

TOM SMURDON: Hi, everybody. Welcome to Sound Design for Oculus Quest and Beyond. I'm Tom Smurdon, I'm the Audio Content Lead, this is Pete Stirling, he's the Audio Engineering Lead. Thanks. So a few things that we're going to go over today is performance with the Oculus Quest, how many sounds can we get out of it, how many voices, and that's all spatialized voices. We're going to go over Bogo, which was an experience we came up with up in Seattle with the Oculus-Rex team, and that was just a test to see how far we can push the Quest, and so we're going to talk about the audio part of that. Pete's going to dive into dynamic room modeling, and he's also going to be talking about the work that Facebook Reality Labs has been doing with propagation, and then we're going to dive into what the Oculus Audio SDK is going to have coming up soon. A lot of people have been talking about 3 DOF versus 6 DOF. I'm just going to explain that really quick again. So, 3 DOF is what the Oculus Go and Gear have, that's three degrees of freedom, that's just when your head can pivot left and right and everything's on a pivot, so sound designing for that is a little different than working with 6 DOF. 6 DOF is more what working on Rift is like, where people will actually move around. Like in Bogo, we found people would like get on the ground next to different things, and since it's untethered, people tend to move around a lot, and so you have to watch all your attenuation curves and everything else. I'll go into more of that later, but next Pete is going to talk about performance.

PETE STIRLING: Yeah, so like Tom was saying with Oculus Quest, it's a 6 Degree of Freedom headset, and this is more like Rift, and so people are going to be expecting very high-fidelity experiences, but achieving a high-fidelity experience on a mobile headset is a challenge, and so you need to be aware of some of the performance considerations, so I'm going to be going through that with you now. So when we talk about performance, there's a few different elements here that you need to think about. The biggest difference between a PC and a mobile chip set is the GPU. It functions very differently, and this is where the vast majority of resources, programming and engineering time, will go into, porting a title from Rift to Oculus Quest. Fortunately for us, we don't worry about the graphics, but the CPU is very important for audio because that where all our signal processing, the spatializer, everything is running on the CPU, so this is going to be the biggest priority for audio people like your good selves. Memory budget is another thing to be mindful of. Again, it's going to be less than what you've got on PC. On PC, you could have 16, 32 gigs, sort of the sky's the limit. On a mobile platform, it's more constrained, you're going to be more in the ballpark of 2 gigabytes, and you're sharing that with the rest of the game, all of the textures and the geometry and the other things going on, so you might want to be thinking about more compression and that sort of stuff, and having a more constrained amount of memory being used. And another thing to think of is the size on disk, so on PC, you might have a 3-terabyte hard disk, you can install thousands of games. On these devices, on Oculus Quest, you're going to have much less space, and so having a smaller app size is going to be important, which again is going to affect the size of the assets and the type of compression you're using on your audio. So something I think is really good to do at the outset when you're working on a constrained platform is to have some idea of what these performance constraints are going to be ahead of time, so work with the engineers on your team and talk about what sort of CPU budget you can have for audio, and the performance budgets for memory and disk space and those sorts of things as well, and if you know those ahead of time, it can help you plan out the project and think a little bit about how to maximize the performance you can get out of the device. Now, I've got some numbers here, and these are kind of ballpark numbers. I ran some performance tests on an Oculus Quest, and this will give you an idea of what the

performance cost is of some of the major features of the audio spatializer. So the direct path HRTF from the source to the listener is about 0.4%, so this is really cheap, and you can definitely afford to put this on every single sound, and we highly encourage that you do that. It's really important to spatialize all the audio in the scene, so you're getting that real spatial image of the sound, and at this performance cost, there's no reason not to. Now, the more advanced features like early reflections, these are a little bit more expensive performance-wise, so it's almost 10 times as much, and so you don't want to be having early reflections on everything, that's going to absolutely kill the CPU, so you want to be really mindful of using that, if you use it at all.

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Generally, for Oculus Go and Gear VR, we recommend people just turn reflections off, it's kind of an easy way to keep the CPU budget under control, but if you've got some good reasons or you've got some feature sounds, you may want to use it one or two, that will be totally fine. And the other piece here is the reverb, and you can see that's sort of a similar cost to the early reflections, but this is a shared performance cost because there's one instance of the reverb and all instances are sending to it, so if you're using our reverb, you only pay that fixed cost, so it's totally reasonable to be using the reverb and the direct path HRTF. There's obviously other options for reverb – Middleware provides reverb solutions, there's other plug-ins as well, they're all viable options – but if you're evaluating a new reverb for your next title, I highly recommend you include ours in the list. We rewrote it last year, and it sounds quite good and it's really fast, so it's definitely worth trying that out. And so that's kind of the theory behind it, but I'm going to hand back to Tom to talk about an actual project.

TOM SMURDON: Actual project

PETE STIRLING: A real one.

TOM SMURDON: So Bogo was the experience we made up in Seattle with the Oculus-Rex team. That's also known as the Oculus Real-Time Experience team. We made Dream Deck and we made First Contact, and just a bunch of different things that everybody in the room I'm sure has seen already, so Bogo was just pushing the boundaries on Oculus Quest and what we could do. We went through a ton of iterations, it's a virtual pet. She's super cute and she'll do all kinds of things, like she'll fetch sticks. She gets dirty in some mud, you can clean her up. You can feed her, all kinds of different things, watch a fireworks show with her. Here's a little clip so you can check it out.