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Rebecca Allen and Scott Fisher: Virtual Environments, Virtual Reality and Associated Realities

LACMA Art + Technology Lab Conversation Series

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*I wanted a digital aesthetic. I wanted a kind of abstract look, certainly for the characters, but even for the landscape.* - Rebecca Allen

*One of the most exciting things down the road is being surprised by these spaces.* - Scott Fisher

Peggy Weil: I want to welcome everybody to the inaugural Art and Technology Conversation Series. Tonight we're going to discuss Virtual Environments, Virtual Reality and Associated Realities, and look at these technologies within the tradition of landscape and portrait, poetics of space, and place considered within the tradition of art practice and from the point of view of artists.

I'm going to do a very brief introduction and introduce our speakers, and then we'll look to the present and to the future, to address the challenges and potential of the medium as it stands today. We'll also consider the capabilities of a technology that is being developed, aggressively marketed and funded by commercial gaming and entertainment (acknowledging also the military's role in this development) and ask what the relevance and the promise of VR and AR are for individual artists and art and art venues.

This morning, while considering the topic of virtual environments, I thought I would cast about my immediate environment, and I really didn't have to look far. Here we have the cover of the January 19, 2015, issue of *Forbes 30 under 30*, and the caption reads "*Palmer Lucky, Age 22, Facebook's \$2 Billion Man Legitimizes Virtual Reality.*"

But then even closer to home, (note, these props are atoms not bits) the front page of the New York Times Business section today, Thursday, January 22, the lead article in the Business, headline reads, "*Jumping Into Augmented Reality, Microsoft introduces a 3D Headset.*" And because this is a newspaper, I'm actually going to read the relevant part of the article: "*More important than the device's performance, though, is its apparent utility. The promise of virtual reality is held up often in tech circles these days, but the practical uses have always seemed limited.*"

I think tonight's talk enjoys good timing because here, at LACMA, we can consider the impractical and, if not the illegitimate, the *legitimate-neutral* or non-commercial applications and uses of this technology.

Even though VR and AR have only very recently landed into our hands as something accessible in the form of \$300 dev kits, these technologies have a long history, and we're lucky to have two speakers tonight who are colleagues.

Rebecca Allen is a media artist and researcher whose work spans 3D virtual environments, artificial life, augmented reality, mobile applications and unique multi-modal interfaces. She's pioneered the integration of computer graphic animation and live performance venues for music and dance, collaborating with, among others, Twyla Tharp, Kraftwerk and DEVO. She's held positions in research and industry from games to mobile, and is professor and founding chair of the UCLA Department of Design Media Arts.

Scott Fisher's work in research focuses on immersive environments and technologies of presence. As director of NASA Ames View Project, he pioneered the development of key VR technologies integrating head coupled displays, data gloves and 3D audio into immersive first person experiences. He was the co-founder of TelePresence, Inc., where he continued these developments. He is professor and founding Chair of the Interactive Media Division and Associate Dean of Research at the USC School of Cinematic Arts.

What neither of these paragraphs really address is that both of you began your trajectories and careers as artists. Certainly, Rebecca at RISD and perhaps before as a student, and Scott certainly before and as a fellow at the center for Advanced Visual Studies under Otto Piene at MIT, and both of you migrated with an art practice into these institutions: MIT, NASA, Atari, Nokia, Apple that had access to this technology.

And I venture a guess, and this is what we'll talk about, is that neither of you went there because you had glitter in your eyes about technology or wanted to become programmers or were particularly interested in computers or engineering, but instead, and I'm familiar with your work, you were compelled to follow up your interest in deep space, deep time, doing stereo, tracking humans and interactive performance space, and actually needed access to these equipment, which offered an avenue to express these things.

We'll start with by giving Scott and Rebecca a chance to show a little bit of their work before starting a discussion. Thank you very much.

Scott Fisher:                   Okay. Thanks, Peggy. Let's go to the way back machine. Here's the '50s and '60s, a lot of interest in 3D comics, 3D movies, and this amazing this called *Sensorama* that was built here in L.A. My friend Mort Heilig lived in Pacific

Palisades, tried to sell it to Disney, and we can talk more about that later, but this is kind of my main inspiration, was thinking about these 3-dimensional images.

The one thing that probably goes through my complete career, which I'm still involved in now, is making stereoscopic images. And here's some examples of a kind of library I've done of images that can only be taken with a stereoscopic camera that is two lenses, two eyes binocular vision. I've made a lot of books, hand-bound books and stuff, with 3D images in them.

I followed demolition companies around for a couple years doing stereo photos of the buildings being torn down, and then representing them so the original building to one eye and the open space that it vacated after it was torn down to the other eye gives this kind of interesting representation of the kind of spatial occupation or presence that that thing would have, and I can talk more about that later.

I ended up working at the Center for Advanced Visual Studies as an artist in residence at MIT for a few years under Gyorgy Kepes and Otto Piene as Peggy mentioned. And being at MIT was like being a kid in a candy store - amazing technology, amazing resources of people in just any domain you could imagine. And I eventually got lured from CAVS over to what was then called Architecture Machine Group run by Nicholas Negroponte, which then morphed in what's now called the Media Lab.

The amazing thing was that building the technology there was an opportunity to take the stereo stuff I'd been doing beyond just a simple photographic process to using things like head tracking devices that originally had been used for military pilots to do weapon aiming. So, we used those, actually, for a lot of different projects. I was able to do a 3D drawing system by drawing a 3D space, near field drawings where you could build these 3D objects, and then eventually trying to think very specifically about this issue of first person viewpoint, first person experience.

So, on the left of this image is a early image by Hermann Helmholtz, a psychophysicologist thinking about binocular vision and field of view. And then on the right, a picture, of course, by David Hockney. We took, I think, 18 images photographically to represent the same kind of field of view. So, this is a question that has really intrigued me for a long time. How do you give that sense of presence, a mediated sense of presence, using everything from photography to these head trackers to gesture input and on and on and on? I'm going to show some more examples of that later.

One of the main projects I worked on was trying to make this, which was called viewpoint dependent imaging. The idea was to track head position in front of a monitor and move back and forth so that as you moved your head, the image would change. We would shoot thousands and thousands of pictures of a particular scene, store them on video disc - I don't know if any of you have seen a video disc; a big shiny thing - and program it so that you could move around and get motion parallax.

Motion parallax is a very strong cue for depth. And I felt like I could die at that point. I mean, this is the ultimate stereo image to be able to have - look right - it was effectively like a hologram, but it in the video domain.

I ended up going to Atari, and that closed down quickly. I went across the street, started working for NASA, and specifically developing interfaces for the U.S. Space Station. I had worked at Atari on interfaces for arcades, trying to make a multi-sensory arcade like Mort Heilig's Sensorama. We tried to hire Mort. NASA ended up being the one place I could actually do this stuff. They were very excited about this idea of an immersive space as an interface to all the different kinds of things that happened on space stations.

So, here I am, arts background, coming through MIT, getting a little bit better at the technology, and then people like Marvin Minsky coming in and teasing me about, being a rocket scientist. He's, like, what are you doing here; you know? You're an artist working in NASA. It makes no sense. So, I think that's a good thing. So, maybe that's another thing we can come back to.

Those are a couple visions, the first head-mounted displays. This is about '85 to '88. NASA lasted for a few years; actually, quite a few years. But at one point, continuing to get the funding for my group to keep building the technology seemed like a kind of a pointless task. Also, they wouldn't let me go to an art conference to talk about what we were doing and, so, I quit.

I ended up starting my own company called Telepresence Research. The focus of that was really to think about the content. We'd spent now over a decade building the hardware; the gloves, the head tracking, very wide field of view displays, looking at all kinds of other things. And the whole reason the whole team had gotten into this in the first place was to be able to design the content, interesting experiences.

The focus on the company then was to do experiences mostly for theme parks and museums and other venues like that. I got a commission from the Pompidou Center in Paris to do an installation of a new piece that we called *Menagerie*.

One of the main things for me at this point was that all the virtual environments we'd done to this point were really pretty static. They were just pretty low-res graphics. You could go in, you could walk around, you could explore a little bit, but after a few minutes, it's just totally boring because there is not much else to do. So, the point of this piece was to make a more responsive space. To literally have it populated by these characters.

These were programmed by Michael Amkraut, Michael Girard and Susan Amkraut with a generative soundtrack by Mark Trayle (now at CalArts,) and there was spatialized sound so that these things would sneak up behind you and you could hear them coming. And if you turned, they would run away. There were flocks of birds around on the ground. If you moved up to them, they would flock and they would fly off.

Now with the graphics we have now and the computational technology we have, that's no big deal, but at the time it was a huge kind of *aha* moment in the sense that all of a sudden, the space felt incredibly alive. And I think to me, the sense of presence there just went off the charts. I couldn't believe what was happening. So, we continued working in that area, although we did a bunch of other projects to pay the bills.

This particular one is the Virtual Brewery Adventure in Tokyo where there were 12 different viewing stations and one interactive station where one guy drives so everybody else's was kind of 'brain in tow' and you get to fly around inside the beer making process. All the yeast is blowing up around you. It was fun to make. Sapporo Beer paid a lot of money for it. We got a huge number of visitors going through this thing.

So, this and the Pompidou were both public installations at a time when there was so much hype about VR and nobody had really seen it. It was kind of fun to get stuff out there and get feedback about what worked, what didn't work. This project ran, I think, for seven or eight years 24 hours a day on some SGI machines, but it was pretty whacky stuff.

A transition point for me then was, that the VR stuff is great, and we were making a lot of progress, but it was just, in the U.S., impossible to get funding. I had always been very inspired by Robert Smithson, you know, a lot of the earthworks artists: James Turrell, also Robert Irwin and Andy Goldsworthy, to some extent. To me, those artists are doing something with site specific work that is, in a sense, augmenting that space.

And to me, that was something that was really interesting that I thought that I could also do with technologies.

I ended up in Japan, and as many of you I'm sure know, there's an interesting landscape practice in Japan, especially gardening practice, but there's this idea of *Mitate*, this idea of building something into the landscape that alludes to other things. It's not just about the landscape, it's about memory, it's about evoking associations with all kinds of other things that maybe you did before or maybe that you've read about.

And I thought, boy, in VR we never got that; you know? All the virtual spaces we made were completely flat. The kind of emotional power of them just wasn't happening at all. So, I was really perplexed about this, what do we have to do to invest that into these virtual spaces? So I went on another direction, and we - around '99 - we started building up more of an augmented reality system to superimpose graphics onto our physical space.

It seemed like a logical thing to have the virtual start leaking out into the physical world, right, because it was in many other ways. Here's a system that we took maybe three, four years to build where you could walk around the campus where we were working and use your mobile phone to just click on stuff, and then you would see 3D graphics super-imposed onto, say, a tree that you clicked on. It was like a virtual field guide.

Here's something called a *Chushakuza*, which in Japanese means roughly 'annotation theater,' so we designed it so that with the augmented reality headset, browsing the space you would see virtual objects and virtual stories and texts authored by other users embedded in that space. So, it was this memory and story space.

I'm going to try to end with just a couple things to that, again, have inspired me to suggest where things might go now. I've always wondered, and I've always regretted

why we went down the path of photorealism with a lot of the early VR stuff, and it's happening kind of all over again. And I think it's not a good rabbit hole.

The nice thing about VR is that you can generate these worlds that you can't go visit every day. I mean, for simulation, for training education, great, yeah, we need it for that, but there are so many other things we can do. I mean, what would a Kandinsky watercolor be like in a virtual space? This other image I put up is it's a kind of an interesting etching of sort of multiple spaces running together, which, again, we don't have these same kind of physics to deal with.

And then last of all, I think some of the current work I'm involved in still with augmented reality is more about showing multiple scales being able to move around within a wide scale of information about a particular landscape or environment that surrounds us.

Rebecca Allen: Thank you. So, we share a lot of eerily similar paths, but maybe approaching things from a different direction. I was, as an art student, working with drawings and graphics, and at some point said, I really want things to move. So, that got me into motion-based work, but I thought of it as experimental kinds of animation, and I started to make some animated films this way and realized the huge amount of work and labor involved in doing animation of any type without a computer in the old days. This was in the early '70s.

And while I was in art school at RISD, at Brown University next door they were doing some very early work in computer graphics, and I had heard, maybe on some TV show, that computers might be able to be used for animation. I remember at that time when I thought of my life as an animator, I actually talked to someone and found out women weren't even allowed to be animators in the animation industry then. And I thought, well, that's not going to work out very well.

You could be what are called in-betweeners: you make the in-betweens, the master animator draws the images. And I thought, I want to make my own films, but I know they're going to be taking too long, and that was one of the motivations to look into computers.

The other motivation to look at technology is that I really admired a lot of the work in the art movements that were coming out of the Industrial Age where artist and designers were trying to help society understand this machine age that was starting to be all around them. And movements like the Bahaus and constructivists and futurists. So, they were big inspirations for me.

And I thought, okay, now in the '70s, what's going to be the new thing? And I thought the electronic age, the computer age, it was just starting to happen, just starting to be talked about, and I thought it was really important that artists would get involved in this new technology because even today it's still mostly run by engineers, computer scientists, and I think it's really slowed us down and - and made it a lot less interesting than it could be to have lacked that artistic vision.

Since then, since way back then, it's really been a vision of mine to infiltrate this highly technical world. And at that point it was very highly technical because a computer that's way, way, way slower than my smartphone, by a long shot, and would cost millions of dollars, be huge, and you would have to go to some industrial place to do it. Brown had a couple of these.

I dug up some of my very first computer animated pieces working in this kind of very tech lab-like environment, I wanted to shake it up a little and intentionally wanted to use the human form, I wanted - I had this idea, I want to get a human and a life-like natural presence in the computer, so here are some of the first drawings I made on a grid. These were two-dimensional based on a movement piece that where the computer

would be the in-betweener. And, so, now I had my in-betweener, and I could be the animator.

The was the first piece I animated on that computer at Brown. These are just some of the drawings from it, all, like, following points, tracking points, figuring out where it goes, and it was from some films I was working with of these kind of old '50s girly type movies. This was the first animation that appeared on their screen of this woman, lifting her dress up. And some people didn't get the humor of it, but it was part of my sense of, I'm infiltrating a world that I really don't belong in and, so, I might as well go all the way with this.

And even with my animation, this is using Sharpies and Letraset and stuff you don't even know about, most of you, ways of doing graphics work. I used a lot of graphics tools, these are coupled frames from animation I did. But I was, even then, though this part wasn't done on the computer, what was very important to me is what will be this digital aesthetic? We've got a whole new set of tools.

Scott mentioned how as these computer tools progressed, as 3D graphics, 3D modeling progressed, again, I think because it didn't have the artistic influence it was, like, let's build a sofa that looks or chair that looks just like this, and a table look just like this, and we'll get the light to reflect exactly the way it does, and I wanted to go the other way; let's create a new aesthetic that's really a digital aesthetic.

I also went on to go to MIT, but I'll skip over that period. Following MIT I went to a place called Computer Graphics Lab in New York, and they were doing some of the first computer modeling and 3D animation systems. And, in fact, Ed Catmull was the director there. Some of you may know him. He's the long-time founder and head of Pixar, and did some incredible early work. And this, actually, is a model of his ex-wife, one - the first human models that was ever modeled.

I was on a mission to take this model that was just a stiff mannequin and get it to move and try to bring it to life. And in this picture, which was the part of the first animation I did of just trying to get this character to walk up the stairs with all the symbolism that brings and this idea of going from a wire frame, and then we were working on getting things to be smooth shaded. So, this was part of this sense of, what is the digital aesthetic?

Later in that time in '82, Twyla Tharp, like a lot of people who were interested in new technology at that point, found their way to our lab. I had done some earlier work with human motion besides the piece I showed you, so I ended up doing a collaboration with Twyla Tharp called *The Catherine's Wheel*. David Byrne did the music. And in this case, I created a computer-generated saint, Saint Catherine, that she wasn't able to present in her live performance, but with this being on film, we could do it. And this was, all long before any commercial software existed; it was very much a research project.

But because I was an artist, I didn't want the research just to be in papers and tech conferences. I wanted it to be out to the public and get people turned on to what this new technology could do from an artistic perspective. And again, thinking of - you probably can't see too well here, but even the way I was working with the character form here, instead of just a wire frame character kind of image, I would throw out a few of the vectors and try to make it a sketchy kind of a look. So, again, working on this digital aesthetic but something that went a little further artistically, and a saint being a kind of ephemeral creature, this sort of representation worked for me.

Later, just some of the other works I was involved in designing, directing some music videos again because, as an animator, MTV had just started, and I thought, wow, finally there's a popular format for short films, animated films, and that naturally led me to music videos. People found me in various ways, but I took on the task of creating computer animated music videos as art works with some music behind it. That's the way

I saw it. And, again, trying to use some of our techniques to develop a style, a kind of look that would just be impossible to get with any other kind of technique. Here's a few frames from that.

I have a couple pictures from Bauhaus Theater, a big influence of mine as well, and this character was inspired from that. And then I worked with Kraftwerk, a perfect collaboration, Kraftwerk German musicians were totally dedicated to creating a digital sound, not analog, to create a unique digital sound. And then I was trying to do the same with the images. So, it was inspiring for both sides to be working.

I was able to influence some of the music, and they definitely influenced me. I always had to put this under research. I'd always have to have the excuse, this is a research project. In this case I'm working on facial expressions and parametrized faces that we were working on to get the faces to move. And, so, this could justify getting researchers to work on these music videos.

And then this would serve like the album cover for the album back in the good old days when your work could be in a big album, and it looked nice and big. I didn't want realistic faces, I wanted, I called it a cubistic look, this kind of faceted look; so, trying to explore this look of a digital image, and then this came out of a video work. And then here, actually, is Kraftwerk who recently performed here in L.A., they took this and it inspired them to make their own wire frame costumes. Life inspired by art in this case.

So, once computers got to be fast enough, the way I saw it to do virtual reality, meaning you could render images fast enough that you could interactively move through a 3-dimensional space, I took a weird side track into the games industry. I thought I could maybe influence it in some way, which was a total joke in the early '90s, but I did learn some things.

And then I'd left and went back to UCLA, where I currently am, and decided to put together a unique system to build an artistic system to build virtual environments, virtual worlds, but, of course, most importantly, I was interested in the life in these virtual worlds. That's always been my interest: the life forms. I had moved into an area called artificial life. We created our own system, and it was meant so that artists could use it, too; easy to use, but very technical kind of a system, to create behaviors, and relationships, and reactions, and feelings of these characters.

You could define what kind of personalities they were through their movement, whether they were timid or aggressive or they liked this character but didn't like another. So, we had to build this all ourselves. Nothing was existing at that time. This was in '97 when we started this. We called the project *Emergence*, and we built our own special 3D engine. It was all PC at that time. And a specially designed engine built by Loren McQuade and a couple of great undergraduate students at UCLA at that time - along with this behavior scripting language.

I wanted a digital aesthetic, I wanted a kind of abstract look, certainly for the characters, but even for the landscape. The landscape had more of realism, but the colors were more synthesized. And then we defined this world of artificial life. What inspired me to do this is as I was thinking about virtual reality and people were talking about avatars, most of you probably know that term. Avatars are referred to often as it's how you, the real person, is represented in a virtual world.

And I was thinking, what about our bodies? So, if we're all going to be immersed in these virtual worlds, it's kind of all in the head. Where are our bodies? Are our bodies in the world? And, so, I came up with this piece called the *Bush Soul*, the title came from a West African belief that we have multiple souls: we have a soul in our body, we have a - a dream soul, and they had something they called the Bush Soul, a soul that would live

in wild animals in the bush and would, sort of, inhabit wild animals. And this gave me the inspiration for this piece.

I thought, okay, as a human, I'm going to enter this world of artificial life in a virtual world, and I'm going to even inhabit some of these creatures that we built, and I was represented or the user was represented as a sort of sphere - a sparkly sphere of particles. That was your soul. It would enter the world.

Here's a few of the images from the world, the landscapes. Creatures were going through their lives and , when we'd show these in art installations, you'd have a joystick to navigate your soul, which is that little sparkly thing in the middle there, and you'd wander through this world. But I wanted to bring the physicality in, too, so I used a force feedback joystick, which I was looking up - they aren't even making them anymore, which is really weird, but there were a number of force feed joysticks coming on the market, and this is in the late '90s. And, so, you would be navigating with this joystick, but in this world that we created, there was a sense of energy in certain parts of the landscape, the way a lot of cultures feel like some part of a landscape has special energy, and we embedded that in the world. When you would get to that place, you'd start to feel the energy through this force feedback, so it was a way that your body could actually be part of this virtual world. And, actually, only through the sense of touch could you get a certain type of information about the world.

Like Scott, I went from virtual reality into augmented reality because I wanted to be also in the real world as well as virtual world. This is 2000, this came out a commercial device. Take that Oculus Rift! I don't get the Oculus Rift thing because there's been a number of these things on the market, and Oculus Rift is only the newest one.

But there was an experience here, I won't show the video for it, but you would collaborate with someone, you would blow into the device, and you'd see this little

stream is your breath; that's how you'd navigate and interact. And then I admit, I worked with eyeglass displays in 2003, more like bifocals. Here is an example of them. And just for fun, here is me turning on the Google guy, Sergey Brin, to eyeglass displays which people are crediting as where they got the idea to do Google glass.

Scott, I'm going to ask you a question, if I could. You're very involved in environments and have been with your work that I know in stereography, the stereo image, but you talk about the stereo image and a displacement of time, and I don't know if that can relate to VR, how you see VR today, if that's somehow that sense of playing with a displacement of time in any way affects virtual reality?

Scott Fisher: I'm not sure I can make a connection to VR, but what I was trying to do, I showed some pictures following the demolition companies around, and the other piece of that was to not only to document it and think about disparate, like I described a little bit, about disparity in time between the two eyes, in addition to the spatial disparity of 65 millimeters to get the stereo image - but I also followed them to where they took the stuff for recycling, and I went back and did a lot of research on where the original materials for the building came from.

In one case, a granite building in downtown Boston, which led me, of course, to a lot of the granite quarries in Central Maine. I ended up photographing the quarries in stereo, and I've been doing that ever since. I spent the last six years filming every quarry on the island of Vinalhaven that hopefully will be in a little stereo book soon, but the interest there for me is to try again to look at this idea of permanence and spatial occupation and, question what the sense of solidity, and sense of change means and how could I get myself to be more aware of things changing around me: Could we use technology to do that? And I think certainly augmented reality can do that now. The obvious example is the then and now photos.

There's been a lot of really wonderful work recently of being able to now superimpose photos or even 3D models, to some extent, of previously existing structures onto spaces where they used to be. In an immersive virtual space, I thought probably one of the most interesting things that we'll see as a result mostly of Google Maps and the other services that do that.

So, if you think about it, Google's cars go around and around constantly. I don't know what the current cycle is, but they're constantly updating the models that they are recording of the world pretty much everywhere. Now it's even under water, they're mapping everything. Once we get another 10, 15 years into this and we've got, you know, maybe, hundreds of cycles per year, that starts to become this kind of incredibly dense database of landscape that you could then imagine that you could start navigating through in a temporal dimension in an immersive space; does that make sense? So, it's kind of like this interesting time machine in a way; right? That's something that I think would be an amazing application - to get that to work. Can I ask you a question?

Rebecca Allen:       Yeah.

Scott Fisher:        You brought this up: ever since I've known you, you've been animating human motion, and I know that's absolutely critical of importance to you but one of the things I just realized as you talked about it is we've never talked about the representation of ourselves in these virtual spaces.

And for me, when we built some of the first NASA spaces, back in the '80s, people would get immediately SIM sick. I mean, they'd get dizzy, they'd get headaches, and I couldn't figure out why that was happening. And at the time we were working on the glove, we designed these data gloves. We had VPL build them for us. And then we got them in there, and we had a virtual model of the hand driven by your own hand. And as

soon as we did that, people stopped getting or stopped complaining about being sick. As soon as they had a reference point for their own body, it made this huge difference.

But now I still see virtual spaces with really clunky characters, badly animated characters, and barely - some are starting - I think maybe Apple or Google just patented, actually, technology to have a video camera on the headset to see your own real hands in the virtual space. So, that could be interesting. But the question is, and that's your expertise, how much of yourself do you feel like we would have to see in there and how can we animate it in a way that - we're not talking about body suits, are we? Because that would be crazy.

Rebecca Allen: Yeah. I struggle with that, too, because when I see virtual worlds with human characters in it, I'm more drawn to the human motion. I think that it speaks to us.

Scott Fisher: But it's so hard to do. I mean, because you know right away when it's wrong.

Rebecca Allen: Yeah. But if it's an abstracted form -

Scott Fisher: Oh, sure. Okay.

Rebecca Allen: - then you can - you get the essence of the human motion -

Scott Fisher: Sure.

Rebecca Allen: Without it, if you're trying to be photorealistic and something is a little bit wrong or you have a human computer character and the movement is a little bit wrong because the human model is very realistic - then it feels wrong. But they've

shown that with just seven points on the body, you can easily identify human motion, even if it's male or female.

So, without much precise accuracy in the movement, I think people - this is something I've played with more - I think I'm more interested in an accuracy of movement and then total abstraction of the form because even if the movement isn't perfect, it doesn't matter if it's not attached to a realistic human character.

Scott Fisher: Ah.

Rebecca Allen: So, I'm going in another way where I'm more away from the realistic environment.

Scott Fisher: So, less photorealistic.

Rebecca Allen: - and more into -

Scott Fisher: Yes.

Rebecca Allen: - the abstracted.

Scott Fisher: Good.

Rebecca Allen: But I want not only realistic, natural human movement, natural movement in general, and in this a life system we built you get a sense of fluidity, there's a physics to motion. I think we really plug into that; it's part of our human nature to plug in to not just human motion, particularly human motion, but also animal motion, natural movement, physics based movement.

Scott Fisher:                    Hmm. So real hands could -

Rebecca Allen:                I don't know about real hands. Now, that's interesting this problem, I guess, of being disoriented, but somehow with your hand being involved, your hand physically being involved may orient you more.

Scott Fisher:                    Yeah.

Rebecca Allen:                And maybe that helped me with my virtual environment where people were always holding the joystick and actually getting this feedback from it, too, so you felt - your body felt attached to the virtual world.

Scott Fisher:                    Right.

Rebecca Allen:                I'm not sure, it sounds like more of a kind of physiological thing you're trying to solve -

Scott Fisher:                    Yeah.

Rebecca Allen:                - where I'm thinking just more artistically, you know, what looks good, feels good, and what are virtual environments like? What can we do with them that's different than what we've seen already? And maybe when we ask questions, I might find out from you guys if you have some ideas around that, too.

Peggy Weil:                    What's missing from these new cheaper systems that everybody can use? Do you still need to go to NASA or Nokia to do what you want to do? What do they have that you can't get in these packages that you might need to do something great?

Rebecca Allen: I think Scott probably knows the tech better, but for me, there's enough off the shelf tech, affordable technology now to do some very sophisticated work. There are game engines like Unity that you didn't have until a few years back, Someone's done the hard work of making this rendering engine. There are even artificial life systems now that you can plug in. There's affordable technology.

I'd like to see things go more with sensory input. I mentioned tactile, using sensors to do more in virtual worlds with touch, certainly with audio more fully realized, I've been doing this for 30 whatever years and have seen it go from completely unaffordable where you'd have to implant yourself in some heavy duty research lab to being able to do it to where you can have some of it at home and actually do some very sophisticated work.

Even this - this is some of the *Bush Soul* piece I was mentioning in 1999, the, you'd have to have the fastest PC that was out there, but even then it was a PC and not a Silicon Graphics machine. Now, you know, you could do this with the simplest machine and do real-time 3D.

Scott Fisher: Well - wow. It's a huge question. I guess one of the obvious things that we're still waiting for is that I think we've both gone through several projects where we've had to really build all the software from scratch because the tools to make the stuff just weren't there; right? So, the Adobe Creative Suite for immersive environments, is likely in our future. Unity is something that we use with the students because it ports to a number of platforms, it's pretty easy to program, so it's getting there, but that's really pretty entry-level stuff.

The physics engines, as Rebecca said, the game engines that are getting really good. We can use all that stuff. So, the physics stuff - I guess one of the things I'm most

excited about that we don't have yet are the kind of genetic algorithms to grow these spaces. Visual effects guys are doing this.

Rebecca Allen:                   Yeah.

Scott Fisher:                   It's in the industry. Eventually we'll get that, but to me, one of the most exciting things down the road is being surprised by these spaces. We can sit there and design them and build them and - and then kind of know exactly what you're going to see, but to be able to just plant a few seeds and have the stuff grow in a certain style, and change, and every time be persistent, and every time you go in there, it's morphed into something else, I think is going to be pretty amazing.

Audience Comment:                   [Question about the experience of wearing HMDs for long periods and potential for improvement]

Scott Fisher:                   The retina displays are a little bit better than the contact lenses. I think we're at a weird time. I think Microsoft did a really smart thing to announce the augmented display right after all this excitement about the Oculus. I'm interested in both areas, of course, but I do think the mixed reality area is going to be way more interesting. There's certainly a place for the immersive stuff. And, you know, to your question specifically, I think the trade-off is that the immersive spaces are better at a lot of things; right? So, we just need to really nail that down. The displays will get better. They will be contact lenses. I don't know. It's weird to see the resistance - I'm surprised by the Google Glass rejection. Have you read *Ready Player One* [novel by Ernest Cline]?

Rebecca Allen:                   [to the audience] How many people have put on head-mounted displays like an Oculus Rift? Whoa.

Scott Fisher: Wow.

Rebecca Allen: Love them?

Scott Fisher: How many got immediate headaches?

Audience Comment: No, the new VR is very comfortable.

Audience Comment: I wouldn't say that.

Rebecca Allen: Comfortable.

Audience Comment: More comfortable.

Audience Comment: Do you think about perception, about how human beings perceive things? I was wondering if you had any amazing insights or discoveries that surprise you about the way we perceive the world around us, and how technologies might create new ways of doing it?

Rebecca Allen: I think about perception, I think both Scott and I have. I'm interested in illusions to the perceptual system, which computers and VR can be very good at. I've spent time in head-mounted display worlds where even the piece I did was projected because when you're wearing those headsets and then you take them off it takes you quite a while to orient yourself back again to the real world.

This proved to me how much an effect this illusion of a different kind of 3-dimensional space can play on your brain and your perceptual system and deceive it, and then to actually watch how my brain, after taking them off, takes a while to say, okay, here I am

and here's space. I would not get up and walk around for a while, too. And this is what has been the downfall of those head-mounted displays as each iteration comes through the game world as, you know, people shouldn't be jumping in the car and driving afterwards.

But, and again, my interest in the motion side is that awareness from working with computers the way I have have, has shown me that we are so tuned to motion and particularly to the physics based motion, the realistic motion, and that we need very little visual representation to understand what that motion is.

Scott Fisher: I'll reference the *Sensorama* Mort Heilig piece and this idea of multi-sensory input. For me, I think the biggest revelation was how important it is to have redundancy. It makes sense; right? We're designed that way. We use our senses to calibrate and make sure that the information is correct.

I think, in particular, sound in virtual spaces, as we design these, is absolutely critical. We spent many years building this thing called the *Convolvotron* to do spatialized sound so you could anchor sound to the virtual objects and walk around them and have Doppler shift. And it, again, just like having your hand in there, was a big difference, having the sound, You know this from movies, great movie sound makes a huge difference, it's more than half the experience. So, that's something that I haven't seen a lot of work in yet, but I'd say that's critical.

Audience Comment: I just wanted to know why, why are we always trying to kind of escape or get away from this reality?

Rebecca Allen: You haven't figured that out yet?

Audience Comment:                    Like do you think we haven't explored this world enough? I feel like maybe there's still some exploration to do.

Scott Fisher:                    Yes, but we learn a lot from modeling this world and building these fantasy worlds. It all kind of connects back. I think also for me, that was part of the transition to augmented reality, it was in order to think about how the virtual could...and I tried for many years to call it environmental media, because it seemed to me it was augmenting my sense of presence. It was augmenting my awareness.

But whenever I gave talks about it, people would just protest and say, "Look, if I'm out taking a hike in nature, why do I want technology between me and this beautiful stuff? Well, sometimes we take field guides. I like having more information about what I'm seeing, the other term was context visualization; How do you provide more context, rather than less?

We see people wandering around on a hike, they see a tree they don't recognize and they go back to their office and their fire up a Google browser and ask, "What was it?" Why not do that in context on sight, using media to do that? It just seems like an obvious thing.

Peggy Weil:                    Why does it have to be an escape? You wouldn't say to a landscape painter, "Why are you bothering to reproduce the landscape?" So, for those of you who might be landscapists or making portraits of the landscape, I think there's something that the way these technologies are being developed and marketed that has predisposed people to assume that VR and AR are escapist, or are only for escapist or fantasy applications. I don't think it has to be that way. It could simply be viewed as a recording of some sort.

Rebecca Allen:                    Or an expression.

Audience Comment: Or maybe, you create these realities and you want to find a way where you'd be more immersed; in it where they evolve on its own with you in the reality. I feel like that's kind of the way the world already works; you know? Stuff changes all the time.

Scott Fisher: That's true. It's true.

Rebecca Allen: Yeah.

Audience Comment: Is it going to mimic that reality? Like, this reality now? How does that play out?

Rebecca Allen: And to agree with what Peggy is saying, art - you could say art in general can be an escape from reality. So, for me, it's an art form, and I guess I could say I'm making escapes from reality, so I don't just look at the mundane world, I see something new and different that enhances my reality. Why do people have to be on their mobile devices all the time now when there's reality right around them? There seems to be some attraction we have to being in what I call simultaneous realities

Scott Fisher: There are some mobile apps, I'm completely addicted to *Ingress*, a mobile game that involves you as you walk around Google's maps of your neighborhood, with all this overlaid data of these smoking portals that I can't not see now when I walk around. It's completely changed my sense of my neighborhood.

Audience Comment: What is it called? *Ingress*.

Scott Fisher: *Ingress. Ingress. Don't do it. Don't do it.*

Audience Comment: Can you comment on the systems available for scanning of 3D environments?

Scott Fisher: There's lots of commercial systems that have been, developed to create point cloud records of spaces. In fact, the new Microsoft Display has supposedly one built in to immediately map out the environment that you're operating in. And because of that, it then knows where to put the virtual objects and, knows where the occlusion is, etc.

It's a great thing to bring up, it's going to be a critical part of any augmented reality experience. We're starting to use them both in traditional cinema. There are cameras now made that take range maps so that, you know, you shoot a scene, you can then go back and do other camera angles without going back and reshooting it. We're getting there.

Rebecca Allen: This crucial part of what's happening to us all now is that we are already living in mixed reality, in these simultaneous realities. These tools like some of the things you talk about, commercial tools can build the reality we see perfectly photographically realistic, so we're able to create virtual versions of any part of reality now.

But what are we doing? And I have to think of this, too. What should artists be doing with this, what is society doing? They're attracted to it. Games are virtual reality and for many people, that becomes their reality, too. I think it's a big question that I'd like to see more artists seriously dealing with; what are we doing with all this? We're going very quickly towards this.

When I did early work, I had artistic ideas, and we actually had to slowly build the technology to finally do them. Now I'm finding that the technology is, for me, a little bit

ahead of the ideas. We've got some amazing technology, and I haven't seen some mind-blowing ideas coming out of the technology.

Audience Comment: I'm thinking about this in terms of neuroscience, and I'm really interested in spatial cognition. I'm just curious if either of you have worked with any of the neuroscience labs at your respective universities to look at the cognitive effects of exposing people to these virtual environments and what that looks like in brain mapping

Rebecca Allen: I'm familiar with the work, and I did one project with Skip Rizzo from USC at the Children's Hospital some years back using this system to understand the sense of pain, and if you can diminish the sense of the pain basically through distraction and immersion. And there's been a number of studies that's shown that this can be very effective.

There are more and more projects involving virtual reality, and sometimes augmented reality. And then now that we have functional MRIs so we can see what's happening in the brain as we're doing this, and there are mirror neurons. We can see these virtual worlds really can fake out our brains, too, and make us behave or think in different ways. They're very powerful. And I think more and more, this has come in to play in research labs dealing with neuroscience in particular.

Scott Fisher: Just a quick thing, we - we've been collaborating with the Keck Institute and some neurophysiologists and neuropsychologists down there for the last year or so, but the research is less about the effects of these virtual spaces. It's more about how the vision system works and how we could make better displays.

Rebecca Allen: Yeah. But I think it's a really rich area to do more in.

Peggy Weil: Very specifically, a reference to neuroscientists working with close collaboration with VR is Maria Sanchez-Vives in Barcelona with her husband Mel Slater, who's also one of the great pioneers of VR, so you could look that up.

Audience Comment: Both of you talk about emotional response for the projects you two have worked on. Which ones were the ones where viewers seemed to have the most profound emotional responses to the work? And not just a physical response, like, "Oh, I'm in a virtual space..."

Scott Fisher: I want to reference a piece that is more about immersive journalism. A colleague of ours, Nonny de la Péna, has been doing this work at USC to put people inside - literally immerse them in news events. And emotionally it's probably the strongest emotional reaction I've seen to a virtual space, of people coming out of these spaces, maybe five-minute experience, and literally crying just completely overwrought.

The scenes she's presenting are of Syrian refugee camps, of people collapsing in from a diabetic coma in a line at a soup kitchen in Skid Row, really tough situations where, and it's interesting because in those specific scenes, the viewer, the guest, whatever you want to call it, has no agency. You're literally there. You can't affect anything. And people will reach for their cell phones to call for help, when this guy collapses.

It sounds like I'm making that up; right? But it actually happens time and again. It's really strange that people want to have some agency and they think they can do something to help this guy and, overall, they get out there and are saying, just, like, oh, my God. So, there's one example.

Rebecca Allen: And then just getting back to my motion thing again and artificial life, this piece is shown to thousands of people experiencing it, and some

people will spend a lot of time exploring the world and really trying to understand and relate to the characters and adding personalities and say, “Oh, no, that’s the father...,” stuff I never imagined, but they really connect to motion.

And anyone who plays video games, especially some of these really immersive games, knows that you can get immersed even more so than a movie engages you, it somehow pulls you in more. And if there is an emotional experience to be had, again, it, VR, is faking your brain out. I think if it’s very immersive, somehow you just feel like you’re really in it and engaged in it more so than the experience. It’s the interactivity, the experience of watching a movie.

Scott Fisher: I mentioned this book, *Ready Player One*, before by Ernie Cline, it is often compared to William Gibson’s novels. There are a lot of interesting science fiction visualizations of these futures, and *Ready Player One* is an interesting one because in his future, for purposes of the novel, everyone is in virtual immersive headsets, you know, most of their day interacting with other people. It fascinates me. It’s a great read. But it’s interesting to see people’s responses. And more often than not, I find people actually thinking that that’s going to happen. So, my question is: Could you imagine that happening? Literally you can’t answer this because you already do it.

Peggy Weil: Should we leave that as a rhetorical question?

Scott Fisher: It’s fine if you want to - But I’m curious.

Rebecca Allen: That’s not so far in the distant future. It’s a couple of years from now, maybe.

Scott Fisher: If it connects us socially, if indeed Zuckerberg bought this thing to so that Facebook will eventually be a downloadable immersive experience

where you interact with your friends, I could certainly imagine that, and that could be interesting.

Rebecca Allen: I bet a lot of you are artists here. So, really take on the challenge to think about where this stuff can go.

Rebecca Allen: Thank you.

Scott Fisher: Thank you.

End of Recording.