

WORK, REST & PLAY

A REPORT ON HOW VIRTUAL REALITY
WILL IMPACT EVERYDAY LIVES



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BRISTOL+BATH

Invest Bristol & Bath is the award winning investment promotion agency for the Bristol and Bath region, part of the West of England Local Enterprise Partnership. It supports foreign direct investment, UK national companies and those companies already in the region as they grow and expand with hands on advice and intelligence.

Having burst onto the world stage as a rapidly growing digital tech cluster, Bristol & Bath is gaining serious momentum in attracting innovative new businesses and brilliant people.

Invest Bristol & Bath is playing a crucial role in bringing innovative new business into the region and has already attracted over 75 companies, creating over 2,200 new jobs contributing almost £170m to the region's economy.

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FOREWORD

This report discusses the rapidly-developing field of virtual reality (VR) and also demonstrates how Bristol & Bath is one of the leading regions of the UK for VR development and education, so I am delighted to have been asked to write this foreword. This detailed and well-researched report is very timely, as new devices and new ways of interacting with all things virtual begin to really accelerate in 2016.

I have been working in the educational application of virtual technologies for around 10 years now, and it is a field that fascinates me. VR is a term that has been used for over 30 years, although its meaning has changed over that time as devices and virtual environments have developed. And, of course, it will keep on developing into the future. It can help to navigate through this rapidly-changing field if we look at VR from the perspective of how we can interact with the virtual, and I guess one of the best ways to do that is to look at it from the perspective of whether we are watchers or participators. By watchers, I mean those activities where we watch 2D or 3D displays that take us through an experience; a trip on a roller coaster, a ride in a hot air balloon or a flight over a heritage site like Stonehenge.

Our sense of immersion in watching activities can be heightened by wearing viewer headsets like Google Cardboard or Samsung Gear which enable us to see 3D environments on our mobile phones. But, in all the 'watcher' activities we cannot actually join in with the activity in real time. In the 'participator' activities we can extend ourselves into the 3D environment, either as first person views or by embodying ourselves as avatars in that environment. The crucial part about

participation VR is that we can meet other users of those environments in real time, talk to them, share experiences with them and make changes to the environment itself. And, with developments in Artificial Intelligence, we can meet and interact with characters that are no longer with us; a few months ago I visited virtual Mississippi and had a chat with Mark Twain!

I teach and research using these technologies all the time, so for me the future looks exciting and full of promise. But I realise that the future can also look strange and threatening, and even herald a fundamental change in human activity and society. VR can be viewed as leading to a dystopian future; from the TV show Red Dwarf's VR game "Better than Life", through science fiction films like "Surrogates" where everyone lives inside their houses wirelessly connected to their android robots who live for them in the outside world, to Stephen Hawking's worries about artificial intelligence, we can sometimes seem to concentrate on the way it can all go wrong. But I have seen so many examples of how it can all go right, too. The opportunities to learn safely from simulations in virtual environments before trying things out in the physical world; the opportunities for people

with disabilities to take part in activities and social events that would be restricted in the physical world; opportunities for people from different countries, religions and cultures to meet regularly and share experiences and understanding without having to travel to do so. All these opportunities, and more, make me confident and excited about the future of VR.

Liz Falconer
Professor of Technology Enhanced Learning,
University of the West of England

INTRODUCTION - THE PERFECT STORM

Virtual reality (VR) is being hyped again. A flurry of impending VR headset launches this year from the likes of Google, HTC and Valve, Oculus, Samsung, Sony and LG has fuelled reports of 2016 being the year of VR. January's Consumer Electronics Show in Las Vegas was brimming with potential - real demonstrations of virtual worlds and applications helping to fuel this belief that VR, a technology that can be traced back to the 1980s with the likes of VPL Research and Atari, has finally come of age.

So is this true? Is 2016 the year of VR and if so what does this mean to consumers and businesses?

First things first. We've been here before with new technologies. While analysts naturally predict big things for VR there is still trepidation, certainly in terms of timing. Over the past year analyst reports have come thick and fast but few pin-point 2016 as the year of VR, although there is considerable optimism in terms of the size and value of the VR market.

A report from [Statista](#) says that in 2017 the revenue from VR products is predicted to reach \$4.6bn. CCS Insight believes that augmented and virtual reality devices will become a \$4bn market in three years, in its report [Augmented and Virtual Reality Device Forecast, 2015-2019](#). Gartner has even weighed in showing VR as emerging from the 'trough of disillusionment' towards the 'slope of enlightenment' in its [emerging technologies hype chart](#).

Clearly the analysts are confident, driven in part by the large brands entering the fray - a new market where Google, Facebook, Sony and Samsung are key players makes it an easier punt for any pundit. This is of course an industry view so are consumers as enamoured with the technology or do they see it as a threat to their jobs? Are consumers excited by the prospect of immersive entertainment or do they see it as a danger to kids and family life?

How VR is perceived and works in the consumer space is important. Consumers help to define a technology and set it on an upward trajectory (or a downward one) although without doubt some of the more intriguing and leading edge applications of VR are to be found in industry. Training simulations in particular will drive interest across verticals.

And what about social media? Will VR be the next social platform as Facebook founder Mark Zuckerberg [suggests](#)? Or is this another Glass moment where the technological capability momentarily blinds industries and watchers from the practical realities? Yes mobile platforms are emerging to help power the experience but who is going to carry around a VR headset? Surely, unless a platform can be ubiquitous and seamless, from home and office to mobile experience, it will always struggle in the mainstream?

Of course these limitations are not in play with fixed environments. Here the potential is exciting, from enhanced learning and training experiences through to more informed buying decisions and of course immersive entertainment.

So are there opportunities for UK start-ups and independent software developers? Good VR experiences demand a mix of technologies and skills. They demand a pull from the market and a push from the technology providers, a mix of creative ideas to solve existing problems and use the technology to offer services never previously considered possible. In fact VR is the ultimate STEAM product, where all the sciences as well as the arts and creativity mix to produce something quite extraordinary. And we are only at the beginning.

CONSUMER PERCEPTION AND PENETRATION

We polled 2000 UK consumers to gauge sentiment on VR and its impacts on life and work.

A simple [Google Trends report](#) of search terms reveals a dramatic upswing in searches for virtual reality in 2015 and early 2016. Compare this to searches for Google Glass and you can see how VR is more consistent compared to the faddish sharp rise and fall of Google Glass.

Understanding of and interest in VR is certainly rising although, according to our survey, few people (67%) have actually tried a VR headset although 70% of people would consider buying a headset in the near future, with Samsung Gear (33%) and PlayStation VR (28%) leading the pack.

Price will play a role here, with 32% of respondents willing to pay up to £200 and 27% up to £300. Only 3% were willing to pay more than £500 which limits the immediate market for the more expensive, high-end systems such as Oculus Rift and HTC Vive.

According to our survey, VR will have the most impact on video games (60%) and entertainment (45%). This is not surprising given the nature of the VR software releases to date. Coverage of VR so far has been very geeky, preaching to the early adopters, which tend to be gamers, although the increasing emergence of mobile related content is helping to promote the concept of 3D surround video if nothing else, even without a headset. Samsung's Gear is sure to capitalise on this drive to easy accessibility.

Education (23%) and healthcare (17%) are also expected to be impacted by VR technology although surprisingly only 10% felt that the defence industry would see a significant impact. Travel (13%) and property/construction (9%) are also expected to see VR-related changes.

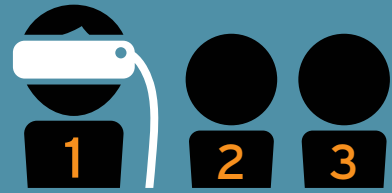
The perception around how VR will influence the home and home life in particular centres on the negative with 23% of respondents (26% of which are male and 19% female) expecting a negative impact on their sex life and 23% also expecting negative impacts on family life as a whole.

In terms of positives, education (22%) and training (19%) are standouts (after entertainment on 48%) but over three times as many men (10%) as women (3%) believe VR will be good for their sex life.

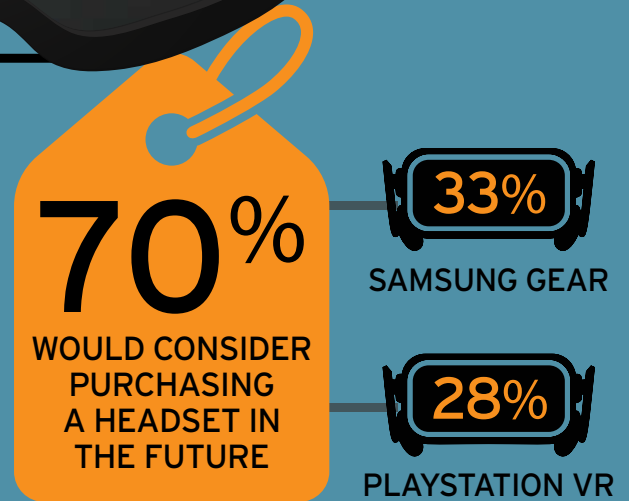
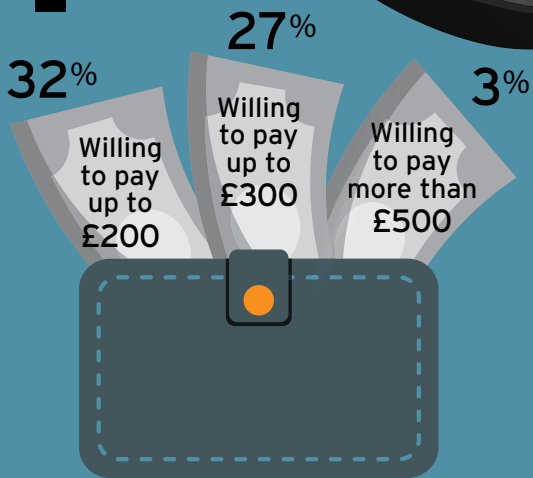
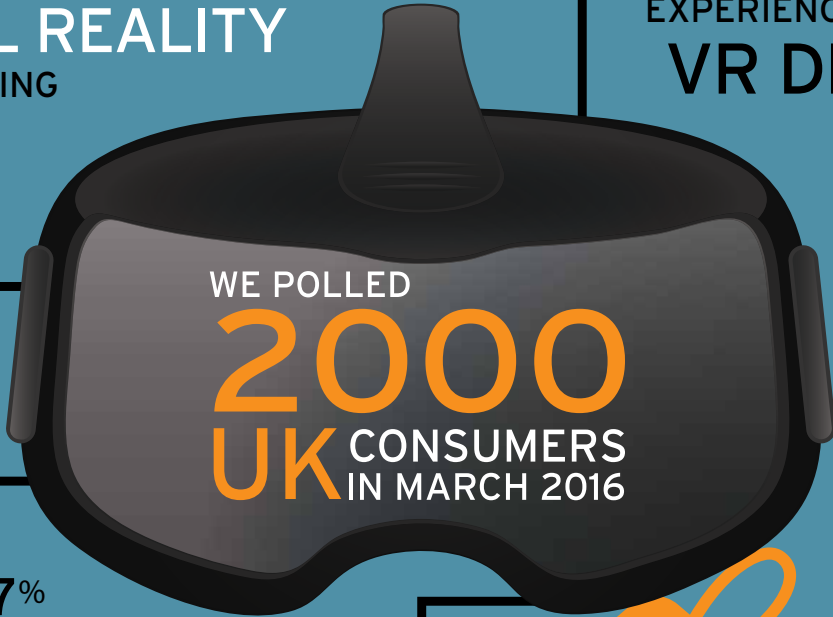
[So is VR a good thing? 75% of respondents believe it will be but of course this is a consumer survey right at the start of the VR curve. There is limited experience of the technology itself and certainly applications are not in abundance. This will change. As VR creeps into our lives through various avenues of home and working life, it will be interesting to see if attitudes change.](#)



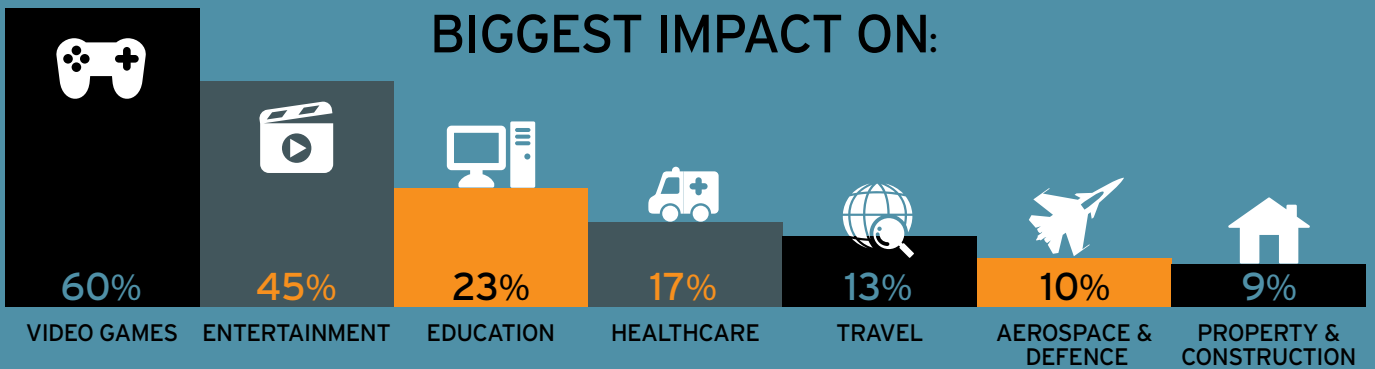
3/4 BELIEVE
VIRTUAL REALITY
IS A GOOD THING



1 IN 3 PEOPLE HAVE
EXPERIENCED USING A
VR DEVICE



VR IS EXPECTED TO HAVE THE
BIGGEST IMPACT ON:

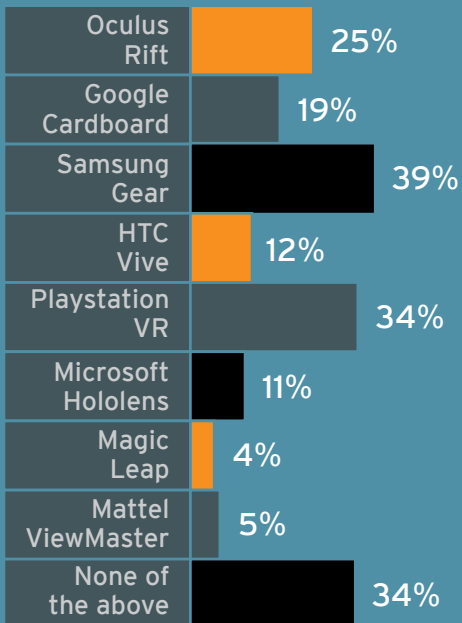


SURVEY RESULTS

For the full survey report visit: www.usurvcom/Cu9KaAACu

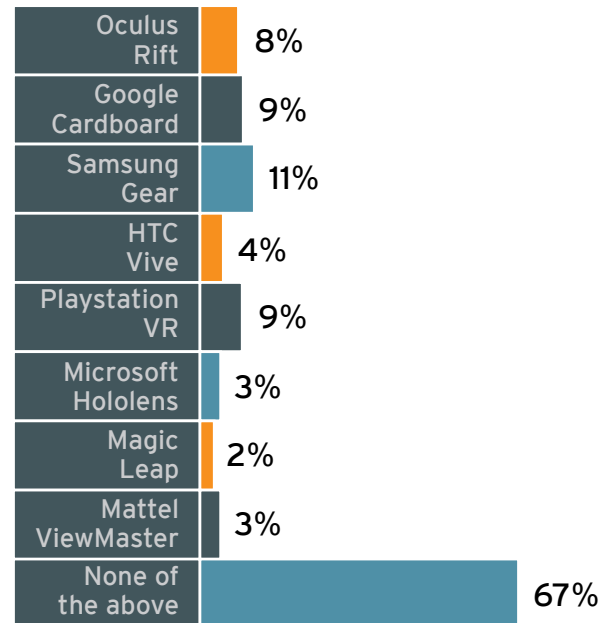
01

Which of the following Virtual Reality devices have you heard of?



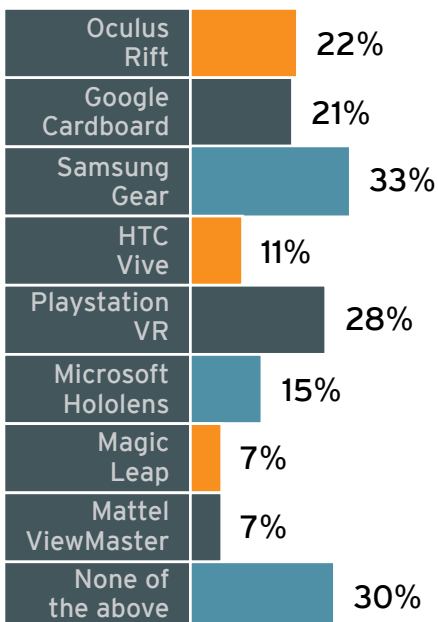
02

Which of the following Virtual Reality devices have you ever tried using?



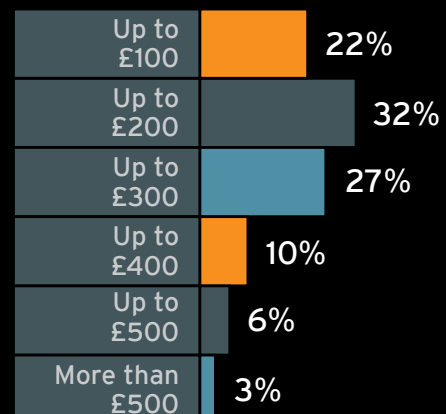
03

Which of the following Virtual Reality devices would you consider buying?



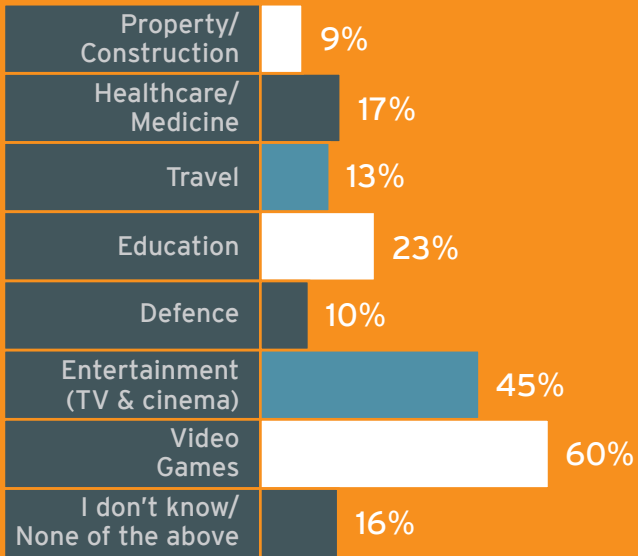
04

How much would you spend to buy a Virtual Reality device for your home?



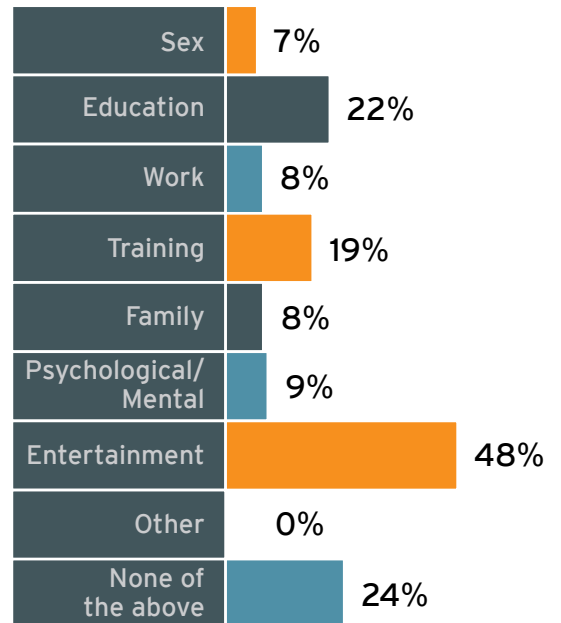
05

Which of these markets do you think Virtual Reality will have the most impact on?



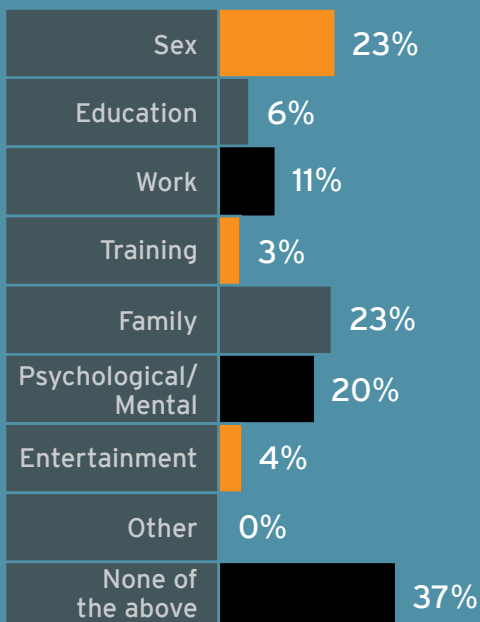
06

On which areas of your life do you think Virtual Reality will have most POSITIVE impact?



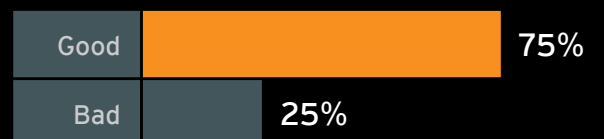
07

On which areas of your life do you think Virtual Reality will have most NEGATIVE impact?



08

On balance do you think Virtual Reality is a good thing or a bad thing?



THE HARDWARE

OCULUS RIFT

www.oculus.com/en-us/rift

Platform: PC

Price: \$600

Available: Out Now

The darling of Kickstarter. Oculus Rift could certainly be credited with reinvigorating the VR market. After raising over \$2m on Kickstarter, Facebook bought it for \$2bn. The requirements include a VR-ready Windows PC (you can download a Rift compatibility tool for Windows), with NVIDIA GTX 970 / AMD R9 290 equivalent or greater video card and over 8GB of RAM. The headset will be bundled with an Xbox One controller, the EVE: Valkyrie game and one other game. The hand controllers, Oculus Touch, will be released at a later, yet to be confirmed date.



HTC VIVE

www.htcvive.com/uk

Platform: PC

Price: £689

Available: Out Now

A collaboration between HTC and Valve, the HTC Vive will compete in the same territory as Oculus Rift. Like its rival it requires a hefty PC (same requirements as above). As well as the headset, there are two bases stations for 360 degree motion tracking and two hand controllers, plus Tilt Brush from Google.



SAMSUNG GEAR

www.samsung.com/uk/consumer/mobile-devices/wearables/gear/SM-R322NZWABTU

Platform: Samsung Galaxy smartphones
- Galaxy Note 5, S6 edge+, S6 and S6 edge

Price: £80

Available: Out Now

Powered by the Oculus VR platform and app store, the Samsung Gear VR is a VR viewer for mobile applications. The smartphone slots into the headset which, through the Gear's lenses, provides a 3D VR experience with 96 degree field of view. There is also a touchpad on the headset for controlling apps and content.

GOOGLE CARDBOARD

www.google.com/get/cardboard

Platform: Android and iOS smartphones

Price: £10

Available: Out Now

A do-it-yourself cardboard viewer designed to enable anyone to view VR content on either an Android or iOS smartphone. There are a few different versions now from either Google or other companies but the premise is the same - a collapsible simple viewer with 100 degree field of view. A good entry level experience that is popular with PR and marketing departments for branded campaigns, such as Volvo, The New York Times and Star Wars.





PLAYSTATION VR

www.PlayStation.com/en-gb/explore/ps4/features/PlayStation-vr

Platform: PS4

Price: £350

Available: October 2016

Sony's biggest advantage in this space is the installed base of PS4 users which currently stands at just under 40 million. The headset will plug into a connecting unit which links with the PS4 console and features an impressive 120Hz refresh rate with a 100 degree field of vision. The system will utilise the PlayStation's existing controllers including DualShock 4 gamepad, PlayStation Move hand batons and the PlayStation 4 motion-sensing camera. There are seven VR ready games in development including RIGS Mechanized Combat League and Battlezone.

FOVE VR

www.getfove.com

Platform: PC

Price: tbc

Available: From May

Another Kickstarter funded development, Fove received over \$480k to get the project running. Its unique selling point is that it claims to be the first eye-tracking headset (to an accuracy of 1/5th of a degree) so that rendering is optimized for whatever the user is looking at. The thinking is that while this makes it more efficient in its processing, it also means that eye movement can be used to control the environment. See the Eye Play the Piano project.





MATTEL VIEW-MASTER

www.view-master.com/en-gb

Platform: Wide range of Android and iOS smartphones

Price: £23 for starter pack

Available: Out Now

A VR and augmented reality educational experience for kids based on the traditional View-Master photo viewer. The starter pack comes with a View-Master VR Viewer, a VR Preview Reel and an adapter for the iPhone 5s, iPhone 5c and iPhone 5. There are currently three packs - Space, Destinations and Wildlife.



CYBERSICKNESS AND PSYCHOLOGY

Kay Stanney from the University of Central Florida recently told [IDG Connect](#) that much has been done to address VR motion sickness since her 1995 [TV report](#) on the issue.

“We can now add fixed horizons to our visual content, reduce virtual movement throughout a VR, minimize the length of exposure duration and so on,” she says. “However, until we can provide vestibular stimulation that mimics the virtual movement in the virtual world, I do not foresee this problem being resolved.”

Anyone who has tried a VR headset will back this up but the new breed of headsets with faster refresh rates and low latency should provide a more stable platform on which to develop applications which dovetail with the technical limitations.

According to Valve Software which last year [claimed](#) it had eradicated VR sickness with its HTC Vive headset, the hardware has reached a level where software developers can build, smooth experiences. Valve writer Chet Faliszek even went as far as [saying](#) that developers and not hardware manufacturers are now responsible for any VR-related sickness or nausea.

But that was last year. According to Dan Page, marketing manager of Bristol-based Opposable Group, most of the hardware coming out now is super low latency, with good refresh rates making the idea of motion sickness a thing of the past, but only as long as developers build applications to meet the specifications of the headsets. Developers should not try and push square pegs into round holes, otherwise he says, there will still be issues. More work needs to be done here, he adds.

Of course cybersickness is not exclusive to VR. A recent [study](#) by Coventry University found that up to 80 per cent of the population are experiencing headaches and nausea as a result of prolonged smartphone and computer use. Perhaps self-governance will be necessary to ensure the health and safety of all device users, VR or otherwise?

Interestingly, the yet to be released PlayStation VR will, according to one [report](#), come with disclaimers and warnings about motion sickness and the device not being suitable for under 12s. Expect this to become the norm.

PSYCHO KILLERS

So what about the psychological impacts of VR? Spending time immersed in virtual worlds will have a bigger and more lasting impact on people's behaviour and psychology, according to Thomas Metzinger, a philosopher at the Johannes Gutenberg University in Mainz, Germany, who specialises in the philosophy of mind and neuroscience. He is co-author, with Michael Madary, of a paper calling for a [code of conduct for virtual reality](#).

Speaking to the [New Scientist](#), Metzinger calls for a study into "the psychological effects of long-term immersion in virtual reality." His concern is that prolonged use will ultimately change our brains and lead us into unknown territory.

"The dominant view within neuroscience is that reality is something generated by the brain, as it tries to predict what's causing all the sensations that are impinging on our

senses," he says. "When this old, biological "virtual reality" gets embedded in a technological virtual reality there may be complex and surprising consequences."

This fear of the unknown is also apparent in our consumer survey, with 66% of respondents claiming they expect VR to have a negative impact on family, sex life and mental well-being. How this transpires will remain to be seen as much of this reaction is no doubt based on the existing experience of how computer and video games have impacted these areas to date. Understandably, the notion of increased immersion into games and applications heightens the fear of obsession and addiction, where Second Life could in fact take over real life.

Clearly there are on-going concerns and the industry needs to try and address them and maybe even self-regulate otherwise there will be lawsuits waiting to happen.

“ The dominant view within neuroscience is that reality is something generated by the brain, as it tries to predict what's causing all the sensations that are impinging on our senses,” he says. “When this old, biological “virtual reality” gets embedded in a technological virtual reality there may be complex and surprising consequences. ”

VIDEO GAMES

There are few surprises that video gaming is perceived to be the most likely industry to benefit from VR - 60% of respondents claimed this is where VR would have the biggest impact.

Even before Sony revealed it was developing a VR headset for its PlayStation it was always going to be a technology that would find a natural home in gaming but it hasn't always worked. Nintendo flirted with the idea in the mid-90s with its ill-fated Virtual Boy but is now [rumoured](#) to be looking into the technology for future consoles, although it claims nothing is planned as yet.

Of course the console makers will be looking to see how PlayStation VR is received, something which many of the larger games developers will also be doing before they commit to developing titles for VR. The PlayStation VR will also apparently have a version of [Star Wars Battlefront](#) from EA and Lucasfilm.

It's a new medium, not a new platform. That's the message from UK developer

nDreams during its launch of [The Assembly](#), "an immersive, interactive story in VR." Perhaps this is why so many of the large houses are not releasing or even developing yet. This of course means more opportunity for smaller independent developers to grab space and establish titles.

This is still market creation territory and the difficulty here is just that - market creation. It doesn't exist yet, so sales are not going to be stellar. If anything it feels like the early days of mobile gaming. There are a few early adopters and developers but it may need a marquee game before it really captures wider imaginations.

According to Dr Richard Wilson, [TIGA](#) CEO, "VR is driving additional investment into the UK video games development sector," and that additional investment "is helping to increase employment and growth in the games industry. Games studios and businesses including nDreams, Rebellion and Sony are developing new skills and competences in VR, helping to ensure that the UK is a pioneer in VR gaming."

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Dr Richard Wilson, TIGA CEO



Certainly there is an opportunity here but you get the feeling it's a slow burn and not for everyone. Recently [Blizzard](#) president Mike Morhaime [claimed](#) mobile and not VR was the future of his business. Perhaps it will take the major labels to start releasing VR titles to convince the rest of the industry that VR is here to stay as a gaming medium.

CASE STUDY

THE INDEPENDENT GAMES DEVELOPER - OPPOSABLE GAMES

The challenge for dedicated VR developers has been coping with the delays in VR headset releases. Where 2015 was supposed to be the year they all emerged, the lag with Oculus, HTC Vive and PlayStation has meant that independents have had to pursue client work to make ends meet. Developing 3D content for businesses does of course have its advantages, certainly in honing VR programming skills and building knowledge of the medium.

[Opposable Group](#), based in Bristol's Games Hub has worked with organisations such as Channel 4, The Wellcome Trust and The Technology Strategy Board. Like a lot of independents it has had to build in-house skills in programming, 2D art, 3D modelling and animation, project management, QA testing and marketing and walk a balanced path between client work and developing its own titles.

Founder and CEO Ben Trehwella believes that while this has been necessary, it has also helped to strengthen the team and broaden its vision.

“We want to make connected games and developing for VR has always been our goal,” he says. “The client work has enabled us to build in-house ability quickly and we have found the local community and certainly the south west universities a rich source of talent.”

Opposable has certainly been busy. It has developed its own connectivity platform called [OneTouch Connect](#) that helps developers connect devices across Android, iOS, PC and Mac. Available as a Unity plug-in, it enables developers to get up and running in seconds, with drag and drop prefabs handling most of the complexity. In addition it's developing its own titles such as [Salvaged](#).

SO WHAT HAS BEEN THE BIGGEST CHALLENGE? SKILLS OR FUNDING?

Neither really, although maybe funding if I had to be pushed. Bristol & Bath has a lot of talent, a lot of interesting start-ups but not a lot of funding to help them accelerate,” says Trehwella. “We are looking at organic growth and certainly the interest around VR at the moment can only help. We see VR as a major boost for the independent games industry.”



“ It’s a major medium for gaming but also entertainment. ”

SO ARE INDEPENDENTS TAKING ALL THE RISK IN CREATING VR CONTENT?

“It looks that way. The major labels are keeping things close to their chest but that means there is an opportunity for the independents to develop and grow in a market with limited competition. It’s a great opportunity for the UK and in particular Bristol & Bath which has a growing reputation in start-ups and tech.”

SO HOW BIG CAN VR GET?

“Really big. It’s a major medium for gaming but also entertainment. You can also see the interesting development work in education and other vertical industries where people are trying to solve problems, reduce costs and improve experiences. We’ve only just started.”

SOCIAL VR

When Facebook founder and CEO Mark Zuckerberg says that VR is the next social platform, you would probably be a fool to not stop and think for a moment. While Zuckerberg has his motives of course - Facebook's purchase of Oculus Rift surely has to pay back more than just a headset - who can argue with a man that has built a career on second guessing the world's online social habits. So does the tech back this up?

A look at platforms such as [AltSpace](#) and vTime suggests it does. This is early days but these are two sites already shaping the social experiences of tomorrow. Virtual cinema experiences where shared videos can be watched alongside friends (who you can see sitting next to you, at least in avatar form) and just chatting with other people around virtual campfires - the visualisation of social exchanges will become a normal option.

With this in mind, perhaps all the Second Life critics need to rethink their denunciations? Two years ago its creator Linden Lab embarked on a rebuilding exercise to create a more advanced platform for user content creation, taking into account the expected growth of VR - a second chance for Second Life.

"We want to lower the barrier of entry for VR experience creation," said Ebbe Altberg, CEO of Linden Lab in 2015.

▲▲ [Project Sansar](#) will do for virtual experiences what WordPress has done for the Web: empower a broad range of people to create with professional quality and reach global audiences. By greatly expanding who can create virtual experiences, Project Sansar will also extend the value of VR to a wide variety of use-cases - from gaming and entertainment to education, architecture, art, community-building, business meetings, healthcare, conferences, training, and more. ▼▼

This is the vision but can social sites and platforms really deliver seamless experiences that bring users back in large quantities, time and time again? Or will they develop a core user base and flat line due to the novelty factor wearing off? We are quite a way from making this happen although with companies such as Sony now revealing its [social VR plans](#) perhaps it should be taken more seriously.

The challenge though for social is to make it all worthwhile. The simplicity of Facebook is just that, it's easy to go in and browse and then leave. How many will actually don a headset and throw themselves into a virtual world to view a shared video or image?

Clearly there is scope, certainly within more controlled environments which benefit from collaboration and interaction, such as classrooms. Is this enough for Zuckerberg?

VIRTUAL VERTICALS - HOW VR IS WORKING IN INDUSTRY



While VR's application to video gaming is clear, the use of VR in industry has a similar, if not a more enduring projection. The technology is already working its way into niche markets with some interesting results. Early days or not, there is plenty to get your teeth into and for developers, there are certainly opportunities to help brands promote and enhance products and services.

PROPERTY AND CONSTRUCTION

In January last year London-based Harrods [claimed](#) to be the first department store in the world to sell property using VR experiences. Using VR to showcase homes is a good fit so it's not surprising that so many property agents are jumping on this particular bandwagon. In July last year Savills [announced](#) it was using VR with a number of other agencies across the globe following suit. It's easy to see how VR will become the norm for estate agents, giving customers opportunities to view properties remotely, increasing viewings and reducing inconvenience.

Developed by St Albans-based [Rewind](#), Savills VR experience is currently more promotional than practical. That's the challenge for the industry - how to make VR viewings cost-effective and less time consuming to create, so the barrier to entry is lowered?

Like property, construction fits neatly with the promise of VR. As well as the obvious ability to view and walk through buildings before they have even been built, VR will enable engineers to repair or re-design existing buildings. There are plenty of examples and apps such as [SmartReality](#).

McCarthy Building Companies in California has been using VR in some form since 2012 apparently. The company recently [upgraded](#) its VR technology to an Oculus headset and Xbox controller to show clients what a 2D blueprint will look like in real life. This, says the company, will replace the need to build scaled down, physical models of buildings.



EDUCATION

There is huge potential in education. The ability to view and 'experience' scenarios in safe environments ticks so many boxes across the education spectrum, especially when it is combined with augmented reality.

At the moment many of the best examples are in universities. Deakin University in Victoria, Australia, for example has a [VR Cave](#) to help engineering students walk inside jet engines or buildings, while Aston University in the UK [announced](#) a similar plan last year.

At the University of the West of England (UWE) forensics students are using VR to practice collecting evidence from crime scenes [see case study] while a number of universities in the US and UK are already using digital [dissection tables](#).

There are plenty of tech start-ups too looking to develop applications for education including Ireland-based [Immersive VR Education](#), US-based [zSpace](#) and UK-based [Alchemy VR](#).

Professor Liz Falconer, Director of the Education Innovation Centre at the University of the West of England (UWE) says that it is the coming together of the various virtual technologies that will really drive change. She talks about remote learning, having a class of avatars but being able to educate as if they are in the room, in fact any room, any location, any world. She is already talking with Finnish firm [SenseTrix](#) to try and make this happen.

CASE STUDY

REAL CRIME SCENES FOR FORENSICS STUDENTS - UWE

[The University of the West of England \(UWE\)](#), situated on the outskirts of Bristol in the UK has developed course material for its forensics students that enables them to work on two real criminal cases supplied by the Avon and Somerset Police.

Students access a virtual crime scene created in the virtual world Second Life. At their disposal they have various tools such as markers and evidence bags, which can be used as they come across evidence such as blood stains, items of clothing and so on. The correct items need to be collected for later analysis in the virtual forensics lab.

It looks and feels like a video game developed for fans of Silent Witness. And that's part of the point. It's engaging, interesting but it also teaches students lessons as part of the university's drive for more practice-based learning.

“This virtual crime scene is an additional activity for our students, who already investigate mock crime scenes in a house on one of our campuses” says Professor Liz Falconer. “But the physical scene can be time-consuming to set up, so having a virtual scene too gives the students greater opportunities to develop their practical skills.”

The virtual crime scene encourages students to participate at any time and also to work in teams. Falconer says that the plan is to extend the work and collaborate with the Law department so that virtual courts can be used on the same cases with the forensic students acting as expert witnesses - real role play with real lessons in a virtual environment.

HEALTHCARE

It's worth reading the story of Sergeant Chris Merkle in [Wired](#), and his involvement with VR therapy developed by Skip Rizzo at the University of Southern California's Institute for Creative Technologies. It's a compelling story and an illustration of the role VR can play. In fact cognitive behavioural therapy is a growing area for VR. Applications such as [Pesky Gnats](#), a VR game to help interventions with 9-17 year olds, and Dutch-based [CleVR](#), which has fear of flying and open spaces programmes, are just some of the many recent developments in this space.

The healthcare sector as a whole is certainly a fervent adopter of VR. There are solutions being developed across the board. As well as mental health therapy there is [medical imaging](#), enabling doctors to see and feel patient images, [omnidirectional treadmills](#) for physiotherapy, a pain management [game](#) and of course [surgical training](#).

Recently [surgeons in France](#) used VR to help them easily identify parts of the brain as the patient used a VR headset to enter an artificial world. By creating an artificial world for the patient, the surgeons could map certain zones and connections related to functions that could not, up to now, be easily tested on the operating table.

AEROSPACE AND DEFENCE

Reducing risk and cost while improving efficient learning and maintenance is something most industries would strive for but would often find it unobtainable. In the defence industry Bath-based [BMT Defence Services](#) believes that VR can enable organisations to meet these targets by focussing on the human factors. Simon Luck, BMT's head of information services says that VR is excellent when it comes to helping with design and interface issues and visualising often complex equipment and scenarios [See Case Study].

As a medium for training through simulation the application of VR in most sectors is obvious but in aerospace and defence, where scenarios are expensive and often difficult to replicate, it will find an assured home. As you'd expect there is not a shortage of applications in this space with numerous examples of platforms to walk into and around machinery to learn about parts and functions.

One of the key developments in defence is the integration of virtual displays, or 'virtuality' into a real world. For example, the combination of VR and AR to produce 'in the field' experiences is gaining momentum. For example, Honeywell recently announced it is developing a [VR windshield](#) to use with military vehicles to enhance situational awareness, which is part of the US [DARPA](#) project. In the UK developments in VR and AR for military generally come under the wing of the [Defence, Science and Technology Laboratory \(DSTL\)](#).

CASE STUDY

ALL ABOARD THE SIMS - BMT DEFENCE SERVICES

Based in an old corset factory on the banks of the river Avon in Bath, BMT Defence Services is a multidisciplinary engineering, science and technology consultancy that sees VR as a key medium for developing its training and maintenance programmes.

In the defence industry the company works on land, sea and air platforms, including designing submarine and ship systems, as well as providing support for the government's ISTAR defence project.

"Human factors are a key part of our VR offering in defence," says Simon Luck, BMT's head of information services, adding that the technology will enable BMT to reduce costs and risk for training and maintenance exercises.

▲▲ The UK defence industry wants to reduce the number of live platforms for training because of the cost, which is where VR can come in. It can provide an immersive experience with the same orientation as live training but without the risk. It won't replace live training but it will certainly make training more effective. It can provide an audit trail too of course. ▼▼

Luck sees VR maturing to a point where combined with AR it can provide complete situational awareness for military personnel. By combining the digital domain with the physical world in a 3D, 360 degree visualisation, it's possible to provide relevant information quickly enabling accurate decision making.

You can see a selection of BMT's VR experiences on its [YouTube channel](#).



TRAVEL

Thomas Cook was quick to capitalise on VR technology following its initial [announcement](#) two years ago that it was going to use VR headsets in retail outlets to offer customers a 'try before you buy' experience. The content was put together by London-based production company [Visualise](#). Last year an [app](#) was made available for download to use with Google Cardboard.

Hotel chain Marriot also got in on the act with its [teleportation experiential marketing idea](#), where users could enter a 'teleportation booth', put on an Oculus headset and be 'transported' to exotic locations. While this was for promotional purposes the idea is a valid one and a number of companies such as [OnlyInVR](#), are now offering services to create the content for the travel industry. In fact the travel related apps are coming thick and fast now. The technology, mixed with location based tracking, and in some instances AR, is opening new avenues. The [Timelooper](#) app for instance allows users to see historical sites as they were in history through the lenses of Google Cardboard.

In Florida the [Dali Museum](#) is offering visitors a truly surreal experience by enabling them to view Dali paintings from the inside. This is surely a theme that will catch on. The age of the humble audio guide may be dead.



© 20th Century Fox Television

ENTERTAINMENT

When the [Virtual Reality Company \(VRC\)](#) announced it was working on a project with Hollywood director Steven Spielberg it was hardly a surprise. Spielberg has had a fascination with VR for some time and his film [Ready Player One](#), due for release in 2017 is a story around a virtual reality game called The Oasis.

As well as the video games industry, the film industry promises to be a rich source of VR-related content. Nokia's [Ozo VR camera](#) for filmmakers was launched late last year with the company also announcing a partnership with VR film studio [Jaunt](#). Samsung has recently [announced its plans](#) to "trail blaze" VR storytelling with its Sundance Film Festival partnership and the opening of a New York VR studio.

It's not just about movies either. In the UK, BBC Natural History producer Paul Deane has a number of 360 projects on the go. He recently launched a pilot film enabling viewers and VR users to have a [360 experience of a kelp forest](#) and plans to unveil more during his [talk](#) at this year's [VR World Congress](#) in Bristol, the UK's home of natural history programming.

In terms of TV, it's worth looking at the work of [The Secret Location](#) studio and its VR experience for Fox Television's *The Sleepy Hollow*.

CASE STUDY

VR IS TURNING THE TABLES - AARDMAN ANIMATIONS

[Aardman](#) is a Bristol-based studio famous for characters such as Wallace & Gromit and Morph and films such as Chicken Run and Shaun the Sheep The Movie. Heather Wright is Executive Producer and Head of Partner Content and sees VR as an exciting technology but still needing critical mass.

DOES AARDMAN SEE VR AS AN EXCITING PLATFORM FOR ENTERTAINMENT OR A NICHE PLATFORM WITH YEARS OF DEVELOPMENT STILL NEEDED?

“Undoubtedly VR is an exciting idea but at the moment VR seems to be catchall term that seems to encompass quite a wide range of technologies and there doesn't seem to be enough critical mass in any one of them that points towards a standardised system which would make it much more appealing for content creators and distributors in terms of keeping production costs down. Storytellers of the film making variety traditionally like to lead the viewer on a journey which is predetermined for them. With VR, viewers are essentially being let loose in a story to explore it for themselves. This requires a whole new film grammar which is certainly exciting but does turn the tables on the film makers and it remains to be seen whether

audiences have the patience or desire to actively finding their way through a story or whether the more passive act of being lost in a story that unfolds before you is significantly more engaging. Therein lies the challenge for film makers - to make the stories so compelling that people want to engage more actively, or whether it's the kind of thing they'd like to do now and again but actually enjoy the more sit back and watch stories most of the time. The jury is out at the moment.”

IS AARDMAN INTERESTED IN OR ALREADY DEVELOPING ANY VR-RELATED CONTENT?

“Aardman is actively exploring lots of ways of telling stories in VR. We worked very closely with Google Spotlight Stories during most of 2015 to create a VR film called 'Special Delivery'. Apart from the obvious challenges of having to work out how you lead a viewer through the story and how you signpost where the viewer should go next, we actually worked very collaboratively on helping them to develop their software. We went for a very simple look reminiscent of the very graphic UPA style of animation from the 1950's and 60's and set the adventure in a world with defined physical edges. Peter Lord and



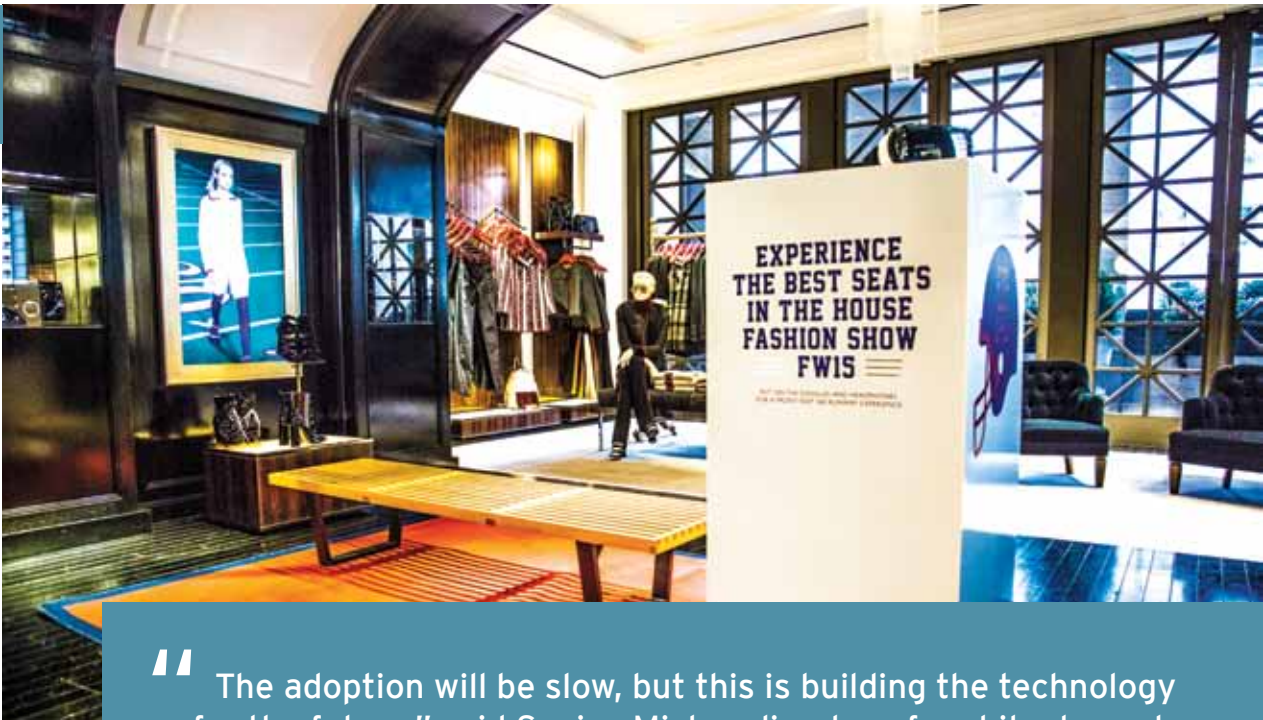
Image courtesy of Aardman Animation

Tim Ruffe were also inspired by Hitchcock's 'Rear Window' to create a story that took place all within the courtyard of New York apartment blocks and of course a central theme of that was that the story was told from one man's point of view who was essentially free to look where he wanted. The story is a cat and mouse style caper around the courtyard at Christmas where a Janitor and Santa just keep narrowly missing each other. So, lots of opportunities for our protagonists to appear and disappear in different places and for the audience to follow either the Janitor's story or Santa's story and get a slightly different take on it each

time you view it. It's also a wonderful vehicle for hiding secondary gags and stories in the background behind all those doors and windows, perfect for multiple views.

We are currently working on a new project with the BBC which takes VR in a different direction again and there will be more to say on that in a few months' time.





“The adoption will be slow, but this is building the technology for the future,” said Sanjay Mistry, director of architecture at Unity, speaking to Digital Trends last year. “People are still going to want to physically buy something in a store, but virtual reality is the experience where they can envisage [the item], and use it more as a planning tool than a purchasing tool. Retail does have to change, and virtual reality is a big part of it.”

RETAIL

Virtual shops or showrooms, such as the one showcased by [Audi](#) at CES 2016 will no doubt get a lot of traction in retail. In October last year [Tommy Hilfiger](#) introduced VR headsets into its Fifth Avenue store in New York too, so it's easy to see how the big retail brands will get carried away with the technology but how much is this PR and how much actually adds value to the experience?

It's perhaps easier to see bigger opportunities online. Tesco dabbled in 2014 with Tesco Pele, a virtual supermarket and although it was before its time, you can see how this could work. Virtual stores, or 'vcommerce'

as it's sometimes now referred to, has huge potential to engage online shoppers in previously unimaginable ways.

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THE UK OPPORTUNITY

Everything is VR at the moment so when the dust settles will we be left with a sustainable business opportunity or will VR crawl back into a niche hole?

Rick Chapman, high tech sector specialist at [Invest Bristol & Bath \(IBB\)](#), the inward investment agency for the West of England, believes that there is a big opportunity if we get the skills mix right. He believes that in the West of England, that mix is already in place. "For two years now Bristol & Bath have featured prominently in the Tech Nation report on technology skills and start-ups," says Chapman.

“ In [2015](#) the region came out as the fastest growing tech cluster outside of London, and in [2016](#) as the most productive. ”

"This doesn't happen by accident. A lot of work has gone into promoting collaboration across a wide range of skills sets, including programming, engineering, education, design, art, television, animation and so on. VR needs this mix of skills which is why VR start-ups are starting to emerge from Bristol & Bath. Throw in the leading-edge work being done in the universities of Bristol and Bath and it's easy to see why there is a pool of talent here, looking to use their skills on fast, emerging, exciting industries such as VR and related industries such as AR, haptics and even robotics."

So this is a big opportunity, not just for the UK but for Bristol & Bath, which has all the right talent, facilities and people to make a real difference in this fast developing industry. Funding of course is a big issue. In 2015 the UK Government's start-up strategic investment arm, Innovate UK launched a [contest](#) for VR and AR start-ups. It offered rewards of £35,000 to six companies innovating in VR and AR, but there are currently no plans for another contest this year.

While private equity funding for VR and AR is tricky - most VCs won't look at the industry until they can be convinced the exits will be big enough to warrant getting involved - there is an interesting [list of the most active VR investors](#), most of which, as you'd expect are in the US. And then there is crowdfunding of course, with Oculus Rift proving that it's an extremely valid medium to raise money and if the idea is good enough, it will fly.

Inevitably the US will take a lead on VR but the UK has an opportunity to be a European base, a centre for research and development and a vehicle for start-up ideas.

It's interesting to see AMD's Roy Taylor is speaking at the [VR World Congress](#) event in Bristol on April 12th. AMD is extremely active in VR and Taylor is an energetic advocate. VR he [says](#) is driving innovation and certainly AMD is at the forefront. Understanding the various roles across the VR technology industry will be key to its success. From microelectronics through to the design and implementation of application ideas, VR is unique in its predilection for integrated skills.

CASE STUDY

VIRTUAL TRAINING - IMD GROUP

IMD uses Immersive Virtual Reality (IVR) tools and equipment to provide real life training solutions to clients in the education, nuclear, logistics, defence, retail, automotive and aerospace Industries.

The business started in July 2015. It has strong links to UWE and a number of its employees are graduates of the University and so settling in the West Country made sense.

“Bristol has a thriving tech, digital and media hub,” says IMD Group managing director Dean Taylor. It’s a major hub that is fast growing and vibrant.”

HOW ARE YOU USING OR PLANNING TO USE VR TECHNOLOGY IN THE BUSINESS?

“VR has already been proven to provide precise, realistic simulations of what people might experience in their field of operation and as the best way to teach people how to do jobs that are complex or dangerous. This includes the training of Aircraft Cabin Crew, Warehouse Staff and in the automotive industry for vehicle damage assessment. We have also recognised the many advantages that VR can bring to our already highly respected training programmes for professional development and compliance and we are looking forward to engaging this exciting technology for the benefit of clients old and new.

“As an integral component of a multi-faceted training programme, VR is increasingly recognised for its value as a powerful educational tool. VR adds a new and exciting

dynamic, making study more participative and interesting and thereby enabling better student recall. Interaction with a course tutor or other students can be facilitated, irrespective of their physical locations, and data from the session retained for subsequent analysis and review, a valuable benefit which classroom-based teaching alone cannot provide.”

WHAT HAS BEEN THE REACTION OF CUSTOMERS AND STAFF?

“The inherent flexibility of VR (we are looking more into the mobile phone as a platform for VR than say Oculus Rift, which is more for the gaming industry) means that there are clear advantages to employers, through savings in time and reductions in cost. By providing the opportunity for employees to have realistic experiences of critical circumstances that they may otherwise not have yet had, VR can have a direct impact on management efficiency and productivity, leading to real improvements in business performance. Customers really enjoy the technology and learning environment, once they have experienced the true benefit of Virtual Reality. Basically what virtual reality enables teachers, lecturers or anyone in an educational setting to do is to deliver large amounts of often complex information in a visually attractive way. Many students find it easier to learn when presented with a visual explanation which they also find easier to retain and recall.”

CONCLUSION

As a technology VR has been around for over 20 years now and been talked about for much longer but the markets still need to be created, even within the video game space. There will inevitably be cul-de-sacs of development, where vertical markets prove unwilling to adopt the technology beyond the initial novelty phase. It won't be for everyone, of course but that doesn't stop this being an industry with huge potential to change the way in which we interact with each other on both an entertainment and professional level.

There will be a convergence of virtual technologies, with AR and VR creating 'virtuality' across sectors, saving costs where possible while also improving experiences. Education is without doubt a major market here.

This year is about building those paths, trialling and testing and developing ideas that use the technologies to improve work, rest and play. Otherwise what is the point?

No doubt there will be times when we look at ideas and ask, why?

Yet there is excitement and energy here. VR is reminiscent of the early days of smartphones, where independent developers took on the risks of mobile gaming and app development, testing and creating the market. As Zuckerberg suggests, it's a new platform, not just for social but for learning and leisure and as technology history has always shown, a new platform equals opportunity for the brave.

Is the UK brave enough? Are investors prepared to back UK talent? Will uncertainty over issues such as cyber sickness undermine progress? Will VR really be a game changer across all sectors?

Surely there are too many big names already involved, too many vested interests and too much vertical potential for VR not to happen now and finally realise its full potential?

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