PAUL F. AUBIN: We have officially seven minutes before we start. But I'm ready, and I like to do this. I started doing this last year. So I'd like to take a few questions before we start. Now this is a Family Editor session, so it can be on the Family Editor or not. I don't care. Don't ask me about InfoWorks. Let's try and keep it to Revit. But anything at all that anybody wants to ask-- again, we haven't started yet. Those of you coming in, and I'm just doing a little Q and A first. Anyone? Anyone have a question? Nobody? Something that's been bugging you? Hey, free consulting for the next 10 minutes or seven minutes. Yeah?

AUDIENCE: So we're just starting to use C4R with consultants.

PAUL F. AUBIN: C4R, OK.

AUDIENCE: Yeah, weren't sure if they were still doing a separate file, and we link it in-- or if they actually work on our file.

PAUL F. AUBIN: I missed the middle part, a separate what?

AUDIENCE: A separate Revit file, do we link it in like a structural [INAUDIBLE]?

PAUL F. AUBIN: So it's funny that you ask. So the question is about C4R. It's funny that you ask that, because I was just in a lab yesterday about this, and I've played with it a little bit myself as well. So Revit will link to other Revit models, when you're in C4R. It seems to not quite be there yet for like DWGs and point clouds and even keynote files I was told, so they're working on this stuff. But Revit to Revit, what you would do is each person on the team, each discipline, would actually have their model in the cloud and they would link through the cloud. It's like auto magical.

AUDIENCE: They wouldn't work on the architectural Revit file?

PAUL F. AUBIN: Not unless you wanted them to. I wouldn't recommend it. I'd still go with linking. Yeah, anybody else have a different experience, using C4R that you wouldn't links?

AUDIENCE: Yeah, if you have a link to your file, thre Revit, they go together. The whole package in two files.

PAUL F. AUBIN: Right, everything is still the same, right? Yeah.

AUDIENCE: You need have two files.

PAUL F. AUBIN: Right, but her question is should she invite the other people to join in her architectural model. I wouldn't change that. Would anybody change that? No, I'd still want the other discipline in a link, right? Yeah, right. Yeah, you're welcome. OK, those of you coming in, we haven't started yet. I'm just doing a little Q and A first. So anyone? Revit question, anything? Could be on today's content, could be something else. Anything? Don't be shy. She wasn't. She broke the ice. No? I could show you a video. How much time do I have. I don't want to start late now. OK, I have five minutes. I can show you this amazing video of what I did in Volterra, Italy in October, if you want to see that. Yeah? OK, I heard a hell yeah, so all right. We'll do that then.

It's like four and a half minutes, so we have just enough time to see that. I have to plug this in. Well, it's just background music, but it's nicer with music.

AUDIENCE: I have a quick question for you.

PAUL F. AUBIN: Oh, now you have a quick question.

AUDIENCE: [INAUDIBLE].

PAUL F. AUBIN: Yeah?

AUDIENCE: I'm new to Revit, and I realize that building the families is one of the most important things.

PAUL F. AUBIN: Right.

AUDIENCE: And get all the parameters you want in there and get them set properly. I saw a video once. A guy mentioned a piece of software used to populate your parameters into your families. Do you have a piece of software that you can use to do that?

PAUL F. AUBIN: I'm kind of old school, but we'll be talking about that throughout the session. But no, I don't. Well, sort of. Hold that thought. Let's do the video, since we had a hell yeah. So this is how I spent October. It's somewhat relevant, because I did some of the Revit work in this, but we had a really cool team of folks-- happened organically. We had engineers, we had civil guys, we had guys that have flown drones before, laser scanners. And we were out in Volterra, Italy for two weeks scanning it three scales, the scale of the city, scale the building, and doing photogrammetry of objects in the museum. It was way cool.

Roman theater-- we have 110 scans of the Roman theater and the point clouds. There I am. Best seats in the house-- we got all access. We're down there in the theater. Tourists don't get

to go down there. It was really cool. And the point cloud is coming up in a second. It's mammoth. It's a big point cloud. We're going to mesh it eventually, but we're still processing data. I don't know why the sound is not playing. Maybe I'm muted. I am muted. Yeah, there you go. There's the point cloud.

So my motivation to go is to get some firsthand experience with point clouds and Revit. And it's Italy, duh. But each person on the team had different reasons for being there, and I definitely got everything I wanted to and more out of the experience.

I could guess, but I would probably guess wrong. So I'll make a note. Remind me later, and I'll get you that information. We didn't go the highest, we backed it off a little bit. But I don't remember the exact number we used.

About eight minutes, seven and a half, eight minutes. So does that tell you? The scan was about seven and a half minutes, eight minutes per scan. Yeah? Yeah, we had two [INAUDIBLE]. So this guy put his GoPro underneath the drone while it was taking off. That was kind of fun.

So, yeah, we had some-- Italy introduced the new regs, like the FAA, two months before we got there. So we weren't able to fly in the city. We had to hire Italian pilots to do the flying. But we were able to fly out there. And if you want to go to Tuscon, you could stay there. They call it Agro Turismo, and it's a vineyard. And it's like a little mini hotel, their version of a bed and breakfast, only way nicer. So, really cool. So yeah, the owners of that vineyard let us scan there. I love the shot that's coming up because it's the drone, the moon, and the monastery off in the background.

So one of the guys on our team is a commercial airline pilot in Canada. And he has a side business where he flies drones. So he had nothing to do with our industry, he just came along. And that was really cool, getting that totally different perspective. But he knew all about aerial charts and all that other stuff. So that was a really cool experience to have. I'm not going over am I? Oh, crap, it's 8 o'clock. OK, I'm supposed to start now, but I think it's almost done.

Steven Shell, now we can start. Steve Shell everyone.

[LAUGHTER]

How much time does this have? All right, it's about 40 seconds more, sorry. I'm starting 40

seconds late, because I don't want to just cut it off. This kid-- we had an open house at the end-- just sat down and started flying around the model. Nobody showed him what to do. He just grabbed the mouse and off he went. Kids, man, they're like sponges. And, of course, lots of food. That was a big part of the experience. It's Tuscon, you have to eat. And amazing sunsets, and, just, everything amazing. So, very cool.

Do I have any of the CEC folks in the room? No? OK. All right, so, anyway, let's close that, and I guess we will make this official. Start this guy.

So welcome, everyone. This is *Revit Families Step-by-Step Introduction.* My name is Paul Aubin, and thank you for coming today. Let's see if that works. That works, great. So I am an author and consultant. I've written a bunch of books. I do video training for LinkedIn Learning, formally Linda dotcom. And, of course, I do lots of live hands-on training and consulting for, mostly, architectural clients around Chicago and around the world.

So just a few admin items before we start. One that doesn't have a slide, so I'm going to start off by asking how many of you took this class before? One person, two, three, four, yeah. Now it was a lab before, right? Yeah, they threw me a curve ball this year. I've been doing this for about five years now, this particular session. And this year they made it a lecture, which I guess is it's interesting in a couple of ways. Unfortunately, you guys don't get to follow along. But the nice thing is I will probably, unless I babble a lot, get through more material. So there's always that perk. And they're recording it, which is something they don't do for labs, so we've got those two advantages of its being a lecture. But I'll get to that in a minute. I actually have structured it still the same way.

OK, nothing to do with Revit families, but if any of you are either in the Chicago area, you have an office in the Chicago area, you have friends in the Chicago area, who are Dynamo people, I would love to talk to them-- because we started a Dynamo user group a couple of months back. And I'm always looking for presenters, so I'm happy to talk to anybody who you think might want to present at ChiNamo.

If you are anywhere along this grey path on August 21st, 2017-- that's this year, later this year-- you will witness a spectacle not to be missed-- a total solar eclipse of the sun goes across the entire continental US. And I'm just totally geeked out by that. I, unfortunately, will probably be somewhere over here or over here, because I have twins starting college. And August 22nd is right about the time when you have to bring your freshmen to college. So I'm

just kind of doing this and hoping that maybe I will miss the 21st somewhere in there, and I'll be able to high tail it down to Southern Illinois where that dot there says that's the longest period of eclipse. So I get the double bonus of being close enough to drive there.

OK, sorry.

[LAUGHTER]

You know I had to put it in there. It's been 108 years in the coming. So let's just do a few introductory items. How many of you had a chance to download the paper? OK, great. I was hoping more. The paper has been up there for months, actually. I think when you guys sign up for AU, it was already there. It is complete step-by-step because, as I mentioned earlier, this was originally a lab. So you can download the paper. The first nine pages are a lot of introductory material, which I will fly through right now in the first couple of slides here. And then the rest of it is entirely 100% step-by-step, including files, catch-up files, so make sure you download the zip that goes along with it as well. And I'll give you a link to that in a minute.

I'm going to summarize, real fast, what's in the first nine pages of the handout. So there are, essentially, two kinds of families. There are more, but I'm summarizing, remember? And I'm going to summarize it like this. They're the ones you can edit, and the ones you can't. So you don't really care about the ones you can't, because you can't edit them. So this class is not about the second kind, it's about the first kind, the ones that we can edit. So when we talk about the Family Editor, we're talking about the first kind. All the other kind are what we call system families, and those are the ones that Autodesk is in charge of. So if you want to do anything with system families, get a job at Autodesk.

System families include things like walls, floors, roofs, that kind of stuff. Now, of course, some of you are scratching your head right now and saying wait, I make custom walls all the time. You don't make custom wall families all the time. You make custom wall types. Am I splitting hairs? Not at all, because the hierarchy of Revit is category, family, type, instance. So very important that you realize that what you're actually editing in any of these guys is at the type level, which is still powerful and useful and keep doing that. But you're not editing family.

So the kind you can does technically include in-place families, which are special and actually can use some of the system family categories. We're not talking about those. The intention in-place families is that they are meant to be one-off, special conditions that you would only use

that one special time. And if everybody used them that way than we'd have a lot less cranky people out there. But, unfortunately, some people don't get that. So if you're ever tempted to copy a system family, don't. You should have been in the Family Editor then. You should have made an actual family, one that you can use over and over again in other projects. That's what we'll be talking about-- is the component families.

I'm calling them component families. They go by lots of names-- component families, loadable families, just plain old families. They have different names depending on which document you're reading, who you're talking to. But these are the ones you can edit, and that's, of course, the subject of this session. So again, there's a little bit more detail on that in the handout in the first nine pages that you can read through if you like.

So recommended procedure, when you're in the Family Editor now, and you're creating your own custom content. And I'm skipping all the in-between where you might start with somebody else's family and do a Save As and just tweak it a little bit. That can often be faster, but it can also be frustrating. So let's just pretend that we've skipped right ahead and decided we're starting from scratch, because that's what I'll be showing you in the example.

So the first thing you need to do is, of course, decide what you want. That might involve a piece of trace paper. That's OK. I'm not against a pencil. It's still a good tool. So you can sketch, but if you want to sketch in your iPad, that's OK too. I don't care how you do it. But you need to plan out what you want. What is this family going to do, what's its purpose. What features will it have. That might be an Excel spreadsheet, listing all the criteria. The gentleman in the back was asking about lots of parameters. So there's clearly lots of things we might want to make our family do. You need to know what all that's going to be, because it's much easier to plan for it ahead of time than it is to try and tack it on later. Trust me, OK?

That's the other reason why doing Save As from somebody else's may sound like a good idea at the time, but might actually be way more work than you think it is. OK? All right, so you create a new family file, usually starting from the correct template, or you could save as existing. You're going to create reference planes. Reference planes are the bones of a family. They're the structure what makes the family work. So reference planes are an important part.

I call this adding smarts-- is the next step. Constraints or parameters-- constraints are the little locks or the equal equals, those kind of things. Think of it this way. They are rules that the end user of the family can't change. It's built into the family. The only way they can change it is to

do Edit Family and change your family, which you might want to discourage them from doing.

How many of you are content creation people? Couple of you. Any Cat or BIM managers in the room? Couple of you. Are the rest of you just using day-to-day working in the software? Yeah, anybody that I missed? No? Yeah, so if you're creating a family, you probably want to hand it off to somebody or use it yourself. But you don't want people messing with certain things. That's what constraints are for. But if you want to give them something that they can fiddle with, that's what we mean by a parameter. It's really that simple. So think of a constraint as something the end user can't change. It's a behavior that they can't change, where a parameter is a behavior that they can.

I want to be able to give them the ability to change the length or the height. That's a parameter. But I want it to always stay centered, or I want the insertion point here, or I want this thing to always be six inches, no matter what I do. That's a constraint. Got it?

Finally, you build geometry. Some people get real impatient working the family editor. They want to jump right in and start building something. But there's a whole lot of stuff that has to happen before you get to the build geometry step. So you're going to see me demonstrate that here, momentarily, and then, of course, flex often. So I'm talking about a flexible family. It is possible to go in the family editor, start building geometry, create something that looks the way you want, save it, and off you go. That is not a flexible family, because it wouldn't have any of this middle stuff-- the smarts. It wouldn't have constraints or parameters. It wouldn't do anything. It only looks one way. That's a perfectly valid family. If you need a thing like-- that chandelier on the ceiling there only comes that way. That's the way the chandelier is. You could go into the family editor, build that bad boy and save it.

That's not what I'm going to be talking about, primarily, today. I'm going to be talking more about assuming that you want to create something parametric, something flexible. OK, so because it's flexible, every so often we want to flex. The beach is that way. So, got it. Here we go. So Family Editor, 00, I'm calling this prerequisites and set up. So let me just tell you where the handout is. So I just did the pages one through nine, my lightning summary. Starting on page 10, complete step-by-step, and there is a downloadable dataset that you want to download-- a zip file, and here's where you will find that, in addition to the app. I think it's in the app, but I don't know what you do with the zip file in the app.

So if you go to my website, you can download it from your computer, and it's both a PDF and a

zip. The version for today is in 2017, but because I've done this class the last five years as a lab, you can actually go down to the bottom of this page and find last year's or the year before or year before. So I've got it in 2016, 2015, 2014. So whatever version you're in, you should be able to find one, unless you are-- please tell me nobody's like 2010 or 2011 or something, right? No? Are most of you [? event ?] 2017? 2017, show of hands? How about dot one? 2017 dot one? Yeah. Where are the rest of you, 2016? Anybody below that? 2015? Yeah, I have some jobs in 2015 too. I don't get to do a lot of content creation in 2017, because all my clients are still on old versions.

So anyway, let me get out of there, and let's switch over to Revit. And I think I'm going to have to sit down, as much as I hate to do it, because it's a little hard to work this way. This is something I always do. This is just a starting file, and I rarely do this much. Sometimes, I just open, create a new template-- or a new file from a template-- and save. And I call it a sandbox, because this is the file that I'm going to load my family into first and make sure that it's not going to break in horrible ways before I hand it off to a live project team. So this is a sandbox, nothing fancy about it. It was created from the out-of-the-box template.

So I'm going to minimize that. And for the first example, I'm just going to use a generic modeled template. Just to keep it as completely basic and focused on overall concepts as possible. So I'm going to go to New Family. And you'll get a list of templates and depending on your installed version, this may vary. OK, how many folks are not US users? Or, in other words, metric is your default template. Where are my metric people? Only a couple? Wow, I'm shocked. Well, great, then I don't have to apologize quite as profusely about my imperial data set. OK, cool.

So, anyway, here we go. So most of you, it should look something like this, unless your Cat or BIM Manager has totally customized this, which is always a possibility. I'm not actually a huge fan of starting with generic model, but I don't want to get off on that tangent. But I'm doing it here, because I just want to focus on the overall common concepts that apply to-- sorry let me put that on airplane mode, so that won't be happening again. If I actually click this little Restore Down icon here in the middle-- no, wait a minute. OK, that was really weird. I wasn't expecting that. OK, I'll do WT instead.

There are four open windows with not all templates, but certainly this one. So I'm also going to do ZA for Zoom All. And we've got a floor plan. We've got two elevations and a 3D view. So I'm going to do the starting work here in the floor plan view, and I'll zoom in a little bit to make it a

little bit more legible. And I'm going to start with a reference plane. Now how many of you are complete noobs when it comes to the Family Editor? Don't be shy. Good, you're in the right class, because this is a complete noob class. How many of you consider yourself Family Editor experts? What are you doing here? It's like, because I'm going to pick up something. I go to basic classes all the time, because I always pick up some little tip that I didn't think of.

Well, anyway, I am going through the whole process, sir-- so, sorry. I know you know this already. So RP or reference plane, not reference line-- they are not the same animal. So we're just going to stick with the reference plane here. They're killing me here with all these little things. I put that one in airplane mode already, and it's telling me I have a flight tomorrow. I know I have a flight tomorrow, but get out of there because I need my timer. I can't stand fractions, so I'm going to make that just a nice rounded number, and I should probably try and stay relatively close to what the paper says here. So I'm trying to follow along.

Now this is a fairly new enhancement, depending on what version of Revit you're in. I think they added this in 2016. But you can click right in Canvas and name these reference planes, which is always a good idea to do. So I'm just going to call that one left. And then, I'll make another one across here, and then set that to a nice round number-- whoops, not zero. And I'll call that one back. And then, because I'm lazy, I'm going to mirror these like so. And then, I'll just name it. That's right, and this one is front. Now those are the standard orientations, but you don't have to use those names, but I'm just reminding myself what each of those reference planes does.

Now, at the moment, there are no constraints, no parameters, no smarts whatsoever, which means that this reference plane-- I could just move it, and it will happily move wherever I want. So I want to do something about that. The first thing I want to do something is-- if you look at this starting reference planes that were already here, this one was called center-front-back. This one was called center-left-right. And they were both pinned. And if you investigate the properties palette, they're both set to Defines Origin. So chances are you don't want your origin point to move. And if they're called center and center, you probably want them to stay oh, I don't know, in the center. And here's an important thing, that I'll get to a little bit later, those two don't have to stay the same. Just because it started off with the center as the origin, doesn't mean it has to stay that way. So hold that thought, file it away, we'll get to that shortly.

So let me get this to stay in the center. So I'll do that with some dimensions. This is just the standard dimension tool that you would use in the project environment. DI is the shortcut. I'm

going to go across from left to center, to right and equalize it. Then I'll go left to right, and then I'll do the same thing here, equalize it, and you guys in the back can not read any of that at all. So I'm going to come down here and change the scale to quarter inch and zoom in a little better to make that just a tad more legible.

Unlike the project environment, you don't care what scale you use in the Family Editor, because nobody is going to see these views. These are only Family Editor views. So change the scale, do whatever you want there. It's fine. Right now, the equal, equal is a constraint, and it behaves like that. Notice when I dragged one of the reference planes, the other one went the other way, and hey, the center is still in the center. So that's all you need to do to make sure that the center stays in the center.

Well this one, I want to make it a rule, a piece of smarts, that my user can change. That's going to be one dimension, and the other thing is going to be another dimension. It just occurred to me, I forgot to tell you what we were building here. Shame on me, right? Let me switch over here, just for a second here.

We're building a box. And you're like, a box? Yeah, a box, because everything around you has a box in it somewhere. And if you can build a fully parametric box, that's the basis of so many other families that you're going to build. So, I'm sorry, I should have remembered that I had another slide to tell you what we were actually doing. So there you go, let me get back to Revit here. So yeah, I want to define the length of the box, the width of the box, and maybe the height of the box. So these are all pretty basic things you might want to do.

So here is my six foot dimension. And they recently moved the label dropdown from the Options bar to the ribbon. So for those of you that are on 2016 and prior, it's going to actually be here. And if you download last year's handout, the screenshots will reflect that. But in this year's handout, they reflect the new location of it, which is sitting up here on the ribbon. And to create a new parameter-- because if you look here there aren't any. It just says none. You use this little icon right here.

So I'm going to click Create Parameter, and then give it a name. And I wanted to choose the names that I actually said in here. Did I call it length, call it width? What did I call it? I guess I'm calling it width. Width, and I'm going to make that an instance but not reporting. We're not talking about reporting right now, or maybe at all. It's a little more advanced.

So I'm going to call it width. It's actually possible to click right here and say, this is the width of

the box. Now I think width is pretty self-explanatory. So if you create a parameter that is so-called self-documenting, you can skip the tool tip. But the nice thing about the tool tip is like especially if-- I've got some families where I might have 10 length parameters that do other things. And I call them X1, X2, X3, X4. Nobody knows what those are. So you can put little tool tips in to give people a clue. Oh, X4 is doing this and whatever. Because otherwise, the name would get really long and unruly.

So it's a way to keep the name short, but still tell people what it's for. So I do recommend the tool tip, but don't get obsessed about it. Over here, I can just call this depth and just leave it alone, because depth is so-called self-documenting. I'll also make that instance and click OK.

So at this point, you can tell that something's different because we've got the names on the dimensions. Those are now labeled dimensions. And here's the way it works. Up here on the ribbon, there's this Family Types button. If you do a lot of Family Editor work, you might want to go edit your keyboard shortcuts and give that bad boy a shortcut. I didn't do it here in 2017, but I have done it in the past. When you open that, it displays this dialogue, which we can do various things in. But what we're going to do right now is that last step on the PowerPoint. We're going to flex our family.

So you can see the two parameter names listed there. In parentheses, it says default next to them. That's confirming for me that I checked that Instance Parameter option. So default means you're not actually changing the permanent value of this parameter, you're just setting the default value. Think of it like you buy something, it comes in the mail, and factory default was there was three holes. And it's set to hole number two. That's a default. It's just factory default, but you could set it to whole number one or whole number three if you want to-- Instance Parameter.

So let me change this to maybe five, let me change this to maybe seven and click Apply. Yay, I have made my first parametric family. But this is so important to get that workflow down, because now it's like the back of the shampoo bottle-- lather, rinse, repeat. And so everything else we do, we're going to be repeating the same basic methodology. You need to build the structure, apply the smarts, and then flex it, and then move on. Don't think you're so clever that you're going to go through the whole family, set up all the reference planes, set up all the parameters, and then do one big flex at the end. You know what's going to happen at the end-- poof. And if we could make smoke appear on the screen-- you know?

It will break, and then you'll have no idea where to start troubleshooting, because you've got 30 parameters in there. And you're like gee, I wonder which one caused the problem. So if you do them in little chunks like this, it's much more efficient, and you can tell where there's a problem right away and deal with it. It will break, that's part of the process. This is not foolproof. So I'm trying to walk you through a very-- I often describe it like it's a dense forest, where there's only that one path. And you know all those movies where they say don't walk off the path. There's so many places where you can step off the path and fall off a cliff or do all kinds of things and bad things happen to your family. So just be ready for that. If you get serious about the Family Editor, you learn as much, if not more, from your spectacular failures as you do from your successes. I can't even tell you how many cast-off Corinthian columns are sitting on my hard drive that did not work at all.

So let me see where I'm at here. We need a height now. So let's do that, so again, here's the repeat part. Put this back here, stretch this one up, change the scale, make it a little more legible, zoom in, add a reference plane-- I'll just type RP-- drag it across, whole number here-- because I hate fractions-- cancel, select it, call it top. See I'm just repeating everything that I just did a minute ago. And then, in some cases, you can just make that temporary dimension permanent. In this case, because the family is so simple, I can get away with that. But be careful doing that, because sometimes that dimension is referencing something you don't want. So I actually prefer to set my own witness lines. But here I'll be OK. I know because I've done this before.

I'm going to call this height, Instance, click OK, and I'm going to skip flexing for this, because I know that's going to work. But do as I say, not as I do. Let's make some geometry. Uh-oh.

AUDIENCE: Can you explain the difference between family and shared parameters?

PAUL F. AUBIN: No. I mean, I could, but I don't have time out of the scope of this. So the question was could I explain the difference between family and shared parameters. Being a basic level class, we won't be doing any shared parameters at all. But simple is they can be shared between many projects families and other things, and they're a little more advanced. And talk to me afterwards, sorry. I can't do it. Yeah, can't do it. I did that fast. Here on Create, there are just five shapes-- extrusions, blends, and if you do this, it will give you a little animated tool tip, which is a little slow there. There you go-- showing you what that thing's going to look like. So if you're unsure, just watch all the little animated tool tips. I'm going to do a simple extrusion for this, because that's all I need to create a box. It puts me in Sketch mode.

You've all created a floor before, right? Anybody not created a floor? One person has not created a floor. OK, well for the rest of you, making a box is exactly like making a floor. You sketch, and I'm just going to snap to the reference plane armature that I built. I'm going to lock all the way around. And when I finish it, it will apply a default thickness right there. Notice that default thickness is completely ignoring any of my structure, because I haven't told it I care about that yet. So I'll just take the box, and I'll stretch this grip up here, and snap it to that, and lock it, and now I'll flex. And let's just make sure. The height is only thing we haven't flexed before. It's working, so now that reference plane is driving the height of the box, where these other reference planes are driving the width and depth of the box.

So at this point, I'm going to save this. And since it's such an exciting family, I will give it an equally exciting name. I guess I already have a box, so I'll call this box one and save it. I could do Load into Project and Close, but I'm not done with this yet. So I'm going to leave it open, and I'll click Load into Project. And this is why I had my sandbox file, so that I can quickly load it into a sandbox, test it out, and see if it's working. So I'm going to place a couple of these-- maybe inside, I can place them outside. And you see how they are all using the default values. That's what that word default meant. But because they were Instance Parameters, I can now click on them, and over here on the properties palette, you will see the parameters that you've created.

So there's my depth, width, and height. You can make this one nice and tall, you can make this one nice and deep, you can make this one over here really narrow, and you get the idea. Now you have complete flexibility over the shape of that box. So you have a fully parametric box, so what? Well, think back to the PowerPoint slide. That same strategy, that same armature now becomes the seed for so many other families.

And in fact, I will often do that exact thing, and then save it as what I call a seed family. And then, I can just do a Save As of that family and use that as the starting point for my next family. And that's exactly what we're going to do. So I'm going to take that box and turn it into something a little bit more useful now. So I'm going to be creating a shelving unit, so you know where we're going with this. And the shelving unit will start with this box, which will become our shelf. So let me minimize this guy again and take this family. And let me click back into the Plan view, do Window Tile, just to reset the views, Zoom All. And then, let's do a Save As right away, because I'm notoriously bad at-- I'm like oh, I'm going to work on this, and I go, and then I do Save, and then urgh! I just saved over my seed.

So I'm going to start with Save As, so that I don't forget to do that. And I'm going call it shelf. And it looks like I don't have one ready, so I'll call it shelf one. By the way, did you see the folder there, this is the data set that I provided for you. So there's catch up files. They're labeled with letters. So I've got it at all steps along the way. So in a lab, I do that so people can keep following along. But even then when you're working on your own, if you missed a step somewhere, and you can't figure out what it is, you can just jump forward to the next one and maybe that will help trigger it. So I left all that in there for you.

So what do I need to do to this to make it not a box, but really more of a shelf. Well, I'm going to change one thing about the fundamental structure of this family. And then the rest is just going to be flexing it to make it more shelf-like. So there aren't too many shelves that are two feet thick and whatever dimensions I've got established here. So for the width and the depth, the width is what would be the length of my shelf. Maybe I'll go with four on that. And the depth, maybe only needs to be a foot or so. So I'll go with one on that.

Now I'm OK with depth, but I don't really like width any more. You could describe that as the width, but maybe I want that to be the length of the shelf. Well, one of the things you can do is come down here and look at these little hyroglyphic icons down here, because they used to be named buttons. But now we have little pictures, because-- I don't know, going back to ancient Egypt or something. But, whatever, I'm going to edit the parameter-- little pencil icon. And instead of width, I'm just going to rename this to length. Now-- sorry, I might want to spell that right.

You can change the tool tip too. I forgot to show you where the tool tip shows up. There it is. See how when you hover over it, the tool tip is the little second part there. But if I hover over one of the ones that I didn't give a tool tip to, they just say the name. So that's why the tool tips are nice-- is that you give people that little extra bit of information. So I've renamed that to length. Height, on the other hand-- I don't really want to think of that as height any more. That's going to be thickness now.

So I'm going to give that a new name. And let's go OK and start with that. So that's good, but, of course, the depth is way off. Well, I'm going to leave it that way for the time being, because I want to take this reference plane. I'm going to copy it down here somewhere. I'm going to name that underside. And then put a new dimension. This is where, again, I'm going to do the dimension myself on purpose. So here, it's easy. I'm going to zoom in nice and close on this,

so you guys can see in the back. Here it's easy because it's only one thing here. Don't do that.

See the tool tip. I know the tool tip is really hard to read back there. But the tool tip says extrusion shape handle. It also says that same thing right here on the status bar. For the recording, they can't see me pointing to the screen. Well, I don't have one of those little onscreen laser pointers, but it's the lower, left hand corner. It says extrusion shape handle. That's bad. It's not always bad, and I'm not going to explain all the reasons why it could be bad. I'll explain it this way, consistency is what you want. So I want to go reference-to-reference, which is much more consistent with the right hierarchy and proper behavior than if I do one to a reference and the other directly to the geometry.

There are times where dimensioning directly to the geometry is unavoidable. I'm not going to get into any of those examples in this session. But, as a rule of thumb, reference-to-reference is always going to give you a more stable result. Let's say it that way. So start with that rule of thumb. And like all rules of thumb, when it comes time to break them, you will know. But until then, don't. It's like mom told you about falling in love, you'll know it when it happens.

All right, so let me select this now. And I already have a parameter called thickness, and I'm just going to apply that. And, in this case, I knew that was pretty low risk, because I only had that one thing and nothing attached to it. But sometimes, when you apply the dimension and simultaneously flex it, bad things happen. So in a case like that, it would be better to go to Family Types, set the value equal to what the dimension is currently, apply the dimension, and then flex-- because sometimes if Revit tries to do both things at the same time, it just gets a little out of order or whatever. It's like when two people try and go through the door at the same time, and they bump into each other. It's like that. So you can prevent that by just flexing first, and then applying the dimension.

Anyway, I don't need this anymore. So I'm just going to delete it. And so now what I want to do is take this box and reconfigure it. And I don't remember exactly how I said to do it in the hand out, but here's how I'm going to do it here. I'm going to select the box, edit its work plane. Currently it's work plane is sitting right on level one. Well, I just created a work plane called underside. You see it's there in the list. And watch what that does, see how it moves the box down. Now this is not currently attached. See how there is no error there. So I'm going to attach it, because I worry about those things. And anyway, if you didn't attach it, and you flex the thickness, it would just move the bottom reference plane and keep the box the same.

So attaching it to there now allows me to flex the thickness and make this more reasonably thick for a shelf. I suppose you could have a two foot thick shelf, but not, typically, very likely. Now in some cases, you can actually flex in Canvas. And it would look like this. And you guys are going to discover this, so I'm going to just show it to you. I don't always do it that way. But again, this is a pretty simple family, so I could get away with it. But once again, sometimes, when you have a complex family, and you flex in Canvas like that, it pushes and pulls other things in strange ways. So if you're looking for the most stable behavior, go to Family Types. But for quick and dirty, you can do it right on screen there, and that can be helpful sometimes too.

So anyway, we now have something that looks a little bit more shelf-like. So there we go, I'll save that. And then I'm going to go right to Save As and call this bracket-- make sure I don't already have a bracket. I don't, OK. I'm probably forgetting steps along the way, so at some point, I'll probably open one of my catch-up files just to make sure. But so far, I think I'm OK. So that's a shelf, very clearly, but what's it going to take to make this a bracket. It's more of the same, so I'm going to do this fairly quickly. And again, because I've given you all the documentation, you guys can go back and do this more slowly on your own. But I want to get to the better stuff, the more interesting stuff.

So what I'm going to do here is squish it, stretch it. Well, I don't really have to stretch it. I'm going to squish it, stretch the height of it this way, and put a hole in it, and taper it to make it look like a bracket instead of a box. So that's what we're going to do. So to stretch it and squish it, I'll go to Family Types. I'm going to do the length last because I don't want to start with something really, super narrow. But I'll take this what I'm calling thickness right now and drop that down to four inches. Now I don't like the name thickness anymore, so I'll actually just go back to, maybe I guess, height for this. So, sometimes, you do a little bit of back and forth dance here. And now my length seems more appropriate as thickness. So even though I've currently got it four feet thick, eventually it will be the thickness of a piece of metal thickness.

So I'll just get all that naming squared away first. And I'm going to delete my box. What? We worked so hard on that. Well, I want to show you another shape. It's boring if everything is an extrusion. Now you could absolutely go into a more appropriate view here and draw a tapered bracket as an extrusion-- absolutely could do that. But I just thought it would be more interesting if we look for an opportunity to do something else. And so, I'm going to do this one as a blend. So I'm in the Front view, looking at the box, the armature here. And go to Create.

I need one more reference plane, because there's going to be a little straight taper at the front there. And this I'll just make 3/4 of an inch. And I really don't have a name for that, so I'm just going to skip that. But I am going to put a dimension here and lock that. Because I don't want that to change. So if you flex this, that's fine. But this little distance is going to stay 3/4.

OK, so now we're going to do a blend. And a blend just goes from shape one to shape two. So shape one is going to be a rectangle, locked on all four sides. And then, you've got an Edit Top button, which takes you to the second shape, so it grays out the first one. And then you can do another one. Now I probably won't get in trouble here, but I've done enough family editing work now that I get superstitious about certain things. So this is going to look weird, and I don't think I did it this way in the paper. But I'm going to do it this way just to show you guys. You're like why on Earth did you draw it that way?

Because remember that whole thing about referencing the right thing-- keeping the hierarchy what you want? I want to make sure that this line is attached to this reference. And this line is attached to this reference, and I can do that with my Align tool. It takes a little bit more effort, but now I can say line up with this and lock it, line up with this and lock it, line up with this and lock it. And it's a little bit more work, but I now know, for sure, that shape is locked to the correct stuff. So if you have multiple reference planes in the same place or other geometry there, that's a real easy way to ensure that you're picking the right thing.

It's also, by the way, you'll notice that I always make my reference planes longer than they need to be, because it makes it really easy to come over here and pick it. If it's sitting on top of something, you can't do that. So always make your friends planes longer than they need to be. And I'll finish that, and there is what it looks like. So it's at least got the wedge shape going for it, but that's a really wide bracket. Once again, that might be appropriate. We certainly might have a bracket that was that wide. But, probably, if it's a metal bracket, it's much narrower.

So what I'm going to do now is flex this distance. Now notice it doesn't show up here in the Elevation view, that's because we originally added it in the Plan view. In most cases in the 3D family, you'll have to have dimensions in at least two views, but try and do it in as few views as possible. It just makes it easier for you to understand your family, and where you need to go to flex things. So I could flex in Canvas, but I'm going to do it in Family Types instead right over here. And I'll take the thickness, and let's go with 3/4 of an inch-- sorry to my metric folks. And that's still thick actually, let's do, maybe, 3/8 of an inch. I don't remember what I did in the handout, but I probably could look if I wanted to. But you don't want to watch me fumble

around in a handout.

There it is-- a little more bracket-looking now. Now I'm going to put a hole through it, mainly just to show you that we can not only do solids, but we can also do voids. It's not the only way to put a hole through this. I could have gone to the Side view and drawn this as an extrusion in a single shape, and you might argue that was easier. But then I wouldn't get to talk about blends or about voids, now would I? Sometimes, we're making decisions because of the educational value here, but there's definitely more than one way to do things.

So here we go. We're in the left elevation. Make that nice and big, zoom in. And for this one, I just want to mark where the center of the hole is going to be. So I'll do a reference plane, maybe, right here. And call that hole center-- what is that, left or hole center? I'll just call it V for vertical. And then I'll do another one here. This would really be vertical, wouldn't it? That should have been horizontal, but anyway. OK, this will be whole center. And I'll just call it hole center, because I don't want to waste a lot of time. Those are bad names. I should've named them better. I'll put a dimension, put a dimension. Again, you see the way I'm dimensioning. I'm avoiding the geometry. Those are really ugly numbers. So let's make those nice round numbers.

That one probably could get away with about one 3/4. And this one, maybe, we could get away with two. No, not two feet dummy. No, I think I want one and 3/4 there too. OK, so I'm going to lock both of those just to save time, but you could certainly make those parametric. So if your hole needs to move around, you could do that. But now that's just marking where the center of this void form is going to go. So do you see out on the forms panel, you can do solids, but you can also do voids. So I'll just do a simple extrusion again. But this time use a circle, start right there, and maybe bring it out to about a two inch diameter, one inch radius. Now you can make this parametric if you want to.

So if you want to say that this is a diameter here-- I'll just call it D, make that an instance, I suppose. So now we can actually control the diameter of the little hole there. So if we flex the bracket in ways that the hole needs to change, we get that flexibility. And another thing you can do with circles is it's probably going to stay attached to those reference planes. But if you want to be absolutely sure, you can turn the center mark on here on properties pallet. It'll give you this little cross in there. And then you can align and lock it. So align and lock, and align and lock. And since I went through the trouble of making those reference planes, it seems like it only takes 30 seconds to do that. That seems like a pretty good thing to do.

Now at this point, when I created that, just like a solid extrusion, it just gives it a default depth. And it was one foot again. And if it's still selected, it hasn't engaged yet. So it's not cutting the solid yet. But as soon as I click away from it, it will cut into there. But if you look carefully, and it might need shading to see this, it's only cutting halfway through. Can you guys see that in the back? It's darker on that screen than mine.

So what I want to do is pick a different view here, and it's more evident right there. Let me change the scale, so we can see it better. So you can actually still select that void extrusion. It's just like doing an opening in a wall or a dormer opening or a shaft opening in the project. It's a void just like those things, and it's something you can adjust now. So all I'm going to do is take this and stretch it. This is tricky, because I want to make sure it's highlighting the reference plane. Can you guys tell that it's highlighting the reference plane? And I'll lock that. And then, this one I could leave alone, because honestly it doesn't matter. But that bugs me, so I'm going to do that too. And now it cuts all the way through.

And the nice thing is because I locked it to the same reference planes. If we changed the thickness of this to 3/16 of an inch, that will stay engaged, and it will flex. Also, we gave it a diameter. So if I make this three inches-- you can make it really big, make it one inch-- make it really small, and so on. So everything's working. So again, stop and flex and make sure that it's doing what you want. And then, of course, I'll save that.

I'm doing OK here, but we've pretty much been doing more of the same. We've been limited to the back of the shampoo bottle, but I had to build a few of the pieces here. And I think it's more interesting for you to see me build it from scratch than to-- I could have pulled all the stuff out of the oven already baked, but, sometimes, I think it's useful to see it actually come together.

So now we're going to do is we're going to assemble these pieces. So the way you approach building a complex family in the Family Editor should be the same way that you would approach building something in real life. This chair that I've been sitting on, somebody created the metal pieces in one process, and they created the upholstery pieces in another process, and then somebody else put them together. So that's exactly what you're going want to do when building up your family. Don't necessarily try and build everything inside the same family. You can nest one family inside of the other.

So here we've got one shelf, and we need two brackets. And so we're going to take the shelf,

and we're going to nest the brackets in. So I'm going to go back to my shelf family then. And I think that one was relatively successful, so I'm going to go ahead and use the one I created with you just so we avoid a little smoke and mirrors. It doesn't really matter. Though I could use my catch-up file. It's really not any different. I'll switch to the Plan view there. And then, here-- the only trouble is you've got a lot of windows open. So what I'm going to do is-- I don't care which bracket I switch to. But this time, I'm going to use Load into Project and Close.

So it's always better to close the family with the Close command than the little x's. If you x them out in the corner, you'll x out all the views. And you'll get there eventually, but then the next time you open the family, it'll only open one view-- the last view that was open. If you close it with a Close command, either that one right there or up on the big R, it'll close all four windows, and the next time you open, it will reopen all four windows. Remember when I started, originally, four windows opened up. That's why, because they closed the family with four windows open. It saves you a little bit of effort having to reconfigure your workspace. So just a little tip for you there. Always use the Close command.

Now, I'm not ready to load it in the sandbox, so I will uncheck the sandbox. But I am going to load it in the shelf and click OK. And now just like it would in a project, it is loading the Component command and placing the element. I forgot a step. Yeah, I forget a pretty important step actually. So I never dealt with the depth of my bracket. So the center point-- it's geometry is still built relative to the center point. So I'm going to improvise here. I'm going to go ahead and put it in anyway. Like this, and I'm going to create two of those. And let me bring this down here, and let's do a window tile.

OK, so there they are, just floating out there. So there's definitely some adjustments that need to happen, but let me show you what step I forgot. So now that I just got through closing it, I'm going to reopen it, because I missed something in there. So this happens sometimes. So I'm going to do Edit Family. And what I completely forgot to show you was-- and so here it is now. This is what I meant with the-- or it makes a liar out of me, right? Maybe the ribbon one does close all the windows. Whatever, OK. Anyway, you see it right there? That's where I goofed. Can you tell what's going on?

There's the solid geometry. There is my back reference plane, up here. Do you see where the solid geometry is? Do you see how this is poking way out here? It looked fine because what's the default depth? It's one foot, right? And one foot gave us a reasonable depth bracket, so

that's why I didn't notice. Because I was like oh, yeah that looks fine, but I completely forgot. I haven't constrained it to anything in this direction. And that also means my reference plane is controlling my [? holer ?] in the wrong place. I totally spaced out on this one.

So let me show you how to fix it, no big deal. OK, so this is where I wanted the object to reference. If I just go right to here, select this, go to Edit Work Plane, you can actually-- let me zoom in better, so you can see that better. You can actually do either the named, so I could choose back from the list, or you can do pick a plane-- six to one, half dozen to the other. So not only did it pull it back there, but it flipped the other way, which is always a favorite of mine. This is going to make me go way off on a tangent here now.

So I'm going to undo that and show you-- well, let me redo it. Let me show you what's going to happen. Here's how you fix that. You just reverse the reference plane. So watch what happens. Let me get closer. Let me make this big-- get closer here. So when this endpoint goes past this other one-- see it? And then, that's fun. It's like an abstract shark. Some people like to memorize rules-- clockwise, counterclockwise, and all this other nonsense. If I told you that I could guarantee you could walk into the Casino, and I would give you 50-50 odds of doubling your money, would you take those odds here in Vegas? Those are pretty good odds, right?

So you can memorize a bunch of rules and try and remember which way to draw your reference planes. Or you can just know that if you draw them backwards, you can do what I just showed you and fix it. You've got a 50-50 chance of getting them pointing the right way, and it's really easy to fix if you don't. The only time that's going to be problematic is if it's already constrained and locked and attached to a bunch of stuff, which is why it's so important to flex regularly.

So here I had one piece of geometry attached to that reference plane. I knew that it would be safe for me to flip the reference plane, because it wasn't going to try and pull a whole bunch of other crap with it. You guys with me, conceptually? So you decide, memorize rules or go with 50-50. I'm way too lazy for rules, so 50-50 works for me.

Meanwhile, this I want to delete, because this one I won't be able to just move with that, because that's a locked dimension. But then I'm going to take both of these-- because I deliberately made them shorter-- and go to my Move command here, and pick this as a start point, and this as a new point, and that takes care of the whole. And the cool thing is it's still

engaged with the solid, because you saw it was cutting the holes. So now, all I have to do is just reconstrain it like this. And because I used the right reference plane, it's already the correct distance. So we fixed two problems.

Now what about this problem? This looks right, but it isn't. Because you see how that's not attached to this. So if you flex the depth, the back will now move with the back, because we made that the work plane. But the front is just free form. So all you have to do is pull it back like I just did, and then stretch it forward until it snaps and lock it. And now, if I flex the depth, it will properly change the depth of my wedge here. And, of course, the locked dimensions are keeping the hole at the back. So yeah, I just completely forgot to do all that, so my bad, sorry.

What this means is-- and I'm going to show you this. So I'm going to do one more step, load it in, and then come back to this one more time. So what this means is-- this time I'll use Load into Project instead of Load in and Close. If I load it back in over here, it will recognize that we've already got a family with that name, and it will ask me what you want to do about it. And there's two options. Right now, at this current moment, for this family, it doesn't matter. Trust me, I don't have time for another tangent. Sometimes, it does matter. I'm just going to choose the top version here, and do you see what just happened? Now let me undo that and show you that in a different view.

See because the problem with these views is they-- let me do control Y now. I don't know if you could tell any better there. But it was coming in from the center line, and now it's still coming in from the center line, but we've moved the geometry back. So it looks like it's shifting, but in reality what's happened is internally there was a shift, not externally.

Well, the better way to have loaded this-- because if you add another one-- you go to Component-- I guess you can't do it in a elevation there. Go to component-- is that the point you'd want to bring in a bracket from? So you remember in the very beginning, I said you could change the insertion point? So I'm going to switch back to my bracket, and here's all you have to do. Right now, the default center reference plane is set to define origin. All I have to do is click this one back here and say you are now the origin. You can only have one origin in each direction, so that, automatically, unchecked this one. You see?

So now if I just save that. So I've now completely fixed this bracket family-- three problems that I had in there. And reload it in. They shift again, because now they are shifting relative to their origin that we just moved instead. So anyway, sometimes it's actually good to see a goof and

how you'd fix it. So the first thing to do is not panic and start doing. It's to stop and think, what happened? And is it something I can correct? Sometimes, undo is the solution. But people tend to do that a little too quick, and then they make it worse. So breathe, and then undo.

So let me just get this set up. You could move these in a couple of different ways. And there's an argument to be made for either one, but I'm going to just stick with the program here, and put a reference plane, set that to some distance. I'll call this left bracket. I will mirror that. Call this one right bracket. And then this part is where I'm going to just do it for the simplicity's sake here in the session. I'm just going to mention both of those and lock those dimensions. So no matter how long the shelf gets, I'm always going to put the brackets four inches off the ends. Could you make it a parameter?

AUDIENCE: Yeah.

Yes, absolutely. Should you? It's up to you, you're the designer. You decide. What you need your family to do? In this case, I'm saying no. It doesn't matter. So I'm going to align this reference plane. And here is where you just have to take a leap of faith. I know that, hierarchically, the center reference plane has more priority than the two edges. But if you really want to, you can zoom in there to find it. OK, some people do that, but they spend their whole life zooming. But I'm just going to know that it's working, but be careful because you can lock to the other ones. But I want to align and lock that to the center reference planes inside of both of those families.

Then here, same thing. If you look at the tool tips, it's actually telling you reference. So that's how you know it's actually attaching to a reference in that family. You want to make sure it doesn't say shape handle, because that will actually flex the family. Like if I do it in the front here-- I don't know if you can tell down at the status bar, but it says shape handle. If I did that, it would actually stretch the bracket. OK, so I want to go from there, and I want to make sure it says reference. And that moves the bracket. OK, so you do pay attention to those.

And then, of course, in this view, I don't want my brackets to go up through the shelf. So what I'm going to do is-- to make it easier on myself-- I'm going to move them down manually first. Sometimes, when there's all that clutter, it's just hard to see what's going on. But now it's a lot easier to say I want this reference plane and that reference. And oh, I get to do it again. Why? Because there's two of them. So you do have to align and lock that in all three directions in order to get that.

OK, so now will flex just a couple of things here. We'll flex the length of this shelf. And what should happen? Bracket should move out, because we set them at a locked four inches away from the end. What about the depth of the shelf? I'm going to make it really deep here just to exaggerate. Is that what you want?

AUDIENCE: Maybe?

PAUL F. AUBIN: Right answer up front, maybe. Is it likely? Yes, maybe is the correct answer, but probably not. You probably want some relationship. I'm going to do it the simplest way, but I think in the handout I might mention it, or there's an example in there where I actually build in a little offset using a quick formula, but I've got another formula example later. So what I'm going to do is select both of these. And I'm selecting them because I've currently got all my parameters set as Instance Parameters. We haven't done any Type Parameters yet. But all my parameters are Instance Parameters, so here's all the numbers. And you could manually flex those brackets to make them match the shelf, but notice that right here, there is this tiny little button. And it says Associate Family Parameter.

And if I click that, it will show me a list of the parameters that are eligible in this parent family, the shelf family. And I can take those parameters in the shelf family and use them to drive the geometry in the nested family, which is what makes this whole nested family process so powerful. So I'm going to choose the depth there and click OK. And do you see how that will automatically flex the brackets for me? And now if I go back and set this to a more reasonable size-- let's do maybe 14 inches and click Apply-- they're both going to flex together.

Now one other thing that we just did in the bracket family-- let's do here. Let's make this the insertion point. So we'll say defines origin for that. And then here, if I shade this-- and I have no idea if I'm way off script here now or not, but I know I'm going to talk about material somewhere in this bad boy, so I'm going to do it now-- it's all this what I call gray cardboard right now. But I probably want the shelf to be one material. Is that thing skewed or is that just my--

It's got to be the projector, because it's that's an Orthographic view. That looks really wonky. You can't do perspective in a Family Editor. You can't do a Camera view in a Family Editor.

So I'm going to make the shelf one material, and the brackets a different material. Now the shelf is easy, because the geometry lives right here. So all I have to do is select that solid, that box, and I have two ways I could apply the material to it. Right here on the properties palette, it

says by category. If you click in there, there's a little browse button. If you click that, it launches the material browser, eventually. And you could choose from any materials that are currently loaded within this file. And if you look at the top, there aren't really any. There's a couple of defaults and that's it.

That's intentional because we typically don't want to load up a family with lots of materials. It just makes them big and slow performing. So, typically, we like to, instead, build what I'm going to call a material placeholder. In other words, we're going to make the material parametric as well. Just like we did the length and the width and the depth, we can make the material flexible. And then you can assign it in the project instead. So that means I'm going to cancel here and click this button instead. And now I get that little associate family parameter dialog again. I don't have a material parameter.

So there's a little hieroglyphic down here. Click that, and I'll call this shelf. It's the shelf material. Now this time, I'll leave it type and click OK. So this will be our first example of a Type parameter. Now when I de-select everything, it's still gray cardboard. So it's not very satisfying. But this is one where it's delayed satisfaction. You have to get into the project environment to really see how this works. And I also left it hanging out there, type. So let's go to Family Types and talk about this. OK, so here we go.

There's your shelf parameter. Next to it, it does not say default, which means that all instances of this type will share the material, even though each instance can have its own length and depth. So it's up to you as the designer of the family to decide how you want each parameter to behave. I will give you a really simple rule of thumb. Let's all picture casework in our mind, because you all have kitchen cabinets and countertops. So even if you're not an architect, or you don't do casework in your job, you all interact with casework every day. Anybody not have cabinetry in their kitchen? Good, OK, so I think you can all visualize this.

Now has anybody ever remodeled their kitchen? Have you ever tried to buy a custom-sized cabinet? And if so, how much did they ask you to charge for that? Lots of money, and you said nah, the standard size is fine. Standard size is a Type Parameter. So if you imagine what the manufacturer provides off the shelf that you can just buy from a catalog, those are your Type Parameters.

Now when the guys from the installer came in and put the countertop down in your remodeled kitchen, they probably brought saws and other things with them. Because the length needed to

be adjusted just ever so slightly to fit your not so straight walls. So even though it might have come in a standard length, it got adjusted in the field. So in Revit terms, that's what kind of parameter. That's an instance. So that's my general rule of thumb to you-- is think about how it will actually be in real life. And if it's something pre-manufactured that comes a certain way, you probably want a Type Parameter for it. And if it's something that's going to be adjusted and fine tuned in the field, you probably want an Instance Parameter for it.

This is just a rule of thumb. You can, obviously, break the rules in many situations, and I often do. But start there, and at least you'll have some sense of what to do next. So chances are you're going to order this shelf in a material. You're not going to sit out there in the field and go-- I don't know, maple, mahogany. You're going to order it. It's going to come some way. So I think material as a Type Parameter makes more sense, because it's going to come that way and get shipped to the site that way. These are trickier, because when I click here, they don't have a material parameter. Why?

AUDIENCE: Nested?

PAUL F. AUBIN: It's a nested family. So to get at the materiality of that object, you have to go back into that family. So I'll do that real quick, edit the family. I can just select the geometry anywhere. I'll repeat the same process. Whoops, I'm searching. I want to click the hieroglyphic, bracket, and click OK. Again, type OK again. This time I'm going to Load It and Close. I'm done with that one. Because I didn't save it, it'll ask me-- do you want to save the bracket? Sure, let's do that. And then, do you want to overwrite the existing?

Now that we're talking about Type Parameters, I can tell you what the second option means. I don't know why they don't just say this. The first option should say do you want to overwrite the family only? The second option you say do you want to overwrite the family and its types? You've got category, family, type, instance, right? If you change something at the type level-- you've all done this in Revit-- it changes all instances of that type.

So right here, we wouldn't notice any difference because we haven't built enough structure yet. But if you had assigned a material to the bracket, ahead of time, and then you said the bottom option-- it would replace whatever material you assigned to the bracket with the one coming in, because you're telling it to overwrite the family and its Type Parameters. If you choose the top one, it would ignore the value you applied, but it would still overwrite the family itself. No time, sorry, get you at the end.

OK, so in this case, it doesn't matter which one I choose, but I'm going to choose the bottom one just for the heck of it. Is it quick? What were you going to say? I feel bad now.

AUDIENCE: Oh, no. Lower the project because it drives me nuts. If you're just editing something for the project, if you could lower the project [INAUDIBLE], it's still built into the project, you just don't override it in the library.

PAUL F. AUBIN: Right, yeah, well, you don't overwrite it in the library unless you save it as anyway. It never touches the library.

AUDIENCE: If you're just doing it for the project, you don't need the-- you're never going to need it again. Don't overwrite in your library. You can't say no.

PAUL F. AUBIN: Yeah, that's right. You're absolutely right. That's a different situation than what I'm talking about.

OK, so now the problem with this is I'm still not done-- because this bracket now is loaded in. It's got a material, but I have no way to get to it yet. So you almost want to think of this as like your Christmas lights or something like that. You're stringing them together. And if you put ones at the top, and then you put the next ones down, and you forget to plug the ones at the top to the ones down at the bottom-- when you plug the light in, you'll have a set that doesn't light up. So what I need to do is plug-in the Type Parameter that's inside that bracket to a new parameter outside of it in this parent family. And so [INAUDIBLE]. But it's just the more you nest it, the more you have to do this kind of plugging the cords together.

So I'm going to select either bracket-- and to show you this, this time I am going to assign a material to it. But if they're both gray right now. But I'm going to click Edit Type, because this is an object that has type that I want to get to. So I'm clicking Edit Type. And then now, in the type dialog, there's that little button. So because it's a type property, I don't click on the instance panel, the properties palette. I just go Edit Type and I get to it there. Does that make sense-- again, same thing in the project. You're either editing the properties or you're editing the type.

So I click this little button. And then, I'll click New, Create Bracket. So I have to make it again and click OK. See how that grayed out? I don't know, it's really hard to tell. But it grayed out, trust me. You can't see it in the back. But that's grayed out now. It's got a little equal sign here, so I know it's assigned. Now nothing happens. It's still gray cardboard, but let's assign

something to it. So I'm just going to click here in Family Types now and assign something. And I'm going to use [? poche ?] because it's bright blue. And when the brackets turn bright blue, you'll know it worked.

So I'm going to click that, click OK, OK again. And do you see how both brackets change-- because we're mapping type properties. So again, it didn't matter that I only selected one. When I did the depth, I had to select both of them, because I was dealing with instance properties. So you need to know how you're structuring it. And if using instance, you do it slightly different than if you're doing type. So, hopefully, that all made sense. It's all in the handout if it didn't.

I got about 14 minutes left, so what I'm going to do is move on to the next piece. And I'm going to push my luck here and keep using my file, but there is a starter file. Oh sorry, I forgot to show you one thing. Let's save this. See, Save As, almost forgot, because if I clicked save right now, it's saved as shelf-- which might be OK, but I'd rather call it shelf with brackets, because it's a little more descriptive.

If I load this into the project, the thing I forgot to show you was-- let's just play it over here. Now it brought in the blue [? poche, ?] but the shelf itself is still gray cardboard. Do you guys know if you select something and then orbit it, it's a much nicer way, so it doesn't run off the screen on you when you orbit. Always do that in 3D. So if I select this now, no material here. I'm in the project environment. I have to go to Edit Type again. And notice that the [? poche ?] came across just because it was already in the family, but here it's still by category. And I'll click this little guy, and then I'm just going to type wood in here and see what I've got for wood materials-- door panel and sash. Oh, here you go, cherry. Bring that in.

Click OK, OK again. And you can sort of tell. There we go. So that's where you actually see the payoff for building type-based material parameters, because when people load it in the project, that's when they can make that modification. And then there's one other thing that we really ought to look at back here, and that is we've been talking all this talk about the Family Types dialogue, but we haven't really said why it's called the Family Types dialogue. Well again, what's the hierarchy in Revit-- category, family, type, instance. At the moment, I don't have any types in here, so you get this really ugly thing that Revit does where if I bring the sandbox back, the name of this type is-- if you do Edit Type-- the same as the name of the family.

Now if you don't want that, then you always want to make your own type in the Family Editor before you load it in. So that's just one of those things that you learn from experience. So in this case, because everything's instance-based, I didn't really need to do it, but I'm just going to show you how you would do it anyway. So over here, next to Type Name, I'll click the New Type, and what is this? Is five feet long, so I'm going to call it 60 by and 14. So 60 by 14, and then I'll do another one, and I'll call this one 48 by 12. And click OK. And I'll set different defaults for that one.

And so what happens is when you create new types here, they show up on the dropdown. And now it's a little easier to flex, because you just choose the one you want off the list, and you click Apply and nothing happens. And then you choose the other one, and you click apply, and something happens-- because I was changing it to the same one I already had. So now, I have two types. Trouble is, it won't auto purge the one that's already here, so when I overwrite existing-- now which one do I want here? I'm going to, on purpose, choose this one. Crap, I was hoping it would get rid of my wood, because I didn't assign a new wood. Anyway, if I had assigned a new wood-- no because I chose the first one. So it left it alone, let me undo. Undo, let me see if I undid enough. Too much, OK.

Let me do it again-- Load into Project, do the second one, it should make this gray, and it doesn't-- oh well. Oh, yeah, you know why-- because this guy is still shelf with brackets. But this one, the new type, and sorry, and this one. You see how you get that extra one now? That extra one has to be purged. It's going to stay there. But that's a great thing about working in a sandbox. So you can figure all that out here before you load it into a live project, and you realize all the little things you forgot, because you were working on a live stage in front of a couple hundred people, and whatever.

So now, I'm going to show you-- whoops, didn't want to close the sandbox. I wanted to minimize it-- a slightly more advanced thing. I'm going to actually close this, and I'll save it, because we've made changes to it. I'm going to open a starter file here. This is shelving unit A and just quickly walk you through what's going on here. There's only one view, there is supposed to be two-- try that again. It is the box again. There are reference planes defining a box-like shape. But then there's a couple of extra reference planes here and here, defining the size of this extrusion, which is like a back wall.

So now this is going to be a shelving unit, as opposed to something you would mount on a wall. It's going to be a freestanding unit. And then down here is an extrusion. And to get that

little lip, I just drew the extrusion from elevation, instead of from Plan. So could you do it in Plan and do a void to cut that out-- yes. But in general, this is more efficient if you sketch it this way, because you don't have to have a void and do that calculation. So if you can draw it with its own extrusion, just from another angle, then do it that way. So that's all that this file starts with.

So what I'm going to do is go to Create, click Component. And it says, I don't have a family loaded, do you want to load one? And I'll say yes and point to my shelf with brackets family that we just created. And, of course, I'm in left view, so can't create it there, so I'll put it here. Now do you see where it's coming in, the insertion point? Now why am I deliberately doing this-- because, again, I'm superstitious, and I like to see it happen with my Align command. I'm going to align to the center, and I'm going to align to this back wall. And that just makes me feel more comfortable. Now, it's sitting down here as well. So I need a reference plane-- click in here-- to mark where I want the shelf to be. And I don't want a dimension. Do you see what it tried to dimension off of the geometry? I wanted to mention that off the floor. Select that, label it, first shelf height. I'll do that one type this time.

So now this guy is here, and I can align. And here-- I don't know if you can see-- it's trying to do the reference plane, shape handle-- press Tab. Now it's trying to do the level-- press Tab again. And I keep tabbing until, eventually, there it is-- generic model shelf with brackets reference. And that moves the shelf up. So the other thing I could have done is like I did before-- move it down, and then it would have been easier to pick it. So it's up to you, but I'm going to lock that.

So that now this reference plane is going to control where the height of that shelf is. And then, in this direction, something we've already seen, is I want the length of the shelf to be driven by the width of this shelving unit. And do you see how that just flexed that in and made it the correct size. Now you could also do the depth. I'm just mapping these parameters, and that makes it a little deeper. It's one foot six right now. We can adjust that.

Well, I want multiple shelves. So, first of all, I want to determine where the top shelf is, give that a parameter-- top shelf. I don't know if I spelled that right. And then that one is what I want to snap the top-most shelf to. We can build an array, just like your standard Array command, and we can build that right into the Family Editor here-- and, more importantly, make it parametric, so we can control the quantity of shelves as a parameter. So I've got that shelf selected, and I'm going to do a linear array, Grubin Associate-- because that's what makes it

parametric, so that's important. I'll start with number two, I always like to start with two, and then flex it, because then I know it's working. And you could either go to the second or the last. Which one do you think I want here? Last-- because of the way I set it up, because I have a reference plane up here.

So I'm going to choose last, and then I'll just start at this reference plane and end at that reference plane like so. So here is the magic sauce now. These are just regular, run of the mill, parametric grouped array here. So there's the group. There's the group. Well, if you select either instance, floating out here somewhere is this little invisible dimension, and that's what you've got to find. Sometimes it's there, sometimes it's off in space somewhere. So you've got to just figure out where that thing is. You'll see it shimmy when you select. Sometimes, you have to zoom to get it to appear.

So you select that bad boy, and I have no idea why the label jumped back down to the ribbon, or the Options bar here, instead of the ribbon. But there it is, and I can you Add Parameter, and I'm going to call this number of shells. And more importantly, what kind of parameter is this? You see right there? So these, automatically, went to a distance parameter, because that's the only thing that can drive a linear dimension. But with an array, the only thing that can drive an array is an integer, because you're saying how many? And you can't have half an arrayed item, as much as some people would like to have that.

I could do this instance or type, it's up to you. I'll do instance in this case, and then go to Family Types, and I will flex it right there. Let's try four, click Apply-- lovely. Let's try three, click Apply. And now, because I did a top parameter offset as well, I could take the top shelf location-- I could say that's at two feet-- and Apply. And crap, I forgot to--

[LAUGHTER]

I forgot to lock that. Let's try that again. I did that on purpose. I wanted you to see what happens. So you're now making this fully flexible collection. This thing is about to start blinking at me, it says I've got three minutes, but I'm going to push it just a little further here. And I'm going to select this guy, and the bottom shelf only, and mirror both of those. And then, I'm going to take this one only and ungroup it-- very important, if you ungroup these, you're going to break all the work you did. But I want to ungroup this one, because I want to make a separate array from it that will, again, use all the same parameters like so. If we had more time, I would make this a different parameter. But in this case, I'll just be lazy and assign it to

the same number of shelves parameter. And, of course, make sure these things are aligned and locked.

Now here's what I want to do differently. I want this side to show all the time, but this side, I want to only show some of the time. So I'm going to select this guy right here. If you look at the properties palette, there's a visibility parameter. And it's checked on, and you may be wondering why would I ever check that off? Believe it or not, there are times when you would, but-- more advanced topic. But what's important for our purposes is the little button next to it, because you can link this thing up to a parameter. And when I do that, the type of parameter is now a yes-no parameter, because it's controlling a checkbox. So it's going to be a checkbox parameter that you can assign either yes or no. So I'm going to call this Gondola unit, which is, I believe, the way the retail people refer to these things. Correct me if I'm wrong, any retail people in the room.

I'm going to select this one, because I want to assign the same parameter to the shelves. But the way you do that is you edit the group, you select the nested item, and then you can get to it here. But because this is all grouped, you only have to do it to one. They're all going to be controlled by that. So last thing is I'm going to create two Family Types, wall unit, and Gondola unit. Gondola unit wants the box checked. Wall unit wants it unchecked. Now, here in the Family Editor, nothing happens. Wong, wong wong unless you are using 2016 R2 or later, and we don't want wireframe here. We can now do this thing called preview mode over here. Preview Visibility On, so there's what a wall unit looks like.

And then, I can flex to a Gondola unit and Apply, and there's what a Gondola unit looks like. So you're building geometry into the family that is on and off conditionally, based on whatever criteria you establish. And then, of course, if I load this into the project and play some of these, there is a wall unit, and there is a Gondola unit. And they look different. Now, there's tons more we can do. There are some lessons I skipped in the handout. So you have lots of bonus material that you can do on your own. And with that, I'm going to take some questions, because I built into my little timer here-- even though it says I have one second left, I really have about three minutes left. So any questions, yes? Oh, thanks. Thanks Steve. Any questions? Nobody?

AUDIENCE: [INAUDIBLE].

PAUL F. AUBIN: So when I brought the-- I'm sorry. I missed that.

AUDIENCE: You nested the brackets into the brackets--

PAUL F. AUBIN: Yes, nested the brackets into-- OK?

AUDIENCE: And you opened up the [INAUDIBLE]?

PAUL F. AUBIN: Well, it just carried it forward from the bracket. Thank you, everyone. Thank you. It just carried it forward, because I had it--

[APPLAUSE]

Thank you. It just carried it forward because it was built into those brackets. I only did that to show you.

AUDIENCE: You can change it?

PAUL F. AUBIN: Sure you can change it, absolutely. Yeah, my pleasure.

AUDIENCE: The question is where to go to check all the formulas instead of hitting the bracket every three feet, for example?

PAUL F. AUBIN: Yeah, I mean, obviously that's a little more advanced, but I do have some examples in the handout for doing formulas. Yeah, just a couple, but I have tons of other resources I've done on formula creation. In fact, they've got a whole course at lynda.com and formula creation. Yeah?

AUDIENCE: For the [INAUDIBLE]?

PAUL F. AUBIN: No, I don't think they get into anything really advanced in there. I'm trying to remember. Yeah, it's pretty basic stuff. Yeah, good luck with it.

AUDIENCE: Thank you.

PAUL F. AUBIN: All right, you can do it. Yeah? Morning?

AUDIENCE: I do electrical design, and we're just starting off right now. Sorry, I don't have a voice right now.

PAUL F. AUBIN: Tell me about it, I've got to teach another class this afternoon.

AUDIENCE: The light source, the [? fundametrics, ?] is that a type or--

PAUL F. AUBIN: So that's a different template. So when I started, I started with generic model. You would start with one of the lighting fixture families, and it'll have the light source in it. And there's actually a checkbox that lets you turn that on and off. And the reason you might want to do that is if you're nesting lights into other lights, you don't want more than one light source. You only want the top level family to have the light source on. And then the housing and everything else could be nested families.

AUDIENCE: Got you, OK.

PAUL F. AUBIN: So yeah, it will just check the box, and it'll show up a little yellow ball.

AUDIENCE: Excellent, thank you.

AUDIENCE: How do you create a family that's only halfway recessed, a wall, like, for example, a--

PAUL F. AUBIN: You can do it one of two ways. You either use a wall-based family-- and in both ways you do it the same. You either use a wall or face-based family if you want it hosted. That would give you the hosting behavior attached to the wall. So then you would just use a void, like I just showed you, except you'd attach the void to the-- there's going to be a wall in the family template you start with, like a temporary wall. You would attach the void to that wall, and then it will cut into that.

AUDIENCE: So it gives me an outline at the back, at the other side of the wall.

PAUL F. AUBIN: If you use an opening it does. If you use a void, it doesn't. If you use a void, it goes where you put the void. Yeah, so don't use an opening. You're thinking of a door or window family.

AUDIENCE: Thank you.

AUDIENCE: How are you going to mesh that scan?

PAUL F. AUBIN: We've got a team of people-- actually there is guy, [? Storian. ?] He works with the Beck group. He was on the trip with us, and he's been doing a lot of that work, because he's just really good at it. So he's been doing a lot of that work and uploading it to us.

AUDIENCE: Is there a way to be solids also, or is that--

PAUL F. AUBIN: Yeah, well, so we were using AutoDesk tools. So we were using ReCap and ReMake. So with ReCap, it registers the scans, and then you can use their cloud services to upload your point cloud, and it will actually create a mesh. And I actually did that with one of the spaces, much simpler space, that we scanned. It had maybe eight or 10 scans, versus the 110. And it did a really nice job. I was actually pretty surprised at how well it did. On the bigger scans, I think it's a little trickier. So you probably have to get somebody from Autodesk involved, because they can overcome the limits that are built into ReCap.

AUDIENCE: Yeah, that's what I mean. I couldn't upload it. It was too big.

PAUL F. AUBIN: Yeah, but if you're friendly with one of your other AutoDesk folks, you can probably--

AUDIENCE: So last question, Lynda was bought by LinkedIn?

PAUL F. AUBIN: Yes, which was bought by Microsoft, so little fish, big fish, bigger fish.

AUDIENCE: That's why you look familiar because I have taken a few of your courses. Pleased to meet you.

PAUL F. AUBIN: Yes, thank you.

AUDIENCE: Paul, great class.

PAUL F. AUBIN: Oh, thank you.

AUDIENCE: I was curious as to why the first shelf you built, you didn't make it a wall-hosted item.

PAUL F. AUBIN: Well, because you can't turn that off. That's the main reason. So if you make it wall-hosted--

AUDIENCE: [INAUDIBLE].

PAUL F. AUBIN: I think that was my laptop that did that. I probably should close this down. If you make it wall-hosted or hosted in any way--