ASCILITE Wavelength Episode 7 Transcript

Opening

Charlotte Phelps: Welcome to this edition of the *ASCILITE Wavelength Podcast*. I am your guest host, Charlotte Phelps. In this episode, I talk with Christian Moro and James Birt from Bond University about Extended, Virtual and Augmented Reality. Or as they are more commonly known XR, VR and AR. In our discussion, we try to sort out the concepts and their current state of play.

Main Segment: Immersive Reality

Phelps: Hello, everyone. My name is Charlotte Phelps, and I'm joined by Associate Professors Dr. Christian Moro from the Faculty of Health Sciences and Medicine, and Dr. James Birt from the Faculty of Society and Design at Bond University. Today we're talking about immersive technologies. So, how these technologies differ and the educational value of each of these?

So, I've used these sorts of technologies in my classes. For example, in Dr. Moro's class, we used virtual and augmented reality to learn about the heart, to see the lungs change during breathing, and to learn about disorders such as stroke and dementia. And I know Dr. Birt's students have used these technologies as well to explore architecture and construction, as well as art and design. However, I do get a little bit confused with all the terminology that we do use. So, can we first just define these terms? We want to look at VR, AR, XR, and MR. So, we might go to Christian first to help us get a better understanding of these terms.

Christian Moro: Thank you, Charlotte. And the problem here, I guess, is that we can't always agree on what the definitions are, which actually might end up being one of the key take-home messages from this podcast. So, I think virtual reality used to just be simply a computer screen. If you go back in the literature, people talked about VR as anything on computers and digital, a digital representation of the world, and that has now evolved to really focus on…I think, if you say virtual reality right now, I would consider that definition to be a head-mounted display that engages at least two senses. So, not just viewing, but maybe three senses—your eyes, your ears, and you need to have something in your hand that can interact as well. So, the goal now is, I guess, getting more towards that reality. I take the term very literally—"virtual reality". At the moment, no one believes that they're in reality when you're in VR. It's not happening.

You see some things online sometimes that people are like falling over it. That happens. You can lose your balance, but no one believes they're in reality when they're on these devices. But, we're getting closer to it. So, I would say we're not there yet. But virtual reality needs a head-mounted display. You need to have probably 2 to 3 optimally senses involved. So, touch, sight, sound, and that would be the definition now for VR. James, would you agree or disagree?

James Birt: I think that's a very good summary, Christian. I think that VR in the literature is certainly divided in terms of how people identify it. I think if you look back in the literature, you're right; there is definitely a sense around 2D screens. Then there was sort of a movement to the cave type systems where you had projection onto those screens. There is certainly a sense that if you are in a cave or a projection-based system, as long as there is a connection to your movement within there, one could argue that that could be virtual reality, that you may not require the head-mounted display to get that sense of immersion within those environments. However, I would probably agree with the sentiment that a head-mounted display is something that removes the peripheral senses of your vision, that supplements the audio sound—especially around spatial audio and 3D audio. And then obviously, that sense of haptics or touch certainly develops that immersion within sight of the environment. And then, of course, you know, we're moving away from just having the three to having additional senses in there as well, with olfactory—so, a sense of smell. And there's some

really interesting evolutions into that side of things. And then, of course, biofeedback—so, being able to take sensors from our brain, from our heart. So, heart rates and other things that, I think, also elevates that experience and that feedback loop into that virtual reality environment.

Moro: But that's sort of showing then that it is still changing. Like is the term suitable? Like I said, it started as computer screens and then you're at the projection in the caves of the rooms or they have screens around you, and now it's head mounted displays. But I still for me to feel like I'm skiing, I would need to feel the cold. I would need to feel the winds. You know, there's a lot more than humans are very visual creatures. And I get that visual is a major part of it, and that helps. But I don't know that it's reality. It's a virtual environment. So, this is probably a term that's even going to change in the future. They might look back at us in 20 years and say, "Hey, I remember that just a head-mounted display, and that was called VR. And this is all confounded by big business where money just adds, this is a VR device, so you can do VR on your phone, when I don't think it is. I mean, what would be, I guess, what would you say is the lowest form now of VR?

Birt: So, I think in terms of, again, there is a spectrum of VR. So, if we look at Milgram's continuum of mixed reality, then obviously VR sort of sits at that tail end of the of the continuum. But, you're right in saying that VR itself is almost a continuum and that the definition is indeed muddled when it starts to reach those extremities of the of the continuum.

So, if I was to sort of say, what is VR or the basis of VR? One would then have to look at what types of virtual reality one is looking at. Is it three degrees of freedom or six degrees of freedom? And when I sort of mean degrees of freedom, it's do we encompass both rotational data? So, the ability to rotate our heads and see vision alongside the ability to translate or move within those environments, which is our six degrees of freedom. So, one would argue that VR, if it's at its base level, may just be three degrees of freedom, where we have rotational data, something like a 360 view or image or video, something like the old Oculus Quest Go. But in saying that, they've also been decommissioned. So maybe you're right in saying that the big business hardware manufacturers are also trying to push and change that definition of virtual reality. If I was to use a term, I'd probably say immersive virtual reality, which I would look at as six degrees of freedom with the heads-mounted display. But once again, we're changing definitions here, aren't we? We're sort of throwing words in. And then, all of a sudden, we are in a situation where we just keep adding words to virtual reality. So, it might be "immersive plus" or whatever we want to see.

Moro: We've done that with the term XR plus.

Birt: Exactly.

Moro: But is it immersive, though? I mean, what's immersion? Just it has to be stereoscopic, right?

Birt: Yes.

Moro: So, each eye has to get a different image in this. Adding words like immersive, I feel, is only happening because that definition of a VR isn't a reality. And maybe you're right with things like the smell. That's one thing. I don't know what I want to smell in VR, but at least it's something any kind of the control is a very just plastic feeling. You don't feel like you're anywhere real. So, we're getting very good at getting the eyes right, which helps. But I see a lot of VR, particularly as a reviewer, you get a lot of VR articles sent to you that are just simply stereoscopic video that you can move your head around. And they're not wrong, that it's not VR. But you tend to see that a lot where it's virtual reality; that it's just stereoscopic video. Um, so I don't know; maybe we have to get more strict and

say, “Look, it's not reality”. We're not doing reality yet, we're working towards it. But then, what do you call it?

Birt: Well, like you say more words. Like you said it before, “virtual environments” or “virtual educational experiences”. But again, we have more words coming in here. And I think there is a very big distinction that needs to be made between the hype for the hardware manufacturers that—let's face it, they're trying to sell hardware and software and other things. And then where it fits within pedagogy or within the classroom environment, we need to be mindful about how we define it there. And I think what you said before is that that ability to have a head-mounted display, six degrees of freedom, and that visual immersion; I think is number one. Number two is that it should integrate at least one other sense, whether it's haptic—so a feeling of touch—whether that comes through a controller or whether that comes through some elaborate device like a haptic suit or the ability to have heat and cold and other types of things or, probably the easier out of those, is audio/sound. So, I think at least two senses. I like the idea of integration of three. I think, you know, it'd be wonderful if we could say that virtual reality is the integration of three senses within a six degrees-of-freedom immersive headset, something like that, where it integrates that and we set that as a benchmark. But as you said before, all of a sudden, then new headsets come out with, you know, EEG—so, brain-sensing sensors on there—the ability to look at temperature and heart rate, and different algorithms that can calculate different responses in terms of emotion and other types of feelings within these environments. And I think as the technology changes, as our understanding of its ability to be integrated into pedagogy and education changes, so too will the definitions have to change. And I think this is one of the biggest issues with technology in general is trying to just concrete it in and say, “That's it, that's where we sit” is incredibly difficult when it changes literally daily and major changes probably at least twice, if not three times a year.

Moro: We've made it a point, though. I mean, even then mentioning things like…I'm not happy with the current reality that there's an eventually, but I'm not that excited about bringing in smell and emotions. Like, we used to be so excited about the visual, and now we've got that right. It wasn't doing what we're expecting. One of the things in education is do we use VR or AR? We'll get to AR next actually what that is, but VR and what not. But why do we need to get the students out of the classroom? That is something I've struggled with. So, virtual reality takes you out of reality, and puts you in a different entirely virtual environment. Why do you need that? What's wrong with the classroom? Now, in a busy classroom, like a laboratory with students everywhere, there's noise taking them out of that for a few minutes and putting them in their own little personal space can facilitate that individual student experience and learning. But is it always necessary? And I do wonder that we're using VR and we're jumping to VR. When, actually, it's a class, and students should be with others in the class and connected. And so that's been a tricky one as well that we seem to be jumping to an alternate reality, when it doesn't need to be entirely.

Birt: So, I was just going to say I would I think it all comes down to what you're trying to teach. So, if you're looking at scale, for instance, how does one conceptualize something at enormous scale like a universe? How does somebody understand scale at the micro/nano level where our reality, our human scale existence, doesn't give us the spatial understanding to be able to understand the intimate movements of atoms or how planets have gravitational rotation and other things, where being able to see that at sort of a macro or micro level really does help support the understanding by the learner in being able to get that large-scale or small-scale nuances of those particular movements.

Moro: Just watch a video.

Birt: Yes, that's true. So, that's right. Of course, you can use video, but there is something in the ability to have spatial three-dimensional or multi-dimensional, whether it's using time or other types of variables or factors, to be able to understand that. It's a little bit like physics on a video is still just 2D physics, but we don't have physics in a two-dimensional environment. We have it in a three-dimensional environment if we're looking at human world physics. And then when we start to introduce physics at the quantum level or others, again, that is incredibly complex mathematics to try to understand through a video, and that adding those other dimensions and being able to support those other dimensions really does help to scaffold a learner, chunk content, scaffold the leaner through those very complex and difficult-to-understand phenomena.

I would also argue in another context, risk is another thing that we look at. So, whether that is risk in a classroom setting. Imagine you're trying to train somebody on a building site or you're trying to train someone on real-world trauma cases; the ability to be able to have a simulated virtual environment that enable a student to go there without having the risk of falling or the risk of killing somebody or something like that in those environments, I think that is a perfect scenario for virtual reality-based training or educational delivery.

Moro: There's one that was first touted, so we'd use it for virtual dissection, so instead of cadavers and what not. And then you have the risk of you make a mistake and you just you can just revert back and start again. But, there's also some benefit in part of managing risk is part of it a little bit. But, I know when they move to purely virtual dissections, one of the concerns, which we hadn't thought of before, was when you're at university, it's time to make mistakes. Now, construction sites are different. You don't have that. But making sure that you're safe and identifying things properly, there is a bit of that carefree nature in VR.

Birt: So, I guess we've spoken a little bit about it. I was just wondering, from Charlotte's perspective, from the student perspective, but also from a researcher's perspective, what are your thoughts about virtual reality and its sort of place within the classroom, etc.?

Phelps: Mhm. So, you've both brought up some very complex terms, I must say. We didn't make it still sounds very complex.

Moro: We didn’t mean to.

Phelps: I mean the technology is just amazing, and it still wows me every day. I think it is great that we can use it in the classroom. And Virtual Reality is a really great tool for learning, and I personally enjoyed using it and being immersed in the environment, particularly with organs and learning the function and the structure of things, which was really great. And from a medical point of view, being possibly able to do surgeries with it is really amazing as well. So, I think that's really great. But yeah, there is still so much, I guess, confusion for me around what it does actually mean. And you know, what are the benefits of it? It's cool. I think it's amazing. It's really intriguing and great that I can use it, but I can also do the same thing with 3D models as well, which I find…Or what about if I want to take down notes or something like that, but I'm immersed in this huge environment where I can't do that? So, is that where some of these other technologies come into play, for example, augmented reality? What do you both think of that? Because I think that is something else that we've used as well. And I really liked that. Virtual reality was, I think, sometimes a bit too much as amazing as it was. So, what do you think about augmented reality? Because I think I preferred that over the virtual reality.

Moro: Yeah. So, with a lot of the stuff that we do in VR in health, science and medical programs is probably better off in AR in a lot of ways. So, let's define it first. All right. So, augmented reality is

using a smartphone or tablet or a device with a camera in its current form…even the glasses…but for now, it's a device with a camera. And the camera sits behind the device and it adds digital virtual elements around you. So, for us, we'll have a table, and it will add the human body specimen or the model of the brain or the model of the lungs that are breathing. So, it augments your reality with digital aspects. Is that how you define it as well?

Birt: I think, for me, it definitely has some digital overlay that has to have a digital element. Probably number two, is it needs to be spatially anchored into an environment. So, something like your Snapchat filter is indeed augmented reality because it's locked onto your face. So, it has a spatial anchor, which is your face, and then, of course, you've got the different stickers and other things that become the digital overlay. So, I definitely think those two factors need to be in place. So, it needs to have a digital overlay, and it needs to have some spatial connection into the environment. That is where it probably becomes more complicated, because whether you're spatially anchoring or essentially placing the object into your environment, whether that is on a horizontal plane like a table or a floor, whether it's mapped onto an individual face or structure, whether it is geo-located into an environment in the world…So, it's positioned in a world space. At the end of the day, there's lots of ways that one can augment environments through that anchoring approach. And of course, each one of them has a complexity and a sort of a leveling up that needs to be done for each of those different methods. But they all essentially come down to that idea that it has to be presented into the real world. You are augmenting a reality. In our case, we are augmenting our human reality.

Moro: Yeah, it is not just adding a digital model to the world. I mean, we have a digital screen that displays a photo or something. So, it's actually more the defined term that your reality is becoming augmented. Like, you can walk around, you can touch it on the screen. You do lack that stereoscopic vision. So, you are you are viewing a bit of a pseudo-3D, which makes it hard to get that depth perception. So, that's one area, which virtual reality, or at least the stereoscopic videos do help, particularly in something like am I looking at organs and the interrelationship between them, blood vessels going off a certain angle? You can really get that in VR. You can't really get it in AR. You see it, but it's sort of an illustration of what 3D would look like.

Birt: Especially if you're using a 2D screen. I mean, you've got to think that you're using in a lot of cases a tablet or a mobile device, which presents those objects into the world. So, yes, it is anchored. Yes, you have movement. So, you have a six degrees of freedom in a lot of cases because you can rotate and move and translate within those environments. So, it gives a sense that you have a virtual augmented environment. However, you're right in saying that unless you have it displayed stereoscopically (i.e., using a head-mounted device or, in the future, contact lenses), then we are only getting a single-view vision using that one camera and screen.

Phelps: Okay, so, it seems a little bit more, I guess, simple in a way to virtual reality. It's not as complex and not as many senses, I guess being augmented there. Well, is there a halfway ground between these two? Is there something where we can still have a headset and still be immersed in an environment but still be in the real world as well?

Moro: Well, this is a term of mixed reality. So, mixed reality is something which is a is a tricky one, where you have devices, such as Microsoft HoloLens is one, for example. They call them the mixed reality devices, where the problem is, it's a bit of virtual and a bit of augmented. Do we need a different term for it? For me, wearing the HoloLens, the first time I put it on, it was something different. It displayed initially an AR-like model of a dog in the ground that you could walk around and pat. And then, there was another sort of scene where you were in Venice or Rome, actually, and you were in a fountain, and it became like virtual reality. I couldn't see the walls around me. So, if

somehow the machine converted to a virtual reality, so there was that device. It was able to mix between augmented and virtual, and I couldn't pinpoint which one it is. The thing is, I'm still in the ground. I'm still in my own reality, so that's pretty more augmented. What do you think mixed reality comes in, James?

Birt: So, obviously, if you look at the continuum of the mixed reality, you're sort of going from a real-world physical environment through to that spectrum of full virtual. Mixed reality sits really right, if one was to look at it, aside from the continuum, but to actually pinpoint it on there, you would say it's right in the centre. It is essentially right at that midpoint where virtual and augmentation or the real world come together in a full blended environment. So, how does one approach these things? Well, it's this idea that, in a way, we have no sense in our mind of the difference between the virtual space and the physical space—that we truly believe across all of our senses that we are within that environment, that reality, that our reality, our human reality is actually a mixed reality between the digital and physical space. And of course, that requires not only the three factors (i.e., haptic and hearing and vision), but so many other factors. Like you said before, if I walk around that space, I need to be in that space—that if there is a chair there, I need to be able to sit on that chair and that is part of my reality. So, we are a really long way away from being able to create those types of environments. I mean, these are the things that you sort of saw in Star Trek and that sort of stuff.

Moro: So, well, the devices now that are marketed as mixed reality devices then…Because this is my problem, I've had on three occasions gone to publish articles on the HoloLens, which is called a mixed reality device. And I've called it mixed reality. And the reviewer has said, no, that's just AR, and they're right, even though the marketing and the device on the box say, "Windows Mixed Reality", it's not. It's sometimes marketing, and yes, I see it as a different device now because it can do both AR or VR. The problem is only doing one thing at a time. It's either doing AR or VR. In those studies, yes, we were doing a mixed reality device, but I was only using the AR capacity. So, we called it AR. But it's just interesting that we have these terms. When it actually comes to defending them, how is it different from just augmenting your current reality? It's not. And this is, I guess, the funny thing is that we just spent now 24 minutes talking about exactly this, that, you know, how do you get into the space? Oh, we use VR, and yet, we can't even decide the full definition. So, I guess we have decided: so, for one, currently so virtual reality head-mounted display to ideally three sensors involved is the virtual reality where you can't see anything around you. Augmented reality is, in its current form, you need something anchored? That was what you thought. Yeah, I agree. Yep. So, we need something. Using a device with a camera that can see through that can add an anchored model object calendar, whatever it needs to be, but can add something to your world to augment it, whereas you're still in that space and you're still in the world. And mixed reality, at the moment, is something, which is the future. It's there's nothing yet that can display it.

Phelps: So, then from there, can we then talk about some of the educational benefits from it just to sort of then sum that up and put it into some perspective as well. So, when should we use each one, and what technology or devices should educators choose, and for which purpose as well? And I think it's great that we have to, you know, associate professors here from two different areas and fields. So, it would be great to hear from both of your perspectives, what you think for that, those educational benefits.

Birt: So, I think, Charlotte, you mentioned it before in your in your piece a few minutes ago where you said, I'm not sure, I don't know where it fits, etc. There's two different questions there. You've got the technological question, and then, you've also got the pedagogical question. So, what I might do is I might sort of tackle the technological question, and I'll get Christian to tackle the pedagogical question. So, I guess when we think about the technology, if we're in the classroom and we're trying

to take a student away from that space and we're trying to get them to visit somewhere that that is not in that physical location, then we really want to explore something like virtual reality—that ability to immerse them in an environment. If we're looking at areas like high risk, if we're looking at areas around scale—so whether that is human scale, whether that is macro and micro scale—these are the types of areas where we may want to consider using virtual reality, because it allows us to embody those. In terms of the augmented reality, I think when we're trying to simplify. So, VR tends to be a lot more complex, because it's using a lot more of your senses. It tends to make you feel a lot more stressed inside those environments. So, when we're trying to simplify and just present certain facts or knowledge elements, whether that is like a three-dimensional view of a building or of an anatomical structure, then I think that approach of more simplistic and just using it to give what you're trying to achieve, which might be spatial understanding or scale understanding or being able to understand that things aren't just in cross-sections and cut throughs, that we actually have an object that is three-dimensional and that we can look at it from lots of different angles. I think that's where AR is really helpful. Likewise, I think from an accessibility point of view, the ability to use a bring-your-own smartphone device with augmented reality is certainly far easier for an educator and also the institutions to be able to utilize smartphones or tablets, whether that's brought your own or whether that's supplied by the institution. So, I think from almost like an accessibility and scalability factor that we really need to look at AR as a lot more accessible than perhaps virtual reality, given that there is a movement away from putting your smartphone into a Google Cardboard. I mean, all of that is essentially deprecated now. It's not even available. So, the headsets are moving towards that six degrees of freedom. And they're still relatively expensive, given that $600 or $700 purchase, alongside the fact that you've also got a smartphone, means that it is an additional expense. It really is then needing to be warranted on why one would be using the VR device as opposed to other devices. So, I'll pass it over to Christian now.

Moro: I'm thinking more as an educator in class. Five years ago, I was using a lot of VR actually, and there were times in labs when it was dead silent. That was the Gear VR at the time. Every student is sitting there and silent, and I started to learn. Now I'm using it a lot more reserved, because there's a benefit of being in a class around other people. There's a benefit of being with an educator and an instructor and working together. And you can ask questions and answer questions. Charlotte mentioned it perfectly, but she's like, I can't even take notes when I'm in VR. You can't see the world around you. What it does offer, though, is stereoscopic depth perception. So, I'll now use virtual reality for very small amounts of time. For example, if we're teaching the brainstem or the inner ear, great examples where illustrations just don't do it, and I need to blow the object up bigger than you'd ever see in a cadaver. This is a very unique niche areas of biomedical sciences and medicine, and that's useful there more than the others because you can see the depth. You can see which bits are behind which bits. You can see insertions of little muscles and nerves and where they come in. So, that makes a bit of sense, but very rarely because you've got a class, everyone's learning, and then it goes silent as people just sit in their own world. And I think collaborative is better when we're together in a room, and that's where AR has been much more useful. So, I've actually converted a lot of the virtual reality things that I've used back into AR. It's not as amazing depth perception, but it works. It's still better than illustration in a textbook. So, I, like you, said it's more accessible. It's easier to set up. The students aren't lost. You can see what they're doing and help them. Whereas, in VR, you try to troubleshoot. Half the time the students can't see the model or the object, and they're spinning around. You're wasting valuable learning time. So, I found that they're all useful in a way. For me, the virtual models have been the big thing. So, it's all about how do you display a virtual model? Augmented has been working great for that. And I think it's been fantastic for learning, and it helps. But there's still also is it doing more than just having the silicon models in our labs? We just

have like a model of the brain sitting they can hold or 3D printed, probably not a little bit interactivity. We can add some audio, but it's one of those things that I'm using more and more sparingly. Our research has shown consistently that students enjoy it, and I think Charlotte actually pretty much said it exactly. Students enjoy it. They enjoy learning from something different. But it's not benefiting or impacting their learning; what helps their learning is us as educators, guiding them through that experience, whether we do it from an illustration, we draw it ourselves, we give them a virtual model. So, if you're not using VR, I don't think you're inhibiting or harming the students in any way with their learning. If you are using it, great. It's the same, but it's one of those things. Take it with caution. But yeah, so VR meaning depth perception in particular. But I don't like to take them out of the environment. Augmented reality has been fantastic. As long as your reality's needed, you need to add to that reality, or can you give them something? But the best thing still is, and I think 3D printing is like an old tech. But 3D print the inner ear, and you can hold it and see it like never before. So, we're moving away from that traditional tech of 3D printing, but yet, this hasn't really added that much yet to the real world. The other problem is virtual models are still not that lifelike. I know they can be, through photogrammetry and things, lifelike. Virtual models are still look like virtual models. They're nothing like the real world. The colours are a bit off, the shapes are a bit off. So, it's something that yeah, watch this space. But at the moment, it doesn't inhibit learning, and it's fun. And anything that's fun that helps them learn in subjects that are otherwise dry has brought a bit of life to that, which has been fantastic. So, I do like that.

Phelps: I think that's a great summary of all of those technologies after talking about the complexity of them and then just bringing it right back down into why we are actually using it. And I know for certain, that has definitely helped my understanding with why we use it. And I do really value using the technology. I think it's amazing that we have access to it, and it's really fun. So, thank you so much to Associate Professors Dr. James Birt and Dr. Christian Moro for helping with some of that understanding around these technologies that we can use. And I hope it has cleared up some of those confusions for others as well out there. Thank you so much.

Moro: Thank you.

Birt: Cheers! Thank you.

Closing

Phelps: And that concludes another *ASCILITE Wavelength Podcast*. I have been your guest host Charlotte Phelps. Thanks to my colleagues James Birt and Christian Moro from Bond University for joining us.

Music for the podcast is produced and performed by Kevin MacLeod of Incompetech.com. Thank you for listening to the *ASCILITE Wavelength Podcast*. Find out more at ASCILITE.org.