MARCELLO SGAMBELLURI: Welcome. How's everyone doing?

[FAINT CHEER]

Come on, now. How's everyone doing?

[AUDIENCE CHEERS]

Yeah! Does everyone want to learn about families in Revit?

[AUDIENCE CHEERS]

Yeah! All right. Very good. That's much better. My name is Marcello Sgambelluri. I'm BIM Director at John A. Martin & Associates. Structure firm in downtown L.A.

Today, we're going to be talking about more families in motion. It's going to be really exciting. Today's really like a 2.0 version of a lab that I taught last year called Families in Motion. Families in Motion, last year lab. Did anyone attend that lab last year? OK, so about 15%. OK. Very good.

So, today, like I said. It's an updated version, kind of like a piece of software. So we will be going through some review for all the people who haven't. As well as you're going to see some new things. All right.

So I want to get to know everybody here. My presentations are very informal, as you know. And I get really excited about this. I'm going to run around up here, maybe I'll run down there, and I'll get so excited, and we are going to have a lot of fun.

So, I just want to know who I'm talking to. How many people have used Revit to build some type of family that had to move? All right. And that's what this class is all about.

If you have a family that needs to move, whether it's translation or rotation, or combinations of, or many combinations of them, this class is for you because we're going to be talking about that. And this is going to challenge the role traditional methods that you think about for family modeling. We're going to do adaptive components, we're going to do classic family editor,

we're going to do 2-D, we're also going to do a lot of different concepts in here.

And, so I have to warn everyone this is an advanced class. OK? This is going to be hard core Revit family modeling concepts. OK? Yeah! All right.

So, this is not for the faint of heart. If you're a little worried about it, feel free to leave right now. Everyone want to stay? All right.

Don't give me a low mark because it was over your head, because you have all been warned. All right? OK. Very good.

So, we're going to have a lot of fun today. I'm just I'm so excited. Oh my goodness. You can follow me on Twitter. I also run a blog site, the Revit Complex. I also do a podcast called Simply Complex Podcast. So, I'm heavily involved with this stuff and it's really exciting.

So, let me talk about what we're going to do today. And because everyone here is a Revit modeler, I was talking to a lot of people, really, I'm here because of you. I'm proud of everyone in here. The fact that you're Revit users and you are Revit modelers, you're already awesome. You're already the champions in your office, you're already my heroes. OK? You're welcome.

So, today, at the end of the class, I'm going to turn you into Revit super heroes. How's that sound? All right. OK. Good.

And, so we've got a lot of interesting stuff to go over. Anyone has a question, just raise your hand. You don't have to go up to the microphones here. Feel free to call out-- once I call on you, you can ask the question, no problem. I don't mind getting interrupted up here.

All right. So, let's go ahead and get started. We've got about 53 and 1/2 minutes to do this. Got a lot of material to cover. All right, let's get started. Here we go.

I already talked about this. We're going to talk about the Revit software. We're talking about massing, adaptive, traditional family to make a move, all right? We're going to be challenging a lot of the concepts that you've known to actually make families move. And we're going to do some really fun examples today.

The first one will be this one, a piece of construction equipment. We're going to be using the massing an adaptive component to do this. And then, we're going to take those same concepts and we're to turn them, and we're going to use them in a traditional family editor.

And we're going to do this one. Yeah. Classic family editor all right? All right.

That's just two of seven that we're going to do today. So, let's just go ahead and get started. Everyone ready to rock and roll?

AUDIENCE: Yeah!

MARCELLO SGAMBELLURI: Oh, yeah. All right. Let's do it. OK. Here we go.

So, families in motion. Let's do it. So, the first one is this. This is a family. You may think it's complicated, but it's not. This is a lift to put a person in. You can place them in there and then it lifts them up. I'm going to show you how to actually do the mechanics inside of Revit to animate it just like this, to make it move just like this. And, what if I told you that this is ridiculously simple to do? And you don't have to invest anything in order to do that. OK?

You want to see how you do it? Oh, so easy. So easy. OK. You're like, really? Oh, yeah. It's so easy.

OK. So, let's go ahead and start to think about some of this stuff. Let's go ahead and start to think about this stuff. And let's start to challenge some of the stuff that we know today.

How many people have actually had to build a family where you have a rotation parameter in there? And how many people absolutely love the rotation parameter when it hits 0 and 90? OK. Right?

I don't think I need to demonstrate it to this crowd because you're already my Revit heroes. But, just in concept, it goes like this. Right? And then, what do you do? You put this here. And then, this is your rig. So, you put stuff there and make it rotate, right? And you set a parameter here. And then you change this to, what? 0? Everyone, right? And then you change this back to 45. And then-- oh my goodness, look at that. What just happened? Right?

So, you've got these instability issues that you have to deal with. But even that aside, there is even more exciting stuff I'm going to show you.

So, let's challenge this. But what's even more exciting today because we're Families in Motion 2.0, is we're also going to challenge the typical way we think of translation parameters. And what do I mean by that? I mean this thing that we know and love for so long. I have never

taught this before and I'm so excited to show this.

I want everyone to challenge yourselves on this parameter. OK? Right? You can do this. You can make a parameter like this. Right? And you want it to move, you can do like this, right? I want everyone to rethink this.

I'm going to show you some methods that you can also use to replace that, to add stability to your families. All right?

You're like, "Marcelo, what do you mean?" All right. Let's go ahead and get going, and you'll see exactly what I mean. So, everyone keep an open mind as we move forward. All right. Here we go. Ready?

Woo! First example. All right. So, that first example you saw, that lift. Some of the people who took the lab are going to be familiar with this concept. But, basically, we want to be able to build a family that's able to flex and move to these particular parameters. Right? Now, if you have a family where you only have a door swing open once, OK, fine. Then, you just add the rig once and you're done. But, what if you have multiple arm movements? What if you have a piece of a-- what if you have a articulating TV stand, or medical lights, or other things like that? Or a [? ?] wall lift, like this.

These are the things you can use to help you build the rig. OK? And I'm going to show you.

So, we are in the massing editor at the moment. And the adaptive component editor, all right? So, it's really simple. Just think about the way these things work. Instead of using that classic two right-angled reference lines and then a line to host it with that angle parameter, well, in the massing environment, what if we just used a circle? And what if we took a point and then, instead of placing it, and then-- here we go, center, we placed one at the center, and then we hosted another point onto the line? Well, the developers were kind enough-- if we put a spline to point here, and we made that a reference line.

The developers were kind enough to give us the ability to host points to lines, and able to rotate them like this. Not only that, but the developers were even kind enough to give us the ability to turn the parameter into an angle. And you can actually place it at zero. And you can place it at 360. And you can place it at 90, you know, or whatever. OK?

So, this is a concept we're going to use. Think about that. But also think about this. Every single work point has an additional reference plane on it. Excuse me, we're going to use that

power.

So, we have a point. We host it. We do a circle rig. We can host something onto that reference point, and then keep going on and on.

So, this is how it works. I know I'm moving a little fast, but you'll get the idea. All right. Let's do it. Ready?

So, I'm going to start the first one. I'm going to go ahead and come over here. If you need to build a piece of equipment, go get the cut sheet from the internet or the manufacturer, they'll be happy to give it to you.

So, we're going to start the first point here. We've got to follow these rules. Ready? First, we want to set the reference plane on that first point. Like that. Then we want to put our first circle there. Now, we're going to move it to be big enough to this first rotation point. This first linkature. And, why do we do that? Because we want to host a point right there.

Now, I'm not quite exact, so don't kill me, OK? I mean, you can get more exact when you use it later. Then, you can pick these two points and you can put a line through it.

Then, when you look at this in 3-D, you can see you already have the start of your first linkage. Do you see that? Am I using that classic 90 degree rig with the angle parameter? Right? No way. No, not at all. So I'm using this, right? It becomes very stable. And doesn't it feel natural to have a circle when you want to do a rotation parameter? Doesn't it feel natural to have it follow a circle? Because isn't that what's happening? Or a piece of a circle. An arc. OK. Good.

So, let's keep going. So, let me move it back. Let me go back to that view. All right. Now, this is where it gets super cool. You can stop there, if you just had one rotation, or you can keep going. So, in this case, we actually have multiple ligatures, don't we? Multiple links, excuse me. Rigid links, I suppose.

So, then, we can actually make the circle bigger and catch the next rotation point. And then, we can click these and add a spline through point. The reason I'm adding a spline through point, instead of this line in 3D snap, is, if I pick those two spline through point, I know for a fact that those two points are hosting that line, OK? If you have no idea what I'm talking about, you've been warned already, right?

[AUDIENCE LAUGHS]

All right, very good. So, you all are hanging in there. Awesome. Let's keep going.

I call this, kind of plug-and-chug. Because we're doing live demos and sometimes it takes a little while, but that's OK. So, I'm just going to walk around and do this again. And you'll help me with the last one. Ready? Spline through points.

I want to do the last one. So, how would I set the last rotation rig on that last circle? What's the first thing I do? What? Set. Very good, set. And here's the thing. Someone came up to me and said, "You know what? Why do I have to keep track of where I'm setting my reference planes where I'm drawing? I have a really hard time doing that" I'm like, "Well, then you shouldn't be building families".

[AUDIENCE LAUGHS]

If you have no idea what reference plane you're drawing on, don't build families. All right? I said it.

So, you build it there. You go Set. OK, cool. Then, the next thing we do is, well, we could, I suppose. Circle. How far does it go? To the next rotation point. Let's just say there. And what I do now? Add a point right there to the rotation right there. And then you come here, and you come here, and then you say, spline through point. All right. And then, we can come here to our 3-D view, and we can see that we've got something pretty cool going on.

I'm going to add-- I always like to add a point. Because what's important, really, are the bones of this. Not necessarily all the other quote, unquote "stuff" that you like to put on it. OK. So, I'm just going to put this here. Just so we have something to look at.

So, that's a little big. But you understand. That's basically the stuff that would be all the hydraulics, and all the little linkages and so on. So, you understand. All right. So, really cool.

So, now, let's go back to the view and we'll see how this works. So, now, what you do is, because you already have these hosted, when this moves, everything else better move. So, let's move it to the next point. You see this? What's happening? Everyone see this? Everyone see what's happening? I've got a question for everyone. Did I nest anything in here? No, look at that.

Oh, see how easy that was? See how easy that was? How cool is that? Come on, now, how

cool is that?

[AUDIENCE CLAPS]

Isn't it ridiculously simple?

AUDIENCE: Yeah.

MARCELLO SGAMBELLURI: Yeah. Of course. All right. But it gets way better. Oh, it gets way better. Watch this. OK? So, now that you have this set up, you can actually take this and move it another position. But, do you see this has like a telescoping part to it? Well, because this is already hosted on reference circles, if you want something to telescope, all you have to do is just-- anyone? increase the diameter of the radius. Super cool, right?

Now, everyone is my Revit hero in here, so I don't need to explain how to add parameters and so on, right? You got all that, OK? Right? I mean, you can do that, so I'm not going to go over all that.

But, yes, you would be adding parameters to this to drive it, if you wanted to. Or you can use grab and pull a line. There's something even better. Watch this.

Now that everything is linked together-- this is super awesome, OK? Because the developers actually never really-- I don't think, quite honestly, realized this was going to be the case. But, because you're moving like this, technically, you are simulating what we call inverse kinematic motion. Where you kind of know where the end is, like that bucket, but all the ligatures in between self calculate themselves, like where they need to be. And that's like inverse kinematics, OK? So, that's what we're simulating here.

But, if you take all the nodes and select them all at once, you don't have to pull them one by one, if you wanted to move this. You can actually do it like this. Is everyone watching this? Does everyone believe this is Revit? OK, now. Come on, now. How cool is that?

[AUDIENCE CLAPS]

All right. One more thing I want to mention is, you can say, yeah, that's great. But, you know what? What I'm going to have to do now, now that I have that all built, is, I'm going to have to be able to-- let me back up, now that's all built, Marcello, do you see these limits? That won't-- this actually has the ability to move all the way back on itself, right? And that's not technically

what this is supposed to do. Well, if that's the case, where is it supposed to go from? Based on the specifications, it's only allowed to go about to here.

Or this one, for example-- let's see, let's talk about this one. This one right here, is only technically allowed to go to about there, right? Well, what you can do is, you can actually-- what you can do, then, is, do you see the circle that's driving it? This one? All you have to do, then, is just break it.

So, from here, to wherever it needs to go. Do you see that? And then you can delete it. Forget about those formulas, if, then, at, eh, ah. Forget it.

[AUDIENCE LAUGHS]

All right? You've got a natural bumper there. It's awesome. All right? OK, now. How cool is that?

[AUDIENCE CLAPS]

All right. Simple, right? So, you say, "Marcello, that's all fine, that's great, but I build my cranes, my construction equipment, in the Classic Family Editor. Marcello, you can't do that in the Classic Family Editor" Oh, you can't? Watch this.

OK. Remember that telehandler? Oh, it's getting real now. First time I've ever showed this. Ever. Watch this. I'm getting really excited. OK. Remember that picture? This, right? So, we've got the base. What I'll talk about is the boom. How you rotate it, and then, how you can basically make a telescope. Isn't that what we did?

So, let's think about the tools we have in the Classic Family Editor to replicate that motion. So awesome. And it's-- and it's-- Come on, now, and it's, what? Ridi-- or, ridic-- come on, now. Ridi-- Ridiculously simple. Oh, my goodness.

[AUDIENCE LAUGHS]

Watch this. OK. So, let's think about what we're doing with the rotation rate. We were hosting something on a circle, but it was moving about, a circle. Well, is there anything in-- well, OK, first of all, we have circles, but we don't have points in the Classic Family Editor, right? We've got those four options. Extrude, Blend, Revolve, Sweep, Swept Blend, right? How are we going to do this?

Well, don't you see that point that sweeps or rides along that circle? It's actually making a, what kind of motion? Would you say like a revolve motion? Can anyone guess what we're going to use?

AUDIENCE: Yeah.

MARCELLO SGAMBELLURI: That Revolve. Oh, it's so powerful. Watch this. I use it all the time. OK, ready? So, I've got this thing here just to show where the rotation will be for that first boom part. All right, here we go. All you do is go, boom, Revolve. OK? Set. Pick plane. I'm going to put it here, just because that's where I want it to rotate about, although you could set up a reference plane, or whatever. But I'm just showing you the concept.

Access line. Let's build it, I suppose, between these midpoints. Can I get it from here? Let's see here. OK. There it is. Boom. All right. Good?

That's the access line. Boundary line. Where would that be? That would be-- now, I'm kind of eyeballing this, but you would probably be getting it more exact than I am doing it, right? Probably be out there.

OK. Now, you're like, "Well, that looks kind of funny, doesn't it?" Well, guess what? You can open these things up. Revolves. Look at that. See how you can open up this revolve? Well, guess what? You've got a nice flat face there to reference things to. OK?

So, watch this. I'm going to bring in the boom, but just remember that's just stuff. So, I'm going to bring in the first one. Here we go. Ready? Boom. And I'm going to host it right here. Do we have to turn it? Probably have to turn it. OK. There we go.

All right. I know. We're going to do a little adjustment here. I think-- Let's kind of zero. Depending on where you place the original revolve, depends on what face would make it zero. So, you play with that if you want.

But, anyway. I'm going to move this down because it would be about right here. I mean, I know it's not quite right, but that's the rotation. So, do you see that? OK.

So, now, guess what? This can be made a parameter, and this can be made a parameter. Do you see that? Yeah. Guess what this could be? That could be zero. Could be 360, 90. And you got these little pool handles. Do you see this?

[AUDIENCE CLAPS]

Oh, it gets way better. It gets way better. Now, you're like, "You know what? I have another piece that telescopes. How am I going to do that? Is there anything, any type of element that has telescopic ability in these, here?"

Oh, extrusion. I love you, extrusion. Watch this. Pick plane. Boom. Now, do you know why we're hosting it here? Because that is where we're going to be placing our extrusion. Boom. And do you see that also has a length parameter? You can scoot this one back, if you want, because then, this could go to zero. Right? But you understand that concept. OK. Cool?

Let's go ahead and hide this, just for a moment. Let's bring in our articulating one. We can do this one. And we're going to host right-- probably there. Are we upside down? No.

Good thing about the Classic is, it's pretty good about readjusting. And now, we're going to turn this all on. And then-- no, that looks pretty good. OK. So, ready? Here we go. Another moment of truth. Ready? This actually rotates and it also telescopes. Come on, now.

[AUDIENCE CLAPS]

So, easy. Oh, ridiculously simple, right? Oh, it gets better. It gets better, right? We've got the fork at the end, right? That also needs to rotate. All right, well, bring it in! Here we go. Ready? So, here we go. Oh, here we go.

Create. Because it's rotating, it's going to be a revolve. Revolve. Set. Pick plane. Boom. I'll put it there. I always do Access Line first, just so I can see what's going on. There we go.

Boundary line for this one is a little more, not obscure, but because we're kind of out in the weeds in 3-D. Out there. It doesn't really matter. Only because the revolve is like a-- and we're going to open it Up. The revolve is like an element to guide you to host things to it, isn't it? Yeah? OK. So, then, we got this, and this. OK?

Now, people ask me, "Well, you have this thing right here, in here. Gosh, what are you going to do with that?" I mean, what do I do with that? It's just, really horrible, I mean, what could I do with that? Hmm.

[AUDIENCE LAUGHS]

I don't know. So, anyway. So, here we go. Boom Fork. All right, here we go. Boom. All right.

Did we kind of get it? Yeah, pretty much. I mean, I'm just eyeballing, but like I said. Do that right. And then you can take this and then you can move this around here. 270 would probably make it zero. Let's see here. Yeah. Like that, right? 270. For 270. Yeah. Pretty cool, huh?

[AUDIENCE CLAPS]

OK. Cool. Yeah, all right.

So, there's a few other things you can do with this. For example, do you see this end angle? You can actually make that a parameter, if you wanted to, for example. And the reason I want to do that-- I'm going to call it Endboom, maybe. Endboom. The reason I'm doing that-- I'll say OK.

And I'm going to make this one, that drives this one, I'm going to say-- I'm going to call it start, maybe Startrack, or something. You know, that's the rack.

Now, the reason I'm doing that is because, do you see, typically, in these kind of things, because now these parameters are all together, typically, in these telehandlers, when you do something like this, these forks need to remain parallel to the Earth, right? Because you don't want to pick up a pallet and have it spill everywhere, right?

So, do you see how this revolve is the angle relative to the planet? This revolve is also relative angle to the planet. So, all you have to do, if you want to keep this vertical, is, say, I want my Endrack to always be equal to my Endboom. And it will always be vertical to the ground, or parallel to the ground. How cool is that?

[AUDIENCE CLAPS]

All right. Yeah OK, cool. I mean, I know the fork, sometimes, you are like, "No, Marcello. Sometimes, in the job site they have the two--" OK, sure. So then, add another parameter, plus a little bit of rotation. Right? And then, any time they need-- just put that little bit of rotation, but it'll always be based off of that relative which is the plane horizontal to the Earth. OK?

Now, isn't that ridiculously simple? All right. OK, cool.

[AUDIENCE CLAPS]

Wanna keep going? It gets way better. It gets way better. All right. What are we doing next?

I'm going to-- I have a-- No. What are we going to do? What are we going to do? I'm debating on which to go next. Getting really excited here. Because you guys are really getting this, and I suppose we can do this. All right, I suppose we can do this.

So, we talked about the revolve, right? But we kind of left it loose, right? The revolve. I mean, we didn't really constrain the other end. There's a lot of power in constraining the other end of the revolve, right? I mean, we have one face we host to, the other face is just kind of flapping in the wind, right?

It's better to take control of that. And what you want to do is, you actually want to be able to, say, you always follow your start by like this much, or something. And what I mean by that is, if you happen to have like a door and you want to have it swing open, or bi-folding doors. Or, in this case, we're going to do a revolving door. OK?

So, if we're going to do a revolving door and its rotation, and we're in the Classic Family Editor, the 3-D Classic Family Editor, what element am I going to use? What element could I use?

AUDIENCE: Revolve.

MARCELLO SGAMBELLURI: Revolve, right? Are you going to use the reference plane? Reference plane? Reference plane? Angle parameter? Maybe not. I'm not saying, "Go back to your office and change all your families", all right? This is something you have in your back pocket, right? And that's the thing. So, you're the Revit hero, we'll make you Revit superheroes. You are just going to walk through your office like this, and you see someone drawing that thing, and you just be like, "You know?" Pow! And you just whip out that revolve, right?

[AUDIENCE LAUGHS]

You're like, "Check this out", right? So, that's the thing. By the way, I better do it now.

Has anyone downloaded the handout online and read it cover to cover? OK. I actually happened to bring hard copies.

[AUDIENCE LAUGHS]

There is a short version that's the handout that you get on the app, as well as on the web site. That's the hand out. This is available in the data set. All right? So, I'll pass this around, just make sure I get it back. A thousand pages of goodness, and it actually turns into a flip book,

as well. So, I will hand these around. There you go. That's that side. And, here you go. It can go that side. And then--

OK. Very good. So, check that out. Dataset. This is all available to you. All right. Where were we?

Revolve. Revolving door. We're going to use a revolve. Well, is that obvious? We've got a revolving door, what are we going to use? We'll use a revolve, right? OK, really cool. So, watch this. Here we go.

Revolve. Pick axis. Pick. We're going to revolve about the center. We're going to say Boundary Axis. Now, the boundary is not such a big deal. And we'll explain that in a minute. OK. But, like I said, you can open this up, right? 180.

And, do you see? Basically, what you can do is, do you see this is the start? Come on now, behave. There we go. That's the start, and this is the end. OK? So, that's the start and that's the end, all right?

So, what you want to do is, you want to host something to the start of it. So, set. Here we go. We're going to do the face there. We're going to do a reference plane. And we'll actually just host it right there, OK? And that's where we're going to put our revolving door. Because, why? Because this can actually rotate and carry anything with it, do you see that? You can host a panel on to it, whatever.

But, what are we going do with this thing? Right? If this thing happened to cross that one, then it would break. So, all you have to do is just make two parameters. A start angle. You could just make one call the "Start". Suppose. OK. And then, you can make one called "End". Make one called, "End".

And you'll always want the End to follow the Start. So, you just go over here and you just say, OK, if I want the End to follow the Start, then I'll just say End, you are always equal to my Start, plus a little bit extra. I like about 5 degrees, we can debate that a little bit more. But, do you see this little piece? Right? Now, this little piece can actually rock and roll and right around. And it can do wild and crazy things like, 90 degrees? I know, I know. Come on now, zero degrees?

[AUDIENCE CHEERS]

And, I don't know, I don't know, 5,000 degrees?

[AUDIENCE LAUGHS]

Right? OK. So you get the idea. We're having a bit of fun. But, anyway, just to finish this out. You've got the idea. I don't need to continue, but I will.

So, here we go. We've got a extrusion. Set. [LAUGHS] OK. And, then, I'll just place that there.

I'm just building. What I'm doing is, I'm basically building an extrusion, but this is what would represent your door panel. Which would happen to be a revolving door. If you have the right material, it would probably be thinner, yeah, yeah. But you understand, right? Also, I suppose I'd have to rotate, copy this thing, I suppose. I'm not going to make it exact. That's the structural engineer in me doing doors, so, forgive me.

But you get the idea, right? So then, when you do this thing. Then you can just grab either one of these, and then away you go. OK. And then, I suppose we could even show you how it looks in a project. You load this thing in.

Do you know why I'm doing this? Do you know why I'm doing this? Because I've been teaching Revit since 2012, and everyone is like "Marcello, I see you build all these families, but, you know you don't do anything practical. You never put anything in the project environment, Marcello". And I say, "What's a project environment?".

[AUDIENCE LAUGHS]

I'm just kidding. So, I am doing this to show you. All right. So, here we go. So, it is real. I know you do have to put these on sheets, eventually. I understand. So, here we go. What you could do is do this, and you just have yourself a rotation party, right? Well, I want to go 30 degrees. Oh, 30. 45? Am I going to get bold and do-- because when you test your old families, you are like, "Should I do one?" But now, you're like, yeah, you stand up tall, and you're like, "I'm doing zero". How cool is that?

[AUDIENCE CLAPS]

All right. Thank you.

So, between all that, we're really starting to understand that there's really a whole lot you can do, right? Just with the Revolve and the Extrude. And then, if you're in the Adaptive

Component Environment, with the Host Rotate and Build Circle, right? OK. But it gets even better, it gets even better. We've only just begun to scratch the surface of this potential.

So, I've got another example here. Are there any questions? I feel like I'm doing all the talking up here.

[AUDIENCE LAUGHS]

AUDIENCE: I've got [INAUDIBLE]

MARCELLO SGAMBELLURI: Go for it. I'm listening to you.

AUDIENCE: So, when you're putting linear things in a typical vanilla Family Editor, you can assign instance parameter and with reference, then you get little arrows you can drag. Why does that never seem to show up as the ability to have angular drag arrows in the Project Environment?

MARCELLO SGAMBELLURI: Oh. The question was-- I'll shorten your question. The question was, when you're in the Classic Family Editor and you put reference planes, and then you assign them, you can get those spool handles, as long as they're linear dimensions. Why can't you get pull handles for angular dimensions? That's an off topic for this class, OK. We'll talk later. But you do get pool handles in the Family Environment if you use revolves. So, you know, let that make you feel a little comfortable. OK?

[AUDIENCE LAUGHS]

All right. OK. Where do we go? I suppose I better do this now.

OK. So, the idea is, "You know, Marcello, that's great, but I model all my stuff in 2-D detail components. How do I make 2-D detail components rotate? How do I do that in 2-D detail components?" So, I thought about this, and I'm like, "Yeah, it's-- you're right. How do you do that in 2-D detail components?" So, I decided to come up with a fun example here to show you this.

So, really, the first step is-- this is 2-D detail component. But the first step, really, is just to go ahead and build yourself a AT-ST detail component, OK? Everyone just go out and do it, all right? And then, I'll show you actually how to animate this thing, OK? It's really cool.

So, there's no 3-D button here, right? There's no rotation. But there is a lot of cool things in the 2-D detail component that you might miss.

One is, the bones. How do you set up bones for the inverse kinematic motion? It's really easy. All you do is, take reference lines, because it's 2-D, right? So, you know what reference plane you're drawing on?

There are different work planes that you can draw on in the 2-D environment, and you've got to be very careful of it. But in there, lies the beauty of what we're going to do, OK? We're laying down reference planes. So, don't assume it's all going to be put on one reference line, I mean, one work plane that will never change. That is not true.

But, what you do is, you can build your bones just like this, right? I mean, from joint to joint. Sorry, I'm not a AT-ST anatomy expert, but I'm sure some of you in here are, so, please, please be gentle with me on this. But, here's the thing. When you click-- first, you have to build something, and then, you can reassign it to a work plane. It's really cool.

So, the bones. What you can do is, you can start with the feet and say, Edit Work Plane. And you can say Pick Plane, and you can assign it to this one. Then, you just go to this bone, and you just kind of plug and chug. Say Work Plane, and then you assign it to this one.

Basically, what you're doing is, you're working your way back to the source of the movement. And in that case, it would be like this drive train, right? I'm sorry if I didn't call it all right. And then, basically, do you see here? We're Just talking about the bones. Do you see how it's actually moving in all relative now? Super cool, right? Yeah, but you're like, "Yeah, but I want all this to move". So easy. Watch this. All you have to do is take all the other stuff, and then just do it again. Edit Work Plane, and then place it on the bone. So, it's like, first, you build the bones, and then check the muscles and the skin, and then put it onto the associated bone. I mean, doesn't that make sense?

Now, I'm not going to be super accurate here, because I don't have a lot of time. But, basically, you have to select all these hatch patterns, excuse me, regions. And then, assign them to the appropriate bone.

How come that didn't work?

For example, do you see what we're doing? You see that? That's what we're doing. Oh, there's a little lag there. Huh. How cool is that, everyone? Let's get going. How cool is that?

[AUDIENCE CLAPS]

Yeah. OK. Cool. [LAUGHS] Yeah, I do. I geek out about this stuff hardcore. Oh, my goodness.

All right, let's see here. Work Plane. There we go. Next, would be this one. I suppose we'll get that little thing, too. By the way, this is all available in the dataset, so you can have at it and play with it. And then, Pick Plane. I think we're here. I think I do have to do this one. I suppose I should. I Suppose I should. I'll do this one, too. Where is my minus? OK. Here we go. OK. One more, one more. Hang in with me. One more. And then, we go Reference Plane. And then, we pick the bone, right? Cool. Ha ha.

So, now you could actually move this, accordingly. It's so cool. Oh, my goodness. I don't know about this thing. Oh, we lost that one. But I guess that's OK. You understand what we're doing, right? I didn't get that one, but that's OK. And I know you're going to argue with me, like, "There is no way it would move like that" I understand, but, you know.

[AUDIENCE LAUGHS]

But you get what I'm saying? Let me get rid of this. Isn't that cool? How cool is that? That's how you move 2-D detail components.

[AUDIENCE CLAPS]

All right, so-- Thank you.

You can put dimensions between them. Have yourself a party about that stuff. Right? We're Revit heroes in here, so you don't need me to go over that.

2-D detail components. Man, we're on a roll. Let me just keep going. Wow. Wow. We're doing good on time. OK. Great. Let me keep going. All right, well, let's keep going.

OK, so what's the problem with 2-D digital components? Now we're getting really theoretical. Crazy, wild. What's the problem with 2-D detail components? They're 2D. So, that really bothered me. And I'm like, "You know? What if you want to rotate it out of plane?" You can't do that, or can you?

What about this? I'll show you really quick. Never showed this to anyone at Autodesk University. Super awesome stuff. Right?

So, you're like, "Yeah. You know? But my detail component, every once in a while, needs to actually rotate out of plane because the way we see it in the view". We actually do that with some structural beams. If it's coming out at an angle, our detail component needs to actually rotate out, based on that cut-plane perpendicular, right? So, all you do is, you can do stuff like this, ready?

And you can actually get your pool handles. And you can actually make it rotate in 2-D. Ooh. How do you do that? Cool stuff. I love this. Oh, my goodness. Watch it. It's so

AUDIENCE: Ridiculously simple.

MARCELLO SGAMBELLURI: Ridiculously simple, right? If I edit this family, all it is just, you have some pre-set positions, like 0, 15, 20, 25, 30, kind of how it's going to look. Right? And then, you can actually regenerate the stuff using Dynamo or whatever. You have a 3-D component, you can rotate it and then capture it. Build the hatch pattern, capture. You build the hatch pattern. It's really easy to do.

And then. Just based on-- I just set it up to this reference plane with some equations. I'm not going to go into detail because you are all super awesome Revit users. Basically, any time that threshold passes one of these criteria, then it turns one on, and then it turns all the rest off.

Easy, right? Yes, so easy. Yeah, super easy. Maybe I should show the equation and you can take a screenshot of that. But, yeah, it's so easy. Really simple.

So, 2-D detail components don't have to be plagued with being 2-D, OK? There it is. Boom. Hashtag 2-D-detail-components-don't-have-to-move-in-2-D. Got it?

[AUDIENCE LAUGHS]

All right. Yeah. We're rock and rolling now. Any questions? OK. Rocking and rolling. I've got another one for you. I can go all day. All right.

Let's talk about another adaptive component. Let's talk about this case. Window washing davits. Oh, I love window washing davits. What is a window washing davit? A window washing davit is a-- you've got that thing on top of a building that has to hold the chair that someone climbs into that it needs to operate. And it's actually pulled by a cable. OK?

So, I'm going to show you how to actually simulate cable motion. And cable motion is important because it wheels in, but it also wheels out, right? So, in a sense, the length

changes. Right? But, because its intentional, all the time, or should be, then it's allowed to actually move freely about its rotation point or spool point, right? Be able to suck in and move out.

So, how can you simulate motion that allows to actually shorten and lengthen, but also move at any point along the plane at which that cable needs to be pulled out of? All right? We'll talk about when it's out of plane, but let's talk about when it's in plane. Everyone got it?

You know what I'm going to say, right? I won't. I know I've been stressing it too much, so I won't say it anymore. But, basically here, I already had this built for you, and you can have this if you like. This is actually to 2-Spec. So, I'm going to say this is kind of the easy part. Now, right? I mean, after you've built that lift, something like this with just standard static shaft, vertical shaft and horizontal shaft that rotates only about 1. You're like, "This has one rotation point? That's so easy" Right?

And that's what's going to happen at work. You're going to go back and you're going to be a superhero. And they're going to say to you, "I've got this family, and, you know, it's got these two armatures, and they kind of do like this. And then, these kind of rotate. And then, they kind of like telescope. And it also needs to be in the Traditional Family Editor. And it's really difficult to do". And you just stand there like this. They're like, "What's wrong with you? What's wrong with you?" You're like, "I'm waiting for the difficult part", right? Because it's so easy. You just think about what plane you're in. Rotate translation. That's really all it is. OK?

So, this is pretty simple stuff. I won't get into too much detail about it. Although, this point does drive this little carriage, right? That, then, the cable would split out of. You understand? I have this family pretty much complete. All we're going to do is build the cable. So, watch how easy this is.

So, I'm going to isolate that point. And then, I'm going to do like this. Because I was thinking, "You know what? I could build a circle. I could build a circle, and I could put a point on the circle". Right? And I could use the trick that I used before, where I grab this, and I grab this point, which is the one that's driving that carriage. OK? Everyone with me?

And then, I can do spline through points. And then, this cable is allowed to move like this. And I could change this diameter, and it could do like that. But that's kind of old school.

[AUDIENCE LAUGHS]

Right? That was so 15 minutes ago. [LAUGHS] What you can do now is, you can actually take this thing. Let me make it a reference line. And then, you can create a surface out of it. OK? And then, basically, cable movement, instead of hosting it onto a curve, you can also host a point onto a surface.

Oh. I just opened a whole new world to everyone. Everything we were doing was like linear. Like point on a curve, right? Just think about what you can do with a point on a surface. Oh, it's crazy awesome. Right?

So, you can just say Pick new host. Boom. And then, now you have this in here. Right? I won't bore you with the details, but you can pick that, and pick that, and pick that, and you can swing it all around. And then, you see this? Isn't this like the-- let me hide this for dramatic effect.

[AUDIENCE LAUGHS]

Isn't this the cable movement that you would want? I mean, you can make this longer. But isn't that what a cable would need to be doing? Right? Like that. I mean, you can set parameters to this, like U-V coordinates, as well. And then, you can just have yourself a cable party. All right? How cool is that?

[AUDIENCE CLAPS]

It gets better. Now that you have opened your eyes to the world of surface hosting. This is actually hosting in one plane, right? Well, what if you have ball joint motion? Not planar motion. What if you have ball joint motion? Right? Sphere, right? Ah, sphere. But, this would be a sphere. Come on, anyone? What would I do instead of a sphere? I would do a--

AUDIENCE: Cone.

MARCELLO SGAMBELLURI: Close. Hemisphere. Right? Oh, awesome. OK. Watch this. So, I thought I'd bring the old girl out of retirement to show you this. Anyone's seen the Revit cow? Come on, everybody. She's back out of retirement. The Revit cow. The Revit cow, everyone.

[AUDIENCE CLAPS]

Oh, there she is. Oh. Hello, old friend. So, I'm going to show you how to do ball joint motion. And we're going to use it to simulate a cow's head movement. Because that's how it pretty

much would move, right? I mean, it wouldn't twist its head way-- right? It is ridiculously simple.

OK. Watch this. All you do, all you have to do is, build a cow and build a--

[AUDIENCE LAUGHS]

All right. And a sphere. But the really cool thing about a sphere and a revolt-- so, the massing environment also has a revolve. But, when you cut a revolve down, instead of 0 to 360, you can make a hemisphere. So, I think I can turn this to 180. Yeah, there we go. See that? That's a hemisphere.

Now, do you see this point? This point drives the cow's head. So, all I need to do is actually host that onto the hemisphere. And then, beautiful things happen. Oh, my goodness, beautiful things happen. Watch this. See? That's how a head of a cow moves. How cool is that? Oh, come on. How cool is that?

[AUDIENCE CLAPS]

Oh, yeah. So, a lot of things, quite honestly, in nature and in-- I mean, how far do you want to take this? if you want to talk about ball joint movement, a lot of things--

Let me go on my ball joint movement rant. A lot of things in nature, a lot of mechanics don't have multiple joints that are balls. This is a ball joint, that's a ball joint, that is a ball joint. So, you typically have a lot of instabilities. Like, so, in your arm, you have this as a ball joint, but this is actually a planar joint, right? And then, this is also a planar joint. You've got the radial bone to kind of help you a little bit there. But do you understand what I'm saying?

So, taking this out to inverse kinematics and multiple joints that are balls, you typically don't have that unless you have an action figure, or something like that. A toy. But, I mean, you could-- Here's why I'm bringing this up. Because someone asked me, "Well, can you do inverse kinematic with ball joints?" Sure you can. But, I mean, just think about on a practical level, what would it be. And yes, I said practical. Because, I mean, it's really not that, but I can think of one example that actually did kind of simulate this.

So, you can take a sphere and you can set reference plane in another sphere. Perhaps there. You can do that, I suppose. Let me see. Let me see if I can get it. Oh. Kind of hard to see, now. OK. See if I can get it. Is that it? Yes, it's about there. OK. I guess that's pretty good. Something like that, right? And then, 180. Like that, right?

This reminds you of any droid you happen to see in a galaxy far, far away? Right? You know, right? Little happy BB8, right? Kind of doing his thing, where you tell him sad things and his head drops, and so on.

But, this is things you can do, and have a lot of fun with it. But, I mean, really, from a practical standpoint you don't have it. But, I mean, if you wanted to keep going with something like this, you certainly could. And you can just add another point, right? Like this. And then, you can connect these two points up, and then so on. And you can keep moving and have multiple ball joints.

So, you understand. You could do multiple ball joints, if you want. Or you can just keep cute little BB8. Or you can just do movements of cow heads, or shoulders, or whatever you want. OK? So, how cool is that, everyone?

[AUDIENCE CLAPS]

So, I would honestly say now, that we've come to a point where there's pretty much nothing that's stopping you from creating amazing things inside of Revit with the Family Editor, right? They're like, "Well, it's a 2-D Detail Component". So? "Well, it's going to be in the 3-D Classical Environment", so? Bring it on, right?

Because I'm going to say now, that everyone here, you're my Revit superheroes. Come on, now. Give it up. And I've got a special gift for everyone.

[AUDIENCE CLAPS]

I've got ribbons for everyone in here, and it says Revit superhero.

[AUDIENCE LAUGHS]

All right? So, what you do is, when you leave here, we're not done yet, but you know what you can do when you leave? Oh, where's my thing? Here. OK. Here I go. Like this, right? Someone gave me their-- I got it here.

OK, so what you do is, you put this on, right? You get this on here, OK? And I'll give you extras if you want to make more, put more on here. Maybe you want to make a-- You can make a cape, you know? Like this.

[AUDIENCE LAUGHS] And

They will be like, "Hey, how was that class?" "Oh, it's pretty good, you know?" You can stand like this, and be like, hey. Stand by a fan and let it-- you know. So, have yourself fun with it. But I'll hand these out. Can you two help me do this? Just grab them right there. And we'll pass these out. And then, I'll be around at the end of the session and I'll hand out extras, here. You deal with it, OK? Thank you.

OK. So, pretty cool, huh? Yeah. All right. Are there any questions?

[AUDIENCE CLAPS]

You know what? I have a little time. Does anyone want to see anything fun?

AUDIENCE: Yeah.

MARCELLO SGAMBELLURI: I wasn't going to do this, but you're like, "Oh, OK". Encore?

AUDIENCE: Yeah. Encore.

MARCELLO SGAMBELLURI: Encore. How many people want to see me build this in three minutes?

[AUDIENCE CHEERS]

MARCELLO SGAMBELLURI: All right. Can you cue some music, please? Anything. [EXHALES] I wasn't planning on this, but we're doing awesome on time. Come on, cue it up.

[MUSIC PLAYING]

All right. So, what do you do with any kind of mechanical equipment? You go out, you get yourself, go to the manufacturer and get yourself some blueprints. Come on, turn it up. There we go. All right?

Get yourself some blueprints. Watch everything I taught you today. And enjoy. Ready? Here we go.

[AUDIENCE CHEERS]

All right. Are there any questions? Yes.

AUDIENCE: What was the animator that you used at the beginning?

MARCELLO SGAMBELLURI: The animator?

AUDIENCE: Yeah. That little video you made. Like, what--

MARCELLO SGAMBELLURI: Oh. How do we make-- Actually that was the-- the question was, what's the animation that we use to do the Family-- the lift. That, I built inside of Revit, and then I sent it to 3ds Max and I rigged it up, and then I built it. But I suppose what I could have done was, built it inside of Revit, assigned the rigs to it, and then animate it using Dynamo. I suppose I could have done that.

Any other questions? Yes?

AUDIENCE: About ellipse How-- any functionality with the ellipse--

MARCELLO SGAMBELLURI: The question was, is there any functionality with ellipses? Absolutely. And ellipsoids? Absolutely. Or surfaces? absolutely. Or any curve? Absolutely. Right? So, you can just go ahead and have yourself a great old time.

OK, everyone. I want everyone to go out there, do awesome things. You're my Revit superheroes! Thank you.

[AUDIENCE CHEERS]

OK. Cue music. Oh.