences such as AR navigation, translation apps and tourist experiences. Looking ahead, consumers will not only maintain a high interest in these experiences but also anticipate greater diversity. In fact, a considerable 67 percent are drawn to such experiences that are likely to become widely available in the next two to four years. Examples include AR-enhanced sports viewing or concert events, augmented tourist displays and public art exhibitions that utilize digital content to enhance reality and create unique interactive experiences.

The desire to venture beyond the confines of the home is strong among consumers, evident in the fact that 7 out of 10 consumers express readiness to pay a premium for AR/MR devices that can be used outside of home or on the go once these devices hit the market. On average, they are willing to pay a 20 percent premium for such devices, with arenas and venues commanding the highest premium, among others.

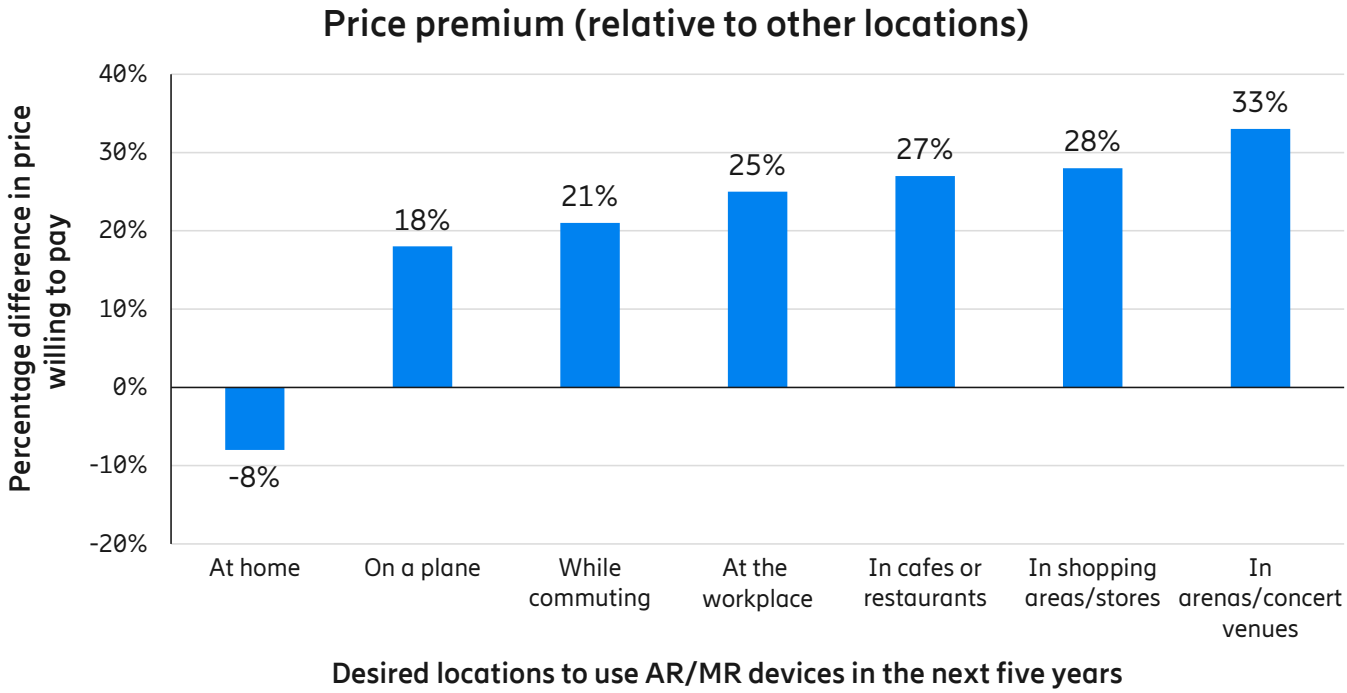
AR device connected to smartphones as a precursor for standalone AR devices

As discussed previously, the proportion of consumers combining smartphone AR with VR/AR/MR devices is expected to double in five years. But how do consumers envision using them? They see a scenario where AR/MR devices are connected to smartphones and serve as companions, with 62 percent indicating they are open to connecting AR/MR devices to their smartphones, provided that these devices will improve in terms of weight, portability, and battery life in the next few years. Consumers are already accustomed to using peripherals and accessories connected to their smartphones, which means that the transition to connecting AR/MR devices is not a significant leap.

> I think (bringing XR devices outside of home) is more important because at home there's only so much that you can do. It'd be great if I could bring it outside. For example, bringing it on vacations, to other countries.
>
> _ XR user, Japan

Connecting AR/MR devices to a smartphone would also reduce the amount of computing needed to be carried out by the device as some or all of it could be offloaded to the smartphone which could also provide performance boosts and network access. This would solve some of the main hassles with AR glasses today, such as the added weight and size required for optimal battery and computing performance. Another method to facilitate advanced computing is by shifting calculations to either the edge or cloud, which increases the need for network access.

All this speaks for tethered AR/MR devices, likely in the form of glasses, as companion devices to smartphones while allowing technological advances and use cases to catch up.

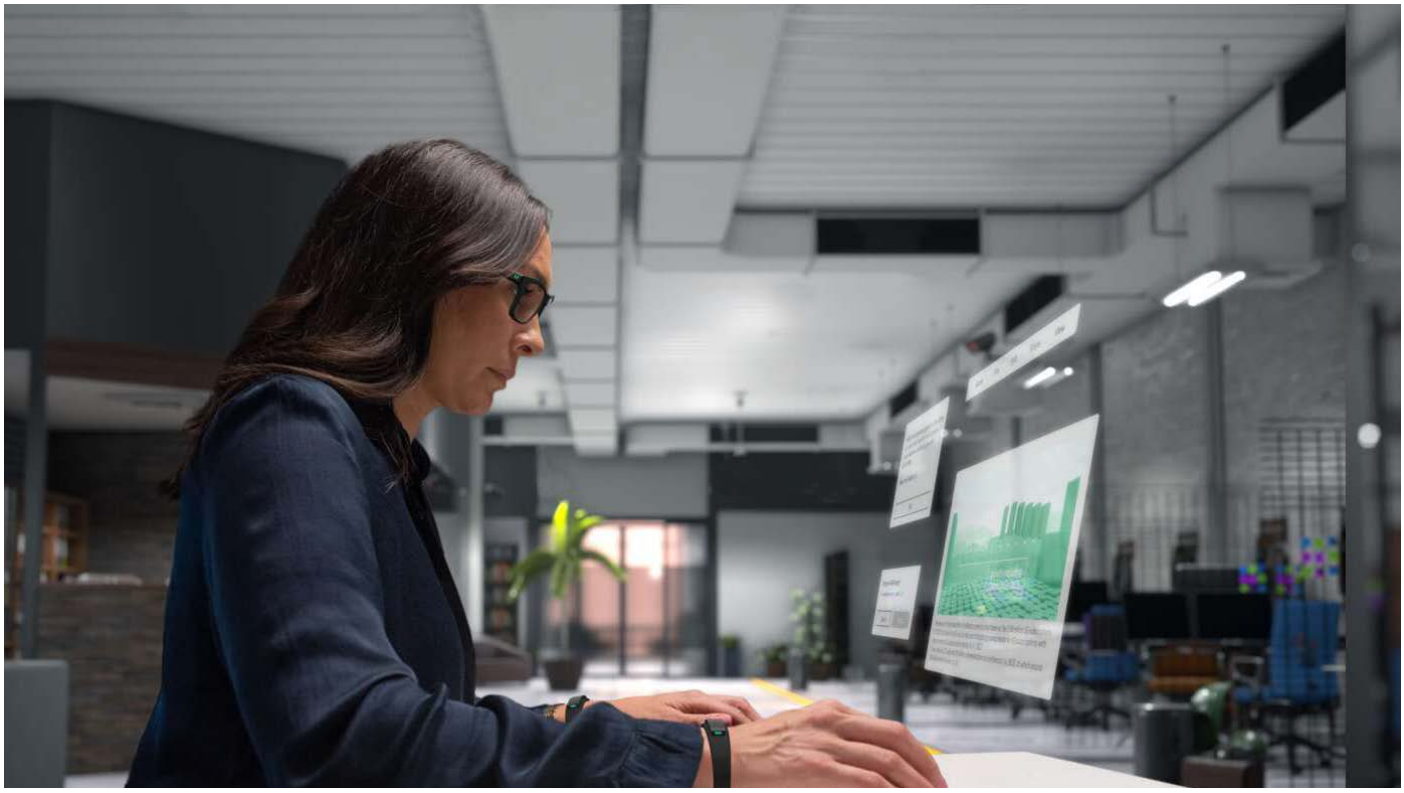


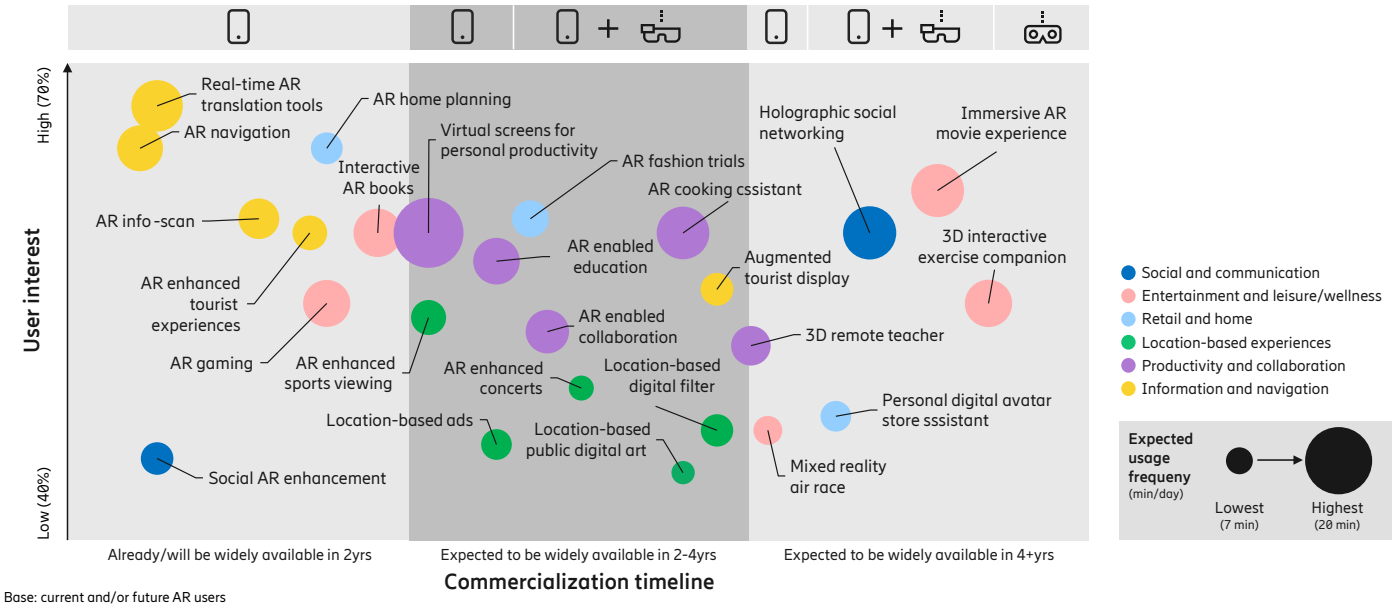
Three stages of AR experience evolution

To gauge consumer sentiment towards various AR/MR experiences, we tested 26 use cases to assess their consumer appeal. While information and navigation, along with shopping-related experiences (primarily for home planning), are deemed most appealing globally, nuanced preferences were observed across different markets. For example, in China, consumers show a high preference for AR gaming, entertainment and productivity applications, whereas in the US, alongside home planning experiences, consumers also express significant interest in entertainment and social networking-related experiences. Conversely, in the UAE, 3D interactive exercise companions and shopping experiences related to fashion are particularly appealing.

As the industry advances globally, we foresee a three-stage transition for consumer AR experiences over the next five years. Initially, basic AR experiences will become widely available to consumers, a stage that has already commenced and will continue to evolve in the coming one to two years. This will be followed by a second stage where more location-based and geospatially aware experiences become accessible to consumers. Finally, more advanced, and native experiences will begin to emerge and become available to consumers.

As AR experiences evolve, the devices available to consumers will also undergo a transformation. This evolution will commence with smartphones dominating the initial stage, followed by portable AR devices acting as companions to smartphones to enable experiences outside home and on the go. Eventually, standalone AR devices will emerge to facilitate native and more advanced experiences.





Base: current and/or future AR users

Stage one: Smartphones are the most accessible devices for consumers, with social and informational AR experiences dominating the use case landscape.

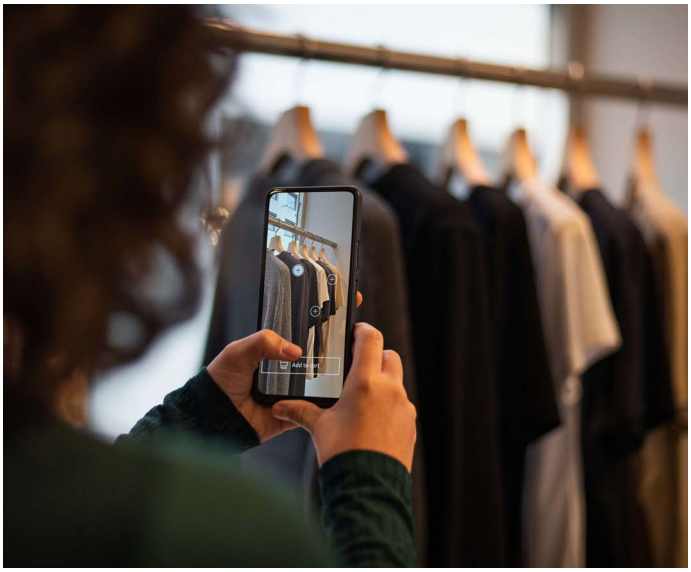
At this stage, smartphones serve as the dominant platform for consumer-friendly AR experiences, with many transitioning from traditional smartphone apps to the XR realm. Today, AR experiences on smartphones encompass exploration and decision-making assistance, such as translation, navigation, and information scanning. Additionally, consumers appreciate AR filters/lenses on social apps and AR gaming. However, the quality of current AR experiences is constrained by the capabilities of smartphones.

Stage two: Lightweight, portable AR/MR devices are expected to become more accessible to consumers, with geospatial AR experiences diversifying the use case landscape.

At this stage, alongside smartphones, consumers expect lightweight, portable AR/MR devices to become more accessible. They are willing to connect these devices to their smartphones, aiming to elevate their experiences. As geospatial AR technology advances in more precise location tracking and enhanced environmental awareness, consumers can expect a wider range of location-based and surroundings-aware experiences. Notably, consumers express interest in AR-enhanced sports and musical events, AR tourist displays, and location-based AR art displays. Additionally, location-unbounded education, collaboration and virtual screens for productivity enabled by AR will also gain traction among consumers.

Stage three: Consumer-friendly standalone AR/MR devices will begin to emerge, with native AR experiences further diversifying the use case landscape.

In this stage, the use case landscape will continue to evolve, offering more advanced and native experiences to consumers. For instance, consumers will be able to enjoy mixed reality cinematic experiences anywhere and have 3D digital exercise companions during workouts. Simultaneously, devices will evolve to meet these demands. As consumer expectations for use cases and user experiences surpass the capabilities of smartphones and earlier tethered AR/MR devices, more capable yet consumer-friendly standalone AR/MR devices are expected to emerge. These devices may feature built-in connectivity and will gradually become available to a wider group of consumers, elevating consumer experiences to a new level.



In the eye of the beholder, form, privacy and social acceptance

Interest in XR is high among early adopters, but adoption among the general population is still lagging. The existing devices do not meet the consumers' expectations and it will take more than what the current devices can offer today to rock the boat. In 2019, our research in the study "Internet of Senses" showed that 45 percent of the early adopters expected lightweight AR glasses by 2025. Fast-forward four years and we are still a long way from that type of technology being available for the general population. The reasons for the slow development are complex and involve not only technological hurdles but also social acceptance, the design and form of devices and concerns about privacy.

The form factor's impact on social acceptance

How a product looks and feels is crucial to whether it takes off, but the form factor is important not just from a physical comfort standpoint, but also from a social and societal perspective. The expectation for AR/MR devices to be worn in various public settings is high, with 57 percent of consumers anticipating using the devices in at least three different locations outside the home five years on. However, new potential users are deterred by social concerns regarding how they look and will be perceived, and 35 percent of current device users express major concerns about the appearance and social perception of wearing these devices.

> People look stupid and people may look at you weirdly if you wear AR glasses.
>
> _XR user, the US

The design and stylishness of wearable technology have an impact on how users approach it. If a device does not align with collective standards and views on what is normal design

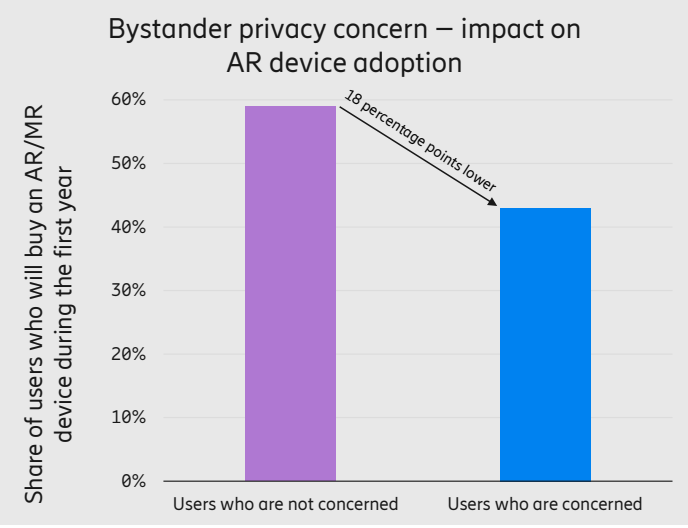
and behavior, the wider community will be hesitant to pick it up. In our study, 61 percent of the consumers said they would not wear AR/MR devices in public if they were not visually appealing. Considering that mainstream users are more self-conscious and less tolerant of new and unusual-looking technology compared to early adopters, designers need to adapt if they want to reach the general public. However, on a positive note, 65 percent of the respondents believe that blending digital and virtual elements in the physical world would be helpful, and they are curious and willing to bring AR glasses with them into public spaces in the future. To make these devices more widely accepted, designers must push the boundaries of socially acceptable design and behavior while also conforming to some extent.

Social acceptance seen through the lens of bystanders

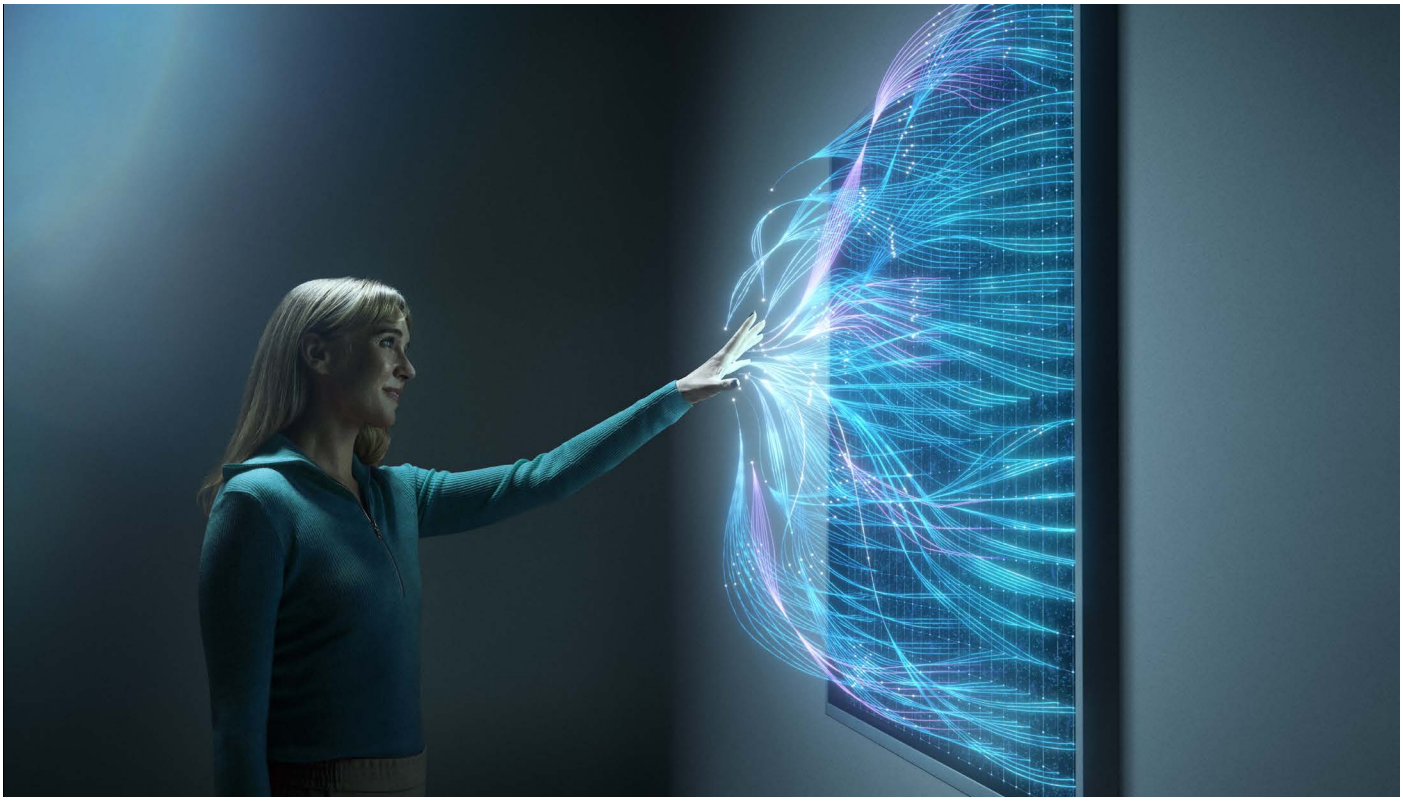
An important facet of social acceptance is bystander privacy, namely when individuals are captured in pictures or recordings invertedly or without their consent by those who use AR/MR devices in public. However, for many consumers, being recorded as a bystander by someone using an AR/MR device is not the most worrying aspect. Instead, what concerns them the most is the sharing of these pictures or videos with others, whether with or without their consent.

Out of our responders, only 21 percent say they are not comfortable with being around other people who use their AR/MR devices to capture pictures or videos and 31 percent are not comfortable with being caught on camera in someone else's extended reality experience. However, when it comes to sharing videos or pictures with inadvertently captured bystanders, 60 percent globally expressed apprehension, with certain markets showing even higher levels of concern. For example, 71 percent in South Korea expressed such apprehension, representing an 11-percentage point increase. This is not surprising, as consumers in most markets today are generally tolerant of others taking photos and recording videos in public spaces with their smartphones. But consumers are also mindful of the potential for media to be misused when shared online, which may underpin the unease expressed over sharing AR media with bystanders captured. The rise of generative AI, capable of training on personal images and videos to process and analyze extensive amounts of personal data for tracking individuals, further exacerbates these concerns.

The amassed impact of bystander privacy issues influences consumers' willingness to adopt AR/MR devices. This becomes evident when examining the share of consumers intending to purchase an AR/MR device during its first year of availability. Notably, for those who are concerned, the intention to adopt is 18 percentage points lower than for those who are not concerned. Naturally, the impact varies between markets. While most markets show a similar level of impact, consumers in China and South Korea indicated the lowest impact at around 9 percent, nearly 10 percentage points lower than the global average. These differences between markets could be attributed to multiple factors such as culture, awareness of personal privacy protection, and regulations.



The path ahead, pondering the next five years



The future of the consumer AR market hinges on the next few years, as the industry battles with technological and social limitations that hinder widespread mobile usage of AR/MR devices. One potential future development is combining AI with AR glasses. AI will be important to produce and run AR experiences and it could potentially be used to help block out content that would be a privacy concern. Another potential avenue is AR/MR devices with an inbuilt AI assistant. Many consumers are positive about the prospect of having a personal AI assistant at hand to help with the minutiae of everyday life. Coupling this vision with sleek AR glasses that provide access to personal information, the internet, and sensory data, the assistant could support various tasks, provide information overlays, extrapolate data, track position, and function as an extended screen. Maybe that is the future device that could take the same type of ubiquitous position in our lives as the smartphone has today.

Ecosystem players need to step up efforts and foster broader consumer adoption

The evolution of the AR market will require efforts from a range of ecosystem players to drive both technological development and consumer adoption. Collaboration within the ecosystem will be essential to propel AR technology to its full potential, focusing on diverse areas such as improving connectivity, ensuring seamless transitions between devices, improving application and content relevance, addressing privacy concerns, and shaping the societal acceptance of AR/MR devices.

Device: The form factor of AR/MR devices plays a vital role in society's acceptance and the current form of AR devices does not meet the public's expectations for on-the-go devices.

Consequently, the industry needs to both conform to and challenge societal norms. To gain acceptance, the public needs to be nudged toward familiarity in small steps using basic use cases and devices as gateways to more advanced usage. But these are processes that take a long time and for them to pick up, the starting point must be with something that is either staggeringly good or a device that is seen as stylish and can be worn in public without shame. Remarkably innovative or fashion-forward devices could initially spark wider adoption.

Application and content: Software and content developers should take note of the trends that more and more users expect to use AR/MR devices outside of home and on the go, together with their smartphones in the future. This means consumer expectations of versatile applications, and high-quality content tailored to diverse locations and network conditions will increase, providing an opportunity for app developers to elevate user experiences by exploring and utilizing network APIs. Similarly, consumer expectations of seamless transitions between the devices will also increase, demanding application development to be approached from a device-agnostic point of view.

5G network: As portable AR/MR devices, likely in glasses form, gain popularity and social acceptance for everyday use, their reliability and utility in various contexts will increasingly hinge on network and cellular connectivity. Network infrastructure must be optimized for widespread usage outside of home and on the go. Wide area connectivity or 5G hotspots will be vital in high-traffic locations such as airports, train/subway stations, arenas/concert venues, stores or shopping areas, social establishments such as cafes and restaurants, or while commuting.

On the other hand, increased AR adoption and the use of smartphone-connected portable AR/MR devices will also present new revenue opportunities for communications service providers (CSPs) in both consumer and developer markets. For example, CSPs can offer higher tethering allowances for AR/MR devices and premium plans with quality of service (QoS) differentiation in high-traffic locations for consumers. Simultaneously, they can provide developers with network APIs optimized for XR traffic demands.

Privacy: Addressing user and bystander privacy issues will be critical for the industry to gain traction, necessitating actions from all players and legislative bodies. Mandating and developing features that protect user and bystander privacy, including personal data such as identity and location, by default can address these issues, but it will require cross-collaboration between society and industry. Additionally, there is potential for new roles in this area for CSPs. CSPs could offer new services by assuming the role of a trusted broker to safeguard sensitive data, encrypting or anonymizing user data according to national or regional regulations that they are uniquely positioned to understand.

In conclusion, the evolution of the consumer AR market requires collaboration across the XR industry and various sectors to educate the public, innovate device design, diversify use cases and build robust connectivity infrastructure to support use in dynamic environments. Only through these joint efforts can AR technology reach its full potential and contribute to societal advancement.

About Ericsson

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