JEFF MOTTE: So good morning, everybody. Thank you all for coming to the very first 8:00 AM session at AU. I know this is a tough one to make it to. Obviously, we've got a really cool panel today, kind of all focusing around VR and the AEC space, the architecture space. Curious how many people here are either using VR, MR, or MR in production right now? Wow, OK.

And of those who haven't put your hands, up how many plan do that within the next year? So it's like the remainder of you, good. So first of all, let me just introduce our panelists here and then I'm going to have each of them do a little intro. So we've got Joel Pennington here from Autodesk.

Scott Dewoody-- sorry, it's early in the morning here. From Gensler. Anthony Cortez from ARUP. And Gaspard from piranha in New York City.

GASPARD GIROUD: Hey, everybody.

JEFF MOTTE: Cool, thanks. The reason I'd asked you all that question earlier because we did a survey on CG architect I guess July of this year and we asked the same question of whether or not people were using VR at all. You can sort of see on the right hand side here, it's kind of the make up of who answered the survey. But when we dig into the details here, we asked which HMDs everybody was using.

So you can see, obviously, the Gear VR, the easiest kind of entry cardboard, the vibe, obviously really high. And we asked whether or not they're using it in production and then, of course, whether or not they plan to experiment with these same HMDs in 2016 or into 2017. And then I guess this is the part that I found really interesting, is whether or not people were actually using it in production.

And right now about 70% said yes and then 77% said that they would plan to do it next year. So I think it really kind of shows how timely this VR is and how applicable VR is to architecture and how excited everybody is about this space. So I just want to go down our panel here, maybe just quickly because I want to get into the questions, introduce yourself and just kind of what your role is with VR and maybe what you're working on right now.

So Joel?

JOEL PENNINGTON: Sure. So I joined Autodesk about 6 and 1/2 years ago from Disney. So I come from the film and game world. I spent many years doing virtual production for [INAUDIBLE]. And before that I worked at Electronic Arts building motion capture work flows for all the sports games that folks here hopefully play and love. And that kind of was a springboard to architectural visualization in a roundabout way. But the challenge that I was given was, can we take what we're doing in the entertainment space and make it available to folks in AEC.

And can we do that, not so they have to know how to use the game engine, not so they have to know how to go and do special technical direction work, but rather can they work from Revit, stay in a workflow that makes sense to them and get into an interactive experience very quickly. So tough, but we're cracking that nut.

JEFF MOTTE: Scott?

SCOTT DEWOODY: So my name is Scott Dewoody. I've been with Gensler for about nine years. My background is actually not in architecture. I studied 3D illustration. So I started at Gensler as a visualization artist. And now I'm what we call the firmline creative media manager. So I'm overseeing all of our rendering technologies, R&D into VR, AR, MR. Overseeing workflow processes and development of software that way, and tools internally. So that's my role at Gensler.

ANTHONY CORTEZ: Good morning, my name is Anthony Cortez. I've been with ARUP for 13 years now. And I work in the visualization group. And we support all of the different [INAUDIBLE]. Structural [INAUDIBLE] and acoustic [INAUDIBLE]. So my job is to basically work with them. Gather all of their calculation models and create an integrated model, which then traditionally [INAUDIBLE] the renderings or animations. But lately, we've started using virtual reality, augmented reality, to be able to help our clients visualize what their projects would look like, would perform like years before they get built.

So I've been doing that for a while now. It's a lot of fun, it's like playing with LEGOs all day. You know, I hope the share-- I'll be sharing with you some of the projects that I've worked on. I've been doing the VR stuff for quite a few years now. So I'm looking forward to sharing some of the insight with you on some of the projects and workflows. Thanks.

GASPARD GIROUD: My name is Gaspard Giroud. I am an architect by training. I founded a company with my business partner nine years ago. He's an animator. So we always did work between the world of architecture visualization and commercial work. And today, seven years later, we have a

company that has four divisions. One is advertising or communication, a creative studio. One is realistic branding, marketing and visualization. We just opened it. It's called Public Square.

We have an aerial filming division. We do a lot of visualization for architecture, so we did a lot of aerial filming and now we're doing it for TV and film. And finally, we just started a division for virtual reality and we're working on a VR platform. And that's how I joined.

JEFF MOTTE: Excellent.

JEFF MOTTE: So I think a lot of people that have just started to get into AR and VR, they're trying to figure out how they use this in this space. So I'm wondering, you know, one of the reasons we use it is to improve communication within the architectural space. I mean, do you think that's an important part of this? And how do we improve that process?

JEFF MOTTE: So guys are sharing the mic here, I guess.

SCOTT DEWOODY: I'll go and kick it off. It's really important in the communication process because in my experience, a lot of clients sometimes in architecture have a hard time visualizing even with a rendering but even when you look at a 2D drawing, a plan, you don't get the sense of depth and space that you do with VR. And so everyone knows when they put a headset on what they're looking at because it is almost like looking at reality in the same way, especially if the renderings come close to photorealism.

And clients just, they seem to automatically get it because you know what you're looking at. And what I mean by that is that we all know-- ceiling heights, we all know our experiences in the real world. And so moving into an architectural space that hasn't been built, you try and make the same parallels and they come very easily. It's much like watching a CG movie with a human character.

And if it's not done right, you can tell something isn't right with that character because we look at humans all day. And so it's that-- I don't want to call it the uncanny valley but that is kind of what it is.

GASPARD GIROUD: So at Piranha we don't use VR for design, as a design tool. We use it for a marketing tool. So I don't actually have so much experience in using it as a design tool.

JOEL PENNINGTON: One of the things that we've learned is that we made some assumptions at Autodesk around visualization. And we thought, OK, virtual reality could be used to help convince someone

during a pitch or a pursuit process, yeah, we're the right architectural firm for the job.

But we actually have learned over the last year that the designers themselves to kind of riff off of what Scott was saying, is that they're actually going into virtual reality to do like a little mini design review. They want to see what the building is like before anyone else has done it. And in fact, we've done some tests with architects who are 20 year professionals. And they notice things once they get into virtual reality that they didn't see in the design package.

And that's quite interesting to me because this does seem to move from, this is just for a visualization to, oh, maybe this has some application in the design process.

ANTHONY CORTEZ: Yeah, it's pretty cool how virtual reality comes back every 17 years or so, right? Yeah, I remember, you know, from like Lawnmower Man in '94 to like 2000 when GPUs started being used. And then now with the advent of our new HMDs, the Oculus Rift, you know it finally came back and I think it really caught on now. And it's pretty exciting, you know, to be able to experience or witness that evolution of technology from back then when we were just using AutoCAD and 3DS to do our visualizations.

And then later on we've got Revit, we're doing BIM. So just like seeing the evolution. And I think the next step is VR right now. And I wanted to share it with you-- oh sorry-- one of the earliest VR projects that I've worked on. We did it for our client, GSA. It's for the courthouse in Mississippi, Jackson, Mississippi. This was done back in 2003.

And traditionally, GSA would build prototype physical mockups of these courthouse spaces out of plywood. And so we offered, you know, we told them that because we are working with you in multiple disciplines, like lighting and acoustics, we're able to take this and create a virtual 3D model that includes all of that lighting calculation information, the daylight lighting coming in, so you're able to walk around and see different sightlines of sitting in a judge's seat or sitting in a back row, if there's any glare coming into the room.

And it was very valuable for them to be able to experience that in 3D and virtual reality. So yeah, even how the real would sound. And it's the design iteration process of it that really helped them come up to the final. And this was actually presented at the Disney labs, the Disney cave in Los Angeles back in 2004 where you have a panel of judges. They're all sitting down in the same room looking at this virtual model. And they are able to experience what the design would look like.

And it pushed the project forward. Got approval. Got clearance. We got paid. And now there's the Jackson courthouse in Mississippi. So yeah, definitely communication is one of the key processes in making these projects go forward. And we've also been using augmented reality, as well, to visualize projects.

Over here we've loaded our models into iPads and tagged them with GPS coordinates so that we're able to load up a model of-- like an infrastructure model-- of water collector, a rainwater collector. And be able to view that in context on the sidewalk while our team was walking around New York City in the Bronx. And these, then, they can orientate the models. They can move it around. And all that information goes back to the office, which is, again, communicating the design in real time.

And there's other examples that I'll get into later. [INTERPOSING VOICES]

JEFF MOTTE: Yeah, so your last slide there, with the judges in the courtroom, kind of segues into the next question. I was at an event, an Oculus Connect event, I guess about a month ago. And Mark Zuckerberg kind of introduced this concept of social VR, which really plays into the concept of collaboration within VR. And I'm wondering if any of you guys have run into experiences where you've tried VR in a collaborative environment or even developing something that kind of plays into that and how important that is.

SCOTT DEWOODY: I would say collaboration is extremely important because every time I introduce a new partner Gensler to virtual reality, their first question to me is, so can we put multiple people in this at the same time? And I see collaboration sort of being the next new buzzword around VR. Where it's like now that we've got these singular experiences and we kind of know how to start developing for it, it's like now we need to put more than one person in it.

Because we'll do presentations to clients with four or five of them in the room. And so we may get four or five year Gear VRs and have them all sort of look the same project at the same time. But if you could have everyone in actually the same project at the same time, someone can curate it and walk everyone through and say look to your left, look to your right. We all kind of know where they are really looking.

I think that's going to be key because again it goes back to communication. So now we can communicate better because we're all in the same virtual space.

JEFF MOTTE: Is that something that you guys have solved yet? Or are you still working on trying to figure out

how that works, technically.

SCOTT DEWOODY: Technically we know how it works. I just have to start putting it into the actual motion. A couple of years ago, we started developing our platform around unity and got a multiplayer server up and running internally. And were able to connect load in models in there and have people walk around, just like you would a normal video game. But taking that to the VR level shouldn't be too difficult in there now.

GASPARD GIROUD: I do think VR will get adopted. There will be a mass adoption at some point. But I think it's a very isolating experience. And it'll take a lot before you get to a place where it's become collaborative and people can share experiences in there. I think we have to realize that in order to do that you have to create avatars. And human-like avatars are extremely-- that's another step that's going to take many, many years before we can do that and yet it will probably be very uncomfortable.

So I think that's a very big obstacle that VR has to overcome and is probably going to take 7-10 years.

JEFF MOTTE: Is anybody going to that that event at Top Golf? It's like, I don't know, there's supposedly this place down the street from here, it's called Top Golf, where you're there. And you're surrounded by screens. And you've got a golf club. And you're swinging the golf club virtually. And the whole environment is around you. And it's all CG.

But it's, you know, more and more I think there's going to be more opportunities to be able to create these sort of experiences so that you can have multiple people, multi players, working and playing together. A huge, huge phenomenon that happened this past summer was the whole Pokemon Go. It's AR. It's not VR. But the just the phenomenon of it was that it was released. 100 million people downloaded it.

After a month or so, it generated $250 million after one month. And you had 100 million people playing it every day for, I don't know-- together, collaborative. Together. So I think it's just-- the technology is there and we're just trying to find the right applications for it.

JOEL PENNINGTON: So to add on to the concept of collaboration, I don't think it can only happen in VR. I think it has to be device agnostic. So if you've got a principal at a firm who is just not going to put goggles on his or her face, that person needs to be able to experience that collaborative environment from perhaps a desktop or a tablet.

Or if you have folks that are on the field, maybe they're in some form of augmented reality because they're looking at a situation where HVAC is intersecting a structural member. Who knows? But I'm thinking it can't just be a bunch of people in VR, a bunch of people in AR, a bunch of people in MR. But it's got to be across those boundaries.

JEFF MOTTE: Have you guys ever read that book, Ready Player One? Anybody? Great book.

JOEL PENNINGTON: That should be required reading for everyone in this room.

JEFF MOTTE: Yeah. I mean, that is like the ultimate-- the killer app for virtual reality, social virtual reality, right? You know, being able to load up different worlds and interact with each other. I think Second Life had a little bit of that going in two dimensions. But again, it's something that could evolve into the Ready Player One in real life.

Right now, how are you guys using AR, VR, MR in your own firms and agencies and studios. I mean, maybe give some specific examples of applications that you guys are working on. And then even to that end, something that you've seen out in industry that you think is kind of, that's it, you know, that's where it should be going. This

SCOTT DEWOODY: That's a long question. So at Gensler we've started developing our own viewer app that designers and clients will be able to use. You can check a version out. It's actually on the app store now. It's Gensler VR. So we've been doing that. We do a lot of just still render 360s, which is what that app supports. But we find that just the still renderings is sort of like really good bread and butter to get the idea across.

But even then, now we're diving into more like the room space VR with the HTC Vibe and the Oculus Rift. On the augmented reality, we're working closely with Trimble on the HoloLens. And so we're trying to figure out, kind of again, going back to that can someone be out in the field wearing a HoloLens device, make some markups, and in real time feed that data back to someone at an office sitting in front of the computer who can make those changes to a model in real time.

That is a very interesting use case to us. And we're exploring all different other kinds. Like can I be in a room with the HoloLens looking at a model on the table and have it render in real time via a server or something along those lines. It's really interesting where that technology is going. And we try not to have the two compete.

Like they definitely need to work together. But the use cases for AR and VR are very specific where I always tell people, it's like VR is where you want to completely immerse someone somewhere else, that's the VR. When you want to bring your 3D model into the real world and see it in place, AR is perfect for that.

And we've been doing that. Our LA office is expanding their campus to another tower and so we're building a sky bridge. And so one of our first test goes with the HoloLens was we took a Revit model of the bridge and we loaded into the HoloLens and was able to put it in place and see where the bridge was connecting. And designers were able to walk up and go, really? This is six feet? We need to make that higher. And automatically started making designs decisions and changes looking at the actual model in place.

ANTHONY CORTEZ: OK, so just getting here, I just want to give another example of how it could be useful and is being used in real life. Just getting here from the airport, I hop into a cab and the cab gives me directions, turn by turn directions, via GPS. It brings me out to the Venetian, the front of the hotel. But then when I get outside the car I go inside the hotel lobby. I want to go to the registration area, right?

And I must have gotten lost, you know, like walking through the casinos. Made a left instead of a right. So I think, you know, like way finding is going to be a huge thing for augmented reality, virtual reality, mixed reality. You know, we've developed a couple of applications using the Google Tango where the Google-- has anybody used Google Tango here? Yeah. So it works like-- it does area learning. And what it does is once it recognize and references where you are in the environment, then it loads up virtual information on top of that.

So we've used a combination that and some scripts to be able to do turn by turn navigation indoors using SLAM, simultaneous localization and mapping, that's built inside the Google Tango. And now, I think, last year Google Tango and Lenovo had partnered up together. So our next generation phones are going is going to have this kind of technology in it. And you know, those are just going to be more uses for this, I think.

JEFF MOTTE: Gaspard?

GASPARD GIROUD: So we are using VR mostly for sales or for some of our clients when the product is already finished. So it's rarely useful as a design tool, although I see enormous advantages of using it as a design tool. Some of our clients from the advertising or real estate world ask us to model

and represent their space for selling or marketing purposes.

The other thing that we're developing, so it's a more traditional [INAUDIBLE]. It's not so pioneering. But our main focus is on the platform that we call a VR browser, geography VR browser, which we look at it more as a platform as opposed to a VR expense itself because we're going to invite other vendors to put their expense in there.

And we started by creating a scale model of New York City where you can walk around and then get access to all these experiences. So this is mostly what we're focusing on. And so I think this goes way beyond architecture visualization and this would require funding. And it's a very ambitious project but that's something that is inviting people from all different type of industries to join in the VR world, right?

JEFF MOTTE: Joel, you're at Autodesk but maybe talk about what some of the customers you're starting to see, how are they using this technology now?

JOEL PENNINGTON: Well, so we've got-- we have customers from all walks of life. And they are building their own. If they're a large enough firm, they're able to build their own. They can make their own experiences which are compelling. Lets them win projects, lets them communicate design intent and so forth. There are other firms that aren't big enough to be able to do that, so they're leveraging, perhaps, game technologies and hiring kids out of school, out of film schools or game development schools.

And then there is what we're working on right now, which is Autodesk Live. It's not a sales pitch but really information for y'all to understand that this is using Stingray, which is game technology, and allows us to go from Revit today into an immersive environment without having to hire the folks from the game school, without having expertise or domain knowledge at your firm.

So we're seeing that as the first availability. And then me, specifically, I get to look a couple of years ahead of that. Where are we going to go with products like Autodesk Live? Where is our thought leadership? And collaboration, augmented reality, machine learning and expanding beyond the confines of just architecture. Getting deep into construction. Getting into combining the content from the manufacturing world into architecture are all areas that we're starting to seriously look at.

ANTHONY Can I give another example of how we're using it in the field?

CORTEZ:

JEFF MOTTE: Sure.

ANTHONY CORTEZ: So this here is an image of-- we worked with Virginia Tech to create a virtual reality cube on their campus. It's a 50 by 40 foot black box. And it's a research center that blends science and engineering with art and virtual reality. So the idea is that using virtual reality, they're able to go inside this space and collaborate with different models. They can load up a DNA strand and walk around the DNA strand in this room.

They could go inside and load up a tornado and go inside and experience what it would be like to be in a tornado without getting killed. So it works off of the same technology as motion capture rigs. There's a bunch of sensors all around the different catwalks. And then the Oculus Rift has an antenna on it that records your position and orientation within that space.

And the cool thing about this rig is that 24 people can be in this virtual world at the same time, walking around that DNA strand. And then another aspect of this, also, is integration of sound. Around the theater, the space, there is about 64 loudspeakers that are set up. And we're using this technology called wave field synthesis to pinpoint and locate sound anywhere in this room, whether it's above you, next to you, over to the corner.

And it's another way to immerse your audience. You know, you have your visual. You have your audio. And those are the two senses that makes you feel like you're there. So that's another example.

JEFF MOTTE: So we've got virtual reality, augmented reality, mixed reality and everybody's kind of experimenting a little bit in each one of these areas. Do you think, ultimately, there's one technology that's the direction we're going? Or is it always going to be split up between these three areas based on use case? What are your thoughts on that?

SCOTT DEWOODY: I think there are going to be-- I don't think it's going to ever combine because I think each has a really good, nice, specific use case. But I see applications taking advantage across all three, depending on what we were talking about earlier, where someone in the field might be using AR. And then someone back in the office might be using VR. And then someone might be sitting on a 2D screen modeling off to the side. I mean, the possibilities are endless. But I don't think that those three are ever going to converge into format or experience.

ANTHONY I think some of the tools we're using will help that process along, particularly with the capturing

CORTEZ: tools like using Photogrammetry, using LIDAR scanners. All of that goes into the pipeline of-- that helps set up your virtual and augmented realities. And we're all here because of the AC and probably a lot of you are into the building information modeling. But I think the ultimate goal, at least for our industry, is to be able to take those models, those big models, and overlay it on top of the real world and have your ultimate killer app, which would be like x-ray vision inside this room.

And be able to, I guess, like the ultimate stud finder, to be able to see behind these walls. And using your BIM model that you've already captured, you've already scanned, overlaying it on top of this and selecting different objects in this room and getting specification data, cut sheets and stuff like that. All of that, whatever can help you enhance your visual perception makes you smarter, makes you have-- make quicker decisions as well. And that's one of the huge values that we're going to need to see to keep pushing this forward.

JOEL PENNINGTON: Yeah, I think it boils down to being device agnostic. So use the right device-- the right tool for the right job. And if a virtual reality is the right thing at the right time, go for it. If it happens to be your phone and you want to use your phone as an augmented reality device to look at a piece of conduit in the wall for whatever reason, and that's what you have, great. Use that.

But I don't think we should feel we have to use something specific if it-- today, for me for example, I kind of don't even have a line between my phone email and my laptop email. And it's all kind of blurred. So I expect we'll have a very blurry future with MR, AR and VR.

JEFF MOTTE: So we're starting to see hardware now that everybody can actually use and do productive things with it. But I think one of the biggest challenges is still workflow. You know, all of these development platforms all came from the gaming industry and of course we're all in the AEC industry. And even though many of us are very knowledgeable about how to operate in 3D space and how to develop tools in 3D space, that process is still very cumbersome. And I'm just wondering what your guys' thoughts are on that. How do we fix that problem and how do we make these tools work in a way that's more conducive to working in design and architecture and architectural marketing.

GASPARD GIROUD: I think that Stingray is doing exactly the right thing by trying to get from your 3D model to VR. I think it's a very exciting direction. I think they also were very successful at doing that in the early days of 3D, you know, when silicon machines were not accessible. And then you were able to have a 3D-- even before 3D Max on a PC. And then they [INAUDIBLE] democratize

that use and became a mammoth in the industry. So I think they're doing the right thing.

No, I think what is still a very big obstacle, is that building 3D is not something that is so easy to do. That will be the next step, would be making that model making more democratic. But I think you'd be a better person to answer that question.

JOEL PENNINGTON: So anecdotally, when we were making films like Avatar or A Christmas Carol or other classics like Mars Needs Moms, which no one here should ever watch, we would spend over $100,000 a day to let the director be immersed in the virtual film production world. And that's not a tenable way of working, to say the least.

So we're already leaps and bounds ahead, in my opinion, ahead of where high end film and game development is. I think we're starting to see a shift where folks in the AC world are leveraging technology that is so powerful for what it costs. And to riff off what Gaspard is saying, we're seeing things come out of the woodwork now, out of hackathons, from like tangential industries, showing the idea of not just being in your immersive environment to look at something but being in your immersive environment to start to create the thing. And that's really interesting.

So what does that mean for massing? What does that mean for conceptual design? Do we do that while we're in an immersive 3D environment? If we're in HoloLens, in a HoloLens environment, and we're actually out on site, can we start to push and pull and start to shape a proposed design and see it in context immediately? See it lit as though it was real, as though the sun was directly lighting the actual CG elements that you see through the lenses. These are all starting to bounce around our heads a little bit now.

And if you look at the new version of Microsoft Paint, it is now Microsoft Paint for 3D. So it's a wake up call for us at Autodesk at the very least.

GASPARD GIROUD: I am actually not aware of a Microsoft Painting. Explain a little bit more about it.

JOEL PENNINGTON: So yeah, Microsoft Paint's like the very basic, like very, very, very, very basic version of Photoshop. Lets you draw stuff.

GASPARD GIROUD: I know, I'm talking about the 3D version that you just mentioned.

JEFF MOTTE: It's coming out in their next service pack next year. They're calling it the creative addition, or something along those lines. They're upgrading it to support more direct VR and HoloLens capability in Windows 10. But they're throwing in 3D into Microsoft Paint now. You can import 3D models into paint and I don't know. [INTERPOSING VOICES]. It's like, really?

SCOTT DEWOODY: Is it kind of like Google Tilt Brush?

JOEL PENNINGTON: It's similar to Tilt Brush in a way, and also Rif's experience. What's the--

JEFF MOTTE: Medium.

JOEL PENNINGTON: Medium, yeah. It's very similar to both those.

SCOTT DEWOODY: Yeah, that's really cool, especially if you could bring your 3D models into this environment. I think the key is, though, to be able to do your adjustments, your edits, your tweaks in your model in 3D, right? But have those, whatever you do, gets recorded and dynamically linked back to your original Revit files so that those are updated.

JOEL PENNINGTON: We've experimented bringing Revit models into Tilt Brush and have had an interesting experience with that. I mean, we were successfully able to do red marks and markups and save screenshots and things of that nature. Now, getting them out in 3D format is not possible yet. I mean, you can start to see, like as soon as you do that and bring it in, it's like your mind as well is like, yeah. I can actually be in VR and start making red marks.

And having the ability to maybe eventually push those back to Revit would be awesome, right? And so you can start to see the building blocks. And I think we're just going to-- all of us are going to start requesting and doing hackathons and making this stuff happen. And that's the first time I've seen architecture. We've always adopted other things from movies and film and rendering and things like that. But this is the first time where we're adopting gaming technology. But we're consuming it faster than we've consumed anything else before.

And at some points we're actually moving faster, even faster than that industry, where it's like, hey, why can't we do this? Why can't we do this? And they're like, we just don't do it that way. And I'm like, why not? Like, we need it that way. We could do this. And it throws that industry through like, oh, well, I guess we could. And so even now, if you look at it like Nvidia's

developed the new Vulcan API for gaming, moving away from like direct [INAUDIBLE].

You can now have billions of objects on the screen with virtually no hit to performance. And that's going to help us because now when I load in a massive building with thousands of chairs and work spaces and lights and [INAUDIBLE], my designers aren't going to have to worry about occlusion calling and optimizing. It's like, yeah, now you can't just throw everything and the kitchen sink and it should work without too much effort there.

So we're starting to see some of those developments and I think over the next year, six months, I mean it's going to happen I think faster and faster, especially with everyone in this room in our industry just doing more demanding and going, hey, you're not moving fast enough. We're going to go ahead and do something ourselves, which is what sort of we've done at our company already.

It's like we saw some issues where people hadn't filled the gap. And so like, you know what, we just need to get in there and do it.

JEFF MOTTE: I'm curious, just because it was brought up, how many people here have been using Tilt Brush or even Medium if you have early access to it? And using that in a markup or a kind of early sketching phase? I'm curious, just with a show of hands.

JOEL PENNINGTON: I spent a good two hours the first time I was in Tilt Brush and I wasn't even marking up stuff. [INTERPOSING VOICES] It's like, really, painting in VR? And then as soon as you start doing it, like, two hours went by. And I was like, oh my Lord. Like I have to get back to work.

SCOTT DEWOODY: I think there's also a connection now to it where you can put music and connect it to music. Your paint strokes will have audio.

JOEL PENNINGTON: It will pulse to the beat of the audio.

JEFF MOTTE: There's another guy doing a talk this week, Paul Nicholls from Factory 15. He's doing a talk this week, so if you don't see it, I would stop in. But we were having dinner with him last night and he was talking about how for the last couple of months he's been spending eight hours a day in Tilt Brush actually designing worlds and stuff as part of projects that they're working on now. So they've been doing that for quite a bit.

JOEL Because you can actually export your paintings as FBXs now and import them into

PENNINGTON: [INAUDIBLE]. [INTERPOSING VOICES]

JEFF MOTTE: Yeah, he was actually-- what I found really interesting is they were experimenting with how they combine real world and virtual world. So they actually built like a foam mockup of space. And then he would trace that space in Tilt Brush just so he'd have reference in the VR space. And then build around that so then when people were walking around in the VR space and they went to touch what they saw, they were actually feeling something in the real world. So it was actually kind of an interesting use case.

SCOTT DEWOODY: The void, has anybody tried to the void?

JEFF MOTTE: Has anyone been to the Void in Utah? Do you guys even know what this is? OK, so this is a company built out a warehouse. They built physical walls for like a virtual arcade. And so you put on their backpack and their HMD. And so as you're walking around, you could actually run into a wall. And if there's mist or smoke, they actually blow mist and smoke on you as you're walking through. So think of it as like a real life maze but with a VR overlay on top of it. And they just got like the Ghostbusters--

SCOTT DEWOODY: Yeah, the Ghostbusters one in Times Square in New York. It's pretty cool.

JEFF MOTTE: Have you seen it?

SCOTT DEWOODY: Yeah. It's pretty cool.

GASPARD GIROUD: Can we ask, how many people have the [INAUDIBLE], just out of curiosity. So there is a significant amount. Have the [INAUDIBLE]. How many people have tried the [INAUDIBLE]? Everybody, pretty much?

SCOTT DEWOODY: I also I have another question for the audience. A lot of you raised your hands when you're doing VR in your work flow. I think there's like a couple-- two types of VR that is out right now. I guess that the 360 degree panoramic stuff that you would see from like the Google Cardboard. And then there's the fully CG environments. So are you guys doing one or the other or both? [INTERPOSING VOICES]

JOEL Chaos group teamed up with a company that's developing that stuff, too. The [INAUDIBLE]

PENNINGTON: renderings, they're 360 renderings but they're a little more dynamic. You get that parallax feel. So if there is a column in front of you, you can actually look around it instead of just being at a fixed point. So if you guys haven't seen any of that, I've looked that up. So I think it's like [INAUDIBLE] was the Chaos group one.

GASPARD GIROUD: That's what Dead Room is using, right? I don't know.

JOEL PENNINGTON: And then Nvidia with their [INAUDIBLE], they've got a version of it that's not commercially available yet but you can see stuff online with their campus. They did some light field renderings and you can kind of walk around a little bit and check it out. So that's going to be like the next, I think, small evolution. They're very computational heavy at the moment. But as things get faster, that should be more and more common practice.

SCOTT DEWOODY: So going back to the question, the original question about painful workflows, we do a lot of recording using the 360 degree camera balls. And those recordings, you have 10 go pro cameras and they're all recording 4K movies. And you're recording and saving 10 different shots from different locations and just managing all of that information together is the stitching part. That is the most painful thing.

And we're trying to figure out better ways to be able to organize and manage that information.

JEFF MOTTE: So this probably brings up a good question. I mean, there's so much technology out there. And I've spent most of my year traveling around to all the VR and AR events that I could this year just trying to keep up with it. And opinions that I had formed and things that I've seen, even three months ago, I think I would already changed my opinion of them because it's moving so fast.

And for companies that maybe don't have the resources that you guys have and they're looking at all of these options out there, how do you even know where to start? I mean, obviously not everybody can go out and buy every single HMD and every single authoring platform and you know spent a year developing and see what works. I mean, how do you decide what's going to work for you?

GASPARD GIROUD: I think that disruption is the new stability and is going to keep accelerating. So it's a very, very big issue. And I think it's going to bring enormous problem because even from investment purposes, the visibility that you have is getting shorter and shorter. So it is, in effect, a

blindness almost because to a certain degree, there's no way-- at a different time, where railroad was installed through America. You're talking about years where you can put your investment, whether it's financially afford or anything else but you have visibility. That visibility is shortening by a tremendous amount.

And I think there's going to be a very big problem as we keep moving into this in the next few years even. So I think this is a very important question. And I totally agree that-- sorry-- will be [INAUDIBLE]. I'm really, like you said, Paint 3D that I was not even aware of, it's fairly typical that you come across technologies that are very important that you're not aware of. And I think that train is not going to slow down. It's only going to accelerate.

JOEL PENNINGTON: So we have, at Autodesk, tried to stay on top of all the new technologies and from the big players like Valve with HTC for the Vive, with Oculus, with which they have Vive port with Oculus and the Rift, as well as Sony with their virtual reality solution. And then Google, and so on and so forth.

But there's always someone that comes like right out of left field. And I suppose that my group, because we're attaching ourselves to a game engine, that the game team is strongly motivated to constantly update and support devices which are consumer friendly. And that becomes a cost effective way for folks like yourselves or our other engineers and construction professionals to get into the virtual augmented reality technologies because we've tested. But then we weave that and we test again and we develop.

And hopefully we've landed on some technologies which have a bit of staying power. And it is definitely true that the technologies shift. But perhaps we're seeing, like what we see with Google's Daydream and with Microsoft and their new virtual reality headsets that will be coming out, those are leveraging technologies that were developed with Tango and with HoloLens respectively, which was born out of Kinect.

And so they do have roots. They do they do have paths that they go along, if you're willing to stick it out and follow the direction that they're taking. So maybe on the hardware side, the cycle is a little bit slower. On the software side, the cycle is way, way faster. And so I am now trying to understand, trying to reconcile what does machine learning mean for all of this?

I mean, imagine if you could have an AI partner while you're in your immersive environment helping you design, giving recommendations. Or that is the designer and you're a consultant at that point, asking the AI to make choices on your behalf.

JEFF MOTTE: It's kind of scary.

JOEL PENNINGTON: Hopefully it's a good opportunity and it's not scary.

SCOTT DEWOODY: Skynet. That's all I think.

JEFF MOTTE: So somebody then is looking at an authoring platform or an HMD, is there one that they should-- should they just go for the big ones that have the big names, the Vives, the Oculuses because they have the most visibility now? Is that the safe path? Or is there another way to look at it?

SCOTT DEWOODY: I mean, you could call that safe. But I mean, really, if you're just trying to figure out where to go, I mean, at this point like they all kind of do the same thing and they all kind of speak the same language. So I say, pick one. Like just do it. Just pick one. Even if it's Google Cardboard. If that's where you can afford to start, start there because you can code for that.

JOEL PENNINGTON: It's $20.

SCOTT DEWOODY: Yeah, I mean, if that in some places. I mean, you can get Viewmaster made their own Google Cardboard plastic. You guys remember Viewmaster, the little film? They've got-- they went VR now, so you put your phone in it instead and it's Google Cardboard and it's $30 at Target.

So you can start there. That's fine. And if you want to go big, like the HTC Vive, some of the bigger HMDs have that hidden cost behind them because you need the hardware to go with it, like most laptops right now don't run it. So if you think you're just going to be able to buy it plug it in, that's not the case.

But that's OK. I mean, like look at what you're willing to spend and invest in and I guarantee you there is something for you along that line and then just go for it.

ANTHONY CORTEZ: Yeah, it's a nice range.

SCOTT DEWOODY: Yeah, I mean the price point's all over the place.

ANTHONY CORTEZ: But yeah, and for me I think it's-- for the HTC Vive it just takes a lot longer to set up initially. And that's why I would, if I had two choices, I would go Oculus because it's like, you know, you just plug in three plugs and then you're set. You're in your virtual world. And with the Vive, there's the camera-- two cameras you have to set up on the stands. It's a little bit of a longer workflow. So I just want something quick and fast and ready to go and jump into the virtual. For Augmented Reality I like the HoloLens because of its portability. And it's got no wires. Everything's built in. So those are the two that I would go with.

SCOTT DEWOODY: So just, I think, last week or maybe even this week, HTC released their wireless module so that you can go tetherless.

JOEL PENNINGTON: That stuff is going, just going so fast.

JEFF MOTTE: Sold out in like eight seconds. You couldn't even--

JOEL PENNINGTON: It's hard to keep up.

GASPARD GIROUD: How are the reviews on how efficient it is?

SCOTT DEWOODY: Two milliseconds, they say. two milliseconds.

GASPARD GIROUD: I've seen the product and not the reviews.

JEFF MOTTE: With the gaming environment or whatnot, obviously a AAA game has really high fidelity graphics. How important is that to the architectural space or even the marketing space? I remember trying some of the early demos and I saw the screenshots. And my first instinct coming from a higher end graphics part of visualization was to dismiss it. It doesn't look really good. This is probably going to be a really lame experience.

But then once I got into the environment, you know, all of that kind of went away because that wasn't what was important. It was about the emergence of scale. I'm kind of wondering, how do you feel about high fidelity graphics versus just the experience of the scale in space and

how do those relate?

SCOTT DEWOODY: It really depends on what part of the process you're in. I mean, if you're in schematic design, you don't need the super photorealism. Like we never want to do high end rendering in schematic design because clients will just freak out. And you can still do the white model, two tone, three tone color model really quick, really easy in a game engine. And that's all you need. And it kind of grows, just like renderings do.

Like we start out with really, really simple 2D stuff out of like a [INAUDIBLE] viewport or [INAUDIBLE] or [INAUDIBLE], it doesn't matter. You start really simple and then as the project grows, the fidelity of the renderings kind of go along with it. And I think it's going to be this-- we've seen the same at Gensler. It's like, no, I just want to take this model. I'm going to throw it in. I just want it to be white and I want to get that sense of depth and scale.

And that's what's really important. That's what really the designers are looking for. And then on the flip side, we've noticed that people are starting to become better modelers because of it. Because then they're modeling in Revit. And it used to be like, well, it looks good on plan. It's done. And then when they pass me the models of the visualization, like you have no floor. There's a gap over here and there's something-- and this is floating.

And they're like, it doesn't matter. I'm like, it matters. Because now I have to clean it up. And now that the designer is going directly into VR, they're seeing those mistakes and being like, oh, I didn't model this soffit right. Let me take this off. OK, now it looks better. And so the models that are being delivered to like myself and people like myself at the firm are getting better because the designers now are spending actually more time thinking about modeling in their program, in Revit in whatever.

So we've seen a nice uptick in that. So I definitely like VR for that. It's made my life a little easier.

ANTHONY CORTEZ: Yeah, I mean, I just have to agree. You know, it depends on the audience, what your target platform is. That's when you put the quality, if it's a marketing piece, should have the quality in their. Story should be captivating, you know, to keep everybody inside the experience. And for design iteration parts, I think early on the design the simpler the better. You know, there's just so much stuff going on all around you that you could sometimes lose what the point is, what the story is.

[INTERPOSING VOICES]

JEFF MOTTE: You brought up story, I was going to try to get into this a little bit later. But I mean, it's a good point. When you look at the evolution of rendering, it started out as a very technical exercise and the aesthetic and the storytelling was secondary because it was a novelty thing. And I kind of feel like VR is there. So are you seeing story coming into play yet in what we're doing in architecture or is it still very much just about the experience? And how will story play?

ANTHONY CORTEZ: Our stories usually deal with like construction sequences and stuff. So like, this is phase one. You know, and then the cranes come in and starts building the piles. So those are the kind of stories that we tell in virtual reality.

JEFF MOTTE: Gaspard, you guys are doing a lot more marketing.

GASPARD GIROUD: Yeah, we're doing marketing material, so we are obsessed with quality and trying to match the quality that we have, the very glossy material that we produce for our clients. And it's not there yet. Right now, the clients just get so excited about the technology itself that they're not too bothered by it, you know, how pixelated it gets. The field of view that is great is gonna get better.

So that's one of our primary concerns. We do want to bring the highest possible quality and we can't wait for that to keep evolving. For the storytelling part, it's the same thing is that right now I think the technology sort of takes over your senses. But very quickly, architecture position is a very static world. And I think we need to bring narrative in it. And we actually are looking into it, like actively. We're literally producing stories, collaborating with writer's to make the experience more exciting.

Because it's one thing to get there if you've done it a bunch of times. After a while, we want to add more to it. That's for marketing.

SCOTT DEWOODY: Story is always really important, especially in our design phases. But in VR it's a little bit different now because you no longer have control but the user has control. So how do you tell a story when you can no longer physically tell someone you are looking at this when I can be like, hey, what's over here.

And so there's some interesting studies. Like there are some short films in VR now that you can see in like a Gear VR and things like that. And I that, like random chance didn't realize what it was at the time. But I sat in a panel two years ago at [INAUDIBLE] with Oculus Story

Studio. Has anyone looked at these guys? It's a studio-- it's a division of Oculus that is purely dedicated to figuring out how to tell stories in VR.

And it's a bunch of ex-Pixar people that they pulled over a couple of years ago. And their first short is called Henry and I haven't seen it yet. But they were talking a lot of the making of and how they put Henry together and a lot of the things they learned. And one of the biggest things was storyboarding goes out the window with VR. They found that you cannot traditionally storyboard story for virtual reality.

You also have a hard time, again, directing the viewer. So you have to put in cues now that make the viewer look but you're not forcing the viewer. And so one of the examples they use at the very beginning of the film, apparently, a butterfly like flies in the window and it catches your eye and drives you over to the door. And then in walks Henry. And so they're now looking at experimenting, how do you make these visual cues that really--

GASPARD GIROUD: And auditory.

JEFF MOTTE: Sound. Yeah, sound is gonna be huge. [INTERPOSING VOICES]

GASPARD GIROUD: Guiding you. Because obviously you're in an environment that is frameless. You can look anywhere. So it's very hard to guide the viewer's attention. And so I think that's--

JOEL PENNINGTON: Yeah, other techniques like oversaturating something you want a user to look at, that goes out the window. Depth of field goes out the window. They've found that adding a shadow will help ground someone, even if like-- because the first thing people usually look, they look down and are like, where are my feet?

But you don't put the person's feet in, you can actually just put the illusion of a shadow being underneath, even. They found that that actually helps ground a user into the experience a little more. So there was a lot of little things like that they had learned. I'd be curious to see another talk from them because that was two years ago. So I'd be curious to see what they've learned now.

SCOTT DEWOODY: So they're the folks that created it Medium, by the way, and Quill. And they made these tools so that they could make their short films and whatnot. But I think, as architects, as designers, we're natural storytellers. It's our job to try and communicate an idea. But to put the burden of,

here is a century's worth of filmmaking tech and knowledge and now you need to be able to tell short films that could potentially win an Oscar, that's unrealistic for us in the design community.

Does it mean that we go back to the concept of collaboration where, as a designer doing the regular design job of communicating, you can just continue to do that despite being in a virtual environment. And does that let you tell a story and command attention and bring people toward what it is you want to show them.

I hope the answer is yes. If the answer is kind of yes but a little bit of no, then maybe that's where folks like myself come in where we can start to help guide the experience with tools, where we leverage what we know from the film and game world because that's where I come from.

But allow folks, like yourselves, to be able to tell a story, to be able to draw people and communicate those ideas but not have to, again, have gone to film school, went to Game Design Academy and so on. In terms of the visual quality, fortunately we are just excited about being immersed.

However, I think that the bar will always go up, even if it goes up slowly, it will always go up. If anyone goes back to AutoCAD v.14, which was a great version of AutoCAD, you probably have a rosy lens on what the graphics looked like compared to today's software. So it will always improve, even if it's just a little bit. And even if we're doing like a clay model, a three tone model so that the client doesn't get stuck on the material.

The edges will just be smoother. The performance will be higher. The sun lighting will be nicer. It will just happen. [INTERPOSING VOICES]

ANTHONY CORTEZ: I just wanted to share another story. Yeah, this past summer we worked on-- or my colleagues worked on-- this experience called the Hubble cantata. I'm not sure if you've heard of it but it's a performance that was held in Prospect Park for 6,000 people. And it was about an hour long performance.

There was a 100 piece orchestra, a couple of choir singers and opera singers as well. And it was composed. We worked with a filmmaker. So working with like local artists also helps push stories along and experiment more with this medium as well. But our part in it was we designed the sound field that was set up around the park.

So we set up these huge loudspeakers and pushed out 3D audio to accompany the performance, the message. It's basically showing iconic images of the Hubble Space Telescope. And the last eight minutes of the performance, everybody had downloaded or pre-downloaded the app, the 360 degree virtual reality app. We gave them cardboards at the entrance.

And you have 6,000 people there all doing virtual reality, listening to the music. It's all combined. And it was it was quite a show. I mean, it was probably the first multi-use virtual reality experience in a public space, 6,000 people. And it was a free event, too.

JEFF MOTTE: So you guys have obviously been doing this for quite a few years and you've spent a lot of R&D internally developing the tools you have. For those that are maybe just getting into it or maybe those that are maybe only six months, a year in, what mistakes have you made or what mistakes have you seen made that maybe others hopefully won't make by virtue of your experience?

SCOTT DEWOODY: Don't try and throw everything into the kitchen sink at once. That does not work very well. But really, I mean the thing I tell people when they're getting into VR for the first time, there's only two things you really need to consider. Like one, you need to design more because you're now taking into consideration 360 degrees.

And then two, you have to be ready for a little more computational time on the rendering because you're now going from, let's say, full HD at 1080p or maybe 4K for print. But you're now going from that and you're going up to 18,000 pixels on the long side and it just takes more rendering time. But things like the cloud help with that. And there are new render services that you can enlist to help with the render times on that.

So I mean, that's about it. Like you're doing everything else already. I mean, the process is just like making a normal rendering at that point. So it's literally, most applications now, one or two clicks of a button to generate an image for VR and you're off.

JOEL PENNINGTON: It's not just an image. I mean, it could be one or two clicks to get into a full room scale environment now. I would recommend experimenting with all of it. Start with Google Cardboard. Play with that. See where that gets. You only get to look around something. That might only hold your attention for a little while and then move up the little ladder toward HTC Vive and Oculus Rift. And start to get into room scale.

Start to have hand controllers which will let you start to interact with the world. And once you can start interacting with the world, perhaps you'll be able to see more possibilities, to even move further down that tunnel.

JEFF MOTTE: Gaspard, are you guys-- [INTERPOSING VOICES]

GASPARD GIROUD: I think it goes back a little bit to your question. I feel like things are moving so quickly, exactly as you pointed out earlier, is that to a certain degree my advice is useless. Because what we learned is just like, you're going to start over. And actually, we are very proud beta testers now for Stingray.

And they're still developing it. You know what I mean? Like we're all doing this at the same time. So it really doesn't matter at what time you joined the train. It's already going. Everything you learned six months is going to the trash. It's completely useless. We're talking to Oculus and they're like, we're sorting it out, too. You know, we're asking them to do stuff.

So I think it's a very iterative process. And I don't think matters so much of at what time you join. Of course, you do [INAUDIBLE]. The disruption has a huge impact on education. And I think we'll see tremendous changes in the education system at large because of that, because technology advances so quickly that everything you've learned is lost.

And it's a very big problem for a company like us because all the knowledge we've earned, like for some time we've been doing heavy production where you use cinema equipment, big sets, big cast. All that, it's just completely useless. And so I think this train is going to keep accelerating.

JOEL PENNINGTON: Yeah, so because I love motion capture I built a motion capture lab in our San Francisco office. And I don't use it anymore. I now just use the HTC Vive and the Oculus Rift that's plugged into the computer. And all the motion capture equipment is unplugged and collecting dust. And that's only in the span of 18 months that that's happened. So maybe, I don't know, maybe in six months I'll just be using Daydream or some Intel thing or something from some other company I didn't even know about.

SCOTT DEWOODY: I mean, we're looking at doing conference rooms specifically for VR now, like that have the appropriate design or space requirements for the Vive. Or that we have the proper hookups already so people can just come in, plug in the device. All the other equipment's already set up. But they just have to check out the actual HMD from IT and walk in and plug in and go.

And so we're seeing a lot more demands.

A few of our offices have recently moved and remodeled. And that was kind of one of the first things is like, we need a space solely for this. And so we're seeing a lot more of that, even coming from some of our clients, they're demanding. At first they were like, we need a cave. And now it's like, we don't need a cave. Let's just set up a room that we can do room scale VR in.

JOEL PENNINGTON: Yeah, I have been very excited about how the price to enter is just going down to almost nothing when you compare what we did just a few years ago with caves, what we did a few years ago with full, expensive, multi-user motion capture systems. Now we use that same computer. I put a new video card in it. I plug in a consumer grade virtual reality system and I'm in. That's it. That's the high end.

Or I could do the $20 Google Cardboard with the phone I already own.

JEFF MOTTE: Because things are changing so fast, I mean, you know, generally with technology in the architectural space in my experience, there'll be somebody that will be on a part time. You know, their full time job is not new technology x. You know, they play with it for a little bit and they go back to their job. Do you think that's a hard thing to do with VR? I mean, do you really need somebody who's dedicated to staying on top of what's going on or could somebody part time be doing this?

ANTHONY CORTEZ: I think it's definitely important to have somebody there staying on top of the technology because it's constantly changing really fast. Even applications that you've created before may not work on the updates that have been done on the new hardware. So it's always-- it's been changing really fast. So I think it's definitely needed.

JOEL PENNINGTON: I wonder if it's like an 80/20 thing where today you could lean on Autodesk with Autodesk Live and buy an HTC Vive or an Oculus Rift and then you're in. And then as Autodesk Live updates you'll get access to new features and so forth. That's the 20% investment. Maybe then the 80% is-- to get you 80% there. Then the flip side is--

But if you really want to be on the bleeding edge, the vanguard, and you want to go and experiment on your own and get into Stingray or other game engines and push it, become the extreme thought leader for your industry, then the investment goes way up because you've got to be right on the edge. But if you want to be one step behind the edge, maybe leveraging

what we're doing at Autodesk is a way to keep you up to speed with very, very low investment.

SCOTT DEWOODY: I would say, depending on the size of the firm and your company and what you're willing to invest. It could be across the range. I mean, I am like the dedicated person for like 5,300 people. And they all like to go experiment on their own, too. So trying to corral that group and say, OK. Like I had someone come up to me the other day and say, have you seen this? And I was like, yeah, I looked at it like six months ago. Like we're already here.

They're like, oh, getting that person up to speed. And so there's a lot of experimentation going on, which is great. But at some point like a business, you're going to have to start corraling that and saying, OK, we're going to kind of go down this route. And so having someone dedicated for that is probably ideal but at a smaller firm, if you've got someone who's really passionate about it, like let them run with it a little more than you may originally intended to.

ANTHONY CORTEZ: Because people have different skills. People have different backgrounds and they could use this technology to enhance that skill, as well at the same time. You know, like what you would be working on may not be something that somebody else is working on. But that idea for using VR for their purpose, you know-- at ARUP we have people that are in security teams. We have pedestrian planners.

So they probably will use that technology for a different purpose. And I guess having that line for doing research, I guess, for them would be definitely beneficial.

JEFF MOTTE: When we first started, Joel, you had brought up something kind of about this stigma. And I've seen this other people mention it as well. You know, when you get to the higher level within companies and even within certain cultures, there's a stigma of wearing an HMD, especially if you're in front of other people and you're being isolated, you feel like everybody's watching you. You know, what do you think needs to happen for that not to be an issue?

JOEL PENNINGTON: That goes right back to multi-device collaboration. So if people can join in, maybe there's folks that are on Daydream or Google Cardboard. There's folks that are in HoloLens. There's folks that are in HTC Vive. There's a person on their laptop. There's folks looking at a big screen. So that in a 30 minute pitch everyone can get the experience that will sell to them. Or during a design review that you can get all the folks, whether they are located together or remotely accessed into a single environment.

And as efficiently as possible get through the design review. So in my experience when we

bring customers through at Autodesk, there is excitement. But we do get folks that resist putting the headset on. And so sometimes they watch the screen and they get a 2D experience. However, often they watch their colleagues having so much fun that they buckle, and then once they do that they're like, oh, this was great.

But I don't want to force anyone to have to do that.

SCOTT DEWOODY: From my experience in talking to colleagues across the firm, we haven't had really anyone who's been very hesitant about putting on a device. Everyone's always been really excited. I think it's just because it's fresh and it's new and you hear so much buzz around it. But we have noticed that clients untethered devices like Cardboard or the Gear VR more than they do the HMDs, mainly because of that cord.

And so I'm actually really interested to try this new wireless adapters to the HTC Vive to see if that actually solves that issue because they just get tangled up in it. And they get a little aggravated. And sometimes they also just don't like coming to the office. They want you to come to them. You can't really bring the Vive. I mean, you can, it's just you really got to plan for it. And it can get really complicated.

But the wireless, like the Gear VRs, the new Dreamscapes, the Google Cardboard, like we've learned clients have absolutely no problem putting those on, at least at the moment. Now, there may become a day where the honeymoon phase wears off on it and it's like, OK, I don't need to put that on. I get it. We may get there eventually but I don't know. Things are moving so fast and growing so quickly it may not happen for a while.

ANTHONY CORTEZ: Yeah, we haven't had any issues, also, with the higher ups or anybody not wanting to put the glasses on. We even had a client, he was probably 70 years old, South American client. Came into our office. The first like 30 seconds he was in the virtual theater he felt a little bit dizzy or what. But after 15 minutes we couldn't get him off the thing.

GASPARD GIROUD: We do have-- I see a divide in the demographic of people who adopt the system. We have people who refuse to put it one. You know, in markets and real estate, you have older woman with hair that you know has been [INAUDIBLE] before they get to the office, they politely refuse to put it one. So it does happen. And I think that--

Also I noticed, women just don't seem to engage as much in the Vive. The demographic is, I hate to say, young male. They just get super excited about it. And the older you go in age, the

less interested they're in, especially women, especially the hair problem makes that sometimes they simply won't put it on.

JOEL PENNINGTON: So you always have your back up. You have your projection screen playing whatever the person is seeing. And sometimes you have just projections, that will definitely help.

JEFF MOTTE: You mentioned just a second ago one of your clients put it on and became dizzy. I don't think that's necessarily a factor of age. That seems to-- for me, personally, I get VR sick very easy.

JOEL PENNINGTON: That's one of the things.

JEFF MOTTE: So what are a lot of the locomotion methods that are being used, even in games now, if you go to the Rift store now and you look, they have to have a rating. And almost 90% of them are rated intense, meaning you're almost certainly going to get sick if have a predilection to getting sick. I mean, how do how do you control or how do-- what's the best way to navigate around in an architectural space and not get somebody sick or uncomfortable?

SCOTT DEWOODY: Well that's one reason why we lean a lot towards the 360 renderings is because the frame rate is pretty much locked on a phone. And it's the frame rate which introduces the motion sickness. If you pretty much drop below 90 frames a second, you-- the frame drop, you don't-- I mean, even if you're hovering around like 80, 85, like you don't see it but your eye and your brain doesn't make that connection, which is where the motion sickness gets introduced.

JEFF MOTTE: That and that disconnect from ear and eye.

SCOTT DEWOODY: Yeah. But the 360 renderings for the most part, if you have them on a mobile device like a Gear VR that's optimized for that, like we haven't really seen any motion sickness around those. Now, when you start talking about room scale VR with the HTC Vive and the Oculus, it's really, really important that you have the hardware to be running whatever experiences you need to design around that hardware. And you curate your experience around that hardware because if you're working on three GTX 1080s and then you move to one 1080, you're going to see a performance hit.

And so it's going back to how game developers have to like do minimum requirements specifications on their video games and much like this now this new rating. You're going to have to just keep that in mind. And things are going to get better, you know, like I talked about earlier, the new Vulcan API. Things will get better but this is where we are right now. So you're

going to have to look at inclusion calling and you're going to have to look at polycount. You're going to have look at optimizing your scenes in the game engine a little more than you'd probably like to spend right now. It will get easier.

GASPARD GIROUD: You do have FPS, but we're working on something super exciting for our platform. It's a helicopter tour of New York. So now we stay at 90 frame per second throughout, but the helicopter is banking. Your body's not banking. So that disconnect will make you sick. So it's not only in the frame rate. It's also if you happen to be in a platform that's moving in a way that's disconnected from your actual body, then it can get you sick.

JOEL PENNINGTON: To expand on what Scott was saying, my position is it shouldn't be your responsibility to have to make sure that you've set up a occlusion calling and you've fixed polygonal issues and you've decimated meshes and blah, blah, blah. So we spend a huge amount of effort to do that work so that you can get into that immersive experience faster and it doesn't make you sick. It offers a compelling experience.

But when you get there, when you get into that immersive experience, you can then continue to push it further. You didn't have to do all the mundane work, which isn't taking best advantage of your creative capabilities.

ANTHONY CORTEZ: Yeah, I think that's one of the mistakes that people make is you always have to think about the end user's situation or experience. You can't put them-- the reason why the client felt a little sick when he first put it on is we put him on the top balcony level of the theater, right in front. So as soon as he-- [INTERPOSING VOICES] so as soon as he popped it in, he's looking down at the massive theater.

So it's just like, be aware of where you place your user, especially when they first put the glasses on.

JEFF MOTTE: I'm curious, just with a show of hands, how many people here who have tried a VR experience have felt queasy? So it's quite a few. So I'm not alone. I feel better now.

SCOTT DEWOODY: It's not just you.

JEFF MOTTE: So we've only got a couple of minutes left, so maybe just kind of final thoughts on where VR is now and where it might be a few years from now. I mean, in your ideal utopian world what

does VR or AR or MR look like? And how are we using it in an architecture and marketing?

GASPARD GIROUD: I think Joel was right about one thing-- everything-- particularly with this thing about other technologies are advancing very, very fast, in particular AI. And if you see these two merge, I mean what can happen is literally everybody had almost like a scared reaction, like this is all much. And I think this is a very fair thing to ask yourself is that VR is probably going to start blending in with technologies that are raging right now. And that's going to take it to a completely different place.

ANTHONY CORTEZ: Yeah, I think VR is here to stay. AR, I think it's going to be even bigger than VR in the future. I say one billion users by the year 2020. And it's just an exciting, exciting field to be to be into. It's like the wild west. You know, you're kind of making up your own language right now, it's such a new platform, that it's very, very exciting. I'm happy that you all are interested in pushing this technology forward.

SCOTT DEWOODY: Yeah, I see everything going better, faster, stronger where it is right now. Really, I mean, I think the HMDs are going to become wireless. I think the form factors are going to become slimmer. With AR, I think Google Glass was probably a couple of years too much ahead of its time. I think if they held that project off and bring it back in a year or so, I see things going that way. I think we're going to have my glasses can start projecting information for me and things like that.

And I think Google hit it on the head. I think they were just a wee bit early to that train. So I see things like it'll become more consumer friendly. And we're going to see more and more people just using it and expecting it in our everyday lives. We'll be able to walk around and we'll have navigation to your next class. That will be the new AU app. And so the arrow will light up on the floor. And it's like, OK, you need to go this way now.

And your calendar will be displayed off to the side somewhere. And then just how advertising works online right now when you go to Amazon and browse something and next thing you know you're on a news website and an item pops up. It's like, you're going to walk down the street and it's like, ads just going to pop into space saying, hey, you should check this back out. And it's like, no, I don't need that.

So I think it's going to be really interesting to see a lot of that stuff come into our world, which I think is really just the next evolution. I just don't know when.

JOEL PENNINGTON: To be a little pragmatic, I hope that folks in this room will be able to communicate their designs more effectively. And it doesn't matter if you're in a Google Cardboard or on the desktop or using a web technology, that hopefully you can communicate more clearly with your clients and win more projects. And I hope that we can get there as soon as possible.

JEFF MOTTE: We've got five minutes if we have any questions. We can probably use that to fill the last few minutes. Go ahead.

AUDIENCE: [INAUDIBLE]

JEFF MOTTE: So just before I'm going to repeat your question so that it's on the recording. So he was just asking whether or not Apple has entered the market, if we've heard anything on that.

SCOTT DEWOODY: I saw Apple file a patent for a VR-esque device. But I've heard absolutely nothing else other than that. And that was awhile ago. That was maybe a year ago. So I was half expecting the 7 to have some kind of VR capability. And then when they announced nothing on it, I was like, OK, well, maybe they'll do it with the next one. But I haven't seen or heard anything on that front.

JOEL PENNINGTON: There was a really great company out, maybe three years ago, called Matteo. And they had image tracking, object tracking, edge tracking down pretty well. And Apple ended up acquiring them. So I'm sure they're still behind the scenes in the game trying to figure out what they can do with the technology. But I think you know we haven't seen the last of them.

AUDIENCE: I have a question, I was discussing with [INAUDIBLE] but I'm just curious to see if is it your client now that are requesting VR or is it [INAUDIBLE]

JEFF MOTTE: So the question was whether or not clients are asking for a VR or whether you're having to propose it to your clients.

JOEL PENNINGTON: More and more clients are asking for it, we don't even have to come to the table. And some clients are even expecting it, like why didn't you bring VR. Like we're going to a proposal and it's like, why didn't you bring it? OK. So there's been more and more upticking inside of the firm, too, where it's like, why aren't we doing this? I'm like, we are doing this. But no, we've had clients more and more and more and more, I think the words just getting out.

And you know, we've been doing a lot of trying to promote it exterior as well. So I think everyone's just heard about it now and most don't even need a client to bring it up. It should

just be part of it now.

SCOTT DEWOODY: Yeah, I mean, I think it's just the next evolution of our industry. It's like, we went from renderings to animations to interactive presentations. Now we're going to VR, AR. It's just the next level. It's more and more clients are-- they know about it now. At least it's out there. There's a lot of buzz about it.

And if it could tell the story that they want to communicate to their audience, then we always have to go with the best way to play it, to show it.

JEFF MOTTE: There was a question on this side here, go ahead.

AUDIENCE: [INAUDIBLE], are they expecting to pay for the services. Are you seeing a way to put into your road map of available services?

JOEL PENNINGTON: Oh yeah.

JEFF MOTTE: So the question was whether or not clients are willing to pay for the experience.

JOEL PENNINGTON: Yeah, we're definitely putting it as an added service. And they pay for it.

SCOTT DEWOODY: At Gensler, it's a little column a, a little column b. So a lot of the 360 renderings we do, we're just doing them automatically like we would stand renderings. So for the most part, we're not we're not really charging those as an ad service. It's just a part of the design process.

Now, when we start looking a lot of the room scale, HTC Vive, HMD type interactive experiences, those are becoming more of an add service just because of the cost behind them. But doing the 360 renderings at like A360 or any of the rendering engines pretty much do it now. It doesn't really matter what you're using.

Since the process of designing those renderings is pretty much the same up until the point where you say I want it to be VR, the uptick in cost is negligible at that point. There's only, again, it's the extra time to design the entire space, not just a single view. And then the rendering time that goes along with it. And so we don't typically charge extra for those renderings.

AUDIENCE: [INAUDIBLE]

SCOTT DEWOODY: I mean, if you started your project already, I mean, it would probably be easy and beneficial to do it as add service in that regard. But going into a new project where I would say build it into the fee if you can and just do it. Clients seem to be a little more-- they're paying for it but they're not paying for it. It's just how the numbers fall.

JEFF MOTTE: So I think we're all out of time. So I want to thank everybody for coming today. Hopefully you've gained some valuable insight into what's going on in VR. And thank you.