

Appendix Case Studies

Creative tools and workflows for immersive content creation: A report produced by Opposable Group and TechSpark for Digital Catapult, June 2018



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This report forms part of that work along with the following complimentary reports:

- [The Immersive Economy in the UK](#)
(Innovate UK, Immerse UK & Nesta)
- [Growing Your VR/AR Business in the UK: A business and legal handbook](#)
(Digital Catapult and PwC)
- [Immersive Content Formats for Future Audiences](#)
(Digital Catapult and Limina Immersive)
- [Evaluating Immersive User Experience and Audience Impact](#)
(Digital Catapult, Nesta and i2Media Research)
- [Immersive in manufacturing – the adoption and use of immersive technologies in manufacturing and a report covering the feasibility of the use of immersion in a digital twin](#)
(High Value Manufacturing Catapult).

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INTRODUCTION

This document forms the appendices to one of these reports on creative tools and workflows for immersive content creation, conducted by Opposable Group and TechSpark.

The report looks at the key questions around content creation: How is content authored? What tools, techniques, skills, people, equipment will they need? What is best practice? What are the impacts of one workflow over another?

The report asks ten of the top UK immersive content makers drawn from across industry sectors to explain how they make their content, where they draw their influences, and any tips or tricks they have learnt. These appendices provide the information on the research and interviews constructed. The report itself puts together a snapshot of workflows, and examples of how content is being made right now across the creative industries, and provides original research into where the challenges and opportunities lie.

By sharing the insights from these reports, Digital Catapult hopes to consolidate key industry insights and help lower the barrier to entry to this exciting and rapidly growing market. The diversity of entrepreneurs, technologists, educators, developers and content makers working in this space is one of its greatest strengths, which is why we believe the UK will become the best place in the world to create immersive content and applications.

A1. AARDMAN ANIMATIONS

Dan Efergan, Group Creative Director of Digital,
Aardman Animations

Project: We Wait

[View Project](#)

A joint production with BBC Research and Development, We Wait is an immersive story for the Oculus Rift, about a Syrian family making the perilous journey from Turkey to Greece on a smugglers' boats. Launched in 2016 it took six months to produce.

"Interactive storytelling is still flawed, we're still not very good at it," says Dan Efergan, Creative Director of Digital at Bristol-based Aardman Animations. *"We have a linear storytelling industry which is 150 years old and they're really good at creating emotion, regardless of how bad a film is, so I was frustrated with VR when it first came out because we still had so much more to learn with storytelling on previous interactive platforms. We have not worked hard enough to get better at it."*

With the We Wait project, Efergan feels they had that chance to try something different. *"The BBC wanted to explore the future of immersive storytelling and so did we,"* says Efergan who worked as a director on We Wait. The challenge Aardman set themselves was how to make something that used the medium fully to help create emotion within the storytelling. Efergan says it came down to the simple human interaction of eye contact.

"It was the first idea we had for We Wait. One of the things that does change in the VR world is that we know where you are looking and eye contact is quite a deep and fundamental human and animalistic connection. So, we asked ourselves what we could do with a story using eye contact as part of its structure to create something more emotionally engaging?"

Given that the migrant crisis was at a high point in the news at the time, Efergan says there was a lot of interest in looking at it more deeply, to tell some individual stories and the idea for We Wait was born.

THE WORKFLOW

The first step was to create concept art. Efergan says this is something that Aardman does first in all its projects. *"You want to get into the mood of the moments within it, whether it's a filmic story or a VR story,"* he says. *"You need visuals to try and communicate the idea."*

There were then two main strands to the workflow. One was designing the narrative and one designing the technology, although the latter splits into developing the experience and UI and the other developing the actual characters and scenes. *"We bought rigs from asset stores like Mixamo and started building experiments in Unity; eye contact being one of the things we were*

looking at closely. When do people look at you and how do they look at you? What happens to the rig when you bend round? We started looking at how to blend the technical needs and user experience needs.”

The team made what Efergan refers to as “an accidental paranoia creator” during these experiments, where in a headset, someone would be staring at you only to look away when you look at them.

“It got people really paranoid quickly,” he says. “The more active you are, the more likely people are going to notice what you are doing, so we ended up with this pattern we built where if you moved above a certain speed or looked directly at a character, then that character would establish contact in some way. We did lots of testing on this and it became one of the interaction tools we built into the story.”

With the interaction concept agreed upon, the team set to work on the set. Efergan talks about the importance of architecture and he actually built his own scene using Lego, complete with crude plasticine characters. He moved a mobile phone around the scene to try and get an idea of what could actually be seen from different angles, understanding where people should be placed. It’s something they’ve done before building a scene out of cardboard when they realised they couldn’t storyboard it sufficiently. For *We Wait*, the team used a bit of motion tracking from a company called Perception Neuron, which uses sensors feeding directly into a computer rather than using cameras.

Efergan likens it to building a theatre set; *“It’s theatrical. Initially we talked about it being cinematic but we realised we were wrong. You are ultimately in a play. You can’t cut or zoom, you can’t move people easily. Characters are at different distances and need to be seen and heard. We*

faced the same problems theatre directors have when trying to get emotion and narrative across to an audience.”

Processing power and memory also became an issue. Efergan says that a plan to blur scenes, to take the experience smoothly from one scene to another was unworkable given the technical limitations so they had to unload one scene and load another one and try and cover it up.

“That tech restriction forced us to think of clever ways where it would feel like the scenes blurred together,” he says. “We could cover over the joins of the loading time between one scene and the next and went back to one of the outcomes of our earlier tech experiments. We use the guy with the torch who shines it into the viewer’s eyes, to shrink the pupils or force them to close and then we load the scene. When the eyes are readjusting we can slip the scene in quickly - and they’re back where they started.”

Running along in tangent to the technology development was the narrative development, building the story of a family in a boat heading to Greece. Speaking to BBC correspondents, someone from the United Nations, as well as two families, the writer pulled together a collection of facts and stories.

“It all needed coordinating, somewhere between a flow diagram and a script,” says Efergan. “We use certain tools for that - we’ve tried using Twine, an online nonlinear interactive storytelling tool and also Adventure Creator but in the end we just poured all the words we had into a giant flow diagram and worked out how they all joined up with each other.”

UNITY OR UNREAL?

Aardman is increasingly agnostic when it comes to real time engines. It sees value in both but for *We Wait* it used Unity.

"Our animators have a more natural workflow from what they are used to doing already," says Efergan. "With broadcast technologies, using Maya as an animation tool and the kind of way Aardman animates actually flows easier into Unreal than it does into Unity. That's why we're trying to get into Unreal but on the flipside, to get into the centre of it you need C++ coders. We're not a hard-core gaming company so most of our coders are scripters and use C#. Our animation teams find it easier to go into Unreal but our coders find it easier to be in Unity."

Efergan adds that what they've found with real time engines in Aardman is that they are establishing not necessarily a VR workflow but a real time engine workflow.

"The need for the company to be able to tell stories in a way that can run on a real time engine is actually the kind of crossover we have to deal with - sometimes we are interviewing a virtual person so we need something where actors in the background can puppeteer a virtual character - it has a very similar production process at the end to VR."

"We've changed our VR production process every time we've made something because it's always different. Every project has a certain uniqueness to it. There's no cookie cutter creative process to construct stuff."

THE TEAM

Efergan's claim that Aardman is trying to keep the team small is as much about budget as it is about keeping the workflow tight. With one CG artist, one developer, a couple of directors (narrative and interactive), one producer and one part-time sound person, the team naturally has to cut its cloth and is now testing tools and techniques to improve the production process and workflow.

"We've now started using tools like Tiltbrush to sketch out spaces quickly because then the world you are designing in is the same as the one you are experiencing it in, which helps the process," says Efergan. "We're also testing AnimVR, a draw animation system in 3D so the artist can flick from frame to frame easily."

SO, ANY LESSONS LEARNED OR ADVICE?

"Yes, don't believe any rules are set yet. The idea of us having established rules at this early stage is totally incorrect. It's important to approach VR productions with space to experiment and research alongside what you are actually developing. It feels like it's all up for grabs."



A2. AIRBUS

John Arundell, Digital Transformation Leader, ESW Digital Wing, Airbus UK

Airbus is the largest aeronautics and space company in Europe. It operates in 180 locations around the world and has 12,000 direct suppliers globally. It develops applications in VR, AR and MR internally through its Holographic Academies and advanced manufacturing facilities.

"We have already measured a reduction of 20% of non-conformity costs in 2017 compared to 2016 in Light Helicopters. Combined with our other initiatives, we are expecting to see a productivity increase of at least 5%." This statement from the Airbus Holographic Academy says everything you need to know about why the company is so intent on pursuing mixed reality technology across its business. Given the scale of its manufacturing projects, the benefits from MR have already gone into the millions of pounds.

This kind of return on investment is why Airbus is no stranger to trialling leading edge technologies. According to Airbus digital transformation leader John Arundell, the company has consistently explored new methods of improving productivity and reducing error rates, or non-conformity costs as Airbus puts it. *"We are not new to visualisations or wearable technology,"* he says.

For Airbus though the big revolution came with the arrival of the Microsoft HoloLens in 2016.

"Allowing hardware to be situationally aware of its surroundings is huge," says Arundell. *"It means when we introduce things into our manufacturing facilities, those bits of hardware know what they are looking at and all the holographic objects interact with that world as if it was physical. It opens a new realm for us."*

Two years ago, the company decided to set-up the Holographic Academy within Airbus. Its job is to introduce new technology to the business.

"Our biggest project so far is one developed with Microsoft," says Arundell. *"We gave the shop floor operators, the ability to put on the HoloLens and start augmenting their world with warning messages, texts, videos, holograms and even step by step instructions. This has been paper-based for a long while."*

Arundell adds that one of the key elements of the Holographic Academies is that they also enable collaboration. Airbus, currently works with around 20 other companies on development projects, including Unity, Microsoft and Deutsche Telekom, and runs regular hackathons.

WORKFLOW AND TOOLS

With a wide and varied number of projects on the go, Airbus unsurprisingly has a mix of tools and techniques at its disposal. The company has a lot of communication and work tools already integrated into its internal systems.

“In the Academy we use a lot of CAD data and we have to get it into the Unity gaming engine,” says Arundell. *“We use PiXYZ for this. It’s a French start-up that specialises in this and we also have a suite of other tools including Visual Studio and Blender for asset design.”*

“Airbus standardised on the Unity engine, according” to Arundell, *“because the company has strong links already but also because Unreal has not yet chosen to support HoloLens”,* he says.

In terms of workflow, Arundell says that initial ideas normally come from a mix of talking to customers about problems but also talking to various shop floor operators about everyday problems and areas where assembly could be improved by having more immediate access to information.

“We have an advanced manufacturing facility that does a lot of proof of concepts,” says Arundell. *“We will come up with an idea, try to work out the biggest issues and use the advanced facility to replicate the process and test the software. You design software next to the issue you are trying to solve.”*

Of course, it’s not without its challenges. One of Airbus’ highest value products is the A320 but it’s also the technology that has the least digitally enabled data. It has mostly paper-based processes and what is digital tends to reside in siloed databases, mainly because the aircraft design dates back to the 1970s.

“It’s a bottleneck,” says Arundell. *“There are some databases and smart tools but none of them talk to each other so transferring paper data into digital data takes a while and then linking that data with HoloLens is a further challenge.”*

NEW SKILLS

The next step would be to bring the right people in. *“Whenever we do software development we get a user experience person, a software developer and a customer and they get together and develop the software but the difference now, with AR, VR and MR is that it requires some different skills. Some are game designers, some are artists, 3D asset artists and 2D artists.”*

Culturally and technically this has been a big shift for Airbus introducing new kinds of people, with new skills and capabilities to its teams. Development teams tend to be full time although Arundell admits it’s not been easy to fill the roles.

“We definitely struggle,” he says. *“Within Airbus skills that are easy to find are C# developers, C++ developers and engineers, essentially how we’ve worked for a long time. Now we need people who know Unity, which tends to be more game designing and developer people, as well as artists, which we are not used to having.”*

For Arundell one of the biggest lessons Airbus has learned from its pursuit of VR and MR is that the time to industrialise is very short.

“There is a danger that because tech is moving so quickly, by the time we get something to market something else has come along. We saw this with our 3D caves. In Filton we had a 3D cave that cost hundreds of thousands of pounds. By the time it started to be industrialised, the Rift and Vive came out and they were a fraction of the cost, mobile and do almost the same thing.”

A3. BBC

Paul Deane, Digital Development Lead,
Natural History Unit, BBC

Project: Planet Earth II

[View Project](#)

A series of six 360° films commissioned by the BBC, the Planet II VR experience was launched in 2016 to accompany the Planet Earth II TV series.

According to Paul Deane, development producer for the Planet Earth II series of VR/360° films, the series was in many respects an experiment. The BBC he says was keen to explore the medium and this gave him an open remit to try out some ideas and test the technology.

By this Deane is referring to filming techniques, in terms of on location filming but also in post-production. The brief was to do a 360° film for each episode of Planet Earth II covering the different environments, such as deserts, snow and mountains. One was meant to be through the eyes of an animal, two are more behind the scenes views, one is entirely composite and atmospheric and one is much more static, with animals all around.

THE WORKFLOW

"We did what we'd normally do for a traditional TV show," says Deane. "We look at the locations we have potentially available to us, the potential to work with existing shoots, which logistically makes it much easier because we can get access to new locations, particularly ones which are hard to get permits for, such as the Galapagos Islands. We then sit down and work out what's the story we can do for each. It's entirely story driven and we explore whether or not particular stories will work in 360."

While Deane says the creative process was no different to how they would start thinking about making any natural history show, there were some new technical challenges to confront.

"It was different for every film. For each shoot we would have worked out what we want to shoot on and how we want to shoot it. We filmed on GoPros, which is standard fare." Deane says it's relatively easy to use a 360 camera. "We choreographed what we wanted filming and storyboarded it. Basically, you plonk a bunch of GoPros in the sand and press record."

The film is transferred from SD cards and then onto hard drives. Media management can be difficult so someone on the shoot has to be in overall charge of the media. Each camera captured 20-30 sequences which then had to be married up back in the post-production studio in Bristol, where the team used NAS servers to manage data from the portable drives but also for archiving. The workload and flow varied across the different shoots.

"The grasslands, the one with the lions, was a bit more conceptual," says Deane. *"It was almost entirely composited shots so again we would storyboard it and then some stuff was shot on a different camera rig because the GoPros weren't good in the dark, which is when the lions are more active, so we shot with three Sony A7S which are much better. We filmed 240° scenes. These gave us the overlap, which we could then stitch. We composited the rest in post-production."*

TOOLS AND TECHNIQUES

"There's no magic bullet," says Deane. *"We are dealing with the restrictions of what cameras and lenses can do but things are getting better."* He adds that with Adobe Premiere supporting 360 previews, production was made easier as content previews could be carried out as they went along using a headset, whereas previously, they were often working blind. To stitch the various films from the GoPro cameras together, the team used AutoPano from Kolor and then edited in Adobe Premiere and colour graded in DaVinci.

THE TEAM

"There wasn't a full time single production team because there were six films," says Deane, however for the most part there were some clearly defined roles.

"We had someone working on stitching the films together and another person working on colour grading, compositing and graphics. We used a sound team and there was a production manager and a production coordinator."

Adding sound was a crucial element, adds Deane. Audio is added right at the end. Four of films have a spatial sound mix, so as you turn your head you hear the sound change direction.

SO, DID THE TEAM HAVE ENOUGH TOOLS AND POWER?

"We always want more processing power," says Deane. *"The final composite render was taking days to do because they're big files with a lot of composite render or graphics put on top, so that's the same problem everyone has but more power would of course have helped."*

A4. BDH IMMERSIVE

John Durrant, Creative Director, BDH Immersive

Project: Wonderful You VR

[View Project](#)

Launched in Nov 2017, Wonderful You is a 20 minute experience about the womb and how a foetus' senses develop. You are taken on an inside journey to learn about hearing, sight, touch, taste and smell.

Developing for multiple headsets has its challenges. When Oculus commissioned Bristol-based VFX and immersive content firm BDH to create a virtual womb and foetus experience, the idea was that it would be for the Rift but also for the Samsung Gear. While on the surface this was completely feasible, the reality was that it presented some technical challenges.

"We were doing R&D as we went along, you have to be flexible," says John Durrant, creative director at BDH. *"Some of the processes were getting too heavy because the Rift is a PC-based delivery system so processors are quick and powerful to give you sophisticated effects but then we had to produce the same effects on the Gear as well, for a mobile phone, which has considerably less processing power."*

Durrant says the biggest problem was recreating the fluids of the womb.

"The effects we created in Unity were too heavy to be able to transfer to the Gear version, so we had to create Gif loops in After Effects and Photoshop but using key channels we keyed over those liquids in layers into the scene rather than it being generative particles."

This did the trick. Durrant was pleased with the results but says it's indicative of how you have to approach development, especially for new formats such as VR.

THE WORKFLOW

In terms of the development workflow, Durrant says the company approached it as they would any other VFX project they have done for TV or film.

It starts with paper, getting ideas down and writing a four-minute script and storyboard around each sense environment. There is says Durrant a discussion around how the stories are built, fine tuning ideas to fit within the budget. There is a user interface discussion, looking at how people will interact with the experience, mapping out the user journey and sound storyboarding too.

“We wireframe in Unity,” says Durrant, “then start generating 3D objects using Adobe After Effects for animation and design and Autodesk’s Maya for creating the high-end models, skinning those models in Photoshop”.

“It’s also a combination of generating worlds, 360 imageries, which are flat, with 3D objects in the foreground. You have to plan out how the intersection of all those different techniques will work - looking at the script and emphasising where you need the different techniques.”

As models come off the production line they are dropped into the scene to ensure they look and feel right within Unity, the director continuously re-visiting the scene through a headset. While some of the models were brought in from the Unity asset store, the artists constantly added to them making them more realistic and that, says Durrant, is one of the fundamental challenges, generating something that is realistic in a 360 headset.

Durrant was the director on Wonderful You, in and out of headset all of the time, checking all the different elements being built. *“It’s important for workflow for everyone to join and see what the director wants and see how their work is being used in context, just like film production,”* says Durrant. *“It’s really valuable to get the opinion of artists to see what will work.”*

THE TEAM

BDH spent nine months on Wonderful You with a team of 12 people.

The team consisted of a writer / director, producer, narrator, designer, 3D artist, texture artist, art director (directing each individual scene to generate right atmospheres), VFX artist (to generate effects around liquids, light etc), UI developer (interface and interactivity), musician/composer, sound designer, sound recordist, script consultant, scientific advisor (ensuring womb/foetus senses science was right) and an executive producer.

All working out of the same office space, Durrant says the team benefited from close proximity, constant communication and testing were key to problem solving and ensuring the project stays on schedule. He says the VR experience is *“a short film medium so skills are very transferable,”* combining gaming skills and CGI, for example. Clearly it has worked well. Wonderful You had already been downloaded 15,000 times by the end of November. Now there is talk of Wonderful You 2, and apart from maybe using motion capture, Durrant says the approach would be the same.

A5. MAKE REAL

Sam Watts, Director of Immersive Technologies,
Make Real

Project: Top of the Crop VR game

[View Project](#)

'Top of the Crop' is a two-player 'Hero VR' realistic potato harvesting game on the Oculus Rift, with participants competing against each other to harvest the most quality potatoes. **"The biggest enemy for any agency commissioned by a client to produce VR work is budget, time and expectations,"** says Sam Watts, at Brighton-based agency Make Real.

"We were approached by McDonald's corporate communications agency Blue Rubicon, so we sat down with them and went over our four D approach - discovery, design, development and deployment."

"Whenever anyone comes to us, if they say they want X or Y in AR/VR, we will push back and ask, what is your objective and use case? What do you want to achieve?"

The agency was looking for a mix of media in the experience, including 360 videos, full VR and touch screens. All had specific intended audiences and objectives, says Watts but they needed workable and engaging ideas to create a sticky experience.

"In the discovery phase we used something like Google Design Sprint, where can throw a whole load of ideas up and through crowd voting, select and focus on the good ideas," says Watts. **"That means we are not wasting any time going back and forth. We focus on the popular ideas."**

The campaign looked to champion British and Irish farming and inspire young people into thinking about opportunities and the different skills required. It also wanted to educate people about McDonald's sourcing credentials in the UK. The team came-up with the idea of creating a potato picking game using a VR simulation – **"it's more exciting and more difficult than it sounds,"** says Watts.

THE WORKFLOW

"Part of the discovery is understanding how we are going to approach the objective," says Watts, adding that the team became subject matter experts first, visiting farms, driving tractors and using potato pickers. This was important, to give the team an idea of noise, sensations, viewpoints,, so they could then go back and model with some idea of the reality involved.

"Initial designs were drawn out on paper, factoring comfort into the design to take into consideration the potential for motion sickness. Getting the balance between realism and comfort was a challenge", says Watts. "Building the scene, less so", he adds.

"Creating a VR experience is simple in that you have a 3D scene - we use Unity - and once you have that scene you can drop VR camera assets into it and it will work immediately in VR. The skill and craft aspects come from designing the interactions and the overall design mechanics, so that's it's comfortable but also engaging."

So how does the team get to grips with the motion and mechanics of the game to ensure there is an element of realism in the simulation?

"We Gray Box a lot of stuff. We have very simple primitives," says Watts. "We'll get the actual sensation and mechanics feeling right without actually doing the final modelling assets, so we'll be driving around rough blocky, polygonal shapes across a field, which we can make and look and feel bumpy - and then fine tune how bumpy to maintain comfort levels."

Watts says the gamified element comes through one of the team's triple A games background, in designing mechanics and economies and levels. Creating elements of skill and mastery - in this case driving straight, aligning the elevator arm of the potato arm of the harvester accurately within the trailer and keeping an even spread of potatoes - comes from the team's simulations experience.

The team used Unity all the way through the project, from prototyping through to final production. Constant testing was necessary as well as constant client approval, which could be achieved through viewing directly in a headset and pressing play in the editor.

In terms of models and assets, the artist created nearly everything from scratch. *"We only use asset store content when prototyping either to show a client or to raise funding," says Watts. "We do our own or heavily adapt existing assets to our own needs. Asset stores a very good, whether it's the Unity store or TurboSquid. Also you can model in VR in Quill and Google Blocks or Tiltbrush."*

THE TEAM

It was a small team that consisted of a designer, a 3D artist, a developer and Watts overseeing production, deployment and training. The core team, he says has worked together since 2013, so they work closely and understand roles.

PRACTICAL ADVICE FOR ANYONE WANTING TO GET INTO VR?

"If from a web background it's worth looking at React VR HTML 5 a frame tutorial and guides about how to make more open and scalable VR," says Watts. "There are some really good tools such as Play Canvas and Amazon Sumerian to help get people started in VR."

"Being aware of the capabilities and limitations of each system is important. In Unity everything is turned off so you can turn on features gradually whereas with Unreal, everything is turned on by default and you need to scale back to get things stable. If designing for Gear VR, you've got control over the GPU and CPU to balance heat and battery life and loads, whereas if designing for Google DayDream everything is set to the max and the thing will overheat, switch off or run out of battery within five minutes. These are good things to know."

A6. REWIND

Greg Furber, VR Director, REWIND

Project: Ghost in the Shell

[View Project](#)

Launched in March 2017, Ghost in the Shell is a VR experience launched on Oculus Rift, GearVR and Facebook 360 to help promote the movie of the same name.

"We had just seven weeks to complete it," says Greg Furber, VR director at St Albans-based digital creative studio REWIND. The team was approached by US production company Here Be Dragons to help create a worthy piece of VR to promote Ghost in the Shell, a new movie starring Scarlett Johansson, based on a iconic anime story.

Having to generate a VR experience in such a short space of time was a challenge and so getting the project planning right and ensuring the right tools and skills were immediately at their disposal was crucial.

"It was originally intended just for GearVR but we pushed it to Rift as well because we wanted to do something that had a AAA benchmark for the visuals," says Furber.

"We started when the script came in and we had to be honest about what was achievable within the time frame and work out what we could create that would have the biggest impact within the available time," says Furber.

THE WORKFLOW

The first thing was to decide on the real-time engine as REWIND works in both Unity and Unreal Engine, depending on the project.

"This was an Unreal project, for the visual quality," says Furber. *"Unreal can achieve some amazing visual things but it's very hard to get Unity to that place. Unreal is designed for cinematic gameplay and when you're running it on a PC where you've got the grunt behind it, then it's possible to do some stuff that looks fantastic in the engine relatively painlessly."*

The aim of the experience was to take viewers into the world and psyche of Johansson's character, The Major. *"We had a content path,"* says Furber. *"There were a few key scenes from the film that it tied in with, such as Scarlett Johansson's character diving off a building and breaking into the tea room and we had to work out how this would play out as a VR experience."*

The team started off with a grey box, an outline of what the experience was going to be and throughout the process ran different parts of it at the same time, dropping assets in as they became ready. There were a mix of assets at their disposal, from adapted assets, assets created internally at REWIND (using a mix of 3DS Max and Maya for modelling) and some motion capture done specifically for the project.

So is it easy to establish a VR workflow now, especially given such a tight schedule?

“There are shared benchmarks and techniques for every production but there are also new challenges for every project,” replies Furber. *“It’s about understanding what the end product needs to be and what is essential to make it happen and that can be a mechanic, a narrative device, whatever is at the very heart of the project.”*

Despite claiming that REWIND never approaches any two projects in the same way, Furber accepts that *“there are some core fundamentals across all projects”* and the skill is *“knowing when to borrow from previous workflows and when you need to come up with something new.”*

SKILLS

In terms of personnel, Furber says the project *“took up the majority of studio,”* but that it also had to call in some specialist help from outside.

“We used our in-house team where possible but brought in a specialist in motion capture to get the performance right within the time frame. That was our biggest challenge.”

Furber talks about core skillsets and needing to keep hold of key people as they are hard to find.

“Anyone that does real-time VR, they are hard to come by and we desperately want to keep them in-house for as long as possible and help shape and progress careers, whereas the more traditional skills sets - concept art or motion capture clean-up - are easier to bring in.”

A7. SONY STUDIOS

Stuart Whyte, Director of VR product development,
SIE London Studio and Will Burdon,
Technical Director, SIE London Studio

Project: VR Worlds

[View Project](#)

When Sony Interactive Entertainment launched PlayStation VR (PS VR) in October 2016, it was something of a milestone for virtual reality gaming, with one of the most popular launch titles proving to be VR Worlds, conceived and developed by SIE London Studio. A collection of five different experiences, the overall objective for the game was to introduce players to what PS VR makes possible.

“The biggest challenge for us was the unknown. VR is such a new and exciting technology, we’re learning every day what works in that space and what doesn’t. At the start of our journey, we split the team into pairs and tasked everyone to explore different ideas in a speculative way. We used the team’s various insights to shape our approach.” says Stuart Whyte, director of VR product development, SIE London Studio. *“Applying the lessons we learnt through our own reactions and experiences was vital. At that stage we didn’t really have anything game development wise to compare it to so knowing what might and might not work was difficult.”*

WORKFLOW AND TOOLS

SIE London Studio created a bespoke engine for VR development; this engine has continued to evolve and is still used today.

Will Burdon, Technical Director, says that the team did evaluate engine technologies, and concluded there were opportunities to achieve high performance by targeting PS4 console specific features, something that is difficult to achieve for a cross-platform engine. *“In the end we tailored our own engine to achieve high performance for PS VR,”* says Burdon.

During VR Worlds development, due to the complexity of each of the games, they were worked on individually with a team made up of artists and developers. *“With five mini games there is a lot more gameplay that needs to happen, so we had more gameplay programmers, more producers and designers involved to ensure that the experiences were as rich as possible.”*

The workflow, says Burdon, followed that of traditional game development. *“Process wise, developing for VR is fairly similar to a traditional game. The difference is that in traditional gaming you tend to make assumptions from your past experiences. In VR, certain things that work in traditional games just don’t work, so you have to try different things.”*

In terms of development tools, Burdon says it's not so different to a traditional game, with art tools such as Maya (a high end 3D modelling package) prominent.

"We use a proprietary editor, to mark-up object properties, such as physical properties (weight, friction, and so on) and create the logic of the game world," says Burdon. *"But there's a greater emphasis on optimisation - getting the game to update at a consistent 60 frames a second is challenge that we embrace".*

Burdon and Whyte agree this has to be sorted out from the start otherwise you are building up problems for later. *"This is different to traditional game development because you tend to just build it and then tweak it and optimise afterwards,"* says Whyte.

BIGGEST CHALLENGE?

"It's so new," says Whyte. *"I think in traditional games we've taken many generations and iterations of designs, around control schemes, and so on. The challenge and excitement around VR is that it is a very new space and some of those designs and languages from other games just don't work so well in this medium and yet there are alternate ways you can do it that are even better."*

Burdon adds that *"it's different from non-VR gaming and there's not a lot to learn from more traditional types gaming, which is why there is so much iteration going on in this space, even in the first year of PS VR a lot of people are coming up with new ways of doing locomotion, new genres and taking existing genres and adapting them to work in VR. There is a lot of experimentation going on which is very exciting."*

In terms of skills, both Whyte claims it is *"quite similar to traditional gaming development"* but there are a couple of areas where it differs. The gaming engine demands a different mind-set and demands more VFX and effects skills due to the immersive experience.

"The design language is not locked so it's an exciting time for anyone that wants to explore new mechanics, new interactions and new ways to design. It's still a fresh canvas to experiment."

PHOTOGRAMMETRY AND THE PURSUIT OF REALISM

SIE London Studio is currently developing new VR titles and the technology is helping it take leaps forward to enhance experiences.

"We are definitely experimenting," says Whyte. *"On the arts side, we are working to create even more realistic and lifelike character models. We are using photogrammetry to scan in our actors. We motion capture those actors, we do performance capture on the stage, we get voice out of them as well, a full capture. We even have a wardrobe of costumes for characters - the clothes actually exist in real life, which is new to me in this industry."*

Another area the team has been pushing in VR is audio. *"The surround sound you can get from binaural audio is super powerful,"* says Whyte. *"We have a doctorate in acoustics that works on the team and he's currently bouncing sounds around the environment, from the speakers. We know where the speaker is and if he's in a metallic environment, the audio that comes to your ears will be very different from a carpet environment. It's super subtle but reinforces the sense of presence."*

Burdon adds that he is *"very interested in the sense of physicality"* in the VR space.

"It's going to be quite a big thing in future, how to interact with a virtual world in more subtle ways, feeling more physical. Currently it is graphical, a visual presence but I want to feel as if I am in there and can influence the world physically."

A8. TINY PLANETS

Landia Egal, Co-Founder, Tiny Planets

Project: Welcome to the Savoy!

Currently in development phase, 'Welcome to the Savoy!' is an interactive VR experience produced by Tiny Planets, transporting people back in time to experience the thrills of swinging big bands, breath taking dancers and jazz age glamour, by reopening the doors of Harlem's most captivating nightspot: the Savoy Ballroom.

In the late 30s, 'The World's Finest Ballroom' was a beacon of hope and a vision for a better world beyond racism, difference and hate. It was the first place in the world that black and white walked through the doors together, joined by a simple thing called 'Swing.'

Thousands of people packed the ballroom nightly, everyone dancing together regardless of race or social status. With Sharon Davis, Lindy Hop world-champion and Norma Miller, 'Queen of swing', Tiny Planets has set about re-creating this world in VR with the aim of transporting people into a sensory experience of sound, rhythm and movement.

The idea was devised by Landia Egal, co-founder of Tiny Planets. Producing ambitious VR content as a small studio Welcome to the Savoy is an ambitious project that Egal admits is being produced like a film. ***"Unless you are a very large studio capable of doing everything, you need a network of more specialised companies to make ambitious projects happen,"*** she says.

The experience will be created as a Windows VR app compatible with Oculus Rift, HTC Vive and Windows mixed reality VR headsets. Egal is using techniques such as photogrammetry and volumetric capture, bringing together historians, musicians, dancers, actors, model makers and coders to recreate the Savoy ballroom. The project, which is due to be launched in early 2019, is a true collaboration.

"We are a small production house so we have to work efficiently with other companies," says Egal, adding that to keep on top of the relationships you need ***"a good communication and production calendar"*** with ***"roles very clearly distributed."*** The challenge goes well beyond project management of people and Egal, is having to call on some technical expertise to realise her vision.

While the story is driven fundamentally through the memoirs of last surviving Savoy Ballroom member and 'Queen of Swing' Norma Miller, recreating the scene complete with multiple dancers is a technical challenge within the VR framework.

TOOLS AND TECHNIQUES FOR HISTORICAL REALISM

"We decided to use volumetric capture and photogrammetry for the 3D immersion they allow," says Egal. ***"Our goal is to recreate the spirit and feeling of the place."***

She cites limited number of people captured at a time, cost of a retake, integration in the photogrammetry environment, optimisation of the potential of all the data captured and reprocessing, as the technical challenges facing the team.

So, she has called on London-based Alter Equals to manage the photogrammetry, volumetric capture and programming of the VR experience. Created by engineers with strong VFX experience, Alter Equals specialises in the creation of photorealistic objects and environments for interactive experiences (mobile apps, 3D web experience, VR).

"For the photogrammetry, we are using a hybrid pipeline for the most faithful recreation of the Savoy," says Egal, ***"3D modelling from blueprint to get the layouts, scales and shape of furniture and objects and photogrammetry to add the details. We are using calibration of black and white archive pictures in the existing geometry and a mix of painting and compositing for textures and colourisation, using archives and testimonies as a guidance."***

Egal is also working with the creative tech studio Novelab. ***"Novelab will be developing a real-time 3D soundscape, using binaural recording, physical and CG models to recreate the extraordinary acoustic of a place which didn't have sound amplifiers,"*** says Egal.

The tool list for creating the experience includes Unity 3D, Maya, Enwaii, Photoshop, Mari & Substance painter, Fusion, Pro tools & Reaper, LeSound and potentially Houdini.

"Our goal is to transport people back in time through the memories of Norma to experience the magic and fun of a place that doesn't exist anymore," says Egal.

"As the experience of a night at the Savoy is the heart of this project, we believe Virtual Reality is best suited to convey the incredible feeling of being immersed in a sensory rollercoaster of sound and movement, and photogrammetry is the best technique to keep a documentary style and transport people into the real Savoy ballroom from the late 30s."

A9. WALES INTERACTIVE

David Banner, Managing Director, Wales Interactive

Project: Don't Knock Twice

[View Project](#)

In October 2017 Don't Knock Twice became available as a PlayStation VR boxed release for Europe and the US. Based on a film of the same name, the game is a first-person adventure where the player takes the role of a mother, exploring an old house to find and save her daughter from a demonic witch.

"Developing for games can be a bit like failing fast," says David Banner, managing director of Wales Interactive. Banner set-up Wales Interactive with technical director Richard Pring in 2012. Don't Knock Twice is the company's first foray into VR with a full-on game and while Banner admits this has had its challenges, he has stuck to a tried and tested development formula he knows well.

"If you just put your head down and develop and keep running towards a goal, you can make a lot of bad decisions," says Banner. *"On paper, ideas may be good but they may not translate, so we've always thought that developing a demo was the key to getting valuable feedback."*

For Wales Interactive, every games project starts with a demo. *"Normally we just sit in the office and we come up with the ideas but we had the original film set to work with so we visited the house from the film, which was great for the artists to visualise what we wanted to achieve. It was then all about how we learn to develop on the hardware because there are slightly different rules to VR compared with conventional games development."*

Before the team embark on the 10-minute demo, Banner puts together a development document complete with flow diagrams and images that communicate the ideas and workflow to the various bits of the team.

"It's a little slice of everything we want in the game and there's two reasons we do this - one for the guys to get a feel of the project, so we start to understand potential problems we've got to solve and two, to test the market and get feedback," says Banner. *"VR equipment is very new to the team, so it's important to use the demo to test the ideas, but also how people behave in the game within the headset."*

THE WORKFLOW

The demo was built in Unity although Banner says he has also used Unreal but feels Unity is “the glue between all the different disciplines.”

“We created a whitebox layout of the house in Unity to get scale and the basic VR mechanics implemented,” adds Banner. *“As we use FBX format we can use either 3DS Max or Maya to create models and characters.”*

Files are stored on a SVN server, an Apache server that the team of developers and artists use to maintain current and historical versions of files such as code and documentation. The team also uses a free asset management tool called SCM, which enables completed assets to be added to the game and ensures up-to-date versions are readily available and acts as a back-up, so if anyone makes a mistake, they can roll back to previous versions. Although the team usually works in the same office, it uses project management app Trello to communicate and keep up with the project workflow.

The feedback from the demo can impact the workflow for the full version of the game. *“In the game there is a virtual phone that texts you,”* says Banner. *“Even though it has become instrumental in guiding people around the house, we first started using it in show environments because we got fed up of telling people where to go. Some design and mechanics comes out of the demo and can influence the development process.”*

Developing for a number of devices was also a challenge. The team worked in a carousel, moving the various formats around the disciplines for constant testing and tweaking.

“We learned a lot from the demo,” says Banner, *“particularly about keeping people in the game in the various devices, including dealing with potential motion sickness issues. So our workflow is built around the three main devices – PlayStation VR, the Vive and the Rift – and we are constantly rotating, building the game with subtle variations to suit specific headsets.”*

The team cannot afford to focus on one device so the carousel set-up ensures everything is tested on an on-going basis. This includes setting up cameras with different lighting settings balanced for a specific headset. In terms of the animation itself, the team opted to not use motion capture in favour of more traditional animation.

“What you find with animators is that they don’t like ‘mo cap’ because they are just tidying up stuff as it comes out messy. The reality of indy games companies is you are trying to make things as clean as possible, so what you think may save you a lot of time could end up costing you a lot of time, because you could have just animated in traditional way without having all those in between key frames, and made something which is more economical to run.”

The artists used Maya for skinning/rigging characters and a mixture of Photoshop and Substance Painter for creating textures.

KEY TECHNICAL CHALLENGES IN DEVELOPMENT?

"Updates of Unity," he says. "As the technology updates it can break things in the pipeline, so we have to adapt to other people's changes, I guess."

NEW TECHNIQUES

"What we found with Oculus, for example is that if you drop something on the floor you can't pick it up because the set up might not be right. We saw this on lots of different setups so we implemented stretchy hands so that virtual hands could stretch, like Inspector Gadget, to pick things up from the floor."

THE TEAM

Ten people worked on Don't Knock Twice, including what Banner refers to as two hardcore programmers. Banner worked as the game director overseeing the design and artwork side, while Pring was another game director focussing on the programming side. There was also a tech designer, a blend between the programmers and the art department, two dedicated artists focussing on characters and visuals, an animator / UI artist, rigging characters and managing any UI in the game, a sound designer for sound effects as well as music and a PR/comms person to promote and sell the game.

The company also used some external testers. It has a deal with local universities such as Cardiff, This relationship with the universities also extends to employment. Banner says that there is no shortage of skills in the area and that he has never had a problem filling any roles, contrary to popular belief.





Jen Stein PhD, Watershed Professor of Design Futures, Digital Cultures Research Centre

University of the West of England

[View Project](#)

The DCRC is a space for researchers working in the areas of media theory and practice to share their work. Part of the University of the West of England, Bristol, and a strategic research partner of the Pervasive Media Studio, DCRC brings together researchers and commercial producers in the field of wireless applications, social gaming and Alternate Reality Games.

"We have to make sure we have the most up to date tools. I am hoping for more persistent and emergent worlds and I know the power and GPUs are not there yet for VR. It's getting better though. A lot of students here are chomping at the bit to learn Unity specifically for developing in VR. They are also interested in Unreal, but Unity is still the tool to use."

"In the US we had graduates working in a lab as part of a game design MFA programme," says Jen Stein PhD, Watershed Professor of Design Futures at the Digital Cultures Research Centre in Bristol's Watershed building. "Students in the UK don't have the opportunity to work in research labs in the same way."

Stein, who has previously worked at the University of Southern California (USC) as a research assistant professor does however suggest that **"there are some amazing things happening here too,"** pointing to the new Bristol VR Lab and her own work at the DCRC. However, geography (USC is in Los Angeles with easy access to Hollywood production companies and Silicon Valley technology firms to the north) has played an important role.

Stein says that from an early stage, students worked with studios such as Wevr and a lot of alumni went straight into VR jobs. She admits, **"In the UK it's happening, but not at the same level. The challenge in the UK is to increase access to tools, leading edge technologies and also real-world development projects."**

"A lot of students here are chomping at the bit to learn Unity specifically for developing in VR," she says. "They are also interested in Unreal, but Unity is still the tool to use, although ARKit (Apple AR) and ARCore (Google AR) are also increasingly of interest. There is also Microsoft HoloLens toolkit now in Unity. MetaAR is also using a Unity layer for its development environment. These are the general tools that students are asking for and the University is now trying to teach."

TECHNOLOGY CHALLENGES

Of course the challenge for any university is to ensure its technology can meet the demands of leading edge development. Processing power and bandwidth is always an issue and universities are no different. Stein says she has just worked out a spec for the DCRC's computers, trying to get graphics cards that can handle what is needed now but also what it will need in three years.

For Stein more needs to be done in getting students into research or at least providing opportunities for industry and education to facilitate leading edge research.

Stein talks about a growing interest among students in light field or volumetric capture but this interest is not being totally fulfilled.

"Light field capture or volumetric capture is not something that's totally there yet," says Stein. "Lytro is developing really high end sophisticated technology but not a lot of people have access to that. At Uni we are limited to the tools available but so too is the industry. We can imagine and the tools are coming but access is limited."

WORKFLOWS AND THE FUTURE

Do immersive experience productions need their own workflow structure and processes?

"I think they probably do but I have seen that companies are generally using the Hollywood model or visual effects model of storyboarding. The one thing that they are doing more of and there isn't a tool for yet is actually writing for VR. Most people are using spreadsheets and it's becoming a lot more non-linear and you have to plan for people not looking at or engaging with the story you are telling even in games. "Where workflows are obviously evolving is in testing". Stein adds "that putting the headset on is having an impact on how productions are planned and processed."

"We are learning a lot about workflow when we are testing in a space that isn't necessarily the programming space," says Stein. "It's easier to make changes in Unity and test to build when building a game but it's more complicated in VR to get the framerate right and to scale it right. The workflow is definitely shifting from thinking about what it means when you put someone inside of the story rather than just looking at the story."



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