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Interview with Dave Patten

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Interviewed by Wally Smith and Dirk vom Lehn

Dave Patten is Head of New Media at The Science Museum, London, where his role includes managing all aspects of new media, from conceptual design, prototyping and production to project managing external developers and production companies. He has a background in electronics and computer science, and has worked at the Science Museum for over 32 years, developing exhibitions and leading development teams. He developed the technical systems for the Science Museum's Wellcome Wing and Dana Centre, which opened in 2000 and 2004 respectively. Recent work includes Web Lab, the multi-award winning collaboration with Google, Engineering Your Future, an interactive exhibition for teenagers on engineering, the Science Museum Group's Digital Lab.

WS: To begin, we would like to explore how you see the current relationship between the physical and the digital in exhibitions, and museums more generally.

DP: The relationship between the physical and the digital continues to change and evolve. For us, the conversation is around what are the types of exhibition that we're developing. If we're developing permanent galleries focussed on our core collection, that are going to be in the museum for 20 to 25 years, then ultimately, what we want is people to engage with the collection. Visitors can see the real object and engage with the stories around those objects. So, in these exhibitions that heavily draw on our collection we're reducing the amount of technology we put in because technology isn't sustainable over such long periods of time. Save for a few exceptions of technologies that are easy to maintain most technologies won't last for 25 years or so. What will work are technologies that use time-based media – video and audio – where it is reasonably easy to transpose into new formats and to update the playback hardware.

However, anything that you're creating programmatically, is much more difficult. Because the software and hardware changes over time it's not only unlikely you'll be able to replace it with something similar, but almost certainly, the environment you wrote the software in won't exist in the same way. Then you need to look through multiple generations of hardware, operating systems and development environments to get you to a point where you can begin to do update the software.

Because of these difficulties, we're reducing technologies that involve computing and programming in those permanent display exhibitions. Or, if we do use such technologies we're turning to template setups that anybody can drop content in and that are easier for us to maintain over a long period of time. Such updates of systems are relatively easy: you're upgrading the typefaces, the image quality, and change from, say a touch screen you might have put in six or seven years ago, to a screen operated by gesture control - so swipe and pinch to zoom. You can reconfigure the front-end software but still use the same asset and you can kind of make the whole thing feel more contemporary.

WS: What about temporary exhibitions that are in the galleries for shorter periods of time?

DP: In these exhibitions, the use of technology is less of a problem. Then it's more about the mix of objects, traditional interpretation and digital interpretation. When we decide about the format of the interpretation we first look at the subject matter and then decide on what's the best way to tell our audience the story or give them the interpretation they need. Is it through a printed label? Is it through a graphic? Is it through a piece of video? Is it through a piece of audio? Is it through game play or doing some emulation or scenario work?

If it's a collection-focused exhibition, such as a historical exhibition, we really want people to engage with the objects. In these exhibitions screens are often a distraction to people because they're bright, shiny and contain moving content. If you put an object next to a screen, what people tend to gravitate towards first is the screen. They don't always look at the object, even if you ask them to do that.

We've done lots of work, over quite a long period of time, probing the relationship between screen-based media and museum objects, including screen-based labelling of objects. We built an exhibition where we had almost no paper labelling at all. All of the interpretation was done on large touch screen kiosks.

In some of the more recent work we've been using transparent screens. So we can actually put the screen in front of the object and you layer the content over the object. That seems to have the most promise because the object is always directly in people's field of view. There are still some challenges with the technology but it means that you can interpret the object and tell it's story but keep drawing people back to the real object.

WS: What you are describing is a sort of learning processes in the museum, that has at its heart the sustainability of exhibitions. How have you arrived at this point?

DP: This has to do with the permanent evolution of technology and people's approach in using technology. Some years ago, I installed the first tracker ball in the museum, and people didn't know what to do with it. This was in the late 1980's and pre-Windows 3.

Then most people had no experience of Apple Macintosh computers and at that point Microsoft didn't have a mouse-based graphical user interface. It took people several minutes to make an association with moving this ball around and items moving around on the screen. We experimented with this kind of interface for a bit but ended up not installing tracker balls for quite a long time because visitors struggled with that. Within a year of Microsoft releasing Windows 3 the situation changed. People just completely understood the use of tracker balls (which are essentially upside down mice) because they were getting exposed to them in all sorts of places outside the museum.

Another example of this is touch screens. Touch screens were always a fairly intuitive way to interact with computers. When we first put touch screens into the museum, we had a massive problem. We used to have a lot of video screens in the museum to play static video. People assumed at the point when they started to encounter touch screens, that every screen was a touch screen. We didn't always mount video screens very effectively and, in fact, we used to put them on a shelf, in an opening, and people would push and push the screen backwards off the shelf.

Now, we have a lot of 'point and click' touch screens in the museum. Within a few years of the iPhone coming out, people's behaviour changed again and they expected all screens to be gesture based. Then they try and swipe old touch screens and it doesn't work. The visitors then question whether the exhibit is broken or whether it's them doing something wrong. Ultimately this is a problem for us, what museums don't want to ever do is to make their visitors feel stupid. The visitor is always right.

WS: Yesterday, when we were in the Wellcome Wing, I was really struck by how elegant and how ergonomically pleasing it was.

DP: The exhibitions in the Wellcome Wing are concerned with contemporary science, and they are not primarily object-based. There are a whole load of things in contemporary science where either an object doesn't exist that truly represents a story, or the objects are not inherently very interesting. A lot of what we encounter in contemporary science is focussed around a computer or a black box.

For me, one of the things that helped me crystallise this was when I was working with a curator at a time when the museum collected its first DNA fingerprinting machine. It was a big Hewlett Packard desktop computer, with a big box that you put sample tubes in and that analyses DNA. It looked like any other desktop computer. It wasn't until you realised that the machine completed in less than a day, what it took a team of people over a week to do before, that you realised how significant this object was. Just looking at the desktop computer and the big box doesn’t help you understand that significance.

In exhibitions, technology can be a way to bring those stories to life. It allows you to give visitors agency over an experience. Visitors control the experience and can kind of take in the story or information at their own pace or they can try different things out and look at different outcomes. So technology, in some circumstances, works very well, and I think it's particularly strong where the objects in themselves don't necessarily tell the story.

If you’re dealing with things like big data, quantum computing or nanotechnology, it's about taking people to a very different world and a very different experience. You can show the objects but, again, the objects don't really tell you the story. Ultimately, technology is expensive to purchase and maintain. The technology has really got to demonstrate some real value for the museum, by providing a great visitor experience, for us to decide to put it into an exhibition.

WS: Let’s come back to the discussion about the relationship between the physical and the digital. One example of an exhibit that dealt with this directly in the Science Museum, that I remember from a few years back, is the Sketchbot that was shown in the WebLab exhibition in 2012. There was something magical about the way Sketchbot cleverly brought digital data back to something so surprisingly physical and playful. Is that still an idea you try to carry forward?

“The Sketchbot takes a photo of your face using a webcam via HTML5’s canvas and processes this into a line drawing. This data is then sent to the robot arm and it starts to sketch your face into a sand pit. Check out the video below of the Sketchbot drawing my face in the sand. This by far was my favourite experiment at the Web Lab.” https://www.found.co.uk/blog/google-web-lab/#.W0cZWthKiBs

DP: Yes, it's kind of embedded in a lot of our thinking but we're still some way away from being where we'd like to be. I personally would like to see far fewer screens in the museum. That doesn't mean there won't be lots of digital interactives, but I don't think the input or the output always needs to be on screen. Some of the best input and output isn't on the screen.

The Sketchbots were great but they took a lot of looking after. They're mechanical devices and they needed a team of people that were competent and confident in maintaining them. Managing the space between the software and the physicality was complicated because some of those services were Cloud-based. It's has got easier since then but those things can be still be expensive.

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The Sketchbot, The Science Museum, 2013

One of the things we're always doing as a museum is looking at different ways of interpreting objects. In the Information Age gallery we wanted to help visitors understand how some key objects worked. So we developed a series of physical models that you interact with, and that drive screen-based content.

One of these exhibits is a Morse code key. On display we have an actual Morse code key In front of it, you've got a white resin cast Morse code key. You tap on the key and basically, that starts to unfold the way a morse code key works on the screen behind the object. You can send real messages that really respond to the actual key press you send.

So with these kinds of exhibit there’s always a real object (from the museums collection) in your field of vision. The transparent touch screens are doing the same thing. They're allowing you

to tell the stories and look at how objects work. You can do the same with projection mapping. So you can get rid of the screens completely.

There are a number of companies and people that are working on the development of peppers ghost type screens that allow you to overlay digital information on physical artefacts (museum objects) . At that point, you really start to blur the boundary between what's physical and what's digital. I think our generation still largely thinks of those things as different. Increasingly, the young generation doesn't. It's just a world experience and some of these things happen to be numbers and images, and some are three-dimensional. The boundary is really blurry now.

WS: Are these technological changes, and the changing in expectations around them, also leading to new ways of thinking about galleries?

DP: I think a good exhibition tells a story, it can't just be a fabulous selection of objects with some panel displays and that's all you need. I think digital technology is still relatively new to museums. I've been working in the field for 30 years, but museums have been around for hundreds of years. We've been writing label captions for hundreds of years. You could argue, we're still actually not very good at it or that it's really hard to write a good label caption.

WS: What role, for example, do you think new developments like Virtual Reality (VR) and Augmented Reality (AR) will play in near future exhibitions?

DP: Bigger museums like us are paying attention to the opportunities offered by VR. But, I think all of us are definitely moving towards Augmented and Mixed Reality that will allow us to do all sorts of really interesting things for our visitors in the museum in a far less intrusive fashion. In the future, these experiences will probably be had using some kind of lightweight wearable device. These technologies will allow you to take objects to pieces, in front of visitors' eyes, and show them what's inside and how they work. You can generate context around objects.

All of these technologies are possible now, in various ways, and will become increasingly easier to do. One of the big challenges for museums is having the resources to be able to generate enough content to do any of that – it is often difficult to find the time to go back and reinterpret older exhibitions and galleries.

We have a digital record of the objects in the museum’s collection, which has grown over quite a long period of time. The quality of that data often not very consistent. It depends when it

was put in and who put it in. For the museum, just to go back and to clean up all of that data will take years of curatorial work and this may need to happen before you can start to generate new things using that data.

It would be fabulous though if you could build an exhibition and add multiple levels of interpretation to it. For example, you could imagine going to an exhibition on the history of steam engines and steam trains, and you could look at that purely from an engineering and design perspective. What were the design challenges? How were they met? You could look at how things work. But you could also look at their social and historical implications and contexts.

WS: Is seems that the digital is blurring the boundaries between the various GLAM institutions. So, for example, many libraries have exhibitions now. Museums can use APIs to make their collections into archives for others to search. I wonder then, is there a struggle now for each institution to maintain its distinctive identity? Do you in the Science Museum, for example, have new overlaps and crossovers with your neighbour the Victoria & Albert Museum?

DP: I think the V&A and the Science Museum are really interesting. There's a constant blurring of the boundaries between the two museums. This is partly because they come out of a common heritage. We all grew out of the Great Exhibition and the Science Museum collection was originally at the V&A where Rory Hyde recently created ‘The Future Starts Here’, an exhibition that shows plenty of technology (see Hyde Interview). Ultimately, this whole quarter of London was set up really to bridge the divide between art and science.

I think, in some ways, maybe in the digital realm, there's an opportunity to join art and science in a more satisfying way than exhibitions allow. But I think, we do create exhibitions here that certainly draw across from the V&A, and likewise, their exhibitions cross over into our territory.

It feels appropriate that we both do that because I think the things that make museums unique are their collections. All museums went through that period 15 or 20 years ago, when there was huge internal debate about the building of websites and how the online publication of collections would impact visitor numbers. Some argued nobody would come to museums anymore. That just blatantly wasn't true. If anything, websites that publish collections drive people to the museum because people see those things online and want to come and see the real things. There's something interesting to be in the proximity of real artefacts. To stand next to Stephenson's Rocket. To stand next to the first aeroplane that crossed the Atlantic. That's a special kind of tangible

experience that you don't get in quite the same way, just viewing things online – although higher quality VR and MR systems may eventually change that.

Also, museums are inherently social experiences. You tend to come with other people. At the moment, you don't visit online spaces in quite the same way and therefore can lose that sense of social experience. I think within that premise, there is a real danger to museums that we could unwittingly unpick experiences that are inherent to what a museum is. For example, it is increasingly easier to personalise the museum experience. So if people tell us a little bit about who they are and what they are like, we can direct them around the museum and find the things for them they want to see. One of the great joys of going to a museum is that serendipitous experience. You think you've come to see something and then you walk past something else and suddenly, your visit is completely different.

DvL: What then do you make of the attempts of some museums to offer visitors personalised experiences?

DP: When museums try to personalise visits, I am interested in how you can try and keep a sense of serendipity and surprise in there. How can you avoid the fact that a personalised visit may lose some of its social aspects and still allow for a shared experience? Part of the joy of museums is, when you go with other people you probably spend as much, if not most of the time talking to the people you're with; maybe about the objects; maybe about things suggested by the objects or the contents; maybe about other things.

You can certainly imagine a time in the not too distant future when you're using your mixed reality glasses and you're walking around and having a really personalised experience as the glasses are delivering content just for you, taking you through objects that are just for you. However, such a visit becomes really isolated and may lose all of that shared experience.

With any new technology, we need constantly to be thinking about not just what it can do but what might it change about the museum experience that is precious to us. Should we just take it on board and experiment and see what happens? Or should we say, actually, that could change the museum experience in quite a negative way so let’s not go there at the moment.

WS: This leads to a question about exhibition development. When you develop exhibits and exhibitions, how do you go about testing them before deployment?

DP: In some ways, every exhibition is only ever a ‘Beta’. They're never complete. It's a one-off prototype. We have always run a very iterative development process, certainly for digital exhibits in the museum. We don't come up with an idea, go away and build it, install it on the gallery floor and expect that it will work. We build and test a series of prototypes. Either we do it or we're working with external developers who are building prototypes for us. And we're testing those prototypes with our audience, throughout the process, to make sure the audience can understand what it is they're doing. They can understand what it is they need to do, that they take away the key message and have an enjoyable experience.

WS: Have you got a panel of participants to test exhibits?

DP: No, we test with museum visitors from the floor. The testing is done by our audience research group in the museum, sometimes in dedicated areas of the museum, but we can also do it anywhere. We might set up a prototype in a gallery space that is empty at the time and do the tests there for a month. Or I might have something we want to test and may just set it up somewhere for a couple of hours, and that will give us some useful feedback.

We also have the Digital Lab initiative, which is quite new. When John Stack joined the Science Museum Group as Digital Director, three years ago, he developed a new digital strategy for the museum. One of the things in that is the Digital Lab which is not a place but a concept or workflow. It allows us to do some of the more experimental work as well as to bring in potential new funding streams to the museum. Operating at the intersection of design, technology and content, the Digital Lab allow us to explore the new forms of audience experience that are enabled through emerging digital technologies.

DP: Some pieces of work fit well within that concept. So, for example, we've just come to end of the first tranche of work funded by Samsung that we're calling ‘enhanced digitisation’. The work relates to the digitisation of our collection. Our collection is predominantly three-dimensional. We wanted to explore the different ways you might capture objects in 3D and how does that fit within our existing workflows? How long does it take to produce a 3D-scan of an object like a steam engine? What are the storage requirements for that, and how can visitors use the 3D-scanned objects?

So we did some rotational photography, 3D scanning, photogrammetry, 3D modelling and some LiDAR scanning and built some small demonstrators, looked at how you embed those

images in webpages and explored where else people might use those assets. This all helps our internal discussions as we decide on how we move forward with this type of digitisation.

It allows us to step back and say, digitisation is actually this range of things. At one end, there's the full blown LIDAR scan, photogrammetry three dimensional modeling of something. At the other end, there's a high quality high resolution photograph. When might you do this as opposed to this? When is this useful and when is that useful?

We've just scanned Stephenson's Rocket with LiDar and photogrammetry, that took 11 and a half hours and that was just one object. It comprised of a series of LiDar scans and about two and a half thousand photographs. As well as the 11.5 hours to do the capture it took several weeks to process the results of that and get a model. That's not possible for every obejcts (or even a significant number of objects) when your collection is large.

WS: So do you have a staged process, whereby you experiment with an idea and then reach a go/no-go decision point?

DP: No because, as with all things digital, there isn't a clear-cut point where you make that decision. So we might do something and say, okay, this is how you do it. This is how long it takes. With the current technology, this is not feasible to do for large volumes of objects. Looking at the technology that will be available in three or four years' time, it may well be feasible. So we need to revisit those things. A lot of work in digital is about taking the time to step back and see what you've done. You have to look at some of the things that appear to be less successful, or that the public doesn't seem to be ready for and check if that is still the case? Would they still be challenged with that? Technology is constantly changing and so are people and their experience of technology.

So for example at some point we were really interested in looking at how you might tell stories in VR that are hard to tell in other media. What is it like to actually put the visitor inside the interpretation? For us it is important that VR technologies really encourage visitors to want to look at the object that was at the centre of generating that VR experience. We did a piece of audience research around this, with really positive result that suggest that VR experiences really can drive people to look more closely at the (real) object.

But VR is quite expensive to make and to manage on the floor of the museum because the headsets are still expensive and fragile. You need to staff the experience. So it's not something we could currently widely adopt in the museum. But if you had a special exhibition with one object you

really wanted to bring to life in a different way that may be a way of doing it. It also let us start to think about, what does it mean to story-tell in an effective way in immersive environments. We're really interested in all forms of immersive environments, from large scale room projections that have lots of people in them, through to mixed and virtual reality.

In effect, when you're telling stories in those kinds of environments, you, as the participant, become the director of that story. It's a really different way of story-telling and consumption. So this is a way of beginning to dip our toe in the water. What does that feel like? How do you start to tell those stories? When do you need to draw people back so they're all looping through any really key concepts and when do you let people be more free to explore?

Then for the final part of the work, we ran a couple of hackathons looking at different ideas. As part of the new digital strategy, we opened up our main collection system with an API. That's partly because we need to do that so as to rebuild our own website. We wanted to do some work (i) to see whether we'd got the APIs right for and, (ii) to see how usable they were.

So we had a two-day hackathon with about 70 people coming into the museum to build a whole lot of prototypes using the API. They built everything from chat bots, projected displays of objects, through to some really nice games based on the API. We ran a another hackathon event which was about making ideas rather than working prototypes to explore new ways of surfacing and discovering objects in our online collection

DvL: Thus far we have primarily focused on the process of exhibition development. Let's now turn more to the audience. How do you think the deployment of new technologies in exhibitions relate to the expectations of the audience? What do visitors expect from the Science Museum? Do they come with expectations maybe to see and use the latest technologies?

DP: We have nearly three and a half million people a year and they're coming from very different backgrounds. Some people expect to see the latest science. Some people expect to be able to interact with things, whether it's physical interaction or digital interaction. Some people come because they want to see the art we've collected, or they want to see a particular object. People come for all sorts of different reasons and with different motivations. We are a big museum and we kind of need to try and satisfy them all.

The question about the deployment of novel technologies is interesting. We tend not to focus too much on that, partly because we've done it in the past and it's really challenging. We're

not using really new technology because museums really aren't set up to do that. The investment is high, the failure rate is high. Instead, we're bringing technology that people may not have experienced in museums before, into a museum context. At the end of the day, museums need to present things that people want and enjoy, and you don't want to build lots of things that don't work. So you need to be careful about how you use them.

DvL: How do you decide about what technology to deploy in the museum. How do you arrive at such decisions?

DP: I spend lots of time going to all sorts of non-museum-y places like shops, particularly high-end retail. Because I think they're investing in all the interesting forms of interaction. High-end retail outlets effectively make themselves destinations, and they need interesting things to do that. We also visit big trade shows to look at what latest tools are coming out. What are we going to be seeing in two or three years' time? You're constantly looking for inspiration in all sorts of places other museums, through to just being out in the street. Sometimes it's about new technology and sometimes it's just seeing technology in a very different way and you think, actually, that's brilliant.

DvL: From your experience, do you think that people's expectations towards the museum have changed in these respects?

DP: I think museums sit within a much broader context that drives expectations. For example, there's an expectation that the quality of videos we show in museums compares to a BBC documentary. And with computer games people expect a quality that is on par with games developed by Electronic Arts with their multi-million pound budget.

Obviously we don't have the budget to do that. So we have to think really carefully about whether we should sit within that ecosystem. As people's experiences of the world constantly change, their view of the museum changes and their expectations of what they're going to see changes. Also, people visit, not just this museum, but lots of museums. If we do something that people really enjoy, they'll expect to see some of those things replicated in other museums over a period of time.

But I do think the museum is a constant mixing and balancing act, to get that myriad and appropriate experience for different audiences. We get a lot of school audiences, so what are we doing for schools? How do we facilitate schools being here who have quite different needs from general visitors. They come with their lunches. Where do you store their lunches? How do you

provide enough toilets in one space for that to be a great experience too? So it's not only about the exhibitions but also, about the infrastructure and service for those visitors.

I guess all museums at one level are interested in the personal technologies people bring with them to the museum. But at the moment, there are still a lot of challenges that make that not something that we feel we can really work with. We've commissioned several reports looking at what people do with their mobile phones in and out of museums? What might they do in the museum? What are their barriers to doing things in the museum? What do they want and what don't they want?

It was a bit of a surprise to lots of people in the museum, that quite low down on that list of what visitors want is more content. What lots of visitors were saying is, there's enough content in the museum already so why would we possibly want more? But then lots of people want slightly different types of content.

And, we're not very good at offering content in languages other than English. You can certainly see, with the rise of Google Lens and Microsoft Translate, that people will use their own personal devices to automatically translate text and it will make the museum experience for overseas visitors a more positive experience. You can also see an emerging of number of technologies for people with disabilities. Where, at the moment, we do lots of close captioning of videos and sign language, in the future, I think increasingly we'll see people use the devices they bring with them to do all of that for them. That will change the tasks that we need to do in the museum.

But there is also, I guess, a bit of an inherent danger in there that anybody can do something on a mobile phone in a museum and it isn't necessarily us. So if we're not doing it should we be aware of what other people are doing? Should we worry about that?

We ran the first study of mobile phone use in the museum in 2012 and the second in 2015. There isn't a marked shift between what people are doing and expecting to do with their mobile devices. If anything, their use of the Internet within the museum has gone down slightly. The reason for this drop-in Internet use is that in comparison to 2012 now almost everybody’s got a smart phone.

I think there isn’t yet the killer application for mobile devices that work across museums. And building apps is very expensive, and they are quite hard to market. We have produced apps

that are really successful. They download well not only in the UK but also in the US, in Russia, in China, in India and in South America. These successful apps, like some of our gaming apps, tend to be free, and therefore, in effect, are paid for by the sponsor of the exhibition. Although we're not making money on those apps, they are worth the cost because we are using them to share the museum experience and the museum brand.

DvL: Do you develop these apps in-house or is the development outsourced to specialised providers?

DP: We have a small team in the museum that builds conceptual prototypes, and we might build small exhibits. Together with the museum's content team we identify good digital opportunities within an exhibition or within a gallery. Then we manage the process of getting those into the museum. We will identify potential partners to work with outside the museum or we'll run tender processes and then manage that process from conception to delivery and installation.

If you grow a team that's big enough to deliver on a big exhibition, then you can be carrying a lot of the additional cost when you're not working on an exhibition. If the team is internal, you're reliant on the skills you have internally. But this is a rapidly changing field. You probably need to invest quite a lot of training to make sure that the team always have the relevant skills. I've always been worried that you'll take a group of people on, they'll be really good with a particular technology, then the technology gets out of date, and it will be really hard to get them to move on to new technologies. The joy of working with people outside is you can identity people who are really good at the thing you need and have the skills set to do the thing you need.

DvL: In terms of the developments over the past few years, what has been the biggest change in the make-up of your team?

DP: 20 years ago, partly just because the development of environments was much more tech heavy then, there was a lot of low level coding and it tended to be things that individuals could do. The kinds of experiences we create now, by and large, are not things that an individual can do. You need teams of people do them. So you'll have audio specialists, an animation specialist, a coding specialist, etc. Therefore, what I'm looking for are people that have got a little bit of experience of all of those and know how everything fits together. They may be really good at one element of that but it's kind of the understanding that the raw creative process, I think, that has changed.

DvL: Let’s come back to technology. As we were wandering through the museum we came past exhibits like the flight simulator. How do you make decisions about the display of such exhibit, and what technology to use?

DP: Exhibits like the flight simulator: that’s a purely commercial proposition. It's run as a commercial activity for the museum. When the simulators were put in, they're looking at things that are very loosely aligned with the museum experience, that are commercial. Because, ultimately, we're a national, free museum. We can't charge for access to the core collection. But we can charge for experiences like IMAX and simulators and these are important sources of revenue for the museum. We make sure that there are films themed around the content of the museum. The simulators, for example, allow visitors to fly an Apollo rocket or you can ride in a Red Arrow etc.; flights that relate to our exhibitions, such as the aeroplanes or the exhibition about space.

The VR experience is slight different. It's the first time that one of those more immersive technologies has become available, where we can afford to own and make content that's about the things that we really care about. It’s about objects in our museum. So the Space Descent VR is based around Tim Peake's TMA-19 capsule, which the museum acquired for it’s permanent collection, that came back from the International Space Station. So you can come to the museum and see the real and then you can ride in VR, with Tim Peake, in that real capsule. That actually is a really strong experience because you've seen the object and you have experienced the journey it made. You can then go back and see this real thing. It makes you appreciate this amazing object that travelled at 180,000 miles an hour, in an uncontrolled freefall and at the extreme temperatures generated during re-entry . This is insane and really makes you think differently about it.

I think that it's kind of interesting that we can now start to build experiences about things in our collection that we care about. So we could build a flight simulator but it probably wouldn't be like one of the commercial flight simulators you see now. For example, we might do something about the first flight across the Atlantic because this is a significant object in our collection.

The cost for these kinds of technologies has begun to decrease so that large museums now can afford to make their own content. For example, we own all rights for Space Descent VR experience and can license that to other museums and venues. We may choose to run it as an in-museum experience for two years and then decide to publish it, for example, in the Oculus app store and all of this helps us recoup the investment we made in the product.

WS: Does each exhibition have to be almost like a little business that must pay for itself to survive?

DP: Exhibitions all have budgets. The on-site commercial activities are really important because they bring in additional money to allow us to improve the museum and its infrastructure. As a museum those commercial opportunities are very important part of the overall experience and ever more tightly bound to our cultural offer and brand.

WS: This brings us to the question of careers. What kind of skills do people need nowadays if they are starting out on a career in museums and galleries, especially if they want to work in the new media department?

DP: It varies for different museums. So for my team, I am looking for people who have a level of technical experience. They can develop exhibits in a particular environment and understand the challenges of doing that. I want people who are really creative, who can work in multidisciplinary teams and who can help shape the vision of exhibitions and experiences. Then, they can take and champion that vision into products. But it's important that that's underpinned with a technical ability because when you're working with agencies, you must know whether things are possible or not. When a developer comes back and proposes a particular development you need to be able to judge the costs of the proposal and how much time it will take to implement.

DvL: When you talk about a common background in technology, I suppose what you are talking about are coding skills? What other skills are required to work in a department like your's?

DP: When we go out to advertise for jobs like that, we'll say we want the experience of development environments and might list three or four more specific skills, including for example coding skills in Unity, HTML and Java Script. Photoshop or Illustrator, working with APIs and with Cloud-based Services and a basic understanding of networking as well as simple video editing skills are also useful.

Ultimately, I want somebody that can understand and love the content and then use technology to bring that to life.

DvL: You have been working in the Science Museum for a while now. What is it with museum work that keeps you so passionate?

DP: I've been working here, at this museum, for 32 years. I wouldn't still be doing this if I wasn't really passionate about it. I came to the museum thinking I was going to be here for four years and do one project. Museums are just amazingly creative places. We have more stories than you could ever imagine. I love being a part of that, helping craft and tell those stories to visitors. But also I love that the people who work in museums are really passionate and really interesting people who come from a variety of backgrounds, Every project that you work on in the museum, you're working with a different combination of people. The speed of change is constantly accelerating, and you're always running and that's just exhilarating!

WS: That's true for museums in general, but for the technology side it's perhaps even more true.

DP: Yes, indeed. With technology the changes are rapid. At the moment, for example I think we are only at the beginning of the development of personal devices. Soon we will see really lightweight, wearable devices and some kind of glass/headset device, probably in the next five years. Once those kinds of devices become commonplace, the ability to transform the museum is huge. That's really exciting and ultimately, might mean you can hide all the technology away. For me, I'd love to be able to do that and not be confronted by it because it can be a distraction. But I still want visitors to be able to have those amazing transformative experiences. I'm as excited working in the museum now, as I was when I was a child coming to the museum and having those amazing experiences.