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MERGED REALITY

Understanding how virtual and augmented realities could transform everyday reality

An Ericsson Consumer Insight Summary Report
June 2017

CONTENTS

METHODOLOGY

Qualitative study

Group discussions in virtual reality (VR): Ericsson ConsumerLab innovatively conducted one of the first known qualitative focus group discussion series completely in VR, using an HTC Vive in an online environment called Altspace VR. Participants were from different parts of North America and Europe.

In addition to the VR focus group, we also performed two traditional focus groups with current users of VR from Japan and South Korea.

We also ran a series of qualitative VR tests with 20 Ericsson employees to understand how lag in VR can trigger nausea. We simulated three different levels of testing: VR set-up with no lag, with medium lag and one with increased lag. The aim was to understand how the VR experience was impacted when the lag is altered, and the corresponding threshold of tolerance for these consumers.

Quantitative study

This report presents insights from the online survey of 9,200 consumers in France, Germany, Italy, Japan, South Korea, Spain, the UK and the US. Respondents were aged 15-69, and were aware of the concept of VR. We believe that in order to understand the potential impact of VR on human experiences, it was essential that the respondents were aware of VR. Currently, VR is something that only a proportion of the population are familiar with – this sample represents 51 million smartphone users who are aware of VR, out of over 800 million living in these 8 markets.

As an innovation in qualitative research, we conducted focus group discussions in VR

All reports can be found at:
www.ericsson.com/consumerlab

Definitions used in the study

Early adopters:

Current users of fixed VR headsets who use VR several times a week. Given that this was an early adopters sample, they represented 15 percent of the sample. (Mobile only VR users were not included, since they have more casual usage.)

Consumers who are planning to use a headset:

Currently non-users of VR, but interested in using it in the future. This group represented 49 percent of the sample.

Laggards:

Currently non-users of VR, and not interested in using it in the future. This group represented 15 percent of the sample.

VR: Virtual Reality **AR:** Augmented Reality

THE VOICE OF THE CONSUMER

Ericsson ConsumerLab has more than 20 years' experience of studying people's behaviors and values, including the way they act and think about ICT products and services. Ericsson ConsumerLab provides unique insights on market and consumer trends.

Ericsson ConsumerLab gains its knowledge through a global consumer research program based on interviews with 100,000 individuals each year, in more than 40 countries and 15 megacities – statistically representing the views of 1.1 billion people.

Both quantitative and qualitative methods are used, and hundreds of hours are spent with consumers from different cultures. To be close to the market and consumers, Ericsson ConsumerLab has analysts in all regions where Ericsson is present, developing a thorough global understanding of the ICT market and business models.

TRANSFORMING EVERYDAY REALITY WITH VR AND AR

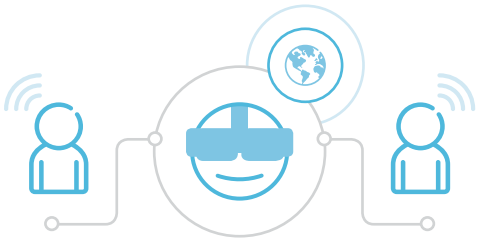
Incorporating technology into our everyday lives is quickly becoming the norm. The World Economic Forum calls the idea of merging the real with the digital – the Fourth Industrial Revolution. Virtual and augmented realities could encourage a similar technological revolution – one where consumers transition between virtual and physical worlds effortlessly for their everyday life activities.

However, in their current form, virtual and augmented technologies collide rather than merge with our physical reality. Today the bulky headsets cut off the user from their surroundings, as well as hinder mobility, and a highly interactive VR experience can induce nausea for some users.

Consumers expect next-generation networks like 5G to address these challenges and enrich shared experiences by providing a fast and high-bandwidth network.

In this Ericsson ConsumerLab report, we explore the impact of these imminent changes on consumer lifestyles, from the perspective of early adopters, laggards and consumers who are planning to use a headset in the future. We also look at the enabling role that next-generation networks like 5G could play.

> Virtual and augmented realities could encourage a technological revolution where consumers transition between virtual and physical worlds effortlessly for their everyday life activities



KEY FINDINGS

1 7 out of 10 early adopters expect VR/AR to change everyday life fundamentally in six domains: media, education, work, social interaction, travel and retail

- Two in five early adopters believe classrooms and offices will be replaced by virtual spaces. A quarter think AR will enable travel information and map overlays onto our physical environments by next year
- Half of early adopters expect AR and VR to be integrated in one device, as a pair of AR glasses with in-built VR capabilities
- Even laggards expect VR/AR to deliver new ways of training in industries like air travel, national security and healthcare

2 Media is already being transformed. Consumers expect virtual screens to start replacing televisions and theatres in less than a year

- As many as half the early adopters have already increased their video usage in VR. More than a third have shifted some of their video viewing on physical screens to video experiences in VR

3 Lack of mobility, bulky headsets and network lag keep merged reality at bay

- One in five early adopters have already decreased their usage of VR
- Half the early adopters believe that the current VR headsets hinder mobility. Almost a fifth also consider sickness caused by VR to be an issue
- Even mobile VR users restrict usage mostly to home. Mobility is hindered by battery drain and the fact that the headset blocks the user's view

4 For merged reality to become mainstream, 5G is central to provide mobility, improve social experiences and address nausea

- More than a third of early adopters expect 5G to make VR mobile by providing a stable, fast and high-bandwidth network
- 30 percent believe that 5G will enable more social experiences and will also improve the battery efficiency of devices
- A quarter of early adopters expect 5G to address the nausea and sickness in VR

TOWARDS A MERGED REALITY

There are a number of examples of consumers being offered experiences that merge their physical reality with virtual experiences, challenging traditional notions of 'real experiences'. The location-based, augmented reality game Pokémon Go allows players to catch virtual pocket monsters on streets, parks and subway stations. Global hotelier Marriott teleports its guests to exotic locations virtually, allowing them to decide on a vacation spot. The Guinness World Records book allows readers to have their picture taken with the world's shortest man through an AR-enriched app and send it to friends and family.

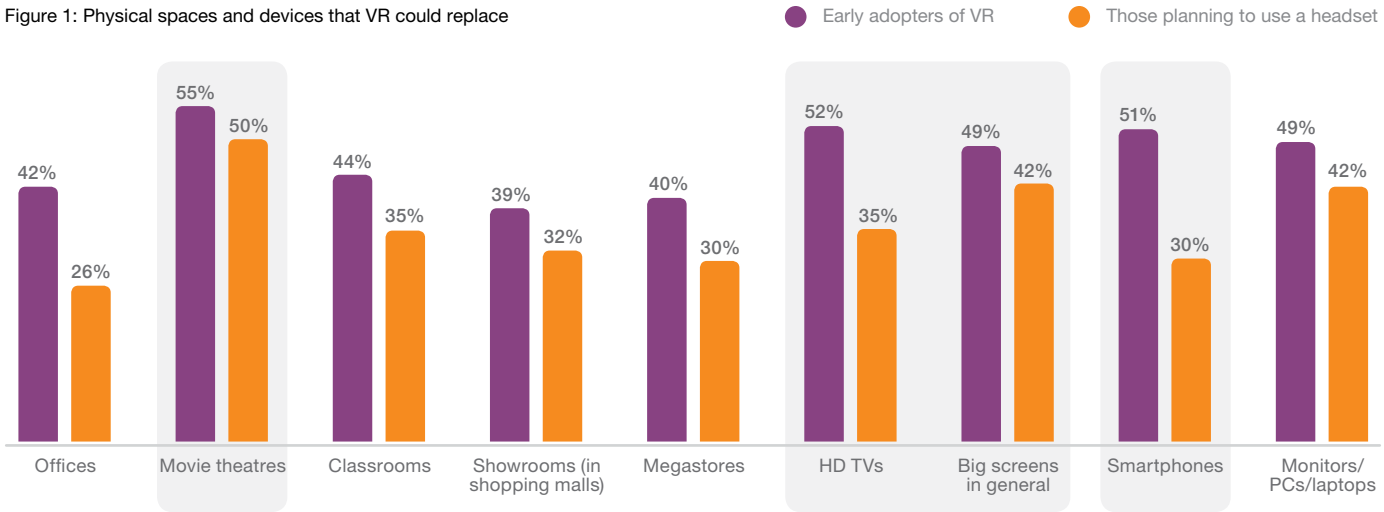
When the boundaries between people's perception of physical and virtual reality start to blur, this could result in a drastic impact on lives and society. The way we live, work and consume information and media may fundamentally change. Consumers could stop buying TV sets, for example, and choose a virtual screen instead. Physical spaces like offices and changing rooms in clothing stores may be replaced by virtual spaces. Surfing the web may be transformed from clicking links to walking through virtual portals. The virtual world may no longer remain the ultimate form of isolation or escapism, but could become the social network of the future.

From the early adopters surveyed, three in five believe VR will change everyday activities, such as video viewing and social networking. Even among current non-users of VR, almost half of the consumers who are planning to use a headset believe that VR has the potential to create a significant impact in the future. Almost half of the early adopters believe VR could replace physical devices like HD TVs, big screens, smartphones and laptops, and nearly a third of the consumers who are planning to use a headset also believe so.

> **"Everyone's going to do everything that they do on their personal computers, tablets and smartphones, in virtual reality."**
>
> David, Canada,
> VR focus group discussion

The way we live, work and consume information and media may fundamentally change

Figure 1: Physical spaces and devices that VR could replace



Source: Ericsson ConsumerLab, Merged Reality, 2017
Base: Smartphone users aged 15-69 across 8 markets who currently use tethered VR headsets at least several times a week or plan to use a VR headset in the future

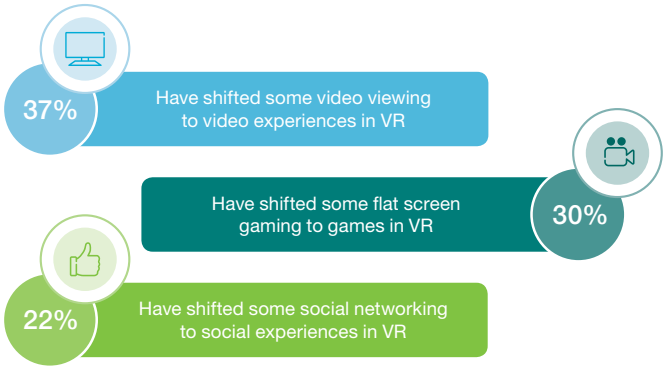
CHANGE WILL SPAN SIX DOMAINS

Virtual and augmented reality have the potential to impact many domains and activities. Recent developments have already seen VR and AR evolve beyond gaming. The US presidential elections were streamed live in VR and seen by VR users from around the globe, gathered as crowds in shared spaces. President Obama bid goodbye to his fans through a VR tour of the White House. VR applications today span music, movie releases and previews, travel, shopping, journalism and, of course, social networking. For example, Facebook Spaces is a social VR app that lets you hang out with others inside your headset.

In the qualitative part of this study, consumers told us they expect VR/AR to change six domains the most – media, education, work, social interaction, tourism and retail. In the quantitative phase, we then found an astounding 7 out of 10 early adopters expect VR/AR to change these 6 domains fundamentally. Furthermore, as many believe that VR/AR will become mainstream in all six domains. This impact already goes beyond current early adopters: even among those planning to use a VR headset in the future, as many as 6 out of 10 believe that the education, media and work domains will be changed fundamentally.

7 in 10 believe that VR/AR will become mainstream in media, education, work, social interaction, tourism and retail

Figure 2: Disruption in media has already begun



Source: Ericsson ConsumerLab, Merged Reality, 2017
Base: Smartphone users aged 15-69 across 8 markets who currently use tethered VR headsets atleast several times a week

> "I remember when there were no microwave ovens and the first oven was introduced – I put a potato in it and it cooked in just five minutes. VR is revolutionary like that, extremely revolutionary. It will be something that changes everything."
>
> John, US, VR focus group discussion

Leading digital transformation

When the internet first arrived, media was among the first domains to be transformed. Now consumers expect media consumption to change just as rapidly with the mainstream adoption of VR and AR. In fact, we are already witnessing VR starting to transform the media domain.

Close to half of early adopters have already increased their VR video usage since the time they started using it. Thirty-seven percent of early adopters have started shifting their video viewing to VR. Among the frequent mobile VR users, as many are watching videos as are playing games on a daily basis. Those who are planning to use a headset in the future believe watching videos in VR will be one of their top activities – even more than gaming.

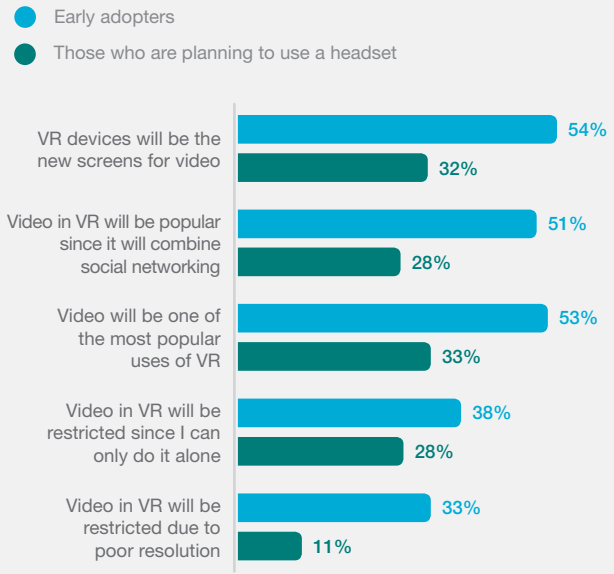
More than a quarter of early adopters believe that, within a year, they will be watching movies on virtual screens without owning anything other than a VR headset. More than half of them predict video viewing will be the most popular activity in VR. Over a quarter of laggards are also open to watching content on a virtual screen without having to go to a theatre or owning a physical screen.

Socializing in virtual reality

Another unique aspect of video viewing in VR is the ability to combine it with social networking. Today, it's possible to watch media with friends in VR application rooms like Bigscreen and AltspaceVR. A participant in one of our VR focus group discussions said, "The money here is going to be in the concert industry [...] I can watch my favorite band with integration between a fully immersive VR experience and 360 degree streaming camera, with hundreds of others from around the globe". Live streaming of concerts and sporting events could potentially be a huge application for VR in the media space. Sixty percent of early adopters expect that interactive music concerts and events in VR will be mainstream in the next three years.

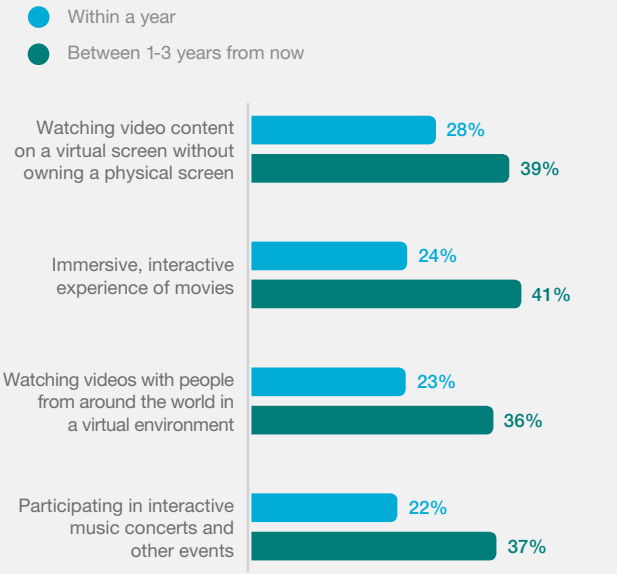
Ironically, there are simultaneous positives and negatives to VR. On one hand we meet a lot more people in the virtual environment, while on the other we may be isolated from people in our physical environment due to the nature of the current VR headsets. While 51 percent of early adopters believe video viewing in VR will be popular since it can combine social networking with video, 38 percent also believe video viewing in VR will be challenging because it can only be done alone.

Figure 3: The use of VR with video



Source: Ericsson ConsumerLab, Merged Reality, 2017
Base: Smartphone users aged 15-69 across 8 markets who currently use tethered VR headsets at least several times a week or plan to use a VR headset in the future

Figure 4: Share of early adopters who expect their media consumption to change in the following ways



Source: Ericsson ConsumerLab, Merged Reality, 2017
Base: Smartphone users aged 15-69 across 8 markets who currently use tethered VR headsets at least several times a week

UNLIMITED LEARNING AND TRAVEL

Consumers believe that VR and AR could drastically transform education and learning. Sixty-one percent of early adopters believe that VR could be used for education and social purposes. In fact, 49 percent of consumers who are planning to use a headset, as well as 25 percent of the laggards also believe so. Replicating physical classrooms, textbooks, field visits/experiments, and learning through demonstrations and interactivity are some of the ways that VR could transform the field of education and learning. A quarter of early adopters believe that, within a year, students will be able to gain practical experiences without actually leaving the classroom.

Laggards are open to using VR for education and learning. In the context of education, they are particularly open to specialized and technical trainings being delivered virtually, especially in the field of medicine and surgery.

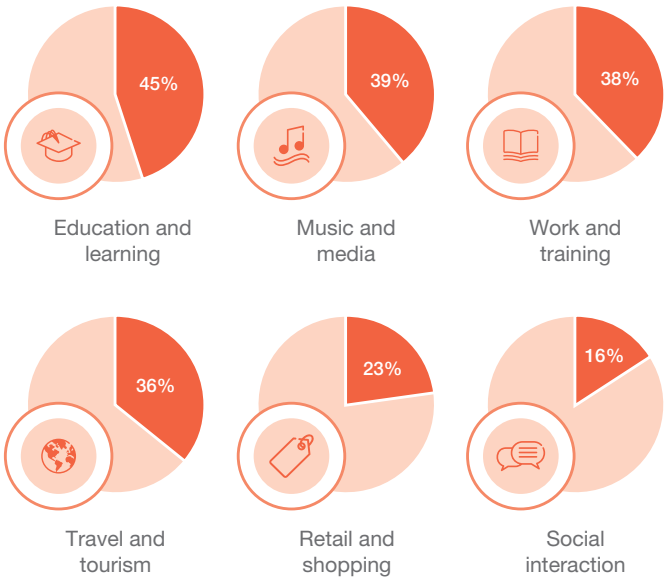
AR-enabled adventure

The other domains are not too far behind. Travel and tourism could go through another transformation. Twenty-five percent of early adopters believe that in a year from now, we will be exploring destinations through AR-enabled information and maps overlaid onto our physical environment. VR will also give rise to a new concept of tourism and adventure – 23 percent of early adopters believe that within a year we will go on adventure trips virtually with others.

Consumers expect VR and AR to have an impact on daily activities and experiences across other domains as well. Twenty-six percent of early adopters feel that within a year we will be shopping virtually for large items like furniture, and even experiencing them in our homes before purchase.

25 percent of early adopters believe that we will be exploring destinations through AR-enabled information and maps overlaid onto our physical environment by next year

Figure 5: Percentage of laggards open to using VR/AR in different domains



Source: Ericsson ConsumerLab, Merged Reality, 2017
Base: Smartphone users aged 15-69 across 8 markets who are rejecters of VR, that is they are not interested in using VR in the future

> **Virtual classrooms will be the next evolution. You needn't be limited by physical space or even the distance between home and school, sitting in traffic and hoping that you would reach the classroom in time. VR does away with a lot of physical limitation that current educational systems face."**
>
> Steve, US, VR focus group discussion

LADEN WITH CHALLENGES

Not yet mainstream

Many consumer devices and headsets have been launched in the last couple of years. Facebook recently announced that it would be moving towards AR to connect with friends and family, and Google launched its own VR headset as well as its VR platform Daydream last year. Yet despite this, VR is still to hit mainstream. Although consumers express a strong inclination towards using VR for video consumption, most content in VR today is still in short videos.

The VR paradox

Many perceived challenges were with the current state of VR hardware: the headsets are heavy to wear, especially over a long period of time, and are complicated to set up. The headsets also cut users off from their physical surroundings, restrict mobility and are socially awkward to wear. Hence, paradoxically enough, the user may be able to travel to any destination in the virtual world, but cannot go anywhere in the real world as the headset blocks their view. VR today suffers from several 'mixed reality' paradoxes: it provides realistic, immersive experiences, but it does not merge realities.

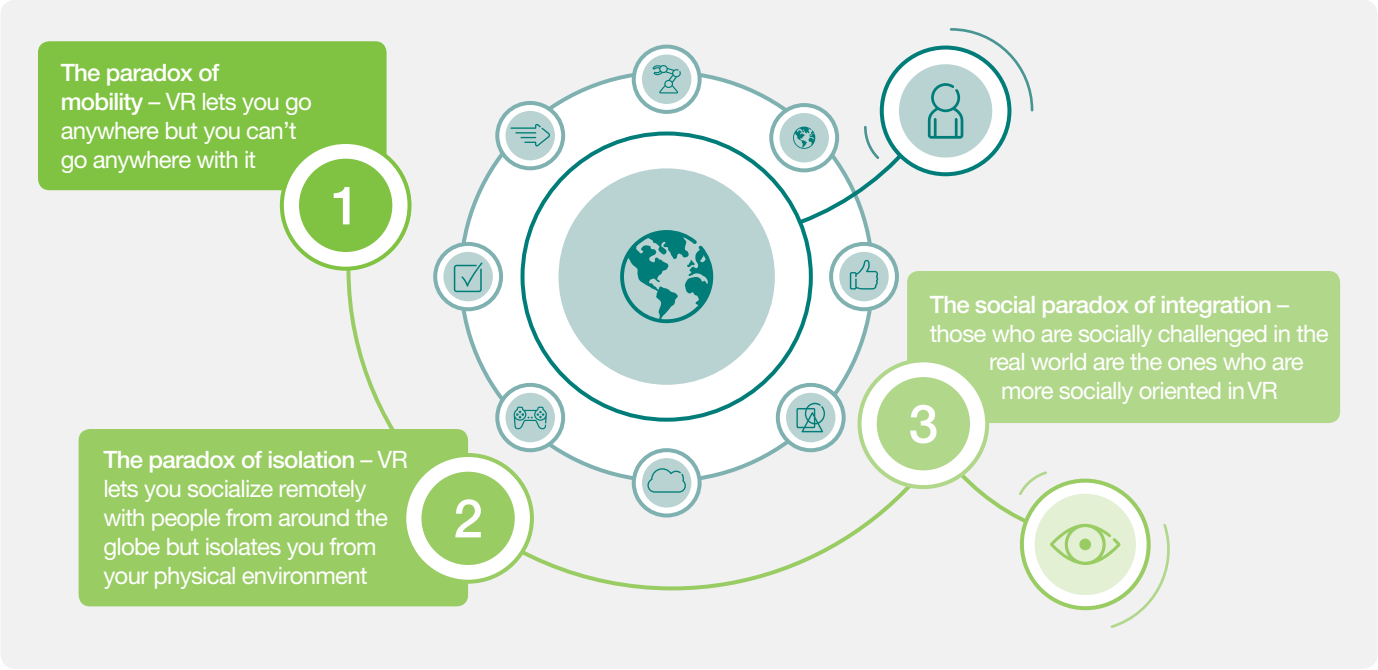
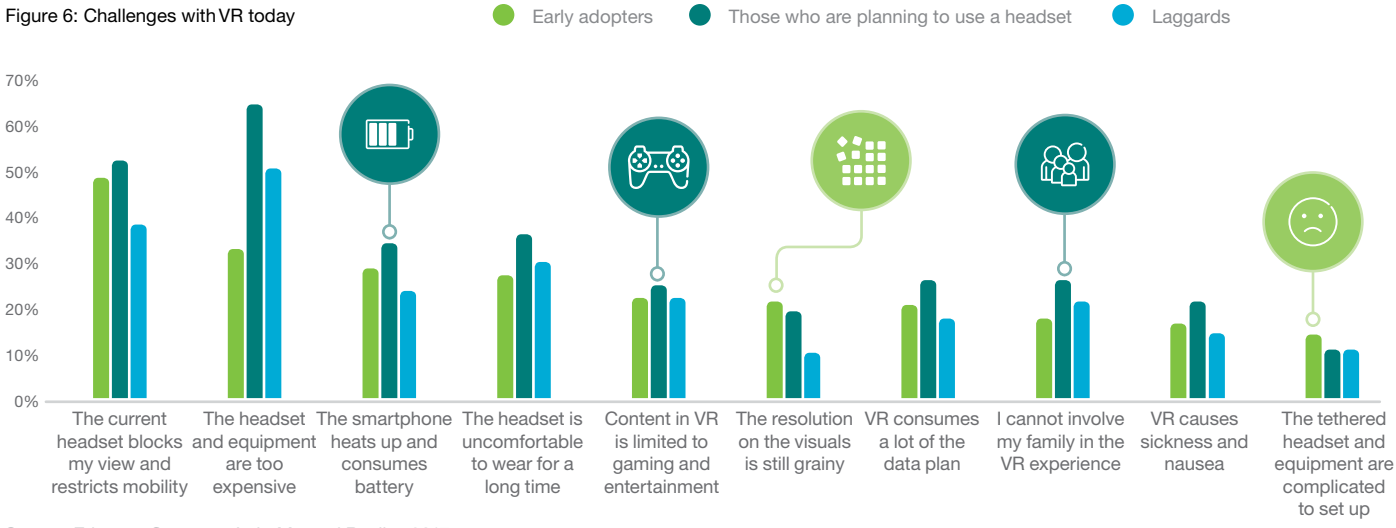


Figure 6: Challenges with VR today



Source: Ericsson ConsumerLab, Merged Reality, 2017
Base: Smartphone users aged 15-69 across 8 markets who currently use tethered VR headsets at least several times a week or plan to use a VR headset in the future; or who are rejectors of VR – that is they are not interested in using VR in the future

Stationary motion sickness

VR can leave users feeling sick because of latency issues. The delay between the movement in the virtual world and actual movement in the user's physical body may leave them feeling nauseous. As per the 10 Hot Consumer Trends of 2016, published by Ericsson ConsumerLab, 1 in 3 consumers wanted motion sickness pills for use with VR and AR for this reason. Almost a fifth of the early adopters find sickness to be a problem in VR. Users also complain of a poor visual experience due to low resolution.

Hence VR can be physically draining and restricting for users in its current state. Non-users also have similar concerns with VR; though their biggest turn-off is that it is expensive.

Consumers also expect VR to integrate haptic feedback (that is the sense of touch) – more than half of early adopters believe that haptic feedback is an important element that is missing from VR today and must be added in the future. While 60 percent think this will enable new possibilities in video, simulations, gaming and shopping, another 56 percent believe that adding haptic feedback will make VR more valuable for specialist industries, such as healthcare and therapy, and for training.

> **Earlier, I used to be in VR for 30 minutes every day about 4 times per week, but now my eyes hurt too much, and there is a strange dizziness […] so I have reduced my usage to 10 minutes 1 to 2 times a week."**
>
> Seong Jun Kim, South Korea, traditional focus group discussion

Smartphone-enabled VR headsets

While the smartphone versions of VR headsets provide mobility and are easier to set up, they have their own challenges – more than a third of mobile VR users complain that the smartphone heats up and consumes a lot of battery power. Since you look awkward when using the headset and cannot walk freely, due to being cut off from your surroundings, as many as 68 percent of mobile VR users only use their headsets at home. A quarter of mobile VR users have in fact reduced their overall usage of VR since they started using it.

Do we want a virtual society?

These are only the physiological challenges associated with VR, but could VR also have a negative impact on society? Almost a third of early adopters agree that VR is socially risky and people may start disliking their physical reality and social relationships. VR, by virtue of being realistic and immersive, could also be used negatively to manipulate the human brain. A participant in one of the VR group discussions claimed, "VR could have a negative influence as well because you could control or manipulate someone's thoughts with something immersive like this, like by showing them some negative visuals". For instance, a violent video game could start feeling like murder – something that VR developers are already showing concern over.[1]

But when the technological challenges are overcome and headsets are no longer bulky and restricting, so that consumers can transition between the virtual and physical worlds effortlessly, the social risks of escapism and individualism may cease to exist. In such a world, the users wouldn't necessarily know if they are in the virtual or physical world.

A quarter of mobile VR users have reduced their overall usage of VR since they started using it

> **People might get really obsessed with VR and just be completely satisfied with the virtual world. It can be a very powerful escape for many people, especially for people who don't like going out, and this might be quite dangerous."**
>
> Anthony, Mexico, VR focus group discussion

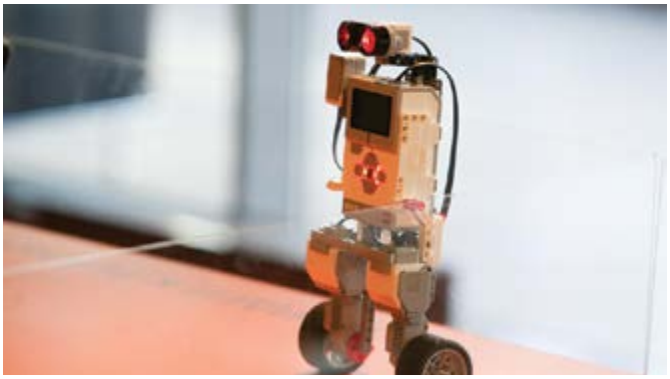
[1] uploadvr.com/is-it-okay-to-kill-in-vr/

AR WILL INTEGRATE VR

VR today is fraught with challenges. In its current state, VR only mixes reality but does not merge with it. Our consumer research indicates that one way of overcoming this paradox, and moving towards a merged reality, is to integrate VR within AR. Consumers perceive AR to avoid a number of issues that hold VR back from becoming mainstream, especially when it comes to everyday practicality – they say they can still interact with the real world, with their friends and family, rather than locking themselves away in a virtual space. It is for these reasons that early adopters of VR also believe that AR has greater potential to go mainstream.

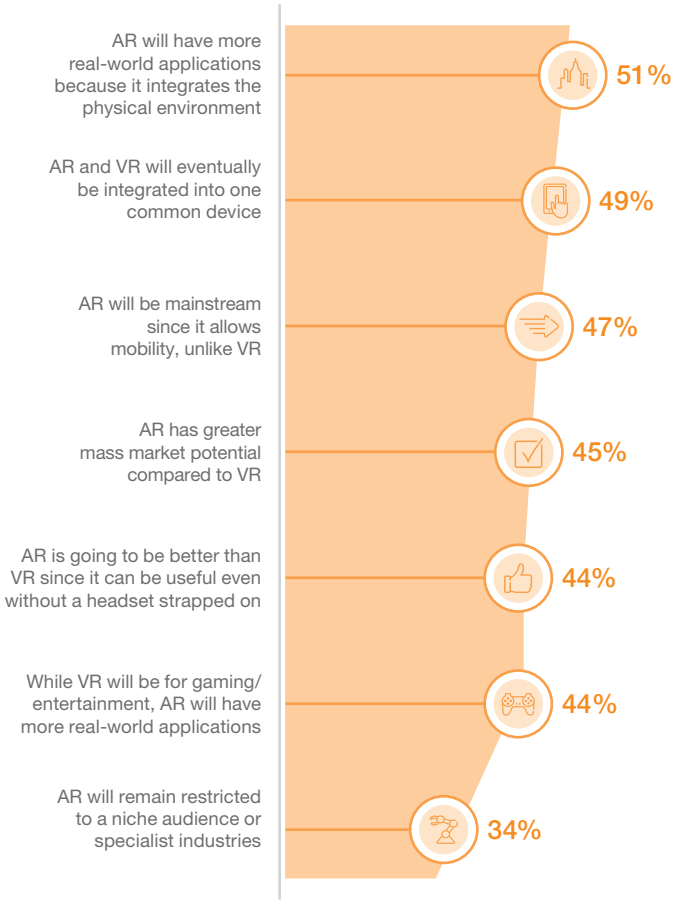
However, these early adopters also believe that as technology evolves, AR headsets will subsume VR as part of the experience. An AR experience does not necessarily require a headset. The AR game Pokémon Go merely uses the smartphone screen and camera to deliver the experience. Similarly, Snapchat Lenses uses the camera to overlay features and expressions on the user's face. Facebook recently announced that they will be developing smartphone cameras as the first mainstream augmented reality platform. Similarly, when VR becomes part of the AR experience, our interviews indicate people expect a pair of AR glasses with in-built VR capabilities rather than a bulky headset that blocks off the real world. They will then be able to enjoy a movie on a VR screen and (see and) eat their popcorn as well.

> "Eventually VR and AR hardware will merge and you will be able to do both from a single device. At some point you might be able to put a shield over the device where it will project everything out so that you can go back into the immersive view that VR gives you right now."
>
> Miku Shudo, Japan,
> traditional focus group discussion



> "VR will become engulfed by AR as an addition to the experience. It is just the early stage where we are building both technologies separately before we combine them."
>
> Min Jun Song, South Korea,
> traditional focus group discussion

Figure 7: Integration of AR and VR



Source: Ericsson ConsumerLab, Merged Reality, 2017
Base: Smartphone users aged 15-69 across 8 markets who are aware of VR

Early adopters believe that as technology evolves, AR glasses will subsume VR as part of the experience

5G EXPECTATIONS

Realities will not merge if the user is tethered to a computer or cut off from physical reality. Early adopters of VR expect next-generation networks like 5G to play a central role here. Thirty-six percent have expectations on 5G to provide VR mobility through a stable, fast and high-bandwidth network. Thirty percent of early adopters also expect 5G to enable tethered headsets to become wireless.

Shared experiences, social video viewing, tourism and live-streaming are all everyday social activities that early adopters expect to hit mainstream in VR within the next one to three years. But social VR in this sense could be a resource hog and may require a network with less lag and higher bandwidth. Low latency is crucial to making social VR work, as it is incredibly difficult to maintain a conversation if there are delays in responses and reactions. Thirty-one percent of early adopters expect 5G to enable more shared experiences through a network with less lag.

Improving merged reality

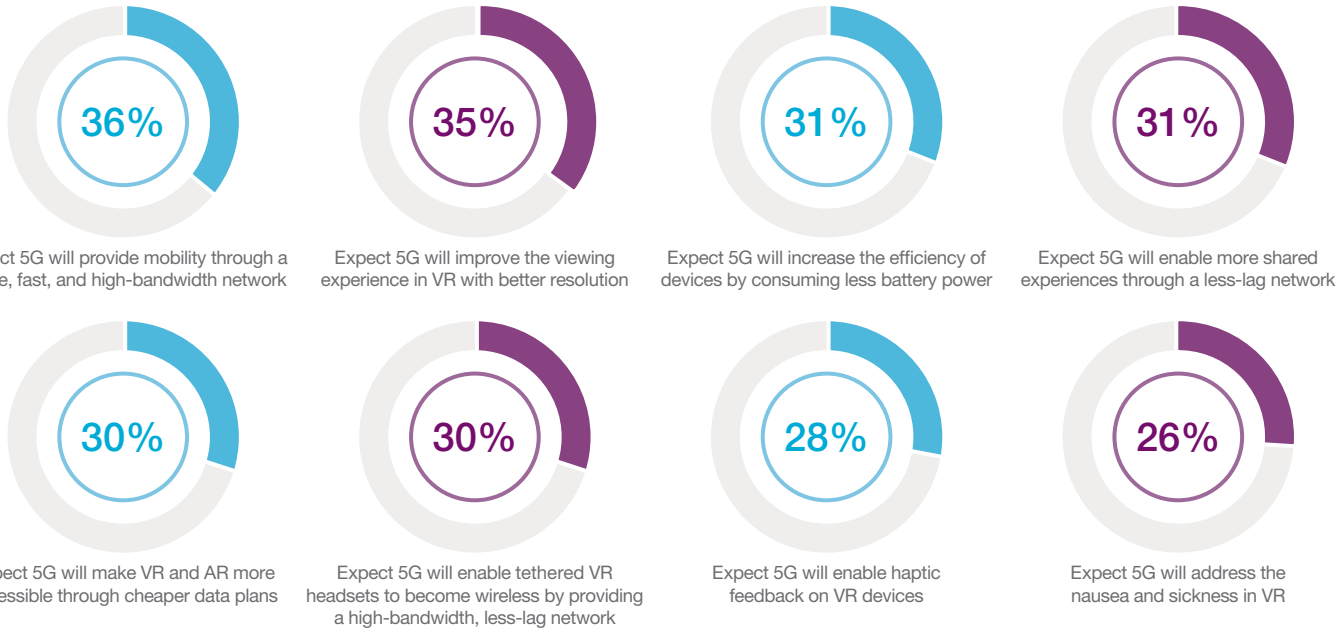
The other challenge today is whether our bodies will accept virtual experiences given the nausea and sickness that it could cause. In our qualitative tests, a few were almost immune to nausea, and a few would always feel nauseous. But for the majority, the amount of lag determines if they feel fine or feel sick. A network that minimizes lag in responses could address this issue, believe more than a quarter of the early adopters surveyed.

Almost a third of early adopters also believe that next-generation networks like 5G could improve the efficiency of connected devices (such as smartphones) by consuming less battery power, while a similar ratio believes that 5G could make VR and AR more accessible through cheaper data plans.

Increased use of AR and VR will move us towards a merged reality where users no longer separate between what is augmented, virtual and physical. Merged reality will allow us to transition from an internet of information to an internet of 'realities'.

> "When 4G came everybody started streaming. When 5G comes it will support VR, and VR will become your phone. On a train or plane… you will put your headset on and talk to your social groups or watch a movie […] 5G will make VR mobile in this sense. I might be on a plane but be working in my virtual office and be productive even while traveling, and I need 5G for that."
>
> Daniel, US, VR focus group discussion

Figure 8: Share of early adopters that expect 5G will play a central role



Source: Ericsson ConsumerLab, Merged Reality, 2017
Base: Smartphone users aged 15-69 across 8 markets who currently use tethered VR headsets atleast several times a week

We are a global leader in delivering ICT solutions. In fact, 40 percent of the world's mobile traffic is carried over Ericsson networks. We have customers in over 180 countries and comprehensive industry solutions ranging from Cloud services and Mobile Broadband to Network Design and Optimization.

Our services, software and infrastructure – especially in mobility, broadband and the cloud –are enabling the communications industry and other sectors to do better business, increase efficiency, improve user experience and capture new opportunities.

Ericsson has one of the industry's strongest patent portfolios with a total count of over 42,000. R&D is at the heart of our business and approximately 23,700 employees are dedicated to our R&D activities. This commitment to R&D allows us to drive forward our vision for a Networked Society - one where everyone and everything is connected in real time – enabling new ways to collaborate, share and get informed.

Ericsson is a world leader in communications technology and services with headquarters in Stockholm, Sweden. Our organization consists of more than 111,000 experts who have provided customers in 180 countries with innovative solutions and services. Together we are building a more connected future where anyone and any industry is empowered to reach their full potential. Net sales in 2016 were SEK 222.6 billion (USD 24.5 billion). Ericsson is listed on NASDAQ OMX stock exchange in Stockholm and the NASDAQ in New York.

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