

E&T

VOLUME 11 ISSUE 3 APRIL 2016

TO CHEER ON
YOUR TEAM

TO MAKE A SCARY RIDE
EVEN SCARIER

TO CREATE NEW
WORKS OF ART

TO EXPLORE REAL AND
IMAGINED BUILDINGS

TO THE HEART OF
THE NEWS

FRONT ROW AT THE
FASHION SHOW

TO BETTER HEALTH

TO THE SCENE OF
THE CRIME

WHERE WILL VIRTUAL REALITY TAKE YOU?

WHERE WILL VIRTUAL REALITY TAKE YOU?

2016 may be the year that virtual reality (VR) technology breaks into the mainstream. Hardware manufacturers like Oculus are gearing up, with the first Rift headsets reaching customers at the end of March, and many people will be lining up to experience different 'realities'. It will all start with the big markets of gaming and entertainment, but what else can VR offer? E&T takes a look at the opportunities in fields as diverse as manufacturing, healthcare, criminal justice and many more. Where will it take you? Only time will tell.





VR IN...

GAMING



Virtual reality has been prolific in the gaming industry since the 1980s, when Sega's Master System 3D glasses promised to take you inside a virtual world. The best, however, is yet to come.

The HTC Vive, a VR headset specifically designed for gaming



By Paul Dempsey

THE PRESSING question facing VR gaming concerns how high a price it can sustain. Yet in the longer term it's all about Moore's Law economics, content – and whether another currently absent tech titan will finally join the fray.

When a \$599 (about £415) launch retail price was announced for the Oculus Rift headset at this year's Consumer Electronics Show, the reaction was nearly unanimous: "Too high!" Because it isn't just about the headset. Coupling the Rift to a PC that can render titles with sufficient fidelity adds about \$1,000 (£693).

Jason Paul, GM of chipmaker Nvidia's Shield gaming arm, explained the computing challenges to VentureBeat late last year:

"If you look at your typical PC gaming experience, 90 per cent of the gamers out there play at 1080p (HD). For a smooth experience you don't want to go below 30fps (frames per second)," he said. "Compare that to VR where the displays are about 2k (horizontal resolution of about 2,000 pixels), but you have to render closer to

3k, and you don't want to go below 90fps. It's about a sevenfold increase in raw performance to render for VR versus traditional PC gaming. You have to do that in less than 20 milliseconds response time, from head rotation to what shows up on your display."

Nvidia is tweaking its Maxwell GPU architecture specifically for VR, upgrading software and drivers and building out an ecosystem – then add cost-down semiconductor economics. Oculus founder Palmer Luckey, for his part, sees the Rift's settled range as between \$200 (£139) and \$400 (£277). That all-in \$1,600 (£1,110) is early-adopter pricing.

With parent company Facebook's deep pockets, Oculus is suffering today's blowback for first-mover advantage and, it hopes, capturing the love of the most hardcore gamers. After all, there is a format war already under way in VR headsets. HTC's Vive (in partnership with Valve's Steam gaming platform) and the Sony PlayStation VR (formerly Project Morpheus) will arrive

soon. Google is looking for more from its Cardboard skunkworks.

Sony is Oculus's biggest threat today. Its headset is compatible with the PlayStation 4. While VR-specified PCs are comparatively rare, the Japanese giant can market 36 million homes. At time of writing, PlayStation VR is due to launch imminently. Analysts expect Sony to price it aggressively.

Yet these are opening shots. Investment bank Piper Jaffray forecasts VR headset sales of only 12 million this year and many are likely to be cheaper units for use with smartphones, like the \$99 Oculus-based Samsung Gear VR.

The real ramp-up, says Piper analyst Gene Munster, will come in 2020 when enough "compelling content" is available and, he believes, Apple will have entered VR, leveraging its huge installed base.

By then, two more rotations of Moore's Law should also bring the necessary PC silicon prices to mass-market levels. At that point, it won't necessarily be just the big boys who can gear up.

VR IN... MOVIES



Nokia's OZO
VR camera



Hollywood has fully embraced the dawn of the VR age.

By **Paul Dempsey**

ANY ENTERTAINMENT format needs content. There must be something to watch. Convincing content providers to adopt a new one requires two things: first, powerful research and development and promotional support for the core hardware platform. Second, a comprehensive infrastructure that enables cost-effective development and production of the content itself.

The early signs for VR moviemaking are that those components are in place.

In hardware, Sony (PlayStation VR), Facebook (Oculus Rift), HTC (Vive) and Google (Cardboard) are the spearhead – megabucks players that have made Hollywood take notice.

There is potential for a format war, but parallel progress on the infrastructure front is overcoming those concerns.

In December, Nokia announced availability of its OZO professional-grade VR camera. Providing a 195-degree field-of-view using eight synchronised 2k x 2k sensors and equipped for spatial audio recording, OZO's starting price is \$60,000 (£41,000). It's steep for holiday snaps, but incredibly competitive for pro-standard kit.

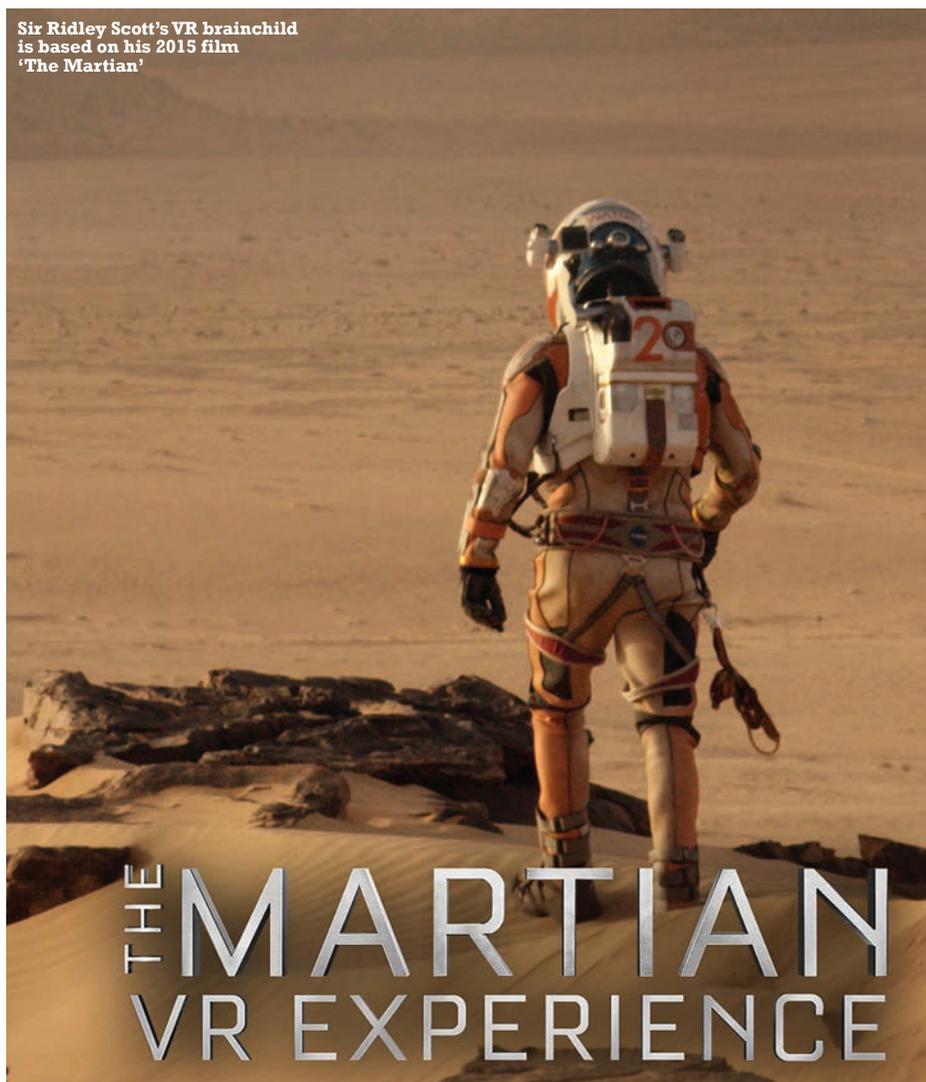
Other key infrastructure builders include Lucasfilm's ILMxLAB (part of The Walt Disney Company), Fox Innovation Lab (part of Rupert Murdoch's 20th Century Fox studio), exhibition specialists Dolby, effects group Framestore and a raft of impressively-staffed consultancies such as The Virtual Reality Company (the last of which has one Steven Spielberg as a senior adviser).

The mention of Spielberg brings us to one of VR's biggest infrastructure advantages: leading directors are backing VR aggressively.

VRC's founder Robert Stromberg told January's Sundance Film Festival that Spielberg has a project in hand "solely for VR". That could prove as massive a boost for the format as Spielberg's support for CGI on 'Jurassic Park'. However, this time, Spielberg wasn't the first member of Hollywood's movie royalty to embrace a new technology.

Sir Ridley Scott unveiled a VR spin-off from his latest blockbuster at this year's Consumer Electronics Show. 'The Martian VR Experience' lets you navigate another

Sir Ridley Scott's VR brainchild is based on his 2015 film 'The Martian'



world through astronaut Mark Watney's eyes. Scott, in turn, followed in the footsteps of Christopher Nolan. He offered a VR tour of Endurance, the spaceship from 'Interstellar', in 2014.

Also some way below the summit, there is as much work going on as talk. Sundance and the upcoming Tribeca Film Festival provide showcases for VR's less famous pioneers.

As impressive as these festival works are, they show what still needs to be done, but, a critical point, that debate is now largely about filmmaking 'language'. A simple example concerns one of its most basic tools: editing.

In a traditional movie, we are used to a director jump-cutting between different perspectives in a single scene. Yet does that become jarring in an all-enveloping environment and shatter the suspension of disbelief? Should VR take its visual style more from the fixed perspective of theatre's proscenium arch and the stagecraft used there to position or highlight actors and objects?

It's not an engineering question, but a cognitive one – and that's largely the point. Hollywood has accepted the viability of VR technology and is getting down to the nitty-gritty of how to exploit it.



So you think museums are old buildings full of artefacts sitting behind glass? Not any more.

By **Dea Birkett**



VR INTO THE... PAST

VR allows museums to share artefacts and exhibits with visitors even when they are not physically there

TODAY'S MUSEUMS are embracing new technologies to help preserve and bring alive the past. From wandering around a Roman villa wearing a toga to diving in an extinct coral reef, museums don't only allow visitors to look at the past, but they take them there. The Natural History Museum, London, Coral Reefs exhibition used virtual reality to recreate a 500-million-year-old sea, making the creatures swim before your eyes.

VR isn't only being used to transport you to the past, but to the museum. Visitors from all over the world can virtually walk through the British Museum's galleries, wandering past over 4,500 exhibits, using innovative indoor Street View footage created in partnership with the Google Cultural Institute. Teachers can transport their students to Bloomsbury from the classroom. The British Museum, already the second most visited museum in the world, now boasts a virtual audience of over 35 million.

The £2m EU-funded DigiArt project seeks to develop this use of VR for any museum. Professor David Burton of Liverpool John Moores University Drones Research Laboratory (a DigiArt partner), and director of the General Engineering Research Institute, says: "We're bringing together two worlds: firstly, the archaeologists and anthropologists who understand the science of uncovering and interpreting the past. Secondly, the engineers, computer specialists and UAV/drones researchers who have the knowledge and skills to capture this past in 3D and display it in exciting and accessible new ways.

"Working together, these form a team that will change the way we experience our past. The techniques will be trialled to recreate a Neanderthal cave in Belgium, 300BC Ancient Greece and a medieval English town."

Creating another reality doesn't have to involve unreal costs. The Great North Museum, Newcastle, used Oculus Rift 3D headsets to visit a virtual Greek villa. Chronicles VR developed the headsets with just £3,000 investment from Gateshead Council, complemented by funding from the university's start-up programme. Fifteen objects from the pottery collection were photographed to create 3D models to put on display in the virtual world – the urns on the patio and the washing bowl in the sleeping area, for instance.

By providing a context for objects, VR boosts rather than threatens any museum's unique selling point – that it holds a collection of real things. At the Great North, for example, they discovered offering VR experiences increased the number of visitors who then engaged with the real thing. "We had queues coming out of the door during the trial, and the museum found that once people had used the headset, they went to look at the collections and experienced the real artefacts," says Rachel Derbyshire, founder of Chronicles VR.

The *Loughborough Echo* even used VR when its local museum, Snibston Discovery, was itself becoming extinct, shutting down due to cuts. It offered its readers a virtual tour before Snibston closed its doors for the final time.

RECONSTRUCTION D-DAY LANDING VIRTUAL REALITY EXPERIENCE

As a tribute to engineers who devised and masterminded 'Operation Overlord' – the Allied invasion of Europe on 6 June 1944 – Dassault Systèmes, which specialises in 3D design and simulation software, developed an impressive VR experience reconstructing in 3D the engineering inventions underpinning the historic Normandy landings, including the LCVP (landing craft, vehicle & personnel) designed by US engineer Andrew Higgins and the WACO CG-4A gliders, LCVP's silent aerial counterparts.

The undisputed highlight of this VR project is a complete 3D replica of the artificial Mulberry B Harbour at Arromanches – a system of roadways on pontoons stretching far into the sea, which was the brainchild of Major Allan Beckett of the Royal Engineers.

Aside from its historical and commemorative value, this recreation demonstrates the vast possibilities of VR in the more up-to-date (and often confidential) military and defence areas.

Dassault Systèmes has strong faith in the power of VR experience. In the words of Monika Menghini, a DS executive: "We firmly believe that experiences are bigger than products."

To view this impressive VR recreation, visit www.3ds.com/dday

Vitali Vitaliev

VR AROUND THE... WORLD



VR should encourage active tourism and enhance our travelling experiences.

By **Vitali Vitaliev**

VR WILL play an important part in future travel by previewing, facilitating and enriching traveller experiences in useful and exciting ways, yet not entirely substituting real-life adventures with VR experiences, no matter how convincing and realistic. In fact, that future is in many ways here already.

With numerous VR applications already available, a would-be traveller can have a thorough VR and 3D preview of an intended hotel or restaurant at their destination. At the Hotelympia exhibition, held at Excel London between 29 February and 3 March 2016, a registered visitor was able to enjoy a walk-in immersive VR experience by exploring the newly-built Hilton Bankside hotel in London and appraise the ambience, if not yet the food, of two brand-new London restaurants: German Gymnasium in the King's Cross area and M Restaurant in Victoria.

The popular VirtualTourist website (www.virtualtourist.com), which already has 1.3 million members, apart from offering VR previews of thousands of destinations and hotels can also put you in touch with a real-life local travel guide to advise on the issues still outside of VR's reach.

VR and AR are already helping travellers to overcome language barriers. One of the linguistic tools, 'Word Lens' (recently bought by Google and incorporated into Google Translate (translate.google.co.uk), involves translating printed words from one language to another in real time using the video camera built into a smartphone – with no Internet access needed.

People with severe disabilities and illnesses can also use VR to 'travel' the world. Using the Oculus Rift headset (www.oculusvr.com), users can visit all four corners of the globe from the comfort of their hospital beds or, indeed, armchairs.

The same Oculus Rift headset is increasingly used by package holiday companies. Thomas Cook, for example, invites potential customers to take virtual tours of hotels and resorts, with sounds, such as those of birds, crickets or the ocean surf, added to the VR images. They can also look inside Thomas Cook's plane fleet cabins and decide exactly where they would like to sit.

The most ambitious of all existing VR companies specialising in travel is perhaps Silicon Valley-based Jaunt (www.jauntvr.com/about), which uses omni-directional



Augmented glasses for travelling could be the future

round cameras in combination with 3D microphones to recreate real-life destinations in minute detail as well as to record real-life events happening there (carnivals, parades, football games etc). According to those who had tested Jaunt's VR technologies, it is like actually being at the location and having things pop out at you, for the user has an impression of being transported to the actual setting of the recording camera in real time.

No matter how sophisticated VR and AR can become in the future, physical human interaction will always remain the cornerstone of travel. Yet all those amazing technologies, such as the already-existing

Dassault Systemes' VR and AR recreations of Paris, Singapore and Egyptian pyramids (<http://www.3ds.com/passion-for-innovation>), will continue to enhance our travel experiences, making them much more educational and fun.

In the words of Professor Bernard Fischer, the world's leading expert on virtual heritage, a typical travel guidebook of the future will be "a VR- and AR-based simulation of the tourist destination which exploits the principles of problem-based learning to encourage active tourism... when the visitor no longer passively follows a guide, but is actively engaged in a quest or adventure".



Many more artists could begin to blend VR with art to enhance the viewer's appreciation.

By **Rebecca Northfield**

VR IN... ART



DOORS is VR, interactive, portal-like and captivating

HAVE YOU ever peered closely at your favourite painting and wished you could see beyond what was in the piece, or just wanted there to be more in it? Ever wanted to get inside, experience the atmosphere, the sights and the sounds first hand?

That could be a lot closer to reality than you think.

Museums and galleries are beginning to embrace VR to create new and exciting experiences for visitors, injecting new life into an already magnificent form of human expression.

VR technology is becoming easier to produce, and many companies are dabbling. It may be easy to create VR, but it's very difficult to create beautiful VR.

However, that is exactly what some creative types are trying to achieve: artistic, visually stunning VR and, so far, they have been quite successful.

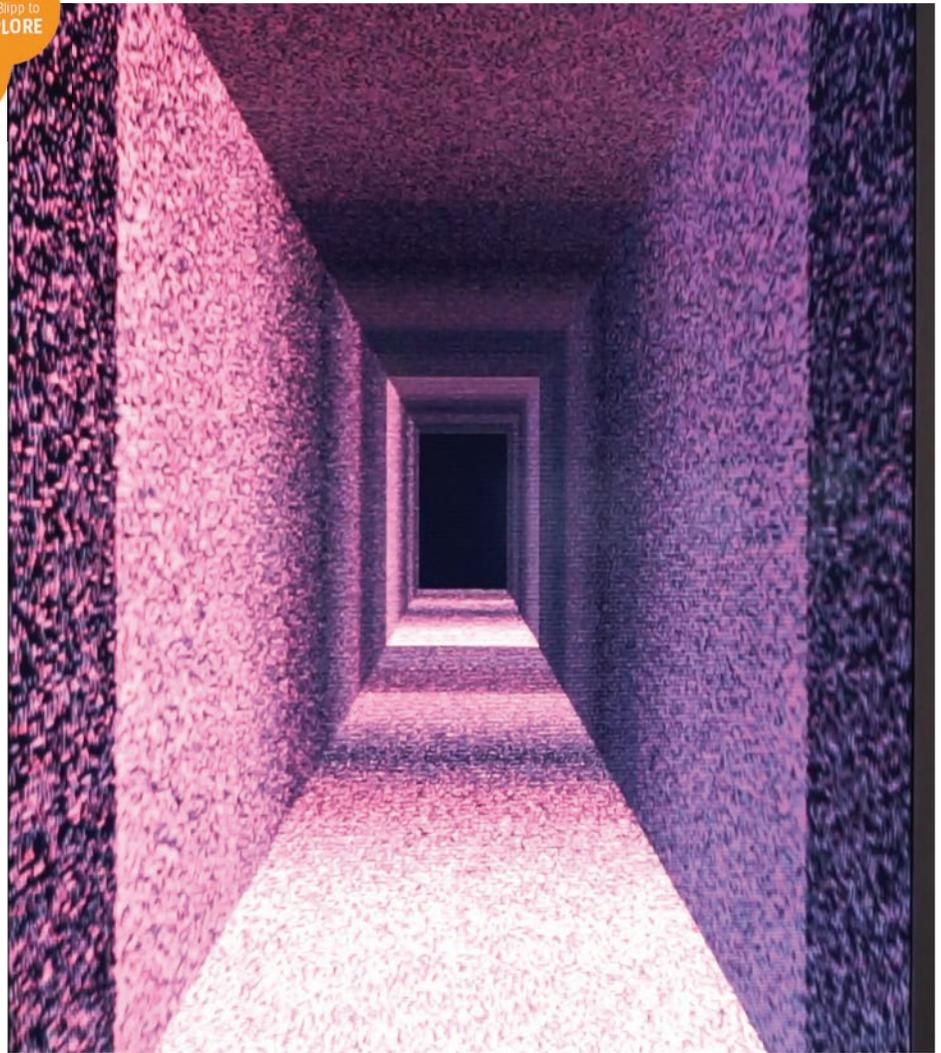
'Dreams of Dali' is an exhibition running until June 2016 in the Dali Museum in Florida, USA. One of the most celebrated and eccentric artists of all time, Salvador Dali captured his imaginings with a quality that spikes a desire to look beyond the 2D surface. 'Dreams' does just that. Using VR technology, they have created an experience unlike any other. Visitors put themselves in a fully immersive 3D environment and explore Dali's 1935 painting, Archeological Reminiscence of Millet's 'Angelus', using Oculus Rift. It feels as if you are in the mind of the master himself. Watch the 360-degree video here: www.youtube.com/watch?v=F1eLelocAcU

Another installation literally opens the door to the VR world, and it doesn't require headsets. 'Doors' from Théoriz studio (www.theoriz.com) is an interactive, portal-like piece created to start a conversation about shared VR experiences. It almost bridges the connection between the real world and the virtual one. David-Alexandre Chanel, creator of 'Doors', says that "when it comes to Doors, our work is focusing on blurring and questioning the limit between reality and virtuality.

"This is already present in lots of forms of art and was present before the whole enthusiasm about VR. Our line of work is focusing on experience."

Kathy Greif, marketing director of the Dali museum, says the best use of VR is to create experiences, "something that evokes a physical feeling, and preferably something you literally can't do in reality.

"My favourite part [of Dreams of Dali] is the elephants – you stare in awe as these



giant, graceful, surreal animals move right across your path.

"This just can't be experienced in real life – this is what VR was made for."

VR is on the rise and is starting to embrace the possibilities of digital art and mixed realities. One could question whether VR art will become a movement in itself, but Chanel doubts it: "I don't think VR can become an art movement, just like an art movement is not defined by a technology but by its use," he says.

Greif says that "in the end, [Dreams of Dali] certainly is breathtaking, but its intention wasn't to create 'art', it was to create a new way of looking at, and appreciating, art".

However, Oculus Story Studio has ventured into actually creating art using their VR technology; more specifically their Oculus Quill, which was previewed at Sundance in 2015. You can select colours and brushes using the controllers and motion cameras from Oculus Touch. Users can motion in the air using their arms and the movement appears on the 3D canvas.

'Dear Angelica', a short VR film from Oculus Story Studio, was created by artist Wesley Allsbrook, who named the Quill after Inigo Quilez, a VFX supervisor for Oculus. The 3D film encapsulates what VR and art

can achieve, with Allsbrook's motion and fluidity with the Quill an art performance in itself. See the video here: www.youtube.com/watch?v=JbzbX9F6Lhs

Quill is similar to Google's Tilt Brush app, but Oculus has yet to publicly release the new VR art tool. However it may inspire a new medium of art, with infinite possibilities.

With all the activity and advances in technology, what does this mean for the future of VR and its relationship to the art world? Greif believes that "progressive museums are leveraging technology to create unique experiences for their visitors – both onsite and online. I think the critical thing is to not use technology for technology's sake, but to consider how to blend it with art to enhance the experience or create a new one".

Chanel concurs: "As there is nowadays a big interest in VR, it is more likely that an artist will produce more artwork or get inspired by VR, as we did for Doors.

"It's also interesting to note that VR can be part of an artistic piece, but through helmets like Oculus Rift, can also be used as a tool to visit virtual exhibitions, as it's already been done through the Internet or video games.

"It's not safe, though, to say that [VR] is going to be a 'real' industry. That depends on many more parameters."



Galactica is the newest addition to the Alton Towers family

Mixed realities could be on the horizon for all attractions.

By **Rebecca Northfield**

VR AT THE...

THEME PARK



Holovis strive to create VR experiences for clients



Galactica will take riders on an other-worldly experience



VIRTUAL REALITY has become fashionable, with companies rallying their investments to ensure they are at the forefront of this progressive technology and its apps.

Thus, when one thinks of the perfect pairing of app and VR, it could be with a great escapism experience: theme park attractions and rollercoasters.

A fast-paced and adrenaline-pumping rollercoaster can push thrillseekers to their limits, so what could happen if it became multi-sensory and fully immersive, with limitless possibilities and infinite variety?

You can find answers, not in the birthplace of Disneyland, but somewhere less obvious: the UK.

Old Blighty has become the frontrunner of using mixed realities to create extreme experiences, as park giants Thorpe Park and Alton Towers unveil their AR attractions in April.

Thorpe Park's 'Derren Brown's Ghost Ride' is a multi-sensory experience held in a purpose-built warehouse, with a seven-tonne Victorian train carriage and 60 bespoke Vive VR headsets by HTC for riders. Derren Brown, the illusionist and mastermind of the Ghost Ride, says the mix of "virtual reality, grand illusion, special effects and live

action" will change the 'rules' of theme park attractions.

Alton Towers will also be opening Galactica, a mixed-reality rollercoaster where passengers can travel through several galaxies, with the twists, turns and falls timed perfectly with their VR headsets.

"By augmenting the VR with the synchronised movement of the ride, we can create an experience that you simply can't get anywhere else," Alton Towers claims, so what could VR eventually be capable of when it comes to theme parks? Could we see the end of 'real-life' rollercoasters?

Chris Savage, CEO of Wistia – a video marketing platform which is also expanding into VR – doubts it: "I don't think VR will be included in every theme park ride, but many more of them will find ways to use VR to enhance the experience.

"They will be able to mix live motion, feelings and smells with visuals and audio that can help transport someone to a completely different place."

CEO of Holovis – specialists in sensory experience design – Stuart Hetherington, agrees: "We still need the physical presence of iron coasters in the park and [rollercoasters] are the only type of ride that

can provide the G-force needed," but he adds that VR can enhance a coaster experience and refresh staple attractions.

Caecilia Charbonnier, co-founder of Artanim Interactive (developers of immersive and interactive systems around motion capture and VR) has a differing opinion, believing that theme parks can move totally to VR if they achieve "a sufficient degree of realism by recreating the sensation of being in a rollercoaster (in terms of motion).

"Once this has been achieved, then we can definitely move to VR for this kind of attraction – which will also be much safer for the visitors."

Charbonnier adds that VR could "provide users with the flexibility to change 3D environments as they please, without the need to rebuild the entire attraction".

It is not certain whether theme parks could take on an all-VR selling point – The Void in the US is attempting to woo the world with its 'first VR theme park' tagline and will open this summer, but it's still having teething problems. Yet using VR for at least part of their package could save theme parks vast amounts of time and money, which could mean cheaper thrills for all of us – and safer experiences.



VR AND... BETTER HEALTHCARE

Whether it's making painful treatments more bearable, helping people to overcome mental health problems or supporting surgeons in their decisions, VR looks set to transform healthcare.

By **Lawrie Jones**

RECEIVING TREATMENT for severe burns can be a traumatic experience. Wound cleaning and bandage changes cause pain that, even with opioids like morphine, 86 per cent of patients still reported as excruciating. In 1996, after witnessing how engrossed children became while playing video games, researchers at the University of Washington's Human Interface Technology Laboratory (HITLab) came up with the idea of providing VR games to those being treated for burns, hypothesising that immersion within a game could have positive benefits for the patients, who would concentrate more on the game and less on the pain.

Wearing a VR headset, patients were thrust into a game that by modern standards is laughably primitive. But it didn't seem to matter. In all tests, patients reported reduced pain levels, with medics able to go about their work more efficiently and effectively.

Anecdote quickly became evidence with peer-reviewed research published by the Society of Behavioural Medicine in 2011 showing just how powerful immersive games can be as an analgesic. The technology is now being used by the US Army to help wounded

soldiers while receiving treatment.

It's just one example of how the total immersion offered by virtual reality is helping to transform healthcare. Training the next generation of students, helping soldiers to cope after a traumatic incident and even creating realistic and interactive maps of the entire human body, virtual and augmented reality technologies are coming to a hospital near you.

Facing your fears

Virtual reality seems to have been around forever, never quite breaking through to the mainstream. "The view is that it died after the 1980s," explains Professor Mel Slater, who leads the University of Barcelona's Experimental Virtual Environments Laboratory (Event Lab). According to Slater, that's not the case. "There has been an absolutely massive amount of work in the past 25 years in very diverse areas from psychotherapy, to physical therapy, to sports, to medical rehabilitation, to travel, virtual meetings and studies of moral dilemmas."

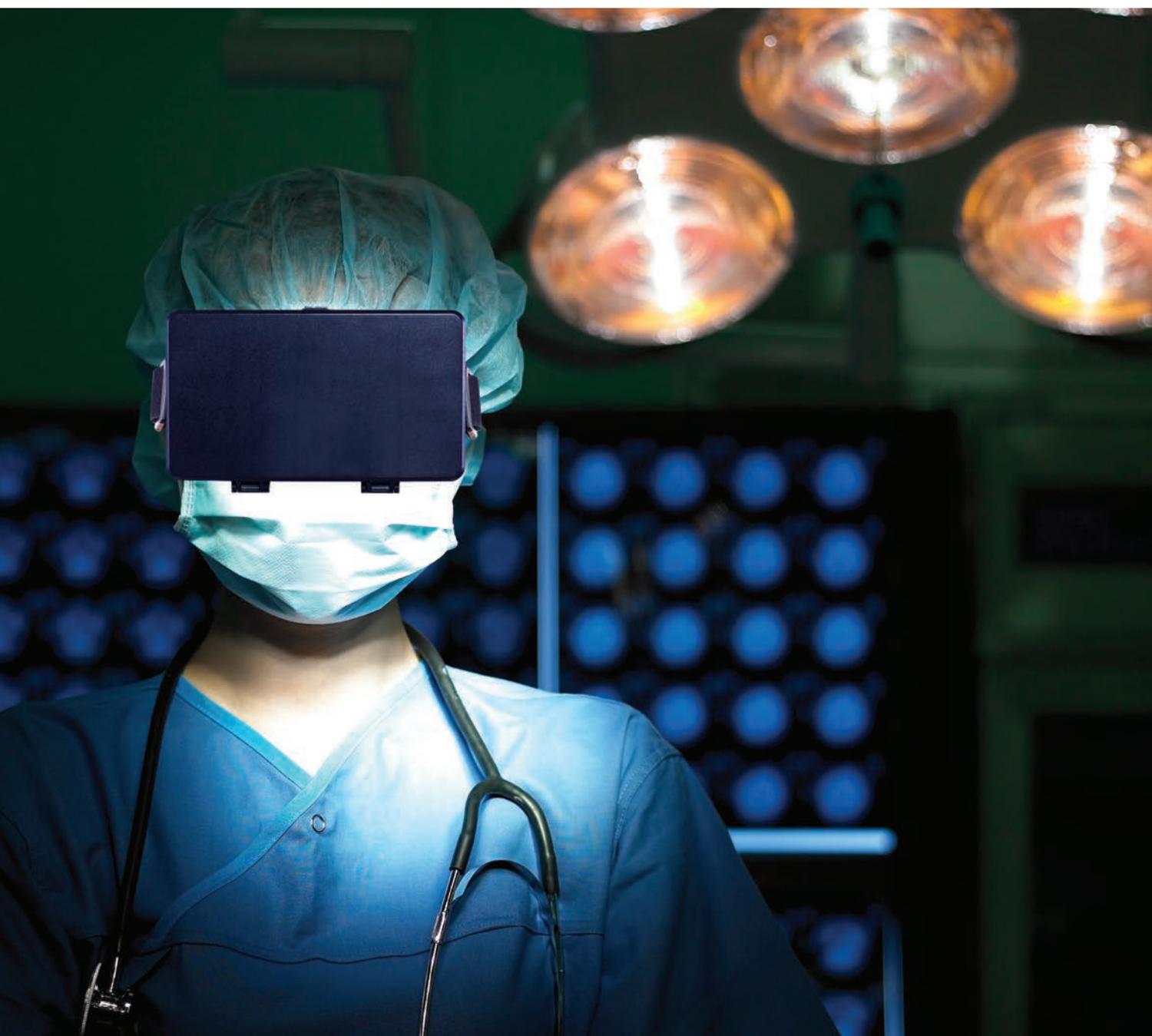
Behind the doors of healthcare facilities across the world, virtual reality technologies

have been used to treat patients for years, while at the same time clinicians and researchers patiently go about developing systems that are safe and build an evidence base for the mass adoption of technology.

Since 2005, the US Army has used exposure therapy and virtual reality simulations to help treat those returning from conflict. Soldiers suffering from post-traumatic stress disorder (PTSD) are being transported back to a virtual warzone to re-experience combat.

Strapping on a headset, the soldiers work through traumatic scenarios in the safety of the virtual world, with the support of a trained therapist, by retelling their story. Using accurately rendered surroundings originally built for the Full Spectrum Warrior game on the Xbox, the realistic environment effectively allows the soldier to travel back, reliving the experience and confronting their fears in what is known as a 'virtual Iraq'.

The work in the US is one example of how VR is used to treat mental health problems like PTSD, chronic anxiety and a host of other conditions. "We take the victim back to their memories, and build the environment



in a virtual world,” says Willem-Paul Brinkman, an assistant professor at Delft University and a part of the Dutch Virtual Reality and Phobias (VRET) programme.

Brinkman and VRET colleagues at Delft University and the University of Amsterdam are using VR to help create a better future for the victims of childhood sexual abuse. Working with trained psychologists, the team are able to reconstruct scenarios from their past, allowing the victim to recontextualise their experience. “We can build a 3D environment so the participant can see the scene of their abuse from different viewpoints,” explains Brinkman. Through the relatively safe environment of VR users can begin to confront these difficult memories, often defusing them of their power.

In a more prosaic example, Brinkmann describes how VR can help those suffering from common social phobias such as delivering a speech to a large audience. Immersed in the VR world, participants can deliver their talk, with the controller able to change the parameters and stretch the participant. “We can make the audience look

interested or bored,” Brinkman says. It might sound run-of-the-mill, but for those with anxiety conditions like agoraphobia, the results can be incredible and make a real difference to their lives.

Out-of-body experience

Most VR systems place us in the environment with all of our hang-ups and proclivities, but the work of Slater is taking us out of our own bodies and challenging some of

the fundamentals of our own identity. “When you put on a head-tracked head mounted display and look down towards yourself, what do you see?” Slater questions. “Normally it’s a continuation of the virtual environment. However, a virtual body can be programmed into the environment so that when you look down towards yourself you can see an alternative, virtual body.”

By doing this your mind can be tricked, creating a perception that the virtual body is your own. Slater and colleagues have used this to illustrate how our perception of ourselves can be challenged. In one experiment the team put participants in white, black and purple bodies for up to 12 minutes. During that time the participants do very little; they see their body, view themselves in a mirror and watch as some people walk by. “What happens is that the implicit racial bias against black people decreases only for those in the black body,” Slater says, adding: “We have recently repeated this experiment and found that the effect lasts for at least a week.”

It may sound like fun, but the work of Slater, Brinkman and colleagues is >



Clinicians at the Insigneo Institute marry real-life experience with the virtual world



'A general surgeon in a rural environment could use this system to perform urgent, life-saving care when transporting the patient to a major urban hospital isn't feasible.' Daniel Anderson, Purdue University

< conducted in a rigorous and controlled environment. The research is about challenging self-perception and understanding how the view we hold of ourselves can be manipulated, and the resulting influence – positive or negative – that it can have on our actions.

Augmenting the real world

During an operation, one false move could cause permanent damage. So-called virtual reality systems have been used for nearly two decades to train students to carry out certain operations, but they are more like very detailed interactive games. The benefits for training in a VR environment are clear, but what happens when surgeons start working with real patients? Here it's not virtual reality that's making the difference; it's augmented reality.

"VR is all about a user being immersed in a virtual environment and getting the feeling of 'presence'. AR is different in that it is about placing additional contextual information onto the real world," says Daniel Anderson, a PhD student in computer science at Purdue University in Indiana and one of the increasing number of innovators pushing the boundaries of what's possible with augmented reality technology.

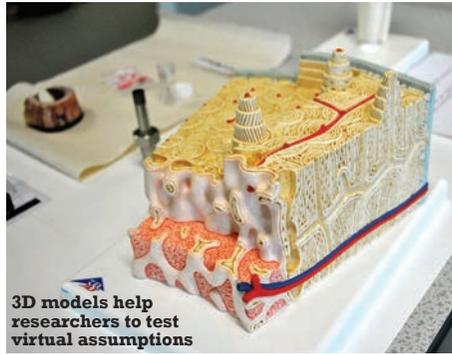
Augmented reality systems like Google Glass overlay technical information on the everyday world – making our reality better. They also allow other people to see the environment from the wearer's perspective, offering the perfect opportunity for training and development. The system was put to the test in 2014 when Shafi Ahmed, a surgeon at St Bartholomew's Hospital in London was the first to live-stream an operation. Using Google Glass AR HMD, viewers were treated to a unique experience, with more than 13,000 students across 115 countries tuning in.

When they pick up the scalpel for themselves and start to carry out operations, trainee surgeons are traditionally supported by a mentor looking over their shoulder and providing advice. In certain circumstances reference books or information screens are also used to provide support. Processing all this information while trying to treat the patient severely stretches what psychologists call our cognitive load – essentially our total capacity for mental effort.

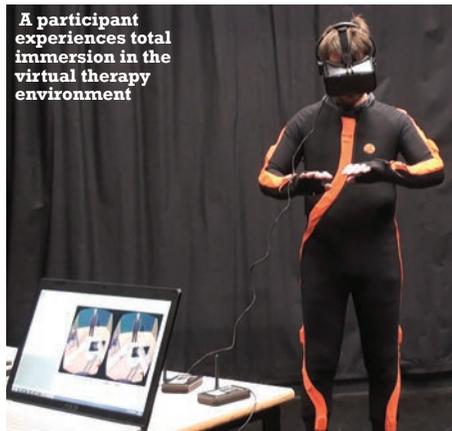
It's here that AR can help. During surgery for instance, augmented reality systems enable mentors to overlay information on the patient, annotate areas and even call up relevant information, significantly reducing the cognitive load and, as a result, pressure on the surgeon.

In one exciting project at Purdue University, augmented reality systems are being developed for use in the most challenging of environments: the battlefield. Supported with a grant from the US Army, the System for Telementoring with Augmented Reality (STAR) uses touchscreen displays, transparent screens, tablets and colour and depth sensors to link battlefield medics with distant specialists.

In the heat of battle a soldier who has been shot will need urgent medical attention to



3D models help researchers to test virtual assumptions



A participant experiences total immersion in the virtual therapy environment

DOWNLOADS VR ON PRESCRIPTION

■ Developed by students at Delft University, the Multi-Modal Memory Restructuring System software has been designed to help treat post traumatic stress disorder (PTSD). There are a variety of virtual environments that are available for free download at:

<http://ii.tudelft.nl/3mr/>

■ Phobos is a VR environment for Oculus Rift that is being developed to support cognitive behavioural therapy treatments for phobias like fear of heights, flying and spiders. Currently in development, you can download a free beta version at:

<https://share.oculus.com/app/phobos---phobia-and-anxiety-mgmt---dk2-tech-demo>

■ Dr Mel Slater is pushing the boundaries of what's possible with VR. You can keep up to date with his psychological experiments in tackling perception and altering our realities at: www.youtube.com/user/EVENTLabBarcelona

■ After conducting hip replacement surgery, a group of French surgeons created the world's first virtual reality surgical video for the Oculus Rift. The stomach-churning experience can be downloaded free at:

<http://imgur.com/a/srJbT>

■ Bringing the world of augmented reality and surgery closer is Dr Marlies Schijven – the Google Glass surgeon. Watch interactive films and become inspired by the latest in clinical augmented reality at: www.googleglasssurgeon.com



stay alive, but with limited facilities and potentially limited skills, the field surgeon may be struggling. The STAR system will link the medic with an experienced mentor who can talk them through the procedure, providing real-time notes and annotations on a transparent screen, as well as giving personal support and encouragement. The surgeon sees the patient, the instruments and their own hands, but with the mentor's mark-ups overlaid on them.

The system is much more sophisticated than just relating images, as Anderson describes: "We use computer vision algorithms to reposition the mentor's annotations so that they appear anchored to the element of the operating field they describe." In other words, if the organ is repositioned during the operation, the notes relating to it will move on the display.

While created for the battlefield, STAR has clear applications in civilian life too. "A general surgeon in a rural environment could use this system to perform urgent, life-saving care on a patient when



Cutting-edge facilities give Insigneo's technicians a head start in simulating the processes of the human body

transporting the patient to a major urban hospital isn't feasible," says Anderson.

Virtual Human

During surgery every interaction with the human body can have potentially life-long consequences for the patient. At the moment, AR systems like STAR and a number of others in development are able to reference the current environment, but what would happen is they could be used to predict the impact of any intervention by the surgeon?

Mario Viceconti is a professor at Sheffield University and director of the Insigneo Institute for *in silico* Medicine, which is contributing to a European project to develop the 'Virtual Physiological Human' (VPH). Over £200m has been earmarked to create realistic and reliable models of the human body that would provide accurate predictions for surgeons and clinicians working on some of the most challenging areas of medicine, including the neuromusculoskeletal system.

The challenge is enormous: not just to create the models themselves but to manage

the processing challenge of calculating accurate and reliable results. It's all part of a new branch of '*in silico*' medicine, which involves the use of computers to trial new drugs or predict the impact of surgery.

Marrying the theoretical and the practical, it's an area that Viceconti sees merging with the worlds of virtual and augmented reality. "Historically the models in real-time simulations are inaccurate. Ours are very accurate, but slow." Conquering the computational task is simply one of processing power – something that has historically been tackled very quickly by manufacturers, he points out.

The models being developed by Viceconti and colleagues could provide surgeons with real-time feedback on the decisions they make. The challenge is a big one. "We need to merge our very accurate model with augmented reality, so a surgeon can ask 'What will happen if I do this?'" It's a step beyond what's capable at the moment, but Viceconti imagines a world where a surgeon can use virtual models as reference points for

TRAINING A SURGEON'S VIEW OF VR

"If you look at other simulation training tools currently out there, we have reached a plateau," says Shafi Ahmed, colorectal cancer lead at Barts Health NHS Trust and a partner in a UKVR start-up, Medical Realities. "Virtual reality offers something different."

There are two elements needed in a successful surgeon, says Steve Dann, another co-founder of Medical Realities: "Surgical operative experience entails both cognitive decision-making based on procedural knowledge and technical ability. Often, it is the latter that is the focus of surgical training models."

Both Dann and Ahmed agree that there is a problem in surgical training, which they are tackling through technology – and that despite its importance, procedural knowledge is poorly taught around the world.

Ahmed also says that despite promises, many medical simulators simply fail to live up to expectation. Where VR has the advantage is in providing an infinite number of virtual training environments, where students can experience any challenge imaginable. One key difference is that the virtual environments created by Medical Realities are being designed and tested by medical professionals.

The hope is that these simulations – all of which are being created for low-cost, commercially available technologies like Oculus Rift – will help raise standards of surgery for everyone, not just those who can afford it, to the benefit of patients.

Ahmed believes our future surgeons will embrace the world of virtual reality as an alternative to studying from books. "Today's trainees are young, innovative and eager to adopt new technologies in the educating workspace."

all decisions made during surgery.

Take the example of a knee replacement operation. During the procedure, the surgeon needs to decide where to enter the body, cutting ligaments and tissues, as well as where to locate the prosthetic device. All this can have a real bearing on the patient's future ability to work and function. The virtual human model could provide advice based on the actual physiology of the patient. "It could change lives," says Viceconti.

The host of low-cost VR and AR devices being released and developed is creating a genuine public interest in immersive technologies. "I expect that now there will be a huge flowering of applications, that will seem a bit chaotic at first, but gradually settle down so that it becomes part of our lives as much as mobile phones," says Slater.

Brinkman and colleagues see the technology increasingly being used in clinical settings, and have – in the open-source spirit – made some of their models freely available to anyone who might wish to try them out. *



The Ministry of Sound club in London, captured digitally by Virtual Walkthrough

VR IN... BUILDINGS

Taking the slog out of viewing and choosing property.

By **Dea Birkett**

VIRTUAL REALITY equips architects, developers, estate agents and house hunters with all the tools they need to design, market and purchase a property before ever setting foot inside. 'PropTech' will let you do everything – from fit out the kitchen to pick out the wallpaper – without having to leave the design studio or showroom.

Sol Rogers, founder of digital production studio Rewind, says: "VR will be a complete game-changer. For developers, it offers a myriad of opportunities. Clients can download an app and view every floor plan in 3D. You can even position furniture in each room. This will provide a much better feel for a property than previously possible. By the time you see an estate agent, you'll be ready to be sold to, saving time for all involved."

There are huge cost savings if VR is adopted by architects (who no longer need to spend time and money building physical models) as well as developers, as James Dearsley, founder of the Digital Marketing Bureau, points out: "Considering figures from Knight Frank in 2015, 49 per cent of all new-home house buyers in London were overseas. It's a significant cost for developers to attract these buyers. VR will revolutionise this market place."

Virtual Walkthrough is a specialist business that puts whole virtual properties online, on social media, mobile devices and over email, reaching potential purchasers in their sitting rooms. Co-founder James Morris-Manuel says: "Previously, estate agents relied on photographs, the fish-eye lens or panoramic viewpoints to view a property. Virtual walkthroughs and virtual reality headsets now allow customers to gain a better understanding of what they can expect from a property. We use 4K HDR technology, so all captures are in extremely

high resolution – so much so that you can clearly determine patterns on fabrics."

Rewind recently completed a project for estate agents Savills that involved using cutting-edge 3D scanning technology to capture super-high-resolution data from inside a £17 million mansion. This data was then put into a bespoke application created specifically for Savills, allowing clients to walk around a hyper-realistic 3D rendering of the real house, giving a true sense of space and scale to whoever was strapped into the headset. Viewers could explore all aspects of the property in incredible detail, through both self-navigated and guided tours and have unique viewing solutions and positions not normally possible in the real world.

These technological tours aren't just for those purchasing a million-pound property. This year, the Student Housing Company launched an app enabling students to explore their halls of residence off-plan, accessed by touchscreen technology in the firm's Southampton marketing suite.

Acoustic modelling

Virtual viewing goes beyond mere looking. Now you can also listen for echoes even before there's a wall for them to bounce off. In February, international engineering consultancy Cundall launched its new Virtual Acoustic Reality (VAR) system, which uses audio-prediction modelling and gaming-quality graphics. The Cundall team combined the Oculus Rift virtual reality headset with a gaming engine and high-quality audio, making it possible to create an immersive audio and visual tour of a building before it's built.

A pre-programmed acoustic model calculates the conditions at many locations across a grid and the 3D walkthrough enables

the user to travel across that grid, hearing in real time how the sound changes.

Applications could include a teacher within a model of a classroom assessing how well a pupil can hear them; a piano in a concert hall, to judge the effects of reverberation; or extraneous noises within a restaurant, so the designer can mitigate them with specific acoustic treatments. If a proposed development was next to a motorway, the noise impact on the new homes could be shown. Potential problem areas can be identified and alternative solutions tested while the building is still at the design stage.

Although you may be able to hear a pin drop on the virtual parquet floor, VR still has its limitations. You can't smell the coffee. "You can't yet create the property-viewing secrets of baking a fresh loaf of bread just before people arrive – but this won't be far away," says Dearsley. "Sensory stimuli are being added all the time. Smell is perhaps the hardest of the senses to trigger, but there have already been experiments with trying to simulate the smell of cut grass, for example."

In the future, will we ever have to leave our lodgings to design and discover the home of our dreams? "Virtual walkthroughs aren't designed to prevent you from going to a property. On the contrary, they've been created to get customers to the right property," says Morris-Manuel. "They ensure no time or money is wasted in inappropriate viewings, and allow you to 'revisit' a property via a walkthrough to remind yourself of what a space is like. VR will redefine the house-hunting process." Yet it will never completely replace a knock on the front door, he adds. "There's no substitute for physically being in situ, and benefitting from a feel for the property you are going to live or work in."



Put yourself in the front row at designer shows, and use your avatar to try before you buy.

By **Jade Fell**

FASHION MAY not seem like the most exciting outlet for virtual reality – virtually browsing the high street is a far cry from simulated bungee jumping and the like – but think outside the box, and there are so many ways that VR can become vogueish in the fashion industry.

Let's start with the basics – fashionable VR. Is there a market for glitzy alternatives to standard VR devices? It seems niche, but there have been rumours that Dior plans to introduce stylish and chic VR headsets, with a scintillating logo embellished across the front, in select boutiques.

However, Amelia Kallman, innovation consultant at interactive technology company Engage Works, remains unconvinced: “When you understand how transformative the experience of being in a virtual world can be, the aesthetics of how you look wearing a headset in reality is irrelevant,” she says.

VR recently made headlines during Stockholm's Fashion Week. In a project dubbed ‘Democratic Front Row’, three celebrities gave up their front-row seats for Swedish designer Ida Klamborn's show – and were replaced by robots equipped with VR cameras. With the help of Google Cardboard, fashion lovers could view the show in real time from the comfort of their homes.

Dior Eyes, a headset designed to give access to sights and sounds of the fashion show



‘You can shop on Oxford Street in your lunch break without the travelling!’
Hrvoje Prpic, Trillanium

The potential for VR at fashion shows as a revenue-raising device is evident. This could be in the form of pay-per-view service, allowing access to exclusive fashion events, or by spreading the brand's consumer reach.

Why stop at viewing fashion, when you can purchase catwalk trends in VR? Virtual shopping may sound like a more complicated variant of the online version, but in practice it offers shoppers the opportunity to make more informed choices.

“Online shopping cannot provide a showroom experience,” says Hrvoje Prpic, CEO of Trillanium, which specialises in developing online VR experiences for shoppers. With platforms like Trillanium, says Prpic, shops are able to provide a real-world experience of shopping. “The only difference is that this can happen anytime and anywhere. You can shop on Oxford Street in your lunch break, without the travelling.”

Unbelievable as it may seem, the next step in the industry may actually be trying

clothes on. Could VR offer a solution to the nightmare of online size guides?

A wave of start-ups has emerged to address the problem. In 2009, Zugaro introduced The Webcam Social Shopper, software which allows shoppers to use a webcam as a mirror to try on items, while London-based Fits.me developed its Virtual Fitting Room, which pairs shoppers with stores that best match their measurements.

In the future, Kallman envisages customisable avatars with the ability to try on clothes, ensuring that those jeans fit not just your style, but your body, perfectly. As VR becomes more advanced, she says, the whole experience could become even richer. “Wearables, gesture and voice recognition, as well as haptics – the ability to ‘feel’ textures and fabrics through produced sensations – will all have a major effect.”

VR ON THE... CATWALK

DOWNLOAD and Blipp to EXPLORE

Democratic Front Row, arranged by Tele2 and Fashion Week Stockholm, brought the celebrity experience to anyone with the right app and viewer.



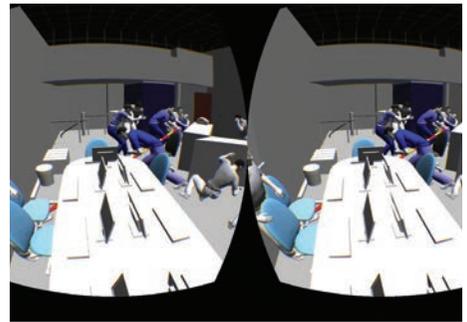
Taking a jury to the scene of a crime could change the court system and the way evidence is presented.

By **Crispin Andrews**

VR AT THE...

CRIME

SCENE



VR BURGLARY

Police solved just 12 per cent of 750,000 domestic burglaries between June 2014 and 2015.

In order to learn more about how burglars operate and to help law enforcement and security companies devise more effective deterrents, researchers from the Netherlands Institute for Crime and Law Enforcement and Portsmouth University have set up a virtual-reality burglary environment.

This consists of the exterior and interior of three adjacent houses and their immediate surroundings. Study participants, consisting of University students and convicted burglars currently in prison, wear an Oculus Rift headset and move around the virtual street. They select a target, break in, search a house and finally exit with the stolen goods.

Thus far, the study has found that experienced burglars tend to follow similar routes: upstairs first, then downstairs living rooms, checking coat pockets for wallets, credit cards and small valuables but ignoring electronic equipment. "It's almost like they're on autopilot," says Portsmouth University forensic psychologist, Claire Nee.

defence or prosecution lawyers could use it to admit a 3D reconstruction of their client's view of events, based on witness statements.

"If prosecutors used this, the defence would want to know how the data has been gathered to feed the VR machine," says Professor Peter Sommer, a digital forensics expert. "Defence would ask whether the data is sufficiently complete to create the virtual picture, if any of it is based on interpretation, or influenced by the unconscious bias of those who put the reconstruction together."

Professor Sommer adds: "Reconstructions could be very vivid and create a strong impression. This could mislead a jury if information is not complete."



3D scans would arguably give juries a far better sense of a crime scene than diagrams and artful lawyer descriptions alone

LAWYERS SPEND HOURS during trials describing in meticulous detail what occurred during a crime, in the hope of painting a favourable picture in the heads of a judge or jury. To this end, they allocate a lot of time preparing testimonies, photographs, video footage and other documents.

What if virtual reality could take those people, on whose judgement fates are decided, back to the crime scene? Lar's Ebert from the Institute of Forensic Medicine in Zurich, Switzerland, thinks it could help juries make more accurate choices. Last year, Ebert and colleagues from the university produced a paper and video examining the use of 3D reconstructions for the courtroom.

The Swiss researchers programmed information about one particular shooting into the software for the Oculus Rift gaming device. From this, they created a 3D reconstruction of the scene which included bullet trajectory and featured characters with the correct

height, arm-length and posture, but without clearly identifiable features.

The visual information came from security camera footage from the real crime scene and laser-scans of room measurements. Investigators already use 3D laser scanners to create panoramic digital snapshots of crime scenes in minutes, and CT scanners to provide detailed pictures of injuries.

Ebert explains that VR reconstructions provide more precise details from which opinions can be formed and courtroom judgements made. He believes that VR works because it presents events in 3D, tracks movement and enables juries to experience another person's line of sight, which could be essential in assessing witness testimony. "Those watching don't have to imagine what might have happened," he says.

In Switzerland, this technology could be used by judges and state attorneys to do the pre-trial fact-finding. Elsewhere in the future,

VR IN... SPACE

VR-cations for the mind on the long trip to Mars. By **Crispin Andrews**

IN MARCH 2015, Russian cosmonaut Mikhail Korniyenko and American astronaut Scott Kelly set off for the International Space Station. A year later they have just returned, so they didn't beat the record 437 days and 7 hours set by Valeri Polyakov from January 1994 to March 1995.

Nasa has long used VR to help prepare astronauts for tasks that they'll perform during voyages ever since the Hubble telescope needed repairing in 1993. However, with journeys to Mars being planned, one former astronaut, Jay Buckley, has decided to see if VR can help maintain astronauts' mental health by exposing them virtually to the world they've left behind.

Nasa says that it takes around eight months to get to Mars, maybe less by the time the first astronauts make the trip. Still, going without sunlight or fresh air for that long is not good for a person's mental health.

VR has long been thought to have therapeutic value and Buckley, who is now Professor of Medicine at Dartmouth Medical School, wants to

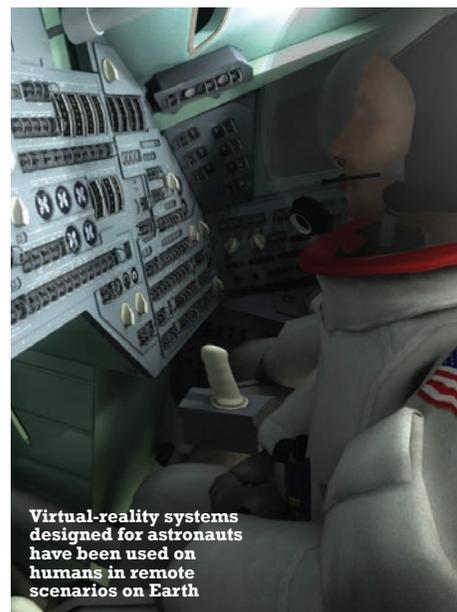
find out if it can help astronauts combat the effects of long-term isolation.

The VR program contains scenery designed to calm the mind. "The VR tricks the brain into thinking you're outside strolling on a beach, or with family at home," says Dartmouth Professor Lorie Loeb.

The technology has been tested during an eight-month astronaut training camp on a volcanic island in Hawaii. Buckley's team has also given Oculus Rift headsets to Canadian military personnel stationed 500 miles from the North Pole: a small group of people in a confined and hostile space.

Nasa predicts that its first Mars spaceflight will happen in 2030. Potential astronauts are still at school, so the space agency has designed a VR Mars experience game with the Massachusetts Institute of Technology and game developer Fusion to help inspire kids to take up a career in space.

During short missions, players explore and interact with the Martian landscape in a Z-2 space suit, a real prototype currently under development at Nasa. Players also get



Virtual-reality systems designed for astronauts have been used on humans in remote scenarios on Earth

to drive the Mars Rover prototype. Virtually, of course. Game designers produced the Mars landscape using video and audio footage from recent space missions.

The Mars 2030 Experience will be out later this year and so will Apollo 11 VR, a launch title on the Oculus Rift, HTC Vive and PSVR. Here, players relive Neil Armstrong and Buzz Aldrin's first steps on the Moon, using audio and images actually used by Nasa's Mission Control centre in 1969, and footage captured by the legendary astronauts themselves. Players lift-off, dock the lunar module, walk across the surface of the moon and carry out experiments.

VR can help soldiers fully prepare for combat.
By **Mark Williamson**

VIRTUAL REALITY could almost be made for military applications, since the key advantage of simulating as opposed to actually engaging in a conflict situation is that nobody gets hurt.

According to Brigadier SC Sharma, president of Axis Aerospace, "The military uses VR for everything from training and safety enhancement to analysing military manoeuvres and battlefield positions". Given even a basic understanding of what teenage gamers do with PS4s, it's easy to imagine how a more immersive version could provide training for real soldiers. In fact, VR can be extended to the battlefield itself and used as "battlefield visualisation", says Sharma, "to control combat operations in real time and help commanders assess their options".

According to René ter Haar from the University of Twente in the Netherlands, VR can also help 'after the fact' in the treatment of post-traumatic stress disorder (PTSD) "by exposing veterans to virtual situations that resemble or represent the trauma". By reliving the situations in a low-threat environment, he argues, they can "process the emotions [associated with] the traumatic events and overcome their PTSD symptoms".

In future, Haar believes that, as facial animation improves, human interaction factors such as "communication, leadership, awareness and emotion" will become more important in training simulations. A good deal of military activity these days involves

VR IN... WAR

'peacekeeping' in unfamiliar cultural environments. VR training can provide experience in 'soft skills', explains Haar, such as obtaining meaningful information from civilians, reading body language and understanding the consequences of poorly delivered instructions.

Back in the realm of the joystick, flight simulators date back to the First World War, when ground-based simulators were developed to train air-gunners.

Today, of course, a standard six-degrees-of-freedom platform, force-feedback flight controls and vibrating seats provide a much more realistic simulator experience, not only for flight training but also for the simulation of weapons systems.

Actual combat missions are arguably becoming more like simulators than the real thing, as helmet technology – with its integrated 3D displays and night vision capabilities – increases to the point where pilots and gunners are effectively embedded in the machine.

The US Army is keen to go further, however, by addressing integration. Most training simulations are designed to operate independently, such that pilots in a flight simulator train without interacting with soldiers in a simulated ground-attack exercise. Col John Janiszewski, director of the US Army's National Simulation Center, hopes to change this with the 'Future Holistic Training Environment Live Synthetic'. The plan is to create a "live synthetic system that fuses the main areas of simulation into one", explains Janiszewski, "allowing participants scattered across various centres to fully participate in training exercises in real time".

It is already common for a 'pilot' to control an unmanned aerial vehicle via satellite, from a distant continent. It is possible, without too much reliance on sci-fi, to imagine a scenario in which VR is no longer restricted to training but extends throughout the field of operations, effectively replacing those 'boots on the ground'.



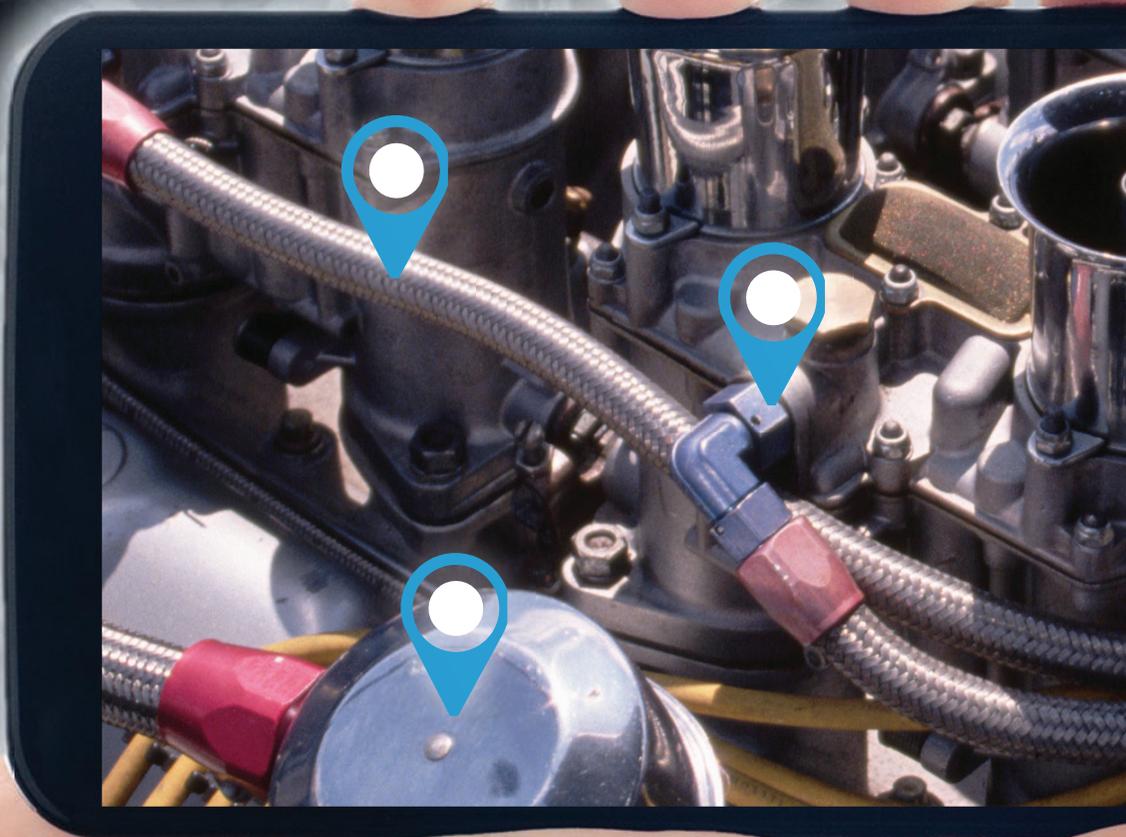
How does industry make best use of augmented, virtual and mixed realities?

By **Holly Cave**

VR IN...



THE FACTORY OF THE FUTURE



ALAMY CITY IMAGES

Virtual and augmented reality technology is being placed directly in the hands of industrial workers



WORKING AND collaborating in virtual and augmented realities can boost productivity in every phase of the industrial development process – from initial design to assembly optimisation. Despite the set-up cost, more and more manufacturers are realising that these mind-altering environments provide a huge opportunity to save time and money.

Designers, engineers, executive decision-makers and even clients can iterate on designs in real time. Plus, having a virtual, 3D prototype can cut the time, money and materials needed to create a series of physical prototypes.

Virtual reality (VR) is the main approach currently being used. It sees the user completely immersed in a computer-generated reality, or virtual world. Yet if manufacturers want to visualise and manipulate computer-generated content in the real world, it's augmented reality (AR) that's needed. This emerging technology offers the user digital information overlaid onto their immediate surroundings.

While this data can be contextualised to the user's location, or to where the device's camera is pointed, it's not the same as being able to see holographic objects pinned, or anchored, to specific physical locations or objects in the real world. This is where future mixed reality technologies, such as Microsoft HoloLens and Magic Leap, are likely to revolutionise the industry.

Getting it right first time

As it stands, most industries that have already taken the step into using VR and AR have implemented the technologies in the field of product design. Balfour Beatty Rail, for example, uses VR engineering for planning and prototyping. Electric car start-up Faraday Future has revealed that its first concept car, the FFZERO1, was created from scratch in just 18 months with the help of time-saving VR and AR design processes.

In response to demand, world-leading 3D design software company Autodesk has a number of AR and VR initiatives under way. Its LIVE Design package combines the company's existing 3D modelling tools with its games engine, Stingray, to create virtual experiences of buildings, interiors and walkthrough designs. The firm showcased this approach in December 2015 at its annual conference, with users accessing the virtual experience by wearing a HTC Vive virtual reality headset.

"Mixed reality changes every aspect of how you work with your data, environment, peers and customers," says Garin Gardiner, senior business development manager in manufacturing at Autodesk. "Similar to how we saw the shift to the cloud give us increased collaboration, mixed reality takes this one step further by allowing us to interact directly with the environment in which we're creating – in 3D."

Autodesk has recently started working with Microsoft HoloLens – a mixed reality and holographic system – to create a transformative design environment. The hope is that the new Fusion 360 platform will enable collaboration, rapid iteration, >



HARDWARE

THE TECHNOLOGY THAT TAKES YOU INTO A VIRTUAL WORLD

The components and input devices of VR/AR systems are making virtual worlds not only look convincing, but feel real, too.



Head-mounted display
Headsets produce a 3D view of a virtual world by displaying images of different perspectives to each eye.



Stereophonic speakers
Piping different acoustic perspectives into each ear creates a 3D soundscape.



3D controllers
Wands and hand-held controllers are used to pick up, move and manipulate things in the virtual world.



Gesture control
More complex than other controllers, these gloves and sensors track the position, orientation and movement of the user's hands.



Motion capture
Full and part-body motion-capture suits translate the wearer's movements into the virtual world.



Haptics
Gloves, controllers, clothing and more can be loaded with haptic technology, which mimics the sensation of touch.



Treadmills
Using a treadmill can allow the user to walk in their virtual world. With omni-directional treadmills, it's possible to move in any direction.

< digital prototyping, design reviews and client presentations to be improved during product development.

"It's more intuitive to do this in 3D space," says Gardiner, "and Fusion 360 will give us a hyper-collaborative environment that can be beneficial for any manufacturer or any enterprise that needs to facilitate collaboration between an industrial designer and mechanical engineer in real time – for example, enlarging the casing on a game controller to accommodate a larger battery."

The HoloLens team is also working with Nasa, Dassault Systèmes, Trimble and others to develop industrial uses for holographic computing experiences.

Over at car manufacturer Ford, virtual manufacturing efforts are focused on the early design phase of a vehicle, by performing digital analysis before any physical builds are done. The most recent launches to benefit from the technology include the 2015 Ford Mustang, F-150, Edge and 2016 Explorer.

On average, more than 900 virtual assembly task assessments are made two or three years in advance of each new vehicle launch. By virtually simulating the build process, using both human and virtual test subjects, Ford can assess the physical labour that's needed to build the vehicle, ensure the manufacturing process is feasible, and identify areas which may cause fatigue, strain and injury. The data collected guides engineers towards minimising these stresses.

"The virtual process has been deployed in all regions for vehicle operations manufacturing engineering and powertrain manufacturing engineering. And we've seen a 90 per cent decline in manufacturing-driven issues found during prototype build and launch," says Gene Coffman, technical leader for virtual manufacturing at Ford.

The company uses full-body motion capture with 52 sensors to provide complex data on how one of its so-called 'industrial athletes' would move on the assembly line. Then, by putting on a head-mounted display, that person can immerse themselves in a

virtual world to test processes and movements on life-sized, 3D designs of the vehicle.

"We're continuously looking for additional opportunities for using VR," says Coffman. Our current focus is more around identifying gaps in our current virtual capabilities and developing solutions to fill those gaps."

Jaguar Land Rover uses similar processes to test out manufacturing processes before production begins. The company also has a Multi-Seat Rig – cutting-edge visualisation technology that enables engineers and designers to see and touch new products long before prototypes exist. Sitting inside a physical cabin wearing an Oculus Rift VR headset "bridges the gap between the virtual and physical world" and allows engineers and designers to collaborate from day one.

Virtualis – a long-established British supplier of advanced visualisations – agrees that it has seen clients use virtual technologies to improve communication between departments and personnel with very different backgrounds.



A Jaguar Land Rover employee tests out virtual manufacturing at JLR's annual technology showcase

"Say you're building a submarine," says company spokesperson Sarah Cockburn-Price. "You could have somebody high up in the Navy who doesn't know much about engineering but knows about nuclear submarines, you could have somebody who knows everything to do with manufacturing engineering, you could have somebody that knows everything to do with design engineering, you can have somebody else that really knows about materials and FEA analysis, and you could have an ergonomics expert. Put them all together in a room over CAD drawings and only perhaps the design engineers would be happy. But put them all together in a virtual world and you haven't got the barrier of the specialist language or the specialist skills. And it's all one-to-one scale so everything is the size that you think it's going to be."

Putting the pieces together

Augmented reality is also rapidly making inroads into production lines and day-to-day operations, as it becomes more accessible. The ability to superimpose contextual digital content onto the real world is incredibly valuable as a source of real-time information.

Boeing is embarking on pilot projects that might eventually see augmented reality as an integral part of its aircraft assembly process, for example, by overlaying real components with digital ones.

Elsewhere in the aerospace industry, Lockheed Martin is experimenting with AR 'smart glasses' that act as real-time manuals to instruct engineers how to build and repair F-35 fighter jets.

Similarly, at the end of 2015, Volkswagen's Wolfsburg plant saw the roll-out of Google Glass as a standard piece of equipment. Employees currently use this basic form of augmented reality for order-picking, receiving information such as storage locations and part numbers directly in their field of vision. A barcode reader camera in the glasses then lets the worker know they've selected the right item by superimposing a green or red colour over the item's barcode.



Motion capture in VR tracks how easily car parts can be assembled

The main benefit is that instructions and communication are visual and acoustic, and the employee keeps both hands free.

“The problem with a classic barcode scanner is that you have to hold the scanner in one hand,” explains Leslie Bothge from the Wolfsburg plant. “However, within the picking process you need both hands to pick up one part, so the employee has to put the barcode scanner somewhere. With the smart glass, he’s hands-free and automatically gets the information on where to go.”

Having received positive feedback from staff, Volkswagen is planning to use the smart glasses in other areas of the production process, as well as in sales and marketing.

Virtalis has seen many of its clients starting to expand their use of VR and AR throughout the lifecycle of their products and into other business operations. Many companies that initially buy a virtual solution to solve shortfalls in the design process find that they then use the technology to do ergonomic analysis, FEA stress analysis and to look at manufacturability, decommissioning and even market research and sales.

“They’re taking the kit out to trade shows, with all the same data, and there’s no need to spend more money,” says Cockburn-Price. “Once you’ve invested in the technology for one thing, you might as well leverage that and use it throughout the lifecycle.”

Virtalis has supplied hundreds of its ACTIVEWALL interactive 3D visualisation systems to clients around the world. One is being used by BAE Systems Marine, which has put the power of the technology into the hands of the workers themselves.

Cockburn-Price explains: “When they’re building their submarines, they don’t make people schlep off to the IT suite. Instead, they actually strap a portacabin to the side of the submarine. It’s the most ramshackle thing – just a portacabin stuck to the side of this nuclear submarine! If the welders want a bit of help with knowing what to do next, they just break off from their work, go into the portacabin, have a look at the requisite part,

GAMING

HOW REALISTIC DOES VR NEED TO BE?

VR can be a disconcerting experience. For many, hanging off a cliff face is still vertigo-inducing, even when it looks like a 1990s videogame. So could virtual worlds become too real? Some developers have realised the heightened emotional impact of translating their games into VR. In the PlayStation game ‘Rigs’, for example, it’s quite deliberate that users won’t be killing people or dying themselves.

Scientists and psychologists suggest that developers will need to keep VR cartoonish, so that users stay grounded. Yet unrealistic imagery may not be enough to minimise the psychological impact of VR. Ongoing research at centres such as Stanford University’s Virtual Human Interaction Lab has found that advanced graphics aren’t needed in VR to achieve the sensation of immersion.

“Good tracking and rendering capabilities surpass other factors like graphical quality in terms of feeling immersed in the environment,” explains Jeremy Bailenson, the lab’s founding director. “With convincing tracking systems, people will respond to VR as if it is real, even with rudimentary graphics.”

see how it’s done and then go off and do it. They tell me that so many of the things in a nuclear submarine are symmetrical that they could easily get them the wrong way around and it’s so obvious in 3D in a way it’s just not in 2D CAD.”

Learning the virtual ropes

It’s a natural extension to move from systems like this – which optimise worker safety and ergonomics – to workplace training using VR and AR technologies. Replicating work environments in virtual environments allows companies to train their staff to deal with situations they wouldn’t normally be able to train for safely and cost-effectively, for example, in hazardous environments, or

areas that are difficult to access.

“We do virtual helicopter crew training for the Royal Air Force,” says Cockburn-Price. “All the crew train together, wearing headsets, inside a virtual world within a wooden mock-up of a helicopter. In the real world, it costs £18,000 per half hour to go up in a Chinook but the four of them can train virtually and rehearse and rehearse and rehearse, and they’re using the landscape that they would do on an actual mission.”

Specialised venues are also centralising cutting-edge virtual technologies to make it easier for engineers to gain access to advanced training. At the newly opened National Training Academy for Rail in Northampton, engineers are learning new skills in the UK’s first dedicated immersive training suite. By viewing detailed 3D models through Oculus VR headsets, trainees will be able to familiarise themselves with engineering processes and safety systems before even setting foot on a real train.

The future of mixed reality

Yet challenges to expanding the use of VR and AR remain. Until it’s seen in action, it is impossible to know whether mixed reality frontrunners such as Microsoft HoloLens live up to the hype.

Every industry will be demanding headsets and hardware that are more robust, more reliable and more flexible than what’s currently available. Ever-improving gesture tracking will help users interact more naturally with virtual and augmented imagery. Haptics – if well-integrated into these technologies – will let users feel a greater sense of physical interaction by receiving feedback as they touch and manipulate virtual objects and holograms. In industry, a culture shift is often needed to give employees the mindset to explore and learn these incipient technologies.

The opportunities are endless. “There’s this great saying I’ve heard one of our clients use,” says Cockburn-Price, “that in the virtual world they can see what can’t be seen and they can do what can’t be done.” What could be better than that? *



Workplace VR goes far further than digital-paintball teambuilding excursions. Faster servicing is only the beginning.

By **Chris Edwards**

VR IN THE FUTURE...

OFFICE

DOWNLOAD
and Biip to
EXPLORE

AFTER CONDUCTING research that found service technicians spent almost a third of their time looking up information on a product they maintain and trying to digest the information, vehicle maker Caterpillar began to look at ways to make its manuals easier to understand.

One option was to use video. Jim Wagner, visualisation architect for service publications at Caterpillar, says millennials will often ask, instead of reaching for a printed manual, "don't you just have a YouTube clip I can watch?"

But Caterpillar, in common with a number of other companies, doesn't think the sit-back, absorb-little nature of video quite does the trick. So the company is developing a number of augmented-reality (AR) applications based on tools from CAD specialist PTC that will couple live video with animations that show how to dismantle gear, repair it and put it back together.

"You have a model placed in a context where you can understand it much more easily," says Wagner.

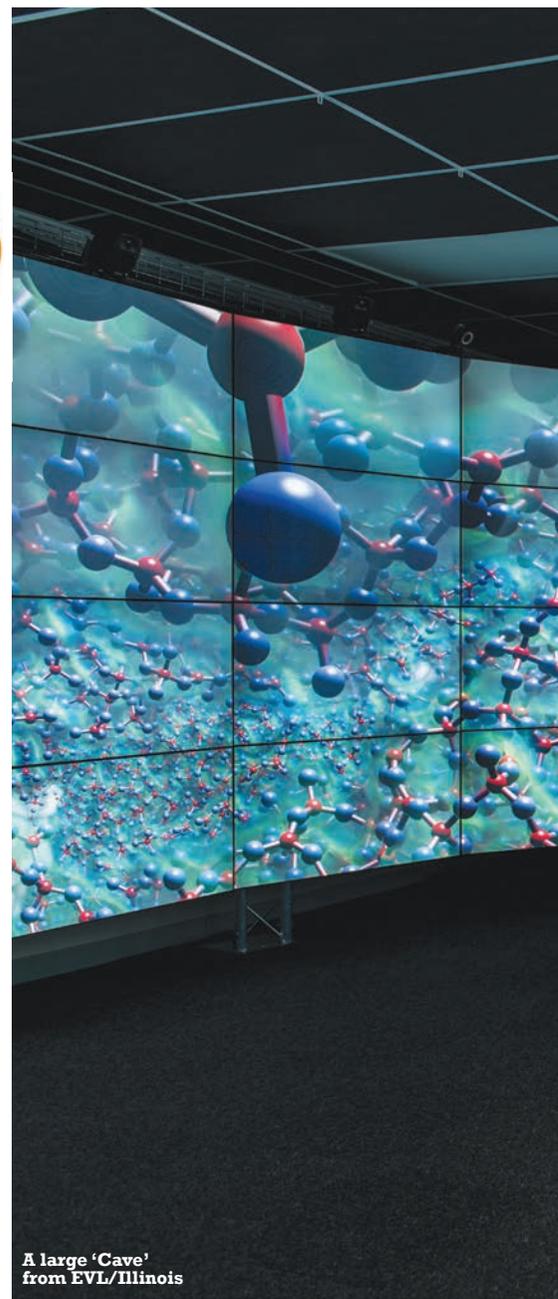
Today's versions of workplace augmented reality (AR) rely on handheld tablets being held over the equipment. Hexagonal icons stuck on the bodywork

An avatar from USC, which could end up replacing our faces



USC Institute for Creative Technologies

PTC Vuforia app used to repair a bike



A large 'Cave' from EVL/Illinois

VR CONFERENCES

A MEETING OF MINDS

When Intel launched a collection of chipsets last year designed to make it easier to hook a laptop up to a projector, the company promised to make meetings more productive, and commissioned Atos to measure the success of the programme by how much more time people spent in meeting rooms. VR and AR may put an end to the corporate meeting room entirely by ushering in the workplace version of the silent night club – where everyone dances to the sound of their own headphones – but with Starbucks as the venue.

In a VR meeting, there will be no need to plug in a projector – the Powerpoint will be part of the immersive environment that includes images of all the co-workers invited to the meeting. By placing images of people in the setting of a meeting room, VR could potentially overcome some of the lingering issues with teleconferencing and videoconferencing that lead to many companies continuing to insist on face-to-face interaction unless that is impossible.

In his Turing lecture more than a decade ago, Fred Brooks, IBM veteran and author of the seminal book on IT productivity 'The Mythical Man Month' said face-to-face contact between the US and UK teams was instrumental in the development of the operating system for the System/360 mainframe even though the project used extensive teleconferencing. He argued: "The most successful tele-collaborations are built in extensive face-time histories."

The ability to appear in a space next to the virtual desk for a quick chat may obviate the need to set up many of the formal

meetings needed today for geographically separated teams.

At the same time, the nature of VR technology presents issues that may lead people to reject its use. No-one will want to conduct a meeting using raw, live video: they will simply be looking at other people who have their faces hidden by VR facehugger helmets. Unless holographic projection becomes a usable reality, virtual meetings will call for the use of avatars that use motion capture to emulate body language and expressions. Can you be sure in that environment you are talking to the right person?

At a talk on future security problems at the Design Automation Conference in San Francisco last year, DARPA advisor and Booz Allen Hamilton associate Saverio Fazzari pointed to the advances made in 3D animation since the launch of virtual newsreader Ananova more than a decade ago.

The character Digital Ira developed as a showcase by graphics processor company nVidia showed how much the technology has moved on. "We are today looking at a pretty good representation of the human face. This is how far we've got in 10 years. Where will we be in 10 years from now?"

Digital impersonation is the ultimate in identity theft and through VR, a hacker would not need the mask-making skills of the Mission Impossible Force's Ethan Hunt. As companies take even the meeting rooms out of their hot-desking offices, employees may be faced with virtual conferences where the only thing they can be sure of is that they are there.



tell the applications which make and model they are dealing with and help orient the software to the live image so they can overlay the animated graphics correctly. As digital eyewear becomes cheaper and robust enough to use in the workplace, the wearables will take over from tablets.

Aircraft maker Airbus sees digital eyewear as being a major part of its 'Factory of the Future' programme. Airbus is faced with the issue that fuselage assembly is manually intensive and involves the use of thousands of fasteners, each of which needs to be tightened correctly. A graphics overlay can help guide the worker to parts of the airframe that need attention and provide live feedback on the amount of torque that needs to be applied for each operation and give the go-ahead for the next fastener in line once each one is finished.

Some applications will call for feedback through the network. An AR application developed by Sysmex for its medical equipment shows the operator how to clean and unblock its fluid delivery systems. As some steps need parts of the unit to be powered down first, the machine reports its status to the AR application using the network so that it only shows the next step

once the machine is in the right state.

Similar applications are likely to move into retail. In a project for a UK supermarket chain, PA Consulting developed a prototype based on Google's Glass eyewear to help supermarkets and other stores check how stock is being presented. Big suppliers often have agreements that control how their goods are displayed in the stores, from pricing through to the location and size of special displays. Today, it involves a lot of paperwork.

The headset works out where to guide the wearer using Bluetooth signals sent by electronic beacons. When they arrive at the shelf, the software shows the worker an image of how the display should look. If it passes, they can tell the software it is okay. If not, they can check whether stock needs to be brought up from the warehouse.

In these applications, user interface design will be crucial. The dividing line between help and being patronised by the computer is pretty narrow. We can only hope that augmented-reality applications do not suffer from 'Clippy' syndrome: "It looks as though you're trying to extract a fuel rod from an overheating reactor, would you like some help with that?"

FINANCIAL VR REAL TRADING BUBBLES



Financial traders are famous for staring at walls of monitors. If trials by Bloomberg are successful, they could have a complete dome full of graphs and tickers. The financial information company has conducted tests on a virtual trading application that renders a sea of monitors on the display of an Oculus Rift headset.

The monitors float in a curved array in front of the trader, who can draw back to see them all or zoom in on just one. Today, they have to use a mouse to move around the space. Bloomberg is looking at ways to use gestures made over a Leap Motion mid-air gesture sensor to swim through the streams of data.

Another company, PTC, is looking at ways to use gestures in computer-aided design (CAD) applications. "If I'm a CAD user I need to perform various mouse and keyboard gymnastics to get different views of a model," says Jay Wright, general manager of PTC's Vuforia business unit. "Wouldn't it be cool if I could see that model at actual size in my studio and walk around it? Wouldn't it be cooler to see inside it and do a virtual flythrough?"

Motion tracking coupled to VR and AR software can help designers break away from the mouse and keyboard. The concept has already been applied in universities and research institutes for uses such as building design and chemistry through room-scale 'cave automatic virtual environments' (Caves). Chemists have used Caves to walk around models of complex proteins to see how small changes in their make-up alter them.

Caves have the advantage of allowing easier collaboration. A number of universities have set theirs up as a combination of videoconferencing chamber and model display. Others have focused on building a more immersive environment. Ten years ago, researchers at the University of Illinois at Chicago built the Varrier, a Cave that uses stereoscopic displays to present the occupant with the illusion of 3D projection.

Even touch could form a part of the VR-based design systems. Bristol-based Ultrahaptics has developed a technology that uses bursts of air from a panel underneath the hands to simulate the feeling of touching different objects.



VR AT...

Watch your favourite artist perform up-close and personal, wherever you are.
By **Jack Loughran**

GIGS



The Jaunt One VR camera for 360-degree image capture



Jaunt's first VR release was Sir Paul McCartney playing at Candlestick Park, San Francisco

A NUMBER of virtual reality apps are promising to revolutionise the way we experience music by placing the user in a virtual setting – on stage with your favourite band or in the rehearsal studio recording a new album – in order to feel closer to the artists, or to experience live shows as if you were in the audience or on stage.

VR platforms like Google Cardboard, which is the most popular at the moment, are more focused on the visual rather than aural experience. However, the eagerly awaited Oculus Rift is due to launch at the end of March and includes a set of headphones that are described as 'entry-level professional'.

"We're working on audio as aggressively as we're working on the vision side. We have a whole team ramped up," Oculus CEO Brendan Iribe said in 2014. "As part of this initiative, we've licensed RealSpace 3D's

audio technology, a high-fidelity VR audio system developed over 10 years."

RealSpace is designed to bring realistic soundscapes to virtual experiences in a 3D environment. Its creators have even released an 'Audio Panoramic Camera', a 20cm sphere containing 64 microphones synced up to five cameras that capture a '3D sound' to go with the visuals.

However, questions arise as to how popular different kinds of experiences will be. There is no doubt that gaming is being touted as one of the biggest features; indeed the Oculus is largely being marketed as a gaming platform. Yet other experiences are still yet to be widely adopted.

Miles Perkins works for Jaunt VR, whose smartphone app is trying to bring VR musical experiences to a wide audience of Google Cardboard users. For music

performances in the future, he says that Jaunt is just scratching the surface of VR potential. "VR augments the experience of a music performance, in that even someone that was in the crowd can now gain an on-stage perspective of the concert," he says.

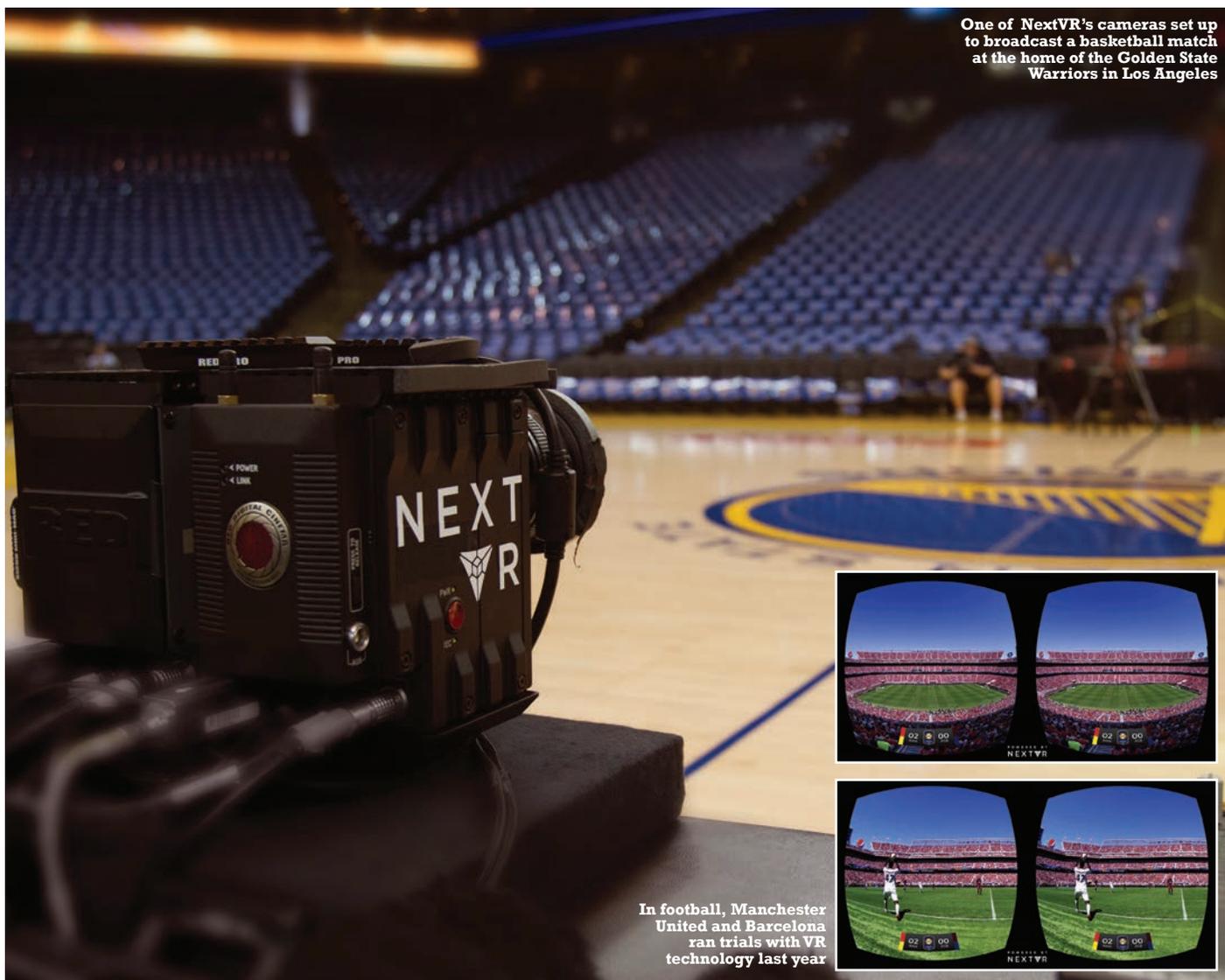
Perkins thinks that VR will never try to replace 'real' live concerts or performances, but "VR gives people a more immersive experience because they allow the musicians to interact with each viewer on an intimate level that is otherwise unavailable."

So how will VR events earn their keep, and will they affect the revenue from the real-life events? Perkins says: "By recording rehearsals, backstage scenes and live performances themselves in VR, artists can then turn around and sell the experience or give out VR headsets at future shows to see the additional immersive content."

VR IN... Broadcasters and big leagues get in on the action.
By **Paul Dempsey**

WEBLINK
To view videos go to
bit.ly/leandt-VRapps

SPORT



One of NextVR's cameras set up to broadcast a basketball match at the home of the Golden State Warriors in Los Angeles

In football, Manchester United and Barcelona ran trials with VR technology last year

RUPERT MURDOCH calls live sport “the battering ram”. He thinks nothing is better at driving new broadcasting platforms.

His US Fox Innovation Lab and his majority-owned Sky television operation in Europe are already researching how competitions such as English Premier League (EPL) football might pummel the public into adopting – and paying a premium for – virtual reality.

Murdoch is not alone. The EPL itself and its most profitable club, Manchester United, are already talking to VR technology providers. Yet it is in the US that most serious trials have taken place so far.

The opening game of this year's NBA basketball championships, Golden State Warriors vs New Orleans Pelicans, was distributed live in VR to owners of NextVR-compatible headsets. NextVR, one of the leading VR production houses, has also run experiments at NASCAR races and golf

tournaments, and at United's pre-season game against Barcelona last summer in Santa Clara.

We are some way from attaching cameras to sportsmen or women (motorsports being the most notable exception). Yet VR can offer “the best seats in the house” – or what the industry itself calls an “infinite seat”.

Ringside seats at a Vegas fight or courtside seats for the LA Lakers support five and six-figure prices in the physical world. The opportunity to place a VR rig in one of those and then sell it virtually thousands, if not millions, of times over has inevitably piqued promoters' interest.

Closer to home, a VR subscription to your football team might allow you to toggle between different angles according to where the action is: the half-way line, behind either goal, and so on.

Meanwhile, VR sport is comparatively cheap to produce. What happens on the

pitch does not change; you chiefly install a new set of camera rigs as appropriate. Gaming requires the construction of complex virtual worlds based on new development platforms; VR drama needs new ways of shooting and editing.

The main challenge is distribution. For live sports, “Buffering...” is a red card.

Existing broadband networks reportedly struggle when streaming flat 4k video at a 15.6Mbit/s data rate (based on trials run by Netflix). That is for a pixel count of 4096×2048px.

The minimum pixel count for live 4k VR is 12,288×6,144px – a nine-fold increase. Moreover, that's for any form of content: sport involves a lot of movement and therefore the highest data-rates.

That is a big obstacle. However, with potentially billions in subscription sales on the other side, Murdoch and his fellow players are likely to breach it soon enough.



'Immersive journalism' achieves the objective of putting viewers on the scene of world events.

By **Dominic Lenton**

VR IN THE... NEWS

DOWNLOAD
and Blip to
EXPLORE



Pro-democracy protests in 2014 were filmed by a single photographer for immersiv.ly's 360° video 'Hong Kong Unrest'



Emblematic's 'Project Syria' transports viewers from a busy street to a virtual refugee camp

YOU'RE STANDING on a busy street corner in the Aleppo district of Syria. People are going about their business and somewhere a young girl is singing when without warning a rocket strike hits, sending dust and debris flying everywhere. The scene dissolves and you find yourself in a refugee camp where thousands of people affected by the conflict are trying to get on with their lives.

Luckily, returning to the safety of your real life is as simple as removing the virtual reality headset through which you've been experiencing the sights and sounds of war and its aftermath. Unlike watching similar scenes on television however, the emotions you're feeling are likely to be more intense and stay with you much longer.

This is immersive journalism, a technique using virtual reality to put the public in the middle of the scene as news unfolds that – if it catches on – could transform the way we witness events around the world.

The 'Project Syria' piece was commissioned by the World Economic Forum for its meeting in Davos in January 2014, with the aim of encouraging world leaders to do more about the vast numbers of people who have been displaced in the country. Instead of just listening to reports though, delegates donned headsets to get a real sense of what's happening based on audio, video and photographs taken at scene.

It was written and directed by Nonny de la Peña, an award-winning documentary filmmaker with 20 years' journalism experience writing for titles like *Newsweek*

and the *New York Times* who has been dubbed the 'godmother of virtual reality'. Currently a graduate fellow at the University of Southern California's Interactive Media Arts department, and creator of the website immersivjournalism.com, she is co-founder of the company Emblematic which has built several pioneering news-based VR constructs.

De la Peña's first foray into this type of reporting was 2012's 'Hunger', the true story of a diabetic's collapse due to starvation while waiting in line at a food bank in Los Angeles. Palmer Luckey, one of the creators of the Oculus Rift headset, was an intern working on the project.

In a talk at the TEDWomen 2015 event in Monterey, California, de la Peña told the audience how she went about turning the incident into a VR experience.

"I knew I couldn't make people feel hungry, but maybe I could figure out a way to get them to feel something physical. We didn't have very much funding, so I had to reproduce it with virtual humans that were donated, and people begged and borrowed favours to help me create the models and make things as accurate as we could. And then we tried to convey what happened that day with as much as accuracy as is possible."

The reaction to 'Hunger' at the 2012 Sundance film festival proved how effective this could be. Even though the headsets used were roughly built prototypes, audiences were left in tears, with some actually crouching to try and help the seizure victim or talk reassuringly to them.

It was after watching 'Hunger' that the head of the World Economic Forum commissioned the piece which was to become Project Syria. De la Peña sent a crew to the region to gather material and the results were just as effective, invoking a level of emotional engagement in viewers that stirs up feelings of empathy not witnessed with other ways of reporting events.

"My whole life as a journalist, I've really been compelled to try to make stories that can make a difference and maybe inspire people to care," says de la Peña. "But it really wasn't until I got involved with virtual reality that I started seeing these really intense, authentic reactions from people that really blew my mind."

The 360° solution

Building a virtual construct of a scene that a user can move around in and interact with, similar to the way VR gaming works, is effective, but it's expensive and requires a lot of planning. In contrast, 360° video based on actual footage from a number of small, cheap cameras like those made by GoPro is a quick way of putting the viewer in the middle of a scene. They can look around by moving their head, but their movement is restricted to where the person who took the film went.

One example of how this works is the film of Hong Kong pro-democracy protests made by UK-based firm Immersiv.ly. Founder and CEO Louis Jebb, previously a journalist with the *Spectator* and the *Independent*, believes this type of reporting can recapture the

Even relatively basic 3D animations have been claimed to provoke an emotional and sometimes physical reaction in viewers



interest of a public who have lost faith in mainstream news they find depressing and alienating.

“Traditional news sources have for generations been supplying content with an aim to ‘beating’ their rivals or winning awards, rather than with a concern for the effect that their content has on its audience,” he writes in a blog on the Immersively website. “Over time this ‘professionalisation’ has created an emotional disconnect between newsmaker and news consumer.”

The company started life in 2014 as a WordPress test site where users could record the effect consuming a story had on them, as well as discussing it with the site’s editor via Skype. What Jebb describes as “the ‘ah-ha’ moment” came when Facebook bought Oculus Rift in March 2014.

“If we wanted people to care about news, what could be more compelling than putting them at the heart of the action?” he says.

The company’s first proof-of-concept piece was the seven-minute documentary ‘Hong Kong Unrest’, filmed and edited by one-man crew Edward Miller, a pioneer in 360° video who later became the company’s head of visuals. It was demonstrated on Oculus Rift in December 2014 and released first on an immersivly microsite, then on YouTube when that platform started supporting 360° video in March 2015. It’s now available for Oculus Rift using the immersivly app.

As with any technology that threatens to disrupt the established media, some in the industry are raising concerns about this

sort of immersive reporting. Whether it’s a full-blown virtual environment or a 360° film, one of the main benefits claimed by evangelists is that it brings viewers closer to the truth by placing them in the story and letting them interpret the evidence themselves. Potentially, users could even run through the same events from different perspectives to see how witness reports complement or contradict each other.

That creates problems for reporters and editors though. TV news often comes with a warning that “The following report contains scenes that some viewers may find upsetting,” but with VR, there’s no ability to frame a shot to exclude, say, dead bodies. They could be blurred, or omitted from a scene but that would lead to the editor exercising some form of censorship, immediately eliminating the idea that viewers are seeing the unvarnished truth and raising doubts about reliability.

Authenticity

The solution, Nonny de la Peña says, is to ensure that the same best practice that would be followed in any other area of journalism is exercised when using VR. If the producers of an immersive experience didn’t capture the source material themselves, they have to be exacting about identifying its provenance and authenticity.

‘One Dark Night’, an Emblematic production telling the story of how teenager Trayvon Martin was shot and killed by neighbourhood watch volunteer

George Zimmerman, was based on real recordings of calls to emergency services, witness trial testimony and architectural drawings of the area where events took place. In this instance, the process added to the story, as forensic specialists who reconstructed audio recordings made on the night claimed that Zimmerman had cocked his gun at a crucial moment.

According to de la Peña, this illustrates how the basic tenets of journalism don’t change. “We’re still following the same principles that we would always. What is different is the sense of being on scene, whether you’re watching a guy collapse from hunger or feeling like you’re in the middle of a bomb scene.”

Another concern is that this way of consuming news can be so emotionally exhausting, and the nature of news means that subjects are invariably challenging. Emblematic has a construct that allow users to experience life in the Guantanamo Bay detention camp, while another, ‘Use of Force’, shows what happened when 35-year-old Anastasio Hernandez Rojas was beaten and tasered to death by a patrol on the US-Mexican border.

Animations may be crude compared to what the latest generation of games consoles are capable of, but viewers frequently describe having a physical reaction to what they’re seeing. It’s clearly a powerful technique, but do audiences really want to experience that depth of involvement in traumatic events on a regular basis?